Annotated Atlatl Bibliography

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Introduction

I began accumulating this bibliography around 1996, making notes for my own uses. Since I have access to some obscure articles, I thought it might be useful to put this information where others can get at it. Comments in brackets [] are my own comments, opinions, and critiques, and not everyone will agree with them. As well as a focus on information I need to remember for my projects, I try in particular to note problems in some of the studies that are often cited by others with less atlatl knowledge, and correct some of the misinformation. The thoroughness of the annotation varies depending on when I read the piece and what my interests were at the time. The many articles from atlatl newsletters describing contests and scores are not included. I try to include news media mentions of atlatls, but many have little useful info. There are peripheral items connected to my atlatl interests and projects, relating to topics like archery, dating the introduction of the bow, primitive hunting, projectile points, rock art, childhood weapon learning, skeletal anatomy, Paleoindian material, and politics of archaeology. Through the kindness of Lorenz Bruchert and Bill Tate, in 2008 I inherited the articles accumulated for Bruchert's extensive atlatl bibliography (Bruchert 2000), and have been incorporating those I did not have in mine.

Many previously hard to get articles are now available on the web. Most of my articles and many others are posted on Academia.edu. If I know about it, I will sometimes indicate such an electronic source as well as the original citation, but at heart I am an oldfashioned paper-lover. There are also innumerable atlatl video clips on Youtube now. Some of course are garbage with shaky video of bad throws and misinformation, but there are many good clips of throwing motion, ideas for manufacture, scenes from events, and some experiments and discussions of how atlatls work. Only a few are included here. Similarly, anyone interested in atlatls and related issues should see the postings on the Atlatl Forum at the Paleoplanet webpage

http://paleoplanet69529.yuku.com/forums/26/t/WAA-Links-References.html and on the World Atlatl Association pages at http://waa.basketmakeratlatl.com/ , updating in November 2017 to http://worldatlatl.org/ . These non-academic sources contain a vast amount of information, much of it from experienced practical users. There are designs for atlatl gear, manufacturing tutorials, informal experiments at many levels of sophistication, archaeological discussions, links to organizations, other pages, and published articles.

One of my wisest professional strategies and personal decisions was the realization that atlatls could be an enjoyable sport and social group, and a serious archaeological research focus, and a great way to teach students about prehistoric technologies. One of my frustrations as an archaeologist has been the difficulty of getting some of my colleagues to join me at events. Some very smart people are just a bit too stodgy. And not all recognize the value of the non-academic communities formed around such interests as atlatls, flintknapping, and other primitive skills. It is fair to say that investing the time to become skilled with any prehistoric technology can be difficult in an academic life, but if you intend to do archaeological study of atlatls or stone tools or basketry or fire-making or any prehistoric technology, you need at least a little practical experience. If you don't have time to become adept yourself, but want to do experiments, there is no excuse for not connecting with the many people who have the skills you want to study. Some of the many silly things written about atlatls by people who didn't bother to learn how to use them or talk to those who do can be found in the bibliography.

Besides all that, the small community of atlatl enthusiasts, and the sport of atlatls, is FUN. Two of my best life-long friends found me through my atlatl interests, and many others in WAA and elsewhere have enriched my life. I will repeat a plea I have often made to colleagues: *Atlatlists are an audience archaeologists should be sharing their information with, and learning from, and with whom we can collaborate*.

The articles use a variety of measurements. Some useful conversions:

1'' = 2.54 cm 1' = 30.48 cm 1 yard = .9144 m1 cm = .394" 1 m = 3.28 feet (3' 3 1/3'')1 mile = 1.609 km 1 km = .622 miles1 hectare = $100 \times 100 \text{ m} = 10,000 \text{ sq } \text{m} = 2.47 \text{ acres}$ 1 acre = 4840 square yds = 4046.9 sq m = .40469 hectares 1 m/sec = 2.236936 mph = 3.28084 ft/sec (Rule of Thumb: 1 mps = 3.3 fps = 2.2 mph) 1 km/hr = .2778 m/sec = .622 mph1 mph = 1.609 km/hr = 1.466 fps = .44704 m/sec1 ft/sec = .6818 mph = .3048 m/sec1 oz = 28.3495 gm or 437.5 grains 1 grain = .0648 gm or .0023 oz1 gram = 15.43 grains or .035274 oz 1 kg = 2.203 lbs, 35.274 oz 1 lb = .4535924 kg, 454 gm, 7000 grains 1 ton = 2000 lbs = 907.185 kg, or .907 metric ton, 907 kg 1 metric ton, 1000 kg = 2205 lbs9/5 (= 1.8) x degrees C + 32 = degrees F i.e. 1 degree C = 1.8 degree F degrees F - 32 x 5/9 (= .56) = degrees C i.e. 1 degree F = .5556 degree C Kinetic energy: $\frac{1}{2}$ mass X velocity squared. Units: 1 joule = .737562 ft-lbs, 1 ft-lb = 1.355818 joules Momentum: Mass X Velocity. Units: slug-ft/sec kg-m/sec 1 slug = (32.2 lbs) = 14.59 kg 1 kg = .0685 slug

1 ft/sec = .3048 mps 1 m/sec = 3.28 ft/sec so 1 slug-ft/sec = 4.447 kg-m/sec 1 kg-m/sec = .225 slug-ft/sec

1000 cc = 1000 ml = 1 litre 1 litre = .26 US gal 1 US gallon = 4 quarts = 8 pints = 16 oz = 3.79 L 1 cubic m = 1000 litres = 1 million cc = 35.31 cubic feet, 1.3 cubic yards 1 cubic foot = 0.03 cubic m

Ackerman, Robert E.

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1996 Cave 1, Lime Hills. In *American Beginnings: The Prehistory and Paleoecology of Beringia*. Frederick. H. West ed., pp. 470-477. University of Chicago Press, Chicago.

SW Alaska, sparse artifacts include 10.7 cm long frag of antler or bone arrowhead slotted to fit microblades. Beveled end of what may be antler foreshaft, w ochre [sim to Clovis?] Pt is assoc w C14 dates 9530 +60 BP, sim to other pts like it in area (West 1996) [thus very early for bow and arrow if right]. Faunal remains w possible cultural modification from lower level w dates 13-15,000 BP.

Adair, Robert K.

1994 The Physics of Baseball 2nd ed. HarperCollins Publishers, New York.

Aguirre, Alejandra, and Ximena Chávez

2012 Personified Knives. Electronic document, Aztecs at Mexicolore webpage, accessed May 2013, URL:

http://www.mexicolore.co.uk/aztecs/artefacts/personified-knives

Offering 125 at Tenochtitlan, in stone box, levels represent cosmic levels. Flint bifaces dressed as gods - Ehecatl-Quetzalcoatl, Xochipilli, Techalotl, and generalized warriors. The last identified by assoc weapons: miniature atlatl with cross-peg grip, side-notched proj points, bow. [The first two are shown, but not clear where they come from. Image from codex shows side-notched pts on atlatl darts, but specimens look small, no scale given. Ehecatl-Q also shown with shield and curved sceptre and miniature sceptre in stone - this actually may be symbolic atlatl.]

Ahler, Stanley A. and Phil R. Geib

2002 Why Flute? Folsom Point Design and Adaptation. *Journal of Archaeological Science* 27:799-820.

Folsom fluting produces a very thin point that can be hafted in a split haft with only

leading edge and tip exposed, allowing maximum penetration but controlling breakage so that only the tip breaks off and the point can be resharpened and reused many times. Probably an adaptation to mobile bison hunting where a reliable, maintainable weapon is needed, but where suitable material is not always available. [Assumes used with atlatl. Summarizes previous ideas on fluting, proposes a convincing hafting model.]

Akerman, Kim

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1978 Notes on the Kimberley Stone-tipped Spear Focusing on the Point Hafting Mechanism. *Mankind* 2(4):486-489.

On light spears 170 gm ave, 150-200 cm long, reed or bamboo with hardwood foreshaft, point attached by resin and sinew. Currently opalescent pyrex ovenware glass preferred for points at Kalumburu, bought for purpose, given to skilled craftsman, fractured with hot wire. Metal leaf points also made. Points often small, 1.5-2.0 cm long. Foreshaft notched but not split, lashed to prevent splitting, butt of point left thick. Resin molded around base of point and down shaft for strength. Impact fractures when hit hard object, shattering if miss in rocky country. Resharpening. Resin hafting advantages: allows point to come free rather than breaking as shaft vibrates in target, curved points can be aligned with shaft, neat join for better penetration, very small points can be used. Large ostentatious pts more for gift exchange than use. Now made for tourist trade.

Akerman, Kim

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2006 High-Tech, Low-Tech: Lithic Technology in the Kimberley Region of Western Australia. In *Skilled Production and Social Reproduction*. Jan Apel and Kjel Knutsson eds., pp. 323-346. Societas Archaeologica Upsaliensis, Uppsala.

Ground-edge tools like axes, grinding equipment, unhafted flake blade and core cutting tools, hafted knives and scrapers, pressure flaked spearheads in 3 different lithic zones. Heat treatment of rock common.

Kimberley points as spear heads, knives, trade goods. Descriptions of flaking process. Man might have 5-20 at one time, but renew or replace maybe 4/week. Glass favored, takes 15 + minutes.

Composite spears 250-350 cm, ave wt 170 grams, so could be thrown with long spear thrower up to 140 yards, accurate to 80. Solid wood spears thrown with shorter desert style thrower often with adze on handle.

Akerman, Kim

2010 To Make a Point – Ethnographic Reality and the Ethnographic and Experimental Replication of Australian Macroblades Known as Leilira. In *Experiments and Interpretation of Traditional Technologies: Essays in Honor of Errett Callahan*. Edited by Hugo Nami, pp. 407-430. Editiones de Arqueologia Contemporanea, Buenos Aires.

Large flake blades, usually quartzite or silcrete, up to 240 mm, hafted in knob of resin as knives for men or women, or as spear tips. "technological observation in the recent

ethnographic present may not always reveal the true nature of technological understanding and ability that existed in the traditional ethnographic past." Quotes several detailed accounts of knapping. Many pieces rejected by knapper before successful blade, but at quarry, others might collect and use his rejects. Hard hammer percussion with large core resting on ground. Current knappers not as skillful – 1960s to 1980s selling blades hafted as knives or spears, but mostly using recovered quarry rejects. Blades for spearpoints have base thinned, hafted with beeswax. Those used in knives are not thinned, and a wooden "finial" may be added to the haft and decorated with totemic marks, but is non-functional. Some recent accounts of traditional knapping are flawed because the knappers observed remembered poorly or had never been very skilled. "some indigenous peoples try to discover for themselves how 'the old people did it'. I have heard indigenous people describe how Kimberley points were made, by heating a flake of stone and carefully dripping water onto it."

Describes his replication, compares to Levallois technique.

Akerman, Kim and Patrick McConvell

2002 Wommera' - The Technology and Terminology of the Multipurpose Spearthrower in Australia. Paper for ARCLING II Conference on the Archaeology and Linguistics of Australia, Canberra 2002. Electronic document, URL http://crlc.anu.edu.au/arcling2/index.html

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Grey 1841 noted similarity Aust words for 'throwing stick': *wamirra* in New S Wales, *amirra* in Central Aust, *midla* in S Aust, *mirra* in W. Sydney area term *wom-murrur* or *wommera* became standard, changed to *woomera*. But common roots of words not clear, also much variation in spearthrower form and terms. Reflect spread of people/language, or spread of tool? Look at as diffusion of multipurp atl w stone adze. Revised Davidson typology. "Leaf-shaped" throwers assoc w sub-tropical regions, 5 types in W Aust and in central and W deserts. [Typology not usable because no illustrations given, descriptions too brief, appear to be only 2 leaf-shaped types instead of 5].

Leaf types used as dish, music, digging stick, adze (attached stone, tooth, or shell blade). Stone blades used into 1970s, + later for tourist trade. Thrower types that can have blades all assoc with *-mirru*- root in name. No arch evidence for dating, but some rock art. Lewis (1988) Arnhem Land rock art - long period no throwers, then early art w broad atl (like W desert type) starting ca 6000 BP, replaced by x-ray art w long narrow lath atl (like N Aust type) ca 2000-1000 BP

Mirru and related roots also refer clubs in some areas, club words may come from thrower words. Lengthy discussion of sound changes and language relations to conclude many words are related, derive from single form *wamirra. Suggest broad type atl spread from Cape York Penninsula to west, perhaps w people. In N, atl type changed to lath-like when adopting composit reed spears, but kept old word.

Akerman, Kim, Richard Fullager, and Annelou van Gijn x 2002 Weapons and wunan: production, function, and exchange of Kimberley points.

Australian Aboriginal Studies 2002 (1): 13-42.

NW Australia, bifacial pressure flaked points. Microscopic residues and use-wear. Change in production, design, function, and distribution through time. See lithic bibliography.

Oral tales: culture hero Tjungkun made 1st spearthrower from limb with branch stub (later became long slender form with lashed on hook). Wodoi made 1st stone tipped spears to throw with them. Other myths, intro of pressure flaking by blanket lizard, dentate points made by nightjar etc. Kimberley and other points often used to tip long compound spears, also as knives, and for exchange.

Phragmites for shafts of composite spears. Point in resin blob on foreshaft, usually < 4 cm long. Spears long and light, av 170 gm, "low mass, high velocity with point that disengaged from the shaft to promote bleeding." [only light in comparison to other Aust spears].

Alex, Lynn M.

2000 Iowa's Archaeological Past. University of Iowa Press, Iowa City.

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Drawing of atlatl in use, poor pic of mammoth hunters w atlatls. Bannerstones and gorgets as atlatl weights, with Archaic dates.

Alexander, B., and C. Alexander

1988 Les Eskimos: Chasseurs du Grand Nord. Courbevoi.

source in Stodiek 1993 for photo of ethnographic Inuit throwing a harpoon – atlatl is flipping, vertical

Alexander, Hubert G. and Paul Reiter

1935 *Report on the Excavation of Jemez Cave, New Mexico*. Monographs of the School of American Research, No. 4. University of New Mexico Press, Albuquerque.

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Pueblo III material primarily represented. Loose fill, lots of ash, partly dry with vegetal and artifact remains, looting disturbance. Numerous points, mostly obsidian, [mostly look like small dart points, few late arrow points, but outline drawings are pathetic]. Late PIII pottery. Y-shaped antler shaft wrench large enough for dart shafts. Fragment of a fending stick. Arrow shafts and foreshafts. Dart foreshaft, notched for stone point, L = 2.75" diam = .5", roughened taper. Seven short sticks tapered at both ends but not very sharp may be dart foreshafts too. Possible butt end of a cane dart shaft, cut off. Sporadic occupation beginning early, associated with ceremonial use of nearby hot springs, continuing through late pueblo period to modern times.

Allain, J. and A. Rigaud

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1986 Décor et fonction: quelques exemples tirés du Magdalénien. *L'Anthropologie* 90:713-738.

"Decoration and function: some examples from the Magdalenian." Decoration relates to function and is sometimes functional e.g. grips. Ochre remains as traces of mastic on bone points with basal incisions. Bâton percé ["shaft straightener"] shows wear from levering and handle decoration for gripping. Harpoon points more likely to tip hand weapons than thrown.

Allely, Steve

1992 Great Basin Atlatls: Notes from the N.W. Corner. *Bulletin of Primitive Technology* 1(4): 48-56.

Describes several atlatls of different types. [Good illustrations, good source to use replicating different styles.] Includes good drawings of Roaring Springs, Nicholarsen Cave [= Lake Winnemucca], Plush Cave, and McClure atlatls.

Allely, Steve

2008 Ishi's Archery Tackle. In *The Traditional Bowyer's Bible, Volume Four*. Pp.269-290. The Lyons Press, Guilford, CN.

Nicely illustrated with detailed drawings. Bows, arrows, stone and other points. Useful info on fletching, arrow points, drilling foreshaft socket by twirling shaft. Photo shows Ishi's odd shooting style off R side of bow. Arrow fletching not spiraled. Stone pts attached with sinew alone, or sinew + pitch.

Allely, Steve, and Jim Hamm

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2002 The Encyclopedia of Native American Bows, Arrows, and Quivers, Vol 2, Plains and Southwest. Bois d'Arc Press, Goldthwaite, TX.

[Very fine drawings of a variety of ethnographic archery equip, but too little descriptive and provenience info. A number of stone pt arrows, including a couple misc Anasazi, and the Hidden House quiver, bow and some arrows, but not complete documentation or enough info. As Hidden House has now been thrown away under NAGPRA, that was a sadly missed opportunity.]

Allen, Harry

2011 Thomson's spears: Innovation and change in eastern Arnhem Land projectile technology. In *Ethnography and the Production of Anthropological Knowledge: Essays in Honor of Nicolas Peterson*, Yasmine Musharbash and Marcus Barber, eds. pp. 69-88. Australian National University E Press, Canberra.

Peterson: change in technol usually by 'substitution' of more efficient or easier to make new forms of known items; adoption of small stone points did not increase hunting efficiency since Austs hunted for millenia without them; thus adopted for other reasons, stylistic? Test ideas with collection made by Thomson 1935-43.

863 spears or parts, Berryman unpub thesis data sheets. Typology based on head

form/material and shaft: one-pc hardwood spears barbed and unbarbed; composite spears with barbed hardwood heads, or unbarbed blade-like heads; stone-headed spears (large *leilira* blade heads); metal heads (shovel-nosed); dart-type spears with plain hardwood heads, both long and short. [All of the specimens of all types are more than 2 m long and weight means 125- 480 gm with dart type the smallest]. Metal head spears 1.5x heavier than others but same length, most shafts are light cane or 'softwood'. Small darts are 'ultra-light' and used with 'goose' spear thrower [this is the extremely long N Aust form - no pic or explanation given]. Two sizes: mean L 262cm Wt 199g; mean L 157cm, Wt 60g.

Widely distributed, made in Glyde R area of reeds, in Arnhem Land by trade.

3 forms spearthrower: 1. N Aust notched lath - flattened shaft w parallel margins, prox grip notches. E Arnhem form shorter, curved margins, small notches - Cundy thinks late intro to go with metal head sprs. 2. N Aust cylindrical sprthr - long stick w round x-sect, peg attached w knob of resin, tassel common on prox end. 3. Goose spear thrower - cylindrical shaft of wood or bamboo, cement rim at prox, peg entirely of cement. Not known in collection which spears collected with which throwers.

Generalized hunting/fighting spears w wood or stone or metal heads all similar performance wt + L, [all used with thrower], 66% of collection. Adoption of sprthrwr [believed late but not explained] led not to new low-energy high-velocity system [but that is exactly what the dart type is] but retention of solid wood spears and basic high-energy low-velocity system that adjusted to a more middle range with lots of variation. Metal-hd sprs for large game - humans, cattle, etc. Metal and stone heads detachable for use as knives, carrying. Dart type are specialized for fighting in Arnhem, while in NW W Aust they are used for hunting too and have small proj pts [Kimberley] attached.

So substitution not supported; instead old forms retained while selective pressures promote new forms and adjustments to traits of all types of spear to make them 'spear-thrower capable.' Spr-th intro ca 5000 yrs ago, marked by use of small stone pts too light for hand-thrown sprs.

Allen, Harry and Kim Akerman

2015 Innovation and change in northern Australian Aboriginal spear technologies: the case for reed spears. *Archaeology in Oceania* 50 (Supplement): 83-93.

[Good]. N Austrial, Kimberley, Victoria River, Arnhem Land. Spearthrower origins – appear late in rock art in N Aust. Small stone points appear c 5000 yrs ago. Tasmanian, Bthurst and Melville Islands lacked spearthrowers, so not essential to survival. Many Aust spears still heavy, retain older high-mass low-velocity hand thrown spear form; intro of spearthrower did not replace but hand-thrown spears modified to fit. Distance of optimal use of spearthrower 10 m [too short]. Selective pressures to change or not – not just efficiency, also ease of manufacture, availability of material, skill level, mass of heavier spears. But multiple forms of throwe and spear co-exist all over, spear forms do not seriate, except in Kimberley, pressure flaked pts replaced percussion flaked. By 20th C, reed spears (Phragmites) predominant form in NW W Aust. Bamboo also used, confusion in lit, but bamboo for heavy stone and metal heads used in E Arnhem land.

Figure of spear forms, spearthrower forms: N Aust notched –lath form, NW Aust lath form [the very long w ovate notched handle; he implies came in shorter and longer versions], N Aust cylindrical form [w tassel at handle], sabre form [thin flat but curved], and goosenecked [very thin rod with resin handle and hook] – developed W Arnhem Land for use with reed spears.

Good info from museum collections and ethnog accounts. 1925 account says young men carry 15-40 reed spears in fighting. Reed spears not made in E Arnhem, imported from W + C Arnhem. Tend to come in 2 sizes, large (reed or bamboo) ave 273 cm and 213 gm + small reed with plain wood head ave 166 cm and 71 gm. Co-exist with heavier all wood forms ave 266 cm and 350 gm.

Oral tradition and rock art agree that reed spears and stone pts were introduced into Kimberley. Small percussion points assoc with spear assemblage of multiple composite forms in Arnhem Land and Kimberleys. Peak for perc pts 3000-1500 yr ago, by 1000 BP replaced by pressure flaked Kimberley pts in Kimberley, but in Arnhem Land, variety of thrower forms for reed sprs and also for heavier sprs.

Allen, Lee

2012 Sending a Dart Through Armor: The Story of the Ancient Native American Weapon Atlatl, Now a Modern Sport. *Indian Country Today* 6/24/12. Online, URL: <u>http://indiancountrytodaymedianetwork.com/gallery/photo/sending-dart-through-armor-story-ancient-native-weapon-atlatl-now-modern-sport-118425</u>

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Bob Sizemore and SALT group in AZ, quotes Sizemore and C Taylor - "penetrated Spanish armor." Quotes JW on throwing motion.

Allen, Lerick

2017 Did Clovis hunters hamstring the Bowser Road Mastodon? Paper presented at the Eastern States Archaeological Federation 84th Annual Meeting November 2-5, 2017 New London, Connecticut.

2013 – 2016 recovery, Orange County, NY, a human-butchered mastodon; evidence for ritual behavior; and 21 atlatls [maybe] made from mastodon ribs split lengthwise (Gramly 2017). It had long been assumed that Clovis used atlatls (Hutchings 2015), but this is the first recognized artifactual discovery of these implements from the period [Not quite true, see Hemmings]. Chop-marks found on the proboscidean's rear heel bone (calcaneus) and conjoining astragalus, possibly incurred during removing the mastodon's foot. African indigenous hunters eat cooked feet of elephants, especially the fatty cushion inside. Alternative: Clovis hunter chopped at the mastodon's Achilles tendon to hamstring. Historical accounts of hamstringing; Native American tales with 'Achilles heel' motif [but most from Parker 1923, a source badly compromised. As described, it seems a very deep, narrow cut, hard to achieve with any stone tool.] Large 'platter' bifaces found in area, suggested use includes core, ritual in burial, notches for smoothing shaft. They suggest used as axe head for severing Achilles tendon. Hafted a biface (cast) in split shaft as axe, need more experiment. [No real cutting tested, and a thin biface in light haft is

unlikely to work as suggested.]

Alloway, David

2000 Desert Survival Skills. University of Texas Press, Austin.

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[Generally well written and good info, but often not enough. For instance, short section on knapping. Correct enough, but you simply can't knap, even good flakes, with no more instruction than a few paragraphs and one poor drawing of percussion vs pressure flaking, unlike the drawing of simple snares, which you can make work.] Refs Waldorf and JW.

Slings – adequately described, safety emphasized, but 'not hard to learn to use.' [True, but as for atlatls where he explicitly says so, enough accuracy to use for survival is different.] Atlatls 'easy to make but harder to master' 'can propel dart 6 X further than a hand-thrown spear and with 150 X the foot-pound energy.' Artificially lengthens thrower's arm. Timing release is important, too soon and it falls harmless, 'too late and you can drive it into your foot.' [I doubt that's possible, I have never seen anyone come close.] [His info is ok, but all atlatl how-to needs to add that the dart must be flexible]. Bow and arrow – again short, ok info. Bow is easier to use.

Alva, Walter o

1988 Discovering the New World's Richest Unlooted Tomb. *National Geographic* 174(4):510-549.

Good photos of Moche royal tomb at Sipan. Drawing of burial indicated copper pointed atlatl darts [but no atlatl apparent in photos or drawing]. Discusses looting. [see also Donnan 1988]

Alva, Walter, and Christopher B. Donnan

1994 Royal Tombs of Sipan. Los Angeles: University of California.

Moche, Peru, fabulously wealthy tomb.

P 175 drawing of spear thrower: straight rod with cast copper hook in form of animal head, hooked handle in form of human head, geometric decoration on shaft. A second atlatl, not shown, had wooden handle carved with bird head. P 127, procession of warriors with clubs, spears, and atlatls (on pot), but mostly shown using clubs or maces and slings in combat.

Ames, Kenneth N. and Herbert D. G. Maschner

1999 *Peoples of the Northwest Coast: Their Archaeology and Prehistory*. London: Thames and Hudson.

P 236 clear drawing of the Skagit atlatl carving. See Fladmark et al 1987. [However, no other mention of atlatls, despite chapter on warfare and discussion of weapons.]

Ames, Kenneth N., Kristen A. Fuld, and Sara Davis

2010 Dart and Arrow Points on the Columbian Plateau of Western North America. *American Antiquity* 75(2):287-326.

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Anderson, Kate

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2011 Slashing and Thrusting with Late Bronze Age Spears: Analysis and Experiment. *Antiquity* 85(328):599-612.

Several forms, probable different uses. Only 6 survive with complete shafts, all over 1.43 m long. 222 spears known from N Britain; sample of 88 examined. Only 3% tip damage from use; 31% edge damaged comparable to swords [nicks and folded edges etc]. Experiment: leaded bronze leaf-shaped spears 190 gm [L not given] on shafts 1.5 m L for throwing, .78 for slashing. One sword for comp.

Need a slashing motion, not chop [duh!]. Hard blow snapped shafts, difficult to remove stub. Thrusting and throwing did not produce much damage, so can't rule out. Shields of leather and bronze highly resistant, minor dents thrusting, but penetrated by throws. Short shaft necessary for slashing motion [I don't think they have enough weapons experience to say that - e.g. Japanese naginata is long slasher.] Slashing with spear cut pig carcass deeply, against metal produced lots of damage to spear. Against sharp weapon, 'chips' [= nicks? not defined]. Against blunt metal, flattening and 'bowing' [dulling and folding?] of edge. [Not enough definition and illustration of damage types.] Damage on prehist shields suggests spears cast against them, but spears slow and dodgeable, "even experienced spear casters" not accurate beyond 3 m. So casting only likely by bodies of men against other groups. [Sounds like comments by inexperienced early atlatl experimenters - how experienced were they? Go read the Illiad. See Milk's experiments – thrown spears much more effective than suggested.]

Implications - need training for effective use, metal weapons rare, thus elite. Need space to use, weapons easily damaged, suggests short single combat rather than group action. [Interesting, but experimenter probably not experienced enough and "needs training for effective use," some alternatives not considered - e.g. edge damage on thrusting weapons from parrying by another edge.]

Anderson, Tim

2014 Arrowheads: A Beginner's Guide. Self-published, Tim Anderson, Lexington, KY.

Basic info aimed at arrowhead collectors. [Overall fairly good, reasonably ethical].

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Chapter on How Arrowheads Were Used includes Atlatls: from Aztec word. 'I have heard that the Aztec's flint points actually punctured the metal armor of the conquistadors' (121). Atlatls are springy, weights time spring: 'you can perfect your atlatl by making it spring forward at the precise moment, giving your dart an extra 100-foot boost'(121). Dart also springy, it will 'flop back and forth, yet fly to its target – at speeds of more than 150 mph' (122). [other than such spring and speed nonsense, the illustrations and info are ok, and in caption, he recognizes atlatl is a lever]. Drawings of various dart and arrow and knife forms. Point life-cycles and resharpening by beveling

[ok, but accepts Sandia as real type]. Many pages of drawn types and their resharpened forms.

Andreson, J., B. Byrd, M. Elson, R. McGuire, R. Mendoza, E. Staski, White F. 1981 The Deer Hunters: Star Carr Reconsidered. *World Archaeology* 13:31-46.

Angel, J. Lawrencex1966 Early Skeletons from Tranquility, California. Smithsonian Contributions to
Anthropology 2(1).

Early Horizon [Archaic] burials with mano/metate, mortar/pestle, Olivella beads etc, but possible association with extinct bison, horse, camel. [Angel accepts association, but artifacts and stratigraphic problems suggest post-Pleistocene date, no C14 date.] Hard life indicated by skeletons of 30 individs, 3M, 4F complete. p3: Diagnoses "atlatl elbow": 6 of 13 individs show arthritis of elbow "usually including eburnation after friction removal of head of cartilage over capitulum, the "ball" against which concave upper surface of head of radius rubs during flexion and extension of elbow and pronation and supination of hand. What repeated and stressful action combines those movements? One thinks at once of baseball pitcher or javelin thrower, except that this equally strains shoulder and clavicular joints." Atlatl allows throw without extending

and abducting shoulder, but puts extra stress on arm muscles and elbow. [Important article, but incorrect understanding of atlatl throwing motion.]

Anneaud, Jean-Jacques, dir.

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1981 Quest for Fire. VHS, DVD. Fox Home Entertainment.

Movie, starring Everett McGill, Ron Perlman, Nicholas Kadi, and Rae Dawn Chong. After their tribe is attacked by apemen [Australopithecines?] and loses their fire, three Neanderthals [?] set out, meeting hairy cannibals [*Homo erectus*?] and a hyper-active tribe of fully modern humans. From the woman who joins them, they learn to joke, enjoy face-to-face intercourse, use atlatls, and ultimately to make fire. [Got a lot of hype from using only primitive language designed by A. Burgess and body language by D. Morris. Ultimately a story about becoming human, not too bad, but some silliness – pathetic material culture even for Neanderthals (only stone tool use shown is scraping charred end of spear – Neanderthals without stone tools would be as desperate as without fire), motheaten wooly mammoth costumes, absurd mix of hominids from different times, etc. Atlatl use depicted briefly: grooved stick atlatl with crooked handle, light arrow-like darts. Heros use them to triumph over rivals, but naturally learn without practice, although earlier they were shown to be clumsy rock throwers. The depiction shows them loading and throwing, with darts zinging at high speed into enemies, but doesn't look like the actors really knew how to use them. Wonder who made the gear. See Rosny 1982.]

Loveland Archaeological Society

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1988 45th Annual Loveland Stone Age Fair Program. Loveland, CO.

Photos of presenters: Leslie Davis, Allen Crawford, George Frison. List of past speakers, including Frison, Stanford, Bradley. Capsule of CO prehistory, with a couple pages of pics of point types. History of Stone Age Fair, which started in 1934 in Cornish, a time when lots of points were being found in dustbowl blow-outs. Lists of committee members and officers of LAS.

Anonymouso1989 Unusual Spearthrowers from Key Marco on the Gulf Coast of Florida. The Atlatl2(1):4-5.

Two of Cushing's finds described briefly, line drawings. [Not enough info and no proper reference]

Anonymous o 1990 World's Record Atlatl Throw. *The Atlatl* 3(1):6

Bill Holladay at Rabbit Stick 1989: primitive equipment - 380'5", open equipment - 428'6".

Anonymous o 1991 Notes from All Over. *The Atlatl* 4(1):8

Manuel White record throw: 476'5".

Anonymous o 1992 Worlds Record Distance Throw. *The Atlatl* 5(3):7

Wayne Brian 616.8' (188 m) [No equipment info, can't see in photo].

Anonymouso1992 New Record Cast. The Atlatl 5(4):7

Wayne Brian 638'8" (194.67 m); unofficial: 690' (210.31 m) 10/7/92. [Action photo, no equipment info, can see very long atlatl but not dart].

Anonymouso1993 Safety First - Says New WAA Board. The Atlatl 6(3): 1-2

Establishing guidelines. News report of boy struck in head by Crow throwing arrow (not atlatl dart).

Anonymous s 2001? Kwäday Dän T'sinchi webpage, Britich Columbia Ministry of Forestry, Lands, and Resource Operations. Electronic Document, accessed 9/2012 URL: <u>http://www.for.gov.bc.ca/archaeology/kwaday_dan_tsinchi/index.htm</u>

[A bit of info on the find, a few small pictures. Shamefully, none show the body, and none give much useful info on the artifacts either. Two show wooden artifacts, too small to be useful, except that the "hand tool" is quite plainly not an atlatl. The "chronology" of the find goes only to 2000 "research begins" following dozens of consultations and agreements and ethics committees. There is no information from the research at all, nor any mention of the subsequent destruction of the remains.]

Anonymous

2008 History Channel's Journey to 10,000 BC. The Atlatl 21(2):10.

Mike Frank of VA, Smithsonian Inst, made atlatls and threw and knapped for the show.

Anonymous

2008 Death of Kris Tuomala. The Atlatl 21(2):16.

Anonymous [Sean Liam Markley?] x 2008 Early Warfare: Girls on Top. *The Economist Online*, April 10, 2008. Electronic document, accessed 4/11/08. URL: http://www.economist.com/science/displaystory.cfm?story_id=11014530 *The Economist* April 12, 2008: 90.

Atlatls at Valley of Fire event, adequate explanation, quotes Shea suggesting early African invention, Whittaker suggesting "equalizer" allowing women hunting success. Paper version has photo of Anu Kramer and Raging Cow.

Anonymous

n.d. Aztec Codex/Codices. *River-Styx.net*. Electronic document, accessed 8/18/09. URL: http://www.river-styx.net/aztec-codex.htm.

Site features underworld and death mythology. This page is descriptive list of codices with some quotes and pictures, source information.

From Aubin Codex [it is NOT, this is from Sahagun], describing Spanish attack on Aztecs at Huitzilopochtli festival and subsequent battle: "... Then the battle began. [The Mexicas] attacked them with arrows and even javelins, including small javelins used for hunting birds. They furiously hurled their javelins [at the Spaniards]. It was as if a layer of yellow canes spread over the Spaniards." [The javelins are surely atlatl darts.]

Anonymous

2014 What's An Atlatl? *Metro East News Bulletin* (St Clair and Madison Counties, MO) 9(6):1, Wednesday, September 10, 2014.

Large photo and quotes taken from WAA webpage to advertise atlatls at Indian Educational Days at Cahokia.

Anspach, Teej, and Rebekah Merrill o

2004 The Effect of Weights on Atlatl Accuracy. unpublished class paper, Grinnell College.

Throwing at ISAC target with Berg darts, atlatl unweighted and 81 gm weights at 3 positions. For each condition, 18 composite scores of five shots each. Proximal weight poorest; no weight and middle position show no signif diff; distal weight improved accuracy. Suggest improvement is from balancing dart while aiming.

Antz, Gustav

1936 Alte Waffen aus Peru. Baessler-Archiv 19:1-4.

x

[In German. "Ancient Weapons of Peru."] Star headed mace, stone pointed spears, and "pfeilschleuder" illustrated [but my copy is poor.]

Aoyama, Kazuo

2005 Classic Maya Warfare and Weapons: Spear, Dart, and Arrow Points of Aguateca and Copan. *Ancient Mesoamerica* 16:291-304.

In both regions, concludes that bow and arrow arrived earlier than thought (Early Classic, 400-600 AD). [based only on small points made on obsidian blade segments, but probably right] although there is little iconographic sign of bows at any time. Maya elite were involved in craft production, including knapping, and warfare. Endemic warfare explains rise and fall of centers, traceable by points. [General conclusions probably correct, but no real good data on points: he assumes distinctions between bifaces used as tools "spear/knife" and those used as points "dart/spear" based on incoherent and ambigous use-wear ("cutting and piercing unidentified material") and size data, never shows correlations with macro impact damage although he depicts it, and makes specific interpretations of sites and regional trends from pathetically small samples from individual sites, apparently reassured just because his overall sample is large. No specifics on atlatls, just assumed some points used with them.]

Archaeological Conservancy

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2013 Barnesville Track Rocks Elephants Not From the Ice Age. *American Archaeology* 17(4):50.

E. Ohio petroglyphs on bedrock, include 2 'elephants' - Malotki (who believes Utah elephant petros are authentic mammoths) brings in Bednarik to do his microerosional study. Rock crystals broken during pecking are compared for erosion of edges to those in modern graffiti to calculate a calibration curve: elephants probable age 100 yrs = modern graffiti.

1999 "Who's Buried in the Ice News Releases 1 and 3. *Archaeology Online*, URL http://www.archaeology.org/online/news/iceman/1.html accessed 9/13/2006

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Announcing curation in Royal British Columbia Museum of Kwaday Dan Sinchi body and artifacts including spear and parts of possible hunting tools, plans for study, radiocarbon date between A.D. 1415-1445 on hat and robe.

Arkell, A. J. x,p

1951 Possible Magdalenian survivals in Africa. Antiquity 25(97):19-21. https://www.cambridge.org/core/terms. https://doi.org/10.1017/S0003598X00020676

1937 JS Owen found spearthrower in use in El Fasher in S Darfur by Harun Yasin, who had 'copied it from strangers', but not in general use. Mohammed Bugar (born ca 1870s) claims former use by Bagirmi and Sarwa tribes' army, gives increased distance and accuracy. Spears for it 75 inch long with 10.75" iron head, thin wood shaft, heavy in head. In war carried 10 spears in case, some shorter for closer range. Simple blade for war, barbs for lions, detachable barbed head with line for hippo. Use for fishing too, greater accuracy.

HY's spear-thrower is wood, 10" long, 1.5" wide, 1.75" deep. "Top is hollowed to receive the butt end of the spear, and in the front edge is a groove in which lies the shaft." 6" from butt end is leather thong, "on underside a small step is cut in which the palm of the R hand rests. There is a [vertical] groove for the fore-finger in the butt end... and 3 grooves on the top on the R side [2 on both sides] near the butt [and one on one side only closer to the other end], in which lie the remaining digits of the R hand, to hold and steady the shaft of the spear before release. The thong which goes round the wrist and is taut when the spear is thrown, appears to increase the momentum." [Unclear description, muddled about which end is which. I think he means butt of spear is at 'butt' end of thrower with grooves, which means spear is supported by other end extending forward, and no lever action is possible at all, though it might give a better grip on a thin javelin shaft. So this should not really be compared to spearthrowers – it is a javelin gripping device]

MB made some for author, but had seen HY example, so not independent memory. Some had grooves, some not, and he did not use them. Longest was 26.5". MB claimed could throw 100 yds, but failed, could only throw about as far as man without spearthrower. Held with fingers one side, thumb other to steady spear with finger tips [seems about what I would guess]. HY example doesn't lengthen arm, MB arm is lengthened 8-13". No other evidence of s-t use, but most local tribes throw spear from balance point, while Masalit of W Darfur hold with forefinger on butt as with s-t.

H. Balfour thinks closest parallel is Eskimo, examples shown [NO, they are not parallels at all.] They all have short length, groove and socket for butt of spear, and finger notches. Sollas suggests connections between Eskimo and Magdalenian, and "…only possible explanation for occurrence of s-t apparently connected by their short length, groove and

finger grips, as far apart as Greenland and Lake Chad that I can suggest is that they are peripheral survivals from a widely distributed culture, of which the earliest known examples are represented by the Magdalenian." Other possible M survivals in Africa include barbed bone spearheads, red ochre use, perforated stones, *baton de commandement* shaft straighteners, cowry shells.

[One of Arkell's specimens is on display in the Pitt-Rivers Museum. I have a photo, but it is not much like the one shown in the article, and unclear how it would be used. Need to examine!]

Arriaza, Bernardo T.

1995 *Beyond Death: The Chinchorro Mummies of Ancient Chile*. Smithsonian Institution Press, Washington D.C.

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Chilean coastal Archaic fishing culture, no pottery, no agriculture. Long tradition of mummy burial, several forms of mummy. Atlatls, light harpoons, drawings p 89, simple stick with attached hook, single finger loop [inadequate information].

Arutiunov, S. A. and William W. Fitzhugh

1988 Prehistory of Siberia and the Bering Sea. In *Crossroads of Continents: Cultures of Siberia and Alaska*, edited by W. W. Fitzhugh and A. Crowell, pp.117-129. Smithsonian Institution Press, Washington D.C.

Illustrations of various harpoon tips and stone tools. Old Bering Sea Culture (ca 500 BC) "winged objects" elaborately carved of ivory are considered to be counterbalance on the end of a harpoon with heavy head, and incorporate a socket for atlatl hook.

Ashby, Ed o, x

2012 Papua New Guinea's Bows and Arrows. *Bulletin of Primitive Technology* 43:11-19. [Online version dated 2008]

Both stalking and stand hunting. Rusa deer, pigs, crocodiles, small game + fish. Deer taken at up to 25 yards and more. Bows in 80 lb range, pre-WWII of palm, post of bamboo. Strip string, unfletched long arrows. Pre-WWII points barbed wood, replaced now by heavy steel points, but spears still use wood pts. All arrows weighted strongly front of center. Pre-war 80+ cm long, mass around 1000 grains, weight 29-38% FOC. Post-war with steel tips 100+ cm long, mass around 2000 grains, 40+% FOC. Current bamboo bow narrower, because with heavier steel heads, arrows not stiff enough to shoot off of wider pre-war bows. Modern archers use 6-15% FOC, but original stone-tipped arrows 20-40% FOC, and in fact high FOC better - more stable flight, faster paradox recovery, boost in penetration.

Ashby, Ed x

1996 Arrow Lethality. Electronic document, Alaska Bowhunting Supply LLC webpage, URL: <u>http://www.alaskabowhunting.com/Dr.-Ed-Ashby-W26.aspx</u>

accessed 6/2012.

Penetration experiments on African game animals with different broadheads. Single blade broadheads with single bevel penetrate best. Multi-blade forms reduce penetration and are generally more fragile. Kinetic energy and momentum affect penetration, but kinetic energy (1/2 mass X velocity squared) depends more on velocity which drag reduces quickly, while momentum (mass X velocity) is more dependent on mass, and is maintained throughout flight and impact. Thus heavier arrow better penetration. Penetration also affected by 1. mechanical advantage of cutting head. MA = length of cutting blade divided by ½ width of blade times number of blades. 2. efficiency with which arrow uses force available, i.e. does not waste it in oscillation. 3. resistance of the arrow, drag by air and target material.

Damage to head limits penetration. Penetration correlates with percentage of killing hits. Most lethal shot angle is animal quartering away from archer, least is with animal quartering toward archer and shot hitting neck/shoulder junction. Single blade broadhead of high mass, with small diameter shaft is best.

Ashby, Ed x

2007 Why Single-Bevel Broadheads? Electronic document, Alaska Bowhunting Supply LLC webpage, URL: <u>http://www.alaskabowhunting.com/Dr.-Ed-Ashby-W26.aspx</u> accessed 6/2012.

Ashby, Ed

2010 Momentum, Kinetic Energy, and Arrow Penetration (and What they Mean for the Bowhunter). Electronic document, Alaska Bowhunting Supply LLC webpage, URL:

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http://www.alaskabowhunting.com/Dr.-Ed-Ashby-W26.aspx accessed 6/2012.

Ashmore, Wendy, and Robert J. Sharer

2010 Discovering Our Past: A Brief Introduction to Archaeology, 5th edition. McGraw Hill, New York.

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[Nice enough intro text, well illustrated, short.] P. 56-57: Atlatl replaced by more efficient bow and arrow around 500 AD, but "transformed over time into the calumet or peace pipe, thus becoming an important social and religious symbol." [Idea probably from Hall. Illustrated with drawings of arrow, wands?, SW atlatl, Key Marco atlatl with rabbit hook, non-existent SW form with a Hopewell platform pipe used as the hook, and calumet. An evolutionary sequence is implied, but this is rubbish. Knapping and lithic technology drawings are poor.]

Assmann, Cody

2017 Window into the Past. Primitive Archer 25(3): 80, 74-76.

Experiential teaching history - \$5 atlatl course. 24" survey stake, 2 pieces 1/2" wood

dowels, 6" piece of ½" PVC, duct tape, nail. Shape stake, nail for spur. Join dowels with PVC, fletch with duct tape. Dart must have spine like arrow. Discuss natural abilities and learned skill with students. Easy project for teaching ancient technology.

Associated Press

2004 Ice Patches: Hunting Darts, Bows, and More Surface as Ancient Snows Melt. *The Atlatl* 17 (2): 8-9.

Yukon alpine melting: c14 on dart shaft 9,300 years old, another 1,260, first bow and arrow evidence 1,300

Associated Press

X Prehisto

2005 Pa. May Let Hunters Use Prehistoric Weapon. *New York Times*, November 13, 2005. URL <u>www.nytimes.com/aponline/national/AP-Hunting-Ancient-Weapon.html</u>, accessed 11/13/05.

State Game Commission considers legal atlatl deer hunt. Quotes Fogelman, Rowe, Perkins, Carr, Lyons. Attitude favorable.

Associated Press

X

2006 Game Commission Staff Advises Against Ancient Atlatl. *Pittsburgh Post-Gazette* January 10, 2006. URL <u>http://www.post-gazette.com/pg/pp/06010/635508.stm accessed</u> <u>1/11/06</u>

Non-binding recommendation to Board of Commissioners not to legalize atlatl deer hunt, apparently under pressure from anti-hunting groups against "barbarous practices."

Associated Press

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2006 PA Spear Hunters Get 'Shot Down' by Game Commission. <u>www.abc27.com</u> web page URL <u>http://www.whtm.com/news/stories/0106/292684.html accessed 1/27/06</u>

Rec made to commission not to legalize. [Very brief, but with moronic comments from readers at bottom.]

Atwater, Anne E. x

1979 Biomechanics of Overarm Throwing Movements and of Throwing Injuries. *Exercise and Sport Sciences Reviews* 7:43-85.

"Overarm throwing ... involves the sequential action of body segments progressing from the larger, slower-moving trunk actions to the faster, distal actions of the relatively smaller arm and hand segments (43)." Usually takes less than 1 second from start until object release, velocity of ball can increase from 6 m/sec at 100 msec before release to 34 m/sec at release, so severe stresses on body.

Overarm baseball + softball throwing 17-39.6 m/sec, similar with either ball. Seen from

overhead, ball does not follow straight path [in fact, odd zigzag line] because of rotation of the trunk, tendency to side-arm by bending at waist. Tennis serve similar to overarm throw [and seems likely to be more directly overarm - perhaps that is one effect of atlatl - forces more of a straight overarm motion, for greater efficiency?].

Injury - pitchers have hypertrophy of humerus and upper arm muscles, sometimes inability to fully extend elbow. Physical changes to tennis serving arm and shoulder similar to those of baseball pitchers. Shoulder and elbow problems about equally common. [Much more detail].

Auel, Jean

2002 The Shelters of Stone. Crown Publishers.

[see Edgar 2002]

Augustine, Robert F.

2009 *Atlatl: An Archaeological Mystery*. XLibris Corporation, Bloomington, Indiana. [a self-publishing company]

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Novel. Heroine Dr. Jacqueline Michenaud is an archaeologist at ASU. "Expert in archaic weaponry, J had developed significant practical expertise in the use of the bow, the spear thrower (the atlatl in Mexico and Central America), and the throwing stick (7)." Unfortunately, the story opens with her demonstrating to a class, burying her 18 inch, "similar to a crossbow bolt" dart "to the feathers" in a 2-inch thick pine board (8), which only demonstrates that Augustine and his heroine don't really know anything about atlatls.

The plot involves a lost Aztec temple in central Arizona, and further improbable selfdefense with atlatls found in it. They seem to use short copper darts, with detachable cone-shaped stone points -you've gotta be kidding! He doesn't know much about artifacts or real archaeology either. Writing is not horrible, but amateurish.

Austin, Donald

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2005 California Desert Rock Art. Rock Art CD # 1, Petroglyph.us, www.sandcarveddesigns.com, Culver City, CA.

CD, images and short site descriptions for a dozen S CA sites. Atlatl Cliffs site petroglyphs include several probable atlatls [but since no darts shown, nor atlatl in action, can't be positive], depicted as slightly curved shaft, curved hook always up, sometimes another hook (grip, finger loop?) near bottom, with large round, rectanguloid, or bilobed weight in center. [Look like bannerstones, but not found in this area]. Possible assoc w Pinto site nearby. [Nice images, good documentation for rock art fans].

Austin, Toby o

2011 Weighing In On Atlatl Weights. Unpublished class paper, Grinnell College.

Inconclusive experiments; suggests that difference in throwing style can negate any effects of weights.

Bachechi, L., P.-F. Fabbri, and F. Mallegni

1997 An Arrow-Caused Lesion in a Late Upper Paleolithic Human Pelvis. *Current Anthropology* 38 (1): 135-140.

By Mesolithic, bow + arrow widely distributed, but no evidence before end of Upper Paleolithic.

A female burial, Epigravettian, San Teodoro Cave, Sicily has fragment of backed triangular microlith in pelvis with sepsis and healing. Part of light point, so arrow likely [not adequate evidence]. Date ca. 14,000-12,000 b.p. Other examples listed.

Bacon, Jack

1995 World Record Set at Delaney Farm. Aurora Sentinel July 19, 1995:15-16.

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Engvall distance record with modern gear 848' 6 5/8". Tate interviewed. Aztecs "penetrated metal armor"[myth]. Engvall also holds sling record of 1565' 4".

Baer, John Leonard

1921 A Preliminary Report on the So-Called "Bannerstones". *American Anthropologist* n.s. 23(4): 445-459.

C.C. Abbott responsible for term "bannerstone".

3 bannerstones with short stone shafts from NC, one pictured [can't tell if hole goes all the way through]

Describes manufacture process for winged bs from site in PA: slate blocked out, pecked, scraped, drilled, polished. Experiments by McGuire suggest 10.5 hrs for all that. Fragile, unsharpened, no practical use: "mounted upon handles for ceremonial use".

Baer, John Leonard

1922 A Prochlorite Bannerstone Workshop. American Anthropologist 24:438-440.

Pennsylvania, near 1921 example, different material, different form bannerstones - biconvex, easier to work but same sequence. Assoc with steatite, possibly mined near.

Bag, Allen J.

2009 Copper Dart Points. The Dart Dec 2009:7.

Offering swaged copper field points – ISAC rules count as primitive. [Yeah, sort of].

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Baggett, Mark

2009 A Hunt with Aunt Jemima. Primitive Archer 17(3):32-33.

Killed deer with brown glass point, cane arrow, self bow, 8 yards. Entry between ribs, split rib on other side but no exit.

Bahn, Paul o

2016 Images of the Ice Age. Oxford: Oxford University Press.

[Authoritative, readable and highly detailed, many color illustrations. Sometimes too many examples supporting an argument, but without figures, and getting too long. Compounded by bad decisions: footnotes instead of proper reference system, and figures that are not ref'd in text and sometimes irrelevant to discussion.] History of discovery - resistance by some authorities, especially to Altamira (too sophisticated, found by amateur). Pre-Upper Paleolithic art beginnings – numerous examples, espec early modern humans 100-70 kya in Africa, Bloobos Cave etc. Acheulean handaxe from W Tofts, Norfolk knapped to leave a fossil shell. [He also accepts some real dubious stuff, including ironstone cobble with 'eyes' from Makapansgat Australopith site, 'figurine' from Berekaht Ram, Israel Acheulean, and La Roche-Cotard stone and bone 'mask']. This chapter is to make argument that 'esthetic sense' developed early. "Worldwide Phenomena" survey of Pleistocene images [which original intro says will not be done]. Lots from Australia, now appearing in Egypt. [Again some poor choices – in US he likes Vero Beach mammoth, possible Utah petroglyph mammoths, doesn't mention the Clovis engravings from Gault.] The extensive list does show how much there is, often little-known. Likewise for Europe map and discussion of distributions. Parietal and portable art overlaps, but not consistently. Some areas lots of art, others little, some sites huge concentrations. Habitation and art sometimes together, but often not. Quantification difficult and subjective.

Recording – Breuil as pioneer, early difficulties. Subjectivity and mistakes – not possible to be completely objective. New multi-method and digital recording. Chapter on Dating – many new techniques replacing largely faulty stylistic chronologies. Good discussion of problems in dating. Large sites – usually palimpsests of some sort, but organization and sequence often unclear. Fakes and Forgeries – even many accepted pieces come from unknown contexts and thus should be legitimately tested. Faking began shortly after discovery in 19th C.

Portable Art – includes lots of things like beads and other ornaments, and thousands of engraved stone plaques that are seldom discussed. Carvings in bone, antler, ivory. Including 'antler spearthrowers of Magdalenian' pp 144-147, but not much real info. Two kinds decoration: figures in relief along shaft, and figures in round at hook end, which include fighting fauns, a pheasant, mammoths, a leaping horse. Many from Pyrenees, including Mas d'Azil. [Three figures of 'faun aux oisseau' from Mas d'Azil and Bédeilhac are only examples shown, and he makes much of supposed resemblance to Disney pose in Bambi]. About 10 examples survive of bird on turd motif, showing that many must have been made, high output by individual artist, or small group, since all examples from Middle Magdalenian, span of a few centuries [making single individual

very unlikely. The 3 nice photos do not convince me of either the bird on turd interpretation or the birthing interpretation, which is not mentioned].

Bailey, Jonathan

2016 Rock Art: A Vision of a Vanishing Cultural Landscape. Johnson Books, Boulder.

[Fine photographs and more or less poetic essays by Bailey, L. Baca, G. Child, Gulliford, Keyser, Wm. Lipe, L. Loendorf, Meares, S. Thybony, Tosa on SW rock art, landscape, and the obscene destruction of natural beauty and cultural heritage. No atlatl images, mostly N SW, Fremont etc.]

Baker, Shawnx2004 Making a Unaaq, a Greenland Style Knob Harpoon. The Masik: Quarterly
Newsletter of Qajaq USA 2(3):14-15. Electronic document, URL:

http://www.qajaqusa.org/newsletter/Masik_Fall2004_10043.pdf

Dense softwood or medium hardwood for right weight, for competition must be > 1kg. Poplar, fir. 62 - 79 inches long, 4-5 cm thick. Foreshaft should be bone but plastic is acceptable for competition. Balance point at 40-45%. [More details of construction, good photos.] The two pegs on side of harpoon fit in holes in thrower; should be "snap tight" harpoon is not held on with fingers.

Baker, W. E. and A. V. Kidder

1937 A Spear Thrower from Oklahoma. American Antiquity 3(1): 51-52.

Spear thrower predates bows - SW evidence. Cave find from Cimarron R., NW of Boise City. Distal fragment of Basketmaker type, groove, flush hook, good illustration. Associated sandals, corn, no pottery, slotted foreshaft.

Balter, Michael

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2014 The killing ground: clues from a German coal mine show how early hunters lived 300,000 years ago, and how their prey died. *Science* 344(6188):1080-1083.

Schoningen, horse bones and wooden spears in ancient lake. Now ca 50 horses, 11 spears of spruce branches 2 m long. Currently interpreted as multiple hunting events over long time. Spears thrusting or hand-thrown. [Good summary].

Bandelier, Adolf F.

1877 On the Art of War and Mode of Warfare of the Ancient Mexicans. *Tenth Annual Report of the Peabody Museum*, pp. 95-161. Cambridge, MA.

Arms stored in tlachochcalli or "house of darts". P 105 "dart or javelin (tlacochtli, tlatzontectli) was the main weapon of the Mexicans... a short spear of hard and elastic

canewood (otlatl)..." flint, obsidian, copper points, sometimes multi, often tied to arm of warrior, or several carried loose. Footnote: "Torquemada mentions a sort of cross-bow which he calls atlatl... Atlatl however means a strap (amiento) fastening the helmet around the chin." Use of cross-bow not established yet. Gonzala Fernandez de Ovieda y Valdes 'Historia General y Natural de Indias' mid 16 C, says "...Indians fight with darts which they throw by means of estoricas (a kind of avientos) a well made wooden contrivance. With this they hurl the javelin, always keeping the estorica in hand." F. W. Putnam of Peabody Mus identifies the atlatl with the 'throwing stick' of the Aleutians..." [In other words, dart to Bandelier meant javelin, and he had no real understanding of atlatls or their mention in texts at the time, but Putnam did.]

Slings, macana or maccuahuitl swords of wood with obsidian blades in slots. Quilted cotton armor adopted by Spanish subsequently.

Bandi, H. G. s

1988 Mis bas et non defecation. Nouvelle interpretation de trois propulseurs magdaleniens sur de bases zoologiques, ethnologiques et symboliques. Espacio, tiempo y forma, serie I, *Préhistoria* t.1 :133-147.

[Giving birth and not defecation: New interpretation of three Magdalenian spearthrowers on the basis of zoology, ethnology, and symbology.] See Demoulin 2002.

Banks, Alano2010 Shannon County Bannerstones. Missouri Archaeological Society Quarterly

27(2):22-23.

Rare in MO, near W boundary of bannerstone distribution. Only 4 known from Shannon Co. in E Ozarks, 2 unfinished, and one drill core.

Bankston, Brittany M.

2015 How Chaco Got the Point: Exploring the Technological Transition from Atlatl to Bow During Basketmaker III at Chaco Canyon, New Mexico. Unpublished MA thesis, California State University, Northridge.

Hypotheses: Bow did not immediately replace atlatl so evidence of transition will exist. Dart vs arrow pts can be separated by dart-arrow index. Transition will be reflected by small dart pts and larger arrow pts. These reflect trends in how technol is introduced, in regional context. Theoretical perspective of 'cultural transmission' analogous to biological evolutionary processes. Expect limited variability in dart pts after stabilized by selection. When bow intro'd expect high variability decreasing thru time as people experiment and learn. First attempts may be modeled on dart points.

4 BMIII sites in CC examined. Survey shows ca 70 pre-ceramic sites, most on S side. BMIII combined hunt and agriculture. Faunal evidence shows smaller mammals dominant, larger less hunted. Antelope more common that deer or sheep. Suggest garden hunting. Lithic raw materials include Mt Taylor obsid, Narbona Pass chert. Pts

most common formal tool in BMIII. Stemmed pts predominant type in BMIII and PI, corner-notched in early PII, side-notched in late PII. Railey (2010): change from formal to expedient tools correlated with atlatl to bow. Arrow pts small, less material, allows wider range of materials; darts need more good quality stone for larger pts. But found shift to 'flake-based' smaller pts in Mid-Late Archaic.

Bow adoption supposed to be ca 3000 BC in Arctic, diffusing across continent, ca 500 AD in BMIII. But now possibly as early as 100 BC though general transition AD500-600 in SW (Reed and Geib 2013). Technological superiority of bow. Atlatl continuation in some areas (VanPool 2006). Tomka (2013) bow better for small game, doesn't penetrate enough for large, so using both broadens range of prey.

Sites: 29SJ299 – 2 burnt pithouses (3 pts). 29SJ423 early – AD400s-500s, many ph with great kiva (35 pts). 29SJ519 5 ph, brief occup 550-650 AD (12 pts). 29SJ1659 Shabick'eshchee excav 1927 by Roberts, predecessor to 423, many ph, great kiva etc (13 pts).

Point measurements. Dart-arrow index of Hildebrandt and King 2012. Defined 'forms' (= 'types') of pts. Simpson's Diversity Index, using Chaco pts, also S CO, Chuska Valley, Jemez Mts BMII sites. Total 63 Chaco pts [pretty small sample for such a fine-grained analysis]. 299 (1 dart, 2 arrow pts), 423 (30 pts, one Archaic), 519 (12 arrow, no dart, only 3 complete) Shabik (14 pts but only 3 from controlled contexts). 28 pts usable for d-a index – shows gap between 3 darts and 25 arrow pts, so perhaps transition had already occurred, no evidence of transitional pts. The few dart pts could be scavenged, or minimal continuation of atlatl in CC.

BMIII arrow pts stemmed, corner-notched, and side-N. High levels of variability and diversity index [too small a sample, pts illustrated are pretty scrappy]. Made on flakes, thickness less variable.

No evidence for transition at Chaco. High variability suggests experimentation [no, meaningless with this size sample]. Compare to SW CO (Phagan) [most of the pt seem to be small stemmed forms I think of as PI]. Chuska Valley – BMIII stemmed forms, PI corner-notched forms.

Barge-Mahieu, H., H. Camps-Fabrer, V. Feruglio, A. Peltier, and D. Remseyer o

1992 *Bâtons Percés, Baguettes*. Fiches Typologiques de L'Industrie Osseuse Préhistorique, Cahier V. Editions du Cedarc, Treignes.

Barker, Wayne, Brian Hayden, and Alistair Hallum o 1981 *Western Desert Woomera: Fashioned with Stone Tools*. VHS, Australian Institute of Aboriginal Studies.

VHS ca 15 min, [transferred to DVD 2018]. Two men from S of Lake McDonald in Central Australia. Shows one throw, holding woomera flat or slightly tilted, with hammer hold, thumb and forefinger raised to spear. Spear looks >2 m long, wooden barb, "can throw more than 100 m." Select mulga tree, use stone blocks as choppers, notch living tree, split out blank by hammering chopper into deep top cut, prying with stick.

Resharpen choppers by direct percussion with hammer stone, abandon tools on site. Initial shaping with smaller chopper, 2 men working at once. Then small adze, a stone flake on long straight wood handle fixed with spinifex gum. Resharpened with teeth (shown) to avoid loosening hafting, or with odd thrusting blows of sharp wooden stick. Finished by scraping with the adze. Wooden peg hook attached with kangaroo sinew, pours sand on it to dry. Mounts flake on handle with spinifex, oils wood to prevent split. Took 2 men about 12.5 hrs.

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Barnett, Franklin

1977 Crooked Arrow. Beaumaris Books, Tempe.

Juvenile novel. Young Ah-ee lives in a village with his uncle and aunt. He is 14, almost a man, should he become a hunter, a warrior, or a medicine man like his deceased father? His uncle takes him to visit a wise warrior in the largest village [probably Tuzigoot]. Barnett was an archaeologist working in the Prescott, AZ area. Ah-ee's village is probably Fitzmaurice Ruin, which Barnett excavated. Barnett knew the material culture and describes pottery making etc accurately enough in some detail, but he was not much of a writer. Pretty bland, characters lapse occasionally into Indian-speak. Old fashioned view of pueblos (e.g. stereotyped social roles, raids by bad folk from North) not very well informed by ethnography, or a very convincing reconstruction either. Oddities such as: it seems potter was only invented/learned in the generation of Ah-ee's great-grandmother, and the potter is described as admired for her constant innovations. But when she makes a pot too large to fit down the smoke-hole roof entry, she has to wait for her husband to come figure out what to do (make the entry larger, duh).

P 26 describing weapons, in youth of older warrior, some men still used atlatls, though most now preferred 'less cumbersome' bow and arrow. Arrows 'like atlatls' [he means the dart] made of hardwood foreshaft on hollow reed shaft, but many arrows 'now made of one piece of wood.' Easier to make and straighten. [This is all anachronistic and inaccurate.]. As the tale progresses, Ah-ee becomes a hunter, is circumcised at initiation, and proves himself a warrior. It seems there is constant danger of ambush and skirmish with 'dark skinned' enemies. This is perhaps more because Barnett couldn't come up with an interesting plot than because there is any evidence of such a perilous state in these small pueblos of the time. I got tired and quit reading.

Bassett, **Douglas**

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2007 The Atlatl in New York State. New York Atlatl Association Newsletter 3:4-7.

No archaeological finds in NY except points and bannerstones from several Archaic cultures. Photos from Ritchie 1969.

Bassett, **Douglas**

2007 Types of Bannerstones in New York State. *The New York Atlatl Association Newsletter* 2 (2): 9-11.

Types and distribution maps from Knoblock.

Bassett, **Douglas**

2007 19th Annual Eastern Seaboard Atlatl Competition, Letchworth State Park, NY. *The Atlatl* 20(4):3-4.

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Variety of games. Attempts to quantify kills on animal targets - 10 targets life size at realistic distances 7-16 m, 60 attempts, 42% hits, ca 1/3 would be captures, 25% quick death, top six throwers 52% hits, 47% retrieval, 32% quick kill.

Bassett, **Douglas**

2008 2007 ISAC Highlights from the Youth, Top 25, and Aggregate Record Books. *The Atlatl* 21(2):5-6.

Bassett, **Douglas**

2011 Top 100 World Atlatlists in the International Standard Accuracy Contest as of 2010. *The Atlatl* 24(4):3-5.

Ranking by complex calculation: (Total years on list) divided by (sum of rankings for each year) X (total years) X (average score expressed as %) = final score for ranking.

Bassett, **Douglas**

2014 Summary of the World Atlatl Day 2014. The Atlatl 27(2):8-9.

45 teams participated. Average scores for different distances, showing effect of range: 5m N=90, Ave 9.8 w 21 Xs 10m N = 108 Ave 8.9 w 12 Xs, 1 miss 15m N = 108 Ave 7.75 w 8 Xs, 9 misses 20 m N = 72 Ave 7.1 w 3 Xs, 8 misses 25 m N = 72, Ave 6.2 w 1 X, 12 misses

Bassett, Douglas, and Pascal Chauvaux

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2008 The European Round: A Short History, Description, and Some Personal Best Scores. *New York Atlatl Association Newsletter* 3(2):8-10. Also electronic document on WAA Webpage, accessed 4/08, URL:

http://www.worldatlatl.org/Articles/The%20European%20Round%20-%20PC.doc 2012 The European Round: A Short History, Description, and Some Personal Best Scores, updated 1/12. Electronic document on WAA Webpage, accessed 7/12, URL: http://www.worldatlatl.org/ModernAtlatlSport/The%20European%20Round_PC.pdf

Developed from research efforts + competition organized by Stodiek, Cattelain, Chauvaux. Compares top atlatl scores to top archery scores.

Bassett, **Douglas**

2010 2009 Highlights from the Youth, Top 25, and Aggregate Record Books. The Atlatl

23(2):6-7.

Basso, Ellen B.

1973 The Kalapalo Indians of Central Brazil. Holt, Rinehart and Winston, New York.

S

Xingu River basin, South America. Farming (manioc, corn, piqui tree crop), fishing, foraging. Non-aggression valued, not much hunting (taboo against eating most animals). Bow and arrow, now shotgun, for monkey and birds. Few stone tools, just imported stone axes, now replaced by metal. Basso deals mostly with social organization and kinship. Rituals involving multiple villages, not all of same language, include *ifagaka* p 152-153 'spear throwing ceremony'. Practice before in villages, main event in a host village. Practice with dummy in plaza. In ceremony, paired men insult each other, sing songs, opposing teams charge each other but leaders prevent physical fighting. Then 2 bundles of poles at each end of narrow corridor between teams, opponents throw spears with spear thrower, try to hit each other on thigh before they can dodge behind the pole bundle. Apparently repeat without bundle. Equipment burned after ceremony. A symbolic battle where insults raise feelings but 'rituals of opposition constantly in danger of exploding' but village reps keep from violence. Final event of ritual, (songs, feasting) is symbol of the normally peaceful relations. [Unfortunately Basso does not give any more detail or pictures of event or gear. Apparently spear throwers used only for this ritual.].

Baugh, Dick

C

1986 A Note on Indian Bow Making, or the Secrets of Sinew Revealed. *Flintknapping Digest* 3(1): 10-12.

Experiments with sinew – says it shrinks 3%.

Baugh, Dick

1994 A Note on Indian Bow Making, or the Secrets of Sinew Revealed. *Bulletin of Primitive Technology* 7(1):68-69.

Experiments with sinew and sinew backings.

Baugh, Richard A.

1998 Atlatl Dynamics. *Lithic Technology* 23(1):31-41.

Video digitizer and mathematical model used to predict velocity of darts under given conditions. - horizontal force, wrist torque, mass of hand, radius of gyration, weight of dart, length of atlatl. Simpler model than Cotterell and Kamminga 1989. Hand-thrown dart has short lever action (hand+wrist) while atlatl is much longer lever. Conclusions: Atlatl length (between .3-.75m) has little effect on velocity, although optimum length was .45 m. Adding a weight to atlatl can increase velocity up to 2.7%, but if atlatl at optimum length, always loses velocity. Heavy darts do better with short atlatls. Hand thrown dart (2 different weights) has 62-75% kinetic energy of same thrown by atlatl. Flexible atlatl transfers more energy to dart - their atlatl stored ca. 6.9% of dart's kinetic energy - more flex would be even better. Dart flex contributes little energy to forward motion, is mostly vibrational, but important in getting straight throw despite curving motion of atlatl. [Are differences of 3-7% real or random? I am dubious about effects of both atlatl weights and flex, but he's right that dart flex at best adds little energy. I have trouble understanding his explanations of physics.]

Baugh, Dick

2001 Arrow Straightening. Bulletin of Primitive Technology 22:51-52.

Use of heat and grooved steatite shaft straightener.

Baugh, Richard A.

2002 The Tuning of Atlatl Darts. Bulletin of Primitive Technology 23:89-91.

Force is not applied in a straight line, so dart must flex. If end kicks up, dart is too limber, if down, too stiff. Test before fletching. The harder you throw, the stiffer the dart should be. Fairly wide range is acceptable; well-tuned dart works for hard to moderate throw but kicks down for easy toss. Periodicity of dart vibration must match distance/time of throw. Flex of atlatl has little effect on "tuning" and flex of atlatl or dart contributes almost no energy to throw.

Baugh, Dick

2002 Atlatl Flexibility Analysis Via Computer Modeling. accessed 7/02 on http://www.primitiveways.com/pt-atlatlflex.html.

"Extravagant claims made for increased dart velocity with flexible atlatl." Uses computer model to show that to get 11% increase in kinetic energy, need to deflect the tip of the atlatl ca. 10 cm. [Possible with some very flexible atlatls?]

Baugh, Richard A.

2003 Dynamics of Spear Throwing. American Journal of Physics 71 (4): 345-350.

Atlatl is a lever, operating principle is "Wrist torque applied to the length of the atlatl allows wrist rotation to increase the velocity of the dart." Simple computer model to predict velocity of dart, affected by mass of dart and length and mass of atlatl. Horizontal force and wrist torque versus hand position derived from video record of throws; two other variables are hand mass and hand radius of gyration. Some horizontal force applied by hand, but most force from wrist rotation of the lever arm formed by atlatl. Spear, ball and atlatl throws are all the same except for the length of this lever. Can model a flexible atlatl by inserting a massless spring in model between hook and dart.

Model results: Atlatl length for max velocity is shorter than most actual use, but this may be because model assumes that human effort is not affected by mass of atlatl, or

difference in velocity from atlatl length may be too small to be perceptible. [Length of lever does affect velocity, see e.g. Whittaker 2012, 2016]. Atlatl weights reduce velocity slightly, more as they are larger and further from hand. [His graph suggests up to 30% decrease in velocity with 120 gm wt at 80% of distance from hand.] Flexible atlatl should increase velocity. [But seems to have less effect than weights, maybe 12% increase. Also, his model does not take account of the dart flex, and he uses a range of spring models "representing actual practice" – but nowhere is there evidence that he actually measured atlatl flex.]

[I have a hard time evaluating the mathematical model, but we need more of this kind of work.]

Baugh, Richard A.

0 2012 Bow and Arrow Efficiency. Bulletin of Primitive Technology 43:35-41.

Modeling bows as various shapes of spring.

Baugh, Dick

2012 Fun with Cattails: The Whip Dart. Bulletin of Primitive Technology 43:62-64.

Flexible whip and string to throw simple dart.

Baugh, Dick 2017 Neanderthal Physics. owner\documents\atlatls\ Neandertal Physics-1-3-17

Informal thoughts on atlatl physics and misconceptions, especially penetration. Momentum vs kinetic energy: dart has more momentum than bullet, but will not penetrate a sheet of plywood. Expect kinetic energy to be better measure of penetration, but Ashby experiments with archery on animals suggests momentum. Resistance increases as velocity increases.

Baugh, Dick, Vittorio Brizzi, and Tim Baker

2006 Otzi's Bow. Bulletin of Primitive Technology 31:46-49.

Evaluating dimensions, flex of wood, draw length, string, Otzi's stature with computer to conclude that his bow is unfinished because would require draw of 150 lbs.

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Bawaya, Michael

O 2006 A Return to Prehistoric Hunting? American Archaeology 10 (1):11.

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Pennsylvania Game Commission recently gave prelim approval for atlatl deer hunting, await final decision April. Fogelman quoted on challenge, and "I wouldn't be confident I could get off a killing shot."

Beaglehole, J. C.

1963 *The Endeavour Journal of Joseph Banks, edited by J. C. Beaglehole*. Public Library of New South Wales.

p 132 August 1770: weapons always the same except maybe saw through glasses a bow and arrow on last day [probably not]. Otherwise, pike or lance 8-14' long, thrown short distances by hand and 40 or more yards with "instrument made for the purpose." Lances of cane or bulrush with hard wood point. War points of clustered sting-ray spines, hunting spears with simple wooden points. "Instrument with which they threw them was a plain stick of wood 2.5-3' in length, at one end of which was a small knob or hook and near the other a kind of cross piece to hinder it from slipping out of their hands. With this contrivance, simple as it is and ill fitted for the purpose, they threw the lances 40 or more yards with a swiftness and steadiness truly surprising; the knob being hookd into a small dent made in the top of the lance they held it over their shoulder and shaking it an instant as balancing threw it with the greatest ease imaginable." Hard reddish wood, flat, 2" broad, handle covered with thin polished bone. [crude sketch and description indicates N Australia Queensland type thrower with shell at handle].

Beard, D. C.

1983 *The American Boy's Handy Book: What to Do and How to Do It.* David R. Godine Publisher Inc, Jaffrey, NH. (reprint of original edition 1890, Charles Scribner's Sons, New York.)

p. 195 "Throw-Sticks" "The same race that invented the wonderful boomerang also originated the equally ingenious throw-stick..." [illustration and inadequate explanation. Also boomerang, whip-bow, bolas, fish spear, etc].

Beattie, Owen, B. Apland, E. W. Blake, J. A. Cosgrove, S. Gaunt, S. Greer, A. P. Mackie, J. E. Mackie, D. Straathof, V. Thorpe, and P. M. Troffe x 2000 The Kwaday Dan Ts'inchi Discovery from a Glacier in British Columbia. *Canadian Journal of Archaeology* 24 (1+2): 129-147.

"Long-ago person found" 1999 in glacier margin by hunters. Careful archaeological recovery [contrast to disgracefully botched Austrian Oetsi ice-man], but artifacts collected from wide area around body. Dates at least 2 events: clothes 1415-1445 cal AD, wooden artifacts post 1655. Assoc w body and same dates: 1. knife? wood handle w iron stain in leather pouch 2. basketry hat 3. hide/fur garment frags 4. disk bead 5. hide pouch – considered medicine pouch so not examined [sheesh!] 6. simple wooden dart, sapling 170 cm long, sharpened tip, dimpled prox [fletching not mentioned] 7. proj foreshaft, wood 125 cm, beveled one end, broken other.

Other artifacts: 8. sapling walking stick, 230 cm, near body but dates later 9. poss wood proj foreshaft 180 cm, notched and beveled end, distant, later date 1490-1665 cal AD 10. complete wooden implement sim to atlatl, or to netting or snare setting tool. Curved with hook at distal end, comes to flattened rounded point at prox end, 72 cm long, zig-zag décor and ochre staining. Distant, C14 gives several possible late date ranges from 1530

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to 1950. 11. dart or arrow shaft frags, 30 cm, late.

Bits of salmon, prob carried by man, also plant remains near by.

Ongoing DNA, parasitology, diet, skeletal etc studies not reportable yet. Male late teens early 20s, missing head except some hair, feet, R arm. No trauma or tattoos. Historically Athapaskan and Tlingit groups.

[Would be surprisingly late for atlatl gear, but doesn't sound right to me. Dates and actual associations are confusing - what really goes with the body? The "foreshafts" are too big, more likely shaft segments. What's the problem with the atlatl? If it's whole, you should be able to tell if it's an atlatl. Inexcusably, there are no photos of the wooden artifacts, and the description is feeble. Atlatls are not typical in ethnographic times in this area, and if dates and ID are right, this find makes at least two instances. Way too much info on the freezer and conservation details but not enough on the interesting issues. I attempted to communicate with the archaeologists ca 2005, and it appeared that the bullshit "sensitivity" about burial finds these days was holding up proper publication. As if a dead hunter cares whether other people see his gear! However, see Richards et al. 2007 - dates and isotopic analysis of the body were allowed, so perhaps we will someday see the artifact info.]

Beauchamp, Richard K.

1957 Light or Heavy Arrows? Archery, January 1957:6-7.

Bow must accelerate both arrow, and string + limbs of bow ("virtual mass of bow", typically 200-250 grains), so some energy lost to that. He then mathematically calculates velocity, energy [kinetic], and efficiency, to show that as arrow weight increases, velocity decreases but energy available for impact + penetration increases, as does efficiency of bow.

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Beck, Charlotte

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1995 Functional Attributes and the Differential Persistence of Great Basin Dart Forms. *Journal of California and Great Basin Anthropology* 17(2):222-243.

Corner-notched forms eg Elko occur earlier and last longer in E than W. Large sidenotched forms mostly occur where large corner-notched forms have long temporal distributions. Large stemmed forms probably = thrusting/knives, change to atlatl cornernotched forms ca 8500-7500 BP. Corner and side- notching appear same time, but corner eventually dominates, so perhaps more functional, carried on into arrow times, until very late side-notching resumed on arrow points. Costs vs benefits of diff forms, based on "design principles": dart pt should be sharp, symmetrical, impact resistant. CN/SN no diffs in material, manufacture cost, or width + sharpness (influencing penetration), or symmetry/balance. But SN more likely to break higher up point at notches, can't be resharpened, reducing use-life.

Beck, Charlotte, and George T. Jones

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2008 Archaic Times. In The Great Basin: People and Places in Ancient Times, Catherine

S. Fowler and Don D. Fowler, eds., pp. 44-53. School for Advanced Research Press, Santa Fe.

Summarizes the period in a readable, authoritative, and well-illustrated book of popular/professional archaeology. Archaic foragers, beginning 8500 BP, local diversification. New technologies: notched pts replaced stemmed Paleoarchaic points, more efficient hafting, usually break at notches leaving reworkable portion. Probably reflects introduction of atlatl. [Fig 6.3 is the somewhat innaccurate Driver drawing of atlatl use from Plog.] Atlatl "can deliver a stone-tipped spear with considerable accuracy and force over distances of 40-50 feet... effective tool against animals ... herded into places where they could be ambushed." Antelope traps, game drives, nets discussed. Projectile point types and chronology. Bow and arrow arrived 2000-1500 years ago, in Late Archaic, evidenced by Rosegate series proj pts (small corner-notched). Bettinger thinks easier individual hunting, led to more meat sharing.

Beck, Curt W.

1996 Comments on a Supposed Clovis "Mastic." *Journal of Archaeological Science* 23: 459-460.

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Tankersley's definitions of mastic, amber not correct. True amber does not melt. His tests not adequate to establish what the material on the Clovis point is. If it is not amber it doesn't serve as another shared trait between Up Pal and Clovis. [Some of the quibbles are silly, some good, but Beck also misses the point – was the resin adhesive on the point fresh or fossilized at time of use? Can we tell?]

Becker, Lou

1992 Atlatl Boar Hunt. The Atlatl 5(3):1-5.

Large darts - 160-195 gm, steel broadheads, > 1 m penetration in boar at 15-20 m.

Becker, Lou

1995 Atlatl and Primitive Self-Bow Boar Hunt 1995. The Atlatl 8(3):7-8

Hunt story, no lessons.

Becker, Lou

1995 Care and Feeding of Wooden Atlatl Darts. The Atlatl 8(2):1-2

Favors poplar, birch woods. Target = 117 gm, hunting = 259 gm, fletched with 3 or 4 feathers 6.5-7.5 inches long. Explains straightening darts by "stroking" with a hook.

Becker, Lou

1999 Let's Excercise those "Atlatl" Muscles. The Atlatl 12(1):4-5.

Simple excercises with spring cable set.

Becker, Lou

2001 Hunting Rough Fish with the Ancient Atlatl. *The Atlatl* 14(2):12-13.2002 Hunting Rough Fish with the Ancient Atlatl. *The Cast* Spring 2002:15-16.

Michigan carp fishing. Heavy dart (190 gm). Prefers banks and wading to boat.

Becker, Lou

2001 Atlatl Rough Fish Hunting Equipment. The Atlatl 14(3):10.

Prefers wood or fiberglass darts, hand held reel, gives instructions for making reel.

Becker, Lou o 2008 Chucking Darts at Woodchucks. *The Atlatl* 22(1):16-18.

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Tips on woodchuck behavior. Ranges around 15 yards, uses rigid wood atlatl and cane or wood darts with broadheads. Field dressing and pie recipe.

Bell, Robert E.

1962 Stone Bird Effigies from Ecuador. *Central States Archaeological Journal* 9(1):28-29.

Similar to birdstones, used as hooks on atlatls, related forms used as finger rests tied to handle. Birdstones in US could also be atlatl hooks.

Bellier, C. and P. Cattelain x

1989 Troisième Championnat International Rhénan de Tir au Propulseur. *Bulletin de la Société Préhistorique Française* 86(7):166-167, 194-195.

Competition organized by Stodiek at Cologne-Klettenberg, 5 women, 15 men participated. New distance record over last year's 101.5 m - now M. Schirren 140.6m, H. Eckard 132.6, P. Chauvaux 115.45 m. Accuracy best with long "sagaies" - Chauvaux, Pirotte, Cattelain, and Sonja Souvenir champs. Scientific value of such games: compare equipment, throwing styles, and test efficiency.

Bement, Leland C., Ernest L. Lundelius, and Richard A. Ketcham o 2005 Hoax or History: A Bison Skull with Embedded Calf Creek Projectile Point. *Plains Anthropologist* 50 (195): 221-226.

Amateur river find, Oklahoma. Tests include: CT scan, determining that bone flexed = fresh at impact. Shattered point can be reconstructed, damage consistent with impact. Biometric analysis of skull concludes *Bison antiquus occidentalis*, correct for Calf Crk period. C14 date on skull $5,120\pm125$ BP uncal agrees.

So CC pts not just knives, but atlatl dart pts (cites Hutchings velocity ideas).

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Benson, Elizabeth P.

1998 Moche art: Myth, History, and Rite. In. *The Spirit of Ancient Peru: Treasures from the Museo Arqueológico Rafael Larco Herrera*. Kathleen Berrin, ed. pp. 40-49. Thames and Hudson, London.

Benson, Elizabeth P.

2008 Iconography Meets Archaeology. In *The Art and Archaeology of the Moche: An Ancient Andean Society of the Peruvian North Coast*. Steve Bourget and Kimberly L. Jones, eds., pp. 1-21. University of Texas Press, Austin.

Archaeol now confirming artifacts, architecture, and rituals seen in iconography. E.g. mace as symbol; ritualized fighting but iconography often metonomy - "slings + spearthrowers shown but not used. This rather fits the pattern of other shorthand depictions. It probably should not be an argument against serious warfare.

Berenguer, Jose, Carole Sinclaire, Luis Cornejo, and Manuel Escobar elec

2009 *Pescadores de la Niebla: Los Changos y sus Ancestros.* (Fishers of the Fog: The Changos and their Ancestors). Museo Chileno de Arte Precolombino, Santiago, Chile.

[Exposition catalog, in Spanish, with English summaries and fine color photos.] Marine Gatherer phase along coast from 10,000 BP, followed by Early Fisherman stage, with hook appearing in 6th millenium BC, complex mummification in some areas (Chinchorro culture), beginnings of agriculture in some areas, many localized cultural variations. Late Fisherman stage, invention of raft, travel far on open ocean, agriculture. Photo of elaborate atlatl (*estólica*) of wood, [one-hole S. American type] with two faces decorated with copper mineral eyes, and a slot, 53 cm long, p23. Also bows, arrows, several depictions of foreshafts with harpoon, stone, and spine points [chronology unclear].

Berg, Robert S.

1995 A Wild Boar Hunt at Cold Brook: An Eolithic Adventure. *Chips* 7(3):4-5. 1996 A Wild Boar Hunt at Cold Brook: A Stone Age Adventure. *The Atlatl* 9(1):1-2

Same short account of killing boar with atlatl and dart.

Berg, Bob

2001 Aztec Atlatl Battle. Thunderbird Atlatl Webpage (http://www.thunderbirdatlatl.com/) accessed 10/11/01.

Rules for a team game.

Berg, Bob

2001 Benefits of Atlatl Weights. . Thunderbird Atlatl Webpage (http://www.thunderbirdatlatl.com/) accessed 10/11/01.

Flex of atlatl and dart has little effect because you can't get out more energy than you put in. Weights help accuracy only. Weight closer to distal end is less efficient.

Berg, Bob 0 2002 The Atlatl Hunt that Got Weird or Blunt Trauma. The Atlatl 15(2):12

Bob lent his atlatl, killed deer with a rock.

Berg, Bob 0 2002 Atlatl Long Shots and Primal Instinct. The Atlatl 15(1):8

Hunting fallow deer, two long shots, 40-55 yards. Doug Majorsky only wounded the deer because dart was too light $(3 \ 1/2 \text{ oz})$ and stone point too loose. Berg killed his, gear not specified [but presumably stone tip].

Berg, Bob 0 2003 Fishing with Atlatls and Harpoons. The Cast Spring 2003:15.

Carp and gar, using night lights, harpoon tips, line on darts. Photos of tackle and catch.

Berg, Bob 0 2004 Atlatl Hog Hunt on the Alapaha River. The Atlatl 17(2): 1-2.

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Killed hog at 12 yards [no other useful info].

Berg. Bob

2005 Bannerstones and How They Relate to the Atlatl. Electronic document, URL http://www.thunderbirdatlatl.com/newspost/arc5-2005.html accessed 1/20/08.

Part of a kit of tools used to make and repair atlatl darts - bannerstone is spindle weight to spin string and taper dart shafts. Experiments show it works - need cordage for whipping dart shafts and attach fletching. Used as flywheel on bowdrill arrangement to spin shaft while using abrasive in leather to round and smooth dart shaft. Bannerstones are designed to spin, and holes range from too large to too small for atlatl, and too heavy. [These last are unsupported assumptions and contradicted by other experiments, but the basic idea is reasonable and shows how replicative experiments + archaeological evidence can still remain equivocal].

Berg, Bob

х 2006 Benefits of Atlatl Weights. Electronic document, URL
http://www.thunderbirdatlatl.com/articles/ramble/bow.shtml accessed 1/20/08.

Flexing shaft and atlatl stores little energy. Weights add stability to cast.

Berg, Bob

2011 Atlatl Fever. DVD, Owego House Multimedia Productions.

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Gathering material: Georgia cane and ash wood harvest for darts.

Making atlatl: Basketmaker inspired form [finger loops, but large attached hook] of hickory with hand tools – draw knife and shaving bench, flint blade shaver. Grinding antler hook with crushed flint abrasive. Attach with hide glue and hemp. Straightening cane with heat. Makes simple stone point with copper bopper + pressure finish. Fletching and hafting, gelatin glue. Twists flax fiber to make thread for hafting. Fletching [best demo], hafts pt directly on shaft with hide glue + fiber, resin over to protect glue [a bit crude and many steps].

Hammers conical copper point from sheet copper.

Casting: atlatl works because lengthens your arm so you can push for a longer time against the dart [not quite right]. Slow motion shows dart flex [and rotation].

Selecting an atlatl – Bob displays his different models. Prefers hammer grip, Wyalusing model, but has interesting range of types. Building one of his kits with a group of kids watching – demonstrates fletching again and repeats some other.

[Overall, good material – Bob is a good craftsman, demos all clear though some more useful than others, and beginner should have no trouble adapting and varying. Just for interest, I would have liked to see more about his commercial production processes.]

Berger, Billy

2009 The Art of Making Primitive Arrows. Primitive Archer 17(2):16-22.

Good tips apply to atlatl darts too.

Berger, Billy

2009 The Lethality of the Primitive Bow. Primitive Archer 17(5):30-35.

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Defends accuracy, power and effectiveness of primitive bow and stone tipped arrows, lots of annecdotes of successful hunts.

Berger, Billy

2011 How to Make Pine Sap Glue. Primitive Archer 19(2):48-53.

Tips for hafting stone arrow points with sap and sinew.

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Berger, Billy

2011 How to Remove Sinew from a Deer. Primitive Archer 19(5):32-39.

Berger, Billy o

2012 From Humble Beginnings to Hollywood. Primitive Archer 20(5):28-31.

Being selected as part of a "reality" show on Discovery Channel's "Curiosity" series: *I*, *Caveman*. Ten people dressed only in hides, live in CO wilderness, subsist off what they can hunt and collect. Always hungry, low on calories. BB knaps. No bows allowed, use atlatl (photo shows BB in outfit with atlatl). Apparently hunted elk with atlatl, but can't reveal show yet. Photo of bloody point "made by knapper Greg Nunn and used to hunt elk."

Berger, Billy o 2012 Insights of a Modern Day Caveman. *Primitive Archer* 20(6):34-41.

Experience of reality show *I*, *Caveman*. [Lots of romanticized musings about how close to primitive life he got, but must have been great adventure.] The group killed an elk with atlatl and stone tipped spears, apparently a hit in neck at about 30 yards. Butchered with stone tools. Claims "first big game kill made with Paleolithic atlatls and stone tipped spears in modern times." [No detail on equipment, but photos of group show basic atlatl with finger loops and attached hook.]

Berger, Billy

2014 The Favell Museum. Primitive Archer 22(4):58-63.

Oregon. Nicholarsen Cave foreshafts and other finds. Many lithics, obsidian dance blades, modern knappers.

Berger, Billy

2016 Making a prehistoric Anasazi arrow. Primitive Archer 24(1):16-21.

Bergman, Christopher A. and Edward McEwen

1997 Sinew-reinforced and composite bows: Technology, function, and social implications. In *Projectile Technology*. H. Knecht, ed., pp. 143-160. Plenum Press: NY.

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Summarizes bow types; discusses technology and manufacture and mechanics of composite bows, as still made in Mongolia.

Bergman, C. A., E. McEwen, and R. Miller

1988 Experimental Archery: Projectile Velocities and Comparison of Bow Performances. *Antiquity* 62 (237): 658-670.

Bow developed end of Upper Paleolithic, earliest examples are Mesolithic, earliest composit bows 3rd millennium BC in Asia. Experimental bow comparisons should use correct reproductions of old bows and arrows proper to each bow. Velocity is used as measure of comparison.

Arrow velocities achieved were 30-60 mps from a variety of self and composite bows. Compared to 195 gm, 152 cm dart thrown with replica Basketmaker atlatl at 23 mps. [= 75.5 fps or 51.4 mph – within my range, though dart was so heavy].

Berndt, Ronald, editor

1964 Australian Aboriginal Art Ronald Berndt, pp. 44-59. The Macmillan Company, New York.

Includes pictures of spearthrowers, see Strehlow 1964, plate of pictograph hunter attacking x-ray style kangaroo with odd-looking spear thrower, plate of incised Central and Western art including spearthrower, plate of spears and painted flat lathe spearthrowers from Arnhem Land (Groote Eylandt and Yirrkalla).

Berndt, R. M. and C. Berndt

1970 Man, Land, and Myth in North Australia: the Gunwinggu People. East Lansing: Michigan State University Press.

Creation myth: "Ngalgulerg (a mythical woman) gave us women the digging stick and the basket we hang from our foreheads, and Gulubar Kangaroo gave men the spear-thrower." [Not a smart move by the Kangaroo! But presumably it represents Kangaroo giving self as human food.]

Best, Anne

2003 Regional Variation in the Material Culture of Hunter Gatherers: Social and Ecological Approaches to Ethnographic Objects from Queensland, Australia. BAR International Series 1149.

Objects collected 1849-1914 from Queensland (N penninsula of Aust) examined to see if stylistic variation within Q forms regional patterns by drainage or valley system. Uses Bags/baskets, Message Sticks, Boomerangs, Shields, Spears (N = 202), and Spear-Throwers (161).

Lots of generally useful summary of theory - style, hunter-gatherers, use of museum collections. Style of artifacts expected to convey social information, localized by social group with some environmental input [from available material and function, both of which she considers partly stylistic]. Social info conveyed at many levels of complexity and audience. Rock art as supporting evidence.

Spears: mostly 2-part: light wood for proximal piece [main shaft?] and hard for distal point end. Variety of barbs and prongs used.. N Qnslnd usually with thrower, hollowed prox end. Hunting and combat. Photos of making barbs, throwing 4-prong spear w thrower. Distribution mostly considered in terms of point types.

Spearthrower or wommera: Act as extension of human arm. Eyre (1845:305) observed 30-100 yd throw with thrower, 30-40 by hand. Cape York broad bladed throwers used as spear guard during combat. Cundy argues much variation from technol - light high velocity spear or heavy slower combined with proper throwers. Boomerang and straigh-

lath forms used in short range exchange in Cape York and Rainforest regions, leaf-shaped form exchanged in extreme W and shell-handled forms part of long down the line trade from Gulf coast inland. Some areas prefer hand thrown spear - throwers lacking in E Coast and Riverine [SE] areas, most plentiful Cape York [penninsula].

Defines 7 types: 1. straight lath with no handle, 2. straight lath with handle of shell or wood, 3. slight paddle shape, 4. paddle shape with handle, 5. boomerang shape [all these are variants of Queensland type with shaft edge up, large attached vertical peg hook, and often shell handle], 6. leaf shape with adze [W or Central Aust type woomera], and 7. cylindrical shape [stick with hook, one with hair tassel, Mornington Island type].

Distribs: 1 - S central parts; 2 - more N, E Cape York with wood handles, W side and Gulf with baler Melo shell. 3 - paddle shape unique to Cape York, mostly Gulf side (W). 4 - slight paddle shape, never w wood handles, all CY and mostly Gulf. 5 - boomerang form S part of CY and Rainforest area, along E coast. Some are >70 cm long. 6 - all 8 specimens from extreme S = social contacts, Roth says 4 uses: wommera, pituri plate, spear pt sharpener [adze], and sword. 7- extreme W of Gulf - Mornington Island and adjacent mainland at Burketown.

Roth says of 5 - used for fish and other close range game, held different from all other wommeras with blade between thumb and first finger instead of between 1 + 2 fingers. E Coast and Riverine [S E] parts of Qland lack throwers.

[There are simple drawings of artifact types, and nice historical photos of people with them, but disappointingly, no detail photos of artifact specimens, so much of the variation she discusses is poorly illustrated.]

Bettinger, Robert

o,p

2013 Effects of the Bow on Social Organization in Western North America. *Evolutionary Anthropology* 22(3): 118-123.

Bow's advantages can lead to larger group formation through competition, or in opposite direction to smaller, simpler, more flexible social forms.

Quantifying accuracy of bow vs atlatl: uses Herschel algorithm to calculate errors of aim for archers - the distance from center within which 50% of shots will hit. Uses early 1916 archery scores with self-bows at 50 yds for top 5 competitors, comp to 2003 ISAC scores top 5 competitors. [His math is somewhat opaque to me] but the derived coefficients show bow hits targets 1/3 smaller at a given distance, or target of given size at half again as far. Bow increase in reliability increases with distance, or with smaller target. Bow is also faster to shoot and less motion to scare game.

Bettinger, Robert L. and Jelmer Eerkens

1999 Point Typologies, Cultural Transmission, and the Spread of Bow-and-Arrow Technology in the Prehistoric Great Basin. *American Antiquity* 64(2):231-242.

Great Basin transition to small points (= bow and arrow) ca. 1350 B.P.

Two areas anomalous: 1) central NV lots light pts that should be darts - probably because of resharpening limited material. 2) E. CA light pts with base/neck too wide for arrow.

Suggests different modes of transmission: 1 = "indirect bias" copy whole complex at once, vs 2 = "guided variation" more individualistic copying with experimentation, perhaps because of less contact between cultures.

Bettinger, Robert L., Bruce Winterhalder, and Richard McElreath x

2006 A Simple Model of Technological Intensification. *Journal of Archaeological Science* 33:538-545.

[Mathematical economic models.] Ugan, Bright, and Rogers "tech investment model": as increased time is devoted to a subsistence activity, it pays more to invest more in technologies that increase rate of return. Complications: more input produces decreased rate of improvement, thus more expensive tool value only greater than crude version as used more. But if change to different tool, different rules - each functional category [dif tool] has its own cost-benefit curve, they are not continuous within a subsistence domain. E.g. changing form of fishhook is not same as changing to net. Different forms of a technology may co-exist if used by diff subpopulations with differing needs or costs. Local change should be progressive improvements to point of new technology; imports in contrast should truncate refinement of earlier tech, and be notably superior. E.g. CA weapon technology: bow replaced atlatl after 600 AD. At contact, 2 bow forms: simple cheap self bow for small game + play; expensive but more effective sinew-backed bow for large game, war. With intro of guns, backed bow lost, self bow retained. Modeling atlatl/bow coexistence: outcompeted by backed bow, to co-exist with self bow, atlatl should be more costly, produce higher returns - unlikely. Could coexist w sinew backed bow if atlatl replaced self bow uses, low cost, e.g. in Arctic bird hunting.

Betts, Colin

2005 Opochtli's Challenge Atlatl Meet. Iowa Archeology News 55 (3+4): 12.

Reports his event.

Beyer, Hermann

X

1934 The New Atlatl, Found in Italy, a Falsification. *American Anthropologist* 36 (4): 632-633.

Claims Callegari's atlatl in Rome (1934) is copy of specimen in Florence, with added finger loops copied from British Museum specimen.

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Beyer, Hermann

1965 (originally 1926) Sobre una Representacion del Dios Mixcoatl en el Atlatl Mexicano del Museo Britanico. In *Mito y Symbolismo del Mexico Antiguo*, vol 10. Pp. 326-329.

"Concerning a representation of the god Mixcoatl on the British Musem Atlatl." Strebel thinks it's Xipe, because of his cap with strips and crown of zapote leaves [clearly feathers to me + Beyer], but no - lacks human skin cape and swallow tails. Gilded, so no color symbols to help, but surely ID as Mixcoatl, god of the hunter tribes of Chichimec in the N deserts, often depicted in "savage nudity". Here shown with penis adorned with paper strips, as in comparable Mixcoatl from Vatican B Codex. Parallel lines on legs, arm, and belly connect to Milky Way or light of dawn and dusk. Ear ornaments of deer hooves [can't tell] ID as hunter, bifurcated eagle wing feather in headdress. Partly entwined with serpent, ref to name "Cloud Serpent". The spear or arrow from his mouth is probably just an accident or lack of space [Doubt it!]but other Mixcoatl images hold one in hand [and so do other gods]. The plumes above the arm just fill space. He has a fang in mouth as other gods often do. Oval object probably shield with 2 arrows that go with it. [see Diaz + Rogers 1993 Plate 25 for a very similar depiction of Mixcoatl in Codex Borgia, holding an atlatl, much clearer than the one Beyer uses]

Bill, J. H. x

1862 Notes on Arrow Wounds. *The American Journal of the Medical Sciences* 40(88):365-387.

Arrow wounds will be less common as "our Indian tribes are being fast exterminated." But still common, and "in skilfull and desperate hands the wound which it inflicts is attended with a fatality greater than that produced by any other weapon…" Construction of arrows [generalized and odd]: dogwood limbs, straightened by twisting, soft hoop iron head held in by tendon. [Oddly, no mention of stone points.] The wet tendon loosens in the wound, leaving the head. If lodged in bone, requires great force to remove. Poison by having snake bite liver, letting it putrify. But knows no instance of human wounded by poison. Table of body part wounded and fatality rates. Wounds to abdomen + chest most likely to be fatal. Expert bowman can dischard 6 arrows per minute and "a man wounded with one arrow, is almost sure to receive several arrows". If arrow passes through without injuring organs, most will heal "by first intention," cleaning wound if pus forms [no effective antiseptic]. Most wounds must be enlarged to find and extract head [remember this is without modern anesthetic, though morphia and laudanum were used], inserting fingers and forceps. Lengthy discussion of cases, wounds in different body parts, treatments, including such things as "I bled him until he fainted."

Billo, Evelyn, Robert Mark, and John Greer

x

2011 Hunters Shelter and White Oaks Spring Pictographs: Pecos Miniature Art in the Guadalupe Mountains of Southern New Mexico. *American Indian Rock Art* 37:49-74.

Late Archaic, related to Red Linear Style of Lower Pecos in TX, lump as Pecos Miniature Art, prob between AD 1-1000. Hunter Shelter, 4x4m, high on escarpment, limestone. Deer butchering scene, 7 humans have laid aside probable atlatl + 2 dart sets. [Atlatls have hook one end, cross stick other, some have more elaborate décor with 'bush' at hook and forked at grip w possible single loop, but not opposed loops as on BM depictions. Darts are just lines, less than 2x atlatl length.] Rabbit hunt scene: lines of humans carrying curved clubs, pair of dogs, small quadrups = rabbits, 2 cross hatched nets. Similar at White Oaks Spring (small shelter, deeper in mts, stream bottom near water) – both rabbit hunt and deer butchery scenes. Red Linear Style does not show bow and arrow, thought to have entered Lower Pecos region AD500-1000 – RLS prob those dates, Terminal Archaic, Ensor-Guadalupe dart pt period, but there are small forms prob representing arrow points.

Bingham, Paul M.

2000 Human Evolution and Human History: A Complete Theory. *Evolutionary Anthropology* 9(6):248-257.

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The "inevitable logic of death from a distance:" humans can throw, which means that a group can enforce its self-interest, and interest of individuals in it, at low risk to any member, because many can attack one "cheater" without direct combat - "coalitional enforcement." This overcomes the tendency of all animals to compete with members of the same species who are not genetically related. As a result, language, ethics, brain size etc all possible. Historically, increasingly effective distance weapons make possible larger social groups. "Primary coalition" is about 150 people who can all monitor/enforce each other. These operate on same principles as individuals - grouping into 2ndary coalitions etc, as a function of how well they can enforce will of larger unit on its subunits. Example: change from atlatl to bow and arrow in N. America allowed complexity and large populations. [Suffers from the weaknesses of all single-cause, overgeneralized theories – many specifics don't really fit all that well.]

Bingham, Paul M., and Joanne Souza

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2009 Death from a Distance and the Birth of a Humane Universe: Human Evolution, Behavior, History, and Your Future. Self published, <u>www.booksurge.com</u>

[Huge (685 pages) sprawling tract expounding the authors' theories and applying them to everything, from early human evolution to current politics, predictions and prescriptions for keeping the world safe for democracy. Some reads like science, some reads like a slightly deranged political manifesto with masses of relevant and irrelevant factoids, quotations, and side-bars in support. Large sections of basic background explaining e.g. genetics, hominid family tree, etc, interupt the train of thought. The basic idea is interesting, but the sloppy selective use of data, ignoring nuances and contradictions and ambiguities and poor evidence so that the theory can be "confirmed" is continually irritating.]

Death from a distance explained p.110: five "proximal killers" i.e. lions all attack one opponent, absorb 1/5 of the 'return fire' each but get in each others way, only one is really attacking at a time. 5 "remote killers" i.e. with guns, also absorb 1/5 of return fire, but because each is independent, all attack at once, and it only takes them 1/5 of the time to subdue the opponent, so their effect is squared - opponent in same 1/5 amount of time gets 5X as much damage. P. 112: "Humans are first animals to be able to kill adult conspecifics remotely. Everything else about us is simply a consequence of this single fact." Throwing is the unique human skill. Thus individuals can band together to coerce others at low cost to themselves, allowing all human cooperation. *E.g.* a large baboon's best strategy is to keep all good food, because it is too costly for any other individual to fight him for it. Large hominid's best strategy is to share, because others can join to stone him and chase him away at relatively low cost to any one of them. Long gestation, long childhood and learning in protective social group, non-kin co-op allowed by throwing, large brain, bipedality, all work together.

Manuports (throwing stones), prey, stone tools occur with early Australopiths before the brain expansion enabled by social possibilities of throwing. P 182, throwing motion described, velocity in excess of 90 mph [only for a very few humans!] Anatomical evolution allows, shown by fossil skeletons - *Homo* pelvis, arms, legs, different from australopiths. He emphasizes among anatomical 'redesign' adaptations the *gluteus maximus* muscle, more important for violent body motion in throwing than for walking [an exaggeration, and hand/arm is much more important.] Dmanisi finds support - earliest *Homo* in Europe, at beginning of expansion allowed by new throwing adaptation - still small brained, but body more *Homo*, assoc with lots manuport throwing stones + prey bones = power scavenging + hunting.

Communication and language arises as part of this - several long chapters on language, sex, evolution. Finally, Chapter 11: anatomically modern humans dominate by virtue of new weapon, the spear thrower. As predicted, period of low efficiency where evidence of the weapon is main sign of "behavioral modernity." Then they improved it, allowing larger scale of social cooperation and thus rapid development and spread of modern humans. Atlatl "bolt" [why doesn't he read current literature and use accepted terms? "Bolt' is for crossbow, and very different from atlatl darts.] is faster and sharp more distance, more penetrating damage. Greater distance allows more people to participate in coercion, thus larger social group. Fig 11.2 shows a throw, atlatl hook, "bolt" socket, odd diagram of throw, 2 Berg-type atlatls, and point outlines to show that atlatl 'bolt' points are much smaller than thrusting spear and larger than arrow points [but all of this is overgeneralized and inaccurate]. Shea (2006) says atlatl developed 50,000 BP in E Africa/Mid East pops, at point of explosion of modern humanity. [Throughout, B+S pretend that their ideas "predict" such finds, and thus are independently "tested." They ignore the imprecision of dates and other problems with the data too, so they can claim atlatl was invented "just before" modern expansion.] Cruder, earlier [Levallois] points 100,000 BP represent first crude invention of atlatl for dangerous game, soon applied to human coercion, then refined at 50kya.

P 365 - new weapon, bow, allows new scale of society. "Each Neolithic revolution must follow the local introduction of a new weapon." Bow invented 12,000 BC around SE Mediterranean basin, New World 100-600 AD, maybe independent invention. So Neo changes should be 10000 yrs different. Bow differs from atlatl - more accurate, much easier to become proficient. "We have confirmed the properties of these weapons through extensive personal experimentation." [Huh. Not by the evidence of the illustrations, use of terms, and discussions here. But they are right about the difference.] So atlatl too expensive in learning time to maintain coercive skill, though you might practice before a group comes together, hoping to use it before skill deteriorates, but to participate in coercion with a bow requires little practice. [This is the kind of silly reasoning that spoils

this book throughout.] And with the bow, you can now spend time to develop agriculture, storage, etc, and defend your produce. Bows produced the Natufian in Mid East and Mesolithic in Europe, large settled populations that could then develop agriculture. Europe has problems with data loss but New World has late bow and agriculture earlier, but no Neolithic revolution until bow added to agric. P. 376 - Bow arrival is easy to date [side bar on dendrochronology, claims incorrectly that "dating is done using diagnostic stone arrow point types co-buried with datable wood."] And "N. Am. arrowheads are so consistently and dramatically different in size than atlatl dart points that they are easily recognized." [gives crude outline drawings as evidence, but this is also over-generalized].

Bow in SW, 400-500 AD arrival. Non-sedentary pithouse dwelling Basketmakers with simple agriculture, within 100 yrs of bow introduction suddenly become BMIII with large sedentary villages, beginnings of Pueblo culture, leading to Chaco Canyon culture. [As usual a gross oversimplification, extending the change period several hundred years to include Chaco as a result of bow revolution.] Same model for coast, Plains, Cahokia. [The general model is interesting, but it is hard to respect a work where the authors are so blinded by the general model that all nuances, variation, and contradiction in the evidence is brushed aside.]

Bingham, Paul and Joanne Souza x

n.d. 2013 Social Coercion Theory and New Opportunities for Archaeological/ Anthropological Insight. *Evolutionary Anthropology*, in press.

[reviewed for journal 1/13] Explanation of their social coercion theory [but needed clarification] and application to N. Am. prehistory - the adoption of the bow allowed groups to enforce "law" on larger numbers than previous atlatl using societies, and thus groups grew in size, allowing more productive agriculture, protecting stored food, thus again increasing group size and complexity, perhaps also promoting warfare which also promotes complexity or evidence of its effects such as fortifications. [I find problems with the general theory: like sociobiology it provokes interesting analyses, but it is easy to create an explanation for cultural change that follows the theory and is difficult to falsify because so many variables are unknown or poorly defined. Slippery use of imprecise dates make it easier to fit the model to circumstances. Here, many other things than bows are happening to these societies - we rarely know enough details of subsistence, society, meaning systems, and even chronology. And of course not all bows are equally effective.]

Bingham, Paul and Joanne Souza

2013 Theory Testing in Prehistoric North America: Fruits of One of the World's Great Archaeological Natural Laboratories. *Evolutionary Anthropology* 22(3):145-153.

[This is what n.d. above apparently became.] Only 'exogamous' causes likely to effect social change; 'endogamous' things like belief systems are effects, not causes, shown by wide similarities in adaptive systems. Coercive technologies are universal and decisive variable. So arrival of elite bow tech across N. Am. 'is predicted to produce increases in

social complexity as result of bow's superiority in projection of coercive violence' compared to atlatl. 'Warfare theory' - effect results from increased inter-group violence which selects for increased complexity for better military organization. 'Social Coercion theory' - results from improved intra-group 'law enforcement' allowing increased scale of social cooperation and intensification. War as secondary effect. [So actually it's hard to distinguish the two].

Walde and Bettinger article suggest bow slow to be adopted, and bow allowing dispersal and individualization - challenges. Answer: 'front-loaded' resources i.e. grain, fish, requiring much work before storage vs 'back-loaded' i.e. wild resources immediately consumed or stored without processing (acorns). FL requires protection, bow can do, increase pop. BL can only increase territory with larger pop, not density, so no increase in social scale. Prehistoric 'money' is ultimate FL. Only works if non-counterfeitable = shell [nonsense, not that hard to make, even where used as currency, which is why it is not a true money with arbitrary fixed value]. Predict bow allows expansion of currency economy by protecting property and enforcing law, so only happens *after* bow, supporting Social Coercion theory (Blitz and Porth).

[They go on to argue that SC theory or Warfare theory supported in almost all the areas in the articles. But in all cases, dates are not really precise enough about what happens before/after bow, how long changes take. In all cases, other things are happening, as they show by trying to explain both centralization and individualization after the bow by ref to subsistence types. They constantly emphasize that their hypotheses are 'falsifiable' but they are actually so malleable that almost any circumstance can be explained in either SC or W terms, so often in 'falsifying' one, they find support for the other.]

Hohokam case - front-loaded agric long before bow, could falsify SCT. But alternative: other weapon: advanced body armor effective against bow creates shock-weapon elite military 'police' e.g. Mesoamerica. Hohokam had cotton, suitable for such armor, and MesoAm contacts. Predict: evidence of elite cotton body armor will be found at time of first agric intensification, and also shock weapons (sword, mace, club). Such armor conspicuous in Mesoam, why not in N Am? Maybe not right kind of cotton. [All this is just story-telling speculation without evidence].

Bingham, Paul, Joanne Souza, and John H. Blitz x, o, p

2013 Introduction: Social Complexity and the Bow in the Prehistoric North American Record. *Evolutionary Anthropology* 22(3):81-88.

[reviewed 1/13, intro for thematic volume on introduction of bows seen through social coercion theory. See above. Here differences in bows are clearly recognized in some instances, as they refer to "advanced bow technology" and the need for bow to be substantially better than atlatl before it can outcompete them. They also attempt to introduce the bad term atlatl "bolt" instead of dart.]

"North American Neolithic Transition" = increase in social complexity (assoc with bow). Not climate change - Neo in N Am much later than in Old World. Not population growth - too different, effect rather than cause. Not ritual, nor adaptive know-how - not shared across continent. Uniquely human scale of non-kin cooperation allowed by evolution of throwing, reducing individual costs of 'law enforcement' (coercion). Bow is later version, increases scale of coercion possible, thus increases scale of adaptive complexity. Bow is 3x better than atlatl, so expect a 3x increase in local social cooperation [no logical reason for this math!] Coercion theory sees war as an effect of new technology - initial decrease as larger coalitions (populations) allowed by bow intensify productivity, but later increase in warfare as reach max social size, fission, and separate individual territories, need to raid.

Empirical falsification possible: N Am Neo social complexity increases should correlate in time with local arrival of 'elite bow technol' [how tightly? - loose dates allow easy 'confirmation']

Bindon, P., Raynal, J.P., and Sonneville-Bordes, D. x

1987 Sagaies en bois d'Australie occidentale: fabrication, fixation, fonctions. [Wooden Spear Points from Western Australia : Manufacture, Attachment, Functions.] In *Le Main et l'Outil: Manches et emmanchements préhistoriques*. D. Stordeur ed., pp 103-116. Lyon: Maison de l'Orient.

Small beveled wooden points currently made in Wiluna area can be either spear barbs or spear-thrower hooks on Western Desert woomera type atlatl, and resemble bone points from Upper Paleolithic Europe.

Bird, Douglas, and Rebecca Bliege Bird

2000 The Ethnoarchaeology of Juvenile Foragers: Shellfishing Strategies among Meriam Children. *Journal of Anthropological Archaeology* 19:461-476.

Children usually assumed to have little effect on subsistence and thus on arch record. Long juvenile period necessary to learn skills.

Children feed selves but select different shellfish from adults, learn from other children. They collect lower quality resources partly because slower, so encounter fewer of the high quality. They transport more home before processing, increasing presence of lowranked resources in site.

Bird, Douglas, and Rebecca Bliege Bird

2005 Martu Children's Hunting Strategies in the Western Desert, Australia. In *Hunter-Gatherer Childhoods: Evolutionary, Developmental and Cultural Perspectives*, edited by Barry S. Hewlett and Michael E. Lamb, pp. 129-146. New Brunswick, Transaction Publishers.

Children age 5-14 hunt goanna (burrowing lizards) in rocky patches with digging sticks, in preference to different goannas hunted by adults in sand fields. Size affects success more than age/experience, probably because speed of walking increases number of encounters (ca 1.5/hr). [Western Desert, but no info on any use of woomera by child or adult].

X

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Bird, George

1985 The Atl-atl or Spear Throwing Stick. *The Artifact* 23(3):7-18. El Paso Archaeological Society.

Personal meanings of atlatl, describes basic manufacture, woods, finds no difference with weights, likes short dart 2x as long as atlatl [Over simple and impressionistic, nothing new, but ok]

Bird, Junius

1951 South American Radiocarbon Dates. In *Radiocarbon Dating: A Report on the Program to Aid in the Development of the Method of Dating*. F. Johnson, ed. Memoirs of the Society for American Archaeology 8:37-49.

Suggests dates on Nazca atl material [see Johnson 1985] differ because darts may be younger wood than the atlatl.

Birkett, Courtney

1999 Lengths Not To Go To in Atlatls. The Atlatl 12(1):3.

Reports her experiment with different lengths of atlatl: thrown distance increases with longer atlatl, but beyond 2.5' gets too clumsy.

Birkett, Courtney [incorrectly printed as Margie Takoch] o 2016 Review: The Mammoth Stone by Margaret Allan (pseudonym of William Thomas Quick) Signet: New York, 1993. *The Atlatl* 29(2):5-7.

Poorly written fiction, many errors, though supposedly set in Meadocroft time and place.

Birkett, Courtney

2017 Flying with Darts. The Atlatl 30(1):1-2.

Bittmann, Bente, and Juan R. Munizaga

1984 Comments on a Double Mummy Containing a Spear Thrower, in the "Anke Nielsen Collection", Iquique, Northern Chile. *Indiana* 9:383-419. (Berlin)

Chinchorro Culture, Late Archaic, 5000-1000 BC, coastal, non-agric, aceramic, harpoon + spear throwers, also possibly earliest evidence of bow in Americas, like atlatls, some in prepared mummy burials, but Chinchorro mummy dates are unclear and probably span a long time. Other C traits include trepanation, elaborate prep of mummies, figurines, and skull form.

From site of Patillos, double infant mummy wrapped in cloth + leather, atlatl between as stiffener, maybe symbolic or not.

Atlatl = 51.7 cm, wood, grooved, hook separate and missing, single notch and finger loop on one side of handle only. [Photo details obscure, also a figure of simple drawings to

accompany typology/distribution discussion] [If the figures are correct, the loop and notch on this form is on the L when in action, so must be for the thumb, not index finger]. Long comparative descriptions of other atlatls and locations mostly in Chile. Uhle 1919 spearthrower from Arica is similar. Munizaga (1964) has another from "Morro of Arica" Chinchorro period with flat ungrooved shaft, attached hook, hole in shaft that could be for a single thumb strap.Bird (1942) at Quiani has 2 atlatls, one like Chinchorro, second like my "Peruvian" form. Rivera (1975) has one from Alto Ramirez with flat shaft, integral hook, and peg across grip. Uhle (1907) defined 2 types S Am atlatls, but [better] 1917 defined 3 types: 1. stick with handle of leather for inserting finger [= my Chinchorro type], 2. Hole in board or shaft for finger [= my Amazonian type], and 3. Hook instead of handle or hole at proximal end [= my Peruvian type]. At least C + P are early, poss A also. Casanova (1944) thinks C type earlier than P type, but our evidence doesn't support this. Montandon (1934) classifies by hook into male, female and androgynous, which doesn't work well here [or anywhere else – I dislike this system and don't use it]. Metraux (1949) says all S Am are 'male' and only differ in other minor details but gives 3 types: 1. [my Peruvian] 2. [my Amazonian, Krause 1905 calls them Brazilian, and 3. like ethnographic Tapuya [incoherent description].

No Spanish ethnohistoric documents of spearthrowers in N Chile, rare in Peru in Inca period, maybe ethnog Picunches in Central Chile.

[What I take from this is that my 3 types are pretty useful, widely distributed, but chronology uncertain.]

Black, Mary S.

X

2013 Throwing Spears with Gary Nolf. Electronic document, blog at marysblack.wordpress.com, URL: <u>http://marysblack.wordpress.com</u>; accessed July 26, 2013.

Blog, MSB writes 'historical fiction and mystery.' Interviews Nolf, pres of WAA. [Good, basic.]

Blackburn, Fred M., and Ray A. Williamson

1997 *Cowboys and Cave Dwellers: Basketmaker Archaeology in Utah's Grand Gulch.* School of American Research Press, Santa Fe.

Nice book, mostly history of research, rather than analysis of archaeology. Includes material on "Rediscovering Wetherill's Cave 7" the site where Basketmaker culture was first recognized as something different from "cliff dweller" of the later pueblo type, and where evidence of massacre was found in burials. Excellent photos of artifacts, including atlatl from Middle American Research Institute (127), and 'chert knife blade about 5 inches long found lodged between the ribs of a BM skeleton in Cave 7 by members of the 1893 Hyde Exploring Expedition (142). [Despite size, context suggests it was a dart pt, not a knife.]

Blair, J. Allan x

1977 Banner Stones or Spinning Stones? Arch Notes 77(7):37-39.

Durable + small, so not banners, mass too far from center line + hole too narrow, so not atlatl weights. But works as flywheel on spindle.

Blair, Michael

2001 Applying Age-Old Physics. The Science Teacher 68 (9): 32-37.

Uses atlatl, trebuchet, and fire-plow to teach physics. Compares force of hand-thrown and atlatl spears, gives formula.

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Blitz, John H.

1988 Adoption of the Bow in Prehistoric North America. *North American Archaeologist* 9(2):123-145.

Reviews regional evidence: Arctic by 3000 B.C. (microblades and small pts); Subarctic 500-600 AD (small bifacial pts); Plains N by 200 AD, WY by 500 AD, S Plains after 500 AD (small notched pts); Great Basin reduction in pt size AD 1-500, small triangular pts (Desert Side Notched and Cottonwood Triangular) appear 800-1200, if Rosegate series are arrow pts, then bow ca. 200 AD, with probable overlap with atlatl; NW and CA after 500 AD (shift to small pts); Southwest "unambiguous" replacement in Basketmaker III 575-750 AD; NE Woodland triangular Levanna pts 600-700 AD; MidW and SE sudden appearance small triangular pts ca 700 AD.

Patterns: 1. Small points are the only widely useful archaeological criteria. 2. Spread was N to S and rapid so diffusion is indicated as well as migration. 3. Long stasis in Arctic, quick spread further S. 4. Beginning 200 AD, intensifying after 500 AD is trend to small pts. When small and large pts coexist (Gt Basin), there is also other evidence for atlatl. When sudden shift to small pts (SW, Plains, MidW, SE) atlatl rapidly disappears from record.

Atlatl best for water-based hunting, but bow better accuracy, range, more efficient. But no evidence of major change in hunting pattern or success with bow. Bow might enhance individual hunt success and thus individual prestige, or better warfare, allowing intergroup competition and expansion. Some evidence of warfare increases after bow bodies with points, defensive structures.

Bow spread across ecological boundaries as result of its "contagious competitive advantage in intergroup conflict."

Blitz, John H., and Eric S. Porth o,p

2013 Social Complexity and the Bow in the Eastern Woodlands. *Evolutionary Anthropology* 22(3):89-95.

Reduction in point size = arrival of bow ca 300-400 AD in E Woodlands, "initiated a causal chain of cultural changes." In midW, bow + agric > decline of Hopewell culture by conferring household autonomy and dispersal, which first suppressed social

complexity, later created conditions of maize intensification. In Lower SE, agric unimportant, pops concentrated at wild food sources, bow did not lead to household autonomy.

Sample of 922 points of 20 types with established ages [dates - how good?] from 33 sites in AL and MS. Signif decrease thru time in biface W, T, and Weight [tho figure shows lots of overlap, even with 'dart' points and 'arrow' points]. Signif drop below 2 cm in Shoulder W, and Weight, at transition from Copena type to Baker's Creek (initial bow adoption), but T only a few centuries later with Jack's Reef and Hamilton/Madison types (refinement of bow technol). [But is first really bow - or lighter darts?]. Rapid transition from atlatl to bow [300 yrs? 500 yrs?] size reduction = alteration of dart pt prototypes to accommodate use with bows rather than long interval with both in use [how could you tell?]. Bow prob intro from Mountain West.

Hopewell decline not by warfare as earlier suggested, but by native seed crops + bow allowed household subsistence autonomy, no longer relied on periodic aggregation at mound centers to buffer risk of shortages. Bow 2x as accurate as atlatl, reduced need for large-group game drives, allowed more small fast prey (faunal remains support).

In SE, mound centers relied on wild food, less hierarchy. Similar trend in pt sizes, but larger bifaces continued, suggesting atlatl still in use.

Mississippian 800-1000 AD, increase in maize > pop increase, social complexity. Nucleated settlements - response to bow warfare. New diversity of arrow points, including barbed forms for war.

S

However, difficult to test, to get precise sequence of changes, bow, environment, social factors, crop intros.

Blurton Jones, Nick

2005 Introduction. In *Hunter-Gatherer Childhoods: Evolutionary, Developmental and Cultural Perspectives*, edited by Barry S. Hewlett and Michael E. Lamb, pp. 105-108. New Brunswick, Transaction Publishers.

Human extended juvenile period can be seen as allowing foraging skills to be learned before maturity and reproduction. But children learn rapidly, may even be better than adults at some skills, forage optimally for their size (selecting prey and location that are efficient for them), and also hunters may learn late: "!Kung do not begin to hunt until they are 20 or so (Nancy Howell p.c.), and Walker et al (2002) show that Ache hunting success increases during the adult years, as it does among the Hadza (Marlowe 2000a, Blurton Jones and Marlowe 2002). These findings contradict the earliest ideas about subsistence learning and the juvenile period, that learning is not all accomplished before adulthood. Most Ache and Hadza men are married with children long before they reach their peak hunting efficiency. Foraging must be learned, but it is learned as a juvenile and adult and seems to have little direct relationship to the age at which reproduction begins."

Blyth, P. H. x

1980 Ballistic Properties in Ancient Egyptian Arrows. Journal of the Society of Archer-Antiquaries 23. Electronic document URL:

http://margo.student.utwente.nl/sagi/artikel/egyptian/egyptian.html accessed 8/12.

surviving arrows light and flexible, imply weak and inefficient bow

Boas, Franz x 1955 [1927] *Primitive Art.* Dover Publications, New York.

Chapter on Style:

"...we may consider as works of art undecorated implements made by a perfectly controlled technique -- in other words, made by a virtuoso. Such are polished stone axes, chipped arrow or lance heads, iron spear heads, spoons, boxes; in short, any object of daily use, provided only the form which we may recognize as conceived in crude specimens, is worked out in a perfect technique." p 144

P 145 example of regional styles is Eskimo throwing sticks from different areas, illustrated with small engraving of different forms: "fixity of type...related to manner of use" ... The adaptation of the hand to the handle does not permit the use of forms that require unusual muscular movements which would lessen the accuracy and ease of use. Therefore the variations of form are confined to the limits established by the fixed motor habits of the people. Even if a variation should appeal to the eye, it will not be adopted if it should require a new adjustment of the hands..."

p 149: ...resistance to sudden changes... is expressed through an emotional attachment to customary forms.... Love of the special tool... induces man to bestow much labor upon the manufacture...a love that implies pleasure in customary movements as well as in the form of the implement. This mental attitude is one of the most important sources of conservatism in the form of objects of use, and of the tendency to give them the greatest possible technical excellence. The intensity of the emotional relation between a person and his tool is naturally greatest when maker and user are the same person; it must decay with the ease with which substitutes are obtained. Here is one of the causes of the rapid decay in the beauty of form of native utensils as soon as European tools and manufactures are introduced."

Boas, Franz

1938 General Anthropology. DC Heath and Company, Boston.

S

Pp 243-244: "Increased initial velocity of the thrown lance is also secured by an artificial lengthening of the arm by means of a wooden implement, held in the hand, which ends in a peg or groove – an artificial hand that holds the end of the spear. This point being farther removed from the shoulder moves more rapidly and gives to the weapon an increased impetus. The throwing board is probably a very ancient invention." (quoted in Webb 1957)

Bock, John s

2005 What Makes a Competent Adult Forager. In Hunter-Gatherer Childhoods:

Evolutionary, Developmental and Cultural Perspectives, edited by Barry S. Hewlett and Michael E. Lamb, pp. 109-128. New Brunswick, Transaction Publishers.

Skill and "growth-based embodied capital" examined among San and Bantu semi-settled foragers in Botswana. Measured arm pull strength, efficiency in mongongo nut processing, and fishing success with line (boys) and baskets (girls). Mongongo processing improves from age 10-40, declines after, when controlling for arm strength. Continued increase after growth stops in 20s suggests growth-based embodied capital [ie strength] is not the primary factor [ok, but then why does efficiency decline?] Girl's fishing catch rate depends on age, size of fish, somewhat on strength. Boys success affected by strength more than age (= ability to pole canoe to good spots), but size of fish is age-dependent (= higher skill in finding fish, using technology).

Bocquentin, Fanny, and Ofer Bar-Yosef

2004 Early Natufian Remains: Evidence for Physical Conflict from Mt. Carmel, Israel. *Journal of Human Evolution* 47:19-23.

Kebara Cave excavs 1931, thoracic vertebra from burial of Natufian age (14,500-13,000 cal BP) with lunate microlith embedded in body. No healing. If hafted transversely as point, entered body from L, perforated lung. If hafted laterally as barb or edge, entered from below and in front, hit heart. [Would be a light point, probably arrow, but dart also possible.] Social tensions in terminal Paleolithic/Mesolithic hunter-gatherers on cusp of agriculture.

Boeda, Eric, J. M. Geneste, C. Griggo, N. Mercier, S. Muhesen, J.L. Reyss, A. Taha, and H. Valladas o

1999 A Levallois Point Embedded in the Vertebra of a Wild Ass (*Equus africanus*): Hafting, Projectiles, and Mousterian Hunting Weapons. *Antiquity* 73:394-402.

Umm el Tlel in El Kowm basin, Central Syria, open air Middle Paleolithic site. Deep, many layers Acheulean to Neolithic. Level IV 3b'1 = Mid Pal, Mousterian, with thermoluminscence dates >50,000. Small mesial [middle] fragment of triangular Levallois point, 1.4 cm long, bending fractures both ends. In the vertebral foramen [spinal cord] of 3^{rd} cervical [neck] vert [which is broken open, although it looks like the whole thing, both pieces, are present]. Passed through the wall of the vert, needed considerable force. Tip missing, not enough space for it in bone, so likely broke on soft tissue, broken point pentrated bone [That would really need lots of force - it's not very sharp.] Force needed, and bending fracture after penetrated bone both indicate point was hafted. Bitumen as hafting mastic in other levels at site. Probably a projectile, but can't tell what kind, could also be thrusting spear. Suggest parabolic trajectory to enter from R and above, thus likely to be thrown . [Other scenarios equally possible.]

Boldurian, Anthony

2007 Weaponry of Clovis Hunters at Blackwater Draw. In Seeking Our Past: An

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Introduction to North American Archaeology. Neusius, Sarah W., and G. Timothy Gross, eds. On accompanying CD. Oxford University Press, New York.

Accepts assumption that Clovis had atlatls, discusses hafting models for Clovis points and bone rods, and promotes idea of a socketed harpoon with C point as end-blade [for which the archaeological evidence is nil - he's speculating based on one Archaic specimen and analogy to Inuit harpoons.]

Boldurian, Anthony T. and John L. Cotter

1999 Clovis Revisited: New Perspectives on Paleo-Indian Adaptations from Blackwater Draw, New Mexico. University Museum Monograph 103, University of Pennsylvania, Philadelphia

A

Summary and reanalysis of early work by Howard at key site. Geology, type artifacts, excavation account, old and new interpretations.

Pp 94-104 - Projectile point hafting and use: Could be atlatl dart, or thrusting, or both represented by Clovis points. Cotter in 1937 proposed bone rods as foreshafts, also suggested use as lance points (Upper Paleolithic analogy), or as foreshaft to fit a toggle harpoon head with point on it (Inuit analogy). Stanford has same idea. Made experimental versions. Toggles date to early Archaic at least, cordage earlier, might help entangle mammoth or help track it. Counter arguments: if rod survives in sites, why no harpoon heads? "The idea of being attached by a line to a panic-stricken mammoth is not an attractive one." (102) All ethnog toggles used on sea mammals.

Cotter and Hibben among early archys looking at Solutrean antecedents to Clovis.

Folsom points from site mostly damaged, a few new, both workshop and repair/discard represented.

Clovis seen as generalized hunters - Blackwater draw produced also manos, turtle + tortoise bones. But points definitely used on mammoth (blood residue in Alaska). Water as key resource, common to many kill sites. Mammoth populations already declining by 15 k BP, so Clovis would have pushed toward extinction, but as generalized hunters can't be blamed for all.

Folsom as ecological succession to Clovis, many technological connections. Clovis origins debates summarized. Cotter early noted many technological similarities to general Up Pal cultures in N Europe, and to Solutrean in specific, but Hibben's Sandia Cave sequence (shouldered, unfluted pts like Solutrean, followed by fluted version) must now be discarded. Good arguments against Solutrean theory [but he still wants to consider it.] Perhaps entry from both Siberia and across Atlantic.

Boone, Elizabeth H.

1989 Incarnations of the Aztec Supernatural: The Image of Huitzilopochtli in Mexico and Europe. *Transactions of the American Philosophical Society* 79(2):1-107. Philadelphia.

S

Huitzilopochtli began as minor hunting god of Mexica tribe, became state cult of Aztec

Triple Alliance Empire, dominated by Mexica. Came to embody sun, undermining Tonatiuh, patron of eagle and jaguar warriors - war god, ensuring sacrifice demanded by sun. At Great Temple, worshipped alongside Tlaloc, god of rain and agric fertility. But H images strangely rare, probably because limited to important sites of state cult, and varied by context, so Europeans constructed their own when portraying Aztec world.. But his attributes usually include serpent atlatl. Hummingbird helmet or head ornament is the only feature unique to H among gods.

Fig 17 shows page of Codex Telleriano-Remensis fol. 25r depicting H as nomad with blue face stripes, shield, hunting bag, and 2 long "spears" in other hand – [plainly atlatl darts as they are fletched, with cane joints, and barbed tips, but no atlatl.]

Later European representations of Aztec life are "classicalized" and analogized to the devil, and H's serpent atlatl becomes a snake.

Boone, Elizabeth H.

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1996 Andean Art at Dumbarton Oaks, Volume 1. Dumbarton Oaks, Harvard University, Washington D.C.

Robert Bliss collection of pre-Columbian art. P 244-247 Chimu spear-thrower. Central coast of Peru 1370-1470 AD. Said to have been found in a grave near Huarmey, purchased by Bliss before 1953. Spear thrower prob independent invention Old and New Worlds. No Chimu iconography shows atlatls, but earlier Moche shows elaborate contexts of ritual deer hunts [no mention of common appearance in war imagery]. Wooden body partly sheathed in thick sleeve of gold, gold bird-like hook. Sleeves decorated in relief, solder joins. [Focus on metalwork technicalities]. Hook resembles head + neck of bird, hammered from piece of gold bar with added lateral strip for eyes, and 9 small solid balls on back of head. Set through sleeve into wood and soldered to sleeve. [Bird head is possible but not sure. Hook angle is very upright, not optimum for function. No handle piece seems to have been present, or less likely it failed to survive.]

Borden, Charles

1968-69 The Skagit River Atlatl: A Reappraisal. B.C. Studies 1:13-19.

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Found in river (Taylor and Caldwell 1954). Yew wood, 2-hole grip with integral loops, 41 cm long, distal end (hook) missing, [on underside] carved high relief human head surmounted by rampant monster served as weight near grip to compensate for spear as balance while aiming. Compares to Marpole and Locarno Beach (early NW coast) art styles and recent to argue for NW origin. May depict Sisiutl, double headed serpent diety controling sea resources - appropriate for marine hunter. Probably Locarno Beach age (last millenium BC). Locarno B site produced atlatl hook of antler carved with human head. [Good photos; see also Fladmark et al. 1987; picture of carving in Ames and Maschner 1999:236. I rather doubt the functionality of this atlatl - short + clumsy.]

Bordes, L., A. Lefort, and F. Blondel

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2016 A Gaulish Throwing Stick from Normandy: Experimental Study. EXARC Journal

Digest 2016-1:18-21. <u>http://journal.exarc.net/issue-2015-3/ea/gaulish-throwing-stick-discovery-normandy-study-and-throwing-experimentations</u>

A boomerang form of apple wood with several light iron bands around it, interp as light boomerang for bird hunting.

Borgeson, John, and Cecelia Borgeson o 2014 A different Guarani bow. *Primitive Archer* 21(6):24-28.

60 inches, ca 40 lbs, self bow, notches in handle to estimate range. 3 arrows, 2 feather fletching, wooden points. [No provenience info - no info on how old, or why "different" from other Guarani bows.]

Bostrom, Pete

2004 An Indiana Atlatl. *Lithic Casting Lab Webpage*, accessed 1/04 at html http://lithiccastinglab.com

Nice photos of antler handle, slate humped bannerstone, and antler hook "found several years ago by W. Miller" Davis Co, IN. Indian Knoll type gear. [Supposedly found together, but who knows, and if it was, then represents a looted burial with no reliable archaeol information.]

Bouffier, Bernard

2016 Un ISAC à la télévision Française. An ISAC on French televison. *The Atlatl* 29(2):1-3.

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Bouffier, Bernard o,p 2017 The Canecaude Atlatl: an article in pictures. The Atlat 30(3):11.

Replicates a stylized but nice mammoth hook end carved from antler.

Bourget, Steve

S

2001 Rituals of Sacrifice: Its Practice at Huaca de la Luna and Its Representation in Moche Iconography. In *Moche Art and Archaeology in Ancient Peru*, J. Pillsbury, ed., pp. 88-109. Yale University Press, New Haven.

Warfare with clubs to capture sacrificial victims. [atlatls not used in war]

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Bourget, Steve

2001 Children and Ancestors: Ritual Practices at the Moche Site of Huaca de la Luna, North Coast of Peru. In *Ritual Sacrifice in Ancient Peru*, edited by Elizabeth P. Benson and Anita G. Cook, pp. 93-118. Austin, University of Texas Press.

Ancestors and children, warfare and deer/sea lion hunting symbolically related. War +

hunt to capture sacrifices. Pot painting of "smaller figures hitting the deer with clubs while the larger ones, armed with spearthrowers, are giving them the coup de grace." [He has it backwards, as other deer hunts show, and although hunt and war are clearly linked, the deer are not shown being captured and sacrificed - which is why atlatls are common in hunt scenes and rare in battle scenes.] Bloody wooden club from tomb.

Bourget, Steve

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2006 Sex, Death, and Sacrifice in Moche Religion and Visual Culture. University of Texas Press, Austin.

Symbolic connections between depictions of sex (rarely vaginal, usually anal, oral or masturbation) and sacrificial ritual [those Moche were really unpleasant!] Lots of archaeological evidence for specific gear worn in depictions of ritual, other aspects of religious life. Four great subject types in iconography: 1. humans and animals in natural form 2. transitions, mutilated or flesh/skeletal forms, often engaged in sex 3. animals, plants, objects with anthropomorphic elements, often engaged in ritual activity 4. individuals with supernatural attributes, especially fangs, often repeated deities e.g. Wrinkle Face, often engaged in most elaborate rituals.

p. 39 "Ceremonial Badminton" Chan Chan burial with copper crosspieces attached to long shaft suggests individual participated, "casting staff with crosspieces skyward from the summit of the Pyramid and then watching the string unwind..." (Donnan 1985). [Donnan calls that burial Moche].

Bourget, Steve

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2016 Sacrifice, Violence, and Ideology Among the Moche: The Rise of Social Complexity in Ancient Peru. University of Texas Press, Austin.

Human sacrifice was integral to Moche ideology and the 'state'. Details of a sacrificial plaza at Huaca de la Luna, where multiple victims (75+), mostly young men, were killed and left lying in mud from El Niño rains, in repeated episodes. Some killed by blows to the head, some dismembered. Corpses touched each other, intentionally laid out in danse macabre as on some Moche pottery. Some had bones or stones inserted into body cavity. Some tied (impressions of rope), some probably held down to be killed. [Skeletons look like excav of a war atrocity. Which of course it was.] Assoc with frags of unfired effigies of bound men, maybe not prisoners but willing, as their hands are free though rope is around neck. Fly pupae show exposure of corpses, and appear to be depicted on the effigies. Antemortem and perimortem injuries - depressed skull fractures, parry fractures of arms, ribs, nose = warriors. 45 + had throats slit, consistent with blood collection depicted on Moche pottery. Clubbing and decapitation after throat slitting. Two had penetrating wounds to chest [p136 no details, unclear if evidence of projectiles].

Associated Platform 2 had looted burials, wooden club covered with blood. Ceramics with images from Ritual Running, prisoner + Sacrifice Ceremony. Pot (fig 4.52) painted with weapon bundles: shield, mace, 2 darts, atlatl. Artifacts may ID these individs as performers in Sacrifice Ceremony.

Figure 5.33 Museo Larco pot showing fanged deity in Strombus shell, around neck is fox-headed snake, holds two darts with fox/feline heads at butt + simple atlatl.

El Niño Southern Oscillation events (ca every 7-10 yrs) were part of 'ritual ecology' represented by selected marine motifs, integrated with sacrifice.

Bourget, Steve, and Kimberly L. Jones, eds.

2008 The Art and Archaeology of the Moche: An Ancient Andean Society of the Peruvian North Coast. University of Texas Press, Austin.

Bourke, Paul, and David Whetham

2007 A report of the findings of the Defence Academy warbow trials, Part 1, Summer 2005. *Arms and Armour* 4(1):53-81.

Jones 1992 experiments with medieval arrows against steel plate used too light a bow and arrows. Here, 140 lb bow, 70-87 gram arrows, 46-50 m/sec, 75-92 joules kinetic energy. Hardened iron bodkin points penetrated 1-2 mm thick iron plate but not 3 mm. Soft glue failed; socket of point driven open by shaft, losing energy. Fixed by using harder glue. p. 71 lab tests with air cannon replicated bow-shot arrow speed but not flex or rotation. At 10 m, arrow still yawing, not straight impact.

Boyd, Caroline E., Amanda Castañeda, and Charles Koenig o

2013 A Reassessment of Red Linear Pictographs in the Lower Pecos Canyonlands of Texas. *American Antiquity* 78(3):456-482.

Red Linear pictos previously dated 1300 BP (2 experimental C14 dates), now seen as under some Pecos River style pictos (Late Archaic, C14 dates 4200-2750 BP). PR large, spectacular, includes ungendered anthros, some with gear + ornament, including atlatls, "felines + impaled deer are most commonly portrayed animals." RL are quite small, portray gendered humans in group activities w gear, deer + hunting. (Turpin claimed bison oriented, but pictos not clearly bison.

"Four types of atlatl: a. with intersecting horizontal bar at proximal end. b. lg round object poss weight near distal end c. circle or finger loop at prox end [maybe both double and single finger loops are intended], d. simple with no bars, wts, or loops. All have spur on distal end. [Not true in illustrations, and all are quite simple and sketchy. One anthro with bannerstone or weight on atlatl also holds 2 fletched darts with possible bunts. Others hold or assoc with 2 lines (= darts?). Also apparent curved throwing/rabbit sticks.] Anthros with atlatls are male (often phallic), and 30-50% of anthros have atlatls.

Boyd, Donna C.

1996 Skeletal correlates of human behavior in the Americas. Journal of Archaeological Method and Theory 3(3):189-251.

Review. p 223: "Hypertrophied supinator crests and deep supinator fossae of the ulna have been interpreted by Kennedy (1983, 1989) as the result of habitual throwing of

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missile weapons like the atlatl and spear. These conditions appear frequently in prehist and historic hunters and gatherers... Evidence in support... comes from the realm of sports medicine, where athletes habitually using their brachial skeleton for throwing show well developed crests and deep fossa. Over 40% of pro baseball pitchers manifest bony spurs on medial surface of ulnar notch... from throwing stresses."

Box, C. J.

1982 Saratoga, Wyoming (Pop. 2,410): Atlatl Capital of the World. *Early Man* 4(4):30-32.

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Fireside Folk Festival at Saratoga Historical and Cultural Soc, org by Ada Bouril Jackson. Flintknapping, run, parade, trout fry, atlatls. Prominent archaeols attend. School kids learn from 6th grade teacher Rod Laird, 11 yr old Brian Benson beat Bruce Bradley as champ. Adequate definition of atlatl.

Boyd, Donna C.

1996 Skeletal correlates of human behavior in the Americas. *Journal of Archaeological Method and Theory* 3(3):189-251.

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Lengthy review, timely because skeletal evidence "theatened with repatriation." [Rare instance in field of acknowledging destructive effects of NAGPRA.] Reviews with refs and short examples chemical analyses, metrics, DNA, and other evidence used for social and individual reconstruction. Diet – bone chemistry, dental pathology and wear, skeletal morphology, weaning. Kinship inferences – chem, morphology, DNA. Political + economic systems – chem, morph, pathol, demography. Social status. Health, child care, social systems, treatment of illness. Migration and population structure. Activity levels from osteometrics. Activity patterns and occupations from paleopathology – biomechanical study, musculature: P223-224 hypertrophied supinator crests and fossae of ulna interp by Kennedy as habitual throwing. Sports medicine support. But "many different behaviors can result in the same skeletal signature." Degenerative joint disease – experimental support, problems. Violence and warfare – lots of examples of projectile wounds. Experimental faunal analogy to cannibalism.

Bracken, Mark

2000 Straightening Georgia's World Record Setting River Cane. *The Dart*. July 2000: 7-10.

2002 Straightening Georgia's World Record Setting Cane. The Atlatl 15(4):14

Season well, rehydrate by soaking 12 hrs. Heat and bend to straighten, alternate segments first, then back, then alternate nodes, then back. Uses 4-feather fletching, copper point, no foreshaft. [No info on length or weight.]

Bradbury, Andrew P.

1996 Bow and Arrow in the Eastern Woodlands: Evidence for an Archaic Origin. North

American Archaeologist 18(3):207-234.

Re-does Thomas classification function using ethnographic specimens. Discusses differences between weapon systems and their requirements. Functions use width and neck width, elim length, tests on 579 hafted specimens. Lots of Late Archaic pts = arrows [but is his sample good – can't tell – lots of small things in Archaic, but relatively few Woodland specimens]. So bow and arrow arrived in L Archaic, specifically Merom and Matanzas pts, but concurrent use, atlatl not replaced until late Woodland [details useful, but he needs more evidence than point size].

Bradfield, Justin

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2012 Macrofractures on bone-tipped arrows: Analysis of hunter-gatherer arrows in the Fourie collection from Namibia. *Antiquity* 86(334):1179-1191.

Bone points show similar use fractures to stone points. Composite arrows, collected 1920s from Kalahari Desert San groups. Two types: light poisoned arrow with reversable bone pt on linking foreshaft that can be "sheathed" by reversing into cane mainshaft; and robust bone point set directly into mainshaft. Poison for large game, bone only for smaller, but points also have symbolic + trade uses. Diagnostic impact fractures = step terminated bending fract + spin-off fractures. 104 bone pts examined, 21 with fractures = probably used, but cannot assume statistical sample as collector might favor less damaged pieces. Robust pts more damage - used more, less carefully, or less possible to protect. Possible early African bone pts should be examined for similar damage.

Bradley, Bruce

2001 Getting to the Point: Arrowheads at Stix and Leaves Pueblo. *Indian Artifact Magazine* 20(1):36-38, 81.

PI-II SW CO, private site, 26 rooms, several kivas. Kivas and pithouse burned – dates 850-875, 949-970, 1054-; Old pts collected by puebloans, 1 notched for pendant or ritual use.

Late PI has dart pts – but no atlatl in earlier BMIII – was it reintroduced? By new people? Also late in PI tanged arrowheads, in PII cornernotched [much like tanged ones], in mid PII narrower pts, then convex base with side notch. Manufacture sequence described from failures. Flaking tools. [Comparable to my Grasshopper points]

Bradley, Bruce A., Michael B. Collins, and Andrew Hemmings o

2010 Clovis Technology. International Monographs in Prehistory, Ann Arbor, MI.

Clovis technological focus was on bifacial complex and blade complex, with minor component of small tools, and where preserved, bone and ivory.

Stone raw materials indicate mobility or exchange, include intentional choice of nice ones [authors' emphasis on cache sites may exaggerate this]; p.9 some like Knife River Flint were available but not used. P.57 heat treatment apparently not used.

P.56: "Bifacial technology was used by Clovis for the majority of their primary tool blank production, either as cores for flake blanks or as bifaces and proj points. Even the production of blades used a basically bifacial technique..." [one reason for me it doesn't resemble Solutrean industry at all]. Lengthy discussion of overshot flaking. [Numerous illustrations and detailed examples show the variety of point finishes, local or individual styles, but their selection is biased in favor of "nice" pieces, especially in a few color photos.]

Bone, ivory, antler used includes at least llama, dire wolf, horse, mastodon, mammoth, and deer. Most known from FL rivers where no real context. Forms include long beveled rods. Bone points more reliable, could compensate for high failure rate of stone points in manufacture (>50%) [that's got to be an exaggeration]. Good for puncture wounds, especially if greased, possibly with red ochre [huh?]. So 3 projectile forms: thrown stone C points, thrown short bone pts, thrust long curved ivory points. Atlatl hooks of paleofauna bone in FL rivers indicate atlatl use. Some C points highly fractured, may indicate high velocity impact - need more testing p120. Stone and short bone points, including one barbed one, intended to remain in animal, long point as close quarters lance. One bone pt from Blackwater draw mammoth has diving hinge high velocity impact fracture, other examples. Also some rods that are not points. Atlatl hooks made of proximal phalanx of llama, vestigial mammoth tusk, and beveled ivory rod fragment [photos and details].

Bragg, Beth

2017 It came from the ice age, but the atlatl continues to impress. *Alaska Dispatch News* April 30, 2017, <u>https://www.adn.com/outdoors-adventure/2017/04/30/it-came-from-the-ice-age-but-atlatl-continues-to-impress/</u>

Short account of annual Alaska Atlatl Fun and Throw at Alaska Native Heritage Center, org by R. Vanderhoek, AK State Archaeologist, for 18 yrs. Throw from kayak at ballon seal head, other targets include rhino, carrot.

Brennan, Louis A.

1975 Artifacts of Ancient America. Stackpole Books, Harrisburg, PA.

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[Respected amateur archaeologist.] Focus on E N.Am. but general info. Detailed description + typologies of most classes of artifacts: flaked stone including points and tools, ground stone including axes, bannerstones [he accepts as atlatl weights], antler, bone, basketry, wood, copper, ceramics.

[Some interesting mistakes and outdated info: a Folsom point labeled as "Clovis," accepts Sandia, Pikimachay, and Old Crow flesher dated 27,000, probably because he favors a pre-Clovis, pre-projectile point culture. Lengthy but weak description of knapping, e.g. p20 making flake blades "overcomes disposition of stone to flake conchoidally" by preparation of platform and calculation of angle and force of strike. For some reason, doesn't use "knap" or "knapper," uses "chipping" and "flintsmith."] Recognizes heat treatment p24, but "because direct exposure to fire causes pot-

lidding...core materials about to be worked were heated in hot water or other indirect method [the hot water is nonsense]."

Lengthy point typology includes section on atlatls p 29-33. Bow replaced ca AD 1 in SW, AD 1000 in NE, atlatl survived in Aztec and Arctic where allows kayak use + bow strings get wet. Ballistics: weight forward of midpoint. "Rule of thumb that stone point <1.75 inches is arrow point is not a bad one. On the other hand, it is not a reliable one either." Some small points too early for bow, probably on light composite dart. Four good photos of Richard Regensburg of DL Division of Archaeology using atlatl. Indian Knoll type with antler handle + hook, wooden bannerstone, 4 oz as suggested by Mau, close to hook. "Although it appears that the dart is about to be catapulted, the proper throwing motion is to keep the dart and atlatl in contact on a straight horizontal line throughout the entire casting action; the atlatl adds to the length of time of this contact, in effect lengthening the arm (31)." [Must have got this from Howard 1974. Ironically, his 4th photo clearly shows Regensburg using the atlatl correctly, flipping the dart away with the atlatl vertical as the dart leaves, contradicting what Brennan and Howard think happens.]

Breslawski, Ryan P., Bonnie L. Etter, Ian Jorgeson, & Matthew T. Boulanger

2018 The Atlatl to Bow Transition: What can We Learn from Modern Recreational Competitions? *Lithic Technology* 43(1):26-37.

Critique of Grund's (2017) nonsense. Her data sets are both a mess, uncleaned of duplicate names and other problems – they do extensive cleaning of both ISAC atlatl scores and IKAC (Interkingdom Archery Competition, Society for Creative Anachronism) score data. They use various statistical tests that would be better than Grund's to predict curves, but note many problems with using such data. For instance, it is biased by better competitors staying in while lots of less interested drop out [including the generally 4-year college membership of Society for Creative Anachronism], the assumption that year 1 is an individual's actual first experience, increase-decrease between years for any individual relates to practice, ambiguity of equipment and different learning style effects, and so on. Conclude that what the data shows is just "through time, competitors generally show modest improvements with both weapons" and the problems of using such data to compare learning curves.

Bretney, John C.

2012 Atlatl Cliff. In *Rock Art at Little Lake: An Ancient Crossroads in the California Desert.* Jo Anne Van Tilburg, Gordon E. Hull, and John C. Bretney eds., pp. 92-105. Cotsen Institute of Archaeology, University of California, Los Angeles.

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See Van Tilburg et al. for background. Close to Stahl Site ('Pinto'). Of 645 pecked elements, 99 (15%) "consist of a vertical line with a hook or loop at the top and bottom and an oval or circular form in the center of the vertical line." Abandoned sometime after 1500 BP. Drawing of 'typical' Gt Basin atlatl (Winnemucca cave type) w weight and double finger loops. Dart finds at various sites [somewhat confused]. Y-shaped elements

might be exaggerated foreshaft notched for point [I doubt it], also concentrated at AC. Stone weights attached on "top" [terminology confused, most would say 'bottom' or underside] of atlatl. Innovation adding mass or tuning the atlatl, may have increased dart acceleration. Probable aesthetic or ceremonial reasons too. Simple bisected circles not considered by us as incomplete atlatls. [and most apparent weights are solidly pecked]. No spatial pref for atlatl motifs at AC. All motifs oriented toward lake or 'the passing animals.' Atlatl hooks almost always face L, as do bottom 'hooks' or loops. But sheep face R. Reasons unknown. [Suggests opposition to me, and L facing of atlatls seems natural to R-hand user holding up an atlatl]. Dense pecking suggests much time work, suggests symbolic value.

Chronology - different degrees of repatination - most of oldest petros are at AC. Quantified darkness of revarnish by spectrophotometer. Some trend for more patinated atlatls to have longer shafts and oval weights. [Weights shown vary from round to oval to bilobed, usually solidly pecked, always exaggerated size comp to rest of atlatl].

Other motifs - No sheep. Only zoomorph elements are 'paws' with multiple line digits, not realistic representations. Very few anthro elements. Staff or crook - a few, only found at AC, similar to tool or pinon nut collection. 48 of 50 Y forms found are at AC; 81% of complete atlatls. 98% of both atlatl and Y are vertical.

"production of individual elements required considerable time, energy, and attention to sometimes intricate detail." [exaggerated - these things are not hard to make, see Whittaker et al. 1999]. Patterned, iconic symbol 'evokes the eternal presence of the spirit world.' Poss power symbols created in context of ritual, may emph authority of individ leader over group [no real evidence for that]. Poss component of hunting magic, but others, like animals, not present.

Breuil, H.

1952 Lascaux. Man 52 (152): 110-111.

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In French. Responding to Lechler 1951 - he "doesn't know what he's talking about." Object at foot of man is hooked spearthrower with handle. Bird on staff object is not propulseur, because all Up Pal specimens have the carving as hook, not handle. [he misunderstood Lechler who said no such thing]. Magdalenian sculpted atlatls were all ceremonial. Existing specimens were fixed in wooden handles. It must be totem or funerary marker - espec with bird head on man.

Brian, Wayne o 1992 Crashing the Barrier. *The Atlat* <u>5</u>(2):7-8.

Annecdote of record throw, experimenting with equipment, but does not actually describe or give dimensions.

Brian, Wayne o 1994 This'n That. *The Atlatl* 7(2): 2. Claims Guinness record of 638' 8" (209.53 m), but also 660'3" and 699' witnessed, personal best (9/93) 727' (238.52 m) [equipment not described, apparently non-primitive]

Brian, Wayne o 1999 Stone Atlatl Finger Loops. *The Atlatl* 12(3):1-2.

Allen Denoyer found S AZ specimen, now recognized as similar to British Museum Aztec atlatl's loops (pictured). BW replicated [on a Basketmaker form atlatl]. Looks like petroglyph depictions.

Brian, Wayneo2008Primitive Pottery Reproduction. The Atlatl 21(1):14.

Mimbres reproductions, including two versions showing atlatls in use [which is anachronistic, but looks real nice.]

Bridges, Patricia S.

1989 Changes in Activities with the Shift to Agriculture in the Southeastern United States. *Current Anthropology* 30(3):385-394.

Skeletal info from Archaic and Mississippian burials in Pickwick Basin, Alabama. Longbone shaft cross-sections reflect stresses.

Miss. have overall greater shaft circumference = greater stresses/workload in agricultural population. Males more change in arms than legs, females more overall, suggests females took on more new agricultural tasks. Female Miss. stronger and more symetrical arms = mortar and pestle corn grinding. Male Miss. arms more symetrical, more forearm strength = change to bow and arrow from atlatl. Archaic males have higher prevalence of elbow osteoarthritis than Mississipian, but both early and late have more on right than left elbows, and early females have highest right-dominant elbow osteoarthritis. [So mixed weak support for skeletal reflection of change from atlatl to bow.]

Bridges, Patricia S.

1990 Osteological correlates of weapon use. In *A Life in Science: Papers in Honor of J. Lawrence Angel*, J.E. Buikstra, ed., pp. 87-98. Center for American Archaeology.

Bridges (1990) compared Archaic (atlatl using) and Mississipian (bow and arrow using) skeletal populations from northwestern Alabama. She expected to see more arthritis of elbow and shoulder (specifically arthritis in radial/humeral articulation, olecranon fossa lipping, and acromioclavicular joint porosity), and greater difference between left and right arms in both arthritic conditions and dimensions in the Archaic population, and also expected that males would be more affected in both populations than females. In fact, there were no clear patterns, and she was forced to conclude that "in this region, changes in hunting technology appear to have had a minimal impact on the physique." While "atlatl elbow" occurred in 15 to 26% of her male specimens, it was slightly more

common in females, and equally common in both periods, so "it is impossible to attribute atlatl elbow to any specific activity."

Bridges, Patricia S.

1992 Prehistoric arthritis in the Americas. Annual Review of Anthropology 21:67-91.

Surveys arthritis in reports of 25 prehistoric Indian groups, mentions atlatl elbow and references self and others cited here. No good connection between atlatl and arthritis.

Brinton, D. G.

1898 The Throwing Stick in America. Science 7(178):743.

Note, H. Michel in France shows that throwing-stick was in use in Peru. Brinton agrees with M that atlatl was separate invention in Peru, Cavemen, and Eskimo, and should not be used in Cushings new finds in Florida to argue affinities.

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Bridges, Patricia S.

1996 Skeletal biology and behavior in ancient humans. *Evolutionary Anthropology* 4:112-120.

British Museum

1912 A Short Guide to the American Antiquities in the British Museum. London, British Museum.

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Figure 23 good drawing of Aztec atlatl with shell finger loops, warrior and snake in relief [and gilded. No info on provenance. AM5226].

Brittenham, Claudia B, s

2015 *The Murals of Cacaxtla: The Power of Painting in Ancient Central Mexico.* University of Texas Press, Austin.

Central Mexico, not far from Teotihuacan, but style is more Mayan. Extensive murals in temple complex discovered 1975-80s, in acropolis mound. Settled Late Preclassic (100 BC), heyday Epiclassic (AD 650-900) with decline of Teo + Cholula, then abandoned.

Art history approach. ID's number of painters in various murals. How murals were presented, maintained, allowed to decay (stair with captive deptictions to be walked on). Massive 20 m long mural of life-size battle: Battle Mural, bordering central plaza, public visibility. Refs a historical event, names warriors in battle against anonymous different ethnic group. Some are using spearthrower in one hand, with shield in other. Others have spears, one holds stone knife in shield hand. As at Bonampak, brown, almost naked losers ('bird warriors') fall beneath elaborately costumed winners ('jaguar warriors').]The atlatl in R hand of figure E10 is the only one that is clearly visible. Others were at eroded top of mural. Several jaguars, one bird had atlatls. E10 appears to be using a split finger grip though the handle is not clear. The dart is blue, with red

spearthrower on each side of the shaft, and a blued angular form below that may be fletching or more likely decoration on the atlatl. The distal end is missing].

Pp118- Atlatl, spear, knife represent different phases of battle compressed in mural. "Atlatls are long-range weapons, spear throwers which can hurl a projectile over 50 m with considerable accuracy (Hassig, Howard, Raymond, Coggins). Though atlatl projectiles called darts in Mesoam lit, could be over meter long... shown in Battle Mural are quite long and have distinctive triangular blades [consistent with other depictions and with Maya and Aztec dart points]. ...held in distinctive 2-fingered grip with arm stretched out behind the body." A couple individuals have darts in body. E5 with guts hanging out is pulling out a broken dart. Atlatls used for barrage at beginng of battle (Hassig) but not useful at close range '...where the elaborate windup to launch would render the thrower vulnerable (Raymond 1986)." Scene conflates time, with pairs of winner/loser using short range weapons (knife, then spear) alternating with those using atlatl. Two of the figures identified as 3 Deer Antler confront warriors in female clothing and apparently biologically F, but could be denigrating the enemy. Parallels include Archbishop's Stone p 125 showing Mexica conquest of Xochimilca rep'd by a female with exposed breasts [but holding atlatl + darts]. P 136 Obsidian eccentrics from site make a Tlaloc with round eyes, sim to decor of 3DA above.

Brizzi, Vittorio

x,p

2007 Il Propulsore. Paleoworking. Ms posted on Academia.edu, Oct 2016. [seems to be a booklet or powerpoint]

Lots of pictures, short caption texts in Italian. Male vs female forms, F espec common in Arctic. Upper Paleolithic forms. Ethnographic – photos of New Guinea, Tarascan, Australia. "Un dilemma" points for arrows or darts? Dart length issues. To class as arrow point, base thickness should not be more than 5-6 mm. Fluted points in N Am – [poor knapping/fluting diagram]. Ethnographic types: Arctic, several examples [most 'male']. Amazon + Aztec. Baton de commandement with cord. Various forms [my photo from somewhere]. Numerous points and haftings.

Ballistics. [Several meaningless diagrams of acceleration and 'transverse wave propagation'] Mathematical modeling because 'human effort is inconsistent'. Simple diagram, assumes "forward force and wrist torque are functions only of horizontal hand position. Muscles contract with a force independent of contraction rate...so physical effort is independent of mass and dimensions of spear thrower [incorrect because it is a lever]. Spur and hand position diagram at .005 second intervals [usefully shows atlatl spur going up while wrist stays level, then wrist and spur go down together]. Model diagram used to predict velocity adds spring at atlatl spur [which is an incorrect model]. Graph shows 4 dart masses 50-250 g, with 6 atlatl lengths 0.1-0.7 m. Velocity always higher with lighter dart, but little increase with atlatl L, all Vs decrease after 0.4 m L atlatl. [This makes no sense – atlatls less than 40 cm don't work well, and L definitely increases distance thrown, so must increase V.] Max V in his graph is 35 m/s [78 mph, on high end of possible]. Adding weight always decreases V. Increasing atlatl deflection from 0 to .2m increases velocity from 27 m/s to 32. [This is all his mathematical model, with spring, not

reality, not a good model, apparently contaminated by Perkins' ideas].

Brizzi, Vittorio

x,p

2012 Otzi the Iceman: Murder victim thaws out, but who done it and why? Unpublished ms posted on Academia.edu

Consulting for Discovery Channel *Iceman: Hunt for a Killer*. Realistic reenactment of death scenario theories. Training actors to use their Neolithic weapons. Fatal arrow wound through shoulder blade, close to lung. No broken shaft nearby; probably broken off in a fall during flight. Possibilities: accidentally killed by companion who hid body. Injured self by falling on arrow (unlikely [impossible]). Flight from village attack. Murder. Death from wound compounded by cold conditions.

Arrows in his quiver: 12 viburnum shafts unfinished, 2 more broken. One is compound arrow with stone tip in foreshaft. Two arrowheads plus one in his back are S Alpine form. [Further description of the points is incoherent, but he seems to think the fatal one was resharpened.] Did he pick up the broken ones as they were shot at him? Can we calculate bow power from arrow penetration? Arrows are too stout for found bow.

Brizzi, Vittorio, and Alice Brizzi x,p

2012 "Otzi, during his last 24 to 48 hours was probably involved in a really awful battle for survival. Not against the natural elements but against his fellow men." ACOTW Arrowhead Collecting On The Web, 4(6):3-11. Posted on Academia.edu Oct 2016.

Not a ritual burial, escape preceded by running battle fits evidence better. Wounds: cuts on hand and forearm, bruises on back, arrowhead in shoulder, blood from 4 different men on knife, jacket, and broken arrow in quiver. Shaft removed, only head left in wound. 3-D reconstructed from CAT scan data, point is of S alpine form, Remodello type, not N Tyrolean type from mountain cultures. [Pics of his replicas]. Attackers would have been proto-Italic men, Otzi maybe same. Point similar to equipment used by Otzi, but short, could be "last chance" shot [he means used in desperation despite unsuitability]. Short because reworked after damage [possible, but details not visible on reconstruction]. The 2 complete but broken shafts have similar [and rather crude] points. One has a foreshaft. Both points also reworked but fairly heavy. Shaft with point would be 60-70 grams,

Compound arrow details: decorated with spiral pattern. String binds fletching. Black pitch mastic used to haft point and fletch. Foreshaft in conical hole supported by lashing around main shaft. Tang of point in groove lashed with string and pitched. Blood reaction from shaft = deep penetration. Tang break not observable but consistent with high energy impact [can't see it, can't say that!]. Bending break + burination of tip [can't tell from his illustrations]. Residues of hair, protein, muscle. Three feather fletch on both arrows.

Details of second arrow point – similar, also impact damage, residues.

Brizzi, Vittorio

2012? My Bow, Awake! - Ancient Archery Practices in Contemporary Cultural and

Recreational Activities. Unpublished manuscript on Academia.edu accessed June 23, 2018.

[In Italian. Seems to be analyzing bow and body position and movement in medieval art, ethnographic Africa and Asia, and experimentally. No pics of children. Opening quote in English]: "In My time, my poor father was as diligent to teach me to shoot, as to learn me any others thing; and so I think other men did their children: He taught me how to draw, how to lay my body in my bow, and not to draw with strength of arms as other nations do, but with strength of the body: I had my bows bought me according to my age and strenght; as I increased in them, so my bows were made bigger and bigger, form men never shoot well, except they be brought up in it." Hugh Latimer, sixth sermon, 1549

Brokensha, Peter

1987 The Pitjantjatjara and Their Crafts. The Aboriginal Arts Board, North Sydney.

Ethnography mostly written in 1970s, updated 1980s, some old photos. Rifles have replaced spearthrower, but old men retain theirs for fighting. Men make all weapons and sacred boards, women wooden bowls and animal carvings. Spearthrowers are of woomera scoop type, called "miru." Thin and flexible [those I have handled are not really flexible] 87 cm long, 8.6 wide, 450 gm, made of mulga wood. Lashed-on hook, spinifex gum handle with inset adze flake. Reports from 1800s show same form. Cites old reports of "accuracy as good or better than average shot with a rifle up to 60 yards." Photos of manufacture 1975 with steel tools, takes about 10 hours, can sell (tourist market) for \$8. Hunting spear was compound with broad wood blade with a barb lashed on it. Total length 2.7 m, weight 370 gm [huge!]. Manufacture of spinifex gum described.

Brooks, Alison, and David Leslie

2011 Recognizing and characterizing projectile armatures in the early Middle Stone Age of Africa. Paper presented at Multidisciplinary Scientific Approaches to the Study of Stone-Age Weaponry, Mainz, 19-22 September 2011.

"Lithic projectile armatures represent a significant innovation over thrusted spear points in hominin subsistence strategies with relevance to both the life history and behavior of our genus. Recognizing proj points archaeologically is difficult, plan and shape of a proj point may not differ from that of a thrusted armature except for in its area and weight, nor would we expect thrusted spear technology to disappear with the advent of projectile armatures. Currently, researchers disagree on the timing of this important innovation, with some arguing for appearance of projectile technologies during the Middle Stone Age, others during the Upper Paleolithic. Others have argued that the pointed forms of the African Middle Stone Age were not weapons armatures at all but rather resharpened scrapers. This paper will review three aspects of MSA pointed forms: tip attributes, basal treatment, and overall form and will discuss the utility of these in determining the onset of projectile technology. We argue that many of the later MSA industries (Aterian, Aduma, \neq Gi, Sibudu, Stillbay, Howiesons Poort) contain projectile armatures, based on these criteria. In addition, the early archaeological record of the Middle Stone Age documents a number of different point forms date to ~300 kya or before and based on the above criteria, some may be candidates for early projectile technology."

Late Pleist inventions: poison, dogs, proj weapons. Spears continue after bow (Kalahari). MSA bifaces – ochre in binding/mastic leaves hafting traces + harpoons with string wera on bases + microliths with ochre in mastic all 60-75 kya. Blombos Cave 75 kya bifacial spear tips. #Gi Cave bifacial + unifacial pts, 10% with impact, symmetrical small pts <5 cm long 70-80 kya, hunting buffalo, wart hog – good to be at distance Pts small, 8-10 grams, prefer use of exotic stone from up to 200 km away, hafted w ochre compounds – so are they projectiles? TCSA Tip Cross Sectional Area (Shea) in range of thrusting spear but not ethnog atlatl or bow Weight – in arrow and dart range [but comp to US data]

Possible earlier hafted points at Olorgasailie 340 kya

Brooks, Alison, Lisa Nevell, John E. Yellen, and Gideon Hartman x

2006 Projectile Technologies of the African MSA: Implications for Modern Human Origins. In *Transitions before* the *Transition: Evolution and Stability in the Middle Paleolithic and Middle Stone Age*. Edited by Erella Hovers and Steven L. Kuhn, pp. 233-255. Springer, New York.

African Middle Stone Age differs from Middle Paleolithic of Eurasia ["Neanderthal"] industries in having many projectile points. Small size implies not just simple spears. Compound artifacts imply cognitive sophistication. Regional styles imply communication and social groups. Examples: 1) =Gi Site, 77k BP, in Kalahari, 41% of MSA assemblage is pts. Small, triangular, bifacial, ca 41 mm long, 14 mm T, thinned bases for hafting, made on discoidal core flakes, lots impact damage. In size range of ethnog dart + arrow pts. 2) Aduma, Ethiopia, >70k BP, lg bifacial pts, lg pts on Levallois flakes, 100-20 mm L, range of ethnog spear, dart, + arrow pts. 3) Tabun, Israel, MP Levallois + Mousterian pts, roughly contemp w Aduma, 70-50 mm L, range of ethnog spear pts.

MSA pts smaller, more retouched than MP, comp to Thomas ethnog pts where spear thrower pts weigh 2-8 gm, arrow pts mostly 4 gm or less. No arch or ethnog spear throwers known in Africa, but the Aduma pts trend lg to small thru time, are within size range, and African Late SA pts are arrow size when Euro using atlatl, so maybe Africa passed thru spear thrower stage earlier. MSA early spear throwers would fit with other early "modern" traits like use of marine resources, regional styles, [bone tools], ornament + pigment use

Broughton, Jack M., Michael D. Cannon, Frank E. Bayhan, and David A. Byers 2011 Prey Body Size and Ranking in Zooarchaeology: Theory, Empirical Evidence, and Applications from the Northern Great Basin. *American Antiquity* 76(3):403-428.

Ethnographic and archaeological evidence to support argument that hunting larger animals is more efficient in calory return per hour effort than hunting smaller, even when they have high mobility and failure risks. No atlatls.

Brown, James

1996 The Spiro Ceremonial Center: The Archaeology of Arkansas Valley Caddoan Culture in Eastern Oklahoma, volume 2. University of Michigan, Ann Arbor.

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Pp. 465-66. In both looted material and controlled excavation, specimens of boatstones, bannerstones, and bar atlatl weights. Most such appear in the area before 500 A.D., but at Spiro they are in burial contexts of the Evans Phase (1000-1100), at a time when bow and arrow are represented by many small arrow points. Three boatstones are animal effigies, one apparently a locust or cicada, one a double-headed turtle, one a lizard. Bar weight of quartz crystal. Six to eight butterfly, pick, and hourglass bannerstones "attributed to the site" from looter collections. Would be out of normal chronological place, probably secondary use as ornaments. [Hamilton 1952 illustrates more of these artifacts, and an atlatl is depicted on a shell cup in Phillips and Brown 1975 plate 9.]

Brown, James Allison

1954 Wooden Artifacts. In *Caves of the Reserve Area*, edited by Paul S. Martin, John B. Rinaldo, and Elaine Bluhm. Fieldiana: Anthropology Volume 42. pp. 181-211. Chicago Natural History Museum.

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Atlatl distal fragment of typical SW type with shallow channel and short integral hook. Photo shows short and badly weathered. One slotted foreshaft 9.3 cm L, .9 cm diam.

Brown, Jeffrey L.

1967 The Use of Atlatl Weights: A Suggestion. Southwestern Lore 32(4): 84-85.

Mechanical principles (atlatl as lever) suggest that weight decreases efficiency by adding inertia, but also adds angular momentum which increases stability of throwing arc and thus accuracy.

Browne, Jim

1938 Antiquity of the Bow. American Antiquity 3(4): 358-359.

Precursor to Browne 1940, disputes Baker + Kidder 1937 that bow relatively recent, says Folsom points "made for efficient bow and arrow shooting"

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Browne, Jim

1940 Projectile Points. American Antiquity 5 (3): 209-213.

Size of points is not a good marker for dating "pre-bow" - Pt 87 mm long, 37 wide on arrow still shoots - many "too large" pts actually ok for bow and arrow. Experiments with self bow and Basketmaker type atlatl: "Any close degree of accuracy

Experiments with self bow and Basketmaker type atlatl: "Any close degree of accuracy is impossible with atlatl and spear." (says he uses overhead sweep, full extension) 6 mo practice "can't hit buffalo 1 out of 10 at 30 yards." Bow much more accurate. Dart

greater penetration than arrow with same pt. Maximum atlatl throw 81 yards. [I wonder why his accuracy was so poor with atlatl? Poor gear? Wrong motion?]

Brownold, Charles, and Bertram Brownold

1942? Good Sport with a Throwing Stick. [Unknown magazine "HW"?]

[Clipping from unknown craft or pop science magazine bought ebay, ad says 1942, but no date on article.] Simple design for an Eskimo atlatl, 36" unfletched darts of 1/2" dowl, target at 20 to 30 yards. [You'd have a hard time making this work very well].

Bruechert, Lorenz W.

1996 The Bannerstone: A Continuing Enigma. The Atlatl 9(2):1-3.

Atlatl weight theory (Webb) is most accepted, but experiments show doesn't add force or velocity. Baer, Blair suggest "spinning stone" [= spindle whorl] from ethnographic analogy, a find with short slate shaft in bannerstone hole [but only a few wild fibers are suitable for spinning, and associations documented by Webb and others suggest atlatl connection].

Bruechert, Lorenz W.

1995 Recovery of a Spear Thrower in Chile. The Atlatl 8(1): 1-2

Possibly associated with female burial, cemetery ca 1600AD [he must mean BC - Cinchorro stage, Early Agricultural]. Long narrow stick, curved, 60 cm L, 15 mm W, missing hook, partly cane, poor illustration shows what seem to be finger loops. Info summarized from Focacci + Chacon 1989.

Bruechert, Lorenz W.

1998 Mummy Burial of the Muisca Empire. The Atlatl 11(2):1

Recovered with mummy, ceramic cup.

Straight wood shaft with lashed on shell male hook, and larger shell hook forming grip. Ceramic date 1300-1450. [Photo, no measurements]

Bruchert, Lorenz

1999 Dart-Throwers in Washington and Oregon: Similarities and Differences. *The Atlatl* 12(2):1-5.

Whale-bone frags from Seaside, Oregon, Par-Tee Site represent up to 75 throwers. Reconstructed with male or mixed hook [unclear how good the evidence] and integral carved double loop handle like Aztec. Weights found [but not apparently in association]. Dates here and elsewhere show use of atlatl until almost 1000 AD on Pacific Coast. Compares to McClure, Roaring Springs, and Skagit.

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Bruechert, Lorenz

1999 Iceman Discovery in British Columbia, Canada. The Atlatl 12(4):1-2.

Glacial find, man with equipment including atlatl, only 2nd found in BC, apparently new type. Probably caribou hunting, ca. 1445 AD. [short note only, refs other finds, this is Kwaday Dan Sinchi, and probably not atlatl]

Bruechert, Lorenz

2000 Discovery of an Iceman in Northern British Columbia Chips 12(2):12.

Kwaday Dan Sinchi find briefly described. Unusual form atlatl. Dates C14 420-530 BP [this is real late, after bow, I'm not convinced it's an atlatl].

Bruchert, Lorenz

2000 Old and New World Dart-Throwers and Related Topics: An Annotated Bibliography. World Atlatl Association, Aurora, Colorado.

Very thorough and useful bibliography, some annotation, mostly abstracts from articles. Divided into 9 main topic areas, with topical index and keywords. Lots of hard-to-find ethnographic references. [Most refs now included in this biblio]

Bruchert, Lorenz

2001 Publication Confuses Early Old World Dart-thrower Use. The Atlatl 14(3):7.

Criticizes Farmer 1994 – N. African Middle Paleolithic origins of spear thrower based on redating of Aterian stemmed points. These are not adequate evidence of atlatl. [Quite right!]

Brues, Alice

1959 The Spearman and the Archer: An Essay on Selection in Body Build. *American Anthropologist* 61 (3): 457-469.

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Selective pressures in primitive societies where occupation is not specialized should push for bodies efficient for major subsistence activities. Body size is limited by food, so shape is more likely to be selected for. Body is muscles and skeletal levers. Early hominids should be large with lateral build, bulky muscles, short limbs for crushing strength at close quarters before development of effective weapons, but this reduces speed and would tend toward herbivory since such an animal would not be able to catch prey. Earliest weapons would be Dart's femur clubs used by Australopithecus [a now discredited idea], again favoring bulky strength. Spear is first projectile weapon [unlikely]. Throwing would promote more "linear" bodies with longer lever arms, an advantage of modern humans over the "muscle bound" "lateral" Neanderthals. Throwing stick extends arm, could be a means of adapting spear use to people with "lateral" short
build. Linear African people don't use it, throw spears by hand alone.

Bow relies on stored energy input by strength of arm, so shorter limb segments better, probably developed by "lateral" people. "Linear" folk use very long bows, requiring less force multiplied by longer draw, but less efficient. Spear is used by running hunters, bow by stalking hunters, again with suitable bodies for each.

With farming, axe or hoe is like club, favors short strong body. [She admits this is all speculative, but it still represents the worst of the old physical anthropology based on sweeping overgeneralizations and stereotypes, and in this case, without concrete data either. Her understanding of actual bow and spear use is limited too.]

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Bruhns, Karen O. and Nancy L. Kelker

2010 Faking the Ancient Andes. Left Coast Press, Walnut Creek, CA.

Companion to Kelker and Bruhns (2010) Faking Ancient Mesoamerica. p 19 "Thomas Hoving (1996:17), former director of Metropolitan Museum of Art.... reported that a full 40% of the works (some 50,000 items) offered for sale to the Met during his tenure as director were fakes or so overly restored as to be virtual fakes." [Shocking, but from there they make the leap that 40% of art objects everywhere are fakes. They make a convincing case for pervasive faking, but are not justified in applying the 40% figure everywhere.] However, many examples: Much (85% !!) of Gallo's Gold Museum in Lima was exposed as fake at exhibit in Montreal, but continues to display, and book widely circulated, probably the most used source on SA gold [meaning beware of atlatl representations in S. Am. gold]. Mummies and their equipment frequently pastiched together [probably should be wary of old unprovenanced atlatls - they can be easily assembled from parts, including old wood, or completely fake.] Meggers and Evans Valdivia material compromised by faking, as well as their silly trans-Pacific ideas.

Brumfiel, Elizabeth M. and Gary M. Feinman, eds.

2008 The Aztec World. Abrams, New York.

edited volume, fine photos include Offering 106 from Templo Mayor with 22+ fine bifaces, shells, eagle? bones, painted cylinders, 2 carved "solar darts", 6+ flaked or carved stone water or serpent forms, deity etc. Many sacrifice images including "sacrifice with arrows" from codex [victim on scaffold, darts shown same as reeds in name "handful of reeds" - probably indicating material of atlat1 darts or can be read as fletchings]. Three personified flint knives from Templo Mayor. Skull mask with biface nose and tongue.

Brundage, Bill

2007 NYAA, Inc. - The Organization - An Explanation. *The New York Atlatl Association, Inc. Newsletter* 2 (2): 1-2.

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Brundage, Bill

2007 "Whispers from the Shadows". The New York Atlatl Association, Inc. Newsletter 2

(2): 5.

Origins of Genesee Valley Atlatl Association range in protests against nuclear waste dump.

Brundage, Linda o 2007 A 'Little' Noticed Score. *The Atlatl* 20(3):11.

NY youth league. Keegan Gerber age 11 scored 74. Marlin Bassett age 4 twice hit 10X.

Bryce, Byl x 2003 The History, Hunting Tactics, and Specialization of the Atlatl and Dart. Unpublished class paper for C. Hilton, "Modern Human Foragers" Grinnell College.

Bryce, Byl o 2007 Are Two Hands Better Than One? *The Atlatl* 20(2):11.

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Experiments with two-handed long atlatl - difficult and not too successful.

Bryce, Byl x 2008 An Historic Atlatl, or Phatamu, From Mesoamerica. *The Atlatl* 22(1):11-13.

Describes + illustrates Tarascan atlatl and dart, Lake Patzcuaro, Mexico, collected in 1950s by D. Salzman.

Bryce, Byl

2010 East Meets West: An Analysis of Style in Basketmaker II Flaked Stone Technology. Unpublished MA thesis, Northern Arizona University.

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Bryce, William D.

2014 Basketmakers and rabbit sticks: The 2014 Flagstaff Neolithic Festival. *The Atlatl* 27(3):11-12.

Basketmaker battle game.

Bryce, Byll, Jacob Barrera, and Mike Wellsx2003Analysis of Atlatl Score in Relation to Dart Level, Wrist Flip, and Sex.Unpublished class paper for J Whittaker, Grinnell College.

Bryce, William D., John C. Whittaker, and Chuck LaRue p

2013 Conflict among Dispersed Early Agriculturalists: Depictions in Basketmaker II Rock Art. Paper presented at Society for American Archaeology Annual Meeting.

Buchmeyer, Hank, and Frank Lukes

2018 The throwing arrow. The Atlatl 31(2):1-3.

Same principle as atlatl, but with string instead of stick. [This one needs analysis – is it really same principle?] String wraps at notch just distal to fletching, arrow held close to tip, normal throwing motion. [So is there really the rotary acceleration like an atlatl, or just longer input of energy after hand has let go, like Howard's atlatl theory?]

Buck, Paul E., and Anne DuBarton

1994 Archaeological Investigations at Pintwater Cave, Nevada, during the 1963-64 Field Season. *Journal of Great Basin Anthropology* 16(2):221-242.

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Surface collections of dart + arrow shaft frags and points. 143 wood or reed compound dart frags, 18 wooden foreshafts, mostly broken at distal end, up to 19 cm long. Frags small, longest 21.8 cm, "hardwood" [no species ID]. Some reed darts apparently had wood socket inserts. 31 arrow shafts + foreshafts, foreshafts sim to dart, but smaller. Painted decoration in brown and green, white, red on both darts + arrows. 74 stone points; 60 dart, 6 arrow. Elko, Gypsum Cave/Gatecliff, and Humboldt series [Middle Archaic dart types], Rosegate corner-notched arrow pts. Many pts have pitch adhering, impact fractures.

C14 dates on wood and packrat middens loosely associated with artifacts: 3255+80 B.P, 3,400+80 B.P. On two shafts from surface: 6500 B.P. On hearth charcoal near surface 9300+170 B.P. So most material pre-3000 B.P., one early date on dart shaft, possible info on transition to bow [or that's much later stuff - seems too early for transition, and no dates on specimens].

Budinger, Dave

2006 Atlatl Be the Day: Sports Group Could be Spearheading Safe Way to Hunt Suburban Deer. *Pittsburgh Post-Gazette* Feb 9, 2006. Reprinted in *The Atlatl* 19(2):8.

Legalization considered in Pennsylvania. Describes atlatl, mentions WAA. Humorous but ok.

Bulmer, Ralph

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1968 The Strategies of Hunting in New Guinea. Oceania 38(4):302-318.

"enthusiasm for hunting is greater than its material contribution...would appear to warrant." Intellectual aspects: strategy, sometimes requires elaborate + precise knowledge of game, sometimes not. Only large or dangerous game is feral pig and cassowary. Various wallabies usually most important, then tree marsupials and rodents, birds, monitor lizards etc. Male activity, taboos on women handling weapons and axes. Bow + arrow, spear, club, throwing stick. Blow-pipe + sling rare. [no atlatl] Wood or bone arrow tips, several types for different game. Stalking, ambush, drives etc. Weapons require close range [no measures given].

Burger, Richard L.

1998 Life and afterlife in Pre-Hispanic Peru: Contextualizing the masterworks of the Museo Archaeológico Rafael Larco Herrera. In. *The Spirit of Ancient Peru: Treasures from the Museo Arqueológico Rafael Larco Herrera*. Kathleen Berrin, ed. pp.20-32. Thames and Hudson, London.

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Burland, C. A. x 1952 Lascaux. *Man* 52 (154): 111-112.

Responds to Lechler 1951. Should interp cave art in terms of hunters. Hooked object is spear thrower with cross handle "as used on Lake Patzcuaro today". Bird object could be counter-balanced spearthrower, stabbing implement, or ceremonial staff. Bison can't be disembowelled by a wooden spear.

Burton, Jeffery F.

1988 Hunters and the Hunted: The Prehistoric Art of Tom Ketchum Cave. *Kiva* 53(4): 335-356.

Pedregosa Mts, SE AZ, 200+ simple black elements, not conforming to published styles. Lots of quadrupeds - deer, sheep, dog - some geometrics. A couple "arrows" and bows, one possible atlatl under a quadruped [figure shows line 21 cm long with two small cross bars toward one end - possibly but not definitely an atlatl, especially in absence of other evidence or depictions]. No temporally diagnostic artifacts. No horses in art, so prehistoric, bow = after 500 AD, but possible atlatl suggests earlier use.

Buscaroli, Giulia

p,x

2017 A new iconographic analysis of the two Mesoamerican dart-throwers of the Museum of Anthropology and Ethnology of Florence. *Archivio per L'Antropologia e la Etnologia* 147: 33-52.

The two Florence atlatls, carved and gilded [see Bushnell below] 8039 (double) and 8040. Bought from a Mr. Tosi in 1902 "from an ancient family whose name he refuses to disclose." In box dated to 16-17th century. Possibly Zani or Medici collections acquired by Pope Clement VII in 1500s. Oak? [They can't really tell, = dark hardwood]. Traces from tying on finger loops which are missing.

8039 2 hooks + grooves. Hooks carved with human figures: a descending warrior/god and standing lord with alligator headdress. 1 groove w chevrons, 1 with lattice. Dual meaning – sky (deity and chevron) vs earthly authority (lord and mat), and ref to a Mixtec myth. Underside has 7 sequential scenes including sacrifice, serpents + eagles, possibly birth and marriage – whole could reflect commission by a ruler, showing his sacred origins, ritual ability, and political legitimacy.

8040 sim images to 4121 in Pigorini Museum, which is considered forgery by Beyer, but more likely signif differences suggest both authentic and possibly following the same model. Two small holes at distal end could have held feathers. Upper face carved along each side of hook+groove. War on one side with deer = captive for sacrifice, ritual (sacrifice) on other. Most figures flying, relating to Voladores. Serpents twisted with warriors. Under side series of figures: Sun God holding darts + shield and atlatl held to his mouth; female Rain God impersonator on scaffold with 2 darts in her sides; Owl date glyph, Serpent date glyph; ball court scene, offering arrow with blood of victim to Earth; 2 figures armed with atlatls, darts, shields (prob part of sacrifice above); lord seated in temple holding 2 arrows [looks like one dart on atlatl to me]; heart sacrifice; skeletal eagle or Itzpapalotl deity who keeps sun moving; open-mouthed Earth Monster. Perhaps commission by ruler to commemorate a ritual war and subsequent ceremony.

Iconography suggests made in SW MesoAm, Puebla, Oaxaca, Guerrero. Probably Mixtec. Archaic conventions, Trapeze-Ray datable 1000-1300 AD, but Post Classic. [Dating conclusions not clear – need C14!] Probably functional, not just ritual, tried replicas with Don Slater at Andover Peabody Mus.

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Bushnell, D.I.

1905 Two Ancient Mexican Atlatls. American Anthropologist 7:218-221.

In Italy, probably from Cortez. Highly ornamented, gold-coated, non-functional? One is odd double atlatl [is this symbolic rather than practical?]. Both straight, inflexible shaft with groove and integral hook, no evidence of loops which they should have. L = 605 and 575 mm. [No discussion of iconography]

Bushnell, David I.

1906 North American Ethnographical Material in Italian Collections. *American Anthropologist* 8:243-255.

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Two Mexican atlatls in Florence Museum (Bushnell 1905). Another in Kircheriano Museum in Rome. Same kind of wood, dark and heavy, resembling rosewood, gold rubbed away from much of surface, carved in low relief on both faces: back in continuous group of figures, hook anthropomorphic, decoration of 5 human figures each side of groove. [Handle plain, no loops or visible attachment for them.] L = 565 mm, W 20 mm prox, 39 distal. [Photo reproduction not good enough to see details well, no description of iconography]. All 3 atlatls "ceremonial, as no actual weapon would have been so elaborately decorated and covered with gold."

Other items in Florence from Cortez: mask in Uffizi Gallery, jade, obsidian mirror in Prof Giglioli's collection, Codex in Biblioteca Nazionale, plus stuff in Rome, probably once belonged to Medici's. [Meaning that somehow this royal material from Cortez was acquired from them by several collectors and institutions - source of BritMus atlatl?] Pigorini 1885 records 14 other mosaic items in European collections including 7 in Christy collection of BM. [Describes other N. Am. ethnographic material not relevant to atlatls].

Bushnell, G. H. S.

1949 Some Old Western Eskimo Spear-Throwers. Man 49: 121, plate N.

Four, Cambridge U. Museum. Collected by Swaine, 1790s on Vancouver exped. Typical forms, some decorated, repaired. Finger hole + grooves, ivory hook, conifer wood. [No dimensions given but clear plate].

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Butler, B. Robert, and Douglas Osborne

1959 Archaeological Evidence for the Use of Atlatl Weights in the Northwest. *American Antiquity* 25(2): 215-224.

104 specimens, 3 main types, weights range 30-300 gm, distribution mostly Columbian and Fraser Rivers, steatite, felsite, limestone, galena.
Type 1: dome with flat sides + flat or concave base, drilled through sides, one zoomorphic
Type 2: elongate "boatstone" with flat base, notched at ends
Type 3: most common, short, globular, notched across center
Dates est 2500-600 BP
Some found in pairs, mixed types, one assoc with copper bead, most probably in cremation burials.

Butler, William B.

1975 The Atlatl: The Physics of Function and Performance. *Plains Anthropologist* 20 (68): 105-110.

0,X

Counters Howard 1974 - his straight line throw would be unnatural and inefficient. Atlatl *does* work as lever. Motion extends above head to height equal to length of arm and atlatl [which is not really correct either]. Uses a mathematical model, reanalyzes Howard's distance figures for velocity and momentum [did he actually try it? - not mentioned, I expect not. His model is better than Howard, and he admits it is simplified, but some assumptions are so incorrect that I suspect they wreck the model: e.g. the arm and atlatl do not move in a simple arc as one straight unit with pivot point at shoulder. The wrist + atlatl lever is more important.] Calculates a 76% increase in force with atlatl over arm alone, distance increase of at least 1.5 times [these seriously underestimate the advantage of atlatls]. Weights do not increase velocity or distance of throw.

Butler, William B.

1977 Atlatl Functions, Fancy, Flex, and Fun. A Reply to Howard. *Plains Anthropologist* 22(76 pt 1): 161-162.

Admits that functional length of atlatl is not arm + atlatl, just idealized model. Reiterates rotational view, suggests experiment with dart held parallel to shaft to prove impossibility of Howards model, and that dart does rotate on spur [but doesn't do it], mentions possibility of flexing atlatl adding to the throw, analogous to

spinning rod (but the motion is still an arc). Need experiments to see if flexing atlatl requires same energy to propel dart as rigid one.

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Butler, William B.

1979 The Wood Projectile Point Penetration Study. In *Megafauna Punchers' Review* Vol. 1 No. 1, edited by Bruce Rippeteau. [unpublished, circulated]

Spoof journal title of informal report on butchery experiments with circus elephant "Margie" in Denver, June 1979. Includes butchery account by Rippeteau, Clovis thrusting spear experiment by Bruce Huckell. Other participants included B. Bradley, M. Wormington, G. Frison.

Butler made 2 darts of pine dowel, 122 cm long, 92 and 99 gm, apparently unfletched, with sharpened ends, one fire-hardened. Penetration poor, only 3-7 cm when thrown from 3-4 m away into belly skin. Suggests need heavier darts and small diameter sharp points. [Very primitive experiment with poor equipment, doesn't seem Butler was very experienced with practical atlatl use at this time either.]

Butler, William B.

1980 Penetrating Elephant Hides with Wood Atlatl Darts. *Plains Anthropologist* 25 (90): 353-356.

[More formal report of above, but flaws still make it not very useful]. Est velocity 23.2 m/sec, but not measured, darts "much too light and of extremely poor balance" (unfletched), too dull. Lesson: need to be prepared ahead for opportunities like this.

Butterfield, Stephen A., Rose M. Angell, and Craig A. Mason x,p 2012 Age and sex differences in object control skills by children ages 5 to 14. *Perceptual and Motor Skills* 114(1):261-274.

Test catching, throwing, kicking, striking. [But what they actually observe is never defined]. Some evidence that sex differences in these skills persist cross-culturally, thus may have some genetic/evolutionary component (refs). Less difference among Aboriginal children in Australia (Thomas et al. 2010). Object control skills link to sports proficiency. 81F, 105M children grades K-8, 99% Caucasian. Test of Gross Motor Development scores [still not explained]. Graphs 'probability of functionally mature pattern' for all. Throwing + kicking show steady rise, plateau at 9-11, signif sex difference in throwing but not kicking. At 10, 79% boys show 'mature' pattern, while max for girls is 53% at 11.5 yrs. Striking not plateaued, but sex difference.

Butterfield, Stephen A., and E. Michael Loomis

1993 Influence of age, sex, balance, and sport participation on development of throwing by children in grades K-8. *Perceptual and Motor Skills* 76:459-464.

x,p

Maine school children N = 381M, 338F, standard tests [not well defined – what throwing

test did they actually do? Distance, accuracy? Apparently just observed and graded motion]. Children 2-3 throw with forearm extension but no foot movement or trunk rotation. By 3+-5, increase leverage with trunk motion, still not foot. Children at 6+ normally capable of throwing with a forward step of the opposite leg and greater trunk rotation [defined as adult throwing motion]. Percent adult motion 90% by boys at grade 2 and after [so essentially all boys throw well after age ca 8-10], only 60% for girls, who never got much above 80% and were always behind boys.

Buttin, F.

1964 Les Propulseurs de Leonardo de Vinci. *Bulletin de la Société Préhistorique Française* 61(1):56-64.

Drawings of slings, including some apparent rigid forms adapted to throwing spears from a midpoint attachment. [Unclear if really in common use.]

Bybee, John

2012 Harvesting Milkweed Fibers. *Primitive Archer* 20(6):62-64. Timing important, harvest when plants still green, just begin to show black spots of rot on stem (Oct in IA). Curing and stripping info.

Cabaraux, Anne-Francoise

2002 Why Do They Throw? The Atlatl 15(4):15

Short profiles of Jacques Pernaud, Uli Weigel, Russell Richard, Pascal Chavaux.

Cade, Chris

2009 Hunting Hogs with Rocks. Primitive Archer 17(4):16-19.

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Bow hunt on ranch, 550 gr arrow w obsidian pt, 10 yd, broke rib on entrance + passed through.

Cady, Willoughby M.

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1949 Remarks on the Weighted Atlatl. The Masterkey 23(2):59-60.

As arm is straightened horizontally, atlatl is vertical and dart departing. Hook travels faster than weight, so "momentum of weight keeps it on its forward way and assures that the dart moves faster than the weight." Optimum position should be 36-45% of distance from handle to hook [but reasoning not given].

Cahill, Tim

1987 Perfecting Stone Age Technology: The Atlatl, A Great Leap Backward. *Mother Earth News*, July, 1987. Accessed 2/2002 BPS Engineering web page http://www.atlatl.com.

Aztec against Spanish, puncture armor [hype].

Bob Perkins and Paul Leininger, engineering students at Montana State U., "whose work will revolutionize archaeological thinking about atlatls." The "Mammoth Hunter" is first working commercial atlatl, have sold about 75 of them. Explains theories that need flexible atlatl and dart, weight tunes them. "You actually launch a wave down the dart. It reaches the end and begins to travel back. Meanwhile the atlatl bends back and stores tension. At the point of launch, the waves from the atlatl and the dart should cancel one another and turn into acceleration. The dart should be stretched out to its full length as the atlatl is releasing its stored tension. A weight will bring these waves into phase…it's a timing device." [This whole theory is incorrect because neither atlatl nor dart oscilates before throw, they merely bend, and all this flexing adds little if anything to dart velocity.] At 1985 5th World's Open Atlatl Context, only 2 out of 50 competitors used flexible darts. [Check that – hard to believe since rigid darts don't generally work at all.] Perkins and Leininger claim to have popularized flexible dart 1985, winning in 1986.

Cahill, Tim

1998 What About Atlatl Bob? Outside 23(12):55-60. (December 1998)

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Facetious account of Bob Perkins and his encounters with atlatls and primitive skills. [Atlatls not very well described for public audience.]

Cain, David I.

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2010 Atlatl Weight, Power or Accuracy: Experimental Use of Weighted Atlatls. Poster presented at annual meeting of Plains Anthropological Society.

100 shots @ with weight close to handle, close to hook, accuracy measured as distance from center of target. More consistent with weight close to handle; distal position adds power and tends to overpower the dart in throwing [unlikely].

Cain, David Isasc

2012 Sticks with Stones: Controlled Experimentation in the Use of the Weighted Atlatl. Unpublished MA thesis, Missouri State University.

x

Reviews atlatl history, experimentation, principles as lever. Weight - symbolic or practical? Investigates effect on power and precision using a mechanical thrower. A clay pigeon launcher as power, a couple lever arms, and release mechanism [photos, but needs mechanical diagram with details of structure] - largely simulates forearm and wrist action. Atlatl 1-piece osage orange 82.5 cm long, 77 grams without weight. Darts 6' pine dowels, fletched. Moveable lead weight, 95 grams. Expect same throw each time, compare by measuring distance to measure power. Precision [= consistency] measured by shot clustering. 164 weighted shots, 164 unweighted.

Results: All else equal, weighted atlatl throws shorter range, weighted mean range 21 m, unweighted 25 m, and little overlap in the two groups in distance. [So a reduction of about 15% by adding weight.] Distance to center of cluster of shots weighted was

2.79m, unweighted 4.24m, so adding weight improved precision. [However, there may be a bit more dispersion with increased distance of unweighted shots, so the increased cluster of weighted shots may be illusory. Oddly, the plot shows almost all shots dispersing to the Left of the line of throws, so there is a bit of a bias in the machine too.] Conclusion: weights reduce power, but have a practical advantage increasing precision, thus probably accuracy, so probably not just symbolic artifacts. [Good experiment, not unexpected conclusions, but hope he uses the ingenious machine to test some more ideas.]

Cain, David I. and Elizabeth A. Sobel

2015 Sticks with Stones: An Experimental Test of the Effects of the Atlatl Weight on Atlatl Mechanics. *Ethnoarchaeology* 7(2):114-140.

see above

Cain, David I.

2016 How NOT to use an atlatl: Removing the anthropomorphic variation in atlatl experimentation. Paper presented at Missouri Archaeological Society Fall Symposium, Van Meter State Park, MO, October 1, 2016.

See above. He also demonstrated his device and asked for comments and improvements.

Callahan, Errett

1994 A Mammoth Undertaking. Bulletin of Primitive Technology 1(7):23-39.

S

"The Ginsburg experiment" – butchering circus elephant with Stanford, Bonnichsen, Morlan, G. Haynes in 1978. Focus here on spear tests to examine hafting and basal ends of Clovis points. A few hand throws – penetration only to point hafting. Most throws with simple stick atlatl, unweighted – penetration half depth of chest cavity. Concludes atlatl necessary to kill elephant with Clovis weaponry. Variety of points and haftings tried, some illustrated. Deep slot, tapered distal end on foreshaft as wide as point base, not just flute, seems to work best. Penetration usually ends with foreshaft if shaft is larger diameter, so long foreshafts best. Best results with long flexible unfletched spear. [Useful discussion and illustration of hafting alternatives, unfortunately he never did the detailed evaluation of the alternatives that was planned.]

Callanan, Martin

2013 Melting snow patches reveal Neolithic archery. Antiquity 87(337):728-745.

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Recent finds from Norway, Neolithic 4000-1800 BC, 5 arrow frags, one bow. Artifacts help date snow patch + melting episodes. Once thought Roman Iron Age warming period destroyed earlier remains, but now finding them.

Specimens: A - almost complete arrow shaft 3628-3371 cal BC, pine, 420 mm L, v-split for hafting point, nock missing, lashing imprints for fletch, pigment traces. B - willow

shaft frags with small slate point, 3518-3362 cal BC, min L 509 mm, wide v-nock, nock flared, black adhesive w spiral lashing imprints, deep hafting split w adhesive [not IDd], C - pine shaft frag w slate pt hafted in deep notch w adhesive and lashing, 3361-3102 cal BC. D - beech shaft frag E - complete shaft of beech (Betula), 794 mm L, lashing imprints, deep nock, bluntly self-pointed [with what looks like minor impact blunting], 1883-1682 cal BC Neo-Bronze Age transition. Maybe the 'nock' is actually the hafting split and some nock component missing from pointed end. F- bow limb frag, 385 mm L, oval section nock end to rounded square x-section limb, 38 mm W, with hide lashings, elm.

Ca 140-150 Neo bow finds from Europe. Junkmanns two types: propeller = broad flat limbs with narrow grip; staff type = more regular along length of bow.

Variability in arrows may be developing traditions or individ variation in small sample. Tend to be shorter than Mesolithic arrows with lighter points; Neo used slate points, but they are variable.

Callegari, G. V.

X

1934 Un Nuevo Precioso "Atlatl" Mexicano Antiguo Recientemente Descubierto en Roma. 25th International Congress of Americanists, La Plata. *Actas y trabajos cientaificos del XXV Congreso internacional de americanistas*. Vol 2 : 7-9.

In Spanish. Elaborately carved, gilded atlatl w "bone" finger loops. So highly decorated must be ornamental, not functional, and belonging to one of last Aztec kings. Same designs as Florence specimen [From which it may be copied, fake, See Beyer 1934.]

Cameron, Constance

1988 Birdstones and Their Associations. *Pacific Coast Archaeological Society Quarterly* 24(4):54-62.

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Two from CA-Ora-327, Morro Canyon, Orange County, small "pelican" type with downcurving beak and longer "cormorant" type with long neck and short, high, small beak. Dates from shell + charcoal assoc 940-570 BP for first, 2700 + 70 for second. These and other forms described, occur in caches with other effigies, burial contexts, random. [Cameron regards these as effigies, no mention of atlatls. The beak could be a hook but I doubt these are atlatl parts - they are shaped somewhat like Peruvian forms, but the hook end is close to the body or small and frail, the base is small and rounded and would not attach well, and being made of steatite, many are surely too fragile to use as atlatl hooks. So these are not birdstones in the Midwestern sense - an unfortunate coincidence of names.]

Campbell, Paul D.

1999 Survival Skills of Native California. Gibbs Smith Publisher, Salt Lake City.

Covers all sorts of stuff in detail. Chapter on atlatls and darts pp. 307-319. Good illustrations + info on several ancient atlatl specimens (Cerro Cuevoso, Buena Vista,

Nicholarsen, Roaring Springs), some male hooks on round shaft with single finger loop, others flat board with double finger notches. Late survival in Baja California. Dimensions for some archaeological dart shafts given. [Unfortunately promotes incorrect atlatl-asspring and ancestor of bow theories].

Campbell, Paul

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2011 Stone Age Spear Throwers: Antiquity, Flight Fundamentals, and the Compound Pendulum Effect, Part 1. *Bulletin of Primitive Technology* 41:70-83.

Extensive survey of atlatl history, mostly ok. Bows might be as early as spear thrower but don't survive; earliest from "Magdalenian sites around 12,000 years ago in France and N Germany." Tube or stick atlatls, some with cross bar handles "could be gripped closer to the spur for short range targets and toward the end of the handle for longer range targets, including herds of antelope or flocks of birds." Paleolithic ones have carved bone hooks or weights. [He considers these "very short, inflexible" implying examples are complete, which is probably not the case.] Flat board atlatl is other basic form, more recent.

Very short atlatl implies heavy spear, not needed after giant ice age mammals. "Yet some Aborigines... and Inuit... threw very heavy darts until recently. And to throw them, the Alaskan Yupik used very short, stiff, thick, inflexible board style throwers..." [But Australian throwers are extremely long and heavy] Atlatl explained as lever system, so as atlatl lever shortens, heavier spear becomes optimal, while human effort remains the same, and heavier dart compensates for reduced velocity. Describes basic throw. Dart flex necessary but not for spring energy. Shorter atlatl more accurate for close range, also shorter dart, but weight needed for penetration. All elements compromise: heavy dart more momentum and penetration, shorter range; lighter, longer dart more distance, higher velocity, but less penetration, more flex distortion in throw, can compensate by shortening atlatl, etc.

Several illustrations of different atlatls [Key Marco find described inaccurately]. Illustration of Winnemucca and Hogup Cave, with detailed replic of HC.

Campbell, Paul

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2011 Stone Age Spear Throwers: Antiquity, Flight Fundamentals, and the Compound Pendulum Effect, Part 2. *Bulletin of Primitive Technology* 42:26-34.

Flexibility in atlatls not as important as in darts, but if flexy enough, "act like whips, giving them a boost in speed." Ordinary atlatl flex has little effect (Whittaker and Maginnis), but if exaggerate it with a weight? Weights 1. Stabilize for accuracy, 2. Balance dart at rest. Added to most atlatls, weights decrease efficiency. A very flexible weighted atlatl is in effect "segmented" and acts like a whip. Handle slows and completes its snap, "setting off a wave of accelerating speed" up the rest of the thrower. Need a light dart like SW forms. Australian groups use heavy spear, close, with rigid thrower, and light long range spears with whippy throwers. Heizer describes Leonard Rockshelter dart ideal for whippy atlatl [but those don't occur in SW – although he seems to want to see Basketmaker form as one.] Segmented effect is like gears increasing velocity down the

line [confusing comparison – more like a series of levers, not gears]. Whipping is not spring action but they may work together. Nyman (2008) on baseball throws notes sequence of cumulating actions for acceleration. This whipping is "compound pendulum effect." Testing flexible atlatls shows improvement in speed and accuracy with added weight. [I considered the possibility of a spring effect in whippy atlatls, Campbell has thought it out much farther. Now we need some controlled tests, with slow motion recording.]

Campbell, Paul

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2011 A One-Piece Medium-Length Inflexible Atlatl from a Single Bashed Stone. *Bulletin of Primitive Technology* 42:54-56.

Less than 3 hrs to make using willow, river cobble "teshoa" flake retouched as chopper. Thinned stick with chopper and flakes, cut integral spur. Pictures.

Campbell, Paul

2012 The Importance of Doing: Tossing Atlatl Darts in the Woods as Real Science. *Bulletin of Primitive Technology* 43:9-10.

A

Ashby's work with arrows as example of "real world outcome driven research" explaining observed facts, vs controlled experiment + theory building. [Not a good distinction].

Campbell, Paul

2012 A Stone Age Bow, String, and Arrows from a Single Tree. *Bulletin of Primitive Technology* 43:20-31.

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Fremontia, simple stone tools, nice pics.

Campbell, Paul

2012 A Quick Light Flexible Atlatl and Dart Made with Expedient Stone Tools. *Bulletin of Primitive Technology* 44:41-45.

Willow, rasped and whittled with stone, attached hook, light unfletched darts.

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Campbell, Paul D.

2013 *The Universal Tool Kit: Out of Africa to Native California*. Privately published, La Crescenta, CA.

The 'universal tool kit' "does not consist of stone tools. It does not consist of concrete pieces we must lug along – the Australian Aborigine made from a rock at his feet the tool he needed, left it, and went on. The kit weighs nothing. The kit is carried in the mind." – i.e the principles of simple stone tool making. Simple flake, chopper, handax type tools common everywhere, simple, effective. Reuse, recycling old material is efficient source.

Endscrapers and adzes - ethnog examples in Africa, variability in use, manufacture, material, hafting. Alaskan, Plains, Australian examples. San stone arrows. Scraperplanes. Blades (photo G Nunn making Mesoam obsid blade).

Practical Applications: short illustrated articles on making bows, arrows, atlatls, darts with simple flake and core tools. [Generally good ideas, well illustrated].

Appendix p 262-302 Stone Age Spear Throwers: Antiquity, Flight Fundamentals, and the Compound Pendulum Effect. By which he means 'whip' effect of a flexing atlatl. Length of atlatl important: tip of longer atlatl traverses more distance in same time than a short one, but atlatl also acts as lever against arm. Longer atlatl, more effect of weight on the end, resistance against arm increases. So as atlatl shortens optimum dart weight increases. Decreasing dart weight only slightly increasese efficiency because arm already moving at maximum speed. Optimum as heaviest dart arm can bear at maximum speed. [he really means max speed of atlatl tip, max lever action arm can apply]. Lighter longer darts have greater range, heavier darts more momentum; short atlatl + heavy dart best for large game.

Describes throwing motions for target and long range. Atlatl acts as 'catapult' [he doesn't use the term 'lever']. Longer atlatl, more distortion of dart tail is necessary, so shorter atlatl more accurate at close range. Dart should be flexible on proximal end for tail 'wag' but stiff at tip. Not a spring effect, Whittaker + Maginnis showed dart still flexed as left atlatl. [More importantly the atlatl was still flexed]

Aboriginal throw with woomera described: heavy thick dart flexed. Woomera short and wide but thin and flexible [I doubt it. Woomera are actually very long and rigid]. Effects of weight on penetration, Ashby's data indicate momentum more important than kinetic energy.

Yupik harpoon thrower – short + rigid, harpoon thick, minimal flex, so can't use long atlatl.

Long flexible atlatl has 'whip' effect [see other articles, pretty much the same here.] A little flex not a help – JW +M exper shows atl still flexed as dart flies, while an inflexible atlatl would still be in contact with dart, adding force [maybe]. Adding weight to a slightly flexible atlatl makes it whip, experiments: 3 similar atlatls, one no flex, one slight, one more. Inflexible threw 90+ yards, others both 90. Add weight near middle, now flexibles throw 100 yds, whip effect compensates for reduced lever efficiency, while inflexible now only 75 yds. [Maybe. But he doesn't provide enough data to tell if these are real effects or figments of his unsystematic small sample of throws. We need some serious experiments with very long atlatls and proper recording instruments to see if there might be a whip effect]

Cannell, Alan o

2018 Mass distribution analysis of spheroid manuports, spheroid artifacts, and the lithics of play learning. *Lithic Technology* 43(3):141-150.

Round rocks in paleolithic sites, both natural and modified, considered as throwing stones. Throwing goes back before hominids – modern apes. Spheroids from Olduvai and elsewhere. Cave of Hearths ca 500,000 yr old (*Homo erectus*), 227, 166 of diabase from

2 km distant, naturally forms rounded shapes, most not modified, while other material spheroids are, so not hammerstones, intended for throwing. Mass distribution from 75-2125 grams, ave 544, but 40% are between 400-600 gm. Ca 500 gm is 'universal mass' e.g. pound, peso, livre, other ancient measures, and also about ideal mass for throwing.

Mass of spheroids at Olduvai a bit less, so model hominids there as ca 165-175 cm tall, while Cave of Hearths larger, model hominids 181 cm, these models consistent with fossil skeletal evidence.

Niuan (Polynesia) war stones shaped, for duels and battles at close range, mean mass 440 gm.

Smaller stones ave at Koobi Fora suggest collected by smaller individuals, perhaps females and juveniles. Could imply learning complex skills of lithic manufacture, throwing with force and accuracy for hunt and defense.

[Interesting. I think the basic argument that size distrib = selection for throwing is persuasive, but some of the extended modeling from it gets more tenuous.]

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Carballo. David M.

2011 *Obsidian and the Teotihuacan State: Weaponry and Ritual Production at the Moon Pyramid.* University of Pittsburgh Memoirs in Latin American Archaeology No. 21.

Obsidian "was a central component in political rituals and essential for arming the city's military." (17). 1998-2005 excavation in pyramid and plaza. Militaristic state, organized army, possibly rank by merit with personal incentive for success. Changes in technology from Formative include proliferation of atlatl (33), cotton quilted helmets, smaller lighter shields, use of battle standards for organization. Bow use possible, but no depictions of bows, many of atlatls, obsid pts are large. Atlatl range ca 70 m, declining accuracy after 46m (Hassig1992). No macahuitl, so shock attack after missile (atlatl) would be clubs, spears, knives. Human sacrifice common, including heart extraction, assoc w military conquest.

Aztec obsidian industries - cities didn't monopolize sources, obsid used for tribute, weapons stored in state warehouses, rich obsidian lore in myth and ritual use. *Itztli* symbolically linked to powerful forces: volcanoes, divination w mirrors, regenerative power of blood + sacrifice. Prismatic blades, bifacial dart points. Dart = *tlacochtli*, assoc w Toltec, more noble weapon than arrows assoc w Chichimec hunter tribes to N.

Formative (pre-Teo) obsid industries: prismatic blade developed mid-4th millenium BC. Specialist production, independent or attached. Long continuity of basic types from Formative thru Classic (Teo) to Post-Classic (Aztec). Intro of arrowheads possibly during Late Classic or EpiClassic. Formative mostly utilitarian; bloodletters + only a few eccentrics are exceptions. Eccentrics, ritual, ornamental use more later.

At Teo - dense obsid scatters, early model of obsid as critical resource (manuf, export) in rise of mercantile state. But Clark (1986) argues that importance exagerated, data only from unclear surface contexts, need excav of real workshops.

Three workshop deposits, Xolalpan phase (AD 350-550) in plaza, on earth floor, debitage and microdebitage from intense event of production of dart pts and miniature

eccentrics. Pits with debitage, pot offerings, and one with 53 bodies dismembered and used for making bone artifacts - all with obsidian debitage as well. Scavenging of offering deposits by later Teotihuacanos. Wkshp deposit ca 1/3 excav, with 170 kg of debitage, 136 kg/cubic meter.

Dart points were stemmed, ca 7 cm long. No large game, so for war and offering. Some too large for projectile use. Finished by regular pressure flaking. Also making pressure prismatic blades. Small eccentrics from flat flakes + blades - mini pts, crescents, trilobes, anthropomorphs, serpents, canids, bipointed knives, and bloodletters. [There are drawings of representative specimens of all, but photos are far too few and too small.]

Analyzed 40,000 artifacts from Deposits 1 to 3, 30 kg worth. Debitage typology [technological types, but a bit too elaborate]. D3 has bigger debitage. Obsidian from Tulancingo, Pachuca, Otumba. All 3 making mostly bifaces, D3 has ca 42% blade deb. Points made by percussion shaping diamond or stemmed form, then pressure finish. Uses flakes, broken bifaces to estimate 1,836-11,760 pts produced for D1. Larger deb in D3 from larger source pieces, making larger bifaces, wasteful discard - suggests statepatronized production, not individual economization.

Iconography. Depictions of dart + shield, probable atlatls [including some carried by warriors with dart+shield, with a bleeding heart on hook of atlatl, or these may be curved obsidian knives with impaled hearts.] Dart pts not shown realistically. Eccentrics depict predatory animals (canid, snake) assoc with warfare. Trilobe = blood droplets. Undulating bipoint knife = lightning. Anthropomorphs appear to = bound captive/sacrifice. Predatory animals and birds buried at Moon Pyramid. Conflation of dart/serpent on some eccentrics.

Carnegie, David W.

1898 Spinifex and Sand: A Narrative of Five Years' Pioneering and Exploration in Western Australia. C. Arthur Pearson Ltd, London. Reprinted Hesperian Press, 1982.

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p 340-341: Kimberley district spears of superior manufacture, with heads of glass, quartz or insulator from telegraph line. "Spears will pass right through a cattle-beast, and which are themselves unimpaired unless they strike on a bone." Telegraph damaged, attempt to reduce by leaving bottles at poles. Spear heads fixed in lump of gum. "Up to a distance of 80-100 yards the spears can be thrown with fair accuracy and great velocity." L from 10-15'. Woomera held as in sketch [shows flat decorated N Desert form held edge up, spear across fingers, pinned by thumb.] Central desert forms cruder. In Kimberley use light board throwers 2.5-3.5' long.

Carneiro, Robert L. x

1970 Hunting and Hunting Magic Among the Amahuaca of the Peruvian Montaña. *Ethnology* 9(4):331-341.

Field work 1960, population ca 500. E. Peru tropical rainforest. Hunting + horticulture, 50% + 40% of subsistence, 10% fish and other. Generalized hunters of most mammals, including cat species, tapir, peccary, deer, capybara, anteaters, sloth, armadillo, coati,

squirrel, also large birds, caiman, lizard, turtles. Tapir and spider monkey preferred, and most common game. Individual hunting with bow and arrow only. B + A always carried by man, effective. Peach Palm wood, 6-6.5 feet long. Arrow 5' long, flower stem of cane Gynerium saggitatum, with hardwood foreshaft and bamboo lanceolate point. Also hardwood pt w bone barb for small game, and blunts for bird. No poison. Spiral fletching. Bow draws 60-75 lbs. Tracking and stalking skills; more important than marksmanship. "Generally, a hunter tries to close to within 40 feet or less before shooting." Dogs help find game or bring it to bay. Blinds sometimes used.

No magic in horticulture, but hunting uncertain and dangerous, much magic, but no totem animals, prohibitions, or propitiation of animal spirits, or increase magic. Positive magic to improve hunter, weapons, or make game "tamer" and easier to catch: smearing blood on weapon or hunter, plant leaves or infusions, drinking excrement of boa constrictor, hawk talons, bee stings + caustic plants on arms, innoculation with frog poison (hallucinogenic).

Carr, Kurt W., Christopher Bergman, and Christa M. Haag o 2010 Some Comments on Blade Technology and Eastern Clovis Lithic Reduction Strategies. *Lithic Technology* 35(2):91-125.

Blade industries rare in N. Am. Compares E C to more standardized blade-dependent early European industries. E C does have blades, but much rarer, less regular than Euro Upper Paleolithic and Epipaleolithic, and use less high quality material, more expedient, variable, inconsistent core preparation. EC also makes fewer tools on blades, and almost never projectile points. EC points are bifacial, curated + resharpened, while Euro points are on blades, discarded when damaged. Clovis blades occur where large material is available. Clovis adaptation more mobile, less dense population than Europe.

[Although Solutrean industries are not discussed, this applies - one reason why they are not reasonable ancestors for Clovis industries,]

Carrère, Patrice

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1990 Contribution de la ballistiqe au perfectionnement des études techno-fonctionelles des pointes de projectiles préhistoriques. *Paléo* 2:167-176.

In French. Experiments need understanding of complete projectile and physical laws. Provide specifics of some projectiles and their mode of propulsion, regardless of point. Experience allows reconstruction of Paleolithic spearthrowers true to the archaeol evidence: A. 72 cm L, 66 cm hook to grip, 280 grams, can throw over 100 m. Two darts that work well: A. 'fleche' [=arrow] fletched, 1 m L, 45 grams, balance 6/10 of L; B. 'sagaie' [=spear] 1.5 m L, 150 grams, balance 6/10 L, fletched. Large military chrongraph. Throws at 20 m distant target, velocity measured at target and 2.5, 5, and 10 m from thrower. A velocity from 32.9 m/s to 25.4 m/s at target; B velocity from 25 m/s to 20.8 m/s at target. But greater velocity of arrows doesn't mean always better. Kinetic energy is best overall measure of projectile - ½ Mass x Velocity squared. Impact force (puissance d'arret) is product of kinetic energy and frontal surface area of projectile. Thus B has twice the KE of A, though lower V, and 10 times the impact force. [Table of velocity + KE etc for Ishi, English longbow (Pope), modern compound, spearthrower with arrow and with spear]: V = 30, 40, 65, 25, 21 m/s. KE = 12.6, 22.4, 80.6, 14.1, 30 joules. Spearthrower with spear the most powerful primitive weapon, only modern compound surpasses. Bow velocity gives more penetration, but heavier atlatl dart more shock power. Survive together for different purposes, eg terrestrial vs aquatic hunting. Bow quieter, more versatile.

Experimental principles: distinguishing objects used as points by use-wear, manufacture experiments allow recognition of traces. Can observe ballistic properties of points in long flights. Accuracy in experiments is a problem espec with spearthrower; reproducing same velocity also difficult but critical - mechanical device such as crossbow necessary. Target materials - gelatin, polystyrene for penetration comparisons. Animal targets allow damage traces on points to be observed.

Carroll, Chris

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2006 Atlatl Battle. *National Geographic* (October 2006) 210(4):no page numbers. [and not in all issues - bizarre way to publish a magazine].

Brief atlatl background, photo of thrower at Solutre, drawing of throw motion, quotes JW, mentions PA legalization.

Carstens, Kenneth C. x 1978 Review of <u>Great Basin Atlatl Studies</u>. American Anthropologist 80 (3): 741-742.

Carter, Clayton o 2008 The Atlatl: A Modern Adaptation. *Bulletin of Primitive Technology* 36:81-83.

With cord loop at end, can throw dart with nock like an arrow.

Carter, Clayton o 2014 Primitive Crossbow Collection. *Primitive Archer* 22(4):16-21.

Good photos of specimens from Thailand + Vietnam, some info.

Casanova, E. x 1944 Una Estolica de la Punta Jujena. *Relaciones de la Sociedad Argentina de Antropologia* 4:115-132.

[In Spanish. "A Spearthrower from P. J."] With burial in cave. Poor Xerox shows thin flat narrow lathe form, abruptly narrowed to straight handle, and even narrower distal end with hook lashed on. [resembles N Australian Gros Eyelant form to me]. L= 57 cm, W = 3 cm, T = 6-9 mm. Lengthy comparisons with other atlatls.

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Castleton, Kenneth B., and David B. Madsen

1981 The Distribution of Rock Art Elements and Styles in Utah. *Journal of California and Great Basin Anthropology* 3(2):163-175.

60 elements and styles grouped into "geometric, representational, and bizarre" categories and distributions mapped, some associated with particular prehistoric cultures, Desert Archaic, Fremont, and Anasazi. Dating and cultural assignment difficult [and their sample is small and uneven]. More art in S + E (Colorado Plateau) than N + W (Great Basin). Atlatl is "element relatively restricted to CO Plat." and especially in SE corner of state. Duck headed men and elaborate headresses restriced to SE corner. More interaction shown along Colo R. and on CP (ie between Anasazi + Fremont) than between CP and GB (ie between two variants of Fremont).

Cattelain, Pierre

1986 Traces Macroscopiques d'Utilisation sur les Propulseurs Paléolithiques. *Helinium* 26:193-205.

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[Macroscopic use-wear on Paleolithic spear throwers] Experimental and Australian ethnographic analogies.

Cattelain, Pierre

x pdf

1988 *Fiches typologiques de l'industrie osseuse préhistorique, cahier II: propulseurs*. Publications de l'Université de Provence, Aix en Provence.

[In French: *Typological notes on prehistoric bone artifacts, book 2, Spearthrowers*] First finds by Lartet and Christy 1864 Laugerie-Basse, identified as harpoon tip with barb, recognized in publication by de Mortillet 1891 (and unknown correspondant from Ireland in 1864). Distinguishes three types: male, female, and androgenous [= hook + groove like Basketmaker]. Considers only specimens that are clearly parts of atlatls, 118 pieces. Hook wear: slight ring depression around tip, scratches on the back, polish on the tip, and scratches on the face of the atlatl under the hook. Brief experiments: atlatls last well, throwing darts 400-500g, transfix goat carcass. [poor diagram and unclear stroboscopic photo of throw shows overhead flip, but not flex of dart]. Works as lever arm. Ethnographic types illustrated. The rest is partial catalog of specimens, discussed under three types (M, F, A), [with mediocre line drawings and poor photos.]

Cattelain, Pierre

1989 Un crochet de propulseur Solutréen de la Grotte de Combe-Saunière 1 (Dordogne).[A Solutrean Spear Thrower Hook from the Cave of Combe-Sauniere 1.] *Bulletin de la Societé Préhistorique Française* 86(7):213-216.

X

In French. Short distal end piece with male hook, made of reindeer antler tine. Solutrean levels, associated with shouldered points. Decorated with a few lines. On tine, so originally short. Similar specimens beveled to attach to atlatl, tried experimentally. [If context correct, earliest spearthrower find]

Cattelain, Pierre

1994 La Chasse au Paléolithique Supérieur: Arc ou Propulseur, ou Les Deux? *Archeo-Situla* 21-24:5-26.

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[In French. "Hunting in the Upper Paleolithic: Bow or Spearthrower, or Both?"] Not until Mesolithic do we have preserved hafts to show arrow use of small point forms. Grotte de Combe-Saunière I in Dordogne, many pointes à cran (shouldered points), Solutrean, with projectile impact fractures, also backed microblades, laurel leafs, and part of hook of atlatl made of reindeer antler from same levels [thus earliest known atlatl hook].

Summarize ethnographic, experimental info on bows and atlatls for comparison. [Good drawn sequence of atlatl throw, best currently available]. Propulseur (p6) "elongates the hand and integrates it into a complex lever system, with principle axes at pelvis and shoulder, then elbow and especially the wrist, which at the end of the movement, thanks to rapid rotation, gives the critical impulse."

Upper Paleolithic forms [figure includes Combe-Sauniere (simple flat hook) and Mas d'Azil (complete, with faun aux oisseau)] from upper Solutrean (ca 17,500 BP) to upper Magdalenian (ca 12, 500 BP). Experimental reconstructions show efficiency.

Two main ethnographic groups: Arctic, and Other. Arctic: long description of different Inuit and other types, factors affecting dimensions and form such as game, size of user, local style + materials, spears. Other: Australia as example, similar info + figures.

Distance of throws, mostly from imprecise Australian ethnographic info. Tindale measured attempts at wallaby image: good accuracy to 27 m, poor at greater. Ethnographic records of child training from both areas.

Bows: More or less parallel info as for atlatl. Figures of Holmegaard and Vis I Mesolithic bows. Origins probably in Upper Paleolithic, oldest bow and arrow fragments from Stellmoor Germany, Ahrensburgian terminal Paleo (ca 11,000 BP). Dani, New Guinea ethnographic example.

Comparisons: bow used in all environments, atlatl especially in open. Both highly variable, but different bow or atlatl types closely associated with their particular projectile forms. Hunting distance for atlatls up to 45 m, but usually 30-20 or less; same for bow. Bow more accurate: on same targets, atlatlists score 65% of archer scores, beginners learn bow faster.

"Except in extreme cases, the form and size of most Paleolithic projectile points do not allow us to classify them as points of spears thrown by hand or by atlatl, or points of arrows" (p20). Experiments with both common. Discusses own experiments with 100 Gravette points replicating finds at Abri Pataud. Different haftings on darts and arrows, variation in weight and size of points. Goat carcass target, 145 throws, 127 bow shots, 41% and 25% misses. More breakage with atlatl, especially flex breaks, but more extreme fractures with bow; still can't tell what shot the Abri Pataud points.

Cattelain, Pierre

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1997 Hunting during the Upper Paleolithic: Bow, Spearthrower, or Both? In Projectile

Technology, H. Knecht ed., pp. 213-240. Plenum, New York.

Defines atlatl and bow. Spearthrower works by lever action. Discusses two geographical groups 1) Arctic – "used exclusively from a seated position in kayaks in a marine environment" and 2) Australian, used standing in terrestrial settings. Both are highly variable, used with variety of projectiles, often diff forms for same purpose or for specialized purposes, no consistent patterns. Throwing distances recorded over 100m, but hunting from 10-45 m, usually less. Bow range is similar. Bow is more accurate, cites European contests using same distance and targets, participants score 65% as well with atlatl as with bow. Lengthy discussion of experiments with Gravette points replicating finds at Abri Pataud. Goat carcass target, 145 throws, 127 bow shots, 41% and 25% misses. More breakage with atlatl, especially flex breaks, but not really distinctive, so can't conclude whether were dart or arrow points. [Good article, ethno + exper info, refs].

Cattelain, Pierre

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2000 L'apport de la comparaison ethnographique á la connaisssance et aux tentatives de reconstitution des propulseurs paléolithiques. In *La chasse dans la Préhistoire/Hunting in Prehistory*, Anthropologie et Préhistoire 111. C. Bellier, P. Cattelain, and M. Otte eds., pp. 60-69. Societé Royale Belge d'Anthropologie et Préhistoire, Bruxelles.

[In French. The contribution of ethnographic comparisons to the understanding and reconstruction of Paleolithic spear throwers.] de Mortillet 1891 first recognition of paleo spearthrowers by analogy to Aust + AmInd. Early sources Arctic (depiction of Greenland Inuit 1577), Mexican (codices, art, chroniclers), and Australian (ethnog), accumulated info to 20th C, useful now. More than 100 possible atlatl parts from Solutrean + Magdalenian levels in Europe. Most studies say not really useable because: too short, too curved, other uses more likely, too fragile + decorated. Now we can reject these arguments. 1. Complete examples show modification for attachment to longer handle. 2. Curvature misunderstood, and not an obstacle. 3. Use-wear on hooks confirms atlatl use. 4. Wear and repair even on decorated ones confirms use. Ethnog suggestions of size, material, form of accompanying darts, and use. All kinds of game attested, as well as warfare. Australian claims ranges up to and even over 100 m, hunting range usually 15-20 or 30 m.

Cattelain, Pierre

2004 Un propulseur inédit de la Grotte du Placard (Vihonneur, Charente, France). Notae Praehistoricae 24: 61-67. On web at URL: http://users.skynet.be/fa057790/placard.pdf_accessed 10/25/05.

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In French. "An unpublished atlatl from the Grotte du Placard." In Musée d'Angoulême, from 19th C excavations by J. Fermond, no stratigraphic info. Short oval slip of antler, notched to form hook, thinned proximally to splice into wooden shaft. Two others same form known from different sites, plus 3 more variants from Placard. Probably Magdalenian, around 15000 cal BC.

Cattelain, Pierre and Claire Bellier

2002 La Chasse dans la Préhistoire: du Paléolithique au Néolithique en Europe...et ailleurs. Guides Archéologiques du Malgre-Tout, CEDARC, Treignes, Belgium.

[Hunting in Prehistory: from the Paleolithic to the Neolithic in Europe... and beyond.] Booklet, focus on artifactual evidence, well illustrated with line drawings and a few color photos, lots of pictures of European stone and bone dart points, some Upper Paleolithic and ethnographic spear throwers. Also spears, bows, boomerangs, etc.

Cattelain, Pierre and Marie Perpère

1993 Tir Expérimental de Sagaies et de Flèches Emmanchées de Pointes de la Gravette. *Archéo-Situla* 17-20: 5-28.

[Experimental shooting of spears and arrows armed with Gravette points.] Detailed description of experiments replicating and using points from Upper Paleolithic Abri Pataud, see Cattelain 1999.

Cattelain, Pierre and Jean-Marc Pétillon

2015 Le "type 2a" plus ancien modèle de propulseur paléolithique: une nouvelle pièce dans le Madgalénien moyen d'Isturitz (Pyrénées-Atlantiques, France) et ses implications. *Paléo* 26:17-32.

[In French: Type 2a, oldest form of paleolithic spearthrower: a new specimen in the Middle Magdalenian of Isturitz and its implications.]

Reindeer antler, reconstructed recently from frags excav 1932, almost complete. Resembles 14 others, define 2a: short, on rod, not tine [?], simple bevel at end, hook simple, no decoration except short straight lines. Most ancient form of spearthrower known, dating around 19000-18000 cal BP or 15500-15000 rcybp. [It is just a simple flat hook with bevel for attachment to longer shaft. Longer rods with hooks are type 2b.] From same or close layers at Isturitz also 3a and 3b type pieces, decorated with head of horse, and salmon, and 5 type 4 with "sitting horse" decoration. So 'type 2a' at Isturitz is only example where associated with most other types, contra expectation that it is earliest. However, old excavations treated provenience as large unit, when it may actually cover a long time, as shown by C14 dates on other bone specimens.

Cattelain, Pierre, and Jean-Luc Rieu

2002 Le Propulseur. Musee de Malgre-Tout, Treignes, Belgium.

Glossy color pamphlet, 6 pages. Well illustrated basics of Old World archaeology and ethnography of atlatl.

Cattelain, Pierre, and Ulrich Stodiek

1996 Propulseurs Paléolithiques Inédits ou Mal Connus. La Vie Préhistorique 1996 : 76-

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[In French. "Unpublished or little-known Paleolithic spear throwers."] Ten specimens, mostly fragments with hooks. One notable one is small ovoid hook, complete with bevel for attachment to shaft from Roc de Marcamps. [See Cattelain 2004 for another similar].

Cervera Obregón, Marco Antonio

2009 Mexica Weaponry. Mexicolore:Aztecs webpage, accessed June 27, 2018, URL: <u>http://www.mexicolore.co.uk/aztecs/home/mexica-weaponry</u>

Sling, bow, atlatl, spear, macahuitl, shield. Emphasizes importance of experiments – no macahuitl specimens or instructions for use. Atlatl has benefitted from recent research. 120 m range. "In Mexico the group Atlatl México

[https://www.facebook.com/AtlatlMexico/] has been at the forefront of this research, even publicizing the sport of atlatl-throwing." Experiments show it penetrates *ichahuipilli*, (padded cotton doublet under uniform), but only slightly, and obsidian point lodged in shield but did not necessarily penetrate.

Charles, Mona

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2006 The Earliest Mesa Verdeans: Hunters, Foragers, and First Farmers. In *The Mesa Verde World: Explorations in Ancestral Puebloan Archaeology*, edited by David Grant Noble, pp. 8-17. School of American Research Press, Santa Fe.

Summary of Paleoindian, Archaic, Basketmaker II in region. Atlatl was technological advance in L Paleo times improving hunt of smaller animals. Adequate drawing of Basketmaker type atlatl and dart from Wormington (1956). Photo of BMII pts from Darkmold Site, and L Archaic pts from San Juan Mts. In BM III ca 500, atlatl replaced by bow, add pottery.

Charles, Mona C. and Sally J. Cole o

2006 Chronology and Cultural Variation in Basketmaker II. Kiva 72(2):167-216.

Lengthy description of regional variants' material culture and rock art. Considers small projectile points as evidence that bow and arrow were fairly widespread in BM II. [I think it interesting that they present this with little discussion, but as far as I know, there are no datable BM depictions of bow and arrow, and Cole, the rock art expert, cites none.]

Chastain, Dennis

2008 Peter Lindsay: Primitive Technologist. *South Carolina Wildlife* November-December 2008: 4-9.

PL makes stone tools, blowguns + atlatls using stone tools. [OK story, but atlatl info poor - confused definitions, flex as spring, "hinge" instead of hook, "pentrated Spanish breastplate armor", etc].

Chatters, James C.

2001 Ancient Encounters: Kennewick Man and the First Americans. Simon and Schuster, New York.

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First half covers the disgusting story of how the Corps of Engineers and Indian activists tried to destroy Kennewick and prevent scientific study, aided by the federal government, wasting public money to prevent citizens from knowing about our past. Second half describes and interprets the find in light of other early skeletons (they are physically different from Archaic and later Indians) and presents Chatters' theories of the peopling of the Americas.

Kennewick (adult male skeleton, Washington state, C14 dates $8,410 \pm 60$ B.P. = 7330-7580 BC calibrated) has a Cascade type projectile point in healed wound in his right hip. Angle suggests that he tried to dodge, so probably not accidental. Depth suggests high velocity, probably atlatl.

Chatters, James C.

2004 Kennewick Man: A Paleoamerican from the Northwestern U. S. In *New Perspectives on the First Americans*. B. T. Lepper and R. Bonnichsen, eds, pp. 13-26. Center for the Study of the First Americans, Texas A+M University Press, College Station, TX.

Details of pathology including involvement of "atlatl" point in hip, he says entered from anterior, near iliac crest, caused acute, then chronic infection with lytic area, new bone, and drainage cloaca, contra to analysis by Powell and Rose.

Chatters, James C.

2014 Geography, Paleoecology, and Archaeology. In *Kennewick Man: The Scientific Investigation of an Ancient American Skeleton*. Owsley, Douglas W., and Richard L. Jantz, eds., pp. 30-58. Texas A&M Press, College Station.

Two distinct ancient traditions: Western Stemmed Tradition, with finer large points, atlatl, bola stone assoc with lots of birds, primarily hunters. Old Cordilleran Tradition, mostly along rivers, focus on fish, small game, more plant use, more generalized and less diverse artifact assemblage. Context of discovery site and chronology of find. Nearby finds of W Stemmed pts.

Chatters, James C., Sarah K. Campbell, Grant D. Smith, and Phillip E. Minthorn o

1995 Bison Procurement in the Far West: A 2,100-Year-Old Kill Site on the Columbia Plateau. *American Antiquity* 60(4):751-763.

Tsulim site, deflated site of entrapment in sand dunes, teeth and lithics primary remains MNI 8 bison, one event. C14 ca 150 BC. On basis of point stem measurements, most

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points dart, but some arrows too. Other cited work shows atlatl retained for at least 1000 yrs after bow adopted on C Plateau. "It is possible that during the first centuries after the bow's adoption, it lacked the impact power necessary to penetrate the hide of larger or thick skinned species..." [But all based on point size, other site reports.]

Chauvaux, Pascal

2000 Pascal's Corner. The Atlatl 13(3):11.

Photo of stone atlatl, Pre-Classic Maya, from San Juan de Los Arcos, Jalisco, Mexico, in Royal Museum of Art and History, Brussels, Belgium. Votive, 27 cm long. [Mexican form, looks to be non-functional, with squared vestigial loops (not actually pierced), groove and hook. No info on material or weight.]

Chauvaux, Pascal

2003 European Prehistoric Atlatls Inventory Trial. The Cast Spring 2003:12.

Map showing location of European atlatl finds with photos of specimens.

Cheney, Mark F.

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2016 Throwing arrows in the Book of Mormon. Book of Mormon Archaeological Forum, http://bmaf.org/node/641. Also on Academia.edu, accessed Dec 17, 2018 https://www.academia.edu/37058991/THROWING_ARROWS_IN_THE_BOOK_OF_M ORMON

Smith used the word "casting" when he talked about stones and arrows in Lamanite warfare, so perhaps he meant atlatls in Mesoamerica. [No, he was writing an ignorant fake-archaic English imitation of the King James Bible. Cheney writes a bunch of stuff on Mesoamerica, often just ok reporting, some kooky like this one.]

Christensen, Don D., Jerry Dickey, and Steven M. Freers o

2013 Rock Art of the Grand Canyon Region. Sunbelt Publications, San Diego.

[Fine photos, readable discussion, including basics of rock art study, regional chronology.]

Atlatl/dart depictions not common in region, but do occur. Random photos: p 42 Basketmaker pictographs with 2 painted darts with elaborated fletching; p 46 BM in white pigment with group of stick figures around a blobby creature pierced by many darts [is this another version of the 'Ogre'?]; p 47 Elko point and associations of atlatl points with early rock art sites.

Archaic Rock Art: atlatl/dart rare. Many sheep in all styles, but not impaled. Several styles/traditions: Western Archaic = mostly non-representational, pecked. Glen Canyon Style 5 = mostly pecked, geometrics, animals + humans with fat bodies w interior linear designs. Tusayan = mostly painted in reds, straight anthros w minimal appendages, very fine line + small geometrics + zoomorphs. Esplanade Style = elaborate polychrome

painting, espec large anthros with enormous fine detail decoration. P 111 large deer with owl on back, line of stick anthros under, one maybe with atlatl.

Basketmaker Styles: Snake Gulch Style, limited distribution = large polychrome anthros in center, small anthros + ungulates around. Some turkeys or ducks, flute players. Large anthros decorated with possible feathers, clothes, necklaces, earbobs, sometimes carry trophy heads or scalps [authors seem skeptical of interp], and occasionally atlatl darts (e.g. p 119 large white figure with two darts with oval feathers). Some bighorn sheep with exaggerated horns, impaled by darts (p120, sheep painted, darts abraded and scratched), or darts by themselves (p 130 3 or 4 white darts to side of central figures, assoc with small anthros, including one superposed over dart). [Darts seem rare, and no clear atlatl images mentioned or shown).

Cave Valley Style = small less decorated BM type anthros with triangular bodies and appendages, often simple outline or solid, no objects. Transitional BM III - Pueblo I. [Anthros look to me identical to some of the smaller peripheral ones they call Snake Gulch.]

P 148 'use of indirect percussion is a possibility in only a few cases...indirect method capable of producing a much more distinct and consistent line edge' [Nonsense!]

Use of relic artifacts by protohistoric people, imitation of old rock art p 173 Problems with interpretation, including variable, changing, unreliable native descendant interps.

Christenson, Andrew L.

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1986 Projectile Point Size and Projectile Aerodynamics: An Exploratory Study. *Plains Anthropologist* 31 (112): 109-128.

"projectile points are only the partial remnants of complex projectile delivery systems." [one of my favorite pieces of jargon, but true.] So what can we infer about the whole system from the point? Weight and neck width relate to accuracy, flight stability, range and killing power of the projectile. Model used to interpret size trends for bifaces in central Illinois.

Surface collected points from Sangamon Valley IL, assigned temporal types. Assumed points because of impact damage on some specimens; but knife use also likely as shown by beveling – over half the E and M Archaic bifaces have alternate beveled edges and edge-ground hafting elements. Serration also common in Archaic and L Woodland. Such indications of multi-use and long life tools suggest conditions of mobility. L Woodland serration could indicate warfare.

Weight (N = 168) declines thru Archaic, increases in E/M Woodland, sharp decrease in L Woodland and Mississippian. Neck width (N = 312) shows same patterns.

Weight used to separate darts and arrows, Kidder hafted SW material, Browne archery experiments. Fenenga, Baereis bimodal distributions. Evans, Van Buren experiments show heavy points work on arrows; VB suggests 20g as division between dart and arrow. Fenenga bimodal distribution suggests 1.1g mode for arrows, 9.0g for darts, experiments show light dart pts and untipped forshafts work well on darts. Thomas (1978) linear regression.

Accuracy: requires flight stability, a function of center of mass, center of pressure, and weight. C of P must be behind C of M; greater distance between them = greater stability. Van Buren experiments. Mau (1963) experiments – unfletched darts with c of m at 31% from tip, heavy stone pts (28 g). Hickman (1947) unfletched arrows need c of m .36 or less the length of arrow, so for a shaft of 20 g, need point of 6.7g or more.

Projectile killing power: size + depth of wound – function of shape of point, force of impact, location of wound. Archers find mass more important than velocity in penetration (Beauchamp 1957; Klopsteg 1939, 1943). Limited experiments – penetration affected by tip sharpness, inverse function of point cross-sectional area.

Projectile Range: max range is not best measure. Add fletching decreases max range but improves effective (accurate) range.

Projectile durability: secondary to accuracy, power, range, but heavier darts break more points (Van Buren).

Optimizing a projectile is problem of compromises because aspects of above may be in conflict.

Point interpretations. Clovis more likely thrust than dart point, but some impacts. Folsom more likely dart, but ambiguous. Atlatl by 9000 BP E Archaic – hooks known. E Archaic pts large, need heavy shaft, prob unfletched. Resharpening suggests pt weight change not a problem for use [right, change of only a few g often doesn't have much effect]. L Archaic smaller pts may reflect introduction of fletching, rarely resharpened. But Leonard Rockshelter tangentially fletched dart from 7000-8000 BP deposits shows fletching earlier in W at least. Rise in E/M Woodland pt size is a problem: could be many reasons. M to L Woodland change to small pts prob represents intro of bow, but no unequivocal evidence. Advantages of bow [with citations]: higher velocity, more accurate, longer effective range, easier in woods, carry more shots, more rapid fire, arrow pts and shafts require less material to make, bow easier to master (Frison 1978), less movement. Disadvantages: need 2 hands, harder to make and maintain than atlatl, arrow has lower impact force than dart. But bow prob reduced cost of hunting only 15% or less, perhaps warfare more important reason for adoption.

Christenson, Andrew L.

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1986 Reconstructing Prehistoric Projectiles from their Points. *Journal of the Society of Archer-Antiquaries* 29:21-27.

"A pointed-tip projectile is principally a device to kill by introducing the tip, carried through the air on the end of a shaft, into the prey." [Mr. Point, meet Mr. Prey]. Point traits provide clues about rest of projectile: Size, form, breakage, and wear. Size attributes - Weight: Center of gravity must be in front of center of pressure, either heavy point, or fletching to rear. Affects impact force + penetration. Neck Width: reflects shaft diameter. Graphs of weight show decrease thru time 8000-1000 BC, then increase 1000 BC – 600 AD, then decrease again 600-1700 AD. [But his figure of point types is not grouped by those times.] Early points on atlatl darts; atlatl "has the effect of lengthening the arm of the thrower". Reduction in size should reflect smaller shafts and addition of fletching, thus greater range, but less shock-force and penetration. Increase in

size in middle sequence is an enigma. Late reduction in size = bow and arrow. B+A advantages in stalking and espec war: projectile range, more shots per time.

Form attributes: barbs suggested as war arrows, but early metal points usually not barbed. Barbs allow greater length cutting edge per weight. Late SW atlatl pts side-notched, similar size early arrow pts basal notched + barbed. Serration probably associated with cutting use, but also on small late arrow pts.

Breakage: impact fluting unique to projectiles. Burination usually impact too, but like snaps can occur on knives. Wear usually indicates knife use, sometimes impact striations on obsidian.

[Somewhat simplistic discussion aimed at European archers.]

Christenson, Andrew L.

1987 Projectile Points: Eight Millenian of Projectile Change on the Colorado Plateau. In *Prehistoric Stone Technology on Northern Black Mesa, Arizona*. Edited by William J. Parry and Andrew L. Christenson. Southern Illinois University Center for Archaeological Investigations, Occasional Paper No. 12, Carbondale.

Dismal state of SW proj pt studies – emph on ceramics, provenience details usually ignored. Functional effects of point attributes on killing power (diagram): Width + thickness affect cross-sectional area > wound size/bleeding. X-sect area also > penetration. Weight + velocity > impact force > penetration. Blade edge length, point sharpness, shaft diam all > penetration.

Barbs increase cutting edge per weight. Base grinding to reduce splitting, edge grinding to reduce cutting seizing. Resharpening usually indicates knife use, often results in beveling which conserves material. Various kinds of breakage from impact, most also can be from knife use, tip fluting unique to projectiles.

19 hafted knives from literature: only 3 with distinct stem. 9 hafted with pitch only, 6 combine pitch + sinew, 3 sinew alone. 36 illustrated hafted dart pts: L from 33-62 mm, almost all have shoulder or stem, all hafted with seizing. 15 arrows: all but one side-notch or unnotched triangular, L 14-31 mm, all hafted with sinew, sometimes + pitch.

Analysis here – 334 artifacts, 188 assoc with well-dated site components, 6 temporal groups: E Archaic 6000 BC, L Archaic 1300-900 BC, Basketmaker II 800 BC – 300 AD; E/M Ceramic 800-950 AD; L Ceramic 1050-1150 AD; Navajo 19-20th C.

Most bifaces multi-purpose – pts with both knife wear and impact. Only one too large for proj use. Sees three major temporal trends: Fauna remains same, so not a cause of change. Shift from atlatl to bow. Decrease in mobility leads to reduction in multifunctional bifaces, increase in single function proj pts. [But that last is also affected by size change to small arrow points, independent of mobility, which he does admit.]

BMII pts "surprisingly light for dart points" mostly 1.8-2.2 grams. E/M Ceramic pts 20% lighter, usually 1.0-1.45 grams, neck widths smaller [but actually although more smaller points, they cover same range as BMII in both weight and neck W.] Blade edge length distribution is essentially the same. Little differences in breakage patterns. Resharpening, espec beveling, declines from BMII. Size, neck width/shaft diam, and tip

cross-sectional area decline with change to bow. Point cross-sectional area also a measure of durability – declines, as does base grinding, indicating less multi-purpose use.

Recycling points for use or ritual common – here BMII sites have probably Archaic pts. Most BMII pts side-notched, resemble San Pedro type, some corner-notche resemble Elko. Side-notch = standard atlatl dart pt, on wood foreshaft 6-8 mm diam. Drawing Fig 5-5 shows Broken Roof Cave, Sand Dune Cave, and White Dog Cave specimens. Often wear shows use as detached knife. One atlatl weight on Black Mesa from mass burial at D:7:3141: calcite, loaf-shaped, groove across convex upper surface, simple incised line decoration. Multifunction point an advantage to traveling hunter, but relatively short blade edges, resharpening reduces symmetry + penetration. 10 dart pts show burning, presume intentional, ritual.

E/M Ceramic points: some probably Archaic collected. Small points fit Rosegate type, indicate arrival of bow. Arrival dates poor – Morris claims BMII woman killed by arrow at Battle Cave, Canyon de l Muerto, and Prayer Rock district caves have primarily arrow remains, 430-670 AD but provenience poor. Tularosa Cave suggests shift 700-900 but mixing problem. Bow advantages: range – atlatl 20-30, max 80, bow 30-45, max 140m. Reduced proj size, espec weight, reduces impact force and thus less penetration of arrow compared to dart. Blk M arrow pts same cutting length as earlier darts, but reduced weight and x-sect, thickness, and neck width. Barbed = stay in wound. 80% show light wear = used as knives on detatchable foreshafts. Presume simple self-bow. Neusius and Phagan (1983 SAA paper) suggest stone pts for small game are heavier, less labor, so more durable than pts for big game in Dolores area sites.

Late Ceramic pts: more side-notch + unnotch triangular, return to heavier shafts, perhaps stronger bow. In some PIII sites hafted with pitch only to stay in wound. High freq light edge wear but resharpening rare = still used as knives.

Navajo collect old pts for ceremonial gear, use, and interest. N used sinew backed bow and heavy wooden arrows with metal points.

Churchill, Steven E.

1993 Weapon Technology, Prey Size Selection, and Hunting Methods in Modern Hunter-Gatherers: Implications for Hunting in the Palaeolithic and Mesolithic. *Archeological Papers of the American Anthropological Association* 4:11-24.

Literature survey of 96 recent hunting peoples finds: 1. association between hand delivered spears, large prey, certain hunt techniques dependent on features of terrain. 2. less dependence on terrain with atlatl 3. use of bow without regard to prey size or terrain. Early hunting without projectile weapons involved narrow range of strategies and limited prey. Effective exploitation of wider range of terrestrial mammals occurred after efficient projectiles.

Addition of stone points improves penetration. Changes in form begin with Aterian, mostly Up Pal, including stems + other base modification to reduce drag, most important with projectile. Australian use of large asymetrical stone dart tips shows that Levallois points could also be on darts, but need actual atlatl find to confirm, which we have by Solutrean. Bows by 10,500 BP at Stellmoor.

Hand-delivered spears: mostly thrust, thrown rare. Mostly with large animals, in situations of "disadvantage" hunting (i.e. surrounds, dogs, swamps). Atlatl associated with smaller prey, ambush and "approach" hunting, i.e. stalking. [But he only has 9 atlatl cases, all Australians, doesn't include water foul or mammals.] Average effective ranges: thrust spear 0/contact; thrown spear 7.8m, atlatl dart 39.6 m, bow and arrow 25.8 m. Bow used with all hunting techniques (disadvantage, ambush, approach, pursuit, encounter). Shorter av. range than atlatl because need to hit smaller target on large animal. [But does not consider use of poison. And all bows are not equal.] Before projectiles, hunters limited to larger game and cooperative or disadvantage hunting, dependent on landscape features.

Atlatl effective shock weapon against smaller game; maybe less so when larger animal body cavity must be penetrated. Up P barbed harpoons may improve efficiency by working way into wound [more likely, they help imoblize a large wounded animal for further attack.] Hunters like Aleut who use atlatl for marine hunt, prefer bow for terrestrial game. Atlatl may not be as accurate as bow. For large game, Paleo folk maybe reverted to hand spear [Not likely from Up Pal and SW arch evidence], or used disadvantaging techniques. Changes in weaponry prob reflects changing conditions or needs more than technological advances.

Churchill, Steven E.

2002 Of Assegais and Bayonets: Reconstructing Prehistoric Spear Use. *Evolutionary Anthropology* 11:185-186.

[Responding to Kortlandt 2002] Assumes that thrusting spears were used underhand like bayonet based on muscular advantage, military use, and lack of ethnographic details. Ethnog suggests both overhand and underhand use, and preference for thrusting rather than throwing. Underhand thrust allows better withdrawal for multiple thrusts, and better defensive posture.

Churchill, Steven E., Robert Franciscus, Hilary McKean-Peraza, Julie Daniel, and Brittany Warren x

2009 Shanidar 3 Neandertal Rib Puncture Wound and Paleolithic Weaponry. *Journal of Human Evolution* 57:163-178.

Shanidar 3 adult male, one of 9 Neanderthal skeletons in cave, has well-preserved ribs with partly healed injury to L 9th rib. Below C14 dates around 50 kya uncal. Baradostian (early Upper Paleolithic) at Shanidar not until 35 kya; timing of modern human arrival in area not clear. Possible assoc of early moderns with projectile weapons after 50 kya elsewhere; would have been competitive "edge."

Parallel sided (but wider inside than out) wound on top of 9 rib, small injury to bottom of 8 at same place. Healing, but point could have remained in wound; decayed if wood, lost if stone. Probably injured lung, but healing shows 2 weeks to 2 months survival.

Experiments: kinetic energy most important measure of projectile impact. Dart velocity ave 24 m per second [around those I got in Whittaker + Kamp 2007], so KE (.5 x mass x

velocity squared) 8-51 Joules, mostly 26-28 J in experiment literature. Thrust experiment (Schmitt et al. 2003) spear velocity 1.7 m/sec, KE = 42J. This experiment used pig ribs, calibrated cross-bow, stone tipped spears with 3 pts: Mousterian, Levallois, and long L. Spear + pt mass ca 530 gm, velocity 13.4 mps at 31 kg draw weight (KE low end range of heavy thrust spears) and 7.8 mps at 15 kg (KE in low end of dart range). 7 "stabs" [but actually launched spear at close range] with high KE, 11 with low KE, also comp to 26 goat ribs from another experiment. High KE much more damage to ribs, including not just incisions, but fracture, crushing, removal of fragments, and hinged fragments. [But they overlap, so differences are NOT diagnostic]. Penetration depth low, usually less than 90 mm [that's not much].

Conclude: Shanidar injury probably low KE because most damage to one rib, not adjacent ribs, no fracture, just incision. Consistent with dart or knife, accident or agression. Downward wound on L suggests right handed attacker [only if it's a thrust]. Assuming that a heavy Neanderthal hand thrown or thrust spear should have made high KE type wound, this wound is "most consistent" with light-weight, long range (low KE) projectile weapon, implying conflict between Ns and modern humans.

[Interesting, but much less conclusive than they claim. They admit the uncertainties but still reach the conclusion they want, despite artificial conditions of experiment, samples that are far too small, wound features that overlap, too many assumptions about velocity and weight of projectiles, insufficient evidence of N-modern overlap.]

Ciofalo, Andrew J. x pdf

2012 Maya Use and Prevalence of the Atlatl: Projectile Point Classification Function Analysis from Chichén Itzá, Tikal, and Caracol. Unpublished MA thesis, University of Central Florida.

Atlatls prevalent among Late Postclassic Maya along with bows, but atlatl iconographically more important. Using point size, weapons can be distinguished "with high degree of accuracy."

General atlatl history and archaeology [somewhat imprecise], atlatl physics [correct]. Reviews use in Maya warfare [ok but relies too much on Hassig whose ideas are largely guesses about how battles "should" have been fought.]

Iconography: Stela 5 at Uaxactun depicts Teotihuacan warrior helping overthrow Tikal dynasty, earliest documented iconog atlatl in Maya (Friedel 1986; Schele + Friedel 1990). Tikal ballcourt marker of owl + atlatl AD 378. Classic Maya atlatl perhaps mostly dynastic ritual - depictions scarce. Chichen Itza ca AD 900 lintel carvings, cenote finds, murals - CI once considered to have been taken over by Toltec, now interp as fully Maya.

Extant specimens: CI cenote finds [little info], finger loops. Caracol poss shell atlatl hook from cremation with Teoti attributes [but may just be pendant]. Cruciform objects (Johnson 1971) possible atlatl evidence; bannerstones probably not used but may not be identified. Tikal atlatl with bone loops (Harrison 2003:105).

Bow and arrow by Late Postclassic but only atlatl in iconography. Small points by Mid Preclassic. Classic Maya art lacks b+a too, but has atlatl, rare prismatic blade small points, large dart pts predominate (Aoyama 2005). Assume bow intro terminal Classic

from Chontal Maya or Tabascan Mexican mercenaries (Porter 1981). Terminal C small points common; bow could change warfare, ie require walls. But small pts earlier - E + L Classic at Aguateca, Copan (Aoyama), so probably by E C times.

Distinguishing dart vs arrow pts. Atlatl penetrating power 5x of bow (Yu 2006:208). Where weight and microwear info not available, size useful. [He keeps expecting "mutually exclusive" categories] but citing Thomas, Shott, Fenenga. Applies Shott's shoulder width classification function to his site assemblages. Chichen Itza - Cenote cache of pts one still on foreshaft = darts, only 2/54 others class as arrow. Also a ritual context where atlatls predominate. Tikal thin bifaces from general excav contexts, excluding any over 90 mm L = 118 pts, only 10 prob arrow pts. Bimodal distrib [sort of], atlatl common even in non-ritual contexts, arrow present by at least Late Classic, and atlatl present earlier than supposed intro at CI. Caracol - 79 pts, excluding those >90mm, 11 prob arrow. C a bit later than T, so more bow? Contra Hassig (1992) claim that atlatl mostly ritual, abandoned at Tikal and not signif to Classic Maya - iconography alone is not good evidence. Chases think bow at Caracol increased militarism + encouraged defensive walls in terminal Classic.

[Applying Shott to Maya is good idea, though there are problems of representativeness of Shott sample and how well it applies to site collections. Larger point assemblages would be better, but Ciofalo conclusions plausible.]

Clark, J. G. D. x 1972, *Star Carr: A Case Study in Bioarchaeology*. Addison-Wesley Module 10.

Classic environmental/ecological study of a key Mesolithic site in Britain. Site catchment analysis, estimating 4 families could be supported by red deer (and other) hunting in 2-hour radius in river valley. Faunal remains suggest red deer as key game, Clark interpreted site as winter hunting camp with lots of manufacture of barbed antler harpoon points and other artifacts, and knapping. [Barbed pts apparently assumed to be arrows, and microliths to arm arrow pts, but functionality of barbed pts not discussed - large enough to be dart or spear pts, small enough for arrows, but why barbed? Hunting swimming deer in lake? No means of attachment to line. No pts slotted for the abundant microliths - were those wood, or micros for something else entirely? More recent analyses suggest different interps of site, see Pitts 1970, Andreson et al. 1981]

Clarkson, Chris

2011 Points of Contention: Experimental testing of TCSA/TCSP as archaeological measures of projectile effectiveness. Paper presented at Multidisciplinary Scientific Approaches to the Study of Stone-Age Weaponry, Mainz, 19-22 September 2011.

"Several recent articles have argued that Tip Cross Sectional Area and TCSPerimeter are valuable measures of projectile performance that may help differentiate the use of simple and complex projectiles in the archaeological record. Proponents of this view have also argued that TCSA / TCSP are relevant to identifying the origins and spread of complex projectile technology by modern humans. The logic and strength of these arguments will

be examined and ethnographic data on Australian projectile technologies will be presented that questions any firm association between TCSA/TCSP and projectile type. New experimental evidence presented here calls into question the value of these statistics as measures of projectile effectiveness, at least in terms of penetration. An alternative approach to determining projectile type is developed using experimental data on impact fracture size for three different diagnostic impact fracture types. This approach, while found to be valuable, also presents problems for archaeological identification of projectile technologies."

Problems with TCSA: N. Am. not a good fit with rest of world, Australian thrown points are too large to too small, ethnographic analogs not appropriate because of multidirectional evolution from past, and experiments don't support TCSA: poor predictor of penetration.

But complex projectiles are usually high velocity, produce larger impact scars on points. Exper: 154 pts, obsidian + flint, on arrow, thrown spear, atlatl darts, and thrust, into carcass. Impact fracture types: bending spin-off + flutes, lateral chip, burin spall. Spin-off and fluting most common. Obsidian overall suffered larger scars, found no difference in fracture length between weapon type, but burin fractures were longer with higher velocity. Many complicating variables make recognizing projectile type difficult – need multiple lines of evidence, TCSA is not very good, fracture size may be helpful, need large samples, not just individual points.

Clarkson, Chris

2016 Testing archaeological approaches to determining past projectile delivery systems using ethnographic and experimental data. In *Multidisciplinary Approaches to the Study of Stone-Age Weaponry*, edited by Radu Iovita and Katsuhiro Sano, pp. 189-201. Springer Science and Business Media, Dordrecht.

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Tip cross sectional area and perimeter TCSA + TCSP, "are not robust measures of projectile performance or reliable proxies for inferring delivery systems." Size of 3 diagnostic impact fracture types is better but still has problems. Crossbow for several point types, spin-off, lateral, burin fractures. Little difference in penetration by varying TCSP or by point type. Ethnographic Australian leilira points are very large, much larger than any other atlatl dart points, on light flexible wooden shafts, ave 274 gm weight and 238 cm L, balance at 33% from tip. Thrown with Arnhem Land type thrower 87 cm long. Shows that notions about limitation on such point sizes are exaggerated; Levallois + Mousterian points thus could have been on atlatl darts.

Clausen, Carl J., H.K. Brooks, and Al B. Wesolowsky

1975 The Early Man Site at Warm Mineral Springs, Florida. *Journal of Field Archaeology* 2(3):191-213.

Underwater excavations in sinkhole, human remains deposited into water-laid levels [but see Cockrell and Murphy 1978], mention of possible shell atlatl hook.

Clausen, C. J., A.D. Cohen, Cesare Emiliani, J.A. Holman, and J.J. Stipp x

1979 Little Salt Spring, Florida: A Unique Underwater Site. Science 203(4381):609-614.

Lake in sinkhole, occupied in times of low water table. Giant tortoise with fire and wooden stake dated 12,030 ya [uncalibrated]; bison + mammoth on same ledge. Later Paleoindians ca 10,000 bp [uncal] at higher level eating deer. Hearths, stakes dated 9575 rcypb. Artifacts include socketed antler pt with atlatl dart shaft wood in it, oak mortar, non-returning [hook form] boomerang. Compares to Aust form, tries plywood version. Oldest specimen so far in world.

Large Archaic occupation, 8500-8000 ya, burials in muck. Stemmed Newnan's Lake dart pts, deer bone pts. Preservation good, brain in burial, bone date 6000 ya. Carved wooden tablet frag with bird [invisible to me in photo] comps with Key Marco finds of later Glades Tradition, suggests Archaic traditions compressed by later agrics, left conservative tradition to Glades T.

Clement, E., and J. D. E. Schmeltz x [plates missing]

Ethnographical Notes on the Western-Australian Aborigines, by Clement, with a Descriptive Catalogue of a Collection of Ethnographical Objects from Western Australia, by Schmeltz. *Internationales Archiv für Ethnographie* 16(1 + 2):1-28.

NW Australia, W of Kimberley along coast and inland. Eight tribes. p2: Emus and kangaroos speared from ambush at waterholes, 15-20 yards distance. [Plates missing from copy]. p4: flint and glass spearheads [Kimberley type] roughly shaped by striking, finished with serrations by pressing against edge of broken kanga bone (sketch). Empty bottles... "are eagerly picked up by the Blacks and traded into the interior where they are highly prized...Telegraph insulators form splendid material for spear-heads... and it is not uncommon that these are knocked off the poles and thus interrupt communication." Spear-heads fastened to shafts with gum obtained by burning green Spinifex, mainly used for fighting. Wooden fighting spear heads multi-barbed, hunting only one large barb. In tribal duels, spearing in legs is only allowed. Hunting spear shafts 10-15 feet long, wooden heads attached by double-bevel joint. Leiden Museum collection includes lots of spears, Kimberley points and manufacture material, several mihra or woomera, flat, elongate broad leaf shaped, gum at handle, incised ornament.

Clottes, Jean, and Jean Courtin

1996 *The Cave Beneath the Sea: Paleolithic Images at Cosquer*. Harry N. Abrams, New York.

C14 dates show 2 periods of use: ca. 27,000 BP, hand stencils and finger tracings, Aurignacian or Gravettian; ca. 18,500 BP, animal paintings and engravings, about 100, Solutrean related. Two hearths, numerous charcoal bits, 6 flint tools with butchering wear, but no habitation evidence. Animals mostly horse, bison and auroch, ibex/chamois, some cervids, megaloceros, feline, and "killed man." Also 3 auks, some indeterminates, possible seals [not as recognizable as other species], possible fish, poss jellyfish. Numerous abstract signs. Barbed or feathered lines often intersect or cross animals, possibly indicating spears or wounds. Comp with Lascaux, here too a man is falling backwards, assoc with barbed signs (and wounded bison) so these are weapons. "Killed Man" [very crude, engraved outline on back with leg up, long arm w poss hand, crossed by two lines one of which has a "feather" line and a "barb" line attached - originally considered a seal.] It is not naturalistic, represents idea of killed man, but is "unambiguous" [hardly!]. Compares to several other images of wounded humans in other caves. If we have several wounded men theme pictures, then they must have been common. Alternate explanations: lines of spiritual force, carried weapons. Could be destructive magic, exorcism, or commemorate an event

Clubb, Leni

1994 Guinness Record Holder... The Atlatl 7(1):8

Wayne Brian (Mesa AZ) modern distance record, now claims record of 475'3" (144.9 m) with "primitive" [not described] equipment.

Clubb, Leni

1999 The Resurgence Of The Atlatl And Dart - How It All Began. *Calumet: Newsletter of the Indian Peaks Chapter of the Colorado Archaeological Society*, January 1999. Electronic document, accessed 3/5/11, URL: <u>http://www.indianpeaksarchaeology.org/Calumet/Archive/1999/Calumet9901.htm</u>.html

Rod Laird 1980 started teaching kids in his classes, "Kids World Open Atlatl Contest." 1981 adopted by Saratoga Historical + Cultural Soc, attended by Bradley, Stanford, Frison, Wedel, others. Brian Benson (11 yr old) beat Bradley for champ. Laird published booklet. LC attended 3rd in 1983, began prosletizing CO Arch Soc, organizing events. "In 1988, at the Third CAS Encampment near Woodland Park, CO, the first meeting of WAA was held with ten members. Bill Tate was elected President; Leni Clubb, Vice President; Charlie Lilly, Secretary/Treasurer."

Cockrell, W. A. and Larry Murphy

1978 Pleistocene Man in Florida. Archaeology of Eastern North America 6:1-13.

Brief info on Warm Mineral Springs, Pleistocene sinkhole now filled with water, excavations on ledge produced flexed burial dated 10,319 B.P., earlier material below. Associated with burial is shell artifact "atlatl hook" [drawn, not described, see Purdy 1991:197 for photo].

These layers deposited when hole was dry. [Disputed by Clausen et al. 1975 - if deposited into spring, associations not good - if good assoc in dry deposit, and correct ID of artifact, then this is a very early date for atlatl in Americas]

Coe, Joffre L.

1964 The Formative Cultures of the Carolina Piedmont. *Transactions of the American Philosophical Society* 54(5).

Atlatl weights found at Doershuk (NC) site in lowest level associated with Stanly stemmed points (triangle with stem bifurcated or concave based). Mostly unfinished pick forms. Estimated date 5000 BC. At the Hardaway site, 1950s excavations in midden 28 inches deep. Again, mostly pick or lunate forms, 172 unfinished and 65 finished from surface, mostly broken. One antler hook. One semilunar pick form from Stanly level, others are judged later. Only a few illustrated. At the Gaston site, small hollow oval atlatl weights [boatstones] and grooved ovals, associated with Vincent pottery. Estimated date after 500 A.D., earliest pottery, possibly bow and arrow as well.

Coffin, Edwin F.

1932 Archaeological Exploration of a Rock Shelter in Brewster County, Texas. Indian Notes and Monographs No. 48. Heye Foundation, Museum of the American Indian, New York.

S

[A poor job even for its day.] Continuing work of M. R. Harrington. Some scrappy rock structures, very little pottery near surface, lots of perishables. P. 61: "Although many fragments of notched arrowshafts were found, there was no trace of a bow. [Ignoring several miniatures, probably offerings.] The occurrence of the atlatl and the notched arrow, in deposits indicating no great range of time, would seem to suggest that the throwing-stick and the bow had been used contemporaneously." [The excavation was probably not good enough to make fine stratigraphic distinctions had there been any, although they did recognize floor surfaces.] P. 28: "Four fragments of atlatls, all from the end in which the nock of the arrow or spear rests, lay in the same levels as notched arrows. The upper sides of three of them are flat, while the upper surface of the fourth slopes slightly toward the center. The grooves are round. The under sides are all convex. Two of the specimens had been severed from the rest of the implement, probably after accidental damage to the prongs, by cutting or sawing part way through from either side and breaking the remaining fibers." [That's all. No pics. Presumably Basketmaker form, but are "prongs" the hooks?]

P. 27: "Among objects of unknown use are 5 lengths of wood, round, and with one end cut like a tennon...." [Photo shows these are waste from notching foreshafts, but no measures given or scale in photo, so could be either arrow or dart, probably arrow.]

Coggins, Clemency Chase, ed.

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1992 Artifacts from the Cenote of Sacrifice, Chichen Itza, Yucatan: Textiles, Basketry, Stone, bone, Shell, Ceramics, Wood, Copal, Rubber, Other Organic Materials, and Mammalian Remains. Peabody Museum of Archaeology and Ethnology, Harvard University, Cambridge.

[under individual chapter authors]
Coggins, Clemency Chase, and John M. Ladd

1992 Wooden Artifacts. In Artifacts from the Cenote of Sacrifice, Chichen Itza, Yucatan: Textiles, Basketry, Stone, bone, Shell, Ceramics, Wood, Copal, Rubber, Other Organic Materials, and Mammalian Remains. Edited by Clemency Chase Coggins, pp. 235-344. Peabody Museum of Archaeology and Ethnology, Harvard University, Cambridge.

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pp. 244-259 "Weapon Assemblage" includes atlatls, parts, and foreshafts. Atlatl, almost complete, 53.5 cm L, integral hook, groove, two large finger holes with outer sides of loops broken off, and surprisingly long grip proximal to holes, no decoration remains. Atlatl, 4 frags, est L 58 cm, lighter, painted decoration, integral hook, narrow groove, notches for lashing on finger loops, "too light to be functional" [probably wrong]. Two grip frags of a similar form. Two distal frags with integral hooks, painted, carved on underside into serpent head, both hook ends curve so groove is not straight [Coggins thinks makes non-functional but I think she is wrong]. These could be handles of scepter forms. Another distal hook + groove frag [Coggins says "serpentine" but it is not, and it is straight]. Three proximal frags with finger holes and loops carved of the wood. Three more small frags: prox end, hook end, grip area. Apparently there are 2 more serpentine ones in Mexican collections from the cenote.

Atlatl depictions show "invariable bilobal adjunct element" probably fur ornament, no evidence of weights, but maybe similar purpose. Identifying weapon of important men, espec central Mexican affiliation. At CI, probably from phase of "Toltec" influence, AD 800-1000.

Three foreshafts: 40.5 cm L, found with chalcedony corner-notched pt hafted with thread and resin. 45 cm L, light, maybe arrow, notched for pt. 31 cm L, incomplete. 31.4 cm L, self pointed. A number of wooden arrow or dart shaft frags.

Almost all of these materials have been cut, bashed, broken and/or burnt before deposition.

Several fragmentary grooved sticks, flattened and curved, similar to Hopi rabbit sticks and Basketmaker fending sticks. Depicted carried in place of shields; probably used as fending sticks.

pp. 260-263 the fabulous serpent handled chert knife.

Coggins, Clemency Chase, and Orrin C. Shane

1984 *Cenote of Sacrifice: Maya Treasures from the Sacred Well at Chichen Itza.* University of Texas Press, Austin.

Pictures and short descriptions of: P 46 almost complete wooden atlatl, [Peabody Museum, Harvard] straight, groove and integral hook, two finger holes with narrow septum in between [probably the loops were integral carved, now broken off] supposed to be one of 9 found by Thompson. Should have had lobed fur decoration shown in reliefs like Temple of Jaguar [more likely feathers, also she claims reliefs show fending stick in left hand - but all the warriors have is 4 or 5 darts, apparently with stone pts and fletching (Fig 5). Atlatl resembles Aztec ones in basic form]. P 47 long wooden foreshafts and associated corner notched chert (or triangular with flared stem) atlatl dart points and sheet

gold effigies thereof. P100 more delicate atlatl points with corner notches, from cache in Platform of the Eagles. P103, 104 hook ends of 2 serpent atlatls or atlatl/scepters of wood, with hook isolated by carving in deep groove, carved snake decorations with holes for inlay. P 108 fragment of shell finger loop carved with snakes.

Cole, George S.

1972 The Bannerstone as a Spear Weight. Michigan Archaeologist 18 (1): 1-7.

Center drilled bannerstones probably spear weight - give added impact, weights not help if on atlatl. [Nonsense!]

Cole, Sally J. Bos

1990 Legacy on Stone: Rock Art of the Colorado Plateau and Four Corners Region. Johnson Books, Boulder.

Subdivides Anasazi: San Juan River (SE UT) and Canyonlands (E Central UT). Dating in part thru sim images on pottery. Early BM with large shoulders, static but decorated anthros, atlatls + darts, heads, birds + bird headdresses. Later BM less elaborate, more active anthros, birds and bird headdresses, solid triang body anthros, stick figure flute players. BM also plant forms, static solid anthros w elab heads, paw prints, abstract linears. [In other words, lots variability, temporal overlap, unclear chronol implics]

Cole, Sally J. x, o

1989 Iconography and Symbolism in Basketmaker Rock Art. In *Rock Art of the Western Canyons*. Colorado Archaeological Society Memoir 3. Denver Museum of Natural History, Denver.

Focuses on "shamanistic" elements. Early BM "elaborate broad shouldered anthropomorphs, often supernatural in appearance," later BM less elab and smaller anthros, greater variety of subjects. Uniformity of early BM art suggests lots of cultural interaction over region, maybe shared shamanic cult. Shamans = relig specialists, visit other worlds to seek help from spiritual powers, assoc with transformations and death, symbols of death/life/fertility, flight, birds/animals of other worlds, drums, masks, transformations [hallucinatory images]. BM art showing masks/face paint, scalps + head trophys, animals/birds/prints, and bird headed or headdress figures, plants/crooks, flutes, and copulation all fit. [yes, but also figure in less shamanic later religion and art.] [atlatls not discussed]

Cole, Sally J.

1993 Basketmaker Rock Art at the Green Mask Site, Southeastern Utah. In *Anasazi Basketmaker: Papers from the 1990 Wetherill-Grand Gulch Symposium*, V.M. Atkins ed, pp. 193-220. Salt Lake City: Bureau of Land Management Cultural Resource Series No. 24.

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Includes drawing of panel with 1.2 m long pair of "atlatl or dart representations." [My photos of the site show they are darts, with elaborated fletchings not shown in the sketch.] p 215: "When abstract, the representations of atlatls and darts are similar in appearance and serve as examples of conventionalized symbolism." Other examples in GG at Slickhorn. Considers atlatl depictions and the mask BM II.

Cole, Sally J.

2009 Legacy on Stone: Rock Art of the Colorado Plateau and Four Corners Region, revised and updated. Johnson Books, Boulder.

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[Added nice color photos to 1990, also more elaborate subdivisions of style zones and chronology, but no clearer than before.]

Basketmaker II foundations of Ancestral Pueblo culture, [= Anasazi], subdivides BM II: San Juan River (SE UT) and Canyonlands (E Central UT). Early SJ BM (1500-1000 BC) sim Glen Canyon Style 5, later (1000BC -400 AD) related to San Juan Anthropomorphic. Assoc with C14 dates on organics. Early BM with large shoulders, static but decorated anthros, atlatls + darts, trophy (?)heads, birds + bird headdresses. Later BM less elaborate, more active anthros, birds and bird headdresses, solid triang body anthros, stick figure flute players. Birds + feathers important cultural elements. BM also plant forms, static solid anthros w elab heads, paw prints, abstract linears. And small stick figure anthros often as twins or processions, assoc with pendant circle motif perhaps relating to kiva or pithouse or origins. Flute players usually not humped, assoc with broad shoulder women, and sometimes with hunters or warriors holding atlatl + dart [In other words, lots variability, temporal overlap, unclear chronol implics of many forms - this stuff is not easy to date stylistically, and there are many possible element associations.] Figures include many of the well-known like Wolf Man, Sand Island, Green Mask, but only clear atlatl related is pair of darts in white, Cedar Mesa, identified by Coles as 'cattail-like objects'. Photo of BM point, comped to petro of 'arrow forms and blocks attached to a line; in Butler Wash [not dated, could be either dart pts or P I early arrow points] compared to string of PII-PIII arrow points from Cedar M.

Coles, John

1973 Archaeology by Experiment. Charles Scribner's Sons, New York.

[Classic compilation of early experimentation]

p 127 summarizes Browne, Peets, Hill, and Kellar, concludes that atlatls useful at short range, ambush, and against herds.

Collins, Henry B.

X

1959 An Okvik Artifact from Southwest Alaska and Stylistic Resemblances Between Early Eskimo and Paleolithic Art. *Polar Notes* 1:13-27.

Carved bone object with Old Bering Sea/Okvik designs described [at tedious length]. Similarities between Paleo, Esk, and Shang China art [pretty thin]. Mention and [poor]

drawing of "bone atlatl with Okvik decoration from NE Siberia". [Deep V-shaped shaft cross section, spatulate handle without holes, pins, or finger depressions visible, hook not visible.]

Coltrain, Joan Brenner, Joel C. Janetski, and Shawn W. Carlyle o

2007 The Stable- and Radio-Isotope Chemistry of Western Basketmaker Burials: Implications for Early Puebloan Diets and Origins. *American Antiquity* 72(2):301-321.

[Calibrated AMS dates apply to some burials with atlatls: Sayodneechee Cave (produced atlatl weight) dates from ca 400-200 cal BC. Kinboko Cave I (Cist 10 male burial with atlatl) dates ca BC 350-AD 50. White Dog Cist 27 Male with atlatl darts 405-204 cal BC. Cave 6, and Broken Flute Cave, and Battle Cave in C del Muerto (BMII, evidence of violence, unprovenienced skeletal material 355-44 cal BC).] Bone chemistry shows BM reliance on maize agriculture early, by 400 B.C. as much as P II and P III farmers in same area. This supports a model of migration for spread of maize,

rather than gradual adoption by Archaic hunter-gatherers.

Coltrain, Joan Brenner, Joel C. Janetski, and Michael D. Lewis x 2012 A re-assessment of Basketmaker II Cave 7: massacre site or cemetery context. *Journal of Archaeological Science* 39:2220-2230.

Radiocarbon dates on 98 individuals span long interval from 1080-2086 radiocarbon years before present (110 BC - 959 AD). There are relatively few with blunt trauma or embedded points, mostly adult males, and these are distributed through time span, but most not significantly different date, so not strong support for a single "massacre" event. [Actually 22 with cranial trauma and/or points], 18 of 39 adult males show trauma, 21% of all individuals. Contextual info poor, but "groups" defined by Wetherill have varied dates within group. Formation processes account for lack of organic goods, and over representation of weapons, which are not uncommon with male burials in BM. Compared to Crow Creek massacre, lacks universal damage and mutilation, evidence of carnivores. Episodic male violence is better explanation than single event massacre. Other evidence of BM violence in rock art; differentiation of goods and unreliable agricultural subsistence base suggest competition with violence. [for opposed view see Geib and Hurst 2013]

Comstock, Paul

1992 Throwing darts with the Baton de Commandement. *Bulletin of Primitive Technology* 1(4):38-42

Pierced "batons" with cord used as spear thrower. Some archaeological evidence of possibility. [Clever and plausible, needs better instructions]

Connor, Steve

2013 Throwing ability 'helped turn humans from second-rate primate into most

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successful species on the planet'. *The Independent* online June 26, 2013, URL: <u>https://www.independent.co.uk/news/science/throwing-ability-helped-turn-humans-from-second-rate-primate-into-most-successful-species-on-the-8675395.html</u> Accessed August 21, 2018.

Account of Roach 2013 + interview. Throwing enabled hunting, which allowed larger brain, social behaviors like division of labor. Throwing developed in *Homo erectus* physiology as wide waist, lower shoulder muscles, and ability to rotate arm. Also 'cocking' arm stresses ligaments and muscles, storing spring energy. Tracked the upperbody movements of American college baseball pitchers using 3-D cameras and computer animations. Roach: "Adult male chimps for instance can only throw objects at about 20 mph, one third of the speed of a 12-year-old little league pitcher."

Conrads, T. J. o 2003 *The Traditional Bowhunter's Handbook*. TBM Inc, Eagle, ID.

p. 125 "A study done of wounding losses by members of our local club from the mid 1970s to the mid 1980s using all types of bow and arrow combinations showed that over 70% of game shot at over 30 yards were lost. But when those shots were under 30 yards, the recovery rate was better than 75%. The study further showed that tracking distances of wounded animals was cut more than half when the animal was shot under the magical 30 yard distance."

Cook de Leonard, Carmen

1956 Dos Atlatl de la Epoca Teotihuacana. In *Estudios Antropologicos Publicados en Homenaje al Doctor Manuel Gamio.* pp. 183-200. Dirrccion General de Publicationes, Mexico D.F.

Cuautla, Morelos. Two atlatls, made of single pieces of hard wood, 48.4 and 50 cm long. Both have long rod handle (about half length) without grip or loops. Distal half is flat blade or paddle, which turns up slightly at hook. {These are like nothing I have seen anywhere else, certainly not like the typical Mesoamerican form].

Coolidge, Frederick L., Mirian Noel Haidle, Marlize Lombard, and Thomas Wynn 2016 Bridging theory and bow hunting: human cognitive evolution and archaeology. *Antiquity* 90(349):219-228.

Bow use exclusively assoc with modern *H. sapiens*, but evidence in Africa suggests back to 37-65kya or more. Complex technology requiring distinctive modes of thought, attention to different pieces which are assembled into whole, each of which in turn requires a set of tools and processes, implying 'expert' thought needing practice and learning. Elaborate [and confusing] diagram of 'chain of foci' [i.e. chaine opératoire] for making bow, and arrow, and using together. [Argument is persuasive, but unneccessary highly formalized way of discussing simple idea – 'Whittaker's Law'': everything you do

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requires that you do something first to make ready, *ad infinitum*. Or that all technology requires a predecessor set of tools and processes.]

Cordell, Linda S. and Maxine E. McBrinn

2012 Archaeology of the Southwest, 3rd edition. Left Coast Press, Walnut Creek, CA.

[Solid overview text fairly well detailed (but reduced from previous edition) and up-todate, generally readable. But lithic drawings are all pretty poor (Marjorie Leggitt), atlatl diagram too simple and bad, and many typos and sloppy statements like "Paleoindian spears are believed to have been thrown with an atlatl or spearthrower, which provides extra leverage and increases the power behind the throw, rather than having been thrust javelin-style into an animal at close range, which would have been extremely dangerous." (111). Discussion of pre-Clovis is naïve, citing discredited info on Sandia and Pendejo Caves, both of which are rubbish, even with the disclaimer that they are "disputed." P. 156 "Appearance of smaller stemmed or side-notched projectile points at about 500 CE signals the arrival of bows and arrows... more efficient than atlatl for ambush hunting in wooded areas." Annoyingly pc in places: use of "CE" dates, stupidly sunny view of NAGPRA.]

Corliss, David W.

1980 Arrowpoint or Dart Point: An Uninteresting Answer to a Tiresome Question. *American Antiquity* 45(2):351-352.

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Response to Thomas 1978. Point neck width can be a useful attribute marking temporal or cultural change whether or not it indicates anything about hafting.

Cosgrove, C.B. x 1947 *Caves of the Upper Gila and Hueco Areas in New Mexico and Texas.* Papers of the Peabody Museum of American Archaeology and Ethnology, Harvard University 24(2). Cambridge.

Bows and arrows p61-65: 4 complete, 41 frag bows. Three types: all round x-sect; flat back + round belly; center round + limbs flattened back. Crude work, prob no more than 40 lb pull. L 36-56 inches. Painted décor mostly overall, red, black, green. 1 yucca fiber bowstring. Shallow or no string nocks. Arrows - almost 2000, 19 perfect. Reed shafts, hardwood foreshafts. Nocks plugged with wood; 3 feather fletching. L 29-38 inches. Red, green, black, brown paints. Specularite on black paint. Decoration all under fletching, sometimes elaborate banding. Some foreshafts also painted.

p 130-132 miniature bows + arrows. Several hundred bows, some perfect. Small branches or twigs, generally peeled, string of yucca or cotton. L = 8-26 inches. All painted, overall red, yellow, green, black, or combinations. Some bows in sets with attached pahos.

Info on arrows, notching technique for foreshaft manufacture. Atlatls and darts: pp 48-58. 1) Ceremonial Cave (Hueco Mts, just across border from SE NM in TX). Proximal frag

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with finger loops of "sinew" [looks like twisted sinew fibers in photo] lashed on above + below finger notches, marks for missing stone weight, V-shaped trough runs whole length from above grip [more like Aztec atlatl than BM type]. 2) Ceremonial Cave. Complete 24.25" but missing finger loops. Well made, rounded end, hook with a ridge, groove about ½ length, no wts, but 4" sleeve of hide sewn over middle [repair or held charms?], small decorative flutings + zigzag under distal end. 3) Chavez Cave (SE NM). [Unusual form - like Baja CA?] straight stick almost round cross section, 19.25" with no finger notches or loops, distal end raised to sharp edge with spur, shallow groove 1/3 of length. 4, 5, 6) Cerem Cave, small flat prox handle frags. 7) Peabody Mus collections, from Coyote Burial Cave Coahuila, Mexico [not illustrated] split hardwood sapling 21", flat face, rounded under, rounded ends, spur with ridge, shallow groove, no notches or loops.

From Hueco area, **1 full length dart** and 159 foreshafts + frags. Sotol stalks, and light wood with pith for shafts, oak or other hardwood fores. Shaft diams $\frac{1}{4}$ - $\frac{3}{8}$ inch prox, $\frac{7}{16-3}/4$ distal. Complete sotol shaft Ceremonial Cave L = $\frac{61.75}{1,0}$, others 53-67". Fletching with 3 large feathers lashed on. Some painted decoration. Foreshafts tapered to fit in socket without mastic, L 4.25-7.5" diams $\frac{5}{16-3}/8$ ", some with nocks for pts, one with incised decoration.

From Upper Gila area, **1 full length dart** and 31 frags. Shafts all peeled wood with pith center, diam $\frac{1}{4}-\frac{3}{8}$ " prox, $\frac{1}{2}-\frac{5}{8}$ " distal. Fletching 3 feathers 7-8" long lashed on. Complete specimen without foreshaft 65.5 inches long. Foreshafts hardwood, some nocked for pt, a few decorated, some bunts, L 3.5-5 5/8", diam 5/16-1/2".

Grooved fending sticks from same sites, including 2 complete from Ceremonial Cave.

Cotcher, Janice

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2007 Atlatl Lessons Grades 4-12. Resource Room at Math Central webpage, electronic document, accessed 8/31/09, 6/27/18, URL:

http://mathcentral.uregina.ca/RR/database/RR.09.07/cotcher/atlatl/index.html

Atlatl used to illustrated radial velocity, and in other exercises for math and social studies lesson. [Correctly explained as lever, but treating atlatl as if hook moved in circle is not accurate.] How to throw explanation with short video clip, instructions for simple stick atlatl making.

Cotterell, Brian, and Johan Kamminga

1990 *The Mechanics of Pre-Industrial Technology*. Cambridge: Cambridge University Press.

Includes section on atlatl and spear mechanics with physical formulae. "When a spear is thrown by hand, about half its velocity comes from a final wrist flick.... and shoulder velocity is less than 15% of the spear's velocity." (164)

"Because it lengthens the throwing lever, casting a spear with a spearthrower requires less wrist action than if it were done by hand." Angular velocity of wrist with thrower is ca 1/5 of that needed in hand-throwing. (166) "To cast spear 100m requires a velocity greater than 31 m/sec [68.2 mph]." (168) Atlatl should not bend, or it is inefficient - energy of throw is lost in bending the spearthrower. (168)

"Whatever purpose the bannerstone served, it had nothing to do with mechanical advantage. As can be seen from our analysis, a heavy spearthrower is inefficient. (169). Spear should bend, but within predictable limits. "the butt end of the spear has to deflect sideways from its intended flight path." [Photo of two aborigines throwing shows this - sideways because of a partly side-arm throw, but deflection is parallel to the atlatl, as it should be., not "sideways".] "Spearthrower's max length is governed by the need to limit this sideways deflection." It is not limited by strength of thrower's wrist, because long thrower remains in contact with spear longer [through longer arc of throw?] so acceleration is inversely proportional to length of atlatl, thus wrist moment, (product of force and length of spearthrower) is independent of length of atlatl. [What they must mean is that a slower motion over a longer time gives same acceleration and requires same force as faster, shorter atlatl - but in practical use a longer lever arm still requires more force than a shorter, at least to reach flight speed for a dart.]

If spear is rigid, butt is pulled down, angular velocity is imposed on butt of spear, and it tumbles (hooking). For perfect flight, spine of spear should match atlatl, so deflection returns to straight at time of release from hook.

Couch, Jeffrey S., Tracy A. Stropes, and Adella B. Schroth

1999 The Effect of Projectile Point Size on Atlatl Dart Efficiency. *Lithic Technology* 24(1):27-37.

Point size makes no difference in throwing distance. [Weak experimental design (small sample human throws) and incorrect theory of how atlatls and darts work (from Perkins) but conclusion correct. However human variability in throws should be expected to outweigh difference in points, and the real useful info here is the demonstration that within a reasonable range all point sizes work about equally, so point size is not necessarily a good marker of atlatl vs bow]

Coues, Elliott x pdf

1866 Some Notes on Arrow-Wounds. *The Medical and Surgical Reporter* 14(17):321-324. Philadelphia, April 28, 1866.

Surgeon at Ft Whipple, AZ, fighting Apaches. Arrows are light reed, ca 3' L, 3-fletch, painted. Wood foreshaft 8-10" L, "thickly besmeared with a black gummy substance." "Head is apparently a small and trifling affair... made from some species of quartz, chalc, obsid, etc, and is always either white or black in color." 1" or less L, 1/3" W, narrow isosceles triangle. Thin, sharp, fine point, 1-3 jagged notches near base. "Its bulbs [sic, = barbs?] are generally long and sharp." Base notched. "In the end of the hard-wood shaft... is a slight notch, not so deep as that which receives the bow string; on which is dropped a little very tenacious gum; and then the stone head is lightly pressed into place. There is no projecting handle for insertion into the wood. No thongs or wrapping of any

sort are used; and so frail is the connection between the head and shaft, that the Inds themselves are obliged to carry their arrows with great care." Strong bow 4-6' L, almost straight but "abruptly curved" near ends [= recurved?].

Quite diff from Plains short, stout, heavy arrow with large triangular metal head bound by sinew. "both make very ugly wounds." Apache less penetrative force, characteristics of head: 1. minute size, 2. jagged edges 3.friability 4. ready separation from shaft 5. probable poisoning in some instances.

Case: shot in thigh, shaft pulled out, small wound, probe could not find small arrowhead, no abscess or infection, patient recovered. Jagged edges "must decrease rather than aid the penetrative force of the arrow." Extra laceration not serious, but jagged makes it hard to encyst without abscesses, working of head toward surface.

"Extreme friability" [fragility] - "when the head impacts on bone – and it generally transverses soft tissue until halted in this way – the chances of its shivering into bits vastly preponderate over the probability of its becoming fixed or glancing." Enlarging the wound may be necessary to find point, allow exit of pus and pt fragments, dress wound without blocking orifice.

Occasionally and arrow-head... on striking bone in an exposed situation, e.g., tibia, ulna, etc, will rebound with great force." Case, superficial wound to arm. Head connection to shaft "frail" - can't pull out shaft with head, victim usually jerks out shaft alone when hit.

Poison - "reported that they dip the heads in a deer's liver, after forcing a rattlesnake to bit it, and then allowing it to putrify. I reply most unhesitatingly that as a general rule they *do not*, no other than the consequences of mechanical violence following in the vast majority of instances." Can't say never - case: neck wound superated unnaturally, muscles disintegrated, no head found. "Constitutional disturbances following arrow-wounds, even when the injury is confined to bone or muscle, are liable to be out of all proportion to the apparent amount of damage done." Almost always fever, anorexia, sleeplessness, "derangement of secretions", irritability and pain, despondence. [Sounds like infections to me, and he is not claiming poison here.]

Treatment conclusions: 1. explore wound even if have to enlarge 2. extract all frags, clean thoroughly 3. dress lightly and openly, clean any abscesses as the develop 4. Make light of wound to patient 5. Attend to "constitutional symptoms" by normal means.

Coulam, Nancy J. and Alan R. Schroedl

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2004 Late Archaic Totemism in the Greater American Southwest. *American Antiquity* 69(1): 41-62.

Split twig figurines, 2 types: Grand Canyon and Green River. [Represent ungulates that would have been hunted with atlatl.] Discuss ethnographic hunter-gatherer totemism, identify two types for figurines: "social totemism" (clan symbols) with finds in habitation sites, and "increase totemism" (sympathetic hunt/fertility magic) with finds in shrine caves, some pierced by twig spears.

Cowan, Jay

1988 At Long Last, An Atlatl of Your Very Own. *Sports Illustrated* Nov 14, 1988, no pages given. From web URL: http://web.lexis-nexis.com/universe/ accessed 1/24/1998 but does not occur as claimed in print version of that issue of *Sports Illustrated*.

Modern atlatl for experiment and sport, Leininger and Perkins featured.

Cowley, Marjorie

1994 Dar and the Spear-Thrower. Clarion Books, New York.

Juvenile novel. In Magdalenian (Upper Paleolithic) France, young Dar becomes a man, trades his sunstone (iron pyrite fire kit) for carved atlatl from another tribe, reconnects with family. Emphasis is on human relations and moral lessons rather than archaeological detail, but prehistory is reasonably accurate – and Dar has to practice long and hard to master spear-thrower.

Cowley, Majorie

1998 Anooka's Answer. Clarion Books, New York.

Juvenile novel. Epipaleolithic girl is determined to have a different life involving her discovery of clay as sculpture, despite family resistance. People hunt with spears, and bows are just being introduced, but curiously no spear throwers appear in this story.

Crable, Ad x

2007 Boy, 7, Gets First Deer with Rare Spear. Lancaster [PA] New Era, November 13. Lancaster Online, December 2007.

Private preserve, 15 yards, equipment not described. Mentions PA attempts to legalize. Video posted on youtube attacked by PETA et al. antihunters and hunters who feared bad rep.

[See Guthrie, Russell 2007: Video shows boy throwing, deer hit, apparently it ran a bit, but then shows steel broadhead on wooden dart went clean through, both lungs hit, dart broken in deer running, apparently two other shots to finish it off. Good shots of cleaned carcass to show wound.]

Credland, Arthur G.

2010 The Crossbow and the Bow in Modern Warfare. Arms and Armour 7(1):53-103.

X

WWI - medieval x-bows pressed into trench service. WWII guerilla + spy development by US + UK, but by scientists not familiar with bows, so steel bow largely ignored in favor of less practical x-bow forms powered by rubber, derived more from slingshots than from crossbows. No record of combat use.

On the other hand, Vietnam era and later sporting US crossbows reflect Euro x-bow

tradition. Montagnard and other native xbows in Vietnam war.

Cressman, Luther S.

1944 New Information on South-Central Oregon Atlatls. *The Masterkey* 13(6): 169-179.

Plush Cave site described, atlatl from looter backdirt.

Simple Basketmaker type atlatl, missing its loops, groove + hook, no evidence of weight, 19mm wide, 54.5 cm long, [pictures poor]. Associated dart parts and basketry.

Cressman, Luther S.

1977 *Prehistory of the Far West: Homes of Vanished Peoples*. University of Utah Press, Salt Lake City.

p 105 "earliest archaeological record of spear-thrower" in New World is hook from Fort Rock Cave probably dating ca 8500 years ago, and 2 spurs from Five-Mile Rapids on the Columbia River, and others. Compound atlatl (attached spur) preceded simple atlatl (integral spur). Compound atlatl along W coast, associated with boatstone weights. Simple form farther east into Gt Basin. Replaced by bow around 2300 years ago in Gt Basin. Photo of McClure atlatl with stone weight, C14 dated at 1470 \pm 140 BP, "so fragile it hardly seems possible it could have been used." [Last statement wrong, date is very late if accept his replacement arguments]. Long period of bow and atlatl overlap at Lovelock cave etc, suggests bow not just difused, but learned by trial and error. Mechanical principles are different.

Cressman, Luther S. and Alex D. Krieger

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1940 Atlatls and Associated Artifacts from South-central Oregon. In *Early Man in Oregon: Archaeological Studies in the Northern Great Basin*. L.S. Cressman, H. Williams, A.D. Krieger eds, pp 16-52. University of Oregon Studies in Anthropology No 3.

2 complete atlatls and two fragments from Roaring Springs Cave.

Lower levels mostly large points, upper levels large + small points, arrows and bows and darts and atlatls apparently together [but possible mixing of deposits].

Two atlatls together in cach, similar, one large, one small.

Both mountain mahogany, convex wide [inflexible] boards with ridge on underside, integral wood hook, deeply notched grip, no weight, painted with ochre.

L = 70 cm, 53 cm; Max W = 7 cm, 5 cm; small photographs.

Plush Cave atlatl mentioned, Basketmaker form. World distribution of atlatl types discussed. Compares RS atlatl with Lovelock Cave and BM types.

Dart shafts of cane and wood, painted. Point types discussed. World distribution of atlatls mapped and classified.

Cresson, Jack o

2006 Another Use for Sumac. Bulletin of Primitive Technology 32:56-57.

Hafting mastic on experimental foreshafts with stone points. Can only collect fresh, takes long to dry, used without filler, but waterproof + insoluble, his specimens have lasted since 1987.

Crichton, Michael 0 1992 Eaters of the Dead. (originally 1976) Ballantine Books, New York

Novel. Arab ambassador Ibn Fadlan's account of his visit to the Norse is fictionally extended to have him witness the "real" story behind Beowulf - surviving Neanderthals harass the Norse until slain by a hero. [Not one of Crichton's best - hokey strained suspense atmosphere, tedious build-up, incoherent picture of Neanderthals. Crichton talks in afterword about the archaeology and history behind the story, attempting to sound credible, but he didn't bother to understand it or get anything right. All the Neanderthal tools are supposed to be stone, but their victims are "slashed by swords", they have no intelligible culture or economic base, but ride domestic horses, they are associated with Upper Paleolithic "Venus" carvings, etc, etc. They do not use atlatls as in movie version (McTiernan) which is equally bad.]

Crimmins, M. L. x 1926 Petroglyphs, Pictographs, and the Diffusion of Primitive Culture. Art and Archaeology 21(6):297-298.

New Mexico sheep petroglyph with darts = extension of Basketmaker to new area, because association of darted sheep with BM is strong. Atlatl and "dart" described, drawing of darts [unknown source]. [Actually this is the well-known Mimbres style sheep, much later than BM, with arrows in it, not darts.]

Critchley, Zachary R.

2018 The art of the spearthrower: understanding the Andean estólica through iconography. Poster presented at Society for American Archaeology annual meeting, 2018, Washington D.C.

Critchley, Zachary R.

p,x 2018 The art of the spearthrower: understanding the Andean estólica through iconography. Unpublished MA Thesis, SUNY Binghampton.

Birds appear frequently, statistical analyses of all the images he could find in S. Am.

Iconographic approaches. Andean estolica easier to ID in art than some atlatls because of 'fingerhold' [= handle piece] i.e. hook form at each end. Fingerhold often elaborate, usually visible in depictions. Data sources: museums, books, online museum catalogs - primarily archival - surely not complete, not all images good. Both atlatls themselves and depictions of them in other media. Total 228 individual representations, 104 from Museo Larco. Major themes, coastal and highland:

p,x

Coastal. Bulk of study specimens, both depictions and atlatl artifacts. Summary of Moche, Chimu, Paracas, Nasca etc cultures. Moche N = 140 of the 214 records. Over - represented because of collecting, and naturalistic art. 8 metal objects, rest ceramics. In use in 56, held in 50, present in 12 scenes. Often hunting, mostly deer, some ceremony. "Ceremonial badminton". Handlepieces depicted – mostly birds, one each fox, feline, serpent, plant. Deer hunt probably allegory of war. Spearthrower often carried, occasionally used in battle scenes. Fig.8 From Loma Negra in Met Mus Art, Moche warrior cut-out/repouse/decorated gilded copper showing atlatl throw in profile [odd: fingers are reversed in image – looking at figure's chest, so throwing hand should show knuckles, not fingers, and other hand should have thumb up, not down. Hand appears to be wrapped around dart as well as thrower, and handlepiece projects straight down – good example of stylization].

Burial ceremony depicted with Wrinkle-Face on top, about to throw dart in air – suggesting a use for the elaborate atlatls buried with elite. 'Ceremonial badminton' described by Donnan (2016). Wrinkle Face or Ai Apaec- fangs, wrinkled face, feline headdress, serpent-headed tentacles from belt. Fig 10 WF emerging from ceramic Strombus shell carrying atlatl with large hook and rectangle-design handlepiece plus 2 darts with feline heads at one end.

Paracas -2 depictions on cloth, at least 6 sprthwrs in mortuary bundles but not documented.

Nasca – mostly on effigy jars depicting hunt and Anthropomorphic Mythical Being. Only 2 'in use' – one hunt, one combat, other just held. Assoc with trophy heads or other weapons. Fig 11 polychrome effigy jar – warrior with falcon eye marks holds atlatl [in L hand. Lashings can be seen for simple hook and handlepiece. 3 darts in R hand, with triangular black heads (obsidian?) and fletching (unlike unfletched Moche darts)]. Hunters in Nasca art often with parrot e.g. Fig 12 profile hunter with generic atlatl [sketchy but lashing form hook and handlpiece indicated] possible bolas, club, and parrot on the hook end of atlatl [where it can't be handlepiece or part of atlatl]. AMB sometimes shown with darts as spines.

Chankillo (Ghezzi 2006, 2016) hilltop site, warrior figurines Fig 13 [sketchy] with atlatl, and one spearthrower, simple, no handlepiece. [Not clear to me from image if this is a real atlatl or a ceramic model].

Highland: Chavin. Art with intricate visual metaphors 'kennings'. 4 spearthrower depicitions. Warrior relief with trophy head, 'donut-shaped' handlepiece, maybe representing finger loop [no figure shown]. Black and White Portal Were-Raptor figures hold complex tool, Roe (2008) IDs as spearthrower and dart.

Wari – sparse textile depictions. Pikillacta metal warrior figurine 87 mm tall (Tuni + Tesar 2011). Shows finger holding dart against handlepiece. Could be Wari heros but given lack of other Wari spearthrower imagery, as likely used to ID foreign warriors or ancestors.

Inka – no examples in Inca art.

Staff god – depicted in several cultures, rayed head, face forward, holding staff in each hand. Staves often ambiguous, but some clearly spearthrower + dart in opposite hands. Fig 15 Chonchopata Jar (Wari). Tiwanaku Gateway of the Sun.

Bird imagery common all over. Moche especially. Depicted atlatls seem to show living bird head coming out of atlatl [perhaps, but could be stylized bird handlepiece] as symbol indexing flight of dart. Raptors, but also bird with long neck + beak maybe ibis or heron, or maybe hummingbird. Two specimens have condors – Moche in Museo Larco, and with Senora de Cao. Fig 18 – Nasca effigy jar warrior with condor handled atlatl. Fig 19 miniature atlatl with condor handlepiece [Chimu?].

Handlepieces elaborate so not just functional, also meaningful. Most commonly humanoid (40/100). Mushroom, feline, and avian next most common (8,8,6/100). Gender – assumed to indicate male graves. Acts as equalizer, Grund says new users pick up skill faster than with bow [but she is wrong]. No recognizable females with atlatls in Andean art. Phallic motifs also suggest masculine symbol. But Senora de Cao had 23 spearthrowers buried with her. Valuable materials signal status. Gold and other metals mined from earth had strong magical value.

Crosby, Alfred W.

2002 Throwing Fire: Projectile Technology Through History. Cambridge University Press, Cambridge.

Extended essay, reasonably well written, mostly accurate although superficial on details. Early sections favor Calvin's theory of throwing as critical mental development [thankfully he only hints at Calvin's handaxe throwing nonsense], and Bingham's idea of group enforcement by throwing as promoting social development. Ethnographic accounts of remarkably accurate stone throwing. First spears at Schoningen 400,000 years ago. Upper Paleolithic - throwing stick or atlatl, adequate description and diagram. Mentions Perkins' spring theories, but correctly explains atlatl in terms of lever arm. Australian annecdotes, Aztec darts "pass through armored man", Frison experiment on elephants. Beginnings of fire use also discussed. Possible human causes of Pleistocene extinctions.

Cross, John R.

1999 "By Any Other Name...": A Reconsideration of Middle Archaic Lithic Technology and Typology in the Northeast. In *The Archaeological Northeast*. M. A. Levine, K. E. Sassaman, and M. S. Nassaney, eds., pp. 57-73. Westport: Bergin and Garvey.

Technological and typological basis for Mid Archaic (ca. 8000-6000 B.P.) stemmed bifaces in the NE, Annasnappet Pond site. Stanly, Neville, Morrow Mt, and Stark points, all broad triangles with short narrow stems with concave bases, usually rhyolite. At Annasnappet Pond, associated with other lithics, full-grooved axe, winged and cylindrical atlatl weights. Oval feature with calcined skull frags, ochre, 3 Stanly/Neville pts and 1 drill, 2 winged atlatl wts, and 1 chipped slate knife perform, uncalibrated date 7570 \pm 150 BP. Points aligned with weights, shafts estimated at 125-135 cm long. Large pts often snapped and either half could be reworked; variants are mostly result of such. These are probably atlatl pts, and knives. Morrow Mt/Stark pts are thicker, narrower, sharp, with convex base of stem, different stone, less formal, rarely resharpened, probably thrusting spear tips.

Cruxent, Jose M.

1979 Stone and Bone Artifacts from Taima-Taima. In Taima-Taima: A Late Pleistocene Paleo-Indian Kill Site in Northernmost South America, Final Reports of 1976 Excavations. Edited by Claudio Ochsenius and Ruth Gruhn, pp. 77-89. South American Quaternary Documentation Program.

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[Mastodon kill, C 14 dates 12,980-14,200 BP (uncal) on twigs assoc with skeleton - Bryan and Gruhn] El Jobo point midsection in cavity of R pubis of young mastodon. Probably used as dart point with atlatl. A second frag also in pelvic cavity of mammoth, and another surface find [illegible photos only]. Pressure retouch, knife use as well as point use likely. Two flake tools with bones, one on surface. "Tools of expediency" of limestone embedded in layer of limestone pebbles [apparently very crude damaged edges interpreted as retouch, he claims "expert eye" but it doesn't sound convincing, no illustration.]

Crystal, Breck

0 2009 Buffalo Penetration Test. Bulletin of Primitive Technology 37:89-90.

65 lb bow, killed with dacite point which stopped on inside of opposite rib; steel point and antler point also made shots that would kill.

Culin, Stewart

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1898 An Archaeological Application of the Roentgen Rays. Free Museum of Science and Art (University Museum), Bulletin 1(4):180-183. University of Pennsylvania, Philadelphia.

[maybe the first x-ray investigation in archaeology?] Cushing predicted turquoise "heart of fetish bird" concealed under wrapping on Basketmaker atlatl from Mancos Canyon, CO [which has chert biface and predator tooth visible]. Photos. Four stone beads revealed by rays. C. L. Leonard at Pepper Clinical Lab, also looked at mummys from Uhle's work in Peru.

Culin, Stewart

1898 American Indian Games. The Journal of American Folklore 11(43):245-252.

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Games originated as divination. Variations on dice games, recorded among 61 tribes. Pits, stones, disks, staves, sticks used as dice, from 3-13 with 4 most common number, relating to 4 directions, seasons etc. Zuni use 4 split cane, according to Cushing derived linguistically and in morphology/decoration from arrow shafts. One is called "a-thlu-a" or "all sender" laid across fingers, others on top of it - represents atlatl. Banded markings on some pieces represent "crossed wrappings for attachment of finger loops." [Penn BM atlatl specimen shown]. Similar in other SW tribes. Origin of the game then "may be definitely fixed in the country of the reed arrow and the atlatl... the arid region of the SW US and N or central Mexico." Mexican codex god holds atlatl and three arrows.

Cundy, B. J.

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1989 *Formal Variation in Australian Spear and Spearthrower Technology*. BAR International Series 546, Oxford.

[Actually covers only Central Australia and the northern half of the Northern Territory so some important types and variation not included. A very good study although marred by many typos and almost no illustrations of spearthrowers and spears. One of the best sources on spearthrower mechanics and physics, but the explanations are not always clear. I've translated into English as much as I can.]

1. Intro: Variation should be explained by technological and functional factors as well as cultural differences.

2. Technological comparison and performance: Compares to hand thrown spears. Tasmania had no spearthrower, hand thrown spears 40-70 yards, maybe up to 100m, typically spears 4m long, .6 kg. [He discounts shorter distance records as non-comparable, but these Tasmanian ones seem exaggerated, when javelin record is 98m.]

Spear thrower records: Falkenberg (1968) measured throws in Northern Territory of 90-125m, one 180m, but special gear – small reed spears. Thomson (unpub) recorded 49-105 m in Arnhem Land. Mountford (unpub) got 50-91 m. Consider 70 m as a "rule of thumb" average max distance, so not really better than hand thrown.

Accuracy is hard to compare from ethnographic accounts, but usual max accurate range 20 m. At moderate size targets, comparable accuracy to bow, but atlatl accuracy decreases more rapidly as target gets smaller or more distant. So why atlatl? Perhaps reduces necessity of learning throwing skills, i.e., it's easier than hand throwing, both in skill and effort, freeing hunter to invest in other skills and activities. [I think he understates the improvement possible with spear thrower.]

3. Aerodynamic factors: "Vacuum model" of throw considers only gravitational and projection force, not aerodynamic factors, and predicts 45 degree angle for maximum distance throw. But drag (air friction) greatly reduces theoretical maximum. Spears unlikely to have much lift. Center of pressure must be behind center of gravity to keep straight flight, either by having most of the weight forward, or adding drag to rear of shaft, as in fletching. Most experiments suggest center of gravity should be between .25-.33 length on unfletched projectiles. Compares modern javelin, weighted and shaped to glide maximum distance but still land point first. "Range but not in-flight behavior equaled" by Australians. Palter (1977): 293 spears, center of gravity at .25-.48 length, thus many would stall if thrown for distance, but this was of secondary importance in their use.

4. Wound Ballistics: Penetration depends on motion and shape of projectile. Motion measured by kinetic energy, momentum, power, mass, and velocity, with most favoring kinetic energy. (Mass x velocity squared over 2). Because of drag from the material penetrated, heavier projectiles penetrate deeper than lighter higher velocity ones. Shape and size of missile affect drag. Surprisingly little energy is needed to penetrate skin and flesh.

5. Propulsion: Body levers in timed sequence, with slow but powerful (trunk, thighs)

first, then faster but weaker joints (hands, arms), so each contributes its maximum. For light projectiles, skill (timing of muscle sequence) more important; for heavy, strength more important (e.g. baseball vs javelin). Mason (1884) and Howard (1974) use impulse model (atlatl increases time of thrust on spear). Howard's model is unlikely on mechanical grounds, and predicts that spearthrower length is of little importance. Most analyses use lever model, seeing atlatl as lengthening arm. Atlatl is not a lever, but can be analyzed as part of lever system. [A confusing and unnecessary quibble. As subsequent discussion makes clear, atlatl and wrist do in fact act as lever and fulcrum.] Rotating short end of atlatl at wrist by applying strong force moves the long end a greater distance in the same time, thus faster, thus increasing velocity of spear. Analyzes 1970 ethnographic film of throwing. Motion is similar to conventional overhand throw, a sequence of 1) forward body motion, 2) shoulder rotation 3) arm rotation, and 4) wrist rotation [flexion]. Spearthrower increases length of resistance arm of any body lever in the same plane. If used more horizontally [side-arm], emphasizes shoulder + body rotation, if vertical, emphasizes arm and wrist. Stronger individuals may tend to use more vertically. Most of the gain in velocity is from wrist action in last .1 second of throw.

If spearthrower load is too great [too heavy, too much wind resistance] then velocity reduced. If too light, high acceleration reached at expense of power development. Longer spear thrower increases linear velocity at tip (and spear) but increases load about the wrist faster because proportional to square of length between wrist and center of gravity of atlatl.

6) Spear and Spearthrower Articulation

At rest, atlatl weight bends wrist back, spear weight counters this, bends forward. Bannerstones may help balance, but not used in Australia.

As wrist flexes to lever spear thrower, and spear stays in line, the tail of the spear must rise, so spear must flex a distance proportional to the length of the atlatl. The flex also stores energy that can be converted into kinetic energy later, and add to spear velocity, but spear detaches from atlatl before that is complete, so some of the energy stored as flex remains, resulting in wave-like shaft vibration. If shaft does not store enough energy by flexing, it will be tipped toward the ground; too much and it may buckle.

Thrower must overcome inertia of spear and atlatl tip. Longer atlatl has higher velocity, but rapidly loses advantage because inertia is function of length squared, so doubling length quadruples inertia. Shorter atlatl, lower possible velocity, but can throw heavier spear. Different spear and atlatl combinations optimize for either high velocity with low energy (light spear), or high energy with low velocity (heavy spear). [Of course, but how then do Australians use combination of long (and heavy) atlatl with very long and heavy spear? Even with my lighter spears, their woomeras are too long for me. Tables show some spears 400-500 gms, 4 x what mine weigh.] Can make atlatl lighter as gets longer, but then need to increase rigidity because energy stored as atlatl flex will only be released at end of throw as lateral movement of spear shaft.

7) Structural relationships. 1. Positive correlation between mass of atlatl and mass of spear. 2. Inverse relation between length of atlatl and mass of spear. 3. Inverse between length and mass of atlatl. 4. If optimizing for high velocity, atlatl inertia may be reduced

by concentrating mass about the wrist pivot, in which case mass and length may be positively correlated. Test on specimens from Northern Territory, 5 types of spearthrower, but can't match individual spears to atlatls, uses sample means. Expectations generally confirmed.

8) Spear and Spearthrower forms.

Central Australian: Leaf, paddle, or scoop shaped, lashed on hook, resin lump at handle, often with inset stone flake. [What most people think of as Australian "woomera."] Form linked to manufacture from cambium of mulga tree, and secondary uses as tray, club, musical instrument, etc. Appears inefficient – wind resistance of wide shape, but used either flat or edge-on.

Cunnar, Geoffrey, William Schindler, Anne Underhill, Fengshi Luan, and Hui Fang o

2009 Hunting with Talc? Experiments into the Functionality of Certain Late Neolithic Ground Projectile Points from the Site of Liangchengzhen, People's Republic of China. *Ethnoarchaeology* 1(2):185-211.

Longshan Period (2600-1900 BC Neolithic), points of flaked chert (small triangular) and ground chlorite schist and talc schist (larger, elongate triangle with stem). All worked in replic exper shot into ballistic gelatin, but talc very soft, broke easily, cs better, chert most effective. Shattering of soft ts pts may be intentional in war, perhaps for infection or carry poison. Some ethnog comparisons [but fragility makes them ineffective against any armor and impractical to carry, distribute etc]. Size variation suggests some arrows, also spear, atlatl dart, but crossbow not evidenced until later [and NO evidence at all for atlatls – no reason to suggest them here]. Green color of symbolic importance, imitating jade for lower status folk.

[Interesting but small N experiment, talc pts really poor functionality, no context evidence such as burials offered.]

Curren, Cailup B.

1977 Potential Interpretations of "Stone Gorget" Function. *American Antiquity* 42(1):97-101.

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Flat, polished stone 'gorgets' may be tools for making ceramics, appear at same time in sites, similar in form to modern potters' 'ribs'. [Example of bad "looks same, must be used same" argument (see Starna 1979). Bannerstones are mentioned as another interp of gorgets.]

Cushing, Frank H.

1895 The Arrow. *The American Anthropologist* 8(4):307-349.

[Fascinating early article by one of the first experimental archaeologists.] Arrow was invented before bow.

Study specific for general laws of man's development. Good quotes on above, personal

and individual nature of anthro, philosophy of study and need for replication. His discovery of arrowmaking. Arrows described (SW example). "Knapping" - direct, indirect, pressure described. Arrow making - includes straight and smooth w/stone, grooved grinder for foreshafts, wrenches. [Wild] speculations on human and arrow beginnings. Proposes development of spear thrower through some weakly documented [and often dubious] forms of spear sling, spear palm, etc. - short throwers with rope for end. Springy atlatl of cliff dwellers - claims his works, and that he experimented with Maya forms too. Reconstructs a stringed "spear crook or flinging bow" [combination atlatl and bow] from Zuni war paho, and "bow crotch" [an even more absurd idea], from which derives reflex bow. [I have tried a spear crook made by Richard Lyons - it does work, poorly, as a hooked atlatl, not with springing action. Cushing's scheme is an attempt to develop an evolutionary sequence for bows, based on incorrect notion of springing action of atlatls.]

Cushing, Frank Hamilton

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1897 Explorations of Ancient Key Dwellers' Remains on the Gulf Coast of Florida. *Proceedings of the American Philosophical Society* 35(153):329-448.

Describes at length the project and various remains.

Atlatls: two types - 1. Double holed, 18" long, slight curve, originally springy, with groove and spur, flared handle end. 2. Single holed, 19", more curved and thicker and wider, short groove, spur is tail of carved rabbit, handle turned down volute. Suggests that some shark-tooth "swords" were also atlatls [but hard to evaluate from his descriptions and poor drawing].

(See Gilliland 1975, Kolianos and Weisman 2005)

Cushing's original description reads (1897: 43-44):

"It was significant that no bows were discovered in any portion of the court, but of atlatls or throwing sticks, both fragmentary and entire, four or five examples were found. Two of the most perfect of these were also the most characteristic, since one was doubleholed, the other single-holed. The first ... was some 18 inches in length, delicate, slender, slightly curved and originally, quite springy. It was fitted with a short spur at the smaller end and was unequally spread or flanged at the larger or grasping end. The shaft-groove terminated in an ornamental device, whence a slight crease led quite to the end of the handle, and the whole implement was delicately carved and engraved with edge-lines and when first taken from the muck exhibited a high polish and beautiful rosewood color. The other was somewhat longer, slightly thicker, wider shafted, more curved, and as I have said before, furnished with only a single finger-hole. At the smaller end was a diminutive but very perfect carving of a rabbit, in the act of thumping, so placed that his erect tail formed the propelling spur. This instrument also was fitted with a short shaftgroove and was carved and decorated with edge and side lines, and the handle-end was beautifully curved down and rounded so as to form a volute or rolled knob, giving it a striking resemblance to the ornate forms of the atlatl of Central America; a resemblance that also applied somewhat to the double-holed specimen, and to various of the fragmentary spear-throwers. Arrows about four feet in length, perfectly uniform, pointed

with hard wood, the shafts made either of a softer and lighter kind of wood or of cane, were found. The nocks of these were relatively large. This suggests that certain curved and shapely clubs, or rather wooden sabers - for they were armed along one edge with keen shark-teeth - might have been used no only for striking, but also for flinging such nocked spears or throwing-arrows. [then describes shark tooth clubs] ... Now the little cusp or sharp-edged spur at the end of the back-groove was so deeply placed in the crease of the knob that it could have served no practical purpose in a striking weapon. Yet, it was so shaped as to fit the nock of a spear, and since... the handle could be grasped not only for striking, but by shifting or reversing the hold, for hurling as well, I inferred that possibly the instrument had been used in part as an atlatl, in part as a kind of single-edged maquahuitl or blade-set sabre."

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Dahl, Doug, and David Wescott

2012 Developmental Technology: The Dahl Roller Spur. *Bulletin of Primitive Technology* 44:89-91.

Developmental technology = "informed by historic models but adaptations that have no presence in ethnographic record." A problem is that if they are successful they may be claimed as ancient fact rather than new development. Also idea is used without crediting inventor, so named here. George Stewart made split stick atlatl with string between ends and arrow nock on dart; Dahl adds a round bead roller to fit cup on dart end. Does this reduce friction in throwing motion [what friction?] and downward hooking of dart end?

Daily Camerao2016 Leni Clubb Obituary. The Atlatl 29(3):12.

D. 4/17/2016, age 101+. Leni English, child star in silent films. Artist, Boy Scouts, Atlatl WAA founder.

Dale, George A.x1970 Nambikuari Bow Makers. Bow and Arrow 8(5):22-25.

On tributary of Bolivian Amazon. Crippled hunter now bow maker. Bow 7 foot long, 2" W at grip, piuva wood, self-bow, twisted fiber cord, >50 lb pull. Long bamboo arrows with hardwood foreshafts andd points - blunts for birds, barbed for monkey, lanceolate for hunting [actually look like my Yanomamo arrows, and not bamboo]

Dalley, Gardiner F.

1970 Artifacts of Wood. In *Hogup Cave*, by C Melvin Aikins, pp. 153-186. University of Utah Anthropological Papers 93. University of Utah Press, Salt Lake City.

Frags of wooden dart shafts and foreshafts; no cane or reed, no firm evidence of fletching. 4 prox ends, 14 straight smoothed sections, 2 deeply socketed distal ends. Ca .8-1.2 cm diams, willow, beech, other woods, some charred, red painted. Foreshafts: 19,

7 tied in bundle in various stages of manufacture.Tapered + roughened prox ends, some with pitch. Two notched for stone pts. Most .9 cm diam. Notching done by splitting out (as Cosgrove 1947).

Three atlatl frags: 1. Distal, shallow but very wide channel with raised integral spur. 2. central section, flattened curved blade shape, narrow shallow groove, burning, cut marks. 3. proximal frag, flat, sinew wrapped at break end (possibly from finger loops).

Also lots of arrows, compound reed with wooden foreshaft.

Dalley, Gardiner F., and Kenneth Lee Petersen

1970 Additional artifacts from Hogup Cave. In *Hogup Cave*, by C Melvin Aikins, pp. 283-286. University of Utah Anthropological Papers 93. University of Utah Press, Salt Lake City.

[The important atlatl find]: Unscientific excav after project done, provenience unknown. Complete, 56.5 cm long, 3.5 W. Thin, flat board, broader at distal end. Single finger loop. Raised integral spur, shallow narrow groove, pierced by long slot. Burnt decorative lines outline groove on distal half. Lashed on weight of slate, rectangular, just distal to mid of atlatl. Wooden splints lashed under loop lashings, and on both sides of extreme proximal end.Considers allied to SW atlatls [I think only superficially similar – this is more likely a distinctive Great Basin atlatl form]

Daniels, V. and W. A. Oddy

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1993 Analysis of Red Pigment from Aztec Spear Thrower. unpublished ms.

Under gilding on British Museum atlatl AM5226 is white gypsum gesso and red [clay]. Red pigment contains carminic acid, so from cochineal insect.

Darwin, Charles

1909 Voyage of the Beagle. Harvard Classics, P. F. Collier and Son, New York.

pp. 457-458, entry for January 12, 1836, near Bathhurst, southeast Australia: "At sunset a party of a score of the black aborigines passed by, each carrying, in their accustomed manner, a bundle of spears and other weapons. By giving the leading man a shilling, they were easily detained, and threw their spears for my amusement... In their own arts they are admirable. A cap being fixed at thirty yards distance, they transfixed it with a spear, delivered by the throwing-stick with the rapidity of an arrow from the bow of a practised archer."

Davenport, J. Walker

1943 Some Experiments in the Use of the Atlatl. *Bulletin of the Texas Archaeological and Paleontological Society* 15:30-37.

Very accurate and powerful, not as much as bow but good (motion - overhand, wrist snap to extend atlatl adds power).

A

Davidson, D. S.

1934 Australian Spear-traits and their Derivatives. *The Journal of the Polynesian Society* 43: 41-72; 143-162.

Continent-wide typology. Classification by means of propulsion is meaningless for tracing history of development because only difference is the indentation in butt for spear thrower; there are no spear types that cannot be thrown by either method. [Maybe, but that would be because Aust uses relatively heavy spears with atlatls]. Hand-spear prevails where heavy spear used, and peripheral areas, like Tasmania and Melville and Bathurst Islands where thrower not used. Functions of different types are not consistent among different tribes, and don't reflect spear structure, so must classify by physical traits alone. [Nevertheless, he divides each type into 2 varieties, one "for use with spearthrower" and one not, so it might very well be possible to find some patterning.] Main types: 1. Plain Spears: one-piece, plain with oval or flattened point, plain with spatulate head. 2. Composite Spears: some with wood shaft but mostly with reed - 2-pc with spatulate head, stingray spines varying in number, long heads with only short tail piece of reed, "death spears" with stone chips in gum head (S), Kimberley stone-headed spear (N). Both these two best suited for use with spearthrower, rely on sharp point rather than weight. New Guinea reed arrow probably developed from reed spear after those diffused to Aust. 3. Spears with barbs cut in solid [he means a head, which must be used with a reed shaft - his typology is confused, mixing between types and attributes]. 4. Detachable barbs. 5. Bone barbs. [These last 2 he means barbs lashed on to side of tip or forming tip + barb.] 6. Death Spears [alread included under composites] - formerly distrib all along S coast, use glass since Euro contact, probably early type because assoc w plain spears. 7. Stone-headed spears, found only N part of Aust, with flake point more E and Kimberly pt more W. Small distribution with continuing diffusion shows late type, stone heads substituting for wooden ones. Kimberley always with long wood foreshaft on cane shaft. Reed spears of little value without spearthrower, prob originated later [so he contradicts earlier comments about lack of difference between thrower and hand spears.]

Davidson, D. S.

X

1936 The Spearthrower in Australia. *Proceedings of the American Philosophical Society* 76(4):445-483.

In historic Pacific confined to Yap, Palau, parts of New Guinea and Australia [His interest is in tracing diffusionary patterns]. Maybe originated in Asia, but no evidence, spread to Europe in Upper Paleolithic 20,000.

Probably not too old in Australia, but 1000s of years. But lacking in Tasmania and some parts Australia, so not fully diffused, so not too old.

All but couple possible exceptions are "male" type hooks, which need socket in spear. Hand thrown spears usually too heavy too, and some areas had elaborate carved barbs on wooden spears - reasons not to change to spearthrower.

Overlap of spear weights, but hand thrown spears generally heavier. Heavier spear with

thrower needs shorter thrower.

Maps distribution: most of Aust except SE - lacking in "peripheral" areas so recent intro, slow spread. Probably from New Guinea [no evidence]. Reed spears with wooden heads only where spearthrowers, but only in part of spearthrower range, so a later development of spear to go with throwers.

Area of "negative distribution" (E-central) defined by Graebner, Radcliffe-Brown - but actually patchy presence there, little info.

Three types defined, distributions mapped, spread speculated:

1) Broad leaf-like (W + interior) wood slab, gum knob handle, often with stone adze flake inset, some with incised decoration, different regional varieties.

2) Lath-like (S + W coast, North) flat strip of wood, grip often gum, peg hook.

Oueensland subtype (N-E) [should be separate type, quite different], lath is vertical, not flat, no flex at all, little wind resistance, shell + gum handle, peg hook.

3) Stick-like (N + SE). N has tasseled handle, some gum handles, peg hooks, some integral carved hook, often very simple. SE types bulge or paddle-shaped.

Davidson, D. S.

x 1947 Fire-Making in Australia. American Anthropologist 49 (3): 426-437.

Spearthrower used as fire drill hearth, and more often as fire saw - central Australian form, with beanwood shield in northern S Aust, Central A, southern N Aust and elsewhere.

x, p

Davies. Danielle

2014 The Projectile Point in Perspective: A review of classification systems, consistency, and context regarding the dart-arrow dichotomy in North American archaeology. Unpublished PhD dissertation, University of Exeter.

Applies Shott, Hughes, and Hildebrandt and King methods of distinguishing dart points from arrow points to collections from the SW (CO), Plains (ND), and Woodlands (VA). Concludes that they all differ in applicability from area to area, and provide differing conclusions, partly because they are all based on the sample of 'known' material used by Thomas and Shott, which is biased toward the SW, and partly because they emphasize different measurements. E.g. H+K dart-arrow index is Neck W + Max T = 11.8(threshold) - so does not apply then to the mostly unnotched triangular (arrow) points dominating Wdlnd assemblages, so it judges these assemblages as all dart. Hughes system plots aggregate assemblage Tip Sectional Area, Tip Perimeter, and Mass for an assemblage against threshold values, showing supposed balance of assemblage, while the others judge individ pts and can plot % dart vs arrow. Tried 4 Shott indices, using 1 variable (Shoulder Width); 2V (SW + T); 3V (SW + T + Neck W); and 4V (SW +T+NW+Length), but considers the 1V to be best. Problems with missing values for many specimens.

Second major conclusion is that in all the study areas, the transition was not as clear-cut as traditionally assumed, although the transition date looks close to traditional dating. Notes presence in all assemblages of large pts representing retention of older system in some form, perhaps just symbolic. [I think in almost all cases these are older, reused points, or result from mixed nature of site assemblage and stratigraphy, multicomponent occupations etc. What would happen if these were sorted out? Could it be done without biasing the very problem she approaches? Could you look at specific "arrow" and "dart" types? - probably not enough sample. In any case, many of her site samples are quite small.]

The SW sample is from sites in Mesa Verde Dolores R area. Cougar Springs Cave is BMII (N = 13), others include Payne BMIII (N=14); Duckfoot late PI (N=62); Rio Vista Village PI (N=119); Periman Hamlet PI-PII (N=56); Marshview Hamlet PIII (N=22). So covers expected transition period. All can be interp as lg pts surviving along with small, [but I think in all cases, these are just relic pts. The stats for most individ measurements, and for all 3 classif schemes to me show Cougar as the only distinctive site, lacking small arrow pts; all others are mixed. Inluding PIII Marshview, which has a lot of small old pts that get classed as arrows but are not, and it lacks the sidenotched forms I expect. The earlier P sites have the small barb+tanged early Pueblo "Dolores" (arrow) form dominating.]

Plains sample is from sites along the Middle Missouri in South Dakota. All are after about 1000 AD, thus after expected transition at ca 500-1000 AD. Mostly arrow types, including Avonlea-like forms, but again, larger pts too, including a few plainly curated relics. Shott and Hughes system class most as arrows; H+K doesn't work well; sees most as darts, probably because of many pts with high Neck W (shallow notching) and Thickness (crude, quartzite). Many of the 'arrow' pts are large too, some being imports from areas with larger arrow pt traditions, or 'nice' pieces for trade or special use.

Woodlands sample is from inland Virginia Chesapeake drainage. [All are sites with long occupations, multiple components, often excavated long ago and with poor specific provenience info.] Materials are rhyolites and quartz, often crude pts. Large old dart forms, un-notched triangular arrow forms, some surprisingly large. Most sites judged by most schemes to have more dart than arrow, and H+K claims all dart, because the triangular unnotched pts have no Neck W measurement so are disregarded.

Inter-region comparisons difficult. Stats show in general, Cougar Springs dart dominated, and Wdlnd also, but actually just relatively large pts overall. [The neckwidth distributions show that H+K is best at distinguishing in most circumstances, but cannot handle unnotched points.] Concludes none of the schemes is universally applicable; size "is a relative term" varying in time and space "and thus cannot be used as a stand-alone distinction between the point types and projectile technologies". Transition complicated by cultural processes of reuse and retention, visibility muddled by such [and by mixing in sites, something she does not consider enough]. Transition probably more variable and nuanced than the traditional model of abrupt change would have it. P 340: "…no single definition of the adoption of the bow and arrow in N Am can ever truly exist."

Davis, Buzz o 2007 Buzz's Texas Hunt. *The Atlatl* 20(2):9.

Game ranch, hit watusi (African) bull, but not fatal, killed with gun.

Davis, C. Alan, and Gerald A. Smith

1981 Newberry Cave. San Bernardino County Museum Association, Redlands.

Cave in Mojave Desert near Barstow, S CA, excav 1950s. Mostly Archaic material with nice series of Elko and Gypsum points, only one Eastgate (so little late use at all). Best known for split twig figurines, but also one possible atlatl frag [can't tell from picture] and 1066 frags of compound dart shafts. Usually wood foreshaft, (6 notched for points, 10 pointed wood fore or main shaft) cane or wood main shaft, (10 socket ends, some sinew reinforced, 1030 mainshaft frags of willow, reed, elderberry, 11 nock ends, some sinew reinforced) often decorated with paint or sinew wrap. None complete enough to estimate length of whole dart. Suggested that cave and artifacts used for "magico-religious" pursuits.

Davis, Carl M., and James D. Keyser

1999 McKean Complex Projectile Point Typology and Function in the Pine Parklands. *Plains Anthropologist* 44(169):251-270.

McKean complex includes contemporary different Archaic point types, for which different functions are suggested. Duncan-Hanna points are considered to be atlatl dart points, while McKean Lanceolate and Mallory points were used on thrusting spears, thus providing an optimal weapon assemblage. Uses rock art, ethnographic, breakage, and design evidence.

DeBoer, Warren

1993 Like a Rolling Stone: The Chunkey Game and Political Organization in Eastern North America. *Southeastern Archaeology* 12(2):83-92.

Roll the chunkey stone, throw the pole, score by closeness to end point of stone. Gambling game related to universal N. American hoop and pole game. Data from 97 archaeological discoidals or chunkey stones from Cahokia area suggest started Late Woodland as popular game with stones found in middens and child burials, but during rise and peak of Cahokia center, stones are standardized and in burials of elite males. Suggests elite took over as symbol (sun, earth, directions, woodhenges) used to legitimate rulers, and also to control economic exchange and distraction represented by chunkey gambling. [No suggestion of atlatl association with chunkey, which is post-atlatl, but could adapt well as a modern atlatl game.]

Deem, James M.

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2001 Kwaday Dan Sinchi: North American Iceman. Mummy Tombs webpage, URL: http://www.mummytombs.com/mummylocator/featured/naiceman.news.htm accessed 9/13/06

x part

Announces destruction of this find: cremated by tribes. DNA samples reportedly taken, no results announced yet. [Doesn't say if artifacts were thrown away too.]

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de Heer, Rolf (director)

2006 Ten Canoes. Palm Pictures, Australia.

Film (DVD) of Northern Territory Aboriginal story. Young man covets one of elder brother's wives, brother tells story of a similar situation that led to mistaken killing and "pay-back" ritual in which men of the victim's tribe throw spears at killer. A slowly unfolding narrative about the balance and beauty of aboriginal life and the importance of tradition. The "present" story is shown in black and white to mimic Thompson's 1930s ethnographic photos that inspired it, while the embedded "old" story is in color.

Throughout the film men carry and use spear thrower and spears. Spears are long, wooden, most with wooden "shovel nose" blades, although that used in killing has stone blade point, and that used in goose hunt has 2 or 3 barbed points. Woomera is the flat northern Arnhem Land/Gros Eylant type. We also see it used to paddle bark canoes. In the payback scene, a line of men throw spears in relatively high arc. Even with slo-mo the details are blurry, never get a real close look at spear throwers or throwing. Can see spears flexing as they pass over camera on way to target.

[This is a wonderful film, although as an anthropologist I would have liked the camera to linger over more detail of the activities the people are doing. The "making of" feature is also good, shows canoe making but no info on atlatls, and describes how much of the traditional life shown was reconstructed from Thompson accounts and some memory. So it should not be assumed that the atlatlists were adept, although the scenes appear realistic. Canoes and 300 spears made, some shown using modern tools. Problems and pleasures of working with local community described.]

Dell'Amore, Christine

2009 Photo: Oldest Art in Americas Found on Mammoth Bone? *National Geographic News*, Electronic document, URL:

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http://news.nationalgeographic.com/news/2009/06/090610-oldest-art-mammoth-picture.html

Vero Beach Mammoth image, see Picat 2009

de Mortillet, Adrien

Х

1891 Les Propulseurs à Crochet: Modernes et Préhistoriques. *Revue de l'École d'Anthropologie de Paris* 1 :241-248.

[Hooked Spearthrowers, Modern and Prehistoric, in French] Probably preceded bow, retained by primitive people like Australians who never knew bow, or who don't have good bow material, like Eskimo. True arrow points appear in Neolithic. Australia: many forms [three illust, S and W forms]. Equatorial America: Amazon [unlikely illustration of

a one-hole form] and Ecuador [one that might be Peruvian form]. Elaborate examples known from Mexico. Arctic America: cites Mason. W Europe: specimen from Laugerie Basse excavs by Lartet and Christy, reindeer antler shaft with hook, engraved with cervid, reindeer, and probably a fish, incomplete, but 30 cm long [illust], several others mentioned. Like Eskimo throwers, for harpoons as found in Magdalenian sites.

de Mortillet, A.

1910 Le propulseur a crochet chez les anciens Peruviens. *L'Homme Prehistorique* 1910: 235-243.

X

[Hooked Spearthrowers among the ancient Peruvians, in French.] Some Amazon tribes did not know bow, used atlatl, eg Jivaro [obviously wrong illustration of use with hand not gripping properly and in middle, forefinger in hole close to hook - impossible form] "Estola" 70 cm long, longitudinal groove, hook at one end, hole for index finger. In Mexico, called atlatl [cites Nuttall]. For Peru, Michel 1898 describes, and painted vases from Peru show. Example illustrated from Trujillo [Moche? stirrup vessel] with flying masked warrior carrying mace, shield, spears, and hooked atlatl with bird head at base to prevent hand slipping [typical Peruvian form] M. Berthon [looting in Peru] found 2 specimens of atlatl at Niviera, near Lima [good engraving of one] 59 cm long, bronze olive-shaped hook, lashed on 75 mm from prox is perpendicular anthropomorph of antler, not quite in same plane as hook. A bit diff from Trujillo pic. Mentions Uhle but doesn't cite.

Demoulin, Emmanuel

2002 Les Faons aux Oiseaux. Le Propulseur 4/5:1-5.

[In French] Of about 100 Upper Paleolithic European spearthrowers, 7 from France represent the "fawn with birds" motif [a hornless ungulate peering backward over its shoulder at the hook, which is usually interpreted as showing a bird pecking at a fecal pellet emerging from the anus.] All are from Pyrenees and dating to the middle Magdalenian, C14 dated 15,340-13,280 BP. There are two complete (Mas d'Azil and Bedheilhac) and five partial. The facial and back markings indicate *Rupicapra* [Chamois], not fawns or wild sheep, although they lack the small horns of chamois. The bird interpretation has never been convincing [very true!]; the hooks actually resemble hooks on other spearthrower forms, and Bandi (1988) has convincingly argued that they represent a birth. Perforations and traces of resin suggest additional decoration.

The fragmentary specimens seem to be the same as the two whole, but the quality of representation varies, so they are not the work of one artist. The similarities here and in other Paleolithic art show strong cultural rules producing stereotyped representations. Only spearthrowers have the birthing chamois motif, and if we have 7 surviving, there must have been many.

All are male type spearthrowers, and all are carved of reindeer antler. Only Mas d'Azil is complete enough to show how a wooden handle might have been attached by three perforations, and since it is only 30 cm long, there must have been one, since

ethnographic spearthrowers average around 69 cm. Replication experiments show that a lot of time was required, although with practice one gets better with stone tools. Soaking the antler in warm water makes it easier to work. Burins and other stone tools can leave a smooth finish, or the antler can be polished with fine sand or ochre, which is visible on the Bedeilhac specimen. The pieces studied are relatively heavy, around 60 gm, and perhaps helped counterbalance the spear. However, they also seem fragile, especially those with perforations separating the legs, and may have been less functional than decorative or ritual. [Strength is hard to estimate, and may not matter too much if the spear is not too heavy. Emmanuel is one of the modern French using replicas of Mas d'Azil with heavy spears. Pascal Chavaux is another, and says he has broken some throwers.]

Dennell, Robin

1986 Needles and Spear-throwers. Natural History 10:70-78.

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Middle to Upper Paleolithic transition not just flakes to blade technology and Neanderthals to fully modern H. sapiens. Ca 35,000 ya, first bone points, if on throwing spears, more effective hunting. Better hearths, first artistic representation. But little change in way of life. Ca 27,000 ya, full modern humans, much more change. Maybe bow + arrow (Parpallo small points), certainly spearthrower and harpoon between 17-15,000, also needles imply warm clothes, huts, probably sledges, stone drill points imply fire drill, artistic depictions imply cultural contacts and sociality.

Dennell, Robin

1997 The World's Oldest Spears. Nature 385:767-768.

"complete, unambiguous throwing spears 380,000-400,000 years old" at Schoningen coal mine in Germany. In river channels of Reinsdorf Interglacial. Directly assoc w horse bones. Related peat deposits have possible wood handle for stone tools, and .8 m long sharp at both ends "throwing stick". Three complete spears, ca 2 m long. Horse bone w butchery marks, possible hearth.

Implications: definite effective hunting, planning and manuf skill (each from trunk of 30 yr old spruce tree, tip at base hardest wood, same proportions w center gravity at 30% from tip). Help explain early colonization of Europe. [See Thieme 1997].

Dennis, Robx2010Fremont Hosts Prehistoric Weapons Contest. The Oakland Tribune Sept 5, 2010.Electronic version, accessed 9/27/10, URL:http://www.insidebayarea.com/fdcp?1285707311711

Coyote Hills ISAC, Chris Smith, Richard Baugh, Bruce Weidman, Mark Dellinge quoted. "The atlatl ate my brain" = obsession.

Denny, Mark o

2011 *Their Arrows Will Darken the Sun: The Evolution and Science of Ballistics*. Johns Hopkins University Press, Baltimore.

Fairly well-written non-technical explanations of ballistics and weapons history. Atlatl is missing, though discusses transition from throwing weapons (stone, spear, sling) to shooting weapons. His interest is most in firearms, but discusses archery. The math is given in appendices.

A

Denzel, Justin

1988 Boy of the Painted Cave. Philomel Books, New York.

Juvenile novel. In Paleolithic Europe, Tao is almost a man, but has a crippled foot, and will probably not become a 'chosen one' allowed into the Secret Cave to participate in ceremonies. Worse, he day dreams and wants to create art, which is dangerous [a common theme, see Turner 1987 for similar plot]. He has learned to wrap his crippled foot around his spear and vault along as fast as a man can run [so the foot motif is essentially written off]. And he is a competent hunter, although the unfriendly leaders, Volt and Garth don't think so. [It appears that all food must be contributed to the central pot.] Tao goes off on his own to a forbidden swamp area where the game is plentiful, especially after he befriends and tames a young wolf who helps him hunt. This too is forbidden, especially by Volt who was once attacked by a wolf. [Another common theme, the taming of wolf/dog who helps boy become man, e.g. Paver 2004, Kjelgard.] Tao's talents are recognized by the old woman who brought him up as an orphan [another common theme, hero as outcast or orphan], and by Greybeard, the Cave Painter who travels from tribe to tribe making their hunting magic on the walls of the caves. Greybeard trains him, and after various trials he convinces all that the spirits want him to be the Painter and accept his hunting dog. Overall, a pretty good story, although some of the natural history is weak: Saxon the sacred bull who attacks humans and stampedes bison, etc. The food quest is minimized after the first part, and it appears that Tao has no trouble at all feeding himself as a solitary boy living in a cave and learning to paint. The cave painting technology is ok, although the descriptions suggest more elaborate detail than is usual in Paleolithic painting. No atlatls, hunting is with spear. No love interest, a common theme even in children's novels.

Diaz, Gisele, and Alan Rodgers

1993 *The Codex Borgia: A Full-Color Restoration of the Ancient Mexican Manuscript*. Dover Publications, New York.

In Vatican library, probably painted in Puebla (Mixtec rather than Aztec) a bit before conquest. Numerous representations of deities with atlatls. Atlatls are stylized, most appear to be 2-hole type with heavy feather decoration. Often a shield with 3 or 2 darts is carried, sometimes that alone appears to represent atlatl or warrior and armament. Several depictions of deities, Venus and directional, striking others with dart on atlatl. Darts shown fletched, with large triangular heads.

Dibble, David S. and Dessamae Lorrain

1968 *Bonfire Shelter: A Stratified Bison Kill Site, Val Verde County, Texas.* Miscellaneous Papers No. 1. Texas Memorial Museum, Austin.

Rock shelter under cliff, includes bison bone beds associated with sequence of Archaic points. Upper level, the "Fiber Layer" has organics, including atlatl fragment, p61. Three conjoining pieces of distal end, warped and scorched. Shallow parallel groove .3 cm deep, 1.0 W, 15.8 cm long to incomplete hook. Max shaft width 3.4 cm, max T 1.0 cm, aboriginally cut off just proximal to end of groove. Unidentified soft wood. [Photo, looks like a crude and clunky version of SW form.] Dates on charcoal p 57 from 2 hearths in Fiber Layer 1400 \pm 130 BP, 1690 \pm 80 BP [uncalibrated, and only loosely associated with atlat1]. Points in FL are Castroville-like [broad triangular barbed and basal notched] and large side-notched Archaic dart forms.

S

Dickel, David N.

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2002 Analysis of Mortuary Patterns. In *Windover: Multidisciplinary Investigations of an Early Archaic Florida Cemetery*. Glen H. Doran, editor. Pp. 73-96. University Press of Florida, Gainesville.

Mostly primary, flexed, staked down in peat. Several traumatic injuries, only one definite violent death: adult M with antler tine point in pelvis, no healing, extended (unusual) and lacking skull. 30 F, 40 M, 40 subadult. Antler atlatl handles 1 w F [table 4.5 but in text says "none"], 5 w M, 1 w subA. Atlatl cup w spur: 0 w F, 4 w M. Antler flakers: 1 w subA. Antler point: 1 w F, 2 w M, all possibly in body.

Photos of "atlatl handles" - ovoid, drilled transversely [they look like bannerstones, and there is no explanation of why they are called handles, can't see from photo where on shaft they are.] Ends battered, and have one inset with carnivore tooth, others hollowed. Tool? - suggest club. [I suspect knapping tool - tooth or antler insert for pressure, battered end in photo looks like knapping damage.] 4 bifaces - 3 of them large stemmed pts. Photo of assemblage with Burial 90 (11 yr old + neonate) shows shaft wrench, bone rods, and a harpoon pt or atlatl hook of different form from others, and biface knife.

Dickson, D. Bruce

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1985 The Atlatl Assessed: A Review of Recent Anthropological Approaches to Prehistoric North American Weaponry. *Bulletin of the Texas Archaeological Society* 56:1-36.

[Thorough review, good references, some mistakes.]

Throwing motion as described by Kellar: "overhand.... Sharp snap of the wrist at release"

Names in different languages. He uses "atlatl" as whole complex, "throwing board" + "dartshaft" or "dart" as its components.

Krause classification of male, female, hybrid, and Mildner "integral" vs "attached"

hooks. Different grip forms. Non-functional decoration.

Spatial and temporal distribution reviewed. Appears in Europe by end of Upper Paleolithic. Oldest specimen hook fragments from Le Placard cave Magdalenian ca 14,000 BC. Maybe 80,000 or more if tanged points in Mousterian were hafted on darts. Earliest in N Am is spur from Fort Rock Cave, OR, ca 8,500 BP. Transition to bow ca 500-700 AD in SW, 900 AD in TX, after 400 AD in Midwest, 700-900 in NW. Survived in Australia, New Guinea, Micronesia and Melanesia. Arctic Aleut and some Eskimo retained with bow for sea-mammal and water fowl hunt. Aztec + Toltec-Maya "served as kind of artillery weapons used to launch heavy spears in close support of massed infantry." Historic mention in Baja CA, on Gulf Coast + Florida, either as survival or reintroduction from Mesoam.

Survey of performance assessment: Atlatl works by lengthening arm; some disagreements, but he seems to accept Howard's theory of lengthened contact with spear [which is incorrect] rather than lever or spring. But physics less interest than performance. Three sources: experiments, ethnographic observation, historic accounts. Most early experiments not very successful, but "persistence and ubiquitousness" shows atlatl offered advantages. Experimenters try to learn in short time what took "years of constant and closely-supervised training and practice. Given such a limitation, can we ever hope to simulate the actual performance capabilities of such a prehistoric tool? Probably not..." but the more successful tests are useful to measure maximum distance, accuracy, and penetration. Variable distances reported; Palter (1976) holds record -108m. Accuracy hard to gauge from experiments using different gear and people; ethnog record perhaps better. Aleut (Coon 1976) and Tzintzuntzan Mexicans (Foster 1948) show great accuracy possible. Penetration experiments comparable to archery are lacking. Ethnog: quotes Swanton's (1938) Garcilaso de la Vega account. Physics: impact force is mass times velocity, but tip form and target material also affect. If Howard correct, velocity affected by atlatl length [Howard isn't correct, but since the atlatl is a lever, velocity is affected by its length]. Mass of projectile can be increased by larger stone point etc, but quickly reaches limits. Optimal atlatl and dart proportions found by prehistoric experiment, but in some areas evolution continued with invention of atlatl weights. Bannerstones, other interpretations possible. Atlatl weight interp based on nature of perforation, Webb finds in line with hooks and handles. Only in SW have actual weights attached to atlatls, others are intpreted as such. Experiments ambiguous; most show weights have negligible to negative effect. Peets and others suggest counterbalance to spear when loaded. Hudson (1976) suggests large weight makes useful as club. Cole, Parker suggest weight on spear. [His comments, and the survey of experiments, make clear how deficient atlatl experiments were at that time, and how necessary development of skill is to adequately test a technology.]

Atlatl abandoned. Advantages of bow: 1. greater range – Pope's data for ethnog bows shows about 164% greater range than experimental atlatl distances, or 79% greater than reported ethnog distances. 2. Bow stealthier, less motion required. 3. Lighter, shorter shafts = carry more, easier in woods, tho could carry many foreshafts and few main. Why keep atlatl? 1. Often for marine hunting because less affected by damp than bow, boat allows carry large shafts. 2. Heavy projectile = greater force and penetration,

especially good for sea mammals. 3. One-hand use, allowing paddling boat etc. 4. Suitable for line attached to harpoon. 4. Weight + penetration good for military use.

Point size arguments: Kidder, Fenenga, Thomas shows that can distinguish; however, experiments show large pts work on arrows, small or none on darts. Arrow compensates with higher speed for loss of mass. Larger points cost more to make, more breakable, thus gradually lost out.

Symbolic retention, work of Hall (1977) – atlatl became Hopewell platform pipe and the flat-stemmed pipe in Late Woodland times, transformation of weapon into "peace pipe," associations of tobacco, smoking, weapons, life, water symbolism.

Dickson, Don R.

1991 *The Albertson Site: A Deeply and Clearly Stratified Ozark Bluff Shelter*. Arkansas Archeological Survey Research Series No. 41. Arkansas Archeological Survey, Fayettevill.

Lots of projectile points, one atlatl hook from Middle Archaic levels he dates 6000-5000 B.C. Short antler hook with beveled tip, mortise and tenon grooves on bottom, lashing groove across top.

Late Woodland small points mark bow and arrow around 800 A.D.

Dickson, Don R.

2002 *Prehistoric Native Americans in the Ozarks*. Ozark Resources and Historical Publications, Fayetteville.

p. 41 Part of a "sophisticated compound atlatl" found at Albertson Shelter in context dated 7800 ± 80 BP. [apparently new dates since 1991, important because makes this one of earliest dated atlatl pieces]

p. 81 Dalton points rarely show impact fractures, so are more likely knives than dart points.

Dickson, Jim

2001 Aleut Throwing Board. *The Dart: Ohio Atlatl Association Newsletter*. March 2001: 4-5.

Instructions for making rigid rectangular board with inset male hook, shaped handgrip. Traditional measurements by hand size.

Discovery Channel

2011 Weapon Masters. DVD. Discovery Communications LLC.

Mike Loades (weapons expert of unknown background) and Chad Houseknecht (engineer, geek, comic relief) host TV documentary featuring different weapons each week (10 shows), including atlatls. The usual schtick is a bit of history and demonstration from Loades, traveling to sources and interviewing experts, while Houseknecht re-

engineers the weapon with modern technology to understand how it works and improve it. Atlatl segment featured a number of notable atlatlists, especially Bob Perkins.

ML: "So this is a spear thrown with a lever" "Without it man wouldn't have got to the moon" "It's the first human force multiplier" Perkins: "This is the weapon that propelled us to the top of the food chain." Perkins hits a car hood with stone pointed wooden dart, making smallish hole and bouncing off. Then Loades cites Bernal Diaz claiming atlatl could penetrate Spanish armor - "can the atlatl you build penetrate Spanish armor?" ML compares to modern recurve bow. Perkins "Pretty much darts are just arrows on steroids." Slo-mo shows dart + arrow flex "see it kick off the atlatl." Perkins: "that's the key to the system is the flexibility of the dart storing energy and pushing itself away from the launching platform." [but in the slo-mo it looks to me like the dart is clearly flexed when it leaves, not jumping straight.] ML: once the dart is launched all that energy is just wasted in occilation [correct]. Perkins: without flex, not clean powerful launch of either dart or arrow. Loades: "What's the physics of that?" Perkins: Record distance 258 m. [Then he draws "science" stuff with equations on blackboard, but flashy frenetic camera conceals it, which is probably just as well, since it is almost certainly nonsense.] P: "This is a spring mass system. The dart tip resists acceleration. It forces the dart to store spring energy to be released against the spur of the atlatl." Chad "So the whole purpose of the spring of the dart is to effect a clean release from the spur of the atlatl." It "boings" away.

BP and ML making dart in the woods [implying incorrectly that is how Perkins makes his atlatls] while CH is in the shop making modern version capable of beating world record and penetrating armor. Explains "Force" [actually Momentum] = Mass x Acceleration. A branch and handaxe are shown, and the branch becomes an atlatl, but steps not shown or if stone is really used. Antler hook put on with sinew. Unpromising branch straightened for a dart, but the shaft that is then scraped is probably not the same branch. Test shows ML hitting hay bales with new gear. Perkins: "Of course it works, I'm Atlatl Bob!" Meanwhile Chad makes aluminum atlatl with dart rest and a horizontal wire as spur so it will take an arrow nock, [implying that these are his inventions, although since they must have talked to lots of atlatlists, they probably are not.] Aluminum tubing dart gets bent in throwing, so he goes to Easton Archery where they shoot arrows from a fixed modern compound bow through chronograph to see "what goes fastest and penetrates farthest." 245 feet per second, carbon arrow faster than aluminum, larger diam shaft not penetrate as far even though it was heavier and thus had more kinetic energy. So for distance + penetration want small diameter as heavy as possible [not quite that simple].

CH tests different shafts, throws a mop with long 2-hand atlatl "it's just totally unflingable" His test atlatl is very long, aluminum, horizontal arrow nock, rest, held with 2 hands, uses darts about 2 m long, first "tumbles end over end" finally gets 217 foot throw.

ML goes to Valley of Fire to look at petroglyphs with BP: "this was the first true weapon system that we developed. This is the weapon that took the human race from scavengers [images of a ground squirrel, not a scavenger at all] to full-blown big game hunter." BP: atlatl allowed people to get lots of game, thus leisure for art, "truly brought

us to where we are today." As many types as "stars in the sky" - shows a poor "Basketmaker" replica and a bogus "Aztec ceremonial" with a snakey carving. "Apart from Antarctica, everywhere in the world."

CH + ML with Scott van Arsdale "You mean there actually is a World Atlatl Association?" go to airport in NV for distance throw, add Latrell Frederick, college champ javelin thrower. He manages155 m max throw, blame it on Chad's darts, a couple of which broke or bent in throwing.

To test armor penetration, to WAA annual meeting in NY with SvA. 4 atlatlists with stone points: Mark Bracken, atlatlist I don't recognize, Scott, and Bob Berg. Several dents, but no penetration of steel breast plate. Scott then hits dummy in the eye. Mike Loades: "This is clearly a terrifying sight, I mean, you just see the power of the atlatl. But you know, it didn't do so bad against the breastplate... None went through, but by golly they made some severe dents. If you are a conquistador and you have these things raining down upon you, the atlatl in the right hands is a terrifying weapon."

Chad tries metal tips, thrown by Mike Waters, at archery targets, measured with speed gun. 49 "atlatls per second" [he must mean fps] Max shown 52 fps, penetrates foam with stone tip on large foreshaft 4-5.5 inches. Modern darts get up to 67 fps. Traditional darts ave 43.2 miles per hour, moderns 58.5 mph, but less penetration with broadhead and field points. [Lighter darts, but weight info not given. It is not always clear if they are measuring fps or mph.] So Chad mounts a bang-stick type device on the dart to fire a bullet as it hits, and penetrates armor [quite irrelevant]. [Greg Nunn is thanked in credits – did he make stone points?]

[Overall, horribly hokey, but good publicity for atlatls and WAA, ok basic info for public despite incorrect Perkins ideas and overstated "terrible weapon" – the skillful atlatlists make it obvious that atlatls can be powerful and accurate. The experiments are incompletely documented, but make one important point: stone tipped dart does not penetrate steel plate armor. That was always obvious, and in fact Garcilaso de la Vega didn't say it did - in Swanton's translation, it is "mail" (see Whittaker 2015). The distance trial is useless, but the incomplete velocity data are good. The armor piercing bullets at the end are just dumb. I find it amusing that CH with all his modern tech was unable to make a better atlatl than we already have.]

Discovery Channel

2012 Dirty Jobs, Downunder. "Lost in Aboriginal Land".

Series with Mike Rowe as the lead with a high tolerance for odd situations and unpleasant tasks. Here he visits Arnhem Land, North Australia, and goes fishing with members of a native community. Several sequences of spearing fish and stingray with spearthrower. The spears are long, not very straight, flexible, with what look like 4pronged heads. The atlatls are the flat Arnhem Land form. Most throws at close range in shallow water, sometimes spear alone is used. One long throw at unseen target in water spears a large fish. The series is humorous but short on real information; we learn little about the people or their way of life beyond "they eat strange stuff."

Discovery Channel

2016 Dual Survival: The Ancient Art of Hunting with an Atlatl. Youtube clip at http://www.discovery.com/tv-shows/dual-survival/videos/the-ancient-art-of-hunting-with-an-atlatl/

Matt makes spear and atlatl and spears trout. [Look like ok quick gear, can't really see atlatl. Dart of sapling with nail points held in with wire mesh and spread with staple. As usual in such shows, he sneaks carefully up on the fish, but if you look carefully, they are corralled in a ring of rocks so they can't actually get away. I haven't seen much of this show, so hard to evaluate overall. The obsidian knapping segment is pretty poor.]

Diters, Charles E.

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1977 Norsaq: The Throwing Board, Regional Variation in One Element of Eskimo Material Culture. M. A. thesis, unpublished, Brown University.

Regional variation discussed from some 188 specimens. Terminology and typology expanding on Mason 1885. Some arch info. Availability of raw material and specific use patterns most affect design.

Spear thrower almost always assoc w kayak, hunting seals and sitting waterfowl. But lacking in some areas of kayak use, like Netsilik, Nunamiut, Copper Eskimo. Advantages over early guns, bows – resist wet, one hand use, retrieval of game.

Atlatl study hindered by lack of common vocabulary – he gives useful terms for parts of Arctic forms. Archaeological record: cites a couple dozen finds, describes a couple, but oldest are ca. 2000 yr old, Okvik-Old Berring Sea and Thule cultures. Origins unclear – could be from Asia Up. Pal. or indep invention or develop late from N. Am spear throwers, probably the last.

Dixon, James E.

1999 Bones, Boats, and Bison: Archeology and the First Colonization of Western North America. University of New Mexico Press, Albuquerque.

Argues for relatively early entry into Americas by a coastal route. Good summaries of sites and other info.

Paleoindian atlatl use attested by hooks from Warm Mineral Spring, Marmes Rockshelter, and Fort Rock Cave, and fracture patterns of points (Hutchings 1997). Crude drawing of use. Darts should have had bone foreshafts with harpoon-like head holding stone pt. Photo shows one from OH [no info on age or site, see Stanford 1996]. Similarity of Clovis hafting to marine harpoons supports his coastal migration theory [a BIG leap from that poor evidence].

Dixon, James E.

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2000 Human Colonization of the Americas: Timing, Technology, and Process. *Quaternary Science Reviews* 20:277-299.

Summaries of early evidence with his coastal migration theory. Nenana complex (11,600-10,500 BP) earliest arctic, with bifacial points, contemp w Clovis, inland but representing descendants of first migration wave along coast. Paleoarctic tradition Denali complex (10,500-8000) and other microblade users represent different technological orientation, second group of entrants using bow as well as atlatl [would be very early bow if any existed]. Clovis as marginal adaptation to big game in interior of continent, after coast occupied, connected to coastal traditions by his reconstruction of C points as hafted like harpoons.

Dixon, James E., William F. Manley, and Craig M. Lee o

2005 The Emerging Archaeology of Glaciers and Ice Patches: Examples from Alaska's Wrangell-St. Elias National Park and Preserve. *American Antiquity* 70 (1): 129-143.

Background refs. GIS modeling to focus examination of ice patches. Abundant and diverse faunal remains. Arrowshafts, barbed antler arrow points with native copper end-blades (missing), AD 500s-1500s calibrated C14. Two dart or spear shaft frags and one foreshaft w stone point (photos), mean calibrated C14 dates AD 833, AD 1335, and 795 BC (wood) to 1052 BC (sinew). [Note apparent atl/bow overlap, longer than Yukon suggests].

Dixon, Kieth A. o Burling

1956 *Hidden House: A Cliff Ruin in Sycamore Canyon, Central Arizona*. Museum of Northern Arizona Bulletin 29.

Sinagua, est. 1275 AD. Excav 1933 by King, amateur.

With male burial: 2 quivers, one of woven cloth with elaborate design, other leather. Cloth quiver had 12 complete arrows, leather 10 Phragmites main shafts. Arrows 79-90.5 cm long. Fletched with 3 split feathers, 2 spiraled. 5 have stone pts [not illustrated]. Fine scratched decoration in black paint or pitch under fletchings [apparently no colored paint?]. Two bows, one just a stave, other complete, used, ca 130 cm long, D x-sect with to somewhat flattened tips with small nocks. Diam 2.7 in middle, 2.3-2.1 cm mid-limb. Simple self-bow, unID wood, well made. String remnant of sinew. [This wonderful stuff was destroyed under NAGPRA in late 2012, so better documentation can no longer be done.]

Doberstein, Lyle E.

2014 Atlatl Construction. *Primitive Archer Golden Treasure Series*. Originally in *Primitive Archer* 2(3). [1993]

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[reprinted compilation very poor repro quality]. Simple instructions for form with lashedon hook.

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Dohrenwend, Robert E.

2007 The spear: an effective weapon since antiquity. Journal of Asian Martial Arts
16(1): 9-?. http://www.journalofasianmartialarts.com/

"the senior martial art" earliest human weapon, still in use. Throwing and thrusting spears related but different. Thrusting spear "most effective hand-held edged weapon of all time." Only martial art developed for use against other species, shows relation of hunt to war.

Earliest spears had conical points, not very effective. "To reliably fight and kill a dangerous animal with a spear, the blade has to be wide, strong, and sharp. Such blades were beyond lithic technology and it was not until Bonze Age ... that a true fighting spear for dangerous animals became possible." Need strong shaft. Cross piece good, no evidence until Bronze Age.

Age – Schoningen 2m long throwing spears 'indicate people who threw them were strong and practiced" assoc with hunting horses. Weak, slow, 'delicious' humans unlikely to have evolved on savanna – 'semi-aquatic primate in riparian habitat' more likely. Collecting food and fishing with sticks, when move to savanna, transition to "diurnal cursorial predator with a spear" i.e. persistence hunting. [Meh. And the 'aquatic' stuff is nonsense] But safer to throw. Persistence hunt only works in hot climate, so need traps, dogs, "strategic hunting" elsewhere, i.e. Arctic. Harpoon and thrusting lance, develop biface Clovis pts and microlithic points, 'fragile' thrusting spear developed thus after throwing spear, but small point means ineffective individual weapon, poor against predators. [Well, maybe to all of this, but reflects more his biases than evidence.]

Medieval javelins – small heads, and hunting spears – large head and cross bar. Hunting accounts – jaguar, boar – underhand thrust. Some modern hunters throw heavy spear – 6-8m 'to be sure of a hit.'

Javelins, pilum in war. Short javelins used from horse. Bow better, but Aztecs used atlatl with light javelin or dart, still in use as toy into 1940s. Bow supplanted atlatls [he never does explain atlatl properly] because more compact, easier to carry, greater range, rapidity of fire, more powerful, accurate, quieter.

[Lengthy discussions of later spear use in Europe and Asia are interesting and probably better-informed than his prehistory.]

Dold, Catherine

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2003 The Neighborhood Bonebed. American Archaeology 7(2): 32-38.

Bison kill site, CO, ca. 3000 BP. Painting reconstructs hunt with atlatls. [Shown adequately, but unfortunately captioned "used prehistoric spears called atlatls".]

Dold, Catherine

2004 Prehistory Defrosted. American Archaeology 8 (3): 20-26.

Yukon ice-sheets with caribou dung, remains of different animals, hunting gear spanning 9500 BP - 100 BP. Over 40 dart shafts, a few stone points, some in foreshafts. Darts wood, spliced, ave 78" [198 cm]. Around 700 AD shift to bow and arrow, with antler points. Suggest about 100 yr overlap, rapid transition.

Domenick, Jeff

1999 Paleolithic Passion Grips Ligonier Man. *The Atlatl* 12(3):2-3. (from *Pittsburgh Tribune-Review* September 14, 1998).

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Chuck Butorajac profiled: 56 yr old, atlatl elbow, "Half-beard," artist. Sells atlatls with custom grips of crushed walnut shell + epoxy, rivercane darts. Promoting atlatl hunting in PA, future Olympic sport.

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Donnan, Christopher B.

1985 Archaeological Confirmation of a Moche Ceremony. Indiana 10:371-381.

Kutscher 1958 described and named "ceremonial badminton" from 3 vase paintings, reconstructed as throwing "staff" into air with atlatl, staff carries feather "flower" with string and peg attached. String wound around staff unwinds in flight and flower drifts down. Elite ritual practiced on pyramids. Characters and paraphernalia also assoc with ritual race depictions.

Burial excav 1972 at Pyramids, Moche include adult male with "staff", 170 cm long, wood partly sheathed in metal. Short cross pieces inserted through holes at each end. [Agrees they would not have rotated, but doesn't give diam of shaft, drawing shows it as 2-3 cm - would it have been flexible enough to throw with atlatl?] Assoc with copper spatula, tweezers, disk on face = headdress element in race scenes, 6 pots including one depicting race [but NOT atlatl]. [Donnan 2015 - no longer considers it a badminton spear].

Donnan, Christopher B.

1988 Iconography of the Moche: Unraveling the Mystery of the Warrior-Priest. *National Geographic* 174(4):150-155.

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Looted and unlooted royal tomb at Sipan contained individual men with artifacts identifiable as warrior-priest in sacrifice scenes. Good reconstruction painting of Moche warriors with brutalized prisoners in front of such an individual.

Donnan, Christopher B.

1998 Deer hunting and combat: Parallel activities in the Moche world. In. *The Spirit of Ancient Peru: Treasures from the Museo Arqueológico Rafael Larco Herrera*. Kathleen Berrin, ed. pp. 50-59. Thames and Hudson, London.

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Interp ceramic deer vessel from collection [RLH was rich plantation owner, enormous collection, one of founders of Peruvian archaeol. With this article see also Burger, and Benson]. This deer is seated in human position, legs crossed, genitals exposed, human hands, rope around neck. Only deer and humans depicted thus. Combat scenes show only elite males, mostly single combat, no civilians, some sling + atlatl but mostly club, away from settlement in wilderness, no attacks on forts or villages. So ceremonial activity of

high-status Moche males, objective to capture, not kill. Prisoners taken with rope around neck to place of 'arraignment' and sacrifice and blood-drinking. Background *ulluchu* plants may prevent coagulation. So deer depicted thus are analogous to warriors.

Deer hunt scenes show elaborate warrior costumes, nets [and dogs], as in ethnog Inka royal hunts. Same weapons as in war [but seems to me deer more likely to be shown wounded by darts]. Almost no deer bone in sites, so ritually treated, probably not major subsistence source. Women + costumes same in both battle and hunt scenes. Prisoners + jars with rope both = containers for blood. Deer blood prob also, as *ulluchu* plants occur in hunt scenes. Deer may be shown as warriors in combat too.War not for conquest, hunt not for food – both were parallel ritual activities.

Catalog shows deer hunt on pots, earlier Nasca pot with atlatl-armed warrior, Moche spearthrower with handle piece showing gold condor eating corpse. Two handle pieces with inlaid bone felines.

Donnan, Christopher B.

2004 Moche Portraits from Ancient Peru. University of Texas Press, Austin.

Depictions include fine line paintings of bird hunt with atlatls, warriors carrying atlatl and darts, but in combat use maces. Atlatls are Peruvian style, seem to have elaborate hooked handles and distal hooks (spurs), warriors consistently carry 2 darts, which are depicted without fletching, either plain sticks, or barbed pts.

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Donnan, Christopher B.

2007 *Moche Tombs at Dos Cabezas*. University of California at Los Angeles Cotsen Institute of Archaeology, Los Angeles.

Large Moche site. Cleaning up after looters at pyramid uncovered several unlooted tombs. Tomb 2 was high status male 18-20 years old, 181 cm tall (unusual size), buried with human and llama sacrifice, many objects including head dresses of gold placques on basketry, pottery, and weapons. Bundled in elaborate cloth (not preserved). At right side: Spear thower - simple straight round stick [was there a grip piece, as on most Moche atlatls, that did not preserve?], 49.2 cm long, with gilded copper bands, and hook cast [copper?] in form of upright lizard with inlaid eyes. Two barbed copper spear points, 32.5 cm long, presumably hafted into cane shafts [seems like a heavy point on a light shaft?]. Round [basketry?] shield covered with gilded copper plates. Under these were copper chisels in hand, 3 copper tumi knives, wooden war club, hollow rattle scepter in form of war club. Under legs another atlatl, plain wood, 51.2 cm, with simple copper hook. Four socketed conical copper spear points. In a separate compartment was a copper figurine with miniatures mimicking tomb goods including clubs, shields, darts and atlatl.

Tomb 3 had another adult male 18-22, 175 cm tall, in bundle, with sacrificed child and woman. Outside bundle were 9 copper dart points (11.4 cm) and a simple atlatl with copper hook. Goods similar to T2 but fewer, no more atlatls.

Tomb 1 adult male, large 183 cm tall, age 21, with sacrificed woman, not in bundle, atlatl under L arm with copper hook, shaft ca 42 cm L and 2 cm diam. No darts.

Headresses, pottery, similar to T3.

C14 dates calibrated 310-635 AD. Numerical symbolism in some object clusters of 5, 10, 20, 40, use of oppositions, each tomb with small mimicking figure in other compartment.

Donnan, Christopher B.

2016 Moche Ceremonial Badminton Revisited. *Nawpa Pacha: Journal of Andean Archaeology* 36(2):139-160. Online doi: 10.1080/00776297.2016.1239854 URL - https://doi.org/10.1080/00776297.2016.1239854

Iconography of all 16 available depictions shows the technology (normal Moche atlatls, unfletched spears with or without barbs, added cross pieces for catching a feathered object resembling a badminton cock) and social aspects (highly costumed 'catchers' contrast with less elaborately decorated 'throwers'). Associations with feasting, Ritual Running, and sacrifice [though sacrifice doesn't seem to be part of the 'game'].

Workable and plausible reconstruction of gear with atlatlists Chris Henry, Dan Levitt, Devin Pettigrew and others. Now a successful game of 'Moche Toss' at some atlatl events. Videos of events at <u>http://basketmakeratlatl.com/?page_id=1256</u>, Youtube <u>https://www.youtube.com/watch?v=k99dR1UTqPM&feature=youtu.be</u>

All the iconography is illustrated, also reconstructed gear and event.

Donnan, Christopher B. and Carol J. Mackey

1978 Ancient Burial Patterns of the Moche Valley, Peru. University of Texas Press, Austin.

Catalog of burials of all periods (Chavin, Salinar, Galinazo, Moche, Chimu), [some very sketchily presented, others with better info.] Burial M-IV 11 (pp. 154-158) is the one discussed in Donnan 1985. Staff with cross pieces measures about 200 cm long and 2.2-2.5 diam from scale in drawings [making it unlikely to be an atlatl dart. Notably, there is no atlatl or parts that could be atlatl, with this burial, nor with any of the others of any period, including Moche period burials with similar pots depicting the race, warfare, warriors, etc.]

Donnan, Christopher B. and Donna McClelland

1999 *Moche Fineline Painting: Its Evolution and Its Artists.* UCLA Fowler Museum of Cultural History, University of California, Los Angeles.

Chronology of painting styles on stirrup bottles and other vessels, some individual artists identified. Color photos and roll-out drawings of designs, splendid illustrations. [Atlatls appear often, but are not commented on at all, even when they are important in actions depicted, and part of the style differences that distinguish individual artists. Some stock scenes use atlatls: Some warrior processions, some weapon bundles, and some battle scenes, and a few of the complex burial rituals show them, but war emphasizes maces instead of atlatls. They are often seen in Deer Hunt scenes, although sometimes the deer

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has been speared but atlatls not depicted. A common scene described as "Ceremonial Badminton" is some kind of atlatl event, with darts shown as having bars across and flowers attached, and multiple atlatlists, often with bird or animal heads. The atlatl form is Peruvian, often with a bird head at handle, sometimes a mammal (canid or deer?). Darts appear unfletched, but fletching may be indicated in one case. Darts may be plain or with barbed points. Warriors often carry two or three extra, and often darts appear with warriors or shields when atlatl is not depicted. See Whittaker 2006]

Dopp, Katherine E.

1906 The Later Cave-Men. Rand McNally and Company, New York.

[A children's text book novel in her "Industrial and Social History Series," promoting the idea that learning is best when there are hands-on exercises and connections between many subjects of study. Story follows fictional Upper Paleolithic tribe. Episodes are trite and naive, with a lot of silly explanations of accidental invention and old-fashioned views of prehistoric folk. Illustrations are nice, but the artist doesn't understand prehistoric technology any more than the author. So we have spear throwers invented by "hurling one spear by resting the butt against the barb of another" p 145 (idea from Cushing 1895), with illustration of absurdly short throwing stick. Real Paleolithic atlatls not illustrated; they had only recently been recognized. The old idea of *"baton de commandement"* is taken seriously, etc. "Things to do" suggestions range from ok to wildly impractical: "If you can strike off a large flint flake...make it into a knife-saw-file" (with no usable instructions on how to knap, no likely source of material etc!) or "See if you can find a way of making a glacier in your sand-box." or "Tie a slip-knot at one end of a string and show how to set it for snaring birds." This book defines "Quaint."]

Dopp, Katherine E.

1912 The Early Sea People. The Rand McNally Press, Chicago.

[Another in the series, this one based on Mesolithic folk of Danish shell middens. Lengthy but sketchy and innaccurate account of bow and arrow making. Things to do: "Collect stones in your neighborhood and sort out those which are good for arrows." Improbable invention of pottery from clay linings of "boiling baskets and roasting trays." P. 80 drawing of "Some people threw arrows in this way instead of with a bow" which is a direct plagiarism of Cushing's (1895) hypothetical spear-crook, but plays no part in the story. The artifact illustrations are especially ludicrous - didn't the artist at least look at a stone tool? Dopp's works are good examples of 19th century thinking about artifacts and prehistory.]

Doran, Glen H.

2002 Introduction to Wet Sites and Windover (8BR246) Investigations. In *Windover: Multidisciplinary Investigations of an Early Archaic Florida Cemetery*. Glen H. Doran, editor. Pp. 1-38. University Press of Florida, Gainesville.

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E Florida, bodies in peat pond. C14 8120-6980 BP or 8522-7421 BP cal. MNI = 168, $\frac{1}{2}$ <20 yr old, equal M/F. Often wrapped in cloth, with goods. Adult M have most antler tools, all carnivore radius awls and antler atlatl cups/hooks, almost all lithics. Relatively little use of shell or coastal resources = argument against earlier PaleoInd coastal adaptation - doesn't develop until Mid Archaic. Shark and other dental cutting tools more common than stone. Bottle gourd Lagenaria siceraria direct date 7290 BP uncal. Brain masses in some skeletons provide DNA and albumin phenotypes, which show not closely related to any living Native Am. group.

Doucette, Dianna L.

2001 Decoding the Gender Bias: Inferences of Atlatls in Female Mortuary Contexts. In *Gender and the Archaeology of Death*, B. Arnold and N. L. Wicker eds., pp. 159-177. Altamira Press, Walnut Creek, CA.

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Do burial goods accurately reflect life roles of individual? Interpretations of atlatls at Indian Knoll, KY, and Annasnappet Pond, MA, both Archaic.

Indian Knoll – 6100-4500 B.P., over 1000 burials, of which 76 with atlatl components, including 13 females and 14 indeterminate. Early arguments about function of antler hooks and drilled stones: net hooks and sizers, hair ornaments, ceremonial banner stones on staffs. No gender interpretations – "it was not until these artifacts were identified as hunting tools that they became problematic as grave goods in female burials."

Webb identified as atlatls, and checked association of parts, but did not dig much beyond body, so can't tell if darts were with them [although since atlatls were sometimes broken, darts might have been too in which case should be in grave. And many points were in graves]. Webb saw as partly ceremonial because "it is hardly to be supposed that women would have had any practical use in life for an atlatl."

Annasnappet Pond, Archaic component grave containing cremated bone with 2 weights 'aligned' with 2 large points, date 7570 B.P. Pit was large, and cremation could have been offering with perished unburned individual. Sexing not possible. Atlatls may have been articulated with darts [maybe, but can't really say]. Position of points in pit suggests 125 cm darts, shorter than most expect, and not requiring much upper body strength. [But the alignment of pts and weights is irrelevant to dart length, and points may have been on foreshafts, or broken shafts, or unhafted, so suggestion of dart length is unjustifiable.]

Critiques: Winters (1968) did not want to see women as atlatl users, but his interpretations are based on ethnocentric gender biases. Lots of ethnographic cases where women hunt. Atlatl makes spear throwing easy regardless of body size.

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Drake, David and Jim Kjelgaard

1990 The Hunter Returns. Simon and Schuster, New York.

See Kjelgaard 1951.

Drass, Richard, and Robert Brooks

1984 A Boatstone and Atlatl Hook from Central Oklahoma. Newsletter of the Oklahoma

Anthropological Society 32(2):7-10.

Found in grave with M, F, juvenile - near R arm of adult male. Limestone weight, antler hook - Indian Knoll type. Possibly late - site is Woodland, but bones not dated [so no reason to believe it is not earlier Archaic grave].

Dunbar, Jimx1997 Atlatl Replicate Study. Aucilla River Times 10(1) Aucilla River Prehistory Projectwebpage accessed 10/12/2006, URL:http://www.flmnh.ufl.edu/natsci/vertpaleo/aucilla10_1/aucilla.htm.Reprinted in The Dart, April 2011: 17-20.

Testing breakage on Clovis era ivory rods used as foreshafts. Used 2 atlatls - modified Key Marco form with 2 holes, European Upper Paleolithic form. Oak dowel spear 1.8 m long, 227 grams. Silicified coral point and ivory foreshaft made by C Van Orter, wooden + alligator bone foreshafts. Driven into palm trunk 50 times, points and foreshafts survived, lashings failed. Need more exper to test breakage. [Impressive durability of both pts + shafts].

Dunham, Mike

2002 Art of the Ancients. The Atlatl 15(2):1-2. (Anchorage Daily News, 12/17/01).

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Yukon River Yup'ik still hunting spotted seal with motorboats and "nuqat" atlatls. Flat "throw board" with finger hole, 4 foot small harpoon with feathers and ivory or brass head. Multiple boats and hunters include young folk. More effective than rifle because better recovery of seal. [A bit gee-whiz, and little atlatl detail, but ok].

Durán, Diego s Burling

1994 *The History of the Indies of New Spain*. Translated by Doris Heyden. University of Oklahoma Press, Norman.

p. 34: Aztec mythical history - "invented a type of propelled spear we call *fisga*." Note: = atlatl as still used Patzcuaro.

p. 120: Cuitlahuacas rebel against Aztecs, "weapons were covered with ...colored plumes." "The men began to throw darts, which are dangerous weapons because once these darts have entered the flesh they cannot be pulled out. This is due to their barbs, which make them like harpoons. In order to remove a dart is is necessary to make a large opening or to push it out the other side." Men wounded by darts and arrows and stones. p. 109 note: "For "darts" Duran gives *varas arrojadizas*, which could refer to the atlatl or propelled spear, the spear being a cross between this weapon and a dart, thrown by the hand-held atlatl." [other mentions of "darts" which she takes to be thrown by atlatl, but the note shows she plainly does not understand these very well.]

Durkin, Pat

2005 Conservation Congress Continues to Make Questionable Decisions. *Oshkosh Northwestern*, March 13, 2005. URL http://www. wisinfo.com/northwestern/sports/stories/sports_20208982.shtml accessed 3/17/05.

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Columnist criticizing state conservation advisory board scorns among other things their support for legalizing atlatl hunting.

Durkin, Pat

2009 Atlatl, Darts Take Hunters Back to Roots. *Green Bay Press-Gazette*, April 9, 2009. Electronic document accessed 4/10/09 URL: http://www.greenbaypressgazette.com/article/20090409/GPG0702/904090505

Fish + wildlife hearings to discuss use of atlatl for small game, spurred by Riemersmas. Legal in AL, AK, CA, ID, IA, MO, MT, NB, OK, TX, SC. [this time he sounds supportive instead of scornful - maybe Riemersmas educated him?]

Dutour, Olivier

2000 Chasse et activités physiques dans la Préhistoire: les marqueurs osseux d'activités chez l'homme fossile. *Anthropologie et Préhistoire* 111 : 156-165.

[Hunting and physical activity in prehistory: boney markers of activities in fossil man. In French.] Reviews theory, literature. Modern javelin throwing is well documented, relevant to prehistory. Three phase throw: run-up ending on right foot, tranfer of body weight from right to left foot with rotation of shoulders over hips, release and follow through. Elbow is particularly stressed, resulting in arthitic conditions of the epitrochlear muscle insertions on the inner side of the distal humerus. Archaeological example: prehistoric Saharan hunters – "Cromagnoids" from Neolithic lakeside sites with large fauna, microlithic industries, and bone harpoons. Two elbows with characteristic lesions (out of 38), suggest harpooners.

Dyer, Todd x

2007 The Atlatl and Bannerstone. Electronic document, Indian Artifacts and Fossils: The Midwestern and Southeastern Collections of Bill and Todd Dyer. URL: <u>http://www.webdyer.com/artifacts_fossils/home.htm</u>, accessed 1/20/08.

[Carefully done, nice photos, info ok but some errors - oldest atlatls are not 25,000 years ago in N. W. Africa, and Perkin's spring theories are not correct.] Bannerstones as atlatl weights, discusses manufacture and probable use as markers of identity in different areas.

Earle, Wendy Rose

2010 The iconography of Moche winged figures. Unpublished MA thesis, University of Texas, Austin.

[Would be a lot easier to read if she hadn't used footnote references and put figures at the end.] Analyzing fine-line drawings, on 80 vessels, mostly (54) stirrup-spout vessels, which are probably not functional because complicated to make, ritual motifs, heavy decoration, tomb contexts [problematic argument, similar to assuming decorated atlatls were not functional]. Not use ethnographic analogy in interpreting motifs because of 'disjunction' between ancient and modern cultures. Organized winged figures into eight groups: ducks, Falconidae family, owls, hummingbirds, vultures and condors, other birds, bats and dragonflies, and anthropomorphized forms. Some are actors in scenes, others 'indicators' of meaning.

Ducks, 3 species not distinguished. Shown as runners and warriors (weapon bundle) like other birds, and participating in sacrifice scenes. Possibly because ducks are aggressive and fast flyers, or beak resembles *tumi* knife.

Falconidae – several species not easy to separate, Ospreys. Like owls, often depicted as warriors or litter-bearers, but falcons appear as runners while owls do not and only owls have priest role in Sacrifice Scene. Hawks and humming birds occur together, often in 'indicator' role with main figures in battle or running, or both may be main figures. Reference to speed and aggressiveness, hawks as hunters, swiftness and strength.

'Ceremonial Badminton' scene with hawks and others with less recognizable bird heads. [I think the only places they are definitely throwing with atlatls.] Owls more common in other media than fineline. Owls decapitate and store rodents – owl depicted as 'Decapitator' with knife, and as warrior with gear. Owl often a main figure in Sacrifice Scene, presenting goblet of blood to priest. Shown carrying humans = transport of soul to death.

Hummingbirds. Fast and belligerent. Shown with split tail and long beak, often slightly hooked. Similar to hawks in scenes and often with them. Uniquely shown as motifs on depictions of cloth.

Vultures and Condors. Usually distinguishable. Soaring birds of prey, associated with carrion and thus death. Shown eating dead, but more common in other media. Shown as headdress but rarely anthropomorphized.

Other birds. Sea birds, herons, other water birds. Often assoc with Wrinkle Face and maybe with El Niño events. Not anthropomorphized. One scene with parrots.

Bats. Probably vampire. 'Anomalous' in our classifications, but who knows about Moche. Never naturalistic depictions, always anthropomorphized. Only 4 examples, 1 running, 1 throat cutting, 1 goblet holding, 1 pair battling 'Split Top'. Natural associations with blood, sacrifice, death, underworld. But not treated like other winged creatures, more similar to fox.

Dragonflies. 10 fineline scenes. ID by antennae and wings. 'Indicators' in 1 scene with hummingbirds and war, others anthropomorphized.

Semiotic analysis: possible symbolic meanings mostly mentioned above. Anthropomorphized figures could be 'gods' or costumed humans. Tomb 2 at Sipan man has large headdress in form of owl.

[Many figures. Notably, even when depicted as warriors the birds are rarely show using atlatls. A few carry the usual arms bundle which includes darts, e.g. Fig 11 hawk and duck warriors. Fig 18 owl warrior has arms bundle with shield, 6 darts, atlatl, sling, and

net, but carries his mace on shoulder. Fig 19 Owl warrior has arms bundle of shield, mace, atlatl, and 2 darts. Fig 20 hawk and hummingbird warriors carry mace, and arms bundle of shield with 4 darts. And others similar. Fig 33 Ceremonial Badminto scene may be only one where bird figure (hawk) is show actually using an atlatl. Fig 34 scene of 3 men apparently throwing darts at 2 hawks in flight. Fig 47 Wrinkle Face capturing Split Top, with Iguana Man also shows at side an atlatl with bird head handlepiece and 2 darts with barbed points. [So despite easy symbolic association of birds with projectiles, and use of bird imagery on atlatls themselves, birds not shown using them. No bats or dragonflies shown with atlatls at all.]

Edgar, Blake

2002 Chronicler of Ice Age Life. Archaeology 55(6):36-41.

Flattering article on Jean Auel, praising accuracy and detail of her fiction. Excerpt on atlatl use from *Shelters of Stone* "Holding the spear-thrower horizontally in his right hand, with his thumb and index fingers through the two front loops, he quickly slapped a spear into the groove. He slid it back so that the hook of the thrower, which also acted as a backstop, fit into the hole in the fletched butt end, and without hesitation he launched the spear. He did it so quickly, many people hardly noticed the way that the back end of the thrower raised up while he held on to the front with the aid of the loops, effectively adding the length of the spear-thrower to the length of his arm and thereby gaining the advantage of the additional leverage."

Photo of Auel "demonstrating proper atlatl form." [Unfortunately, she isn't – couldn't possibly get a good throw with elbow low, wrist forward. Maybe the photographer's fault, but like much of her books – good story, lots of researched detail, but a bit off the mark as a depiction of prehistory. Here there's an implausible emphasis on rapid-fire speed (also seen in her descriptions of slings), and it's plainly the wrong kind of atlatl! She's describing something like a SW "Basketmaker" form – late, N.American. The Upper Paleolithic spear throwers that we know had no groove, and no evidence survives for finger loops. To her credit, she recognized atlatls as levers, not springs.]

Edge-Partington, J.

1903 Notes on the Weapons of the Dalleburra Tribe, Queensland, lately presented to the British Museum by Mr. Robert Christison. *Man* 3(19):37-38.

Clubs, spear thrower and spears, and boomerangs discussed briefly.

Wommera or koolbinny "straight shaft of wood with wooden peg" attached by sinew and gum. Used with light reed spears which could be thrown 300 yards. Heavy wooden spear only thrown by hand, "accurately to distance of 120 yards." [Distances appear to be greatly exaggerated – more than current atlatl record, more than current javelin record (98 m)].

Ekholm, Gordon F.

1962 U-Shaped "Ornaments" Identified as Finger-Loops from Atlatls. American

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Antiquity 28(2): 181-185.

Shell or stone U, drilled at ends = atlatl loops as seen on two Aztec specimens (British Museum and Rome). Mesoamerican distribution discussed.

Elkins, Aaron o 1983 *The Dark Place*. Penguin Books, New York.

Novel. Physical anthropologist Gideon Oliver investigates old and new mysterious human remains in a NW coast park. One recent vertebra was pierced by a bone point, a feat that would have "taken superhuman strength". Was it Sasquatch? Oliver stands firm on the lack of scientific grounds for any such creature, before the answer arises: it was done with an atlatl. Atlatl more or less correctly described, but who would use one? It appears there is a lost tribe in the coastal rainforest. The story of Ishi is used to make this seem possible, but that was a long time ago in a different world that was not filled with hikers and 4-wheel-drive morons going everywhere. Culture loss is claimed to explain why atlatl and not bow, but since "atlatl had been extinct in N. America for hundreds of years" it actually implies re-invention - the group would not have lost bows, and would have relearned if they did since it turns out they are not totally isolated. Moral issues are raised: if a lost tribe defends itself, is it murder? Should you bring them into civilization or should you and can you leave them isolated or otherwise protect them? Various twists allow a satisfactory outcome. The Gideon Oliver stories are not bad. The forensics are a bit too pat and brilliant, but not outlandish, and at least science is supported over crackpottery, although the lost tribe in this one is really far-fetched.

Elliot, Jack

2014 The Bow's Father, The Atlatl. *Primitive Archer Golden Treasure Series*. Originally in *Primitive Archer* 12(3).

[Print quality of this series is pathetic] Mammoth hunt scenario. Aztec scenario: arrows 'bounce off conquistadors' armor harmlessly...but 6-foot obsidian pointed dart that is thrown with a two-foot long stick...can punch through the armor and shishkabob the conquistador inside.' Atlatl gives leverage advantage. Brown 1940 experiments failed, but Perkins in 1980s reinvented the flexible dart necessary to make it work. "It's all flexible shaft acceleration" says Perkins, so since atlatl first and arrow similar, atlatl is 'father'. Berg and Perkins sell, hunting success stories, Wendell White claims put dart in top of boar skull and out bottom. Bracken comments on how to throw, Berg teaches author, WAA mentioned. [ok except for Aztec and Perkins nonsense].

Elliott, Dan

1989 Bannerstones of Missouri. *Missouri Archaeological Society Quarterly* 6(1):8-13, 18-23.

Summarizes Knoblock's types and describes, discusses stone materials.

Favors Peet's balance while at rest theory, Howard's no catapult action [which is wrong]. No weights in W because group hunting in open. Steatite and catlinite rarely used, hematite some, granite most common. Lists MO specimens.

Ellis, Christopher

1997 Factors Influencing the Use of Stone Projectile Tips: An Ethnographic Perspective. In *Projectile Technology*, H. Knecht ed., pp. 37-74. Plenum, New York.

[Good article, nice compilation of ethnographic data on point use, good consideration of +/- factors in use of stone tips and alternatives.] Not much directly related to atlatls. Conclusions: stone tips make more effective, improve light projectiles, usually indicate large game hunting.

Elphinstone, Margaret

2009 The Gathering Night. Cannongate Books, Edinburgh.

[Novel, families in Mesolithic Scotland. Beautifully written, archaeologically and anthropologically realistic. Elphinstone is brilliant at making characters who clearly live in a different world from us, and require some puzzle-solving to understand, but are also humanly believable and sympathetic. The story is low-key but gripping, involving tribal politics and a mystery. Realistic and detailed depictions of hunting and gathering, no atlatls; bows are appropriately used here.

I think *Gathering Night* and *Reindeer Moon* (Thomas 1980) are the two best novels of prehistory I know.]

Engel, Frederic

n.d. Paracas: Cien Siglos de Cultura Peruana. Juan Mejia Baca, Lima.

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[In Spanish, 2 pages xeroxed only, with photos of Peruvian estolicas with carved handle pieces, one with its dart, also a sling.]

Engel, Frederic

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1963 A Preceramic Settlement on the Central Coast of Peru: Asia, Unit 1. Transactions of the American Philosophical Society, n.s. 53(3).

Pre-ceramic coastal site [ca 1700 BC?]. Burials and bundles in pits. p 118: Pit 16, close to surface, disintegrated mat covered a bunch of stuff including fabric, string, gourds, obsidian proj pt, 2 harpoon foreshafts, two wooden spearthrowers (one 'destroyed'). Fig 132 p 55 shows spearthrower [ratty-looking (probably poor preservation) rod stick with large integral hook, no visible grip modifications]. P.56 "the forehook is carved out of the stem, which is of hardwood, probably huarango." L 43 cm. In same pit, frags of possible darts, "a quiver (now destroyed) made of cane lattice twined with cotton yarn." Poss quivers in 4 other graves and pits. Dart or javelin in Grave 23. "Don't know if darts equipped with stone points" Figs show 3 obsidian and quartz points [but captions are

confused about which came from Pit 16, all are stubby, thick ovates, poorly made, with needle tip.] P 57 figs of two probable foreshafts from Pit 16, one bone, one wood, notched for stone points, 188 mm long. Slings also found.

Engvall, David P.

1995 The Dynamics of: The Off-Axis-Forward-Nock Spear vs The On-Axis-Aft-Nock Spear as Thrown with an Atlatl Spear Thrower. *The Atlatl* 8(4):4-5.

His world record: 848' 6 5/8" 7/15/95.

FNS = nock 1/4 length from butt, different motion, similar atlatl to ANS. ANS: spur moves almost in straight line, spear flexes up or down.

FNS: spur follows curving path, spear flex is concave down, transforms into axial motion to give greater launch velocity. [But no info on equipment details like length of atlatl and dart!]

Environment Canada

2003 Rare Artifacts Melt Out of Ice. The Yukon News, Your Yukon Column 200, http://www.taiga.net/your Yukon, accessed 2/14/03.

Atlatl foreshafts with stone points pictured, dates 4,300 to 6,800 BP, bows and arrows show up 3-4000 BP. Melting and loss rapid now. Archaeologist Greg Hare.

Erlandson, Jon M., Torben C. Rick, Todd J. Braje, Molly Casperson, Brendan Culleton, Brian Fulfrost, Tracy Garcia, Daniel A. Guthrie, Nicholas Jew, Douglas J. Kennett, Madonna L. Moss, Leslie Reeder, Craig Skinner, Jack Watts, and Lauren Willis

2011 Paleoindian Seafaring, Maritime Technologies, and Coastal Foraging on California's Channel Islands. *Science* 331: 1181-1185.

Early sites, contemporary with Clovis/Folsom, 13000-11000 cal BP. One exploiting birds, other shell midden. Variable Paleo adaptations. Small Channel Island Barbed points assoc with bird and perhaps fish or sea mammal hunt, also Amol pts (unbarbed, serrated version of these stemmed forms) and finely worked crescents, abraded bone tools and sawn pc of ochre. Very different from inland fluted point traditions, link to Western Pluvial Lakes Tradition inland, and NE Asia and Pacific NW, to stemmed pt tradition of S America. [news coverage suggests without attribution that the small points could be arrow points, meaning earlier bow.]

Erwin, John, Donald Holly, Stephen Hull, and Timothy Rast x

2005 Form and Function of Projectile Points and the Trajectory of Newfoundland Prehistory. *Canadian Journal of Archaeology* 29(1):46-67.

1000 BP Beaches complex replaced by Little Passage complex, marked by intro of bow and arrow. Analysis of 840 pts agrees, but proj pt function cannot be linked to traits like

side (early) or corner (later) notching because using Bradbury, Shott criteria early large side-notched forms were sometimes arrowheads and vice versa - all size measurement ranges overlap some, tho side-n larger, corner-n smaller. Bow probably did not immediately replace spear thrower, but were complementary - all sites have mix of both, and size and base form (defining traditional types) do not distinguish well between arrow and dart points. [Quite likely, but there is no reason to assume that components in these sites are unmixed or reliably distinct - mixed assemblages are the rule, even if we believe that Bradbury/Shott techniques reliably distinguish arrow from dart.] Adoption of bow may be linked to end of Dorset Palaeoeskimo populations on the island. Warming trend less seal, Dorset leave, broader resource base for LP complex Indians, bow better for that. Or bow may have given competitive advantage, tho little evidence of conflict. Technologically conservative Dorset seem to lack bow.

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Evans, Mary Anna

2003 Artifacts. Poisoned Pen Press, Scottsdale.

Novel, murder mystery. Excavations on Florida islands uncover murder. [Not a bad novel, but irritating to an archaeologist. Heroine Faye is archaeologist, but makes precarious living looting sites and selling artifacts, driven to this by desperate need to protect old family home, but despite betraying her principles here, we are supposed to believe that she is also driven by sense of duty to investigate murder. At the end, her professional mentor declares her looting ok because she kept good records. This is just the looter's common fantasy - that they do good archaeology too, so their destruction of sites is justified. Evans doesn't understand archaeology, the academic world, or atlatls: Faye's Indian friend Joe makes one, "an archaic type of spear that was thrown by slinging its hinged spearthrower in a whiplash motion." It has "a stone weight and a shell trigger..." Acknowledgements say she talked to Craig Ratzat, but she must not have listened. I hate novelists who can't be bothered to get it right.]

Evans, Oren F.

1957 Probable Use of Stone Projectile Points. American Antiquity 23(1):83-84.

X

Testing large points (4-5", 14-40 gm) on unfletched arrows. Accuracy increased [how he measured it is not explained] as added weight, so large points work well on arrows. Bow probably invented many times, he saw a child make a toy bow by accident.

Evans, Oren F.

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1959 The Development of the Atlatl and the Bow. *Bulletin of the Texas Archaeological Society* 30:159-162. Reprinted in *The Plains Anthropologist* 6(13):200, (August, 1961).

[Mostly speculation, but a pioneer in trying atlatls.] Stick with nail atlatl, willow sapling dart 5.5 feet long. "After practicing a few times, a target a foot in diameter could be pierced at 20-30 feet about four out of five times." You guide spear with left, throw with right. "If movement of atlatl is carried too far forward and downward, it throws the butt

of the spear down.." [Sounds like he was using a heavy, rigid dart, and a throw (see Howard) that didn't flip the atlatl.] "... in the hands of primitive man who used the throwing stick almost constantly, the atlatl and spear were probably quite accurate and efficient."

First arrow pts would be large because on unfletched small spear like atlatl dart.

EXARC

2018 Atlatl. Glossary, on EXARC webpage. Accessed June 27, 2018, URL: <u>https://exarc.net/glossary/atlatl</u>

Atlatl in different languages. A wooden shaft used to propel a spear or dart, known from archaeology as well as ethnography.

Català: atlatl Česky: vrhač oštěpů Deutsch: Speerschleuder, Atlatl Español: átlatl [estolica] Français: propulseur Italiano: propulsore Latviešu: atlatl Lietuvių: Ietisvaidė Nederlands: speerwerper, atlatl Norsk: atlatl Polski: atlatl Português: propulsor (arma) Română: propulsor de suliță, atlatl Русский: копьеметалка Suomi: vipukeihäs

Fadala, Sam

2000 Before the Bow. *Primitive Archer Magazine* 8(4):35-40. Reprinted [poorly] in *Primitive Archer Golden Treasure Series* 2014.

[Gee-whiz from archer's viewpoint, not useful.] Features Ken Wee. World Open Atlatl Competition in WY. Claims [unfounded] 200X advantage over hand thrown spear, speeds of 80-100 mph because of improved leverage.

Fagan, Brian

1987 *The Great Journey: The Peopling of Ancient America.* Thames and Hudson, New York.

[OK, readable, reliable, even-handed on controversies, skeptical about some of the "pre-Clovis" material, covers important stuff briefly, sometimes too briefly. A bit too much irrelevant material on early humans elsewhere and late Indians. Stop-action sequence drawing of atlatl throw (180-181) by Simon S.S. Driver has problems: Clovis man is holding the atlatl with fingers wrapped also around the dart, dart doesn't flex in throw, and is over head in next to last, then suddenly down in front for final frame, and the dart point is not Clovis. Still, it does convey idea of a throw with flip of atlatl, but is unfortunately starting to be copied by others, e.g. Plog 2008.] Frison experiments: Clovis weapons could "have inflicted severe wounds on mammoth" but probably not killed easily; Judge argues that many "kill" sites represent wounded animals lost with points in body.

Fagan, Brian

2004 *The Great Journey: The Peopling of Ancient America*, 2nd ed. University Press of Florida, Gainesville.

[Generally readable text, fairly up to date on recent finds and theories. Pretty much same material on PaleoIndian period as 2005. Same poor point illustrations but different atlatl pic: p 180 Driver's stop-action drawing of atlatl throw.

Fagan, Brian

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2005 Ancient North America: The Archaeology of a Continent, 4th ed. Thames and Hudson Ltd, London.

[Best available text coverage of N. Am. prehistory, reliable, readable, detailed, well illustrated, although projectile point drawings throughout are rotten, crudely drawn and innaccurate. Stupidly optimistic p.c. view of NAGPRA.]

P 381 Archaic hunter throwing with Indian Knoll type atlatl, drawing by Thomas Gatlin from Jeffries 1987 [not too bad but not quite right either, dart and arm are well above head and dart is not flexing.] In SE, change from side-notched to corner-notched points may reflect change from thrusting spear to atlatl (J. Chapman idea) ca 7000 BC cal, or p 111 notched pts ca. 8000 BC at Thunderbird in VA. P 412-13 Green River culture (Indian Knoll) atlatl parts illustrated.

Jean-Philippe Faivre, Jean-Philippe, Bruno Maureille, Priscilla Bayle, Isabelle Crevecoeur, Mathieu Duval, Rainer Grün, Céline Bemilli, Stéphanie Bonilauri, Sylvie Coutard, Maryelle Bessou, Nicole Limondin-Lozouet, Antoine Cottard, Thierry Deshayes, Aurélie Douillard, Xavier Henaff, Caroline Pautret-Homerville, Les Kinsley, and Erik Trinkaus 2014 Middle Pleistocene Human Remains from Tourville-la-Rivière (Normandy, France) and Their Archaeological Context. *PLoS One* 9:e104111-13.

Open air site in N France, 183 to 236,000 BP. Three upper limb bones, Neanderthal lineage based on morphological and metric analyses. An abnormal crest on the left humerus represents a deltoid muscle enthesis. Micro- and or macro-traumas connected to repetitive movements similar to those documented for professional throwing athletes could be origin of abnormality. "The overall crest formation most likely results from repetitive micro- and or macro-traumas connected to the synergistic stabilization the arm

associated with abduction and extension. Although the exact motion responsible for this entheseal change is difficult to determine, actions connected to throwing seem plausible, especially given the need for glenohumeral stability in spear throwing, as has been suggested for several Middle Palaeolithic contexts."

Farmer, James D.

1997 Iconographic Evidence of Basketmaker Warfare and Human Sacrifice: A Contextual Approach to Early Anasazi Art. *Kiva* 62(4):391-420.

Pervasive war images in SW: trophy heads, scalps, dismemberment, and weapons, both real and depicted, probable connections to Mesoamerica [not so convincing]. Lots of references to atlatls in Mesoamerican and SW art, burials with atlatls or killed by darts in SW.

[Some of his evidence and interpretations lead to too many unsupported interpretive stretches. Oversimplified innaccurate drawings of rock art].

Farmer, Malcolm F.

1955 Awatovi Bows. Plateau 28 (1): 8-10.

Two bow types in murals: 1) self-bow (similar to archaeological material from Tularosa Cave) 2) double-curved, similar to plains and Athabascan groups in historic SW, could be later introduction to Hopi by these groups.

Farmer, Malcolm F.

1994 The Origins of Weapons Systems. Current Anthropology 35(5):679-681.

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Origins of bow in late Paleolithic or Mesolithic, but what is precursor? Spearthrowers in archaeology by Magdalenian, similar mechanics of spring and flexing projectile. Atlatl weights serve to time separation of dart from thrower [This is all wrong. Atlatl flex does not add to dart velocity and has no functional or ancestral similarity to bow flex].

Similar distributions of early bow and spear thrower: NW Africa, W Europe, Mid E, so probably both originated in Maghreb, where spearthrower appeared in Aterian Culture 40,000 b.p. [No evidence offered, dubious conclusion - Aterian has stemmed projectile points, but no evidence of atlatl, see Bruchert 2001, Iovita 2011; and I don't know of any NW Africa spear throwers either in prehistory or ethnographic times]

Farnell, Richard, P. Gregory Hare, Erik Blake, Vandy Bowyer, Charles Schweger, Sheila Greer, and Ruth Gotthardt x

2004 Multidisciplinary investigations of alpine ice patches in Southwest Yukon, Canada: Paleoenvironmental and paleobiological investigations. *Arctic* 57(3): 247-259.

Environmental background for the Yukon ice patch dart and arrow finds, see Hare et al.

Fawcett, William B.

1998 Chronology and Projectile Point Neck-Width: An Idaho Example. *North American Archaeologist* 19(1):59-86.

Neck-width provides more continuous, simpler chronological indicator than point type. From published data, derives formula for dating points by neck-width. N-W decreases through time, partly because change from dart to arrow, but suggests long overlap between 2500-1500 B.P. [He documents and discusses the trend, but there is too much variability in his data to believe his formula accurately predicts the date of any point.]

Feagins, Jim D.

2016 Boatstones as regional atlatl weights: A few examples and sites from along the Kansas/Missouri border. Paper presented at Missouri Archaeological Society Fall Symposium, Van Meter State Park, MO, October 1, 2016.

2018 Boatstones as regional atlatl weights: A few examples and sites from along the Kansas/Missouri border. *Missouri Archaeologist* 78:63-96.

Relatively rare artifact. Several forms of attachment.

Feder, Kenneth L.

2008 *Linking to the Past: A Brief Introduction to Archaeology*, 2nd ed. Oxford University Press, New York.

Textbook, pretty good. Photo of student using atlatl, others on accompanying CD.

Fennell, Jim

2010 Our Towns: A College Team Takes Aim. *Parade Magazine* May 30, 2010. Online version: http://parade.com/news/our-towns/2010/0530-a-college-team-takes-aim.html accessed 5/1/11.

New Hampshire, Franklin Pierce Univ. "Hurling Ravens" Bob Goodby, Anthro prof advises. U VT is only other college team to compete with them.

Fenenga, Franklin

1953 Weights of Chipped Stone Points: A Clue to Their Functions. *Southwestern Journal of Anthropology* 9(3): 3-09-323.

Weighed 884 points from 16 sites in CA plus 1 NV Anasazi, 1 NB 18^{th} C Apache, 1 ND protohistoric, 1 SD protohistoric, 1 MO Archaic, 1 MO Hopewell. Finds bimodality: less than 3.49 gm, and more than 4.5 gm (only 33 = 3.7% fall between). Suggests small point tradition reflects bow and arrow, late sites, while large point tradition is atlatl, earlier sites. Notes contradictory evidence: Browne 1938 and his own experiments with atlatl show small points, no points, large points all work on both arrow and dart. Late metal

arrow points also heavier, but early ones fit pattern. Some sites with both sizes may have atlatl and bow coexisting. [Widely cited, perhaps a good rule of thumb, but no more than that. Would like to know what else he tried with atlatls.]

Fenenga, Franklin, and Robert F. Heizer

1941 The Origin and Authenticity of an Atlatl and an Atlatl Dart from Lassen County, California. *American Antiquity* 7(2):134-141.

Atlatl of willow, simple stick, slightly curved, with slight finger notches, groove and integral hook, 75 cm long. Cane dart, hardwood foreshaft broken off, 115 cm long, weighs 35.2 gm, v-shaped nock like arrow, 3 radial fletchings. Authors made and tested models, cast 150-250 feet.

Origin: Owned in 1910s-20s by "Charlie Paiute," Maidu, who claimed to hunt with it. His daughter and others deny, as do ethnographic California groups in culture trait studies, although several archaeological specimens are known from the area. Could be conservative survival, fake or experiment by CP, who may have known about SW atlatls, or found a specimen and reinvented use. Authors favor last explanation. [see also below and Heizer 1945, apparently it was diffusion from an archaeologist!]

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Fenenga, Franklin, and Robert F. Heizer

1941 Further Notes on the Susanville Atlatl. American Antiquity 8(1):120-122.

George Evans, son-in-law of Charlie Paiute, worked with M.R. Harrington at Lovelock Cave and others, made and experimented with atlatls after seeing SW types found at Council Hall Cave, NV, and is responsible for the Lassen County one above.

Fenenga, Franklin, and Joe Ben Wheat

1940 An Atlatl From the Baylor Rock Shelter, Culberson County, Texas. *American Antiquity* 5(3):221-223.

From looted cave, associations described.

Basketmaker type complete except missing loops, mesquite?, 438mm L, 25 mm W, groove + flush hook, gypsum weight in middle, incised decoration distal end. Chronological questions discussed [now outdated].

Ferg, Alan and William D. Peachey

1998 An Atlatl from the Sierra Pinacate. Kiva 64(2):175-200.

Found 1976 in small lava tube "Ten January Cave", Sonora, Mexico, in pile of rock and guano, perhaps offering. Hardwood, 55.3 cm long, 1.2 cm thick, 2.0-1.5 cm wide (hook to grip). Reworked to have notched grip with marks for loops, polished, painted red. C14 AMS date ca. 1500 B.C. = beginning of San Pedro ("Early Agricultural" = Late Archaic). Comparative survey of SW atlatl types: Ten January atlatl closest to SW Anasazi in general form, but elevated spur and red paint are southern traits. In final form, had

Anasazi type grip, but maybe replaced southern type straight sides with lashed-on shell loops.

From nearby caves 14 possible atlatl foreshaft blanks.

Current location unknown, documented in '80s by J. Hayden.

Feriz, Hans x

1958 Demonstration of a South-Peruvian Arrow Throwing-Stick. *Proceedings of the Thirty-second International Congress of Americanists* pp.441-444. Munksgaard, Copenhagen.

Burial find near Cayango, with Nasca III ceramics, cloth [archaeological find or looted?]. On L breast of mummy. L = 48 cm, diam = 1 cm, for light arrows, too light for "lances". Copper "arrow-support" [he means hook] in form of long-beak bird with ball at end of beak, spoonbill or Mochica trophy head or unknown mythol? [As near as I can tell from poor photo, the head faces distally, and the other end of the bird has the actual hook]. Handle projection is inlaid ivory in form of anthropomorphic snake head [maybe - then some discussion of snake and animal/human symbolism with odd references to similarity to S.E. Asia.]. "Artful workmanship" shows it must be ritual or display [rubbish!].

Fields, Ronald C. D.

2002 Atlatls: Ancient Missile Launchers. El Palacio 107(2):24-25.

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Research on Mera's (1938) specimens of Basketmaker types from New Mexico (3 specimens) briefly described, and apparently N. Chihuahua (2?) not described. Photo of loops on grip of northern Chihuahan atlatl - fiber bundles coated with black material studded w white blobs (shell?). [Not enough info on any of this.]

Fields, Ron

2005 New Mexico Atlatl Research Continues Sponsored by NMAC. New Mexico Archaeological Council webpage, URL http://www.nmacweb.org/AtlatlFinal3.pdf, accessed 3/16/06

Three atlatls from Mera excavs - Little Pine Cave #1, LPC #2, Rock Fall Cave. Research continuing, C14 dates LPC#1 cal 790-410 BC, RFC 1140-920 BC, dates for 5 other SW specimens from 500 AD to 1700 BC. Ca 70 SW specimens known, possible geographic signif to form of groove in SW, possible late survival alongside bow discussed. [useful beginning to full study of SW atlatls, 3 NM specimens still not enough described or figured].

Fields, Ron

2006 Atlatl Variation During Basketmaker II Occupations at Canyon del Muerto and Canyon de Chelly, Apache County, Arizona. Unpublished ms.

Several atlatls from Earl Morris excavations, now in U Colorado Mus at Boulder. Useful

detailed description.

Figueredo, Alfredo E.

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2010 Nota ilustrada sobre los ganchos de tiradera en la arqueologia de Cuba. *Cuba Arqueologica* 3(1):36-43. Also available in original and English translation at <u>http://www.worldatlatl.org/AtlatlNewsletter.html</u>

[In Spanish. "Illustrated note on atlatl spurs in Cuban archaeology."] Recognized first in Antilles (Skinner 1925) and Antigua (Nicholson 1980), [and other Caribbean refs]. Types compare to California "snakehead" type, flat "folioforme" type [flat with hole, possibly hafted in slot in shaft], others "more or less tabular" with some simple, some sculpted with high projecting anthropomorphic faces. [I wonder if these last are not handle parts as on Peruvian atlatls, rather than hooks.] Folioforme types can be rounded or flat, calls all "peltamorphos" [shield shaped]. Some elaborate forms (Puerto Rico) are birds gripping prey or head, = head hunting as well as atlatl use. Dates for these ca 500 BC - 150 AD.

Discusses distance and accuracy info from other sources. Nicholson says useful for war or aquatic hunting; Aztecs came with bow but adopted atlatl at lake in Valley of Mexico. Easier to use in canoe, water harms bow. But many examples of bowmen in canoes. Atlatl dart better for harpoon with line.

Loven suggests diffusion from Colombia, Nicholson notes could be Paleoindian, but little data. Too early to say much about chronology, but they appear to go from aceramic times to late, with the carved forms consistent with clasical Taino art.

Harrington (1921) illustrated "arrow" 1.2m long, wood point, could be dart. Could have had points of stingray spines, stone, or wood. Taino bows and arrows from E Cuba were very poor, range probably 50 m, only slightly better than atlatl; other Caribbean bows much better. In Cuba, atlatl may have been preferred to bow.

Figueredo, Alfredo E.

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2011 Illustrated Note on Atlatl Spurs in the Archaeology of Cuba. The Atlatl 24(2): 8-12.

Translated and abridged from the above.

Finkel, Michael

1996 Watch Your Backside, Fido... Outside March 1996: p?

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Perkins sells atlatls, WAA holds contests.

Finney, Kevin

2001 Giant Ragweed Darts. The Cast, Spring 2001:2.

Not as strong as cane, but light and flexible, uses foreshaft and endshaft to strengthen, one has lasted 2 years. Prehistoric seed caches suggest if not grown as food, perhaps for darts. Cut in Fall after dried out but before rot.

Finney, Jon Bryant

2005 Middle Iron Age Warfare of the Hillfort Dominated Zone, c. 400 BC to c. 150 BC. Unpublished PhD thesis, Bournemouth University.

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Massive study. Need to apply new models, not just analogy from Classical accounts of Celts. Archaeological evidence focuses on settlements and weaponry. Hillforts should be treated as part of overall settlement pattern. Prehistoric weapons studied by analogy to known cultural systems of weaponry, and experiments, here with slings and spears. [Overall, lots of good material, but the experiments are weak: Some theoretical problems, and no evidence that he developed enough skill to test slings adequately.]

Peru. Archery disappears from Andes after Tiwanaku-Wari Middle Horizon, and sling becomes dominant, perhaps as reaction against the state formation represented by T-W, and assertion of position of allyu kin groups instead with a commoner weapon. Clubs and maces assoc with elite early in Peru (Moche and others) but also lose importance as elite weapon in Inka times. Atl-atl dates to at least Chavin period in iconography (c 1250 BC), and thru entire pre-Hispanic period. Assoc with Moche elite in war and hunting scenes, and Tiwanaku elite statuary. Again, atlatl use lost or reduced with growth of ayllu type society in resistance to state formation, deliberately eschewed as weapon of former elites.

The Inka had to make and use weapons of all ethnic groups under his power, including atlatl, but accounts of siege of Cuzco full of sling use, but no ref to atlatl. Inka elite used yauri, a halberd like weapon with a complex bronze (elite material) blade. Sling was ubiquitous, non-elite weapon, also assoc with Inka elite in founding myths because they were unable to excape the allyu structures.

Experiments with slings. Difficult to learn, historical prejudice mean little work done. Also poor ethnographic record. Archery in contrast remained an elite leisure activity after decline as military weapon. Atlatl has more experiment resulting from interpretation of stone points, and more ethnographic observation. Sling is constantly in motion in use, making instruction difficult. Also a liminal artifact, not conforming to ideology of ideal weapon: doesn't require great strength, nor use of major tools in production. Organic materials that don't preserve well, or are related to "female" production, although in Andes slings are considered "too complex" for women to weave.

Method of casting stones or shot. Used a few written accounts and televised reports of intifada, documentaries of Andalusian and Peruvian shepherds. Two basic ways of throwing: "in the vertical plane to the side of the body" (usual) and "around the head" (only one ethnog ref to this style). First allows range adjustment by angle of release, second horizontal cast would reduce range. Iconography (Shaft Grave rhyton, Tell Halaf, Etruscan, Greek vase) all show sling pouch held out in front by extended L arm, could be beginning of horizontal cast, but actually is loading shot in sling before a side-of-body throw [I think he's wrong]. A third method in ethnog picture is with sling behind back. Choice: use sling in semi-vertical plane, because fits iconographic evidence, description by Roman Vegetius, gets best distance and is least onerous in tests. Slinging is pure instinctive shooting, no "aiming" possible. Choice: Bolivian wool sling for experiment, prehistoric examples from Britain unknown, iconog vague, woven wool would be possible, does represent one real form, so some realistic gauge of effect. [Diagrams of throwing suggest problems – loads with arm outstretched "while sighting at target", then allows sling to "rest" [= dangle at side] before throw, when sling is "turned" four revolutions before cast, following Vegetius. Average initial velocity = 25.38 meters per second, (36.96-21.6 mps).

Observations: Sling needs clear area around slinger. Due to length of sling, projectile is released low to ground, often less than 100mm. [But how can that possibly be, with the overhand throw he illustrates? Must mean 100 cm]. This means walls in front must be low. Peruvian structure, walls less than .8 m, so other solutions needed to protect slingers.

Experiments hard to apply, but "provide certain limits." Distance accounts: minimum 30 m to max 400 m. Max is unrealistic, would outrange Roman siege engines. Slingshot suffers little resistance in air, thus has speed similar to initial velocity at max range, so max range = effective range. [Nonsense]. Shot cannot be too light or has no momentum. Vegetius says slingers should practice even at 600 feet (= c 150 m, and implies extreme range). [tries a number of calculations based on Classical accounts of slings compared to bows, is rightly skeptical of getting good figures]. Table of ethnographic reports of range (30-200m), two experiments: Griffiths and Carrick 1994 (40-90m); Time Team 2001 (80m). Unmeasured observations are unreliable.

Experiment: stones bounce, need measure impact point – on flat beach sand, nonwindy day. Stones of variable shape and volume, so made 90 casts to derive representative trajectory. Sea-worn flint pebbles, recorded mass + volume. Stopwatch accurate to .01 sec timed flight. Distance + time used to calculate initial velocity and angle of release for each stone. Mean initial velocity = 25.38 mps [ca 57 mph, rather slow]. [I don't understand the calculations and there is something wrong with them. He calculates trajectory assuming no drag, and equal distance travelled in each time interval, although at the end "the stone has no forward momentum". Then calculates that drag would theoretically be small, and claims that (188) "the experimental data seem to indicate that the velocity of a sling projectile does not significantly lessen over distance." Bullshit! – that is the theoretical model, not the experimental data. This stupid assumption casts doubt on all his conclusions.] Then calculates that ordinary sling stone would have enough impact force to penetrate skull. (Impact = mass X velocity X duration of impact). Many attestations of accuracy in ethnog and classical lit.

If throwing from above, great increase in theoretical range; may make it impossible for attackers to position themselves to return fire without too many casualties. Within range of experimental stone weights (30-90 g) no effect of mass on initial velocity or on distance. Distances thrown [from graph] ca 35-105 m.

Spears, hand-thrown. Finds of iron heads, can't reconstruct weight of spear. Large heads assumed thrusting, smaller throwing, but too simplistic. Series of calculations of spear flight characteristics. [Including "free vibration" and "spline" i.e. spine, which is largely irrelevant in hand thrown spear.] Length limits guessed from burial contexts, shaft diameter from sockets, calculate weight and length at 600g mass, gets Danebury spears from 1.6 to 4.85 m [which is clearly too long for throwing]. Many heads poorly made, more likely in thrown weapon. [No direct experiments with throwing reported]. Assumes

initial velocity of 22 mps [too high?].

Survey of hillforts – architecture, layout, rampart heights, modeled with his experimental slingstone trajectory. If areas between multiple walls were allowed to grow scrub, hinder sling attacks, at none of the multivallated hillforts would it have been possible to strike inner bank without coming under defensive fire earlier. But excessive multiple walls beyond needs of sling defense, and most entrances vulnerable to sling attack. Terraces at some entrances provide ideal sling ground. Range of defense twice that of attacker, ca 100 m.

Raid warfare assumed for Iron Age, but hillforts not very practical for defending cattle, relatively little evidence of destruction/burning, long occupations. Hillforts essentially invulnerable in their day. Slingstones at forts, other weapons show war, but more ideology of war shown by hillforts than practical use – lots of people to build, but not to occupy. Little expression of social differentiation in wealth objects, and little use of sword or bow, suggests not "heroic Celtic warfare" style of elite combat. Sling expresses ideal of social cohesion. Sling and spear used in open combat by everyone. Warfare and defense of community was ritualized, assoc with ritual deposits of slingstones and other stuff in pits, carvings of naked warriors, sacrifice, trophy heads. Warfare serves elites by helping unite and control local populations, competitive display. Hillforts define territory, ritual space, serve as elite and community display. Warfare was part of ritual cycle, more than process for acquiring territory or personal wealth.

Fisher, John W. x

2001 Elephant butchery practices in the Ituri Forest, Democratic Republic of the Congo, and their relevance for interpreting human activities at prehistoric proboscidean sites. In *Proceedings of the International Conference on Mammoth Site Studies*, edited by Dixie West, pp. 1-10. University of Kansas, Lawrence.

Documented 8 recent kill sites, with informants. 25-35 people butcher elephant in 3-5 hours. Completeness of processing and bones left depends on size, position, nutritional condition of elephant, marrow + grease content of bones (longbones chopped and boiled), distance to village, taphonomy. Skull, innom, scap almost always left. Feet almost always taken. Temporary processing camp.

Fisher, Joshuah

2012 The Building of My First Atlatl. The Backwoodsman 33(4):58-60.

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"power enough...to pierce a Spaniard's breast-plate armor and the man wearing it." OK basic instructions.

Fladmark, K.R., D.E. Nelson, T.A. Brown, J.S. Vogel, and J.R. Southon 1987 AMS Dating of Two Wooden Artifacts from the Northwest Coast. *Canadian Journal of Archaeology* 11:1-12.

Fraser River club - ball-headed with zoomorphs, 1000+130 B.P.

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Skagit River atlatl (Taylor and Caldwell 1954, Borden 1969) [of the three articles, this one has best picture and most useful description].

Carved with monster with inlaid eyes surmounting human head, and incised line decoration. Western Yew, short tapered grip with two finger holes, ca 41x1.0x4.8 cm but missing distal end. Carving ca 9x9 cm. Weathered, incompetently cleaned by finders. [Detailed description of carving given]. Fits NW coast conventions, probably "chief of the sea, keeper of wealth" as Borden suggests. Maybe non-functional - fragile [unconvincing], but yew = bow wood, suggesting wanted flexible strength to add throwing power. Carving would keep proximal end stiff. Date 1700 ± 100 B.P. = Marpole phase, slightly later than Borden suggests.

Flaskerd, George A.

1959 Minnesota Atlatl Weights. Iowa Archaeological Society Newsletter 30:8-9.

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3 of 7 of catlinite, assoc with old sites on lakes

Flenniken, J. Jeffrey o

1985 Stone Tool Reduction Techniques as Cultural Markers. In *Stone Tool Analysis: Essays in Honor of Don E. Crabtree*. MG Plew, JC Woods, MG Pavesic eds., pp. 265-276. Albuquerque: UNM Press.

Killed goats with atlatl darts, noted breakage, morphological change when he reworked them. Claims point types <u>not</u> valid cultural/temporal markers because they can be changed with reworking! [Incorrect, because damaged pts are still reworked into forms current at the time of reworking, as many well-dated sequences show. It just is not as simple as he thinks. Correctly dismissed by Thomas 1986; Zeanah + Elston 2001. The useful information in this article is the high damage rate, damage from animal motion (mostly bending fractures), damage to point bases, support for "Frison effect" of change and reworking of points.]

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Flenniken, J. Jeffrey and Anan W. Raymond

1986 Morphological Projectile Point Typology: Replication Experimentation and Technological Analysis. *American Antiquity* 51(3):603-614.

Similar to Flenniken 1985.

Flint, Weston

1891 The Arrow in Modern Archery. The American Anthropologist 4:63-67

Arrow more important and difficult than bow. Rifled feathering doesn't work. "Last, but not least, is the feathering. Most arrows have three feathers, a very few, two. In proper modern archery there are always three feathers, and these are arranged on the sides of the arrow near the nock, parallel with the stele and equidistant from each other, at an angle of 120 degrees; one feather, called the cock-feather, is always at right angles to the nock.

This arrangement avoids injury to the feathers when the arrow is loosed. Experiments have been made with arrows feathered on a spiral to make the arrow turn like a bullet from a rifle, but with very poor results: first, because the feathering is injured in loosing, and secondly because this spiral motion rather retards the flight of the arrow without giving greater precision."

Foccaci, G., and S. Erices

1971 Excavaciones en los Tumulos de San Miguel de Azapa (Arica-Chile). Actas del VI Congreso de Arqueologia Chilena:47-55. Santiago.

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Apparently excavation finds, pictured poorly in Schroeder 2004. [to find]

Foccaci, Guillermo A. and Sergio C. Chacon

1989 Excavatciones Arqueologicas En Los Faldeos Del Morro de Arica, Sitios Morro 1/6 Y 2/2. *Revista Chungara* 22: 15-62.

See Bruechert 1995 for summary of information on atlatl from grave.

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Fogelman, Gary

1984 The Atlatl: An Early Weapon in Pennsylvania's Past. *Pennsylvania Game News* 55(7): 42-43. (July 1984)

Principle: lengthening the throwing arm. Boyhood flicking apples off stick is similar. [Adequate description of basics]. Hunter could carry one shaft, many foreshafts. Larger points on unfletched darts. Points earlier than about 1 AD are dart points, not arrow. Bannerstones are atlatl weights for more power or counterbalance, some ceremonial use likely too. Accuracy not known, but must have been ok.

Fogelman, Gary L.

1997 All About the At'latl. Turbotville: Fogelman Publishing Co.

Booklet size introduction to use, history, and variety of atlatl forms. [Good place for newcomer to start but too short.]

Fogelman, Gary L.

1999 Top of the World Ma! Top of the World: Atlatling 1998. *Indian Artifact Magazine* 18(1):6-10, 58-61.

Recounts his experiences at atlatl competitions, winning International Standard Accuracy Competitions for 1998.

Fogelman, Gary L.

2006 Results of the 2006 Finger Freezing Contest, Fogelman's, Turbotville, PA 1-7-06. *The Atlatl* 19(2):6.

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Discusses efforts to legalize atlatl deer hunt in Pennsylvania, appearances on TV.

Fogelman, Garyo2009 Chuck Butorajac, 'Halfbeard' Passes Away. Indian Artifact Magazine 28(4):70, 76.

Fogelman, Gary o 2010 Bone (Antler, Bone, Ivory, Teeth) Tools of the Clovis Culture. *Indian Artifact Magazine* 29(4):71-73.

Info from Bradley, Collins, and Hemming book, with his photos of artifacts. Evidence for Clovis atlatl use in atlatl hooks of extinct fauna bone, short bone points, impact damage on stone points. Photos include barbed harpoon, long and short bone/ivory points.

Fogelman, Gary

2012 Columbia Plateau (Oregon) Atlatl. The Atlatl 25(1):7

Two small photos of odd form: curved shaft with integral hook, long boatstone weight, and two peg grip. Made of oak, antler tine grip pegs, basalt weight. "Found over 40 yrs ago". But no further info, private owner [so who knows if it is real, fake, modern, ancient, OR or somewhere else].

Fogelman, Gary and Bob Berg

1998 Second Chance Boar. Indian Artifact Magazine 17(1):30-31, 69.

Boar hunt on NY preserve, GF, BB, and Chris Pappas. Two misses, 3 hits at 5-15 yards. Efficiency of atlatl with stone points, stone tool butchery.

Foley, Vernard, George Palmer, and Werner Soedel

1985 The Crossbow. Scientific American 252 (1): 104-110.

Follett, Prescott H. F.

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1932 War and Weapons of the Maya. Middle American Research Series Publication No.4. Tulane University, New Orleans.

Info from depictions. p384: atlatl sometimes shown without darts as at Chichen Itza ball court, therefore must have other uses than that of spear-thrower, ie symbol of command or scaling hook to help climb walls [Bizarre! Figures show warriors with atlatl, shield, and spear which could equally be dart]. Spear types classified from depictions [reading too much into them].

Ford, Horace A.

2003 Archery: Its Theory and Practice. Taxus Baccata Books, Corvallis, OR. (reprint of 1856 edition).

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The heroic past, when England's archers ruled the battlefield. P 11: "...in no country has the practice of archery been carried to such a degree of perfection as in our own, so it is equally undeniable that no bow of any other nation has ever surpassed or indeed equaled the English long-bow in respect of strength, cast, or any other requirement of a perfect weapon." "Scientific" system for target shooting. Using of course a version of British longbow.

Ford, Richard I. sic

1974 Northeastern Archaeology: Past and Future Directions. *Annual Review of Anthropology* 3:385-413.

p 402: Mound building ends around 400 AD, burials less complex, distinctive pottery ends - i.e. end of Hopewell. Climate change "no longer seems reasonable." "One new technological change that could have been used to disrupt trade arteries was the replacement of the atlatl by the bow and arrow, introduced from Asian and Arctic sources into the Midwest at this time. It was a more efficient hunting weapon and could have become the means for severing existing trade routes, which would lead to a decline of Hopewell." But in WI and MI mounds continue, basic subsitence stays same despite bow and arrow.

Forsberg, Holly

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1996 To Build a Better Missile: Improving on the Ancient Art of Spear Throwing. *Desktop Engineering* March/April 1996: 47-50.

David Engvall - records for sling etc, now atlatl, using engineering software to design. [Bad description of atlatl as "spear attachment"].

Long atlatl, 53" spear, flexible, nock forward of end, circular rather than linear arm motion, achieved 848' 6 5/8".

Foster, George, and Gabriel Ospina

1948 *Empire's Children: The People of Tzintzuntzan*. Smithsonian Institution Institute of Social Anthropology Publication No. 6.

A good old-fashioned "complete" ethnography of a village on Lake Patzcuaro, Mexico. Fishing and pottery making important industries. Pp. 106-107 Fishermen (mostly Tarascan) also hunt ducks with punt guns and atlatl (phatamu in Tarascan), Oct to April. Typically made of palo azul wood, 65 cm L, with 12 cm handle, 2 holes for index and middle fingers. "Non-functional point" [hook] often carved in form of duck's head, shallow groove for spear with 1 cm point [spur]. Reed spear 3 m long, 3-prong iron head, supported by left hand for throw. Only thrown at sitting ducks. Oct 31, day before eve of Todos Santos, most fishermen gather, up to 1000 canoes each with several men. Concentric rings around ducks allow several shots, "the aim of skillful men is deadly, and literally thousands of ducks are killed on this day." Later more individual hunting. Atlatl survives gun because cheap. Some specially skilled makers, standard prices (given in pesos, 4.85 p = 1 US): atlatl 1.00-1.50, spear 1.00. Any implement in good condition, new or used sells for same price. Ducks sold boiled. One poor engraving of atlatl and spear, one tiny photo of use. [see also West 1948]

Fox, Steve

2001 Untitled letter. The Atlatl 14(1):8.

Maruku Gallery in Australia sells Pitjantjatjara Aboriginal art, including spear throwers, still used in ceremony and contest but not for hunting. Mulga wood woomera type, "miru" with spinifex gum hafted adze on some, some decorated, some not.

Frahm, Ellery

1998 Hunting and Warfare of the Americas: The Physics of Atlatl Technology. Unpublished class paper, Physics Dept, Grinnell College.

Critiques most previous discussions of atlatl physics. Arm and elbow or arm and shoulder + atlatl can be modeled as lever whose effective length changes during throw. The lever action transforms greater force applied to one end of the atlatl lever into less force but more velocity applied to the other end and the dart, and initial dart velocity is proportional to the length of the atlatl. Flex of atlatl and dart should consider traits of wood and weather conditions, which also affect optimum angle for distance, between 40 and 47 degrees. Atlatl and dart flex and act as springs, but addition of weight to atlatl is unlikely to affect this. Weight adds to moment of inertia and stabilizes motion of atlatl during throw.

Frahm, Ellery

1999 Using Moments of Inertia to Determine the Positions of Atlatl Weights on a Throwing Board. Unpublished class paper, Anthropology Dept, Grinnell College.

Moment of inertia is the tendency of an object to maintain its path of rotation and increases with the mass of the object and the distance from the axis of rotation. Thus a weight on a swinging atlatl stabilizes its motion and should increase accuracy. The greater the weight and the further from the handle, the more the effect, but the force necessary to swing the atlatl also increases.

Using 5 prehistoric atlatls found with weights attached, moments of inertia can be calculated, finding a narrow range. This "optimal" range of moment of inertia can then be used to model the most likely position of weights of other forms and sizes on atlatls.

Frayer, David W.

1981 Body Size, Weapon Use, and Natural Selection in the European Upper Paleolithic and Mesolithic. *American Anthropologist* 83 (1): 57-73.

Brues (1959) model of spearman vs archer body build relationship to offensive weapons

tested with data from lineally related populations. Brues (1977): spear depends on max velocity of hand at release, bow on stored energy proportional to pounds of pull exerted by arms, so people of "linear build" w long limbs do better with spears, "lateral build" people with short limbs better with bow. But consider other factors: nature of prey, distance. Spear more dangerous, requires closer approach. Atlatl increases to 18-27 m (Spencer 1974); bow much better, so body size and robusticity should decrease as these weapons come in use. Up Pal hunted large game with hand spears early, atlatl by Solutrean, bow prob early Mesolithic, with smaller less aggressive animals.

Reduction 4-9% in limb measurements between Up Pal and Meso, both M and F, but little change between early and late Up Pal. Arm segment proportions and relation to stature change little: "there is little to support a relationship between arm proportions and the use of either spears or bows in the UP or Meso."

Body size may relate to prey, but other factors, like climate, poss also involved, but large bodies nutritionally expensive, so expect an adaptive advantage.

Friis-Hansen, Jan

1990 Mesolithic Cutting Arrows: Functional Analysis of Arrows Used in the Hunting of Large Game. *Antiquity* 64(244): 494-504.

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Width is most important dimension – cuts shaft free for penetration. Cutting efficiency index based on width and penetrating ability, ratio of head width/shaft circumference = wound width; ratio cross section of head/ cross section of shaft indicated penetrating ability. Cutting arrows are just as effective as pointed arrowheads. Hafted arrows illustrated.

Frison, George C.

1965 Spring Creek Cave, Wyoming. American Antiquity 31(1):81-94.

Late Middle Prehistoric [Archaic] material from a cave, including corner-notched dart points, and a C14 date of A.D. 225 ± 200 . Organic artifacts include 5 atlatl fragments of *Rhus trilobata* and shaft fragments. Atlatl distal fragment has integral hook with groove like SW Basketmaker. Proximal (4) fragments have a narrowed handle with opposed projections, possibly had loops, and notches ca 1/3 of way from handle prob for attach weight. Nine distal shaft ends have conical sockets with grooves and some sinew wrapped, some red painted, varying in diameter from 1.2-1.6 cm. Sixteen proximal shaft ends have shallow cup-like depressions, vary in diameter from .6-.7 cm. No evidence of fletching noted on shafts but several cut feathers appear to be fletching debris. Thirteen foreshafts have tapered proximal ends with spiral rasping, nocks made by groove-and-snap, vary in length from 5.1-27.3 cm, diameters .8-1.1 cm. No adhesive on sockets. Two have corner notched points held in nock with sinew only. [Drawings of atlatl material, no photos].

Frison, George C.

1968 Daugherty Cave, Wyoming. Plains Anthropologist 13 (42) pt 1: 253-295.

Late Middle Prehistoric and Late Prehistoric materials. Ten dart foreshafts, some notched for point by tenon method, tenon wastes also found. Conical proximal ends, spiral abrading. Three possible atlatl fragments of Rhus trilobata, similar to Spring Creek specimens, only one figured appears to be proximal end. Associated with medium cornernotched points. Two broken bar atlatl weights. Also some arrow and a bow fragment from upper level.

Frison, George C.

1978 Prehistoric Hunters of the High Plains. New York: Academic Press.

Detailed summaries of many sites, espec kill sites, including Paleoindian. Colby, Hanson, Agate Basin, Casper, Horner, Finley sites. Cultural chronology and projectile points. Photos Late Archaic (200-500 AD) atlatl and foreshafts from Spring Creek Cave. Comments on hunting and butchery with stone tools and bone expedient tools. Lots of experiments with stone points and foreshafts, but mostly with thrusting spears. [Atlatl experiments mentioned in passing, and he seems to feel that Paleoindian hunting would be with thrusting spears].

Frison, George C.

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1989 Experimental Use of Clovis Weaponry and Tools on African Elephants. *American Antiquity* 54(4): 766-783.

Clovis points used on culled elephants, observations on hafting and effectiveness, herd behavior and strategy. Hafted on wooden foreshaft socketed into mainshaft, spear weight 358-432 grams [very heavy for atlatl - were they flexible or more like harpoon?], but heavier got better penetration. Penetration ends when larger shaft reaches hole, so long foreshaft better, but longer breaks more easily. A taper to socket fit for foreshaft worked well if tight; shoulder + plug broke, taper + plug ok but hard to make. Sinew and pitch in slotted foreshaft held points well, tight fit reduces breakage. Hafting needs to be thin for entry; Clovis flutes help. Points survived remarkably long use, one of five did not break (12 shots), others damaged and repaired. Tip damage most common. Rhus trilobata atlatl, with groove and integral hook, 62 cm long, rigid, no weight, 225 gm. Claims "3 decades of experimentation with atlatl and dart," but reports problems with accuracy and trajectory in this experiment. [Wish he would write up his other atlatl experience.] Atlatl thrown spear proved capable of inflicting mortal wounds on elephants: multiple successful hits, although lots that would not have killed too. Successful penetration of rib cage, 9-12 mm thick hide, into lung cavity at 15-20 m. Thrusting spear also successful. Hunter movement necessary in atlatl use might startle animal; other hunters to distract would help.

Butchering with biface thinning flakes. Main effort is cutting hide, quartzite more durable than chert. Dismembering is easy and may leave no marks on bone.

Elephant family groups are formidable; cooperative stalking of individuals most likely.

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Frison, George C.

1991 Prehistoric Hunters of the High Plains, Second Edition. New York: Academic Press.

Some of same material as 1978, but different book. Includes more info on atlatls and weapons, stone tool chapter by Bruce Bradley. [Quality of production is disgraceful - line drawings and text slightly murky, photos look like something printed in 1950s India.] [See Kornfield, Frison, and Larson 2010 for 3rd edition.]

Frison, George C.

1998 Paleoindian large mammal hunters on the plains of North America. *Proceedings of the National Academy of Science* 95:14576-14583.

Quick summary of paleoind chronol, point types, focus on hunting strategies.

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Frison, George C.

2004 *Survival By Hunting: Prehistoric Human Predators and Animal Prey.* University of California Press, Berkeley.

Plains area, Paleoindian to historic, all major animal species, behavioral and hunting technique discussions from experience as hunter, rancher, archaeologist. Atlatls discussed briefly, photo of find from Spring Creek Cave, info on experiments with atlatls, Clovis pts and culled elephants. Stresses importance of knowing animal behavior for hunter and for arch trying to interpret past. It was easier to improve stalking and get close to animals, working with limitations of weapons than to make major technological improvements. Considers metal pts and tools major improvement over stone. Lots of animals taken in drive and trap systems.

Frison, George

2014 Rancher Archaeologist: A Career in Two Different Worlds. University of Utah Press, Salt Lake City.

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Autobiography, emphasizing that his experience with ranching and hunting allowed him to understand animals and hunters more usefully than most other archaeologists. Brief descriptions of the many important sites he worked on. Including Spring Creek Cave and its atlatl material [photos], experiments on elephants with Clovis weaponry [photos of GF and gear, but small], projectile point photos from many sites, butchery experiments. [Fun to read, though some of the potential stories are too short and lack detail, and some others are of personal but not general interest.]

Frison, George, and Bruce Bradley

1999 The Fenn Cache: Clovis Weapons and Tools. One Horse Land and Cattle Company, Santa Fe.

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Magnificent color photos documenting Fenn cache, discussion of archaeology and Clovis in general. [Nice enough archaeology for public and professional, but risks of collaborating with a rich collector are illustrated by overemphasis on esthetic quality of points, and the fact that Fenn subsequently sold the collection, having enhanced its value by having real archaeologists publish it. Everyone seems to accept pieces as genuine, and there is no real reason to think any are fakes, however, it should NOT be considered good data for some things - like the association of a crescent with Clovis points - there is no real reason to believe that all of the pieces were found together, although there are convincing similarities among many of them.]

F + B experiences with atlatls mentioned: F's elephants, B claims atlatl darts "registered an impact over 150 times as intense as that of hand-thrown spears" from instruments of Japanese film crew. Unlikely that hunter would chance damage to projectile points by using them also to butcher.

Frison, George, and Lawrence Todd

2001 The Colby Mammoth Kill Site 48WA322: hunting mammoths; and experiments with Clovis tools and weaponry. In Proceedings of the International Conference on Mammoth Site Studies, edited by Dixie West, pp. 11-26. University of Kansas, Lawrence.

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Colby site WY excav 1973-1978, bones and Clovis points. Original deposit in bottom of steep-walled arroyo, at least 7 animals. Poor preservation, mostly cultural positioning of bones [but prob some erosional] and no good cut marks. Two possible bone tools on camel bone [not clearly tools]. Four distinctive C points, 3 from bone pile contexts.

Few good analogs left for prehist subsistence hunting, very different from modern hunting, which is also getting rarer. Mammoth hide similar in thickness to modern elephant, possibly less armor-like, hair no impediment. Carcasses with rigor mortis not like real hunting. Culled elephants better, fresh, and at least one alive and standing when struck by experimental spears. Bradley made Clovis pt replicas of appropriate stone, darts modeled after Archaic examples, shafts of chokecherry. Atlatl of Rhus trilobata. 1984 just thrusting spear armed with C pt on conical socketed foreshaft. 1985 sim but with atlatl. Jointed shafts for airline travel splinted with elephant sinew bindings. No fletch. [see Frison 1989 for more]. Points effective after resharpening as long as maintained symmetry, sharp tip and edge, and proper hafting.

Bone piles as possible meat caching. Most effective dart if enters at right angle to skin. Lungs, behind scapula, best target. Heart is bad choice, bottom of rib cage and too protected. Neck bad - thick skin, much bone. Stomach wound kills slowly. Substantial flesh wound makes animal lie down, but may not be fatal. Best to wait for good shot. Atlatl and dart effective 15-20 m. More practice might increase distance. Equipment damaged frequently, must be repaired. Variable point survival from breakage at first shot to 12 successful rib cage penetrations. Atlatl energy can be controlled by body movement and throwing arm. Need optimum velocity and accuracy balance.

Fullagar, Richard

S 2011 The evidence for weapons: another functional investigation of Australian microliths. Paper presented at Multidisciplinary Scientific Approaches to the Study of Stone-Age Weaponry, Mainz, 19-22 September 2011.

"Early functional studies suggested most Australian microliths were weapons, functioning as spear barbs and points. More recent work in southeastern Australia has argued that microliths were not demonstrably associated with hunting or killing but functioned as knives, drills awls and scrapers in many different tasks; and only rarely as spear tips or barbs. Small backed artefacts (microliths) found with an Aboriginal burial at Narrabeen (Sydney, Australia) certainly indicate death by spearing. Breakage and usewear on most artefacts indicate use as barbs or 'lacerators', although some had traces suggesting other functions. The evidence for weaponry is reviewed and the traces of use on microliths from southeastern Australia are compared with a recent functional study of microliths from northwestern Australia." Body abandoned on ancient beach ca 3500 BP, many microlithic points in or near bone, some with impact damage on tips and burinated barbs. Interpreted as about 7 spears, each with a microlith tip and barb.

Fullagar, Richard

2016 Uncertain evidence for weapons and craft tools: Functional investigations of Australian microliths. In *Multidisciplinary Approaches to the Study of Stone-Age Weaponry*, edited by Radu Iovita and Katsuhiro Sano, pp. 159-166. Springer Science and Business Media, Dordrecht.

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Microliths were hafted and used in a variety of tasks including elements in spears and multi-functional knives. Spear evidence in breaks and microliths associated with human skeletons.

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Gabriel, Richard A., and Karen S. Metz

1991 From Sumer to Rome: The Military Capabilities of Ancient Armies. Greenwood Press, New York.

Chapters on organization, weapons and lethality, wounds, medical care. [Interest in quantifiably comparing weapon systems, but lots of dubious info used, e.g. they accept at face value ancient casualty counts which cannot possibly be accurate, and use the Illiad to provide statistics on the relative lethality of different wounds, one of the most awful scholarly abuses of ancient literature ever. Their experiments are not described in enough detail, but I doubt they attained any real expertise with the weapons or used appropriate equipment.]

Introduction: describes empirical tests of weapons: Replica weapons used to determine speed, for impact energy calculations. Speed of wielding measured by high-speed strobe photography. Subject male 6' tall, 180 lbs. Energy = weight of weapon times velocity of strike squared, divided by 64 (the gravitational constant). Bow used was modern compound [does that mean pulley bow, or laminated?] but doesn't matter because "penetrating power of arrow is function of its weight and speed of acceleration. Regardless of the weight of the bow, an arrow cannot be propelled faster than 196 feet

per second [134 mph- That is nonsense.] This limitation is due to a number of factors, including air resistance, friction of stabilizing vanes, and propensity of arrow to flex...." Killing power of weapons also specified by calculating area of wound. Test against armor, 2mm brass and iron plates on 4 mm leather jerkin. Standard comparison was 100 lb bow shooting 553 grain arrow with iron tip 196 fps, at armor: 2 inch impact area = 47.4 foot-pounds energy. Some penetration of brass and leather to body depth no more than .75", never got through the leather under iron armor. Calculate need at least 75.5 foot-pounds to penetrate armor to killing depth. Accuracy with bow: from 100 to 250 yds could hit all shots in infantry formation sized box, only 50% at 300 yds, the limit of bow. Simulate chariot by pick-up truck, hit 80% of human sihouette targets at 10-20 yds.

Chapter "Weapons and Lethality": [Lack of real understanding of ancient weapons is suggested by fixation on "obsidian pointed" Neolithic spears and idea that axe was only invented in Bronze Age. No atlatls, but sling info.] Bronze did not revolutionize weapons, but allowed defensive armor [rare and late]. Iron did because it was common, thus cheap [but they don't understand how steel is made]. Sling data: assume 500 grain projectile, 120 feet per second, impact area .75", area of wound 1.2", impact energy only 16 foot-pounds. Compared to arrow at 47.4 ftpds, mace at 101 ftpds. Evolution of axe from slashing to penetrating blade [as with other, e.g. armor, overgeneralized scheme.] Bows: [unclear and incorrect descriptions of principles and muddled understanding of compound and "composite" bows.] Slings: lead and clay shot from 1-10 oz, plumb to tennis ball size, lob heavy shot 200 yds, flat trajectory lighter shot up to 75 yds, Vegetius says Roman slinger could hit man size target regularly at 600 feet. But our exper shows 2.5 foot sling pouch can only accelerate to 120 ft per sec, so a 500 grain shot would only impact at 13.5 foot-pounds. US military says bullet requires 58 ftpds to do minimal damage to human body. Rain of sling stones would be "mostly harmless." [This too is all nonsense.]

Gallardo, Francisco, and Hugo Yacobaccio

2005 Wild or Domesticated? Camelids in Early Formative Rock Art of the Atacama Desert (Northern Chile). *Latin American Antiquity* 16 (2): 115-130.

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Ca. 5000 BP, two styles co-occur, one w domestic llama, other with wild assoc w atlatl hunters. Figure shows vague atlatls + darts.

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Gamboa Velásquez, Jorge

2017 Identificación de una estólica prehispánica del Museo de Caraz, Ancash, Peru. *Bulletin ACERAP* 2:16-29.

[In Spanish, Fr abstract.] Unpublished, in city museum, Ancash mts, N Peru [maybe 200 km S of El Brujo]. Hard wood, appears completely functional. Comparison to similar in other Peruvian sites suggests a form belonging to one of the regional cultures between Early Intermediate (100-600 AD) and Late Int (1000-1450 AD). Flat body, single hole in center, prehispanic type distributed between Lamayeque and the central Peruvian coast. 55.6 cm long, rod-shaped distal half with groove + spur, flat flared proximal half, with a

single hole in the center set in a diamond-shaped flare, a bit less than ¹/₄ length from proximal end [so very long grip]. No real provenience, from unsystematic regional collections.

Comparisons: Uhle 1907 Nieveria (100-1000 AD), Batan Grande Lambayeque (1200? AD), central Amazonia 19th C. Earlier representations e.g. Chavin are too stylized but probably show atlatls with handle pieces [my Peruvian type] used by richly attired actors. Could be Recuay (100-650 AD) but Recuay in mts rarely shows, R on coast has more, combat scenes from Moche vs Recuay don't use atlatls. From Chavin de Huantar is a handle piece similar to Uhle's from Chaviña.

Or it could be later - Huaca Loro en Batán Grande Tomb 1 is comparable (Shimada 1995) high status male with 2 F, one with 2 atlatls of gold sheathed wood, decorated with birds and circles, Sicán culture.

Importance of hunting deer and huanaco varied through time in agricultural societies of Andes. Atlatl also used to show social status, involvement in war for capture and sacrifice necessary for political order and to maintain fertility. Lots of Moche evidence of such (Whittaker, Verano, others), and south coast, and up into Maya, Aztec. In Ancash, deer parts used ritually, suggesting symbolic dimension to hunting as elsewhere. As hunting became less important economically, atlatls took on new symbolic roles.

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Gardner, Fletcher and George C. Martin

1933 A New Type of Atlatl from a Cave Shelter on the Rio Grande near Shumla, Valverde County, Texas. *Big Bend Basket Maker Papers* 2. Witte Memorial Museum, San Antonio, Texas.

Previous finds of notched arrows in atlatl-age deposits could be contemporaneity, or now explained by find of atlatl to cast them.

Ash wood fragment with distal groove and "wedge-shaped" hook to engage arrow nock, narrow, rigid, proximal end missing, decorative notches on bottom.

Cane arrow shaft 3/8" diam, end narrowed by sinew wrap, flared for nock, 3 feather traces.

Experimental atlatl with commercial arrows got similar range but less accuracy than bow. [Hard to swallow - arrow engaged with hook with nock vertical - would the hook really hold for a throw? Can you actually throw something as short as an arrow with an atlatl? – I haven't tried. Unscientific excavation - does the arrow really belong with the atlatl?]

Garfinkel, Alan P., David A. Young, and Robert M. Yohe x

2010 Bighorn Hunting, Resource Depression, and Rock Art in the Coso Range, Eastern California: A Computer Simulation Model. *Journal of Archaeological Science* 37:42-51.

Bighorn population hunted by Coso was depleted after incursion of Numic foragers from Great Basin ca 600 AD with bow and arrow and distinctive scratched rock art style replaced Coso Representational style. CR style focused on estimated 50k sheep images seen as hunting magic 'increase rites'. Intro of bow ca AD 200/300, depletion of sheep, and increased rock art production are linked. Rose Spring site and other faunal data show
intense sheep use in Newbury (1500 BC - AD 300) and Haiwee (AD 300-1000) with drastic decrease in following Marana phase. Computer simulation of human and sheep pops modeled as Numic spreading and outcompeting pre-Numic pops by relying more on pinon and other seed collecting which allowed larger populations, further depleting stressed sheep pops. Sheep pop probably never more than 150-200, ca 2/sq mile. In model Numic pop grows, adds to sheep hunting though less efficient than pre-N [contradicting bow idea?] sheep disappear by AD 1200, pre-N disappear by 1300, Numic pop reaches equilibrium of 300 by AD 1600. Petroglyphs then seen as pre-Numic pop's response to depletion of critical resource and symbol.

Garfinkel, Alan P.

2016 Powerful and Potent:Projectile Point Animal-Humans of the Coso Range. Paper presented at Great Basin Anthropological Conference, Reno, Nevada, October 7, 2016. Online at Academia.edu, URL:

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https://www.academia.edu/29983526/Powerful_and_Potent_Projectile_Point_Animal-Humans of the Coso Range?auto=download&campaign=weekly digest accessed December 4, 2016.

Rock art depictions of projectile points in a few areas also represent humans/spirits or human-animals. E.g Shumla pts in Lower Pecos when inverted = human with raised arms.

Point depictions in Coso Range, of 100,000 elements, only 40 panels with 50 point elements. Often attached to anthropomorphs. Elko series and Humbolt Basal Notched forms. XRF dating of images suggest age 2600+800 cal BP, i.e. Newbury period, supported by other evidence. Period of elevated hunting and obsidian exploitation. Such points interpreted as dart points + butchering tools. Two anthros with attached points are female (pendant labia, birthing) [but just as likely these are phallic]. Possible Mother of the Animals + hunt fertility meaning of some other images. Shamanic, dream connections between sexual + weapon penetration.

Garnett, Justin

2010 An Experiment in Replication of an Intact Arkansas Bluff-Dweller Atlatl. The Atlatl 23(2):9-10.

[Harrington 1924] atlatl, in Mus of the Am Ind, new photos available allow replication. Probably expedient weapon made of soft wood. L = 51 cm, distal diam = 1.95 cm, hook raised 1.95 cm, so used 1 cm diam dart. Replicated using chert - scraper, saw, and hand drill, catalpa wood. Under an hour for an inexperienced stone tool user, suggests a quicky survival tool, so maybe the cross peg grip is not cultural norm but innovation - simpler than loops.

Garnett, Justin

0 2010 Revisiting the Aztec Double Spearthrower. The Atlatl 23(4): 15-16. Double thrower in Italy is intricately carved, may be ceremonial, but should not be assumed so. A reproduction throws 2 light darts at a time well, might be useful for hunting ducks where throwing at flock. [JG demo'd and I tried it at Osage 9/2010 - does work, but hard to single out specific target].

Garnett, Justino,x2011 The Tsegi Canyon Cave 2 or 3 Atlatl: Another "Truncated Handle" FormBasketmaker II Atlatl. *The Atlatl* 24(1):8. Or Electronic document athttp://basketmakeratlatl.com/?page_id=28accessed 3/10/2015

At Harvard Peabody Museum, exact provenience unknown. Assembled from fragments, [good drawing], length ca.54 cm, W 2.5 cm, T .9 cm. Raised spur, short heart shaped groove. Stone weight associated but attachment not visible. Loops missing, short handle proximal to finger grooves, too short to grip. Overall similar to Broken Roof Cave specimen.

Garnett, Justin x 2011 The Kinboko Canvon Burial Cave 1 Cist 10 atlat1 Electronic d

2011 The Kinboko Canyon, Burial Cave 1, Cist 10 atlatl. Electronic document <u>http://basketmakeratlatl.com/?page_id=173</u> accessed 3/10/15.

Description of find from Kidder and Guernsey 1919, their photos, Justin's measurements, photos of his careful replica

Garnett, Justin

2011 Experiments in the use of an early Lovelock atlatl and dart assemblage from Kramer Cave, Nevada (site 26WA196). Electronic document <u>http://basketmakeratlatl.com/?page_id=75</u> accessed 3/10/15.

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Importance of replicating entire systems. Here all fragmented so not a true set, but reconstructed. Integral hook form without finger loops. Info from Hattori 1982 and Milder 1974. Detailed reconstruction of atlatl and *Phragmites* darts, photos.

Garnett, Justin

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2011 Function of added weights in throwing dynamics of the "floating grip": Added weight as modifier of effective dart-spine. Electronic document, <u>http://basketmakeratlatl.com/?page_id=125</u> accessed 8/23/2018

Atlatl loosely held, without fingers on lower handle, leverage applied in final downward snap, speed of which depends on momentum of cast rather than action of stiff wrist. 'Truncated handle' atlatls like Broken Roof Cave or McClure can only be used this way. Weights counterbalance dart. In floating grip throws, dart may leave atlatl tail-down from premature release, due to dart resisting forward acceleration of atlatl and tipping it backwards. [Or just because not getting enough power in throw to flex dart?] Adding weight to atlatl maintains solid contact with dart, adds centrifugal force to 'stiffen' the

transition between hand and atlatl. Experimented with darts + atlatl based on White Dog Cave specimen. Unweighted throws looked like over-spined, weight allowed horizontal throw, heavy weight acted like underspined dart.

Garnett, Justin

2011 Experiments in the Use of an Early Lovelock Atlatl and Kramer Cave, Nevada (site 26WA196). Electronic document, <u>http://basketmakeratlatl.com/?page_id=75</u> accessed 3/10/15.

Garnett, Justin

2011 The art and science of willow coppicing. Electronic document <u>http://basketmakeratlatl.com/?page_id=113</u> accessed August 24, 2018

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Straight shoots for atlatl darts

Garnett, Justin

2012 What are atlatls. Electronic document, <u>http://basketmakeratlatl.com/?page_id=2</u> accessed 8/23/2018

Correct physical explanation as lever system.

Garnett, Justin

2012 The Broken Roof Cave, Cist 1 Atlatl. Electronic document, <u>http://basketmakeratlatl.com/?page_id=491</u> accessed 3/10/15.

Summary of site info, detailed drawing, measurements, description of specimen in Harvard Peabody Museum. Photos of careful replicas.

Garnett, Justin

2012 The Hyde Collection atlatl: A Basketmaker atlatl from Grand Gulch, Utah.

Electronic document http://basketmakeratlatl.com/?page_id=477 accessed 3/10/15.

From McLoyd and Graham, described by Pepper 1908, summary of his info, measurements.

Garnett, Justin

2012 Making a willow dart with stone tools (video) Electronic document <u>http://basketmakeratlatl.com/?page_id=113</u> accessed 3/10/15.

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Garnett, Justin

2012 Tularosa Cave, New Mexico: Fragmentary atlatls and darts from Tularosa Cave, NM. Electronic document <u>http://basketmakeratlatl.com/?page_id=458</u> accessed 3/10/15.

Summary of archaeol info, photos and measurements, from Martin et al. 1952

Garnett, Justin

2013 Atlatl: Old School Multitool. The Atlatl 26(3):1-3.

Basketmaker culture needed mobility. Their unweighted atlatl works as spindle and cord spool, some wrapped with extra cord, also ends work for pressure retouch.

Garnett, Justin

2014 A note about the artifact trade. Basketmakeratlatl.com front page. Electronic document, URL: <u>http://basketmakeratlatl.com/</u> accessed August 5, 2014.

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JG made a nice fake of distal frag BM atlatl, pleads for good ethics, don't purchase artifacts.

Garnett, Justin

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2014 Making California stone atlatl spurs. Basketmakeratlatl.com front page. Electronic document, URL: <u>http://basketmakeratlatl.com/</u> accessed August 5, 2014.

grinding small pebble to shape

Garnett, Justin

2014 Takedown Darts: Modern use and ancient context. The Atlatl 27(3):10-11.

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Advantages: easier transport, storage, easier to acquire and straighten short pieces of material, component replacement. Archaeological examples include the ice patch find near Yellowstone dated 10k BP

Garnett, Justin

2014 Are atlatl darts really springs? Youtube video accessed August 6, 2016: <u>https://www.youtube.com/watch?v=UvPFt9W-zTM</u>

Debunks Perkins' spring ideas. Shows multiple darts, do not spring and propel themselves off ground when flexed. Atlatl is a lever.

Garnett, Justin

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2015 Practical Atlatlry of the Four Corners: A Complete Guide to the Basketmaker Atlatl. Self-published, Kansas City.

Nice well-illustrated short book describing various SW atlatls, with clear instructions on how to make several variants of the grip system, and the rest of the gear too.

Garnett, Justin

2015 Experiments in fending atlatl darts with Basketmaker S-shaped sticks. Poster presented at 73rd Annual Meeting of the Plains Anthropological Association, Iowa City.

Garnett, Justin

2016 Atlatl Fishing: Crafting Spearthrower Tackle for Use on the Water. Self-published, Kansas City.

Nice short book with clear instructions on how to make atlatl and dart gear for fishing, how to use it. Lots of photos.

2016 Phenomenology of Atlatls as Combat Weapons. Paper presented at Missouri Archaeological Society Fall Symposium, Van Meter State Park, MO, October 1, 2016.

Account of experiments dodging and fending darts.

Garnett, Justin, and Devin Pettigrew

2011 A Unique Naturalistic Petroglyph of a Basketmaker Atlatl. The Atlatl 24(2):1-2.

Valley of Fire, NV. Atlatl length 63 cm, dart 131 cm, with fletching and curved as if in throwing. Life size. [outside usual range but comparable to Utah depictions - see Whittaker et al. 2008]

Garnett, Justin, and Devin Pettigrew

2012 Basketmakeratlatl.com: Exploring the Dart-Throwers of Native America. Webpage, <u>http://basketmakeratlatl.com/</u> Accessed August 24, 2018

Many articles mostly listed individually, also lots of pictures, commentary, links, other things not listed. Excellent resource.

Garnett, Justin, and Devin Pettigrew

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2017 Experiments with Basketmaker II atlatls as combat weapons. *Missouri Archaeologist* 78:11-26.

Atlatl basics, throwing motion described, requires lots of movement, potentially scaring game, but lots of hunting may have been in groups or persistence hunting, forms we understand less well. Atlatl use in warfare even less understood from vague Spanish and other accounts.

Experiments with blunted Basketmaker II type darts and atlatls, protective gear. Clubs and shields. Distance 10 yds; darts too easy to dodge at greater range. Atlatl darts much slower than arrows, ave in this experiment 40-60 mph, compared to arrows around 100 mph. Rate of fire very similar, ca 14 shots per minute for both. Model tests limited individual 'duel' or small group warfare, not massed, so rate of fire less important. Dodging allowed only 22% hit rate, shields reduced hits to 4%.

Arrows fly faster, are significantly harder to fend or dodge, and more ammo can be carried. Atlatls might be expected to work in individual 'ritual' combat where posturing is more important than killing, or in massed volleys in group warfare.

Garrod, Dorothy A. E.

1955 Palaeolithic Spear-Throwers. Proceedings of the Prehistoric Society 21:21-35.

66 specimens, Magdalenian, 2 or 3 complete, 6 antler part complete but intended to have wooden extension.

Most hooked (male type), 1 or 2 groove and hook, 1 doubtful female type.

Most (41) plain "stick" type of antler, 21 "weighted" by sculpture on a palm of the antler, which incorporates hook.

Horse most common motif (29), also reindeer, deer, bison, ibex, mammoth, birds, fish, feline, musk-ox, chamois. Shaft often curved so contacts spear only at hook and handle. Some carvings may serve as weight balancing spear. Complete specimens 28-34 cm long, but hole in proximal end may be for peg to hold on wooden handle, or wooden cross bar grip - now need experiments.

Brief individual descriptions, line drawings.

Gaudzinski-Windheuser, Sabine

2011 Hunting lesions in Pleistocene and Early Holocene Faunas. Paper presented at Multidisciplinary Scientific Approaches to the Study of Stone-Age Weaponry, Mainz, 19-22 September 2011.

"For most of our past, the hunting way of life determined our behavioural repertoire, but we actually know little about hunting strategies, techniques employed or social implications. The study of hunting lesions offers a perspective to approach this important topic. The paper presents direct evidence for hunting lesions in European Pleistocene faunas with reference to the Early Holocene. Results of experimental studies on indirect hunting lesions are referred against the archaeological context - why hunting lesions are only scarcely identified in Middle and Lower Palaeolithic faunas." Examples: Grotte du Bichon bear and hunter (Morel 1998), Stellmoor Germany Up Pal Ahrensburgian, lesions + flint tip arrow (Bratlund 1990). Um el Tlel (Boeda) damaged ass vertebra not convincing, taphonomic problems? [Others in audience strongly disagreed]. Boxgrove perforated horse scapula, round hole, 500 kya = heart shot with wooden spear. Problems with early stuff: lots carnivore activity, high rate of bone damage, equifinality of damage causes. Bone fragmentation from projectile experiments mimics marrow extraction.

Gaudzinski-Windheuser, Sabine

2011 Hunting lesions in Pleistocene and Early Holocene European bone assemblages and their implications for our knowledge on the use and timing of lithic projectile technology. In *Multidisciplinary Approaches to the Study of Stone-Age Weaponry*, edited by Radu Iovita and Katsuhiro Sano, pp. 77-100. Springer Science and Business Media, Dordrecht.

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Hunting lesions and embedded points on faunal bone. Middle and Lower Paleolithic evidence equivocal, including Boxgrove horse scapula perforation.

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Gay, Malcolm

2010 Like Great-Great-Great-(Etc.)-Grandpa Did It. *The New York Times*, September 25, 2010. Online version, URL:

http://www.nytimes.com/2010/09/26/us/26huntspearshort.html?emc=eta1 Reprinted <u>The Atlatl</u> 23(4):18.

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Focus on hunter Arron Hendershott of MO Dept of Conservation, and legalization for deer in MO. Quotes J Whittaker, R Madden, R Mertz, Gene Morris (spear hunter).

Gear, Kathleen O'Neal and W. Michael Gear 2004 *People of the Raven*. Tom Doherty Associates, New York.

Novel, imagining story of Kennewick man. Atlatls figure in story, but not detailed. Good story of warfare and morality with interesting characters as usual from the prolific Gears, but paleoindians were not organized like later NW tribes, nor do "Caucasoid" features of K skull mean other "Caucasian" traits as imagined.

Typically, they use the prologue to comment on archaeological politics. This time they re-imagine the Kennewick controversy - a Native American anthropologist attempts to study the skeleton, but is arrested for violating NAGPRA. They rather courageously point out the racist idiocy and unconstitutional imposing of religious views inherent in NAGPRA, and the law's effect of "geographic genocide... killing the history of a continent." Unfortunately they accept the discredited view that K represented a Caucasoid early population, which undermines their points.

Gear, W. Michael and Kathleen O'Neal Gear o

2005 People of the Moon. Tom Doherty Associates, New York.

Novel. Chaco is collapsing [ca 1150 AD] and its hegemony falling apart as the climate worsens and subject peoples can no longer support their rulers. At "Pinnacle Great House" (Chimney Rock Pueblo), the suppressed locals rebel against their Chacoan masters. [This is a vision of Chaco as a theocratic, fascistic state, enslaving local populations and suppressing dissent with warriors and cannibalism - plausible, though many archaeologists would disagree. Good story, a few chronological slips: the katsina cult is coming as a "heresy" - most evidence suggests not until after Chaco in the 1300s; the Chacoans use bows but their Moon People subjects use atlatls - no good evidence for such late survival of atlatls, see Whittaker 2008. But in the story, bows have advantage in war, except that atlatls have long heavy projectiles and can be used when the fingers are cold...]

Geertsma, Nicolas o 2008 Dutch Atlatl? *The Dart*, March 2008:13-14.

Red deer antler segment with hole like shaft-hole hammers but with no good hammer end and a small hook is proposed as possible atlatl hook. Photos, reconstruction. [Possible but not likely, and need dates.]

Gehlbach, D. R.

2002 Hourglass Bannerstones of the Mississippi Valley. *Indian Artifact Magazine* 21(3): 46-47, 79.

Brief, reviews function theories, describes, usually made of quartz, nice color photos, warns of fakes.

Gehlbach, D. R.

2004 Counter-Balanced Banded Slate Bannerstones. *Indian Artifact Magazine* 23 (4): 74-76.

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Ordovician slate easy to use, colorful. Probably more than atlatl weights – questions raised by "excessive weight, lack of balance, and material destruction." Symbolic, jewelry, status. Examples of "counter balanced" [he means symmetrical] winged forms, including prehistoric repairs.

Gehlbach, D. R. o 2008 Many Bannerstones are ... Curious Artifacts. *Indian Artifact Magazine* 27(2):6-7.

Mentions theories of use, photos of several types.

Gehlbach, D. R. o 2014 Bannerstones: Multi-Purpose Tools of the Archaic Indians. *Indian Artifact Magazine* 33(3):11-13.

Some are utilitarian forms, but most of exotic material are too nice and too fragile, suggests display and effigy purposes.

Geib, Phil R. o

1990 A Basketmaker II Wooden Tool Cache from Lower Glen Canyon. *Kiva* 55 (3): 265-277.

Donut Alcove (near Sand Dune Cave). Artifacts in pit. C14 2320 BP + 80 = 760-200 B.C. on piece of juniper bark matting. Digging stick, complete + frag of S-shaped "fending" stick. Frag has battering wear indicating re-use as rabbit stick, complete specimen (and comps) lack, so not originally used as rabbit sticks. Assoc elsewhere with atlatls, suggested use fending off darts "I can attest from personal experience" that it works. Disappear from BM sites with intro of bow and arrow, too fast to fend, in BM III.

Geib, Phil R. o

1996 The Early Agricultural Period: Transition to Farming. In *Glen Canyon Revisited*, edited by Phil R. Geib, pp. 53-77. University of Utah Press Anthropological Papers No.

119. Salt Lake City.

Early dates on SW corn, some from preceramic sites - maize not in northern Colorado Plateau until first centuries AD, up to 1000 yrs earlier southern CP, and Glen Canyon area fills gap, with southern part using maize by 300 BC, assoc with White Dog Phase Basketmaker II culture, northern part not until 100 AD, assoc with preceramic Fremont culture. So early farming BM intrusion in S, while terminal Archaic adaptation in N of GC, possibly with competition, territorial defense and markers, and warfare in BM sites.

BM and Elko series dart pts similar.but potentially distinguishable, side + corner notched forms. White Dog BM generally curvilinear lanceolate profile (see Sand Dune Cave Cache 1 pts), Elko straight edged, triangular. BM wide deep notches, tight bind to foreshaft, often break across notch, but that prevents foreshaft damage and leaves reworkable point.

Northern earlier bow and arrow represented by Rose Spring or Rosegate pts and arrow shafts at Cowboy Cave by 100-250 AD, but atlatl continues in southern, represented by many finds of dart pts, foreshafts and atlatls but lacking arrow pts in Basketmaker II sites. [The shafts at Cowboy are most important, but he says not directly dated - I consider points alone poor evidence.] Sunny Beaches site in center GC area, close to sites with BM remains has arrow pts early 1st mil AD. [They are small, but in form look sim to what he calls Sand Dune Cave pts (Archaic) - long ovoid to triang w wide side or corner notches]. Suggested atlatl = BM, early bow = ancestral Fremont, but other finds suggest arrow pts also assoc w Obelisk Grey (BM) pottery and turkeys. [So still not clear what's what.]

S-shaped fending sticks, photo of 2 from Donut Alcove, refs, suggest ritualized warfare.

Geib, Phil R.

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2002 Basketmaker II Horn Flakers and Dart Point Production: Technological Change at the Agricultural Transition. In *Traditions, Translations, and Technologies: Themes in Southwest Archaeology in the Year 2000*, S. H. Schlanger ed., pp. 272-306. University of Colorado, Boulder.

Experiments and microwear show that horn rod "gaming pieces" in Sand Dune Cave cache are actually knapping punches for manuf of dart pts. SDC cache included hafted and unfinished pts.

Geib, Phil R.

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2004 AMS Dating of a Basketmaker II Hunter's Bag (Cache 1) from Sand Dune Cave, Utah. *Kiva* 69(3):271-282.

A.D. cal 80-330, late BM II AMS dates on dog skin, prairie dog skin, and yucca fiber from bags. Cache includes dart points, some hafted on foreshafts, unfinished points, knapping tools including mt sheep horn punches.

Geib, Phil R. pdf

2011 Foragers and Farmers of the Northern Kayenta Region: Excavations Along the Navajo Mountain Road. University of Utah Press, Salt Lake City.

From Archaic to Pueblo, 33 sites along N16 in AZ and UT. Cultural chronology and overview. Chert types and sources.

Atlatl Rock Cave - shelter with oversized atlatl petroglyph [no picture], damaged by looters. Early Archaic, BM, and Pueblo occupations.

Mountainview - open site, transitional Basketmaker II - III, pithouse, midden, outdoor hearths. Six AMS corn dates 220-350 AD. Plain brownware pottery, arrow-sized points (early for BMIII) and one atlatl weight.

p. 281-284: Increasing evidence here and elsewhere that small arrow points indicating bow and arrow appear in some BMII sites in first centuries AD, prior to conventional date of BMIII around 500 AD. At Mtview, 3 finished pts 3-3.8 cm long, sequence of pressure flaked broken preforms for making arrow points. Also dart points and preforms made differently: by indirect percussion on larger blanks. From The Pits site, small stemmed/cornernotched arrow-sized pt from floor of pithouse, assoc with maize dated 160 BC-90 AD cal. But most of the late BM sites lack small points, have expected corner and side - notched dart forms. Pottery also appears patchily and earlier than expected: different groups adopted new technologies at own rate according to their own needs and calculations.

p 160 Obsidian hydration dates for Archaic sites worked very poorly, OHD not a reliable dating technique.

Geib, Phil R. x

2016 Basketmaker II Warfare and Fending Sticks in the North American Southwest. PhD dissertation, Anthropology Dept, University of New Mexico, Albuquerque.

Reviews evidence for violence in BM. Flattened sticks, often S-shaped and grooved, first reported by Guernsey 1916 and considered as rabbit sticks or fending sticks analogous to some used ethnographically in S. America, and depicted on images of warriors at Chichen Itza, where warriors carry also atlatls and darts; specimens recovered from Cenote there. Multiple lines of evidence of function: ethnography, experiments, usewear, osteological evidence of violence, rock art. Examined ca 500 specimens, C14 dates on 63. Some geographic patterning. Shift in function from light sticks to more like ethnog rabbit sticks, with more traces suggesting such use. But some show damage suggesting fending use. Experiments show fending is possible even at short range. Some ethnog S. Am. tribes engage in ritual duels with atlatl and fend with bundle of sticks. Suggest that similar ritual current in SW, some sticks used to fend, and may have been symbol of warrior status.

[But he immediately introduces and admits two enormous problems: 1. Fending is not efficient; stick not necessary, dodging works too, and you need 2 hands for atlatl use. 2. Rock art depictions show S-sticks and atlatls and possible duels, but not use of sticks.]

BM II defined: 800 BC-500 AD, 'formative' pattern of food production based on

maize + squash, small communities of only a few families. Part of transition from Late Archaic to Formative or Early Agricultural Period, LA with beginnings corn + small seeds but less, ca 2500 calBC-800 BC.

Chap 4 : BMII weapons reviewed. [Horrible term 'fire-type weapons' when he means projectiles.] Atlatl prob not used after 600 AD, but poss ritual signif or icon in art thereafter. Adoption of bow would have ended usefulness of sticks for fending. Atlatl darts from several sites, 1.3-1.7 m long. Foreshafts with or without stone pts, shows set from Desha Cave. Bunts of deer tibia, possibly useful for ritual fight. Stone arrow pts often differ between war and hunt use, no indication of such for atlatl dart points, though notching might provide weak point and breakage [not a good idea]. Wear often shows multiple uses. Points longer than necessary might have more leverage for snap, or introduce more infectious material in wound.

Bow usually not until AD 500, but poss as early as AD 200 in some areas, evidence reviewed, crits Sliva's Archaic Cienega phase 'arrow' pts: much earlier than surrounding, would imply independent invention, point size alone not good enough. Battle Cave burial with arrow in wound actually now dated to PI or BMIII.

Shock weapons rare tho impact wounds common. Most S sticks too light. A few 'baseball bat' type clubs, date poss BM to Pueblo. Large corner-notched knives, one btwn ribs of body in Cave 7, one in innom of another (figs). [I doubt stabbing force could do latter - javelin or dart more likely]. No good evidence of BM shields; round baskets have no handles, shields assoc in sites + art with Pueblo + bow.

Chap 5: BMII Conflict. Two massacre sites: Wetherill's Cave 7, and Morris's Battle Cave in C del Muerto. Cave 7 ca 89 individuals in several groups, redating by Coltrain et al suggest spread over long period, thus not single event. Geib + Hurst reanalysis and more dates show prob a massacre event involving mostly males, often w smashed faces, plus later burials of F + children and a few more killed warriors. Some of the dead have projectile wounds. BC has a cist with several individs, again more males, smashed faces but no projectile wounds.

Other evidence includes skull with embedded self-pointed foreshaft (Pepper 1905), unknown location in SE UT, another in Wetherill Grand Gulch Cave 21 collections with stone pt foreshaft. Both entered neck up into head, both have smashed faces. Clubbed skull from Red Canyon. Cut-in-Two Cave near Bullet Canyon, male cut in half and sewn, Wetherill reported atlatl point 'fell out' of him. Poss F w wounds from Green Mask. Others. Several mass burials, without evidence of violence. Trophies, including full head scalp from Kinboko Cave (Kidder + Guernsey 1919), prob M with long braided hair (F have cropped hair), painted, suspension loop, buried with young F, 385-200 BC. Scalps from near Moab also BMII age. Rock art depictions of such head-scalps [or heads]. Severed arms or legs. Human long-bone flute; flute players assoc with heads + atlatls at Sand Island petroglyphs.

Chapter 6: Fending analogs. Solomon Islands orig, but not good - hand-thrown spears, heavy fending/clubbing weapon. Amazon better, Kamayura of upper Xingu R area conduct duels, fend blunt darts with bundle of sticks. [Use Amazon type central-hole atlatl]. Chichen Itza 3 specimens of flat grooved stick, too light for club. Iconography shows in hands of warriors with atlatls, common part of 'warrior assemblage' but use in

battle scenes unclear, neither clubbing nor fending shown, possible throwing [most likely to me]. Some show shields on L arm too. Diego de Landa reports a possible dart throwing dance with fending [but no atlatl].

Experiment. Parallel expers by Garnett (2015) with similar findings. Equip made by LaRue. Willow darts with bunts + padding. Curved sticks work for fending, even at close range (11-15m) but shields would be more effective, dodging is also natural response. Visibility problems with flexing dart, side-arm throws. Fletched distal most visible but point is what you need to defend against. Fending sticks held consistently, got consistent damage on leading edge and adjacent faces in limited area. Concludes that fending not useful in warfare, but might be in duelling where danger and status displays were the real point.

Chapter 7: Hunting analogies. Ethnog rabbit sticks in SW, common to many tribes. Hopi, Zuni in detail. Flat, H wider + thinner than Z, both narrower grip without binding or resin knob. Use-wear of 19 ethnog sticks - embedded rock frags but not cactus spines, handling polish, damage to distal concave and proximal convex leading edges and faces, but environment of use affects damage. Experiments with S-sticks made by LaRue - rapid use-wear in gravelly envir.

Chapter 8: Analysis of prehist specimens. 'Flat curved sticks' including S-shape, C-shape, w/wo grooves. More than 500 in museum collections. All over W where dry preserves. Correo Shrine in NM had 234 specimens, Ceremonial Cave in TX at least 51, including 5 miniatures. Surprisingly rare in 4 Corners area comp to Chihuahuan Desert considering how many BM + later shelters have been excav. Whole more common than frag, suggest special disposal in BM area.

471 SW specimens incl 5 minis. Single bend most common, only 51 definite Sshaped + 29 poss. Heat bending to shape, LaRue experiments. Flattened x-sections but not airfoils. Fine finish common, more than likely for utilitarian tool. Most have 3-4 incised longitudinal grooves. Often grip wrapped with cord or hide, some to create knob. Sinew wraps common for reinforcement or repair. No wrist straps as suggested by K+G these impractical for throwing but might be present if used for fending. S-stick most common in BM II 4-corners area. Other forms show some geog diffs. Temporal change probable too.

Chapter 9: Functional analysis of prehist specimens. Wear types, embedded rock bits or cactus spines, insect or other feces. Use-wear correlated with embedded rock/spine. End crushing as expected from throwing common, more so on single-bend sticks (40-60%) than S-curved (20-30%). Overall evidence of throwing 57-75% for single-bends, 40-50% S.

Fending wear - couldn't use 'lethal darts'. Most fending produced wood-on-wood contacts, resulting in polish on edge facing opponent and on adjacent faces; also nicks, dents, gouges in edge toward opponent. One single-curve stick from Ceremonial Cave has penetrating damage to edge that penetrates one face causing split in other, consistent with stone point. 3 hafted pts from site, cal C14 dates on shafts AD 20-220, 400-210 BC, 1690-1530 BC and stick 1295-935 BC. [Note further consistent dates for atlatl dart points]. Stick also has sharp cuts on concave edge consistent w fending, but also embedded spines + throwing use-wear. Two S sticks from Correo show no throwing use

but have nicks on concave consistent with fending, one date 1430-1260 calBC, another from Doughnut Alcove in Glen Canyon. Overall 11% of sticks show poss fending; of these, 40-60% also show throwing, no diff between S and single-bend.

Chapter 10: Dating. 63 specimens, ranging almost 8000 BP - 855 BP [cal 7000 BC to 1200 AD in his graph]. Early Archaic (Ventana Cave, Hermit C, Frightful C) light, no throw wear, prob S. Mid Archaic also from S Desert sites like Ventana. Correo Site has 11 dates; S sticks early 1700-1000 BC, single curve later 900 BC - 400 AD. Percent sticks with throwing evidence increases through time in SW, so does Width. So shifting from S to C, heavier, more like ethnog rabbit sticks, simplification of handle, end of wraps and grooves.

BMII S-sticks - 4 direct dates, 4 assoc dates, 755-50 calBC. White Dog phase, WDCave specimens, two with mummy cist 2, Male, also w atlatl darts [so date for atlatl use too] 415-200 calBC. By BMIII using C sticks. Flat curved sticks earlier in S deserts, so could be N Mexican origin of some BM culture traits. S stick ended in S before Colorado Plateau use, with Correo specimens 1000 yrs earlier making a transition. Not really Mesoamerican - Chichen Itza etc are late derived C forms. By time bow replaced atlatl on Colo Plateau around 500 AD, flat curved sticks were like ethnog rabbit sticks, and as such continued in use in S too.

Chapter 11: Basketmaker Rock Art. BMII characteristic broad-shoulder static anthropomorphs. Early derived from Glen Canyon Linear, which underlies some. Assoc w depictions of material culture, also more active figures that might be later BMII or BMIII. But dating problems. Motivations could be 1. Reps of myth narratives, 2. Record of historic events/individs, 3. Rep trance and shamanic experience, 4. Document ownership + territory, 5. Assert status. Uses Wolf Man panel to show how all could apply, scoffs at stupid arguments on both sides around shamanic interps, seems to favor non-shamanic interps. [Does not ref Whittaker, Bryce, and LaRue 2008 or Bryce, Whittaker and LaRue 2013 discussions of violence in BM rock art]

S-stick depictions - some clear, with knob on grip. E.g. at Skewered Man panel [paired], but not in violence scene. Pairing - other sites, also in burial Cist 27 White Dog Cave, Chichen Itza portrayals. [Other things are also paired, seems a more general meaning implied in pairing.] John's Canyon single stick beside pair atlatl darts. Atlatl + 2 dart sets. Distinguishing images of atlatl from darts. Dart feather details - some pairs with one elaborated, one not. Original form of prayer stick? Details of atlatl/dart depend on scale and artistic license, e.g. holding position, large hook.

Violence. No 'war scenes' in prehistoric rock art, all are pairs, 'duels'. Examples: Chinle Wash, John's Canyon, Cedar Mesa, Bluff/San Juan R/Butler Wash. Butler - 3 Duels, each w paired combatants, multiple darts (misses?) and in hands, assoc w flute players and other figures, diff head gear, seem narrative. Bags - containing magic? Also mouth Butler, 3 more duels including pair of anthros leaning on crook-staves with dart in back [similar to our Lit Colo R Ogre petro?]Lobed circles assoc - pithouses, or scalps? Walker Creek (Skewered Man) [we interp as 'birdhead tracked and killed him'] assoc w hide bags, also S-sticks off to R. Chinle Wash (Impaled Neck) - corner notched pt shown, contrasts w side-n more typical BMII shown nearby = extra-local conflict? Canyon de Chelly pictograph - outside main area. Inverted individs = dead? Sheep and humans. [also lots of darted sheep as well as humans] Inverted humans some assoc with head skins [but not darted].

Chapter 12: Conclusions. BM2 S-sticks 'terminal manifestation' of such, no older than 400 BC, but in S deserts, 7000 BC, Correo Cave 1600 BC, so prob evidence that BM2 developed from intrusion from S. Fending: Solomon Island analog not very good, not practical in war, but S. Am. ritual duels better. Experiments show possible, expectable damage. BM2 violence well-documented, rock art shows duels but not Ssticks in use. Arch specimens show throwing damage, some poss dart impacts. Change thru time from S to C sticks, with more throwing use. Zuni ethnog associates rabbit stick with war, war god club. Perhaps in past 'bow priest' was 'atlatl priest' and atlatl duel was criteria for membership, stick badge of office. Correo shrine has 100s of darts assoc with sticks. War god shrine in suitable place for dueling; darts may represent later prayer sticks. Warfare more common and advantageous in agric societies. Ethnic diversity in BM2 promoting warfare. Massacre sites seem to be local pops, not BM farmers vs intruding foragers. Resource stress as possible motivation, periods of frequent drought, marginal agric. Prestige, mates, other personal benefits to competition.

Geib, Phil R. and Peter W. Bungart

1989 Implications of Early Bow Use in Glen Canyon. Utah Archaeology 2(1):32-47.

Usual view = Glen C occupied to AD 400 by Basketmaker II using atlatl, only in 7 C AD did BM III start bow and arrow. But - Sunny Beaches site etc have early b+a evidence (Rose Spring pts).

Suggest late Archaic/proto Fremont occup, using b+a earlier than any Anasazi, who stuck with atlatl, perhaps because intergroup competition prevented technological transfer. [but a handful of points is rather weak evidence for arrival of bow and arrow]

Geib, Phil R., Carrie C. Heitman, and Ronald C. D. Fields

2017 Continuity and change in Puebloan ritual practice: 3,800 years of shrine use in the North American Southwest. *American Antiquity* 82(2):353-373.

C14 dates from New Mexico Laguna War Shrine "Correo Snake Pit" aka *Wahaniak shukuk shtuitauw* reported by Parsons 1918, excav UNM field school 1949 (Sandberg 1950). Deep natural trap, atlatl darts (2000+), arrows (2000+), one atlatl, 'flat curved sticks' (112+), points, foreshafts, other artifacts reasonably well preserved. Dates back to almost 2000 BC, agric beginnings, with continuity of use and behavior – shrine associated with war priest/chiefs and offerings related to physical + spiritual protection, as well as rain/fertility etc. Atlatl darts and later arrows are original form of prayer stick. Flat curved sticks begin with S-shape, later single curve, assoc with war priest as 'club' or insignia, probably fending atlatl darts in ritual combat. [short version of some of the same arguments in Geib 2016 applied specifically to this context]

Geib, Phil R., and Winston B. Hurst

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2013 Should Dates Trump Context? Evaluation of the Cave 7 Skeletal Assemblage

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Radiocarbon Dates. Journal of Archaeological Science 40:2754-2770.

Wetherill excavations 1893 recognized "Basketmaker" culture older than Pueblo, many burials, considered "massacre." Coltrain et al. (2012) redate burials to suggest not a single massacre event. Partly correct, but not all their dates are good, some contextually same events (multiple burials) give divergent dates on different individuals. More dates + contextual evidence show at least 2 events: large burial (58) of mostly males with perimortem damage cal. AD 20-80 = massacre, plus adult female with 3 children. Missed by Coltrain: adult M with dart point in healed wound in vert, plus later head trauma (massacre), plus an adult F with point in back. Estimate 89 individuals, problems with Wetherill and Coltrain counts. 51% of those assessed for damage show trauma. Problems with Coltrain dates - context groups with disparate dates show cannot all be accurate.

Massacre of ca 35 mostly males implies attacking group much larger, thus from wide area - larger scale of social action than expected. Good atlatl warfare date: AD 20-80.

Geib, Phil R., and Kimberly Spur s

2000 The Basketmaker II-III Transition on the Rainbow Plateau. In *Foundations of Anasazi Culture: The Basketmaker-Pueblo Transition*. Paul F. Reed, ed., pp. 175-200. University of Utah Press, Salt Lake City.

UT/AZ border S of Glen Canyon. Sand Dune Cave dates on twined bag from Cache 1 with foreshafts and points should not be used to argue for BM II cultural survival after 700, other chronological issues on sites with BMIII dates but no pottery. Assoc of atlatl with BMII may be partly because BMII now seen as dating back to 1st mill BC; in later part in 1st centuries AD, some evidence of bow - mostly small points with unclear dating. At Mountainview site, 3 dates on maize AD 145-375, with arrow sized pts and preforms, as well as atlatl weight + dart points. Bows seem to arrive a bit before pottery. [Geib wants early bows. This suggests a logical transition point a bit earlier than usually suggested. Why, whence not discussed.] Maize, pottery, turkeys, bow all show variation in chronology of adoption - earlier than previously thought, but spotty, in a II-III transition in first centuries AD.

Geiselman, Kevin

2003 Atlatl From Outer Space. The Atlatl 16(3):1-2.

Fictional Klingon weapon "chetvl" appears to be based on atlatl, and preferred to bow against large or armored opponents. Atlatl with bannerstone resembles Klingon warship. [A nice example of why I don't take Hall's atlatl symbolism too seriously.]

Gibson, Mel (director)

2006 Apocalypto. (DVD 2007). Buena Vista Home Entertainment/Touchstone.

Lavish thriller set among pre-Columbian Maya. Young hero's village is raided for

sacrificial victims, he escapes and kills bad guys in extended chase through forest. The film got a lot of unfair p.c. criticism for showing the Maya as engaged in vicious wafare and sacrifice – plenty of evidence shows that they did both – and for not showing nicer aspects of Maya civilization – heck, it was a thriller.

Various weaponry featured: 1. Obsidian knives with carved handles - blades usually pretty crude looking, but in part of heart sacrifice scene, appears to be fine blade for a bit, but later same knife looks cruder. 2. A sort of macahuitl, which is really Aztec anyway, and here usually has an eccentric of some sort hafted as blade. Implausibly, victims are decapitated with a single blow of such a tool. 3. Self bows with long arrows. 4. Staff slings, probably unknown in the New World. 5. Atlatls - you never get a good look, but they look like highly decorated SW types with weight or fetish near grip, fairly flat and thin. Dart looks to be 5-6 feet, fletched, large stone point, shaft a bit thick, but seems to be flexing in flight. As in all films of early warfare, weapons are shown as absurdly effective when it suits the story - here a long distance, high angle throw hits a moving target.

On disk, the "Becoming Maya: Creating Apocalypto" extra has section on weapons. Done by Simon Atherton. Studio claims that they are "absolutely accurate historically... These are the weapons the Maya had. Here they are being used on screen for the first time..." Arrows and darts whizzing by hero are actually being tossed from a cart following him. A better macahuitl is shown, but the fake obsidian blades that form the edge have fake bifacial scars, rather than being real blades, and you can see that all the knives are crude facsimilies of flaked stone with vague flake scars. The other macahuitl forms were invented because they needed a weapon that could stun as well as kill. "Obsidian is a glass mineral. You would think the glass would shatter but it doesn't." Doubt he's tried the real thing.

Jungle scenes filmed in Catemaco, Mexico. City set built in Veracruz. Over 700 extras, some 250 make-up people etc - the scale of the enterprise was enormous. I wish Hollywood would hire me to recreate an ancient culture. Richard Hansen was the archaeologist consulting, see Hansen 2012.

Gill, Ryan

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2014 Are you shooting arrow heads or atlatl heads? Primitive Archer 21(6):35-40.

Smaller stone points are better, larger don't penetrate as well.

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Gill, Ryan

2018 Primitive elk: the long trail. *Primitive Archer* 26(3):28-37.2018 Promoting penetration with a smooth transition. *Primitive Archer* 26(3):45-49.

Idaho elk hunt with Osage bow and stone small triangular point. Hit too far back, elk still died next day and was recovered, penetration through to opposite rib. No info on bow weight or arrow weight. Second article has more pictures of similar point and hafting with pitch and sinew for smooth transition. P 44 is full page ad for Gill's Primitive Archery, showing Gill with atlatls and dart in 'I Kilt It' shot with wild pig.

Gilliland, Marion Spjut disk

1975 *The Material Culture of Key Marco, Florida*. University Presses of Florida, Gainesville.

Artifacts from F.H. Cushing's excavations in 1895-1896, described and illustrated with old photos, new photos, and water colors from expedition artist. Several atlatls and parts. One 32 cm x 2.2 cm, wood, central finger hole in handle, hook is tail of carved rabbit, handle turns down in carved volute like violin. At least three others with double finger holes, handles flared scoop shape. [Not adequately described, old photos not great either] See Cushing 1897.

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Gilliland, Marion Spjut

1989 Key Marco's Buried Treasure: Archaeology and Adventure in the Nineteenth Century. University of Florida Press, Gainesville.

Account of Cushing's Florida work compiled from documents, notably journals and letters of Cushing, Sawyer his illustrator, Gause his chief digger, and Mrs. Collier landowner's wife. Atlatls mentioned several times among the finds, but no details and it is never clear how many were actually found. C14 and pottery now suggest dates from 750-1513 AD. Atlatls thus a late "holdover" here used along with bow and arrow, continued in use until Calusa met Spanish.

Gilsen, Leland

2011 Miniature Atlatl. Bulletin of Primitive Technology 41:66-69.

Par-Tee site in Oregon has at least 23 bone atlatls [parts]. Photo shows 14 "whale bone atlatl handles" [which appear to be the proximal end, a flat paddle for fingers, with a very narrow neck above that might have integral loops or added loops - appears to imply split finger grip rather than usual northern form with hammer grip and finger hole.] "Miniature" is fragmented but essentially complete, whalebone, spatulate shape with paddle proximal end but thick grip [implying hammer grip?] groove the full length, and integral hook. About 21 cm long [from scale in photo] and .83-.56 thick. Bob Kitch made wooden replica, Jim Gnapp threw at ISAC target, felt comparable to his usual atlatl [not described, and his scores are poor, only 12 hits for 19 throws at 15 m.] Many harpoon pts also at site, short atlatl could be child's or for heavy harpoon.

Gjerdrum, T., P.L. Walker, and V. Andrushko

2003 Humeral Retroversion: An Activity Pattern Index in Prehistoric Southern California. *American Journal of Physical Anthropology* 36 (Supplement: Seventy-second Annual Meeting Program): 100-101.

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[Abstract of a poster, so limited info.] Measurement of angle of distal humerus in baseball pitchers' dominant arms compared to 28 Channel Island California Indians.

Prehistoric males show assymetry (R arm differs from L) and comparable to pitchers, but later Mission period (no atlatls) do not. A suite of features apparently relate to habitual throwing.

Gladfelter, H. Lee, James M. Kienzler, and Kenneth J. Koehler x

1983 Effects of Compound Bow Use on Deer Hunter Success and Crippling Rates in Iowa. *Wildlife Society Bulletin* 11(1): 7-12.

1976-1979 post-hunt surveys. Compound use increased from 32% of archers to 73%. Success rates increased with yrs hunting experience regardless of bow type, days hunted was less predictive. Unsuccessful archers 1.37 times as likely to cripple, odds of crippling increased with # days hunted.

Crippling rate and success rate slightly higher for compound hunters, e.g. 1979 16.8% compound, 14.8% recurve hunters crippled a deer. Over all, comps hunted 60.1 days per deer harvested, recurves 67.8 days per deer.

Gladwin, Harold S.

1937 Independent Invention versus Diffusion. American Antiquity 3(2):156-160.

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[Noted diffusionist defends his position.] Complex artifacts are only invented once, then spread by diffusion. Among examples he thinks prove cross-ocean contact he includes spear-thrower, boomerang or curved throwing stick, bull-roarer and scaffold burial as occurring in both Australia and Texas.

Gladwin, Harold S.

1947 Men Out of Asia. McGraw Hill Book Company, NY.

[Crackpot masterpiece - cleverly written with hilarious snide comments on academic world, caricatures of his opponents as "Dr. Phuderick Duddy" (probably largely A. V. Kidder), sly cartoons of prehistoric people. But the ideas are truly bizarre, extreme diffusionism, unpleasant and silly racial "types," misstatements of archaeological evidence along with a deep knowledge of same.] P. 72 Cartoon of caveman with atlatl facing stern rabbit. "Australoid" race of primitive men spread throughout world early on, as shown by distribution of spear-thrower, bull-roarer, etc, which could only have been invented once. Later "Mongoloids" replaced them in N. Am., bringing bow and arrow, side-notched points. Cartoon showing them overcoming a hairy, brow-ridged Australoid with bow and axe, another invention, the poor Australoid is heaving a boulder while his atlatl and dart lie on the ground. [His later prehistory gets worse and worse, with all kinds of trans-oceanic contacts to explain supposed similarities in the New World. Lack of any real archaeological evidence doesn't bother him. A smart guy gone loopy.]

Gladwin, Harold S.

1957 A History of the Ancient Southwest. Bond Wheelwright Company, Portland.

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[Many discredited diffusionist and racial ideas, other outdated material, odd even for its time]: Earliest Americans were not "Mongoloid" but more primitive "Australoid" people coming out of Asia, spreading S to Australia and New World, shown by physical traits, common use of spear-thrower, boomerang, bull-roarers, tooth mutilation. Earliest tools "eoliths" [most examples now considered natural]. Northern SW "Basketmakers" vs Southern "Cave Dwellers" [Mogollon] shared many traits including spear thrower. White Dog Cave specimens illustrated. [He likes atlatls as evidence of diffusion but doesn't actually say or know much about them.]

Glassow, Michael A.

1972 Changes in the Adaptations of Prehistoric Southestern Basketmakers: A Systems Perspective. In *Contemporary Archaeology: A Guide to Theory and Contributions*, edited by Mark P. Leone, pp. 289-302. Southern Illinois University Press, Carbondale.

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Discussion of systems theory, applied to SW case: Shift from BMII to BMIII = more depend on farming, add pottery, shift from atlatl to bow, all around AD400. Explained by migration or diffusion of ideas from Mogollon area. But a systemic approach considers internal elements. Population fluctuation and increase required new adaptation, leading to more efficient food production (agriculture) and processing and storage of such foods. But these required more field maintenance and building, putting stress on hunting which produced protein. Bow and arrow provided more efficient hunting, by advantage of ambush, expanding hunt to more thickly wooded land, and increasing the variety of smaller animals that could be effectively hunted.

Glover, J. P. x 1875 Curious Australian Implement. *Nature* 13:27.

1 paragraph letter + drawing of simple thrower for light reed spears

Godehardt, Erhard, Jerzy Jaworski, Peter Pieper, and Hans Schellenberg o 2007 The Reconstruction of Scythian Bows. In *The Cutting Edge: Studies in Ancient and Medieval Combat*, edited by Barry Molloy, pp. 112-133. Tempus, Stroud.

Composite bow info [poorly written] on manufacture and tests. Penetration studies using different points against Roman scutum shield (plywood construction with leather) and Persian shield (cane with leather): long oval points best, would break structure of shield after a few hits and cause wounds, bodkins next, 3-bladed did not penetrate well.

Gonzales Morales, Manuel R. and Lawrence Guy Strauss o

2009 Extraordinary Early Magdalenian Finds from El Mirón Cave, Cantabria, Spain. *Antiquity* 83:267-281.

Old excavs = large areas, so many finds but poor records. Modern = fewer finds, better documented. EMC - large cave, deposits Mid Pal to Medieval. Early (no harpoons)

Magdalenian levels 17-13,000 BP. Repeated residential occupations, ungulate + salmon bone, lithics, bone tools, hearths. Art finds: red deer scapula engraved with red deer and bovine, flat spatulate hooked object (15500 BP), slate plaque with horse image. Hook is probably spear thrower hook, made of antler cortex, ground flat with beveled end, some decorative line markings. 89 mm L, 18 W, 5 T. Comparable to other atl-atl hooks from Magd France (Cattelain 1988). Represents cultural continuity over wide area outside region.

González-Ruibal, A., A. Hernando, and G. Politis

2011 Ontology of the self and material culture: arrow-making among the Awá hunter–gatherers (Brazil). *Journal of Anthropological Archaeology* 30(1):1-16.

[Excellent article on symbology and place in society of bows and arrows – likely parallels to some atlatl cultures.] Long discussion of ontology, arguing that in such pre-modern societies, non-human (including non-animate) objects are conceived of as active agents and this view is so in-grained as to be what Boudieu calls 'doxa' – unquestioned and unthought reality.

Awá of the Brazilian Amazon forest, importance of hunting. Village of Juriti, nine men and four teenagers use bows and arrows versus four individuals who use shotguns, one of whom still uses bow and arrows from time to time. "Men spent much time every day making arrows and that they carried with them a large amount of arrows in hunting expeditions, well in excess of what was actually needed."

"Awá bows and arrows are much more than useful implements for hunting and, in older times, fighting. ... crucial in the making and maintaining of Awá male being. .. several facts that support this ontological perspective: 1) an enormous investment in time and energy is made in the fabrication of arrows; 2) the Awá produce an excessive amount of arrows, which go well beyond actual necessities; 3) there are significant structural relations between arrows and key themes of Awá culture; 4) there is an intimate relation between arrows and people, which is perceptible in the way arrows are made, used and discarded."

Slightly curved hardwood bows ca 1.6 m long. 4 types of arrow, 2 traditional and common: *u'iwa* has hooked tip [single barb on wooden point], used to kill birds, fish, monkeys, agouti. *Takwara* is blade-shaped [long narrow bamboo], used against larger game peccaries, tapir, jaguar. Others have midsize triangular wooden point, or metal point in foreshaft. [Figs show long arrows ca 4-5 feet, small fletching. Carried in large 'cumbersome' bundles of a dozen or more]. Possibly historical reduction of types. All composite: proximal shaft with fletching, distal with point, joined with string and resin. Smoked and straightened, decorated with blood, soot. Individualized by decoration and fletching and size related to stature (1.36-1.69 m long for *u'iwa*), immediately recognized by others. "*chaîne operatoire* of arrow-making is complex and demanding... no other artifact in Awá culture ... involves so many technical decisions, technical gestures and sensorimotor coordination." Arrow shafts of wood or Gynerium reed. Distal end socket drilled with drill between feet to hold point. Helical 2-feather fletching attached with string and resin. Bows and arrows formerly scraped with agouti teeth, now steel knives

p

and files. Arrow straightening by heating, biting, bending on head. Hunters possess from 20 to over 200 arrows. Often 4+ hrs per day on arrowmaking, boys eager to learn, absorbed in process. Men who have stopped making arrows devote similar time and energy to preparing cartridges. "They have extrapolated the technical gestures to the new technology and they adopt the same bodily gestures (such as sitting astride a bench or log) to clean, fill and assemble cartridges." Male activity, but a few women make bows, arrows, and hunt, or help make arrows for men. Always make more arrows than are actually used. Carry ave 6-20 arrows on hunt, even though only use a few and recover most of them. An 'economy of waste' – July-Aug 2007 most game taken with shotgun, but in 9 hunts, carried total of 402 arrows, only used 9, only killed 5 animals with arrows [but total 8 hits]. Clumsy to carry and damaged by carrying in bundle through forest. [Awa arrows are size of atlatl darts, so this applies: can in fact carry a lot of darts, but it's not easy] Some other ethnog groups carry lots arrows too.

Overproduction is part of manly identity – similar with Kimberly pts in Australia (Harrison 2004), where they became tourist items. Awa just discard excess arrows. "Structural relations of arrows" [= symbolism, meaning]. Always use dark feathers; colorful feathers are used in ritual and belong to spirit realm. One village outcast uses extralarge arrows and bows and colored feathers, does not observe some food taboos. Arrows are kept 'warm' and smoked by storage in roof. Smoking also part of manufacture, including for feathers. Those stored far from fire become 'dead' but can be revived by smoking. Spirit world is hot; fire, smoke, heat, are male things. Drilling socket is same 'technical gesture' used to make fire. A related group, Guarayu, make fire with arrow shaft as drill and bamboo head as hearth. Arrows also assoc with killing people, though Awa rarely fight. Use arrows, not shotguns in threatening loggers and other outsiders. Bow string also used to tie up penis, word for penis and bow same. [But they want to make it complicated]: "However, the ideas of "symbol of the self" and of things "standing for the self" imply a mediated relation with things and a metaphorical construction of reality, which do not properly account for the deep relation between person and artifact. Spears and arrows are no image or representation. They are not a displacement of the self, but an intimate part of the self. The relationship is ontological, not analogical."

P18 "In many cultures bows and arrows evolve through life together with persons their size, number and decoration changing as individuals grow, mature and get old (Pétréquin and Pétréquin 1990)." [Also] "other artifacts such as spears (Larick 1986; Harrison 2002, 2004), blowpipes (Rival 1996), scrapers (Bórmida 1973: 50-60) and sticks (Kassam and Megersa 1999) accompany the development of the self in many societies. Among the Awá, as in the case of other hunter-gatherers (Dawe 1997, Politis 1998),children start using miniature bows and arrows (splinters of Gynerium) as soon as they can walk. Interestingly, even those men who use shotguns still teach their children how to make and use the traditional weapons and, in occasions, children have to "kill" with bow and arrows a prey previously captured alive by their parents (FIGURE 14 [shows child doing this, looks like ca 6 yr old, very close, very small bow and stick arrows, if he actually killed the agouti, it was a long and painful process). Bodily intimacy of ethnographic weapons. For Awa, making arrows a sensory experience of all senses. Often carry an arrow or two when idle. [Reminds me very much of knapping, my own and other knappers' habits and feelings]. Not usually lent or exchanged within group, one observed instance buried with owner, all this different with shotguns which are not intimately connected to owners. Not made by owner, so ties not created. Broken arrows brought back to be discarded; hunting impacts or old age in storage usual cause of damage. Arrows belong in village and house, house and men linked by

hearth/fire/warmth [and cooking – they don't say if cooking is female activity, but presume so]. Bows and arrows are a 'technology of the self' [= symbolic identity], lead to perfection, purity harmony in Foucault terms, or P23 "lead to the well-being, self-awareness

and a sense of order and orientation of the person in the world." Two survivors of an exterminated group live in FUNAI village and do nothing but make arrows – had 1630 when visited.

As with Awa arrows, characteristics of 'technology of self' P22:

"1) It has preferably to be built by his or her owner.

2) Its fabrication, use and maintenance have to take time and require intellectual concentration and educated sensorimotor skills.

3) It must be recognized by others as personal (even inalienable) property.

4) It has to be individualized to a certain degree (that is, to be clearly distinguishable from similar items belonging to other people).

5) It has to be intimately tied to its owner (it might be often carried away with him or her, even when it is not used).

6) It must have a corporeal, prosthetic character, as an extension of the human body.

7) Its making and use must be frequent and imply routine: the repetition of the same acts is fundamental to the maintenance of ontological security and the continuity of being.

8) When the owner dies, it has to be buried with him or her or destroyed; it is not usually inherited or used by other persons after death."

Weaving could have been same for women, but with forced settlement in FUNAI villages and intro of manuf cloth, no longer weave – have lost status and identity.

"Routines" are strategies of self identity, manuf of arrows a 'routinization' – 'techs of self' [i.e. symbolic importance] of artifacts keeps obsolete technology like stone points going, espec in circumstances of culture contact and disruption.

Gordon, George B.

1916 The Double Axe and Some Other Symbols. *University of Pennsylvania Museum Journal* 7(1): 46-68.

cited by Holmes 1919 as suggesting banner stones represent northern American whale symbolism (quoted in full in Moorehead 1917).

Gotthardt, Ruth, G.W. Kuzyk, D.E. Russell, R. S. Farnell, P. G. Hare, and E. Blake

1999 In Pursuit of Prehistoric Caribou on Thandlat, Southern Yukon. Arctic 52 (2): 214-219.

1997 discovery of ice patches with caribou feces, dart or arrow shaft with C14 date 4360 B.P. \pm 50. Fletched w 2 split feathers lashed on w sinew, prox end missing, small, prob only 50 cm long [how could you tell, and that's too small for dart]. Size = arrow, but early date, atlatl not in S Yukon ethnog, but whip-slings using arrow or small dart and whip action of string attached to throwing stick are known for S. Tutchone + neighbor Tlingit. [but does anyone really hunt with them? Can you get any accuracy?]

Gould, Richard A.

1969 Yiwara: Foragers of the Australian Desert. Charles Scribner's Sons, New York.

[Personal, very readable, detailed and well-illustrated account of a year's ethnography 1966-67 among Yiwara, Gibson Desert of central Western Australia.] p77-81 spearthrower miru or langkuru description: Multi-functionality enhances portability of tool kits. "Elliptical-shaped wooden instrument, usually about 30" L and 4" W, with a knob of spinifex resin at one end for the handle and a small hardwood hook or spur fastened on at the other end with sinew." Often deeply concave, some decorated with complex incised designs. Usually chert or quartzite flake in spinifex. Rarely weighs over a pound. "...gives extra leverage to the cast of the spear." "It takes long practice to acquire skill with this weapon. One can hurl a spear as far as 100 yards.... but real accuracy is possible only up to about 120 feet. By this I mean that an Aborigine man who uses a sprthrower regularly can consistently hit a 2x2' target at this distance, usually by direct flight with the spear, but also at times, by bouncing or skimming the spear off the round so it rises into the target." He tells of his difficulties learning: poor accuracy, unhooking and dropping spear. "Considerable individual variation in technique when using this weapon. The grip on the handle is fairly uniform for everyone, but the left hand may grip the spearshaft, prop it up, or leave it alone, according to the preference of the individual. Some men lean back as they get ready to throw, raising their front foot whch they swing forward and bring down during the cast to give extra force, while others prefer a slightly crouching stance with the throwing arm doing most of the work." (79). [Reinforced with photos of 2 men throwing, also 'characteristic' grip - spear held across fingers by thumb, thrower flat, not sideways, though one each in the throwing photos.] Other functions: friction stick in fire-making, tray for mixing pigment and tobacco with ash, percussion instrument in ceremonies, scraping shovel, wood-working with stone flake in spinifex attached to handle. Sharpened with teeth or percussion. Used as plane or adze, only takes twice as long to shape wood as with metal tools.

p81 spearthrower a multipurpose tool, 'reminded me of a jackknife' with several blades, 'why call it a knife?' - spearthrower similar, "native terms do not emphasize one particular function over the others; instead, they denote the distinctive form of the object and imply all of its many functions as well."

p 83 casual stone tool use if no spearthrower handy, flakes, glass, discarded after use p 83-88 making spearthrower and spear, tied to intimate knowledge of resources, recounts collecting material. Repair of old, wife while collecting notices suitable mulga tree and tells husband. Like Deetz 'mental template' they saw sprthwr in tree, talked as if it existed already. Wedged out piece of wood. Constant noting and appraisal of resources. Spear shaft from *tjawu* Acacia sp, with long straight roots. Dug up, stripped of bark and trimmed, straightened over fire. Almost no speech, but teaching Gould by showing. p 10 - story of emu hunt, mulga wood spear snapped by force of throw as thrown. Cookery + diet: p 16-19, cook all meat regardless of size same way: in trench on back covered by coals for ca 50 min, so lizards well cooked, kangaroo essentially raw [photo of kanga in pit, feet sticking out]. Sharing rules, hunter may get little from his kill but prestige. Mashing cooked goanna with stones. Unbalanced diet, children with swollen bellies could be protein deficiency in this low-protein diet, or just larg amounts of roughage. Describes various veg foods, eaten raw as collected, brought to camp, some ground, mixed with water, and baked, a few dried for storage. "While it is common for Aboriginal women to prepare wild vegetable foods by grinding, baking, parching and in other ways, they cannot be said to have recipes of any kind." [i.e. no complex mixing of ingredients - compare to Auel's silly Neanderthal feasts]

Gould, Richard A.

x,p the Wes

1969 Subsistence behaviour among the Western Desert Aborigines of Australia. *Oceania* 39(4):253-274.

History of contact – explored 1870s on, government resettled abo pop into 1960s, often 100s miles from where their territory, until by 1967 "desert is almost totally depopulated now," and this isolation destroyed social networks necessary for successful bush life. Made it difficult to get quantified subsistence data from a few families still using bush around a couple stations, but getting some gov't rations. Locus of good hunting changes with season and year, meat availability determines movement and group size. But vegetal food always 50-80% of diet, particular staple plants in diff seasons. Compared to Kalahari, poor in quality and variety. Meat scarce too, extinction of some important species, intro of cat, mouse, rabbit which are now hunted. Insects count as meat. Meat preferred to veg food. Women gather and process most veg food, some eaten in bush but staples always brought to camp for processing and eating. Collect ca 10 lb veg food per day, eat ca 2.5-3 lb per person per day.

Ambush hunting from blinds near water holes, some at night for larger game. Stalking too. Use 'typical desert spearthrower and single-barbed spear 9 ft long.' "Experiments of mine at Warburton and Laverton showed to have max accurate range about 120'...a practiced individ consistently hits 2x2' target at this." Dogs kept away from hunt, not useful. Some storage of veg food, but usually not. No way to store meat.

Gould, Richard A. x,p

1970 Spears and Spear-Throwers of the Western Desert Aborigines of Australia. *American Museum Novitates* No. 2403: 1-42. American Museum of Natural History, New York. (Quotes and abstracts reprinted in *The Cast* Spring 2001:8-13.)

Dish-shaped slab mulga [an Acacia] wood, with resin lump hafting flake at handle, mulga male hook at distal end. Av. 30" long, 2.5-5" wide, av. 14 oz. ["woomera" type]

Boys learn to make by imitation starting very young, play non-competitive target games, at 10-12 fathers make good small set, by 14-16 circumcised, make own real set, but no formal instruction ever. All men make own sets, but some considered more skillful. Sharing common among kin.

Long composite or one-piece throwing spears of wood, with wood point and barb, av. 117 inches long, av. weight 18 oz [297 cm, 560 grams, long and enormously heavy by our standards], take 4-5 hrs work, straighten by heating and bending. Manufacture of spear and thrower with stone tools briefly described.

Men consistently hit 2x2' target at 110-130 feet [34-40 m, pretty good shooting with heavy spear], normal hunting distance some less, in 1966-67 majority of some groups used spear to hunt, and fight quarrels, trying to spear others' thigh. Use in social events to signify peace or hostility.

Functions beyond spearthrowing: 1. friction saw for firemaking 2. mixing tray, 3. work wood with adze flake in handle, 4. percussion music, 5. scraping/digging, 6. spirals, zig-zags etc designs = mnemonic map with sacred designs representing landscape features - so only men make or use decorated throwers or understand designs.

Individual variations in throwing style. Extra hook carried in septum of nose. Spinifex resin glue-making described.

Gould, Richard A.

1980 Living Archaeology. Cambridge University Press, Cambridge.

Briefly same info as in Gould 1970. Also: spear thrower replaced every 2 years or so, spears dry out, replaced about every 3 weeks. 1 adze flake lasts for final shaping of one spear thrower, or 2 spear shafts, plus other tasks, so man averages 23 adze flakes per year. Not usually used for butchering etc.

Gould, Russell T.

1987 A Possible Atlatl Weight from Northwestern Owyhee County, Idaho. *Idaho Archaeologist* 10(1):13-15.

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Isolated survey find, oblong boat shape with tapered ends.

Graham, Dale

2014 Elusive Crescentics. Mammoth Trumpet 29(4):17-20.

Widespread in W N. Am, Paleo + Archaic, disappear about 8000 yr ago. Work of Madonna Moss and Jon Erlandson: wetland context, a few assoc w bird bones in sites, ethnog similarities to bird spears and arrows [but very weak]. Mike Lenzi UNV Reno expers: "with refined dart designs and more experienced atlatlist I expect them to be fairly accurate" despite twists and irregularities. Intends atlatl test at bullseye for accuracy, then skimming on water [does that really work?]. Moss: bola weights? Could test [but apparently hasn't]. Beth Smith: not enough weight, sharp edges, often evidence that c's were made from reworked old pts.

Graham, Elizabeth

2009 There is no such thing as 'Human Sacrifice'. Mexicolore: Aztecs webpage. Accessed 2009, 6/27/2018. URL: <u>http://www.mexicolore.co.uk/aztecs/home/no-such-thing-as-human-sacrifice</u>

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[A pathetic pc attempt to claim Aztecs did not practice human sacrifice, but just killed men captured in war, so it was 'war' not sacrifice. Ridiculous sophism, and contrary to facts – lots of archaeological, textual, and pictorial evidence of sacrifice, including children, not just male captives. Followed by series of comments, many ignorantly agreeing and claiming that Aztec sacrificial practices are all exaggerated, a few including me, correcting the record, usually incorrectly rebuked by the site response. Mexicolore is a nice site, they shouldn't put up garbage like this, and they shouldn't defend it when people who know better correct it.]

Graham, Matt

2007 Observations with Primitive Hunting Tools. *Bulletin of Primitive Technology* 33: 73-78.

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Atlatl very accurate, hit squirrel 10 yds, good for fishing. Bow replaced because less movement to scare fast game like rabbit. Darts durable and harder to lose than arrow. Basketmaker style atlatl (diagram) with split finger grip, fingers not all way through holes or lose power.

Bow and hunting boomerang also discussed.

Gramly, Richard Michael

1984 Kill Sites, Killing Ground, and Fluted Points at the Vail Site. *Archaeology of Eastern North America* 12: 110-121.

Clovis points used on thrusting spears, not atlatl darts. Specimens less than 24-25 mm wide do not have ground basal edges, thus are unfinished and discarded because they were too narrow to fit haft. Thrusting spears should be about 25 mm diameter, but not much more; dart shafts much less, so Vail paleoindians using thrusting spears. [Unconvincing. See Hutchings 1997: shaft size should be reflected by flute, not point width.]

Gramly, Richard Michael

2016 Bowser Road Mastodon Site, Orange Co., New York: Freshly Butchered Remains vs Curated Remains. *The Atlatl* 29(3):5-11.

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Right to excavate bought from farmer at auction by amateurs who asked RMG to supervise. Clovis-age C14 dates. Many bones damaged, 3" axe cuts on some. Pelvis, vert, R hind leg missing. One tusk broken up for pulp ivory. Cobble hammerstones and flake tools of local materials, no points or bifaces. Bone tools include a large stemmed point, vert spine 'handles', flake tools of tusk ivory. 140 ivory 'blanks' made by snapping, flaking, grinding, show bag polish. Strontium analyses show ivory tools from different mastodon, though his bone is also different from his ivory. "possibly as many as 16 atlatls [of mastodon rib]...V-notch at distal end, 2 wide and open and could have been spanned by a cord that engaged a nock at the end of a dart; while the other two Vees are narrow and would only have accommodated a peg. We do have actual pegs that may have belonged to atlatls. Some of the atlatls are grooved or channeled for a dart; others have no channel at all. Two atlatls have a roughened patch along their center-line for attaching a weight; the others do not. The form of handle is highly variable -- there are at least four (4) handle varieties. The atlatls I have complete all appear to be 24-25 inches long. Intentionally broken into segments. ['Atlatls' hard to evaluate from the drawings. Photos of 'ivory blanks' - could be worked, but could they not equally be weathered natural frags? I'm dubious – why so many abandoned or sacrificed at kill? Why are they not more clearly atlatls? Why no stone points? What is this bone stemmed point?]

Grange, Roger

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1952 Wooden Artifacts, In *Mogollon Cultural Continuity and Change: The Stratigraphic Analysis of Tularosa and Cordova Caves*, by Paul. S. Martin, John Rinaldo, Elaine Bluhm, Hugh Cutler, and Roger Grange. Fieldiana: Anthropology 40: 331-451. Chicago Natural History Museum.

Atlatl used pre-pottery times through Georgetown Phase, with bow introduced during San Francisco Phase and increasing, with simultaneous use in SFP. But arrows possibly GP, Pine Lawn P, and pre-pottery, so maybe bow earlier, not really accepted until SFP. [Stratigraphy is problematic, so this may be mixing].

Six frags of SW type atlatls, all of oak, most pre-pottery: 3 distal ends w integral hook and groove, miniature prox end, larger prox end w notches but missing loops, one central frag. Plus 3 frags may be unfinished atlatls. Photos, measurements.

Mainshaft frags, all of willow: 2 central sections, 44, 49 cm L, 1.1 cm D; 2 distal end frags w sockets 1.1 cm diam, 4 cm deep; 7 prox ends w nock, taper to diam at nock .7 cm, nock depth .3-.6 cm. No fletching, but 2 w sinew lashing that could have held fletch.

Foreshafts: 8 slotted, of which 4 have stone pts, all Mt mahogany, L ranges from 6-20 cm, diam ca 1 cm, slots 1-1.5 deep. Four bunts, 1 pointed wood, several either broken or manuf discard, including a couple show groove + snap slot manuf. None decorated.

Some bow fragments, arrow shaft and foreshafts.

Grant, Campbell

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1968 *Rock Drawings of the Coso Range, Inyo County, California.* Maturango Museum Publication 4. China Lake, CA.

[Xerox excerpts only]. A "sheep cult" propitiating spirits of the most important game animal. Anthropomorphs with bows or atlatls. Pp 48-55: "sequence of hunting weapons": No evidence of Clovis atlatl. [Basic description and review of other archaeology ok], "held alongside the shoulder and in action provided an extra joint to the human arm as it lifted the spear high and forward on the thrust. Considerable accuracy and great force were possible at short ranges" (49). Three types from rock art depictions. 1: oldest + most common, hooked line with one or two large circles, apparently weights. 2: similar, but with single small loop at handle, 1-3 weights. 3: rare, more realistic, his 3 examples show hooked line with double finger loop, no weight, ditto with large weight, and broader unweighted with double loop and notched grip. [Weights? - not common in CA]

At Lovelock Cave, bow appeared 500 BC, supplanted atlatl ca 1BC, coming S from Asia, spreading into SW early centuries AD.

Only 3 areas N. Am. where atlatl in rock art: W Texas Pecos R., San Juan R drainage in SE Utah (2 recorded instances), desert ranges of SE California and S Nevada, espec Coso Range [we know a lot more now].

Made replica of Basketmaker atlatl and 5' darts. Longer distances achieved when 2 oz weight removed, but more thrust at close range; weights mostly for charms. Ten throws of 2.25 oz dart av. = 195', max 240'. From 50-75' "astonishingly accurate" [no details]. This is distance for sheep hunting from blinds to canyon floor where game passed.

Estimate bow arrived sometime after Lovelock Cave dates, so in pecked rock art, atlatl depictions 200 BC and earlier, transition period of atlatl + bow 200BC -300 AD, bow depictions 300AD to destruction of sheep bands + migration around 1000 AD. Hiatus, then painted rock art with bow around 1700-1900.

[Photos of some rock art, including a panel with many atlatls].

Grant, Campbell

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1978 Canyon de Chelly: Its People and Rock Art. University of Arizona Press, Tucson.

[In NE AZ, nice readable popular archaeology of important area with focus on an early rock art study.]

p 164 site CDM-214 Atlatl Cave has painting of atlatl "the only known representation of a weapon in C de Chelly BM rock art." [but later shows darted sheep, darted flute player, and possible dart that he dates "modified BM" and p 191 a panel with 2 darted sheep and BM figure w atlatl in hand, and others, including a clear atlatl he identifies p 194, and p 211 but which he dates to "Great Pueblo" on 194 - I think the stylistic distinctions do not produce clear chronology, and Grant failed to recognize lots of atlatl imagery] Turkey and other bird motifs so common in CdC he considers mostly "after BM" [but there are bird headed BM figures too, which he dates p 210 as modified BM and notes they associate with atlatl at Trail Creek in Glen Canyon and at Natural Bridges National Monument].

Grant, Campbell

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1978 The Occurrence of the Atlatl in Rock Art. *American Indian Rock Art* 5: 1-21. San Juan County Museum Association, Farmington.

Invention = "man's first efficient hunting weapon" much better against formidable prey such as 'wooly rhinosaurus' [a wonderful typo: apparently early man hunted the "noselizard"].

Upper Paleolithic antler atlatls may be models of full-scale wooden ones. p 6 difficulty of recognizing stylized atlatl depictions. World wide distrib, but atl only in rock art in N. Am., Australia, and one site in Mexico.

US 5 regions: Inyo Co, CA; S tip NV [Valley of Fire; are there others?]; 4-corners UT/AZ; S TX; SE MN. [Lists sites, illustrates examples. Finger loops and weights appear common all over] Only 4 examples in SE Utah, including Butler wash with 'medicine bag.' [We know a lot more now]. Good illustration of BM atlatl in use. Why are bows more common in rock art? Conservative traditions?

Grant, Campbell

1979 The Spear-Thrower from 15,000 Years Ago to the Present. *Pacific Coast Archaeological Society Quarterly* 15(1):1-17.

Nice summary, nothing new, emphasis on rock art, California and W US, several drawings, summarizes ethnographic evidence.

Grant experiments with Basketmaker replica: 200', accurate 30-50', weights give more power at close range, don't help distance.

Grayson, Charles E, Mary French, and Michael J. O'Brien o 2007 *Traditional Archery from Six Continents: The Charles E. Grayson Collection.* University of Missouri Press, Columbia.

[Nice photos, catalogue of selections from collection. Introductory essays rather general and bland, overall not enough info for price. No atlatls.]

Grayson, Donald K.

1993 *The Desert's Past: A Natural Prehistory of the Great Basin.* Smithsonian Institution Press, Washington D.C.

p251-253 point chronologies: Gatecliff + Elko points tipped atlatl darts, are earlier than Rosegate and Desert series points on arrows. Fig 9-7 shows two foreshafts with obsidian pts of indeterminate type hafted [with sinew lashing *over* the barbs as well as around stem.] Rosegate pts mark intro of bow and arrow in Great Basin, first in E (ca AD 300), later central and W (ca AD 700), so replaced atlatl by 1300 years ago.

Grayson, Donald K. and David J. Meltzer

2003 A Requiem for North American Overkill. *Journal of Archaeological Science* 30:585-593.

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Martin's model of Clovis extermination of Pleistocene fauna does not work because timing coincidence not as clear now, evidence of possible pre-Clovis, Americas were a continent, not an island where extinctions might be expected, mechanisms not clear, Old World megafauna survived humans for millenia but also died out at end Pleist. Martin's claim that we should expect no evidence of kill sites because overkill was too fast is non-scientific.

[Generally good but some problems in G + M arguments too: they claim only mammoth + mastodon assoc w Clovis in kill sites, while lots of human associations with many fauna in OW - but OW sites are actually habitation, not kill sites, so comparison is deceptive, and there are in fact other faunal associations in Clovis sites.]

Greaves, Russell D.

1997 Hunting and Multifunctional Use of Bows and Arrows: Ethnoarchaeology of Technological Organization among Pumé Hunters of Venezuela. In *Projectile Technology*, H. Knecht ed., pp. 287-320. Plenum, New York.

Green, John W.

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1966 A Preliminary Survey of the Atlatl Pictograph Site in the Sierra de Kilo, Chihuahua, Mexico. Transactions of the Second Regional Archeological Symposium for Southeastern New Mexico and Western Texas. *Midland Archeological Society, Special Bulletin* No. 1: 9-23.

Other atlatl images in Samalayuca Mts 20 m N of Sierra de Kilo (= Candelaria Mts). Arid L. and U. Sonoran zones. Red pigment, granite erosional shelters, 22 groups of pictos, figures w atlatls or darts most common. Often hold atlatl, sometimes engaged w dart in one hand, 2-4 darts in other. Atlatls may have weight. Darts fletched, barbed or triangular points, longer than humans. Sheep most common animal, some impaled by darts. Possible fending or rabbit stick [doesn't look like it to me]. Some superimpositions, no bows, little pottery, probably old but nothing to date. Nearby shelter with different pictos looted by his informant; small points found. [Illustrations show style very different from BM, but parallels in motifs].

Green, Nancy Rivest

2015 On the Brink of Shards. Moonlit Press, Williams AZ.

Novel, SW prehistory. Two stories eventually collide: Kaiya is a sweet young orphan apprenticed to a wise healer in Walnut Canyon [wrongly called Anasazi]. Drok is the scarred young priest whose promotion of human sacrifice at Tula (Toltec Mexico) is so extreme that he is expelled and wanders into the SW. He becomes obsessed with Kaiya and pursues her to his death; after wanderings through Hovenweep, Chaco, and the Grand Canyon she finds love and they return to the Keyhole Sink [Kaibab Nat'l Forest] to be healers. Not a terrible novel, but not very good either. Green's writing is not bad, and overall the story is pleasant, but sometimes annoying saccharine p.c. creeps in - the gay warrior finds acceptance and his true love, Kaiya's love interest is the blind boy who improbably has become the tribes healer and flintknapper, weepy brother reunions... Green's idea of prehistoric society is modern and capitalistic, not well-informed by current anthropology: traders come to sell their wares, there are markets and specialists who earn their living by crafts and have shops in the marketplace, Tula has a monetary system, Drok's father is a 19th century town drunk. Her understanding of the technology is off too: pottery making is a village festival that requires all hands, the Sinagua pottery is described in rapturous tones as painted with images of animals and nature [Sinagua pottery was not painted]. Kaiya has "pockets" and they make piki bread [not

attested until later] and lubricate the piki stone with watermelon seeds [ethnographically correct, but not present in prehistory]. The blind boy makes his tribe's arrowheads, and when Drok makes fire he "rapidly rubbed the fire sticks together, then twirled them in his small bowl filled with grasses and strips of bark. As the sparks flew out from the whirling sticks, wisps of smoke arose from the bottom of the bowl." And so on. Drok uses an atlatl, but it is just mentioned (208).

Greep, S. J.

1987 Lead sling-shot from Windridge Farm, St Albans, and the use of the sling by the Roman army in Britain. *Britannia* 18:183-200.

Metal detector finds, usually in small groups – *glandes*, US football-shaped lead sling shot. Generally 30-40 mm long, weigh 30-80 grams with most 40-50. Literature review, comparable specimens from other British sites, and Iron Age clay examples, distribution of types in Britain.

Grey, George

1841 Journals of Two Expeditions of Discovery In NorthWest and Western Australia, During the Years 1837, 38, and 39...With Observations On the Moral and Phyusical Condition of the Aboriginal Inhabitants... Boone, London.

cited in Akerman and McConvell as source of word 'woomera' and others

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Griffin, James B.

1983 The Midlands. In *Ancient North Americans*, Jesse D. Jennings ed., pp. 243-301. W. H. Freeman and Co., San Francisco.

p. 255: "bannerstones dissappeared, to be replaced by birdstones and boatstones during the Late Archaic and Early Woodland" He dates LA 4000-1000 BC, EW 1000-100 BC. [But MW Hopewell also has boatstones].

Griffin, Peni R.

2004 11,000 Years Lost. Amulet Books, New York.

Youth novel, generally well done. Eleven year old Esther is attracted to an archaeological dig, and accidentally zapped back to Clovis times where she is adopted by a group of mammoth hunters. The social life is plausibly portrayed and the technology follows current archaeological knowledge. Esther is an engaging character, who does the best she can with the limited knowledge of a child, although perhaps a little too astute about human relations. She knows that eventually the mammoths will be extinct and the world very different, troubling concepts to her new family, but she can't explain why, or what could be done about it. To Griffin's credit, she does not flinch from the "Ick, gross" aspects of Clovis life that Esther encounters, raw insects, spoiling meat, fleas and lice, sickness and death, while making the prehistoric families sympathetic and believable. Everyone carries

a Clovis point as spear or knife, and the men hunt with atlatls but these are not described in detail. The only real gaff is having Esther learn to knap without difficulty.

Grohsmeyer, Janeen

2017 Website Upgrades. The Atlatl 31(1):4.

New WAA webmaster, making site more accessible, paypal payment of dues, member section, posting past newsletters and other articles. Event calendar now sortable, online store, online community in development.

Grohsmeyer, Ryan J.

2016 Accurate measurements and implications of atlatl dart velocity, followed by a glimpse at Yukon atlatl darts. Paper presented at Missouri Archaeological Society Fall Symposium, Van Meter State Park, MO, October 1, 2016.

Through long span, proximal fletched end of darts is tapered as thin as possible to reduce oscillation.

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Grohsmeyer, Ryan J.

2017 An introduction to ancient darts from the Yukon, part 1. The Atlatl 30(2):1-3.

Hunters of caribou on ice, around 4580 years ago, lost darts and points spanning 8400-1200 years BP, now have ca 100 dart pieces, also arrows + bow frags, see articles by Hare. No atlatls yet. Practical hunting gear, not ritual. Variety of designs – multiple styles fletching, most darts "female" but one "male" for socketed atlatl. Birch darts split and carved, willow and spruce darts used saplings.

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Grohsmeyer, Ryan J.

2017 An introduction to ancient darts from the Yukon, part 2. The Atlatl 30(3):1-3.

Grosscup, G. L.

1960 The Culture History of Lovelock Cave, Nevada. University of California Archaeological Survey Reports No. 52. Berkeley.

Considers Great Basin atlatls like Lovelock to be "more like Eskimo atlatls than those of the Basket Makers." [Wrong]

Grund, Brigid

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2015 Learning curves and projectile weaponry: How a shift from atlatl to self bow exacerbates social disparity. Poster presented at 73rd Annual Plains Anthropological Conference, Iowa City, IA, October 2015.

Argues that atlatls are easier than bows to learn, and thus children and women may be incorporated in hunting subsistence and more egalitarian society before transition to bow.

[Contrary to all experience. Based on a poor statistical treatment of ISAC scores and SCA archery scores. See Whittaker 2013].

Grund, Brigid

x, p

2017 Behavioral Ecology, Technology, and the Organization of Labor: How a Shift from Spear Thrower to Self Bow Exacerbates Social Disparities. *American Anthropologist* 119(1):104–119.

Shift from bow to atlatl usually explained as greater efficiency in hunting, espec smaller game, and in warfare, but first must understand performance characteristics of weapons, here, "learnability." technological change. "Pseudo-experimental" [a poor term] data from World Atlatl Association International Standard Accuracy Contest (ISAC); archers in Society for Creative Anachronism Inter-Kingdom Archery Competition (IKAC). Is maximum atlatl or bow skill approached more rapidly within a large sample size of users? (SCA 2015a; WAA 2015).

Bows may have more versatile 'application space' and are assumed to be superior in many ways, but why not adopted everywhere, e.g. Arctic Small Tool Tradition used for 3000 yrs [maybe] before spread to rest of continent. Juveniles usually begin hunting skill learning early, on low-ranked resources. "Scholars generally imply that atlatls can be used effectively by young juveniles, perhaps between 6 and 12 years old (Cattelain 1997; Whittaker and Kamp 2006, 220), but this is based on pseudo-experimental rather than ethnographic data. Informal reports from contemporary atlatl users also suggest that juveniles as young as 7 years old are sometimes capable of killing deer with this weapon (Crable 2007). Ethnographic evidence from bow-hunting cultures suggests that bows are generally not used to take down highly ranked prey until juveniles possess the strength and dexterity required to shoot adult-sized weapons, perhaps around age 10-15, though children often begin practicing with smaller, weaker bows at much younger ages, targeting low-ranked prey such as small mammals and birds (Blurton Jones and Marlowe 2001, 217; Cattelain 1997; MacDonald 2007, 294; Walker et al. 2001, 642)." [So she wants to use this to show that atlatl use begins at younger ages - completely ignoring what she said earlier about all bows and all atlatls not being the same, and seems to be ignorant of the far more common accounts of kids killing deer with bows.]

Throwing ability developed by age 10 but continues to grow, so motor skills should allow projectile weapon use by 10. "Therefore, between atlatls and bows, the weapon that requires less strength and/or dexterity to wield effectively will be more accessible to younger juveniles than the other."

In W and Asian cultures, males better at throwing than females, though don't know if biological or cultural reasons. Narrower difference in Australia, reports of women hunting kangaroo with guns, but not with atlatls, targeted smaller game, perhaps male bias in reporting. Slight evidence of women using atlatls - Indian knoll, W+K 'pseudoexperimental' data. Ethnog archery dominated by men, although Agta women hunt. Modern sport archery likewise. "At present, contemporary data suggest that a sex gap in strength, dexterity, and ballistic skill exists." So again, easier weapon would increase potential hunters if females could use. Whittaker 2013 is only previous quantitative comparison [not true, see Cattelain and Bettinger articles]. Whittaker doesn't show bow easier; compared Feltovich scores sample of one, already atlatl experienced, modern recurve rather than self bow [irrelevant, she doesn't know bows], short term bow curve, atlatl not learning curve [true enough, but the point is that after long atlatl use she was not as accurate as after short bow use, which Grund completely ignores].

Methods: 8 yrs of ISAC, and from SCA (IKAC), which allows long + recurve but not compound bows, 'pre-17th century" forms. IKAC includes timed shooting, so accuracy plus speed, but "This analysis operates under the assumption that each competition adequately measures atlatl or bow proficiency in a manner appropriate to each weapon's unique application space. Rapid reload rate is considered an advantage of hunting with bow technology but is presumably not a limiting performance characteristic of atlatl hunting." [not clear what she means by this, it is just an excuse for comparing incomparable data]. 'Leisurely' learning contexts may mean that industrial and subsistence learning curves will differ. [Then she builds learning curves, but not an honest statistical comparison – she has very small samples, especially because SCA archers drop out of her sample quickly. She fails to clean the data, so there are many duplicate names treated as different individuals. I keep the ISAC scores, and to use them requires enormous cleaning effort. See Breslawski et al. 2017, and Whittaker and Kamp 2006. The IKAC stuff is far worse, really horrible data, inconsistently recorded and probably uncleanable. She uses different curves to compare the two data sets, exaggerating their differences.]

[This is a truly bad paper – no one with experience with the two weapons would come to this conclusion. Grund has no real practical understanding of atlatls and bows. She may have tried them, but has never been recorded in any of the ISAC competitions she analyses. She uses bad ethnographic comparisons and worse statistical analysis of 'learning curves' from poor data. Unfortunately, AA apparently could not find competent reviewers to critique it.]

Grund, Brigid S.

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2017 Stringing Bows on a Processual Powder Train: Coevolutionary Relationships among Environment, Technology, and the Organization of Labor. Unpublished Ph.D. dissertation, Department of Anthropology, University of Wyoming.

[The dissertation from which the published nonsense (2017) comes. Includes two other studies.]

From abstract: "In the first of my three studies on the shift from atlatl to bow technology, I construct bow and atlatl learning curves from modern, pseudoexperimental data. The results of this quantitative analysis suggest that atlatls are easier to learn how to use than bows and can be wielded effectively by wider segments of human populations. This finding implies that this shift in projectile weaponry may have exacerbated emergent divisions of labor in prehistoric societies, and also suggests the possibility that differences in prehistoric population structures may have influenced the (poorly dated) timing of this transition in various locations across the globe.

In my second study, I hone in on a region in northwestern Canada as a spatiotemporal test case, since this area currently contains the largest published database of atlatl and bow radiocarbon dates in the world. I establish a new statistical procedure using Monte Carlo, Bayesian, and radiocarbon calibration methods to calculate the minimum number of dates required on atlatl and bow technology to adequately characterize this transition. I also develop a second procedure for determining whether bow and atlatl technologies overlapped for a significant amount of time in prehistory, and for calculating how long they overlapped.

In my third study, I test whether spatiotemporal patterning occurs in atlatl and bow radiocarbon dates across the northwest Canadian Subarctic. The data most likely exhibit east-to-west spatial patterning in the appearance of bow technology, a tentative result that does not support the hypothesis that bows entered the study area by simple cultural diffusion from Siberia.

In light of these findings, I present several working hypotheses to explain why the transition from simpler atlatl to more complex bow technology occurred in the northwestern North American Subarctic, and suggest that this topic provides an exemplary case study for testing what causes fluctuations in the complexity of material culture in general.

Guernsey, E. Y. o x

1940 The Problem of the Atlatl. *Proceedings of the Indiana Academy of Science*, Vol 49:17-21.

"additional lever or toggle-joint by means of which combination the propulsive force applied to the spearshaft is greatly increased." "We have scratched the surface of an intriguing field of research....and prolific literature." [Already! and mentions experiments personal? - but no descriptions]. Problems: origins, symbolic significance. Green River sites, Webb's conclusions about bannerstones (he regards as poor analogy to Guernsey + Kidders SW atlatls which had only small "charms" attached). Lists Moore's objections to Webb, notes many "hooks" too fragile for atlatl parts, many points would require too heavy a shaft. Also unlikely to be atlatls because occur in juvenile + female burials. Also antler hooks much more restricted distribution than bannerstones. [None of these are good arguments.]

Guernsey, Samuel James

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1931 *Explorations in Northeastern Arizona: Report on the Archaeological Fieldwork of 1920-1923.* Papers of the Peabody Museum of American Archaeology and Ethnology, Harvard University 12(1). Peabody Museum, Cambridge.

Work continued from Guernsey + Kidder 1921 in Kayenta area, Segi [Tsegi] Canyon etc. P 38, Broken Roof Cave, adult M in slab cist with 4 infants, atlatl, 3 foreshafts w stone

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pts, 7 coiled baskets, 2 twined bags, skin bags, 1 w paint, pair sandals. P 39 Amsden's later work another cist, adult M w 2 infants, goods including 4 digging sticks, 7 coiled baskets, 8 sandals, 2 foreshafts w points, broken atlatl dart shaft, stone knife w wooden handle, 2 pts, 2 flaking horn punches, 2 pipes, etc. Basketmaker II.

P 73, plate 48, foreshafts from Cists 1 + 2 w stone pts attached w sinew, 3.75-6 inches. P 71, Plate 50 complete atlatl Cist 1 Broken Roof Cave, 3 views. Very thin slat, curved, elaborate loops of 3 ply folded skin w sinew lashing + sewing, 1 weight + nut lashed on at grip and 1 wt past mid shaft. Oak, 21" long, spur and groove, "beautifully finished". Second atlatl from disturbed burial in Cave 3 shrunken, missing part of proximal, orig 22" long, spur + groove w decorative ridge, missing grips, marks for binding on weight, 2 loaf-shaped stone wts in assoc.

Guernsey, Samuel J. and Alfred V. Kidder

1921 Basket-Maker Caves of Northeastern Arizona: Report on the Explorations 1916-1917. Papers of the Peabody Museum of American Archaeology and Ethnology, Harvard University, 8 (2). Cambridge.

Caves including Sunflower Cave on South Comb (early evidence of stratigraphic difference between Basketmaker and Pueblo), Goat Cave, White Dog Cave. White Dog: p 16 atlatl in cist under female burial in cist 24. In cist 27, 2 males with broken up dart shafts and grooved club on bottom of cist. In Cave 6, south Comb, in disturbed cist, frags of adult and child, atlatl, grooved club. In WD, two dog mummies of diff breeds, collie-like long haired, and terrier like smaller short haired black and white. Atlatls, White Dog C: 1) complete but snapped, oak, 25 inches, up surface flat, under convex, integral hook in very short groove, notches, fingerloops of folded dressed hide. Three small stone weights of fossil mammoth tooth [really?] on underside close to handle. 2) complete, warped, smaller hook, longer shallow groove, 23.5 inches, grooves, simpler skin loops, small chipped stone weight. 3) fragment, with finger grooves and 3 attached weights, one a chipped stone pt, but signs of reuse as paho or ? 4) distal frag with hook and groove 5) prox frag with finger notches but missing loops and weights. Darts -3complete mainshafts broken to fit in graves, 52.5, 55, 1nd 55.5 inches. Straight slender branches of light wood with pithy center. Distal end drilled socket to fit foreshaft, reinforced w sinew wrap, proximal cup also wrapped. Fletched w 3 feathers trimmed but not split [odd], 7.5 inches long. Painted décor. Other frags reused as pins and handle of compound pressure flaker. Five foreshafts w points, tapered prox, slotted distal. Lengths 5.5-6.75 inches w points, 4.1-4.8 without, diam ca .5 inch. One bunt. Points are side or corner notched. Caches w burial in Sayodneechee cave and skin bag in WDC. Grooved club ["fending sticks"] assoc w atl or related gear.

Guilaine, Jean and Jean Zammit

2005 *The Origins of War: Violence in Prehistory*, translated by Melanie Hersey. Blackwell, Oxford.

"Throwing stick" introduced, poorly described p 62. . [Either the original writing or the
translation is horrible throughout.] Origins in Upper Paleolithic, replaced by bow near end Up. Pal. Lots info on European projectile injuries, later than atlatl.

Guthrie, R. Dale

2002 Paleolithic Atlatl Weights and Their Decoration: How Function Affects Fancy. *Anthropological Papers of the University of Alaska* 2(1):137-154.

[Interesting and involved, but relies too much on faulty ideas about atlatl and dart dynamics and ambiguous art.]

Typical atlatl has grip which often secures finger + thumb, shaft, hook, and often weight. Upper Paleolithic antler atlatl weights [with hooks] preserved. Semi-circular antler pieces as possible finger loops. Two depictions of atlatls show cross bars (La Madeleine engraved antler, Lascaux wounded bison scene.) [Both are plausible although other interps possible; the LM engraving shows human with "atlatl" carried over shoulder.] Depictions of fletched darts too. Weights smooth throw, store spring energy, and help tune flex of atlatl to spine of dart, tuning important [he relies on Vanderhoek, and too much on Perkin's incorrect ideas]. Atlatls more decorated than other more expendable antler tools like harpoon pts. Throwing flexible spear by finger grip pushing from rear is predecessor of atlatl with some of same spring advantage [Cushing idea, and not really effective]. Throwing uses complex lever system, with wrist as weak but fast part adding critical velocity, and atlatl also increases length of time force is applied to projectile. [He wants to combine all the theories!]

Atlatl slowly adopted because light thin projectile is counter-intuitive, and because accuracy is hard to learn. Beginning as a child helps, and children's play is source of innovations.

Weight at distal end increases velocity by flexing the atlatl further [not true]. Most breaks occur just proximal to weight/hook at thinnest, most flexed point. In Holocene compromised by fixing weight part way down shaft, where it could be adjusted for tuning. [He shows a N. Am. form.]

Atlatls usually depict game animals. Shaft straighteners similar, but also phalluses + nude females, + fish, but no mammoths or rhinos. So atlatls perhaps not used for fishing and more publicly visible. Both show male concern with hunting.

The famous "faune aux oisseau" atlatl hooks [with ibex kid looking backward] show development of a motif. Localized, more stereotyped than other images, odd position with feces + bird, young animal rather than the usual adult, smaller size than usual. [Demoulin calls these chamois rather than ibex and argues that it is a birth scene, not defecation. Guthrie's drawings make it look like defecation and he even feels he can identify bird on turd as woodpecker]. Design factors: horns etc are fragile, deleted by showing young animal, turning head eliminates weak neck, feces used as hook instead of weak tail. Feces + bird give ibex something humorous to look at. Some complete specimens show 25 cm long with hole for thong - so too short for adult. [Demoulin and Stodiek reconstruct these more plausibly as attached to wooden shaft.]

Projectile point design - too heavy makes shaft flex too much. Relatively small osseous points with glued on microliths. Sharpening of a Clovis pt could be balanced by

thinning shaft to maintain tuning. [He makes way too much of "tuning" – the effect of resharpening a point is negligible].

Guthrie, R. Dale

2005 The Nature of Paleolithic Art. University of Chicago Press, Chicago.

[Elaborate and wide-ranging book with many interesting and original ideas, innumerable drawn illustrations, some too small.] Paleolithic art incorporates detailed ethological information from close observation of animals. Influenced by social status and sex of artists - lots of male oriented "testosterone events," sexuality, etc. Many images by undeveloped artists = young people. [Often disputable over-interpretation of indistinct and ambiguous images - e.g. is a crude drawing unskilled, stylized, hasty, etc.]

[Atlatl info essentially the same as 2002 - some good ideas but misunderstandings of how atlatls work.] Bows not depicted in Paleolithic art - probably not present. Atlatls rare - two depictions, both with cross-bar grips. Fletched darts common, wounds and spear/darts in animals very common.

Guthrie, Russell

2007 Deer Kill with Atlatl Nov 10, 2007. Youtube video posting, URL: www.youtube.com/watch?v=uaEWhGHfCJA accessed 12/30/07.

[See Crable 2007. Private preserve, 15 yards hit by 7 year old boy. Video posted on youtube attacked by PETA et al. antihunters and hunters who feared bad rep, but looks like a clean kill.]

Video shows boy throwing, deer hit, apparently it ran "15 steps", but then shows steel broadhead on wooden dart went clean through, both lungs hit, dart broken in deer running, apparently two other shots to finish it off. Good shots of cleaned carcass to show wound. Equipment looks to be Thunderbird Atlatl model with dart rest, wooden darts.

Gutierrez, Hector

1995 Record-breaking Hurler Really Puts Spear In Gear. *Rocky Mountain News* July 16, 1995.

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Engvall record with modern gear 848' 6 5/8".

Haagen, Claudia

1994 Bush Toys: Aboriginal Children at Play. Aboriginal Studies Press, Canberra.

Study of museum specimens. Numerous short quotations from old sources supporting info. Lots mention of toy bow and arrows [which were not present precontact], shooting grass darts with fingers to impale flies, play with toy weapons as training in needed skillls. Spears and spear games account for large portion of games described by early explorers (mostly men) from every region of Australia. Light spears made from a flowering 'vine', straightened over fire, reeds or grass stems as casual play spears. Mock fights; tips of spears sometimes padded but not always. Composite spears made by adults for boys ca age 10, or by boys themselves. Photo, 1928 small boy about 6 with 3 long composite spears and Queensland type spearthrower. Dodging, parrying, group fights, bark disks and other targets - but most accounts describe hand-thrown spears. Spearthrowers include about 26 in museum collections; ad hoc branch ones, also miniatures of adult forms made by boys or by adults. [no good pictures or info on types, several brief quotes but not much info.]

Hackett, Cecil J.

1937 Man and Nature in Central Australia. The Geographical Magazine 4(4):287-304.

Laments destructive effects of railroad (epidemics) and overstocking (destroying vegetation) and pleads for common humanity of Janjundjadjara and Pitkandjara people. Exped with Tindale. Men armed with spear thrower and one or two spears, women carry digging sticks. Spears of tecoma bush shoot with hardwood point, 8' long, .75-.885" thick. "Almost every time a spear is thrown it is necessary to resharpen the point or remount the head." Trough-shaped desert form spearthrower with gum and stone flake at handle. Photo of manufacture with stone flake in handle as adze. Photos of game (cats, rabbits, lizard, grub, kangaroo, and men with spears + throwers. Thrower used as fire-saw. p. 299: boys play various spear games, as reach puberty, "takes to himself a spear and thrower, forsaking the women and following the men in the hunt, he is marked for initiation."

Haddon, Alfred C.

1912 Reports of the Cambridge Anthropological Expedition to Torres Straits, volume IV, Arts and Crafts. Cambridge University Press, Cambridge.

Papua New Guinea. Pages 196-198. Spears and throwers obtained from Cape York, Australia, and preferred to bow and arrow as "more formidable weapon" and more accurate. Competition observed: "The mark was a tree stump 125 mm (5 inches) in diameter, and the distance was about 40 paces (27.5 m). I reckon that about 10% of the javelins struck the stump, some being hurled with such force that the points projected through on the other side. The greatest distance thrown was about 100 paces (about 98 m)."

Spears ("javelins") for throwers were about 9 foot, compound shaft, bone or wood points. Throwing stick of Queensland type: rigid slat, shell handle, wood spur, 915 mm long.

Haederle, Michael

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2010 Gobal Warming: The Archaeological Frontier. *Miller-McCune Magazine*, October 20, 2010. Electronic document, URL: <u>http://www.miller-mccune.com/science-</u>environment/global-warming-the-archaeological-frontier-23704/

N. Am. ice patch research by James Dixon, Craig Lee, Greg Hare and others. Dart foreshafts from Yukon photo. Dixon has dart foreshafts and arrow parts up to 3000 yrs old from Alaska ice patches, pursuing his theories of coastal route for human entry to N. Am.

with remote controlled sub off AL coast. CL has 10,300 yr old dart foreshaft from near Yellowstone. Exposure of ancient materials as ice melts as evidence of global warming.

Hale, Fraser x

1974 It's An Atlatl Of Course. St. Petersburg Times.

Clipping and 2 original archive photos offered for sale on ebay, 8/1/11 and 8/22/2012. Dr. Harlan Metcalf (dept of recreational education at SUNY, ret.) + friend demonstrating atlatl. One paragraph brief description. One photo shows atlatl flip, and dart flex, other his long single-hole atlatl. [demonstrates that flexible darts were in use 1974, not intro'd by Perkins as claimed]

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Hale, Herbert M., and Norman B. Tindale

1933 Aborigines of Princess Charlotte Bay, North Queensland. *Records of the South Australian Museum* 5(1):63-103 (+ missing).

E edge of NE point of Aust, Mutumui, Walmbaria, Kokolamalama, and Barunguan tribes. p 98-103 Weapons: Walmbaria tribe, Flinders Island - ceremonial fights with spear follow a death. Photo shows baler shell Queensland type, method of holding. Flat of spearthrower used to divert spears in combat. Photos of manufacture, made by all the area tribes, but variations: Koko more slender than Walmbaria, coastals lack shell ornament, use shields in fight. Baler shells made only in Cape York, traded, also used as neck ornaments. Spears with bamboo shaft + wood point at ritual fights, but barbed or tipped with stingray spines for serious fight, sometimes poisoned. Spear photos [vicious clumps of stingray spines!] Women fight with yam [digging?] sticks or jab with short javelins.

Hall, Andy

2006 The Last Spear Throwers. *Alaska Magazine*. URL http://www.alaskamagazine.com/stories/0806/feature_atlatl.shtml accessed 9/1/06

Hunting with Jimmy Okitkun on the Yukon delta, spearing seals with atlatl because in fresh water they sink if you shoot them. Spear of driftwood with ivory or brass harpoon. Chasing seal with motor boat, repeated throws up to 100 feet before success. Graphic shows "nuqaq" simple Arctic form with paddle handle, one hole for finger, ivory hook [much like the one I made]. [Nice article].

Hall, Andyo2007The Last Spear Thrower. The Atlatl 20 (2):1-3, 20.

Reprinted from above.

Hall, Robert L.

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1977 An Anthropocentric Perspective for Eastern United States Prehistory. *American Antiquity* 42 (4): 499-518.

Symbol systems = anthropocentric, vs "geocentric" view of culture focused on ecology, economy, subsistence, ie materialist. A "cognitive archaeology" based on universal associative mental processes in language, magic etc and interdependence of cultural subsystems on these mental processes. "Using clues from the ethnog record and a broad regional, deep time perspective, ... it is possible to infer a structure of symbolic meaning from many archaeological remains." Kennings, homeopathic magic, doctrine of signatures as examples of universal mental principles.

Calumet as ritual weapon. Vestigial customs - exchange of ritual weapons as disarmament. Technically, calumet is stem, not the pipe, symbolically connects to arrows. Flat stem pipes of Iowa and Prairie relate to Hopewell platform pipes. Plat pipe w flat stem = symbolic atlatl with effigy spur (eg Cushing's Key Marco rabbit), and wrappings near mouth = wrapping for finger loops or fetish attachment on atlatl. Atlatl loops are also eyes, eg. on Aztec deities, and Mississippian bi-lobed arrow is sun + arrow or atlatl + dart. Atl root relates to water, atlatls assoc with wells and lakes. Hidatsa (Plains) Stone Hammer Society staff has perforated stone head near center, like bannerstone. Crooked staves and pahos of various tribes resemble atlatls. Symbolic weapons connected to water, sun, fertility, other life symbols, and serve to connect different cultural spheres. Symbolic atlatls survived in above forms after replaced by bow and function forgotten. Hopewell and other "great traditions" work by shared symbolism and ideology as well as economic exchange.

[I find it interesting that this article cites mostly different symbolic connections for atlatls than his later work. Often plausible, but hard to demonstrate - differences between articles show how easy it is to suggest connections of similar forms and vague symbology.]

Hall, Robert L.

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1997 An Archaeology of the Soul: North American Indian Belief and Ritual. University of Illinois Press, Urbana.

[A major work on Native American symbology. Chapter 14 is Atlatls, Courting Flutes, and Calumets, pp. 109-123.]

Replaced by bow ca 500 AD N of Mexico, replaced in lore too, now forgotten by Indians but becoming popular with public.

Atlatls are multifunctional tools with symbolism. Australian forms with cutting flint, single hole form as shaft wrench. Indian Knoll and bannerstone arguments. Occur in child and female burials at Indian Knoll, so not just male hunt gear. Symbolism survived in other artifacts when atlatls no longer used:

Maces and staffs. Atlatl form mimicked in Mississipian maces. Mace form survived as tatooed marks of honor on Ponca girls [but Ponca call the marks "children"] symbolizing membership in society honoring night and female principle, thus atlatl = symbol of earth and path of sun.

Mexican glyph "ollin" (Earth, Earthquake, Movement) = atlatl handle with two loops, = bisected circle motif in Hopewell.

Birdstones, ca 1000 BC, as atlatl handles - some with 4 feet, originally Mesoamerican

bird-crocodile as seen on atlatl handle from Cocle, Panama, = Earth (like turtle in N. Am.). [figure 14.5 shows Cocle specimen, 2 Peruvian atlatl handle pieces, and 2 birdstones (1 with feet) to show similarity, feet are derived from Cocle type image] Birdstones also similar to the movable block on courting flutes - which are symbolic atlatls - e.g. ceramic flute in form of atlatl from Vera Cruz. N. American flutes also associated with war bundles, call to war. [Couldn't it be totally different symbolism of birds in both cases?]

Pipes also associated with war, and with birth/adoption, and with maleness. Tubular pipes could be held in hole in grip of atlatl, and some S. Am. cigar holders appear to retain atlatl form. Tube pipe in atlatl hole = model for platform pipe and flat stem of calumet pipe, some of which have bowls shaped like mace or the loops of atlatl grip - flute which passes air through stem is link, and has similar geographical distribution as calumet. Maya God K is a related symbol. [No reason to believe that E atlatls were flat like SW, in fact, bannerstone holes show that they were not.]

[Interesting ideas, lots of possible connections, and symbols do shift and interconnect, but many are not convincing - it is easy to connect vague symbolisms using major cultural themes and artifacts of superficially similar form, picking items out of cultural context from many different cultures. For instance, there is no reason to think E and midW atlatls had double finger loops like SW, and no reason to think that form is imitated by later clubs, which have a completely different function. Some contradictions (e.g. atlatl = female, then later atlatl = pipe = cigar = penis). Overall the actual evidence for a lot of this is pretty thin. See Whittaker 1998 for critique.]

Hambly, Wilfrid D.

1931 The Preservation of Local Types of Weapons and Other Objects in Western Australia. *American Anthropologist* 33 (1): 1-15.

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Field Museum collections. Isolation by aridity, innate conservatism toward borrowing, local woods, contacts, all affect preservation of distinct geographic types of whirlers, message sticks, spear-throwers, clubs, boomerangs, shields, and spears. Nice drawings of typical incised geometric decoration. Map of W A.

Spear-throwers: Kimberley type, long 90-17 cm, notched lath [northern] form of light wood]. Murchison type, elongate narrow oval, flat up, convex under, resin knob, 74 cm, very plain. Pilbarra/Ashburton type, broad teardrop with narrow grip, incised decor. Eastern district type (but also in Murchison area, S central), plain, broad oval with pointed ends, resin knob, flat surfaces. Mount Margaret [SE part of W A, but some also come from Murchison, S Central] type, long narrow oval, concave upper with incised geometrics, resin knob or plain wood, hard red wood. All types have attached hooks.

Spears, a variety of types [to which she assigns localities that do not correspond to the throwers. Actually there is just a lot of unsystematic variation in barbs, just as her idea of local types is not supported by the locations she claims for the spear-thrower specimens - they appear to overlap greatly.] Spear specimen lengths given, mostly 240-270 cm long.

Hambly, Wilfrid D.

1936 *Primitive Hunters of Australia*. Anthropology Leaflet 32, Field Museum of Natural History, Chicago.

[Exhibit guide, very general, little info]. p. 39 "Spear-throwers vary in pattern...many local types." [illustration of a few, mostly W + central, also Queensland.] "The object of the spear-thrower is to give greater range and precision. The spear-thrower follows the foreward movement of the thrower's arm and so extends the time of control over the flight of the weapon."

Hamerman, David

1989 The Biology of Osteoarthritis. *New England Journal of Medecine* 320 (20):1322-1330.

Cartiledge is avascular - no blood vessels, hard to repair itself. Lots of biochemistry details.

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Hames, Raymond B.

1979 A Comparison of the Efficiencies of the Shotgun and the Bow in Neotropical Forest Hunting. *Human Ecology* 7(3):219-252.

Effects of intro steel axes studied, but not change in hunting technology. Sonnefield (1960) studied firearm intro among Eskimo - superior except for seal hunting where harpoon improves retrieval.

Ye'kwana and Yanamamo Indians of Amazonian Venezuela, South America, 1975-6 in Toki, a mixed village, but tribes mostly separate ways. Traditionally, Yekwana prefer blowgun with curare, Yano hunt more with bow. Only boys use blowgun now, Yek men have shotguns, but Yano men do not. Lances for finishing peccary, tridents for caiman from canoe. 91% Yekwana kills with shotgun, 94% Yano kills with bow.

Shotguns are poor condition modern single shot, reloaded shells with black powder and #4 shot. Yanomamo bows are self bow of D type ca 2 m long, palm wood, arrows ca 2.2 m long, 70-77 gm, cultivated arrowcane stalk, 2-feather fletching from currasow, bowstring of bromeliad fiber. 3 types point: broad lanceolate bamboo, harpoon point with bone barb for birds and small game, curare poisoned wooden splinter point for monkey, plus sometimes an ad hoc blunt. Usually carry one arrow of each 3 heads while hunting, pouch with more heads.

Bow is sluggish, not most efficient bow, but long heavy arrows effective and less likely to be deflected in forest. Effective ranges: for large animals, blowgun 17, arrow 21, shotgun 25 m, for birds + monkeys 17, 25, and 43 m. Shotgun kills more effectively than wood tipped arrows. Hunter can only carry 4 arrows, long and hard to maneuver in forest. Bow silent. In war, can dodge arrow, but not shotgun.

Info on time spent hunting, success rates, differing kinds of animals taken, methods. In 216 days, over 800 animals all sizes killed, some 2900 kg. Yekwana kill more riverine animals including caiman because they have access to canoes, and more birds because they have shotguns, and overall killed more for less time hunted than Yano, because of superiority of shotguns.

Social effects of shotgun: Yekwana hunt less, but more successfully. But becoming dependent on traded guns + ammo, now need to grow cash crops, so more agric labor time, mostly by women. Loss of traditional specialized hunting tools, but bow survives because ammo supply for guns unsteady. Some overhunting, especially caiman and egrets, but with low population density, most game hunted sustainably.

Hamilton, Henry W.

1952 The Spiro Mound. The Missouri Archaeologist 14: 1-276.

Illustrates some atlatl weights and bannerstones from the looting of the mound. One bannerstone has a bead in the hole and was reputedly found strung with others, documenting a secondary use. See Brown 1996.

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Hamilton, T. M.

1972 Native American Bows. York: George Shumway Publishers.

Hamlin. Christine

2001 Sharing the Load: Gender and Task Division at the Windover Site. In Gender and the Archaeology of Death, B. Arnold and N. L. Wicker eds., pp. 119-135. Altamira Press, Walnut Creek, CA.

Florida mortuary pond, Archaic, dates 8120-6990 BP. Good organic preservation, 145 burials. Hunting related artifacts include atlatl cup/hooks, dart shaft, weights, points of antler and stone, all conclusively associated more with males than females and adults more than juveniles. However, of 15 individuals with hunting artifacts, two females had antler points.

Hamm, Jim

0 1989 Bows and Arrows of the Native Americans. New York: Lyons and Burford.

Hampson, Jamie

s B

2015 Rock Art and Regional Identity: A Comparative Perspective. West Coast Press, Walnut Creek.

Trans-Pecos Texas, Hueco Tanks etc. Symbolist positions, including shamanism. Suggests major themes including deer + death - related to rain and spirit helpers, not hunt magic. Anthropomorphic projectile point depictions - barbed [dart] points resemble anthros with raised arms. [Not much about atlatls in spite of important weapon in Archaic, apparently not common image. Shows two examples but neither very good: one anthro with raised arm holding a blob, the other point/anthro with 'atlatl' from head, but this one is probably better interpreted as a dart with a stone point.]

Handwerk, Brian

2006 Ancient Spear Weapon OK'd for Deer Hunt in Pennsylvania. *National Geographic News* January 26, 2006. URL

http://news.nationalgeographic.com/news/2006/01/0124_060124_atlatl_deer.html accessed 1/28/06.

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Preliminary approval from PA Game Commission for legalizing atlatl deer hunt. Pretty much same quotes as others - Fogelman, Rowe, Perkins, Birkett, supportive commissioner Roxane Palone, negative comm. Jerry Feaser. Adequate description, drawing of throw. No mention of anti-hunter opposition.

Haney, Patricia J.

1974 Atlatl Elbow in Central California Prehistoric Cultures. In *Readings in Archaeological Method and Technique*, edited by Robert Kautz. Center for Archaeological Research at Davis Publication Number 4. University of California, Davis.

Assessing correlations between technology, subsistence, and ecology by elbow arthritis in 3 sites representing Early, M, and L Horizons. Joint and arthritis described. Technol efficiency and resulting subsistence improved thru time.

Early Horizon 3/17 male burials have elbow arth, in both L and R, but "hypertrophic bone formation in the olecrannon fossae of 2 of the R humeri, in contrast to only lateral osteophytes on the 2 L hum, indicates a difference in aetiological factors and it is suggested that these 2 arthritic R elbows are examples of atlatl elbow." Late M Horiz Cook site has atlatl spurs, but more evid fish and plant food, bow and arrow. 5 M and 3 F burials with arth elbows, all but one both, suggest more general stress, espec acorn processing. Late H Stone Lake site of 9 adults, only 1 F arth both elbows = no atlatl.

Hansen, Richard D.

2012 Relativism, Revisionism, Aboriginalism, and Emic/Etic Truth: The Case Study of Apocalypto. In *The Ethics of Anthropology and Amerindian Research: Reporting on Environmental Degradation and Warfare*. R. J. Chacon and R. G. Mendoza, eds., pp. 147-190. Springer, New York.

[Good points but rather clumsily written.] Defends *Apocalypto* (Gibson 2006)- fiction about the past provides both interpretations and insight into motives of authors. Critiques based on aboriginalism, relativism, and revisionism can be valid, but also can be attempts to distort the past. Solution is to return to philosophical foundations of science, search for objective truth as part of anthropological goals. In this case, the argument that Maya did not practice human sacrifice is an example of "aboriginalism" - belief that native peoples were exceptional, and have claims over depictions of their past, so depicting sacrifice is "racism, inequality, and slander." This view is revisionism and a distortion of the facts.

Gibson was inspired by National Geographic film *Dawn of the Maya* and made extensive research visits to Tikal and others before writing a "chase" story line for "universal appeal." Built set on 40 acres near Veracruz. Site was "an ancient village site" (150). [No word on the destructive effect of building a fake city on it.] Hansen was

consultant. Enormous detail [photos] "authentic reproduction, seldom if ever provided on film sets." Facilities showing corn, cacao, basket, mat, cotton + weaving, fruit, bean, chile production areas, butchers, markets, potters, with masses of material including debitage, tools, dogs + turkeys, etc. Emphasis on pomp and decay led to ritual structures being shown in Classic rather than Post Classic style, but weathered and remodeling. Yucatec language used to provide aural authenticity. Costuming based on archaeological images.

Criticisms of Ardren and others about innaccuracies are wrong, most of film images supported by evidence. Diseased girl suffers small pox, brought by Spanish, time is 1511-1518, beginning coastal contact. Cocom Maya had extensive trade, engaged in slavery. Spanish ships at end did not represent in Gibson's mind the arrival of the "savior" but of the destruction of the Maya, also set up for possible sequel. Friedel (2007) in Archaeology magazine claims violence is a "big lie about the savagery of the civilization created by the pre-Columbian Maya," and the film "slanderously misrepresents an entire civilization." Not enough of the elaborate set was shown to see more complexity of Maya culture. PreClassic murals showing sacrifice were used because they moved the story line, showing the captives their fate without dialog. Predatory raids, heart sacrifice, and cannibalism are well documented in Maya art and archaeology. There were in fact large areas of forest where hunter villages could live. [Gives extensive documentation of Maya and general Mesoamerican sacrifice.] Wearing flayed skin and cannibalism were also present but not shown in film.

Revisionism and view that indigenous rights always trump scientific inquiry (Zimmerman et al.2003) "defy the establishment of truth and see an unqualified political correctness that is both unwarranted and dangerous to the realities of the human saga." Better critiques recognize that Gibson used Maya society to reflect on larger issues of contemporary society - violence and hypocrisy about it, nature, heroism, the struggles of family.

Hare, Greg

2011 The Frozen Past: The Yukon Ice Patches. Government of Yukon.

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[Nice booklet]. Discovery 1997, caribou dung patches where no caribou in modern times, artifact find. Ice patches melting "in period of extremely warm summer temperatures" [no mention of global warming]. Working with "First Nations" people. Photos of dart foreshafts with points, lashing, etc. Diagram of how atlatl works, "most Yukon children are now familiar with the construction and use of an atlatl." Moccasin 1400 BP. Dart technology - dates from 9000 to 1200 BP. Photo of butt ends with 'dimple' sockets, several of points in hafting. Wooden artifact 'might be small throwing board' [maybe, has square hole where hook could have been]. Wooden shafts and foreshafts assembled with bevel joints + sinew, variable. Caribou uses, hide, bone, antler. Barbed antler points + foreshafts for arrows and darts. Dart point ca 8000 BP slotted for microblades. Stone [biface] points of variable sizes 2000-4500 BP, photo of 22 specimens, slotted dart foreshafts. Bow and arrow technology rapidly appears 1200 BP. Barbed antler points + foreshafts, fragments of maple bow. Volcanic eruption and disruptive ash deposits

changed caribou population at this time and maybe brought in new people or contacts. Bison occasionally found on ice patches up to 300 BP, lots other fauna. Wood change: darts 5-9000 BP made of willow, then shift to birch. Arrows usually spruce.

Hare, P. Gregory, S. Greer, R. Gotthardt, R. Farnell, V. Bowyer, C. Sweger, and D. Strand x

2004 Ethnographic and Archaeological Investigations of Alpine Ice Patches in Southwest Yukon, Canada. *Arctic* 57 (3): 260-272.

Since 1999 146 artifacts from 18 ice patches, mostly hunt technol. 43 wood dart shafts or frags or foreshafts, 17 stone dart pts, 2 antler pts, 2 bone or antler foreshafts; 13 wood arrow shafts, 18 antler pts, 3 bow frags [photos of some specimens].

Dart shafts variable: Several fletched [but no details given!], 8 complete, max L 194 cm, most long and tapered w thick end distal, most "very flexible and must have evidenced considerable spring force when propelled." Some thicker and shorter, more rigid. Largest distal end 1.54 cm diam, smallest prox .46 cm diam. Both staves and saplings; most birch, also spruce, willow, and maple. One made w 3 spliced segments plus bevel for missing foreshaft. 8 prox ends w sockets, 12 distal ends slotted for stone pt, 1 w open socket for antler pt. One barbed antler f-shaft 39 cm L w slot (4360 ± 40 BP). Variety of stone pts, some w ocher [notable because not burial context]. Another antler pt slotted for micro side blades (7310 ± 70 BP). 28 dart artifacts date $8360 \pm 60 - 1250 \pm 40$ BP, with most between 4700-3200. Little chronol pattern in darts, but latest is wood shaft w open socket for antler point, transitional to arrow system.

Arrows -12 complete, 4 w antler pts; 2 nocked ends. 14 barbed antler or bone pts, 3 frags same self bow. Details of arrows. 19 dates: 1300-90 BP with one other shaft at 3600 BP.

Almost no overlap: oldest $b+a = bow frag 1300 \pm 60$ BP, youngest atlatl = 126 cm long shaft 1260 \pm 60 BP. Anomaly: 100 cm shaft frag missing distal, with arrow type nock on prox, prob assoc w stone dart pt, 2 dates 3500-3600 BP. Could be unusual nocked dart, or early arrow unrelated to later b+a development. [Diameter is not given, 100 cm is not too long for arrow and is short for dart, but that makes early date for arrow.]

Wooden artifact 22 cm long w knobbed end, square hole near other end, 1210 ± 40 BP. Could be small atlatl missing inset hook. [Possible, but would be short and odd form, late date.]

[Great stuff! But note that there are still ambiguous artifacts at transition from atlatl to bow. Hope they find a real good atlatl soon!]

Hare, P. Gregory, Christian D.Thomas, Timothy N. Topper, and Ruth M. Gotthardt 2012 The Archaeology of Yukon Ice Patches: New Artifacts, Observations, and Insights. Arctic 65(suppl. 1):118-135.

Since 1997, >207 artifacts, 1700 faunal remains from 43 ice patches. 9000 BP dart shaft to 19th C musket ball. 200+ C14 dates. Three main techniques for dart manufacture,

stable hunt technology for 7 millenia, abrupt replacement of atlatl by bow and arrow after 1200 BP. 104 throwing dart related artifacts, 40 bow and arrow related. 81 wooden dart elements dating 8360-1250 uncalibrated BP. Complete darts >220 cm. Stone points hafted and un. One-piece, foreshafted, and segmented types of darts. Ten 1-pc: 152-220 cm, willow, birch, spruce sapling or splits. One has blunt end requiring socket in atlatl, others have 'dimples.' Odd one also has open socket for antler point, and latest date, perhaps 'presaging arrow technology.' 8 wood foreshafts, 3 antler, 11-46 cm long, bevel, conical taper, or V-shape to fit main shaft. Distinction between long foreshafts and dart segments - <1/4 of overall L. Segmented darts assembled with scarf joints, some 2-pc, others multiple segments.

24 arrow shafts, 16 antler arrowheads, 3 frags of a bow. Arrow shafts of spruce, birch. None with stone pts, and no small stone points found, but some shafts suitable. Arrow points were barbed antler. Most recent dart shaft date 1260 ± 60 BP, oldest bow date 1180 ± 40 BP. One aberrant shaft 100 cm long, like slender dart but with nock like arrow, dates 3600+40 BP, could be early arrow influence from elsewhere in arctic.

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Single .54 musket ball. Moccasin. Microblade core. Faunal remains. [Alas, still no atlatl]

Harper, Cheryl, and William Andrefsky

2008 Exploring the Dart and Arrow Dilemma: Retouch Indices as Functional Determinants. In *Lithic Technology: Measures of Production, Use, and Curation*. William Andrefsky, editor, pp. 175-191. Cambridge: Cambridge University Press.

"rather than signaling the use of dart technology during the Ancestral Pueblo period, some large hafted bifaces recycled from Archaic sites served as cutting or sawing tools, fulfilling need for Ancestral Pueblo people not filled by expedient flake tools." Pajarito Plateau, NM sites, 83 bifaces, Archaic with large corner-notched points compared to Coalition Period (1150-1325) and Classic Period (1325-1600) with small arrow points made from flake blanks, 178 "with the final shape often related to the shape of the original flake blank rather than a purposeful choice by the maker of the projectile tip." [even the poorly flaked points are shaped by choice!]. 3 theories explain presence of both in late sites: 1 multiple temporal components, 2 "replication" of large form for dart point or knife [really should just say "continued making that form"], 3 collection of old points for use as darts, knives, or ritually. Good context usually rules out 1, lack of biface debitage etc rules out 2. Ritual + functional use of old points in ethnography, a few refs. If reused for cutting, should have more wear + retouch [problem: larger points will anyway, they are more multifunction than little STPC arrow points]. If used only as cutting tools because arrows were the projectiles, lg pts in late sites should have more retouch, different shape than in Archaic contexts. If just used ritually, maybe not. Tests: haft area same both periods, but late site pts have much narrower + shorter blades = more retouch. Lg pts occur more often at late nonhabitation sites where tool production is not taking place; small arrow pts more in habitation + ritual contexts. So Archaic pts recycled into a system of expedient tools. Also implies arrow + dart were not contemporaneous.

Harper, Veronica, Azzura Di Marcello, and Jessica Jaynes

2007 Beveled Projectile Points and Ballistics Technology. Poster presented at California State University, Long Beach Student Research Showcase. Accessed on web August 18, 2014, URL: <u>http://www.csulb.edu/~clipo/papers/551Posters-</u>2007/BeveledProjectilePoints.pdf

[C. Lipo students' paper.] Assymetrical beveling, common in mid Archaic, should promote projectile spin at speed of throwing spear, 18 mps (Hughes 1998). Tested 6 beveled arch specimens, 3 non beveled, in low speed wind tunnel. They began spinning at 18 mps, and ceased spin at ca 22 mps. Assymetrical "twisted" bevel spun at lower speeds than symetrical bevel [not clear what they mean], suggesting assymetry intentional. Non beveled pt did not spin. [Why does spin cease at higher speeds?]

Harrington, Mark R.

1924 The Ozark Bluff-Dwellers. American Anthropologist n.s. 26(1):1-21.

Dry shelter excavations in Arkansas. Preserved organics include atlatl and foreshafts. Two cultures recognized: "Bluff-Dweller" and "top-layer culture". For earlier, emphasizes hunting – lots of faunal bone, heavy flint points "too large for arrows" wooden foreshafts, cane spear shafts, and a wooden atlatl. Possible crude arrows also in Bluff-Dweller levels. Atlatl: 1 complete, several broken examples. Made of wood, 19" long, projection at one end for spear and transverse peg at handle for grasping. Comparable to an Aztec type. [Small photo shows rough looking stick with transverse peg high where forefinger and thumb might grasp it. Shaft also appears to have finger notches at that point. Hook might be integral, but can't see it.] Foreshafts about 8" long, some ornamented with incised lines, both binding and mastic used, tapered to fit shaft. Points usually "diamond shape" or side-notched or stemmed.

Associated culture described at length, including: Oval biface found hafted as axe. Numerous corn cobs, also beans in bags, and squash, and sunflower, and gourds, as well as unidentified seeds. Hafted mussel shell hoe. Storage pits for corn. Lots of nets and baskets. "Bushels" of acorns, walnuts, hickory, hazelnuts. Deer skin robes, feather blankets [like SW], breechcloth, moccasins. Sees similarity to Southwestern prehistoric cultures, and atlatl suggests equal antiquity.

Harrington, M. R.

1930 Ashes Found with Sloth Remains. The Science News-Letter 17(478):365.

In Gypsum Cave, NV, artifacts and hearth under sloth dung, which is under Basketmaker material, shows humans associated with Pleistocene mammals. Small photo shows "Bertha Pallan, expedition secretary, showing difference in size of early type (small) and late type atlatl darts from GC." [no other info]

Harrington, Mark R.

1959 A Two-Purpose Atlatl. The Masterkey 33(2):60

[Photo shows basketmaker SW type atlatl with finger loops] found in shelter, Winnemucca Lake, NV. Handle is long and narrow and has an antler attached for chipping, also photographed. [Too short, no further info, and I can't find a better source]

Harris, Rolf o 1975 *Rolf Goes Bush*. A.H. and A.W. Reed Ltd, Sydney.

Travel narrative. RH [Australian/British TV personality, musician, artist] visits back country with aboriginal friends to see life in the bush. [Amusing account, nice photos, but little real information.] Plays with spears, throwing using cordage as "woomera." Spear shafts hardened and straightened in fire. Metal ["shovel-nose"] blade attached with cordage and gum, using moistened woomera to smooth gum. Describes making woomera hook by carving a wooden point using heel of foot as backstop for knife, attached hook to woomera with gum. [photo of spear, drawing of carving on heel, no picture or description of woomera at all. N Aust, but no indication of what kind woomeras.] Claims "could hit Bert's hat at fifty yards" with woomera + spear [but since he calls string his woomera, was it string or a real one, and should we believe this?]. They were going to hunt on this trip but did not.

Harrison, Chris

2006 The Sling in Medieval Europe. Bulletin of Primitive Technology 31:74-79.

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History, accounts of accuracy, good refs.

Harrison, Peter D'Arcy

2003 The Atlatl from Operation 96D, Structure 5D-51, Group 5D-11, Tikal. Appendix J in H. Moholy-Nagy, *The Artifacts of Tikal: Utilitarian Artifacts and Unworked Material. Tikal Report No. 27, Part B.* pp. 105-106, figures 123, 159, 160. University of Pennsylvania Museum of Archaeology and Anthropology, Philadelphia

Poorly preserved proximal portion ca 20 cm long of wooden atlatl with carved bone finger loops. Context in fill in palace room, but late, "survivor of Collapse" of Tikal. No photo, poor drawing, good drawing of one loop shows elaborately carved and drilled for attachment.

Hartley, Ralph J. Bs

1992 Rock Art on the Northern Colorado Plateau: Variability in Content and Context. Worldwide Archaeology Series 1. Ashgate Publishing Ltd, Aldershot.

[How can anyone write so boringly about an interesting topic?] SE Utah. Environmental background, [much of it irrelevant.] Classifys rock art into several kinds of elements: full anthropomorphs, frag anthros, hands, feet, heads, mammals, m tracks, birds, b tracks, reptiles [apparently including any zigzag?] rectilinear non-representational, curvilin,

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concentric, abstract geometric. [He claims these are somehow based in human psychology, but glaringly absent are many motifs with major symbolic value, like tools (including atlatls - no info here) and other objects that are depicted, and categories of action.] Major incomprehensible statistical analysis to show "informational content" of panels in different places varies: boulders (highest), bases of cliffs, and rock shelters (least). [As near as I can tell, chronology is ignored and all panels are lumped. I don't know what "info content" actually measures, but it is NOT information content - maybe number and diversity of his element classes. Useless.]

Hassig, Ross

1988 *Aztec Warfare: Imperial Expansion and Political Control.* University of Oklahoma Press, Norman.

B

Compiled from various sources. Atlatl predates Aztecs, although some myth claims they invented it, or credits god Opochtli. Surviving examples often ornate, perhaps for ceremonial occasions, ca. 2 feet long with hook and groove. Grips with loops, holes, or pegs. [Poor photo shows elaborate atlatl with apparently simple grip; codex drawing shows peg grips on atlatls used against Spanish] Darts made of oak [unlikely] and fletched, a variety of points used. Shown in art carried in hand, not quiver. Spanish sources say could penetrate armour. Suggests range over 55 meters, 60% more thrust than unaided spear [but all this is from old experiments of Browne, Howard, Peets]. Bows and slings also used in warfare.

Macuahuitl (obsidian edged wooden sword) also described, none survive, but 19th C illustration of one in Madrid armory does, and lots of contemporary illustrations.

Atlatl probably used as armies closed for hand to hand combat, after bow and sling barrage.

Hassig, Ross B

1992 War and Society in Ancient Mesoamerica. University of California Press, Berkeley.

15: Olmec had atlatls, but rarely depicted so not important. Two specimens (stone) in Dumbarton Oaks collections [models, not for use]. One depicted on Stela D at Tres Zapotes.

102: Cacaxtla murals show battle scene with atlatls

120: Chicimec [northern barbarian] bow with greater range and rate of fire gave advantage over Toltecs with atlatl + sling

125: Chichen Itza murals with Toltec vs Maya, both using atlatls. 127: Toltec use of atlatl with short sword gave advantage against Maya who wore no armor

137: Aztec atlatls along with new weapons: bow and broadsword [macahuitl]. ...60% more thrust than hand thrown spear, range no more than 60 m, wooden, .6 m long, groove with hook, fingerholes, loops or pegs for grip. Darts of oak, feathered, variety of points, carried loose in hand. Slings with shaped stones, probable range several hundred meters [no refs for any of this].

172: Teotihuacan times, atlatl specialized weapon, required other troops with spears in

integrated use, so only large armies used it, smaller armies favored thrusting spears. Toltec times, atlatl with short sword in combination, carried together, no need for specialized troops. Spread to lesser armies like Maya where elite troops used in combination with shock weapons. Aztec times, superior bow replaced, except for elite troops using before a charge with shock weapons. "Thus the atlatl remained important in armies with large elite components but was displaced by the bow in small armies." Plates: designs on Oaxaca atlatl in Smithsonian 10/8724, scupture at El Tijin, E Classic pot design, stela design from Tikal, mural from Teotihuacan, all showing warriors with dart/atlatl. Drawings 1846 of macuahuitl and thrusting spear edged with obsidian. [many other minor mentions. He is very interested in social + tactical meanings of different weapons, which sometimes leads him to overgeneralize about weapons whose actual use and effectiveness he really doesn't know. His reconstructions of warfare are largely speculation about how battles *should* be fought.]

Hawkinson, Cleone H.

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2014 Curation History and Overview of the Plaintiffs' Studies. In *Kennewick Man: The Scientific Investigation of an Ancient American Skeleton*. Owsley, Douglas W., and Richard L. Jantz, eds., pp. 108-109. Texas A&M Press, College Station.

The Corps of Engineers mishandled the skeleton, allowed Indian access while denying it to the scientists, which resulted in theft of some bone, misplacement of other pieces, contamination by ceremonial juniper burning, etc. Corps, Dept of Interior, and tribes obstructed study as long as possible, including after court rulings allowed scientific study, refusing to approve study plans, not allowing video, etc. P 123 Rose concluded point entered hip from back, Chatters that point entered at an angle from the front.

Hayden, Brian

1979 Palaeolithic Reflections: Lithic Technology and Ethnographic Excavation Among Australian Aborigines. Australian Institute of Aboriginal Studies, Canberra and Humanities Press Inc, New Jersey.

Very detailed description of stone tools and use experiments conducted with aboriginal men and women in Australia. Includes some information on manufacture of woomera type "meru" spear throwers (scoop shape with adze stone hafted in handle) and "crude" spears. [Focus is on hyper-detailed descriptions of use of simple stone tools and their manufacture and wear, useful for lithic studies, not very useful for atlatl interests. Most informants had not actually used stone tools since the 1940s, and not all were competent. No illustrations of finished spear throwers, so hard to judge how well they did.]

Hayes, Virgil

1994 Tuning Weights. The Atlatl 7(3):1-4.

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Weights "tune" atlatl for proper flex of atlatl and dart by adjusting speed/force of throw and flex, which he explains in terms of "archer's paradox". [Interesting ideas, but atlatl

flex is not very important nor does it need tuning to dart].

Hayes-Gilpin, Kelley x,p, B

2000 Beyond Mother Earth and Father Sky: Sex and gender in ancient southwestern visual arts. In *Reading the Body: Representations and Remains in the Archaeological Record*. Edited by Alison E. Rautman pp. 165-186. University of Pennsylvania Press, Philadelphia.

Unitary Mother Earth concept in Native Am. religion only developed in 19th C, previously much variability among tribes, e.g. Navajo + Pueblo religions with multiple female deities assoc with the earth and fertility. Changes traced thru rock art. Archaic: some anthro or spirit figures, sex not indicated. Basketmaker II gendered figures, males with genitalia, F with triangular 'apron'. Pairs, multiple mixed groups, 'stylistic mozaic' indicates mobile bands doing both farming and hunt-gath. Some petros mark territory. BMIII figures smaller, much more diverse. Innovations like lobed circle, reps womb (Manning). Processions, poss indicate developing male sodalities vs shamanic BMII stuff. Iconic depictions proliferate: flutes, crooks, staffs, atlatls wielded by non-sexed and male figures, not Fs. "Atlatl ... seems to persist as a ritual icon long after it is replaced by bow and arrow." [I wonder about that, since rock art is so hard to date. I suspect more diversity in BM II than she wants to see, giving clear assoc of BMII images with atlatls are some simpler figures w atlatls just mis-dated as BM3?] Ethnog Nav + Hopi have multiple gender identities; not clear when emerge, but some rock art e.g. has maiden hair whorls + penis. P I-II - lizard man figures could be lizard, man, delib ambiguous. Zuni link to myth of people in previous world had tails + webbed feet, and lizards travel between surface and underworld. P III-IV human figs sexed, often active. With artifacts, often unsexed or male, but reps of female related deities and katsinom. Females with hair whorls, wombs, genitals, some assoc with flute players (male) assoc with Flute clan, Kokopelli. Birth metaphors include both F and M acts like potting, warfare. Cottonwood Ruin male figure, spread F with sun + water symbols. Navajo Hero Twin stories, born from sun and water. Birth images. Mother of Game or Child-Sticking-Out Woman images.Gender complementarity.

Haynes, C. Vance

2011 Distribution of Clovis Points in Arizona and the Clovis Exploration of the State, 11,000 BC. *Kiva* 76(3):343-367.

A

Table of 109 point finds, including those from Naco, Lehner, Murray Springs. Most points in E half of state, clusters around Tucson + Flagstaff, sparse around Phoenix. Speculative scenario of a band of hunters moving into state from Utah to explain point distribution [but there is really no reason to assume all from one group - too much variability and a span of multiple lifetimes at least.] Assumes C points used with atlatls.

Hays, Kelley A.

1984 Rock Art on Northern Black Mesa. In Excavations on Black Mesa, 1982: A

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Descriptive Report. Southern Illinois University, Carbondale.

Petroglyphs may be pecked by "direct percussion with hammerstone..., or by indirect percussion with a hammer and a bone, a stone, a hardened wood punch, or a chisel. Indirect percussion can produce smaller, finer dints, and can acheive a more controlled, detailed product than direct percussion." [Indirect perc is unlikely - no more accurate, and soft organic punches don't work at all.]

"Humpbacked flute players and weapon representations, quite common in the Anasazi region, are apparently absent on Black Mesa." p. 521

Differences between Basketmaker II and BM III - Pueblo II rock art. BM II consistent with elsewhere [but here lacks the atlatls + darts common in nearby SE Utah]

Headrick, Annabeth B

2003 Butterfly War at Teotihuacan. In *Ancient Mesoamerican Warfare*. M. Kathryn Brown and Travis W. Stanton eds., pp. 149-170. Altamira Press, Walnut Creek, CA.

Butterfly images connected to Tlaloc, a god of rain and war by same goggle eyes, proboscis, and antennae that are the same as the fletching ends on atlatl dart depictions. Good illustration of atlatl armed warrior from Teotihuacan. Butterfly as propagandistic image of duty of holy war, warriors often depicted with butterfly costuming, often conflated with owl.

Heath, E. G. and Vilma Chiara

X

1977 Brazilian Indian Archery: A Preliminary Ethno-toxological Study of the Archery of the Brazilian Indians. The Simon Archery Foundation, Manchester Museum, Manchester.

Typology and distributional study of bows and arrows, with some details on manufacture, curare, fletchings, grip types, arrow points, and social aspects. [But the result is almost worthless, a few photos of bows in use, but no details of individual specimens from particular areas or of exemplary types. In no place is all the info on bows of any one tribe or region put together, or even a complete specimen described in detail; data is all distributed in uneven smatters under topical headings by parts of bow, with enormous wasted time on classification schemes. They boast about the cooperation of an archer and an ethnologist, but details useful to an archer are completely lacking. Not enough detail to replicate any bow, no info on draw weights or even brace height. Some of this is because sources are poor, and they worked mostly from museum specimens, but it is inexcusable that they didn't go out and collect case study details from at least one or two accessible tribes. Any single example would have been more useful than this pointless general study.]

Spear thrower use: one paragraph in section on other weapons, with a few vague literature citations and the undocumented statement: "use of the spear-thrower as a weapon has disappeared in Brazil, but its use persists in competitive sport."

[When I returned to this to find info about Yanomamo bows much later (2014)

my contempt only grows: what a useless piece of garbage. These stupid guys complain about the difficulty of studying bows in the field, but missed their chance to do so and provide a contribution. Didn't even describe the museum specimens they worked with. A few nice ethnographic photos, but often without sufficient caption info too. However, it appears that many specimens they examined are in Manchester and could be looked at by someone competent.]

Heider, Robert

1991 *Grand Valley Dani: Peaceful Warriors, 2nd ed.* Holt, Rinehart, and Winston, Fort Worth.

General ethnography, RH part of expedition 1961 with Gardner, *Dead Birds* film of Dani "ritual" warfare. 57-58: Stone adzes and axes, blades traded in from 'distant quarries' [group not specified] then hafted by Dani owners - "the one essential item of the economy in which they were not self-sufficient." Adze more popular, 5-10/1 axe, used to cut down trees, finish planks, butcher pigs; axes only for splitting logs, firewood. Blades hard metamorphic epidote + clorite rock.

Pig tusks used as tools, sharpened with flint chips. 59-60: Weapons of wood, bows, arrows, spears. Bows 1.5 m long, strung w 1 cm wide bamboo strip. Arrows 1.7 m, no fletch, no nock. Longest shots by one test, 90-100 m. Arrows not poisoned, but "dirtied." Points notched or barbed to break off in wound. Two or 3 prong arrows for bird hunting. Spears valued, 3m length of laurel from Jalemo, thrusting weapon. But 101-102, battles, men armed by personal preference with spears or bow. Spearmen carry long 'jabbing' spears and often 'a couple cruder short spears which they can throw...' No atlatl.

Hein, Wulf

2005 Spear Thrower. Archaeo-Technik Webpage, Electronic document, URL: <u>http://www.archaeo-technik.de/material/spear_thrower_05.pdf</u> Accessed 10/2010.

General discussion of European Upper Paleolithic throwers, illustrated.

Heizer, Robert F.

1938 A Complete Atlatl Dart from Pershing County, Nevada. *New Mexico Anthropologist* 2(4/5): 68-71.

From guano mining in a cave near Lovelock Cave [Leonard Rockshelter]. Length 129.5 cm, three sections. Butt: cane, 38 cm, sinew wrapped at both ends, tangential eagle feather fletching with tufts of bluebird feathers, proximal end left open to engage atlatl. Central section: cane, 45 cm long, no decoration. Foreshaft: greasewood, 57 cm long (of which 10.5 cm inside cane of central section), inserted end long cylindrical taper, point damaged but no stone point was used. [By modern standards this dart is both very short (129.5 cm = 4' 6") and very light (38 grams, Heizer 1951). Wish he gave balance point info.]

Heizer, Robert F.

1938 An Inquiry into the Status of the Santa Barbara Spear-Thrower. *American Antiquity* 4(2): 137-141.

Collected 1793, Santa Barbara, Chumash area, by G.G. Hewett of ship "Discovery." Short (5 1/8") [how would it work? Or is is symbolic only?] board type with groove, raised bone hook, symmetrical 2 finger holes.

No precedents in area, probably results from 250 yrs of Spanish contact and colonization by Mexican Indians.

Heizer, Robert F.

1942 Ancient Grooved Clubs and Modern Rabbit Sticks. American Antiquity 8(1):41-56.

SW prehistoric grooved clubs – are they the same as historic SW rabbit sticks? Basketmaker - long, flat, S-curved, 3-4 grooves. Guernsey and Kidder 1921 suggest association with atlatl as warding sticks, and note similar in hands of Maya/Toltec carvings. Now clubs seem wider distributed in the west, not all with associated atlatl, some with bow. Roberts 1929 thinks TX specimens fighting or throwing clubs. Heizer thinks "specialized adjunct to hunting, first with atlatl, later bow" to dispatch wounded game. Archaeological and ethnographic information summarized (many finds, ethnographic from all over west including Hopi and CA). Should be a historical connection, perhaps from war to later hunting. [I find it hard to picture fighting with atlatl in one hand, while warding off darts with the other hand that has to hold the club <u>and</u> extra darts – a fighting or throwing club seems more likely].

Heizer, Robert F.

1945 Introduced Spearthrowers (Atlatls) in California. The Masterkey 19:109-112.

Three separate historic introductions of atlatl: 1. Santa Barbara [short little thing], collected 1792, is "poor copy of Tarascan type", introduced through Spanish colonial settlement. 2. Two Alaskan spear throwers, collected late 1800s, Chumash area, introduced by Aleut and Koniag hunters employed by Russian sea-otter hunting expeditions. 3. Susanville basketmaker type [see Fenenga and Heizer 1941] turns out to have belonged to a local Indian whose son-in-law learned how to make and use atlatls from M.R. Harrington. So California had prehistoric atlatls, but there is no evidence of survival into historic times.

Heizer, Robert F.

1951 Preliminary Report on the Leonard Rockshelter Site, Pershing County, Nevada. *American Antiquity* 17(2):89-98.

Work in 1949 at site where atlat1 dart found 1936, in deep bat guano layer. C14 dates on guano average 8660 ± 300 , greasewood atlat1 shaft fragment 7038 ± 350 B.P., relatively

humid Anathermal period of the Postglacial. Dart shaft complete, 3 sections, 130 cm long, cane shaft, long greaswood foreshaft with simple tip, 38.5 grams, two tangential feathers, red painted spiral decoration. Long chronological discussion.

Helmick, Troy C.

1996 Atlatl Weights Found in Montana: An Atlatlist's Perspective. *Archaeology in Montana* 37(2):67-78. Reprinted *Indian Artifact Magazine* 17(3):16-19 (Aug 1998). Reprinted The Atlatl 14(3):1-6 (July 2001).

Nine specimens described + mapped, well illustrated, variety of materials and sizes, mostly elongate with central groove for lashing. Lists functional theories [but reaches no conclusion].

Helwig, Kate, Valery Monahan, and Jennifer Poulin o 2008 The Identification of Hafting Adhesive on a Slotted Antler Point from a Southwest Yukon Ice Patch. *American Antiquity* 73(2):279-288.

Ice finds show atlatl darts from before 8000 BP to appearance of bow and arrow at ca 1200 BP. This pt dates 7310 ± 40 BP uncal.; assoc w similar dated shaft frag. 24.6 cm long, now warped, slotted both edges for microblade insertion, one frag remains, slots 1-1.5 mm W, 3-4 mm deep along whole length. Short tang scored for attachment. Incised linear decoration, red pigment traces. Microscopy and spectroscopy show mastic is pure spruce resin with no inorganic additives, and not heated to produce tar or pitch.

Helwig, Kate, Valery Monahan, Jennifer Poulin, and Thomas D. Andrews x 2014 Ancient projectile weapons from ice patches in northwestern Canada:

indentification of resin and compound resin-ochre hafting adhesives. *Journal of Archaeological Science* 41:655-665.

16 projectiles analyzed (now have 24 wooden arrows and 81 darts, mostly frags, 22 antler or bone pts, 25 chipped stone pts). Analyzed 5 detached stone pts, an antler pt slotted for microblades, and 4 shafts of willow or birch. Arrows show less visible residues so only analyzed a composit antler pt, closed socket spruce arrow with antler pt, hemlock arrow with split haft and antler pt, and birch arrow w split shaft hafting. Analyses included Fourier transform infrared spectography, gas chromatography-mass spectrometry, Raman spectroscopy, scanning electron microscopy-energy dispersive spectrometry, and polarized light microscopy. In all cases where mastic found (9 dart artifacts and 2 arrows) it was spruce resin. Not heat processed, but on 3 of the dart pts, mixed with red ochre. Traces of protein and ruminant fat in some could be intentional, from sinew hafting, or from hunting use. Dates include 8103 ± 80 cal BP for slotted antler dart pt; 1180 ± 120 for 'transitional' birch dart (= closed socket for antler pt typical of arrows instead of split typical of stone dart pts). After this date, arrows - oldest analyzed 833 +90 BP.

Hemmings, Christopher Andrew

2004 *The Organic Clovis: A Single Continent-Wide Cultural Adaptation.* Unpublished PhD dissertation, Department of Anthropology, University of Florida, Gainesville.

[Important study, earliest direct evidence of paleoindian atlatl use]. Clovis is a continentwide pattern irrespective of local environmental constraints. "State of the art" specialized technology for a generalist subsistence strategy without good recent analogs, in response to unique envir of Pleistocene. Data from 246 early Paleoindian sites with organic remains, focus on artifacts made of extinct fauna bone. 352 species plants + animals represented, with 116 having direct evidence of use, although clear preference for mammoth and mastodon. Nearly 250 formal bone + ivory tools in 45 different forms. Tight definition of Paleoindian = Clovis only, all others lack Rancholabrean fauna and are a different adaptation. [Makes extensive and convincing case documenting Clovis use of wide variety of plant and animal resources (although burning is not always a secure indicator of an animal being eaten)]. Florida ivory tools overwhelmingly mastodon, not mammoth. Direct evidence of many species argues against human "overkill" but effect of hunting on proboscidians could have been important factor in their extinction, since they were doing very well just before Clovis.

Skeptical of expedient flaked bone "tools" - at odds with formal + curated Clovis assemblages. Formal tools ground, not flaked.

Most Clovis bone + ivory from Florida river sites, where context often poor. Three atlatl hooks: 1. Hendrix collection, Santa Fe R. *Paleolama* proximal phalanx with distal end ground to isolate spur .68 cm long with high contact polish. 2. Mastodon vestigial tusk hook, split, scored for hafting, beveled to elevate spur tip, 5 cm long. Ichetucknee R. 3. Proboscidian ivory shaft fragment reworked into atlatl hook, Santa Fe R. 7.5 cm L, sim in form to others. [also mentions but does not describe similar antler hooks. The photos in my copy are completely illegible, but he provided electronic versions see Whittaker 2007]

Bannerstone [?] of proboscidian vertebra centrum13.5x1.5x5.4 cm, tapered bun in form, hafting hole mentioned but not measured, broken in middle with two drill holes for mend. [He's not sure it's Clovis, resembles later stuff eg Windover].

Ivory points: short ones are "launched;" long ones often considered foreshafts are really lance points [doesn't describe many individ specimens or argue about function much. P 192 confused section appears to dislike foreshaft idea because curved foreshafts not fly straight.].

Only 6 species documented for tool use: mammoth, mastodon, paleolama, dire wolf, horse, deer. Tools and manuf technique same all over continent. Split tusk analogous to splitting large bifaces to make point blanks, a characteristic Clovis technique. Overshot flakes for thinning and as tools. Two co-traditions of point form, parallel sided and excurvate. Blades from cylindrical + wedge-shaped polyhedral cores.

Clovis fluting failure rate 50+% [No!] so bone tools used because more reliable. Ivory pts puncture better if greased, explaining presence of ochre outside of caches [Huh? No connection explained]. Clovis used three alternative point types: short (launched) bone, stone (launched) and long curved bone/ivory pts used as lances and intended not to remain in prey.

Limited art (geometric incisions, one possible mastodon, beads) connect to Euro Up Paleolithic, but lack cave art. Counts points from sites and surveys [not considering thousands in private undocumented hands], argues that kill sites without bone would look very small. Distance of pts from stone sources indicates mobility. Oldest Clovis sites already have exotic stone, indicating prior exploration and travel. Highly mobile population of low density produced thin spread of homogenous cultural remains. "Technology-centered" foragers, relying on technol, mobility, and use of predictable large game, but also very broad spectrum of resources, an adaptation with no recent analog.

Hemmings, E. Thomas

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2007 Buried Animal Kills and Processing Localities, Areas 1-5. In *Murray Springs: A Clovis Site with Multiple Activity Areas in the San Pedro Valley, Arizona*. C. Vance Haynes and Bruce B. Huckell eds. Pp. 83-137. Tucson: University of Arizona Press.

Detailed summary of archaeology of site, edited from unpub dissertation 1970. Loci include mammoth and bison kill areas, camp areas. Other associated fauna include camel, horse, canid.

Area 3 mammoth kill has mammoth footprints on occup surface, possible bison wallows. Partial carcass of adult F mammoth, parts of 2-3 bison. No points with mammoth but 2 lithic scatters include 1 pt and 2 tips, bifaces, blades, many flakes. Famous mammoth bone shaft straightener.

Area 4 multiple bison kill - 7 C pts, most damaged: "Impact damage was predominant, probably resulting from high velocity casting of projectiles, and transverse snapping was secondary, presumably resulting from thrusting into a vigorously moving animal. This may, in fact, represent the sequence of killing, mortal wounding by repeated dart or spear casts and the coup de grace administered by thrusting." [Can't actually make that distinction, eg Flenniken darting goats produced lots of snaps, as does target shooting, but interestingly implies belief that atlatls were used by Clovis. The pts are from 4-7 cm long, including one small obsidian, none really well made.]

Area 5 horse kill: 2 pt bases, flakes etc, only teeth survived.

Hendershott, A. J.

2016 Anasazi cable backed bows. Primitive Archer 24(1):22-25.

Explains building bow in a story. Like Navajo and Arctic forms. [But there is no evidence Anasazi used such bows – recurved and sinew-backed bows are late in SW.]

Hendershott, A. J.

2017 Atlatls of the Eastern United States. Primitive Archer 25(3):57-62.

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A

Few examples to reconstruct. Hutchings study suggests atlatls go back to Clovis times. Bone and antler hooks, some assoc with bannerstones [good drawings but no info on sources] Rock art depictions Jeffers, White Rock Bluff MO. His replicas of Key Marco "cat" and 2-hole atlatls [nice but not accurate] and Bluff Dweller form. Calusa 'saber' atlatl may not be [also KM, prob not atlatl, nice reconstruct but shows it was too heavy]. Spiro shell engraving [it does look like an atlatl but note that it is show gripped but not with fingers in the supposed double hole]. Eastern atlatls likely round inflexible shafts, heavier darts than W, but lots of variety.

Henriques, Martha

2017 North American prehistoric Clovis people threw darts at mammoths at nearly 80 miles an hour. *International Business Times*, April 17, 2017, online http://www.ibtimes.co.uk/north-american-prehistoric-clovis-people-threw-darts-mammoths-nearly-80-miles-hour-1616021

Brief news account, spurred by Whittaker et al. 2017, with throwing video by Pettigrew. Quotes JW, only problem is chronological confusion: "Clovis people thought to have continued to use heavy darts... even after the invention of lighter and more accurate bow and arrow."

Henry, Chris o 2010 Shark Adventure. *The Atlatl* 23(4):1-4.

For TV sports show "Methods of Take," harpooned sharks with atlatl [looks sort of BM with split finger grip but can't see well in photos] and various barbed and/or toggle points on fairly heavy dart [photo of points but no dart detail given]. Sharks attracted by chumming, harpooned from boat [no range info], 40-60 lbs. [Very cool, but atlatlists reporting such experiences should give more detail of equipment, range, penetration, etc].

Henry, Chris

2011 Primitive, or not Primitive? What Really is the Question? The Atlatl 24(2):13.

A good BM replica with steel point is "Open" but primitive materials used in modern laminated atlatl with rest is "Primitive". Should we re-define? [Yes, probably, if the ISAC data is to be of any use. Currently the classification is a remnant tradition.]

Henry, Chris o 2011 Rebuttal to 'Dart Flex' by Richard Lyons. *The Atlatl* 24(3):11.

Side to side motion of dart in flight unlikely to be like fish tail propulsion, which is wavelike. Probably it actually slows dart. Dart flex imparts no spring action, in fact most darts are still in full flex when they leave the spur. [Right, for same reason a flexed atlatl adds nothing - unless you slow dart or atlatl down, it has no time to spring back until after atlatl stops pushing dart.]

Henry, Chris x

2014 Atlatl dart compression and how it relates to accuracy. The Atlatl 27(3):8-9.

With a rigid dart, energy of throw is completely transferred along shaft to tip of dart and whole thing immediately moves, but the force is not straight line, so dart veers off. Flex in dart is necessary to delay time between the pressure applied to the rear and the energy transfer to the tip. At full flex, dart is essentially rigid again, so important that it leaves the atlatl spur as soon as possible. So choice of length, spine, and mass of dart should match timing of throwing motion.

Henry, Chrisx,p2015 Moche Toss. The Atlatl 28(4):1-3.

Donnan found him online, they reconstructed Moche ritual ["ceremonial badminton"] from scenes on pottery. Explains how to construct "shuttlecock" and cord, launched from dart. Catcher cross-pieces of cane attached to darts of competitors to try to snag cord. Youtube video of Moche Toss [done by Pettigrew] at <u>https://youtu.be/k99dR1UTqPM</u>

Herbert, Wally

1981 Hunters of the Polar North: The Eskimos. Time-Life Books, Amsterdam.

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Nice photos and essays on W. Greenland Eskimo. Two photos of throwing harpoon with "throwing stick" from a kayak while hunting narwhal (142, 148). [In both, the atlatl is above the hunter and has clearly made a flipping motion in throwing harpoon attached by pegs along shaft, not from proximal end.]

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Hermann, Ferdinand

1967 Volkerkunde Australiens. Bibliographisches Institut, Mannheim.

In German. Ethnology focused on tribal distributions. Short section on spears and spear thrower, 2 good photos, one showing throw with flexing darts.

Hester, Thomas R.

X

1974a Archaeological Materials from Site NV-WA-197, Western Nevada: Atlatl and Animal Skin Ponches. *Contributions of the University of California Archaeological Research Facility* 21:1-43. Berkeley: University of California

Analysis of looted material from dry cave, near Winnemucca Lake, NV. Unusual atlatl >6000BC. Wooden shaft with attached bone hook and long bar weight (19 cm L, weighs 80-100 gm). Atlatl L = 58.1 cm. [This is the model for Bob Perkins atlatls, aka Nicholarsen Cave atlatl, see Allely 1992]. 2 skin pouches w/stone tools - 5 hafted bifaces and one long obsid biface with wrapped base handle, all used as fish knives plus ? Variable micro + macro wear, not function-specific, but definitely use as knives, fish scales on one [A. Romano points out more likely atlatl dart foreshafts, possibly used in fishing, with a feathered line found with them attached as float. I agree they are probably foreshafts.] The base of points on these are obscured by mastic and sinew lashing, no

notching visible, appear to be stemmed, x-rays confirm. Overall L from 174-230 mm, wood L 126-141, T 13-15, overall weights from 25-70 grams. [So small for dart, but large for arrow, and more likely early form points.]

Second bag had >100 pts and preforms of Eastgate type (shows type's reality), probably by one individual, with compound short antler pressure-flaker. [See Smith et al. 2013 – these pts all similar, and diff sizes could be classed as Elko vs Rosegate]

Hester, Thomas R.

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1974b Supplementary Notes on A Great Basin Atlatl. In Great Basin Atlatl Studies, RF Heizer, ed., pp 29-32. Ramona: Ballena Press

Winnemucca Lake specimen [number 2 - not same as above, see Harrington 1959. Note presence of two different forms in same lake basin, see Hester 1974a]. Basketmaker style handle with pair of leather finger loops, but with antler flaker on proximal end, odd keeled hook which may be incomplete, 56 cm long, max W 2.5 cm, max T 1.25 cm, couldn't weigh.

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Hester, Thomas R, and M.P. Mildner

1974 An Atlatl from Council Hall Cave, Nevada. In Great Basin Atlatl Studies, R.F. Heizer, M.P. Mildner, and L. Spencer eds., pp 33-36. Ramona: Ballena Press.

From Harrington's excavations, 1920s.

Specimen described – basic SW form: a straight flat stick with groove and integral hook, finger notches but no surviving loops, 52.7 cm long, 1.9 cm wide, no thickness measured.

Hibben, Frank C.

1938 A Cache of Wooden Bows from the Mogollon Mountains. American Antiquity 4(1):36-38.

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Some 94 bows and 4000 compound arrows, all damaged (intentionally? + bears), in small cliff dwelling. [Simple self] bows 3-5 ft long, ave 4 ¹/₂. Round, oval, plano-convex x-sect at grip, round limbs taper to slightly flattened. Tips notched, turned back, or unmod for string. 1 bow with yucca fiber cord remnant. 16 bows decorated, bands of black, red. Woods ID'd: oak, pine, pinon, willow, mt mahogany, sycamore; mostly oak. Arrows all compound with reed shafts, hardwood foreshaft; only 11 notched for stone pt. Three feather fletching. Nocks decorated with blue, red, yellow, black in "endless variety".

Hibben, Frank C.

x,p 1965 America's Oldest Weapon. Field and Stream July 1965:48-50, 108-109.

Dramatic recount of hunt based on [Blackwater Draw] Clovis NM finds. [Bad illustration of Clovis hunters spearing mammoth, unscaled figure of 2 Key Marco atlatls, one Aztec, and a dart 'from cave in New Mexico]. Spear thrower is a lever, weights improve balance. Bone and ivory foreshafts for 'javelins' at Clovis show heavily weighted 'darts'

for big game. Aztec obsidian pointed arrows 'ineffectual' but "to penetrate Spanish armor the Aztec warriors used a spear thrower... With it a Mexican warrior could thrust a lance right through the body of an armored horse or the man who sat on it." Ice Age extinctions aided by humans with atlatl. Most points found in N Am are not arrowheads but javelin points. Russell Cave and other Archaic sites 'piled with the bones of animals killed by their javelins' show effectiveness. Modern archers with broadheads criticized because arrows have little shocking power, game often not recovered. Atlatl better because 'javelin' heavier, more shock, better blood trail. More sporting, need to be close, movement startles animal. But "at close range an atlatl dart can be thrust clear through a two-inch plank - good penetration for a modern bullet." [Not bad other than annoying use of "javelin" and gross exaggeration of atlatl power.]

Hibben, Frank C.

A 1975 Kiva Art of the Anasazi at Pottery Mound. KC Publications, Las Vegas.

Identifies atlatls in 2 murals, Pueblo IV (1350-1475 AD). [This would be extraordinarily late. One (p 70) is a rectangle with 2 central loops and 2 slots? at one end, more likely a stylized bird, feather, or prayer stick depiction; the others (p131) are very vague hooks peeking over the edge of shields. Neither is at all convincing, never mind the questions about the accuracy of Hibben's mural recording.]

Donald P. Higgins

2012 A Possible Atlatl Depiction at 3CN345 on Petit Jean Mountain. Field Notes, Newsletter of the Arkansas Archeological Society 366:3-6.

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Rockshelter with pictographs -stylized hands and other elements. Faint pictographs covered with mineral examined with DStretch program. Probably 2 circles bisected by line, possibly with hook, similar to Coso Range depictions, elongate shape of one lobe paralleled by AR bannerstone. Possibly lines up with shadow at solstice. [maybe, but it's a pretty vague image even with enhancement]

Hildebrandt, William R., and Jerome H. King

2012 Distinguishing Between Darts and Arrows in the Archaeological Record: Implications for Technological Change in the American West. American Antiquity 77(4):789-799.

Ames et al. 2010 uses Shott, Thomas etc to suggest Hatwai Eared pts (4400-2800 BP) and Cascade pts (8500-4500 BP) are arrow pts on Plateau much earlier than usual 2300 BP date.

New Dart-Arrow Index is less affected by artifact damage and reworking: Neck width + max thickness, 11.8 mm as boundary between dart and arrow pt. Good proxy for wt + size, works on fragments, not modified by reworking, less subject to stylistic variation.

Test on NW Gt Basin assemblage of well-known types, 1600 pts from Hildebrandt excavs, data from Thomas and Ames, all work well.

Test hafted points: arch darts (Thomas, Shott) 18.5-20.6 mm, and Pueblo Bonito arrows (Thomas) 10 mm. Ethnographic arrow collections (Thomas, Sinopoli) don't work well, often have too-large points. Probably loss of skills and manufacture for collectors.

Hatwai + Cascade pts are dart pts. No reason to accept Ames early entry of bow, or long co-existence of atlatl, which was mostly replaced quickly.

Hildebrandt, William R. and Allika Ruby

2004 Archaeological Discovery of Two Wooden Bows from the Coso Range, Inyo County, California. *Journal of California and Great Basin Anthropology* 24(2):183-192.

Under ledge, probably juniper, C14 prob more than 300 yo. Both ca 1 m long, finely tapered tips with no nocks, reflexed prob by heat bending. Should be typical of rare Gt B sinew backed bows, maybe blanks not yet backed [because although they call them sinew-backed, there is no evidence of sinew at all. And no assessment of strength.]

Hill, Kim, and Kristen Hawkes

1983 Neotropical Hunting among the Ache of Eastern Paraguay. In *Adaptive Responses* of *Native Amazonians*, edited by Raymond Hames and William Vickers, pp. 139-188. Academic Press, New York.

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Bow hunters, self-bow of palm wood ca 2 m long. Arrows are reed shaft with hardwood head, often barbed, ca 1.8 m long. No poison, no dogs until recently. Attempt to approach sleeping deer to 15 m for accurate heart shot. [Details but not ranges for lots other game]. Ca 1/8 of men have shotgun, a few brass shells, use large shot. Range with bow or gun ca 15 m, accuracy similar, but gun more knock-down power. Archery contests for fun, observed accuracy ca 21% at 15 cm target 25 m distant and 45 degrees above horizontal. Accuracy improves as approach 90 degrees, rarely shoot horizontally more than 15 m. Bow hunt returns .53 kg meat/hr hunting over 3500 hrs observed, much better with shotgun, espec for larger game. Game populations rapidly diminished. Quantitative optimizing models applied.

Hill, Malcolm

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1948 The Atlatl, or Throwing Stick, A Recent Study of Atlatls in Use with Darts of Various Sizes. *Tennessee Archaeologist* 4:37-44.

Importance of different grips. Could use one hand to hold back dart and add flexing force to throw if atlatl flexible, "grasping the handle of the atlatl with the left hand and the spur end, including the rear end of the dart, with the right hand." Similar to bow action, probably influenced invention of bow. He then says "sweeping movement is necessary to propel the dart." But he claims the 2-hand method works in cramped quarters to "propel the dart with the wrist alone 40-50 feet." [Absurd – I can't believe that after experimentation he still suggested all this nonsense.] Darts less than 30" didn't work well. Small darts better - up to 60 yards. Rigid atlatl gives longer throws than flexible. Recognizes limitations of his reproductions and skill [also small samples of throws]. Two

atlatls tested with and without small weights near handle, "their value was definitely negative," so light weights on atlatl just fetishes. [Actually, it seems to improve distance for his light darts, but not for the medium or heavier, but as he only measured 6 shots for each of 12 trials, not statistically significant.]

Max throw 242 feet. Most efficient darts 36-40 inches, rigid atlatl more efficient than light, flexible. [Illustrations show he tried a variety of atlatl forms, including Cushing's 2hole, Peruvian, sort of Basketmaker, sort of Great Basin.]

Hill, Malcolm

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1949 A Time Study in Making an Atlatl with Primitive Flint Tools. Tennessee Archaeologist 5(1):12.

Took him two hours and 58 minutes.

Hirst, Kris

2005 The Raging Cow: An Atlatl Contest Among the Corn. Your Guide to Archaeology About.Com webpage, URL: http://archaeology.about.com/od/atlatls/a/ragingcow.htm accessed 4/06

Good basic info on atlatls, description of event, photos.

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History Channel

0 1999 Arms in Action I: Slings and Spears. VHS, A + E Television Networks.

[This whole series is shallow, with overgeneralizations, inaccuracies, and no info on practical use.] Brief scene of knapping British flint [T. Lord?] hafting biface to spear, throwing with atlatl. [But spear and atlatl are crude, doesn't look like skilled throw, but you never see flight or outcome.] Slinging, stones + cast shot [but again, slinger doesn't look skilled, uses odd underarm throw, you can't see whether he hits a target or not - how do they expect to convince anyone that these are deadly and effective weapons?] Rest devoted to Greek + Macedonian phalanx, Roman pilum, later lances.

History Channel

2009 Warriors with Terry Schappert: Maya Armegaddon Educational TV program, A + E Television Networks. 45 min.

Tom Mills provides atlatl expertise, Jim Winn knapping and obsidian tools. Larry Kinsella, Bob Perkins, and Greg Nunn also mentioned in weapons credits. Hyperactive host dramatizes Maya battles, accidentally cuts himself with obsidian edged sword, enthuses over atlatls, argues that they were new weapons from Teotihuacan that changed the nature of Maya warfare from capture for sacrifice into war for conquest. "Transverse waves" are mentioned as allowing dart to fly, but Terry more correctly recognizes that flexibility lets dart stablize after throw, Tom describes atlatl as lever. Also features blow guns, a version of Maya ball game, stone celt/axe [made by LK, producers added

ridiculous unnecessary lashings], spears with improbable huge obsidian biface blades [but looks like they wisely used rubber mock-ups for sparring].

History Channel

2012 Top Shot Season 4: Blast from the Past. DVD.

Survivor style shooting competition "reality show." In this episode the team competition is with a 19th C field gun, and the two individuals nominated for elimination from the losing team compete with atlatls. Jack Dagger, "knife thrower and primitive weapons expert" coaches them. This show is not really intended to be educational, and the background info on the weapons is always pretty weak, as here, according to Dagger: "the oldest weapon system in the world. Before the atlatl there were pointed sticks, and rocks. …like an extension of your arm, going to give you an extra wrist and forearm…handle flexes, generating a tremendous amount of energy. That energy is stored in the atlatl, transferred to the dart, and sent downrange at nearly 100 miles per hour." [All of that is innaccurate or wrong.] Contestant Chee however recognizes: "it's all in the wrist flick." Atlatls used are flat slats with groove and inset hook, and single peg for index finger grip, cane darts, targets 30-60 feet away. Dagger's coaching is ok; both contestants learn to throw adequately in a short lesson.

History Channel

2015 Top Shot All Stars Season 1: DVD.

3rd episode "The Mile Shot". The elimination round for 3 contestants is atlatl at 30, 45, and 60 feet 4' bullseye targets with more points scorable at greater distance. Jack Dagger again coaches, same equipment. Colby Donaldson host narration: "It predated the bow and arrow and was perhaps mankind's original weapon system. It served as an extension of your throwing arm, using angular momentum to propel a dart a speeds approaching 100 mph... to cover a distance of nearly 3 and a half football fields. Anthropologists say it was the great equalizer in stone age societies, ... required skill rather than sheer brute force." JD coaching: need to work on balance, breathing, focus, and delivery. Shows how to nock and find flex of dart to vertical..."keep everything linear, transition your weight, and snap at the end." "Arm over the top down that vertical line." Contestant: "smooth release, keep posture upright." Captioning: ... "required skill rather than muscle, allowed women and children to participate in hunting... scientists speculate responsible for extinction of mammoth."

[Contestants don't like a "primitive" throwing weapon. Coaching is fine, all learn ok for the short time, and the info given is better in this one than the first one.]

Hobbs, Horace P.

1963 The Mystery of the Bannerstones and a Possible Solution. *Archaeological Society of Virginia Quarterly Bulletin* 18:2-7.

Bannerstones, especially butterfly and related forms, could have been mounted to slide on

a central rod between two side rods on a "super atlatl." This explains fragility, small holes, and symmetry. Tested with concrete bannerstone and 5.5' spear [details lacking] against hand throwing and "simple" atlatl. Either atlatl doubled distance thrown by hand; super atlatl did better, up to about 55 yards. Bannerstone adds thrust, and also "counteracts forward weight of spear, keeping it in balance until thrown." Super atlatl

allows stone position to be adjusted according to weight of spear.

[Creative idea, but excessively complicated and implausible.]

Experiment - 40 throws each weighted and unweighted, 7 hits un, 13 hits weighted, so weights improve accuracy. [Too small a sample, and pretty poor shooting anyway.]

Hockett, Bryan, William R. Hildebrandt, and Jerome H. King

2014 Identifying dart and arrow points in the Great Basin: Comment on Smith et al.'s "Points in Time: Direct radiocarbon dates on Great Basin projectile points." *American Antiquity* 79(3):561-565.

Smith et al. says Nicholarsen cache 101 points are both dart and arrow; applying Hildebrandt and King (2012) methods of distinguishing show they are just arrow points. Further argument about Elko vs Large Side-Notched form.

A

Hoffecker, John F.

2005 Innovation and Technological Knowledge in the Upper Paleolithic of Northern Eurasia. *Evolutionary Anthropology* 14 (5): 186-198.

Early (45-30 kya) Mid (30-20), Late (20-12) Upper Paleolithic innovations discussed world wide with first evidence dates for many. Early (dispersal period, before end Neanderthals at 30). Pre-35, only bone awls, eyed needles Kostenki 15 E Euro Plain 35-30. Drills by earliest EUP, so prob fire drills. EUP split base antler point, prob simple traps + snares. Beginnings of notational systems, painted images, and pipes or flutes.

MUP, Gravettian technol, periglacial envir, improved shelters, bone fuel, storage pits. At Buret, Siberia, 25 kya, figurine shows hood = sewn skin clothing. Beveled bone spear pts, ivory "boomerang" at Oblazowa, Poland. Isotopic + bone evidence of broader range of diet. Weaving + netting tools at several N. Euro sites. Intentionally fired clay ritual objects. Larger sites, denser occupations. By Solutrean times in W Euro, eyed needles, self-barbed antler pts (= fishing?), first spear thrower (Combe-Sauniere I) [drawing from Cattelain 1989].

LUP W Euro (Magdelenian) sites include multiple structures, lamps, poss stone boiling pits, large pops. Siberian contrast - short term sites = less productive habitat. Wider food ranges in all, barbed harpoons (Magd and E Euro + Siberia) but hooks only late eg Courbet France. Eliseevichi Russia 1000s fox bones = trapping. Spear thrower common in Magd but unknown in E Euro + Siberian sites. Bow and arrow not sure until 14 kya Stellmoor Germany, but backed microliths in Magd + Epi-Gravettian may = bow. Dogs also LUP. Cave art, lamps, mixed paints.

Hofman, Jack L.

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2001 Mehl's dilemma: Paleomortology and interpretation of the Clovis-mammoth association at Domebo, Oklahoma. In *Proceedings of the International Conference on Mammoth Site Studies*, edited by Dixie West, pp. 11-26. University of Kansas, Lawrence.

Excav 1962 by Anderson. Mehl notes that points and flakes found with bones in good assoc but no assurance they killed mammoth; could have been aimed at predators, carried by wounded animal, used as butchery tools. [uncertainties of provenience]

Holmer, Richard N.

1986 Common Projectile Points of the Intermountain West. In Anthropology of the Desert West: Essays in Memory of Jesse D. Jennings, edited by Carol J. Condie and Don D. Fowler, pp. 89-115. University of Utah Press, Salt Lake City.

Bow arrives around 300 AD or a bit before.

Holly, Lance E.

2010 n.d. Beyond the Point: Arrow Shaft Technology of the Prehistoric Southwest. Unpublished MA thesis, U Colorado at Boulder, 2010.

Surveys surviving arrow shafts in SW from many sites, some literature only, for comparison of Pueblo Bonito and Aztec Ruins. Surprisingly consistent in construction: compound with cane shaft, only 2 of 491 arrow fragment specimens were from self arrows. Foreshaft always wood (many species), mainshaft always reed (*Phragmites communis*). 68 specimens with feather remnants, all with 3 feathers equidistant. (2 feathers attested in lit also). All with lead feather oriented perpendicular to nock. [No tangential lashing? Apparently all split vein?]

Variation is in use of stone points, and painting:

152 foreshaft tips: 55% tapered [= sharpened]; 33% notched [for stone point]; 13% blunt. But Pueblo Bonito has 51 specimens of which 30 (59%) are notched. [There are some sampling problems - first, the sample from PB may not be normal, second, it is included in the overall 152; third, unusual preservation of arrows everywhere may often be in unusual contexts like burials, ceremonial caves, sealed rooms at PB, etc] Aztec has 20 specimens, only 1 (5%) notched, Mesa Verde area sites 31 specimens, 2 (6.5%) notched; and Other Sites (all over pueblo world) 51 specimens, 18 (35%) notched. [Note that MV has 39% blunts, way high - maybe indicates more bird and rabbit hunting, less big game?] Sharpened tips most common everywhere: PB 39%; AR 90%; MV area 55%; Other Sites 55%.

Painting: 55 specimens, most common colors red and green, designs usually solid color between fletchings, narrow bands, or longitudinal stripes, usually all near nock. Foreshafts rarely painted [but while none at AR or MV, at PB 13% of painted is foreshaft, and at Other Sites 39%]. Red dominates in all sites but PB, where green is more common, and AR has some green too.

So concludes connection between PB and AR, where Chacoan warriors or ritualists influenced or brought green, stone-tipped arrows.

[very interesting that in surviving arrows, sharpened tips outnumber stone tips, but he goes overboard - there are millions of points from sites, so stone tipped arrows cannot be negligible, and although in his sample, green may correlate with stone tips (or this may just be at PB), stone tips can't be mostly ceremonial arrows - too many with impact damage.]

Holt, C. Brian

1992 A Brief Study on Atlatl Spur Angles. The Atlatl 5(2): 3-4.

Lower angle spur (less elevated) required flatter throw, less follow through, flatter trajectory, more force.

Holm, Bill

1988 Art and Culture Change at the Tlingit-Eskimo Border. In *Crossroads of Continents: Cultures of Siberia and Alaska*, edited by William W. Fitzhugh and Aron Crowell, pp. 281-294. Smithsonian Institution Press, Washington, DC.

Tlingit, northernmost NW Coast culture, in contact with Eskimo Chugach and Koniag, show many Eskimo features, including throwing boards. Exchange increased after Russians brought Aleut and Eskimo fur hunters. Sea-otter harpoon/arrow is most obvious borrowing – form and decoration, but used exclusively with bow instead of atlatl. But a dozen Tlingit throwing boards are known, with NW Coast decoration. Many appear old and worn, functional but not efficient – poor handle, short length between forefinger hole and hook (about 1/2 total length). Shamanic decoration suggests purely ritual use. [Figure contrasts Eskimo and Tlingit grips, shows 19th C Tlingit throwing board, nicely carved but clumsy looking. Can't see upper face with hook.]

Holmes, William Henry

1897 Stone Implements of the Potomac-Chesapeake Tidewater Province. *Bureau of American Ethnology, Annual Report, 1893-94*: 13-152.

Bannerstones illustrated, referred to as "winged ceremonial stones."

Holmes, William Henry

1919 Handbook of Aboriginal American Antiquities. Part 1: Introductory and the Lithic Industries. Bureau of American Ethnology Bulletin 60. Government Printing Office, Washington D.C.

(23, 24) He refers to "banner stones" which "certainly had no other than sacred and ceremonial functions." Ignores chronological evidence (see Moorehead 1910) to suggest that they may imitate Viking axes, but seems to favor Gordon (1916) idea that they originate in northern American whale tail symbolism. No mention of atlatls.

Hörnig, Angelika

2012 The Bow Builder's Book, Revised 2nd Edition. Schiffer Publishing Ltd., Atglen, PA.

Details on archaeological bows in Europe from Mesolithic to Vikings and English longbows, with detailed descriptions of replication and testing, practical info on building wooden bows of all kinds. [Nice, well illustrated, edited volume written in German; translator needed help with the archaeological terms; info quality varies a bit by different authors].

Hothem, Lar

1998 Chlorite Pick Bannerstones. Prehistoric Antiquities Quarterly 18(3):70-72.

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Pick or wing shaped with hole for wood shaft. Considers Indian Knoll type atlatls too weak for practical use. [They aren't - I've made and used one, as have others.]

Hothem, Lar o

2006 The Point is... Semi-Finished Bannerstones. Indian Artifact Magazine 25(3):73-75.

Finds of pieces unfinished at different stages, info on manufacture, eg. 3 different types drill. Some unfinished but partly polished.

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Hothem, Lar, and James R. Bennet

2009 Indian Bannerstones and Related Artifacts: Identification and Value Guide. Collector Books, Paducah, KY.

Many bannerstones were atlatl parts, demonstrated by excavation context. Invented middle to late Paleoindian period. Photo of reconstruction, Fogelman using. Photos of antler hooks with associated bannerstones [but from looted sites, so who knows]. Oodles of nice photos of bannerstones, a few out of focus, arranged by type, both drilled and "tie-on" usually no useful provenience information. Measurements, but no weight or hole diameter info. Some likely ceremonial - not strong enough for use, too elaborate, too large, or incompletely drilled. Variability suggests different uses, from practical to ritual. Miniatures, salvaged pieces or repaired examples. Manufacture techniques shown by unfinished pieces. Antler hooks and handles [plus a few things that are either outside usual range or had other uses]. Valuation and collecting. [Nice pictures, but little archaeologically useful information.]

Hough, Walter

1891 Arrow Feathering and Pointing. American Anthropologist 4(1):60-63.

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"rifling" the feathers by spiraling invented by ancients, but rarely found in Smithsonian specimens. Beveling point may have same effect.

Hough, Walter

1914 Culture of the Ancient Pueblos of the Upper Gila River Region, New Mexico and

Arizona. Smithsonian Institution United States National Museum Bulletin 87. Washington, Government Printing Office.

[Primitive museum collecting/archaeology expedition - lots of info on artifacts, little on the hastily dug sites.] Tularosa Cave, NM [Same as Martin's] - lots of turkey + plant remains. Bear Creek Cave - pahos and other offerings. Small sites on Blue River. Misc other stuff found by locals.

P. 19: "Points for throwstick darts appear to be extremely scarce...No throwsticks were found by the Museum-Gates Exped, nor is it known that any have been found in this region. The only evidence that such an implement was used is a few foreshafts of darts of the kind hurled by means of the throwstick." [Fig of long ovoid dart pt in foreshaft, found near Lava NM] Fig 136 p. 61 "Bunt head for throwdart from Tularosa cave" [short wooden, with fat head]. Among carved pahos from Bear Creek Cave, one "suggests the throwstick but it is not possible to reach a definite conclusion on the subject." [Plate 20 shows, does look like prox end of atlatl, but since there is lots of variety, and many mini bows, this is probably coincidence.] P. 94: Many crook pahos, Cushing suggests throwstick use, "but the shafts of none of them show any particular adaptation to facilitate grasping."

Blue River Caves - shows lots of arrow fore + mainshafts, fletching, hafted pts. Compound reed arrows, nock strengthened with plug, 3 fletchings lashed on with sinew. Arrows all decorated on foreshaft (red ochre) and under fletching (red, green, micaceous [specular] hematite, spirals, zigzags, lozenges.) Fire-making by hand-drill.

Howard, Calvin D.

1974 The Atlatl: Function and Performance. American Antiquity 39(1):102-104.

Not catapult, flipping device, or lever arm etc. Spur and handle remain level throughout throw - greater thrust because spur remains in contact w/spear longer than hand would. "...during a proper throw, the spur...reaches no greater elevation than that reached by the handle... The spur does not swing upward in an arc, but merely 'follows through' in the original portion of the spear's flight path...throw the spear with the atlatl exactly the way it is thrown without it...The atlatl provides greater thrust than the unaided hand simply because it remains in contact with the spear during a greater proportion of the total thrust than does the hand" (102). At the point where the hand releases the spear and starts to swing down, the atlatl handle goes down a bit, but the hook continues to propel the spear. "Hooking results when the thrower fails to keep the atlatl level during the thrust. Any attempt to use the atlatl in a catapult or whipping fashion will hook the end of the spear, forcing it down, and resulting in a completely uncontrolled flight" (103). [It is possible that Arctic rigid harpoons and throwing boards work by his principle, but for other atlatls this is an unusual theory, and simply wrong – in a good throw atlatls do not remain level in use, the lever action is what does the work was his hook wrong? Did he use a rigid spear? Did he simply not observe correctly?] Atlatl 50.8 cm long, spears 193 cm, ca 166 grams, longer works better because less affected by hooking. "Because the atlatl is not a catapulting device, increasing its length

will not provide a corresponding increase in thrust energy" (103). [This is demonstrably wrong - a longer atlatl does increase distance thrown, another demonstration that atlatls are levers - see Whittaker 2011; Cain 2012, 2015.]

Adds 58% spear thrust [distance is what he really measured] over same spear hand thrown [a considerable underestimate]. Adding 64 gram weight reduced distance [yes, because atlatl *is* a lever]. Good accuracy possible, better than reported by Browne.

Howard, Calvin D.

1976 Atlatl function: A Reply to Butler. Plains Anthropologist 21 (74):313-314.

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Counters Butler 1975. Atlatl is not catapult or flipping device [wrong]. Arm and atlatl are not extended to height above the head equal to length of arm and atlatl [he's right there]. Preposterous because spur would break off under stresses of a throw where the dart pivoted 90 degrees on it. [Demonstrably wrong.]

Howard, Edgar B. x (61-70)

1935 Evidence of Early Man in North America. *The Museum Journal* 24 (2-3):61-159 plus plates.

Burnet Cave, Guadalupe Mts, New Mexico, investigations for early material. Upper levels Basketmaker burials etc, but "grooved point" [fluted] found with hearths deeper than 3'. p. 68: B5 cremated burial in basket [were these really cremated?] with "spur end and several other pieces of an atlatl (#32-25-26) adhering to the side of the basket...and..a pinkish quartz pebble with a distinct band about the middle as though it may have been used in connection with the atlatl."

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Howard, Julie, and Joel C. Janetski

1992 Human Scalps from Eastern Utah. Utah Archaeology 5:125-132.

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Several examples, mostly poor provenience. Some attached to basketry disks. Some include ears, eyebrows. One date: $C14\ 1845 + 80 = cal\ AD1-359$, so dates + basketry suggest Basketmaker. Prefers rain + social meaning to warfare interp.

Howard, Hildegard

1960 Significance of Carbon-14 dates for Rancho La Brea. Science 131(3402):712-714.

Explains stratigraphy of early excavations 1914-1916 in pits 3 and 61-67, which affect interp of new C-14 dates on wood. Artifacts and shell in deep excav in pit 61-67 with problematic association with faunal bones. Artifacts include a bunt foreshaft for atlatl dart and 3 other foreshafts, one was tested at the La Jolla Lab, dated 4450 + 200 years B.P. [date makes sense but I wonder what modern dating would do, considering problem of contamination from ancient carbon from tar deposits. No recognizable association with Pleistocene fauna here.]
Howe, David Ian

2017 A Controlled Archery Experiment to Determine the Presence of the Bow in Prehistoric North America. Unpublished MA thesis, Anthropology Dept, University of Wyoming.

Projectile points decrease in size over time in N. Am; significant decline about 1000 BP, usually interpreted as intro of bow and arrow. Controlled experiment supports a size threshold, but large points are functional too, so maybe appearance of bow in N. Am was earlier than thought. If pt reduction indicates bow at only 1000 BP, then bow was in Old World before humans in N. Am., so why would technology dissappear or not be re-invented earlier if bow is superior to atlatl?

Bow and atlatl technologies. [Bizarre description of atlat]: "hand-held lever...hook at distal end serves as a bearing surface to store kinetic energy... User [throws by] extends their bent elbow forward, releases their fingers and with help of full body torqueing movement or forward running momentum lets the lever, fulcrum, and bearing surface mechanics of the atlatl release its stored potential energy." Replaced by bow in Upper Magdalenian 12,500 BP. "AtlatIs hit their targets with greater power than bows, especially in cooperative hunting situations..." and are easier to make. [He cites only old claims for power, not Whittaker et al. 2017. Throughout, he uses Grund as major source on atlatIs and ignores numerous sources of better information.]

[Bow description is also wrong]: "When arrow is pinched between archer's fingers and pulled back the flexible limbs of the bow are pulled with it under the forces of tension (top limb) and compression (bottom limb)." Earliest bow evidence 71-64,000 BP in South Africa (Lombard). Europe possibly 17,000. But no stone tip needed, so could have been wooden tipped arrows even earlier.

Bow replaced atlatl for several reasons: better for smaller faster prey, more efficient in forest, carry more projectiles so better for conflict, bows harder to learn but easier to master than atlatls [Grund's nonsense].

Thomas, Shott, Hildebrandt + King formulae for discriminating between arrow and dart points described; used Thomas for experimental points. 30 obsidian side-notched points, increasing incrementally in size from 15-88mm long. Knapper John Laughlin used percussion [for whole process?] Used 40 lb modern recurve bow fixed on stand, with chronograph and mechanical release. Carbon fiber arrows with helical fletching. Screw-in bird bunts modified to hold stone points. Polar graph target to measure accuracy. Distance 8 m. Ballistic gel target to measure penetration (7 points).

Eight pts IDd as 'arrow' by Thomas method. Accuracy good, 3 largest points furthest from center, apparent trend of decreasing accuracy with increasing size. [Perhaps because heavier points flex shaft more?] Points 7-13 are slightly worse than expected, then later points fit trend better. [probably stochastic or variation in hafting etc]. Smaller points more likely to break, 6 largest did not [not surprising – much thicker]. Bending fractures. Smaller points penetrated gel deeper, although #s 5, 10 did better than #1 (smallest) [difference probably negligible]. Differences in cutting edge and surface area.

Speed test, initial velocity at 1.5 m from bow. Speed generally decreases with increased point weight (from ca 60 m/sec to ca 30). [Which also affects penetration].

Hits also drift slightly to Right with size increase. Maybe slight movement in bow? Or drag on helical fletching.

Implications: Size break for points too large to be used with bows is about 27 gm. Less than that work ok, and an archer would be able to compensate as well. "The results...suggest bow technology could be earlier than previously thought. Perhaps present since colonization, but onset of increased warfare brought greater knowledge of archery, and led to standardization in the form of smaller points?" Cooperative hunting of megafauna did not need such accuracy "literally like shooting the broad side of a barn... an accurate, lethal shot is necessary to subdue a large bison, but with a group of hunters armed with large (less accurate) arrow points, the chances of landing a lethal shot, let alone multiple, are most likely possible." [Howe obviously doesn't hunt, and doesn't understand the accuracy possible with an atlatl and necessary for real hunting.] "Hypothetical Narrative": hunters shift to agriculture and smaller game, for which bow is better, then around 1000 BP Medieval Warm Period causes crop failure, they need to shift to new territory through war or defend their own. More energy invested in improved smaller points, "leading to more structured cultural violence and a change in weapon technology"

[This is an insufficient experiment from which to draw sweeping and dubious social conclusions. But he is right that it shows that point size is not a good discriminator between atlatls and bows.]

Hranicky, Wm Jack

2002 *Lithic Technology in the Middle Potomac River Valley of Maryland and Virginia*. Kluwer Academic/Plenum Publishers, New York.

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[Full of useful information on lithics and related topics much beyond the focus on Middle Potomac, but rather incoherently organized and written, and he's too fond of creating bad new jargon.] Lots of illustrations of varying quality. Major sections on chronology, lithic technology, point typology, flake tools, caches, miscellaneous implements, and experimental archaeology.

[Small section on atlatls, not well defined, not very useful information. Illustrates atlatl hook of basalt from VA, no provenience given. Mentions "Hardaway site produced an atlatl made from antler" but no citation. How the heck does a "Functional Angle of 45-180 degrees" apply to atlatls?] Bannerstone section summarizes Hranicky 2003.

Hranicky, Wm Jack

2003 Bannerstones: A Study on Their Holes. *Quarterly Bulletin of the Archaeological Society of Virginia*. 58(1): 35-46.

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Accepts bannerstones, barstones and boatstones as atlatl weights. Weights add balance and stability, and inertia in a pendulum system [apparently Webb's idea], silences launch [claims as his idea, but see Perkins 1993]. Virginia lacks high quality forms, only datable contexts are Woodland and probably Late Archaic. Could be used as pendant, or multiple stones on one atlatl. Stone or reed drilling, one or both directions. Some too large for atlatl use (should be <50 mm in any dimension) [no weight information given]. Large bannerstones are higher quality, some holes show polish suggesting strap wear. Hole diameter 11-15 mm usual.

[Problematic statements include:] "Clovis point was a knife and based on its size, not flyable as a spear point." "Bannerstone ...a life-time personal object...for males...made during adolescence and carried until the user could no longer hunt." Replaced only if had bad magic, in which case killed by breaking, or killed at death of owner, but rare in graves. [So what evidence associates them with age or gender?] Some fragments continued in use, drilled for pendants.

Hranicky, Wm Jack

2004 An Encyclopedia of Concepts and Terminology in American Lithic Technology. Authorhouse, Bloomington, IN.

[A mixed bag. Vast compilation (598 pages) of good information from all sorts of sources, usually with references. But lots of irrelevant, useless, and incorrect stuff too, especially strange unnecessary concepts and coinages by Hranicky. Many entries are badly written with typos and errors, and students may be badly mislead by some info. References are tricky too – e.g. Fewkes spelled "Fowkes," I get credited with 2 articles written by another Whittaker, one before I was born. Desperately needed a severe editor. Numerous small illustrations, some good, some awful. Alphabetical organization is confused, inconsistent, and redundant, so it's not very useful as a reference encyclopedia.

Atlatl entries feature confused typology and misstatements: "with weighted atlatl, throwers could double effective distance" ... "Indians never missed a target under 50 meters" ... "increasing or decreasing point weight by 20% causes throwing distance to decrease 10%." Hranicky doesn't understand atlatl mechanics and the diagrams are laughable. Info on atlatl contests is years out of date. This is one of the unsuccessful sections where he tried to include too much beyond his knowledge.

Nevertheless, this book is a useful source to mine for ideas on other topics, and fun to browse in.]

Hranicky, Wm Jack

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2006 *Experimental Archaeology: A Science for Studying Native American Prehistoric Technology.* Authorhouse, Bloomington, IN.

[Again a mixed bag. The short atlatl section is not useful - out of date, relies on strange flexing theories.]

Hrdlicka, Daryl

2002 How Hard Does It Hit? The Atlatl 15(4):16-18.

Energy calculations for atlatl dart compared to other projectiles. Force (momentum) reflects how hard it hits target (F = Mass x Acceleration). Kinetic Energy (stored energy in projectile) determines amount of damage to target (KE = 1/2 Mass x Velocity

squared). Atlatl darts have more impact force and momentum than most bullets (because more mass) but much less kinetic energy (because slow). "Weaker than modern firearms, but still capable of bringing down largest game." They rely on penetration rather than shock to damage target. [Very interesting calculations. Unfortunately he uses US measurements - who ever heard of "slugs" of mass! And no doubt some readers will interpret this as "atlatl more powerful than gun."]

Hrdlicka, Daryl

2003 How Hard Does It Hit? A Revised Study of Atlatl and Dart Ballistics. *The Atlatl* 16(2):15-18. Also posted (2004) at http://www.thudscave.com/npaa/articles/howhard.htm

Three variables for comparison: how hard it hits (kinetic energy), how hard it is to stop (momentum) and how effectively it penetrates (sectional density). Calculations for spears, atlatl darts, arrows, bullets. Darts much less kinetic energy (KE = 1/2 Mass x Velocity squared) than bullets, but more than arrows, and plenty to take big game by archery standards. Momentum = Mass X Velocity so darts less than heavy spears or fast bullets, but more than .357 magnum or arrows. High momentum promotes penetration, especially of harder tissues. Sectional density (Weight/Diameter 2) also affects penetration – denser, smaller projectiles penetrate better, so darts very effective, relatively heavy and small. [Improved version of 2002. Good explanations of physics, but I still think a "slug-ft/sec" is a measurement used in slow garden races.]

Hrdlicka, Daryl

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2003 NPAA Northern Plains Atlatl Association Web Page. URL http://:www.thudscave.com/npaa/index.htm (accessed 2/2004) or NPAA Atlatl Plans URL: <u>http://www.thudscave.com/npaa/designs/index.htm</u> Accessed Aug 19, 2018.

Many links and articles, including the following by Hrdlicka. One of the most useful atlatl sites.

2003 Intro to the Atlatl.2003 Using the Atlatl: The Basics. Also printed 2009 in <u>The Dart</u> August 2009:5-8.

Distinguishes 4 grip types based on how dart, not atlatl, is held: Knuckle (split finger, Basketmaker, with dart between knuckles); Thumb (thumb and index thru loops hold dart); Modified Thumb (1-hole Eskimo with index thru hole, thumb helps hold dart); Hammer (dart on rest, not held by fingers, modern) [so no holes, no rest like Peruvian would be what? Thumb or M Thumb? A good idea for classifying grips but not exhaustive.] Good description of throwing motion.

2003 Shaft Wrenches.2003 Terms for the Atlatl.

Ethnographic (Australia has most) and modern, "Klingon," and ancient [Sumerian, Egypt, Sanskrit – I know no other evidence for atlatls in these areas and suspect the words relate to spears or rabbit stick type "throwing sticks"]

2003 Peg Styles.2003 Atlatl Weight Attachments.2003 Handles2003 Carving Soapstone Weights2003 Atlatl Plans

"found, made, reverse-engineered, and otherwise gathered a number of plans and designs... arranged according to where in the world this type was used." [Some 75 designs, varying quality and usefulness, good source of ideas]

2003 Australian Children's Darts <u>http://www.thudscave.com/npaa/darts/auskiddarts.htm</u> (Accessed Aug 19, 2018.) 2003 Dart Construction.

Tips and plans for a variety of darts, straightening, fletching, etc.

Hubbard, Montx1984 Optimal Javelin Trajectories.Journal of Biomechanics 17(10):777-787.

"thrower imparting most of the acceleration of the javelin to a final velocity near 30 m per second [67 mph] within a period of about 0.15 s (Miller and Munro 1983). [assumes knowledge of terms like "pitching moment," so not enough definition for ordinary reader to understand. All aimed at making a computer simulation, no field experiments.] Range is affected by 1. Initial velocity. 2. Height of release (limited effect, can't be more than ca 1 m above shoulder) 3. Initial flight path angle. Varies angle from 30-34 degrees, producing theoretical change from 115.45-114.39 m of range [i.e. not much]. Also vibration of javelin – treated in simulation as rigid, but it isn't. Thrower has about 6 m/sec of velocity from run-up before throwing action begins. Design parameters such as 1. Mass: 800 g is minimum allowed by rules. Increase to 809.6 g decreases range by 0.15m, also changes some other parameters. 2. Moment of inertia 3. Density 4. Wind. Optimum javelin shape would require difficult computational fluid mechanics, and wind tunnel tests.

Huckell, Bruce B.

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1982 The Denver Elephant Project: A Report on Experimentation with Thrusting Spears. *Plains Anthropologist* 27(97): 217-224.

Spears with Clovis points used on elephant carcass. Rather thick foreshafts, point secured with sinew covered with resin. 5 by H, 4 by Bradley. All used with 2.5 m shaft. Thrusts at chest or shoulder height [but doesn't say if over or underhand]. Penetration into

ribcage/abdominal area 75-274 mm, none the full length of foreshaft; penetration usually stopped at either point lashing or mainshaft socket. Breakage mostly of foreshafts; point damage limited to minor tip removal and basal corner snap. Right-angle hit less likely to snap. Movement of point in foreshaft causes burin damage to base. Ventral region of elephant is vulnerable to Clovis type thrusting spear.

Huckell, Bruce B.

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2007 Clovis Lithic Technology: A View from the Upper San Pedro Valley. In *Murray Springs: A Clovis Site with Multiple Activity Areas in the San Pedro Valley, Arizona*. C. Vance Haynes and Bruce B. Huckell eds. Pp. 170-213. Tucson: University of Arizona Press.

Spatial analysis of debitage. Many materials, mostly of unknown sources. Numerous knapping clusters of related debitage, mostly representing repair or manufacture of bifaces, including points. Knapping was done in small concentrated areas.

Points - almost all damaged, none very carefully made, mostly short flutes, often multiple, could be fluted by direct or indirect perc, possible also pressure. Basal margins and concavity all ground. Several severe impact fractures. Reworking of damaged points. Points used on bison show more damage than those used on mammoth - perhaps more bone on smaller animal, perhaps used thrown spear on bison vs thrust on mammoth.

Blade and flake tools. No blade cores, blades rare in Clovis, cannot be called a blade based industry.

Huckell, Bruce B. and C. Vance Haynes

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2007 Clovis Paleoecology as Viewed from Murray Springs, Arizona. In *Murray Springs: A Clovis Site with Multiple Activity Areas in the San Pedro Valley, Arizona*. C. Vance Haynes and Bruce B. Huckell eds. Pp. 214-228. Tucson: University of Arizona Press. Competing models of Clovis: big game specialists with no modern analog, vs mammoth sites are biased sample, more generalized subsistence likely. At MS, assoc w mammoth and bison kills, horse and canid bones but assoc unclear - at most C sites, scattered other animal remains in unclear assoc, often because as at MS, a favorable spot under drought conditions. 14-22 mammoth kill site, including 4 in San Pedro valley, suggest consistent prey. At MS and elsewhere, knapping aimed at maintaining necessary specialized weapon points, which were often lost and damaged, but worth recovering and repairing. [Never says whether he thinks atlatls used.] Termination of megafauna after "black mat" that covers MS mammoths and others suggests Clovis caused extinction, but mat also reflects climate change. San Pedro sites are microcosm of extinction event: decline in environment carrying capacity (dry), with addition of new predator.

Hudson, Charles

sic Burling

1976 The Southeastern Indians. University of Tennessee Press, Knoxville.

pp.47 Eva site Archaic, hunting with short spears "ejected from spear-throwers" "a wooden shaft about 2 ft long with a hook on one end...effectively increased the length of

the hunter's arm..." Bannerstones or boatstones as weights of uncertain function "may have enhanced the velocity of the spears... or made the spear-thrower suitable for secondary use as a war club."

Hudson, Travis, and Thomas C. Blackburn

1987 The Material Culture of the Chumash Interaction Sphere, Volume 1 : Food Procurement and Transportation. Volume 5: Manufacturing Processes, Metrology, and Trade. Ballena Press: Los Altos.

5 vol, synthesizing material collected by John P. Harrington starting 1912, and others. Info from H notes, some commentary, lots illustrations but photos mostly poor quality. Much of the data is linguistic.

Vol I:81-132 bows, arrows, quivers etc. Self bow: continued into late 19 C. Lengths <3.5 ft to 4.5 ft. For small game. Sinew-backed bow for large game and war, more powerful + valuable. Elderberry, juniper, other woods. Arrow on R side of bow, pinch grip, but also some bows used slanted with arrow on L. Bows (sinew backed) made by specialists, and to get you joined a brotherhood. Bowstrings of vegetal fiber or sinew. Sinew backed bow shorter and stronger, recurved. Juniper, pinon, elder wood reported. Decorated with paint. Both self arrows and cane compound arrows. Stone points – contradictory knapping info [including unlikely indirect perc with agate pebble as punch.] Most informants didn't know much. Bone bunt pts, criss-cross stick bird points. Wooden self-pointed foreshafts in cane. Carry 12-20 arrows in quiver. 3 fletch. Hot shaft-straightener on cane arrow. Archaeol arrow making kit contains flakes, feathers, hafted shark tooth, hide, beads, stone pt, wood pt, notched wooden shaft, etc. Harrington notes – war arrow longer or shorter, different type cane. Arrow lengths 75-82 cm. Photo of 10 arrows w small side-notched pts. Arrow poison of putrid liver or poison animal, or gall.

Curved rabbit sticks. Slings known.

Spear thrower p 143-145: Harrington thought used recently. Heizer 1945 rec 2 types: like Aleut, and like Tarascan, introduced in historic times. Figure – [the abbreviated specimen known from Heizer 1945 and others, called "fragment" here, collected Sta Barbara by Vancouver. Always seemed odd, too short to use, maybe it is indeed a cut-down, modified, Tarascan relic.] Other figure – Eskimoid thrower from S Rosa Island – Aleut type.

Vol V: stone tools of various types. Lots of nice hafted knives, mostly triangular stone blade set in tapered wooden handle. Steatite shaft straighteners, shaft wrenches. Pressure flaking and tools [poorly described, informants ignorant]

p. 120 chipping tool like pressure flaker used to shape shell beads

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Hughes, Susan S.

1998 Getting to the Point: Evolutionary Change in Prehistoric Weaponry. *Journal of Archaeological Method and Theory* 5(4):345-408.

[Mixed paper.] Evolutionary perspective: traits of technology are invented, tested, discarded or kept as advantages appear. Engineering principles should tell us what

s B

attributes to examine. Begins with long discussion of engineering characteristics of thrusting spears, fletched and unfletched darts, and arrows. Three equations describe projectile motion, basis for tip variables to consider: kinetic energy, penetration, and drag. Four dimensions of weapon engineering: penetration, accuracy, distance, and durability. Evaluates particularly mass, width, and tip cross-sectional area (TCAS) as important attributes of points. Data from others for velocity, mass, and kinetic energy of arrows (means 46.9 m/sec, 29.9J, 29.5 g) and darts (means 23.6 m/sec, 32.5J, 110.9 g). [doesn't use Hutchings and Bruchert, some velocity calculated from distances].

Spine important in arrows and darts. [Incorrect def of archer's paradox, hard-tofollow and incorrect explanation of dart flex, including Perkin's oscillating waves pushing dart from thrower, although atlatl not claimed to be spring.] Balance - unfletched darts and arrows likely to have forward balance by either heavy head or light endshaft; fletched ethnog arrows much wider range of balance point, from 20-55% from tip. Penetration vs durability of points.

Applies expectations to interpret sequence of points from Mummy Cave, Wyoming. Concludes small late points indicate rapid and complete replacement of atlatl by bow and arrow 1500-1300 BP, spearthrower dominated assemblage from beginning as early as 9200 BP to 1500 BP, and thrusting spears (very large points) were in use as supplement throughout. Before 7970 BP, points large but variable, probably because used to balance unfletched darts; after fletching, less variable, somewhat lighter. [Her overall conclusions are plausible and probably right, but the engineering section, although has some good ideas and info, is very theoretical, not based on practical experience, and has a lot of weak reasoning, incorrect theory, and inadequate data. Her ideas about the advantages of different weapons in particular are weakly supported and overgeneralized.]

Humane Society

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2006 Commission's Decision to Chuck Atlatl Hunting Hits the Mark, says The Humane Society of the United States. URL:

http://www.hsus.org/press and publications/press releases/pa commission bans atlatl hunting

"atlatl is a primitive, small wooden sling... Because it is hurled rather than aimed, an atlatl spear is very inaccurate, even in the hands of a skilled user...the commissioners have come to their senses and returned atlatl hunting to the history books where it belongs... To launch a spear an atlatlist must jump up and stride quickly forward, swinging his arm in an overhand throwing motion. This movement often frightens the intended target, who then tries to flee, making a clean kill unlikely." [Ignorant and biased.]

Hume, David L.

x,p

2009 The development of tourist art and souvenirs – the arc of the boomerang: from hunting, fighting, and ceremony to tourist souvenir. *International Journal of Tourism Research* 11:55-70.

Discusses classes of tourist art, using boomerang mostly. But woomera fit too. Often miniaturization [and skeumorphic changes], and decoration blending traditional and imported techniques and aesthetics. Souvenir must memorialize an experience, a place, thus should have some level of 'authenticity' to a place. Boomerang is ideal – uniquely recognizable form assoc with Australia, but can be stretched: a N Territory type can represent all of Australia. Photo of Aust landscape painted in gouache on a simplified W Desert spearthrower by Albert Jamatjora 1943.

Hunter, Wryley

1992 Reconstructing a Generic Basketmaker Atlatl. *Bulletin of Primitive Technology* 1(4):57-61.

Good information and illustrations of several Basketmaker (SW) atlatls, including good drawings of Broken Roof Cave, Lukachukai, White Dog Cave, Sand Dune Cave specimens, with table of dimensions and specifics. Diagram of loop system on SDC from Lindsay et al. 1969.

Hunzicker, David A.

2008 Folsom Projectile Technology: An Experiment in Design, Effectiveness, and Efficiency. *Plains Anthropologist* 53(207):291-311.

Used 25 F points replicated by Patten (80 counting reuse after damage and reshaping), hafted 5 ways, fired with crossbow at 30-35 m/s perpendicularly into beef carcass ribs. Foreshafts on 220 cm, 240 gm shafts to simulate atlatl. Fluting helps hafting - easier to fit convex foreshaft notch interior to flute surface than usual concave notch interior to lenticular point, but labor intensive. Hafted to full length of flutes.

Foreshaft types all performed similarly regarding break types. Break types: snap 30%, crush 21%, edge damage 15%, burination 12%, impact flute 8%, longitudinal split 3%, complex + snap 11%. Foreshafts rated on manufacture cost, pentration, durability, and point preservation. Of 108 shots, 32% between ribs to lethal depth, 42% hit rib but still lethal depth, 26% failed to penetrate 40 cm (judged as lethal). The 73 rib impacts damaged 73 pts (18 destroyed), 18 foreshafts, and 3 mainshafts - foreshafting protects main shaft. Hafting protected point - most damage to tip, point could be rejuvenated as in Ahler + Geib model = highly maintainable. 39% of shots minor damage, 32% no damage, 12% major damage, 17% total destruction of point. Average survival of 4.6 shots. Fragment frequency compared with archaeological finds. Rejuvenation index based on length reduction allows assessment of relative numbers of uses of archaeol assemblage points, then 75% lethality rate allows estimate of number of kills represented [as he notes, this is getting rather far from evidence; too many intervening variables of technology and human skill, eg accurate hits, exper was not with atlatl etc].

Hurst, Winston B. and Christy G. Turner o

1993 Rediscovering the "Great Discovery:" Wetherill's First Cave 7 and its Record of Basketmaker Violence. In Anasazi Basketmaker: Papers from the 1990 Wetherill-Grand

Site in Utah where Wetherill first recognized people earlier than pueblos. About 90 burials, evidence of violence including atlatl dart points in bodies, clubbing, scalping, stabbing with stone knives and bone daggers.

Distinguishes knives (>9 cm, diagonal notches) from atlatl dart points (smaller, diagonal or horizontal notches). The point assemblage is comparable to other Basketmaker points, less so to Archaic (Elko) point series.

Hutchings, Wallace Karl

1997 The Paleoindian Fluted Point: Dart or Spear Armature? The Identification of Paleoindian Delivery Technology Through the Analysis of Lithic Fracture Velocity. PhD dissertation, Simon Fraser University.

"Velocity-dependent fractures on fluted points reveal fracture rates associated with highvelocity impacts, indicating the use of the spearthrower" No clear evidence of Clovis atlatl, but early dates on hooks from Marmes Rockshelter and Warm Mineral Springs, both 9-10,000 BP, others. Summarizes Clovis and Folsom tool kits and hunting strategies. Problems of classifying points as dart or arrow tips, criticizes Odell's flake point hypothesis – accidental fractures look similar.

Fracture surface features on flakes reflect manufacture. Relation between Wallner lines and fracture origin reflects velocity of fracture. [Fracture mechanics details and derivation of fracture velocities difficult to understand, illustrations in my copy reproduced poorly.] Test on manufacturing techniques, with velocity distinguishing pressure, soft percussion and indirect perc, and hard hammer perc, but variable and overlapping, especially pressure. Impact fracture should be in the "dynamic loading" or high speed range of fracture propagation.

Problems of reconstructing hafting system for experiments [good example of reasoning from variety of evidence]. Uses flute width to estimate shaft diameters of 12-17 mm. Compares Huckell 1982 and Frison 1989 experiments. Prehistoric darts (mostly SW and Gt Basin) 3-19 mm diameter, foreshafts 6-19 mm diameters, most 8-11 mm. Coleman, boar hunter, prefers 221 cm long, 11mm diam, Clovis point 20-30 gm, total weight 240 gm, similar to Australian average weight of 246 gm.

Ethnog hunting range data poor, suggest accurate range 10-30 m.

Coleman's Georgia boar hunts - 51 hits, 58 misses, kills from 3-46 m, average 15 m. Measured spearthrower velocities, see Hutchings and Bruchert 1997.

Point fracture velocity tests using large cross bow at short range, shots against stone and beef ribs. All points obsidian, more or less Clovis form. Darts 167-296 gms, velocities averaged 35.6 m/sec, kinetic energy 117-165 Joules. Fracture velocity data from 53 points, spanned rapid (38%) and dynamic (62%) loading rate regimes. In other words, lots of variability, with fracture velocities "spanning full range of fracture velocities associated with stone tool manufacture. This suggests that the impact fracturing of lithic projectiles is a complex process which involves more than just those fractures caused by

the extreme force of sudden impact." Fracture velocity less affected by impacted material (stone or rib) than in manufacture experiments. Compared also javelin, spear, and arrow, and dropped darts. Spear continuous pressure produces quasi-static (slow) fracture, javelin much slower than dart and arrow, which are similar. Only arrow and dart produce fractures in the upper dynamic loading range.

[I have trouble believing that projectile velocity makes much difference to fracture velocities which are 10-50 times greater, ie projectile velocities around 35 m/s, fracture velocities from 454-2231 m/sec. Also, note fairly consistent dart velocity, highly variable fracture velocity. His explanation that fractures are complex, and one impact may produce evidence of several speeds may be right. He would say lower ranges aren't definitive, but high range only achieved by arrow or dart.]

Examined archaeological specimens, total of 668, mostly fluted points and fragments, from many sites. Clovis – 19 pts with "velocity dependent" fracture features, 63% in "dynamic" range. Eight Folsom points, all within dynamic range. [Problems here include small sample, and calculations of fracture velocity apparently based on Modoc obsidian rather than actual material of points.]

Low fracture velocities in flute scars suggest pressure fluting of Clovis.

[Very interesting, high potential. I want to see other similar studies before I'm fully convinced.]

Hutchings, W. Karl x

1999 Quantification of Fracture Propagation Velocity Employing a Sample of Clovis Channel Flakes. *Journal of Archaeological Science* 26:1437-1447.

Wallner lines and fracture wings, features of fracture surfaces, reflect fracture velocity; known for years, see Faulkner 1972 and others. Rate of fracture propagation in knapping is related to velocity of loading, affected by percussor density, mass, angle + speed of impact, and support of core + hammer. Undulations (ripple marks) not velocity-dependent, but show orientation of the crack, the longitudinal elastic wave. Wallner lines and fracture wings occur on surface when fracture waves encounter a local irregularity in material or the fracture boundary. The angle of divergence of these features reflects fracture velocity (they propagate faster than the main fracture itself) and is material-specific.

Few measurements of fracture velocity reported previously. H uses several hundred Glass Buttes obsidian flakes + blades, percussion, pressure, indirect perc. Different velocities distinguishable: "Quasi-static" 300-400 m/sec by pressure; "Rapid" 600-800 m/s by indirect perc, direct perc w antler, and at higher velocities 1000 m/s by stone percussors. "Dynamic" loading i.e. projectile impact, should produce fracture velocities 1000-1500 m/sec [but this appears to be estimated from someone elses flint experiments]. Examined Crabtree chest crutch blades, 46-117 m/s [i.e. very slow]. [Note that NONE of these velocities are directly measured, they are calculated with the assumption that this technique works and the constants for the obsidian material are correct.] Overlaps: some pressure fract velocities up to 615 m/s, so some pressure is not really quasi-static. The groups are statistically distinguishable despite overlap, but "not

all measured values will be assignable to specific reduction processes."

Archaeological sample: 12 obsid Clovis pts. Experiments show all techniques can be successful at fluting and produce similar results. Velocities measured from scars [usually only one or two fracture wings observable – small samples] show fluting by pressure techniques, slow application of large amounts of pressure – ie something like chest crutch.

[I am still worried about the assumptions here, and the explanations are still not as clear as needed. Why doesn't he label the fracture features he observes and their relationships on clear photos of specimens instead of idealized diagrams?]

Hutchings, W. Karl

2011 Measuring Use-related Fracture Velocity in Lithic Armatures to Identify Spears, Javelins, Darts, and Arrows. *Journal of Archaeological Science* 38:1737-1746.

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Fractures occur under different loading rates: quasi-static, slowly increasing contact force such as pressure flaking; rapid loading by impact such as in percussion flaking; and dynamic loading by high speed impact, restricted to certain projectile technologies.

Wallner lines and fracture wings originating from fracture boundaries and irregularities in material have velocity-dependent angles. A single impact may cause multiple fractures of different velocities at different places on a point. [Looking at his photos and diagrams (better than above) I still wonder how you can measure the angles of microscopic intersecting curved lines in a clearly replicable way.]

Experiments with custom crossbow of variable draw weight up to 204 kg, projectiles of variable weight, velocity measured by chronometer. 300+ obsidian points shot into beef ribs. Spearthrower darts from 167-296 grams [heavy!] at velocities around 36 m/s [ca 80 mph, too fast]. Fracture velocities spanned rapid to dynamic [i.e. lots of overlap]. Also shot 6 darts into stone by hand using atlatl, velocity not recorded but estimated between 34-43 m/s as in H + B 1997 [velocity estimates way too high] but got same range of fracture velocity measurements as beef ribs.

Javelins: 137-296 grams, velocities averaged 25.1 m/s [ca 56 mph, within range of javelin info; Olympic javelin (800 gm) throw over 90 m requires at least 30.3 m/s (68 mph) (Whittaker et al. 2017)] 45 shots, only 2 in 'dynamic' fracture range.

Arrows: 44.5-55.8 grams, shot with 45 lb compound bow, velocity 33.5-46.6 m/s [which should have told him his H+B dart velocity is too high since it is the same!]

There is a great deal of overlap in fracture velocities produced by diff loading rates, so only limited inference, but only arrow and dart projectiles produce fractures reflecting dynamic rate.

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Hutchings, Karl

2011 When is a Point a Projectile? Impact Fractures, Scientific Rigor, and the Limits of Inference. Paper presented at Multidisciplinary Scientific Approaches to the Study of Stone-Age Weaponry, Mainz, 19-22 September 2011.

"Employing modern experimental results to explain past behaviours demands, however,

that archaeologists not only practice rigor in their experimental research, but give careful consideration to the limits of inference."

Points identified in archaeology by morphology – neck/stem width, overall size and shape. Fenenga, Thomas, Shott give standards. Dart shaft data shows .8-1.1 cm diam, but some <.6 cm. NC Cave dart foreshafts and other NV info from Tuohy. One problem is overgeneralizing from small sample.

Tip Cross Sectional Area, TCSA

Diagnostic impact fractures: problems with ambiguity of production – are they really diagnostic? Odell applies to flakes, argues for early flake points, but Hutchings examined experimental debitage (246 pc), 74% suitable for points, 6.1% of them had damage suggestive of point use = erroneous "use-wear".

Middle Paleolithic points ID by such methods – not adequate evidence for projectile use, need better scientific reasoning. [Curiously, he did not mention his microfracture methods, though in conversation he remains convinced that is the way to go.]

Hutchings, W. Karl

2015 Finding the Paleoindian spearthrower: quantitative evidence for mechanicallyassisted propulsion of lithic armatures during the North American Paleoindian Period. *Journal of Archaeological Science* 55:34-41.

"non-subjective quantitative data derived from velocity-dependent micro-fracture features" on damaged points to ID propulsion. No previous evidence of Clovis atlatl, just assumption [ignores Hemmings FL material].

He describes briefly the fracture features, as "quasi-static (e.g. pressure flaking, thrust spear), rapid (spear, javelin, to dart), and dynamic (dart, arrow only). Admits great deal of overlap [doesn't give original experimental velocity data for projectiles etc from which his crack velocities are derived. Oddly, dart give higher than arrow.]

Examines 668 pts, finds 19 Clovis with 21 fracture velocity measurements, 8 Folsom pts with 11 measurements, and [a mixed bag] of 'pre-Archaic' pts (16 specimens). Clovis about half in "rapid" range, half in 'dynamic', Folsom all in 'dynamic'. Suggests likely that Clovis pts armed variety of weapons, including atlatl darts since bows not attested that early, "or some other as yet unknown propulsion technology [Huh? What could that possibly be?]. Atlatls might improve mobility because they distance hunter from target; javelin and lance need to be close, usually with "terrainbased" strategy involving traps etc.

[Problems remain unfixed: different fracture velocities for different materials, not necessarily the ones of the specimens; the derivation of these velocities in the first place, including claims of experimental dart velocity that are far too high, etc, see earlier comments]

Hutchings, Wallace Karl

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2016 When is a point a projectile? Morphology, impact fractures, scientific rigor, and the limits of inference. In *Multidisciplinary Approaches to the Study of Stone-Age Weaponry*, edited by Radu Iovita and Katsuhiro Sano, pp. 3-12. Springer Science and Business

Media, Dordrecht.

Hutchings, W. Karl and Lorenz W. Bruchert

1997 Spearthrower Performance: Ethnographic and Experimental Research. *Antiquity* 71(274): 890-897.

[Key article, good references]

Experimental focus has been on how spear thrower works - but performance capability is more interesting. Browne, Butler, Patterson threw incorrectly, thus failed to evaluate right. Advantage of spearthrower is it imparts "much greater projectile force than the bow."

More than 1/2 spear velocity comes from "rotational acceleration of wrist and forearm" [so does atlatl work by magnifying that?]. Velocity data should not be derived from distance throws - measure directly at launch and target by photo.

Dart variation affects performance more than atlatl.

Ethnog range of dart lengths is 1.2 m (Eskimo) to 3.4 m (Australia).

American West darts from caves consistently light (45-90 gm), short (116-160 cm). Ethnog hunting range data poor (Arctic + Aust refs), suggest accurate range 10-30 m. Coleman's Georgia boar hunts - 51 hits, 58 misses, kills from 3-46 m, average 15 m. Velocity measurements by others 20 to 40 m/sec.

Tested darts 82-545 gm at 15 m target distance. Velocity 28-64 m/sec, averages 33-47 m/sec, even heavy dart worked fine, 220 gm best matched to atlatl - need match so dart flex and oscillation "allows it to spring away from the hook after maximum acceleration of the spear thrower." [This last is not correct.] Average velocity of 36 m/s with heaviest dart tested, 545 gram. [The velocity figures are impossibly high - see Whittaker and Kamp 2007, Whittaker 2010. Anything over 35 m/sec (78mph) is suspicious; here they claim max of 64 m/s with a 273 gram dart (= 143 mph!); 36 m/sec with 545 gram (= 81mph) – NOT possible.] Kinetic energy from average throws >350 Joules = 4x arrow from modern compound bow. [So their calculations are based on incorrect accuracy estimates, greatly exaggerating KE of atlatl dart, although general conclusions ok.]

Conclusions: 1) Need adequate skill to test. 2) Spearthrower <u>not</u> inaccurate or inefficient. 3) More powerful than generally realized - capable of more force than arrow, and when used at similar ranges, equivalent accuracy. 4) Replacement probably because bow easier to use.

Hyder, William D. p,x

1997 Basketmaker Spatial Identity: Rock Art as Culture and Praxis. In *Rock Art as Visual Ecology*, edited by Paul Faulstich, pp. 31-42. American Rock Art Research Association, Tucson.

Group boundaries defined by shared understanding and stylistic traits, while maintaining differences to communicate difference between groups. Rock art marks territories. BM here Grand Gulch region, dates 500 BC to 400 AD. Foraging, agric fields on mesa tops + canyon bottoms. Lack of habitation near canyon storage suggests these areas were

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'hedge' areas, only periodic use, which creates need to identify one's space with rock art in absence of other features. Loose social structure, small groups, local control of land. Surveyed 13 randomly selected plots in Grand Gulch, one included Big Man panel in GG with M/F pair of large anthro pictographs, near access route, agric land, storage in caves. Several other similar sites briefly described. White figures with headdresses 'fountain heads' common, at Green Mask associated with possible Big Man pair figures, but not positioned like others. Big Man sites may bound local agric and gathering areas. [Concept of boundary marking is useful, but not enough data here. No atlatl mentions.]

Imamura, Kaoru

2016 Hunting play among the San children: Imitation, learning, and play. In *Social Learning and Innovation in Contemporary Hunter-Gatherers*, H. Terashima and B. S. Hewlett eds., pp. 179-186. Springer Japan, Nagoya.

x

San children learn life skills through play and imitation, and more from playmates than adults. Overt instruction rare, but older boys often help younger ones by taking over and finishing a tool.

[incomprehensible (garbled?) distinction between 'emulation' and 'imitation']: chimps copy behavior by emulation i.e. to learn outcome or goal, disregarding necessary actions, poor at mapping visual image of another's body onto own movements. But emulation more efficient way of learning new skills than imitation i.e. precisely copying behavior whether or not it is understood, and humans do more emulation as mature. [This makes no sense.] Humans better able to incorporate info of others' body movements.

San mimic a lot: impersonate others to describe their characters, reenact experiences, mimic animal behavior. Ca age 5, learn tool use, knives, axes, hammers etc. Borrow adult tools, given own knife around 10. Make toys including slingshots, bow + arrows, model cars + planes. Form same-sex playgroups age 5-12, peer transmission of skills by watching and imitating. Play has little use of play equipment, no tag or hideand-seek games, no competitive games like races, some play similar to adult behaviors, e.g. play 'house,' girls make dolls. Boys play hunting using small bows + slingshots to kill birds etc, feed selves. Make fires and cook corn powder from home and small animals from bush. Consider this play rather than work. [maybe, but they are feeding selves]. Observed boys play-act hunting with hobby horse and toy spears, pretend butchering of younger kids playing the animal. This is new behavior because less actual hunting. [Maybe.]

Iovita, Radu pdf

2011 Shape Variation in Aterian Tanged Tools and the Origins of Projectile Technology: A Morphometric Perspective on Stone Tool Function. *PLoS ONE* 6(12):1-14. electronic document, accessed 12/29/11 URL:

E:http://www.plosone.org/article/info%3Adoi%2F10.1371%2Fjournal.pone.0029029.

N. African Middle Stone Age technocomplex - the Aterian is older than previously assumed (back to earliest Middle Stone Age), and associated with anatomically modern

human morphology and behavior. Aterian is defined by the presence of 'tanged' or 'stemmed' tools, assumed to be among earliest projectile weapon tips. Actually, very variable, with some pointy ones, other dull or even rounded, more like scrapers – assemblages are similar to scraper-rich Mousterian, except with tangs. Microwear studies are problematical. Classical morphometrics and Elliptical Fourier Analysis of tool outlines are used to show that the shape variation in the sample exhibits size-dependent patterns consistent with a reduction of the tools from tip down, with the tang remaining intact. They were sharpened like scrapers and knives, usually asymmetrically, with tangs remaining large while blades got smaller = sharpened in hafts. Comparison of shapechange trajectories between Aterian tools and Late Paleolithic arrowheads from the N German site of Stellmoor reveal significant differences in amount and location of the variation.

The patterns of size-dependent shape variation strongly support the functional hypothesis of Aterian tools as hafted knives or scrapers with alternating active edges, rather than as weapon tips, but represents one of the earliest evidences for hafting modification, and for combination of different raw materials (haft and stone tip) into one implement.

Iovita, Radu, and Katsuhiro Sano

2016 Summary and Conclusions. In *Multidisciplinary Approaches to the Study of Stone-Age Weaponry*, edited by Radu Iovita and Katsuhiro Sano, pp.289-297. Springer Science and Business Media, Dordrecht.

Iovita, Radu, Holger Schönekeß, Sabine Gaudzinski-Windheuser and Frank Jäger

2011 Controlled ballistic experiments with glass replicas of Levallois points. Paper presented at Multidisciplinary Scientific Approaches to the Study of Stone-Age Weaponry, Mainz, 19-22 September 2011.

"Evidence of Neandertal hunting: faunal data, Schöningen spears (Thieme 1997, Nature 385:807-810), Umm-el-Tlel stone tip embedded in a vertebra (Boëda et al. 1999 Antiquity 280:394-402), and increasing evidence for hafting in the Middle Paleolithic. Despite much work on identifying fracture and wear patterns associated with stone projectile use, no unambiguous criteria exist, because previous studies have not sufficiently controlled for confounding factors.

Results of a rigorous experimental program should enable us to create a reference collection of impact fractures. We test the effect of kinetic energy, momentum, and angle of impact on fracture patterns in identical glass copies of an archaeological Levallois point from Jabrud (controlling for shape and raw material fracture properties). The copies were cold-pressed, resulting in a material similar to obsidian. A series of recent controlled experiments in flake propagation (Dibble and Rezek 2009 JAS:1945-1954; Rezek et al. 2011, JAS:1346-1359) have further demonstrated the similarity of glass to siliceous materials used by past hominins and, consequently, its suitability for experimentation. In our experiment, the projectiles are slot-hafted with beeswax in wooden shafts and shot at

homogeneous targets of synthetic materials (ballistic gelatine, ballistic soap, and

synthetic polyurethane plates which simulate the properties of cortical bone). They are launched from a high-precision ballistic air-gun which measures the exact exit velocity with the aid of a photoelectric barrier. Each point is only launched once. The test velocities are matched to those of experimentally and ethnographically observed speeds found in the literature. Preliminary results indicate that the variability of damage traces is much higher than expected for such tightly controlled conditions. However, of the factors investigated, the angle of impact seems to provide the most reliable indicator of damage extent on the tips of the projectile points."

Fractures considered were flute-like, ventral and dorsal, transverse snap + spin-off, crushing from point skipping on surface of "bone" plate. After about 18 mps everything shatters, so only used velocity up to 22 m per sec. Upward trend in damage with increase of velocity, then peak where bone plate shatters. Some pts did not break. Angle of incidence important – 30 degrees got most flutes and longer fractures, some fracture types more common at different angles, acute angle produced more damage. [Useful but very artificial experiment – the L pts are identical, but edges are beveled by process; the hafting is very crude, and the projectile does not behave like an arrow or spear.]

Iovita, Radu, Holger Schönekeß, Sabine Gaudzinski-Windheuser and Frank Jäger x

2013 Projectile impact fractures and launching mechanisms: results of a controlled ballistic experiment using replica Levallois points. *Journal of Archaeological Science*, in press.

Focus on effect of kinetic energy in formation of diagnostic impact fractures on glass Levallois points. Speed, kinetic energy, impact angle considered, rest controlled by artificial points and target material, air propulsion + velocity measurement. 266 gm spear, 7-30.5 meters per sec, range up to lower end of H + B. Six damage categories: flute-like (subsumed under longitudinal), burin-like (subsumed under longitudinal), transverse/snap, spin-off, tip crushing, microscopic (incipient or very small fractures). Decreasing impact angle from direct and increasing velocity both increase longitudinal fracture by enlarging platform width. As V increases, scar length increases, but weak trend except at 90 degrees. Transversal snap fract more common in slow velocity. Bending initiations are common but occur with non-impact situations too, just loading large platforms on fragile pts. Step terminations likewise quite common in impact but cannot be considered diagnostic. Animal targets are not homogeneous, and results would be less diagnostic in natural use. So distinguishing 3 weapon systems - hand, atl, bow will be difficult. Can separate extremes of velocity some based on freq of longitudinal fractures and their size, but in arch would need very large samples. For Neanderthals, both skeletal analysis and ballistic study of points suggests thrust or hand launched, no atlatl

Iovita, Radu, Holger Schönekeß, Sabine Gaudzinski-Windheuser and Frank Jäger

2016 Identifying weapon delivery systems using macrofracture analysis and fracture propagation velocity: a controlled experiment. In *Multidisciplinary Approaches to the*

Study of Stone-Age Weaponry, edited by Radu Iovita and Katsuhiro Sano, pp.13-28. Springer Science and Business Media, Dordrecht.

Literature model of unilinear progress from thrusting spear to javelin to atlatl to bow, based partly on rare finds of preserved organics, in between which we only have stone points. Usewear in various forms to ID projectile.

Experiment using glass casts of Jabrud Levallois point to see diffs between thrusting and projectile. Target of ballistic gel and synthetic polyurethane 'bone'. Points hafted in slot in dowel with bees wax [a bit crude]. Propelled by air gun, 7-30 m/sec, overlap lower range of Hutchings and Bruchert dart velocities [which should not be used, they are incorrectly high]. Thrusting experiment used a pendulum, 1.1-2.7 m/sec.

Examine macrofractures: projectile produced fewer fractures, thrust many more longitudinal fractures. No signif diff between fracture scar lengths except slight when impact angle kept at 90 deg. Hutchings' fracture propagation features largely confirmed, 3 loading rate ranges. But although range for thrusting spears in experiment sim to H, median is within his 'rapid' range, while 84% of H fractures on spears were in 'quasistatic range.' No fracture speed measures within dynamic range, prob because we could not accelerate our spears above 30 m/sec, at the low end of his atlatl velocities.[But this comparison shows why H info is no good – his high atlatl velocities produce a false comparative measure.] H+B velocities probably 'represent an upper limit for what one might encounter archaeologically." [Not even that, they are probably far beyond it.]

So simple macrofractures even in controlled experiment don't distinguish thrusting from projectile impact. And too many variables in real hunting to interpret resulting fractures, although seems that thrust spears more likely to be damaged. Only a weak relation between projectile speed and fracture speed, and large variation in fract speed for any projectile speed. [Interesting but should not be using H+B velocities].

Irwin, Arthur

2000 The Hooked Stick in the Lascaux Shaft Scene. Antiquity 74 (284): 293-298.

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Famous scene with bison, apparently pierced by spear and losing its intestines, falling or fallen man who is possibly bird-headed, bird on stick, and small line with hook and cross-piece at feet of man + bison. Barbed spear is broken on ribs of bison [a silly over-interpretation of slight jog in shaft obscured by line of bison stomach] and other object is a "short-harpoon" which would be used to open belly. [Cites N. Am. bison hunting ethnog, but fails to make any real connection, especially to any such weapon, which he compares to Pume "throwing instrument" which is actually an arrow! A much better interp is that the hooked object is a spear thrower, an interp he mentions but denies because Marshak (1972) says the "cross-handle" would not work. But it probably is an atlatl, and for that matter the bird on staff also has a hooked end and could also be an atlatl. But they are pretty undetailed images, and this is a pretty ignorant article.]

Ito, Garrett and Scott Klauminzer

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1988 Final Project: Atlatl Analysis. Ms. on file, Department of Physics, Colorado

College, Colorado Springs.

Jackson, Margaret A. o 2008 *Moche Art and Visual Culture in Ancient Peru*. University of New Mexico Press, Albuquerque.

Some ceramic fine-line and other art is narrative and structured in a language-like way. A couple images of warriors with atlatls. "Revolt of the Objects" narrative shows weapons, clothing, tools as animated warriors [but oddly atlatls don't appear.]

Jaeger, Ellsworth

1961 Nature Crafts. The Macmillan Company, New York.

All kinds of Indian crafts, at various levels of detail. Simple hooked stick atlatl p 18. "Overhand fling" but no mention of spear flexibility. [There were more people trying atlatls in these days than we realize, but maybe not very successfully] p13-18 rudimentary knapping, pressure against a board, nail in handle as tool. [not very usable description of knapping].

Janetski, Joel C.

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1993 The Archaic to Formative Transition North of the Anasazi: A Basketmaker Perspective. In *Anasazi Basketmaker: Papers from the 1990 Wetherill-Grand Gulch Symposium*, edited by Victoria Atkins, pp. 223-241. Cultural Resource Series No. 24, Bureau of Land Management, Salt Lake City.

Bow and arrow arrived ca 200 AD, although C14 dates on wood charcoal may be a bit too early, but certainly early millenium, and after corn.

Janetski, Joel C.

1980 Wood and Reed Artifacts. In *Cowboy Cave*, Jesse D. Jennings ed., pp. 75-95. University of Utah Anthropological Papers 104.

Atlatl p 75: in Unit IV (See Jennings 1980 for dates), mountain mahogany, broken and charred at both ends. Roughly and abruptly notched 2 cm from prox end, probably not for fingers but to hold loops. Overall L = 42.2 cm, W = 2.1, T = .9 cm. Central groove begins 2.8 cm from distal end, so female type [No, surely mixed BM type though a bit robust, but hook is missing, photo too poor for more info]. Three dart mainshaft frags, prox with cup, central with sinew lashing, distal with socket. No surviving fletching. Three foreshafts, one complete sharp, 2 frags. Split twig figurines from same level IVc as atlatl and some of shaft frags. Ungulate hyoid bone pendants.

Janetski, Joel C.

1984 Addendum to Brigham Young University Department of Anthropology Technical Series No. 83-73: An Archaeological and Geological Assessment of Antelope Cave (NA5507), Mohave County, Northwestern Arizona. Ms. on file, Department of Anthropology, Brigham Young University, Provo.

[Not seen] cited by Madsen 1992 to say atlatl dates 1850 ± 60 B.P. [presumably uncalibrated, if typical of the 1980s, probably a date on loosely associated charcoal]

Janetski, Joel C., and Michael J. Hall xfig

1983 An Archaeological and Geological Assessment of Antelope Cave (NA 5507), Mohave County, Northwestern Arizona. Department of Anthropology Technical Series No. 83-73. Brigham Young University, Provo.

Among finds, in looter's trench, most of a Basketmaker atlatl, with distal end burned off. Oak, 41 cm L, 2.2 W, .5 thick. Loops of yucca fiber wrapped in hide.

Jarman, Josh o

2010 In Step with Ohio's Past. *The Columbus Dispatch* [other info missing] reprinted in *The Dart* September 2010:11-12.

Flint Ridge knap-in, Strischek organizing atlatls.

Jeffries, Richard W.

1987 *The Archaeology of Carrier Mills: 10,000 Years in the Saline Valley of Illinois.* Southern Illinois University Press.

Illustrated by Thomas W. Gatlin; drawing of Archaic Hunter throwing with Indian Knoll type atlatl. [Used by Fagan and other].

Jenkins, Jason

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2008 The Ancient Atlatl. *Rural Missouri* January 2008. Electronic document URL: http://www.ruralmissouri.org/08pages/08JanAtlatl.html accessed 1/2/08.

Good description of basics, features R Madden, J Garnett, and R Mertz. Hunting issues. [One of the better press pieces.]

Jennings, Jesse D.

1980 *Cowboy Cave*. University of Utah Anthropological Papers 104. University of Utah, Salt Lake City.

SE Utah, pinon-juniper, big alcoves on S side of open canyon [I'd expect Basketmaker stuff in them],1975 excav, presence of extinct fauna dung - sloth, bison, elephant, horse, camel-like ruminant, but under the cultural layers, not associated with artifacts. Looting disturbance, nearby Walters cave destroyed by looters. Point sequence of Archaic dart

points ending with small dart/arrow Rose Springs types. Unit IVc has Elko and Gypsum types.

Date from level IVc on charcoal p24-25 [no more specific context given] 3635 ± 55 BP [uncalibrated]. [Jennings considers the material from IVc, level with atlatl, to be "terminal Archaic rather than Basketmaker II" the equivalent of "BM I" which is probably equivalent to Sand Dune and Dust Devil Cave material.]

Jilo Dira, Samuel, and Barry S. Hewlett

2016 Learning to spear hunt among Ethiopian Chabu adolescent hunter-gatherers. In *Social Learning and Innovation in Contemporary Hunter-Gatherers*, H. Terashima and B. S. Hewlett eds., pp. 71-81.

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Use of throwing spears probably technological shift with modern humans after Neanderthals (Wong 2014).

Chabu = forager/farmers in SW Ethiopia. Men often spear hunt several times a week, don't use guns. Spear hunting more complex than other subsistence activities – requires skill, knowledge and physical competence, hypothetically more likely learned later, i.e. adolescence. Expect 'model-based biases' i.e. learn from perceived most successful hunters. Dense forest. Data from 9 semisedentary villages, total pop 405, maybe total 16 villages, 1500-2000 pop. Hunt, gath, fish, trade, small farming. Major game = buffalo, duiker, bush pig, bushbucks, antelope. Wild plant foods mostly women. Farm banana, taro, cassava, maize, papaya.

Interviews with 28 boys 9-16, + 51 adult men. Observed boys hunting with men in small groups, sometimes with dogs. Several named types of hunting: dog training by single owner, stalking sleeping animals by men only, ambush near water with no dogs, running game with dogs by men and adolescents, snaring – good for older men and children but still need spear to kill trapped animal. Five named spear types, all with wood shaft and metal point, plus one untipped mini for kids. Spears thrown in hunting, 10m or more distant.

Learning: 6-7 listen to stories, role-play hunts among kids + adolescents, learning to trap small game, elders may give toy spears. Spear hunting starts 9-12 but not regular hunters until 14-15. Ask to join men. Learning forest by going with men to forest foraging camps from 10-12. Adults decide when youth is ready to go, may make him spear at that point. "Collaborative learning" i.e. with peer youths. More likely learn from uncles and older boys than fathers (partly family structure of fragile marriages).

During observation – scaffolded learning i.e. allow kid to kill captured game, supervised butchery, provide spears, explain actions and techniques, point to tracks, tease for mistakes. Youths do prefer more skilled men to learn from, but also friends. Fathers often missing for adolescents, so other kin and peers more important.

[Interesting but no info on actual techniques or throwing motion in use of spear, no tests or observations of accuracy or distance – cultural anthropologists don't seem to realize we need this kind of info to evaluate a weapon, and yes, how you learn it]

Jimenez, Carla

2010 Today's Question: Do You Plan to Use the Atlatl This Season? *Columbia Missourian*, September 29, 2010, electronic version, accessed February 7, 2011, URL: <u>http://www.columbiamissourian.com/stories/2010/09/29/todays-question-do-you-planuse-atlatl-season/</u>

Legal for deer firearms season, legal for small game since 2007. Madden, Mertz. No responses.

Johnson, Ann S.

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1971 Finger-Loops and Cruciform Objects. American Antiquity 36 (2): 188-194.

Eckholm 1962 IDs loops from two specimens with them [Brit Mus and Florence?]. Two frags from La Playa site, Sonora, Mexico, Trincheras Culture, AD 800-1100, Hohokam relations. Loops relate to SW [but her distrib map is mixed up]. Chipped and polished cruciform objects may have been attached to atlatls. Found in line in a couple burials, curved staff atlatl of Quetzalcoatl described as "starry." [This is real weak evidence since none are assoc w known atlatl parts].

Johnson, Elden

1956 Review of The Atlatl in North America. American Antiquity 22 (1): 86.

Notes Kellar wants to use only direct evidence, not point size or problematical artifacts. Thus can't claim Paleoindian origin.

Johnson, Fredericko1951 Introduction. In Radiocarbon Dating: A Report on the Program to Aid in the
Development of the Method of Dating. F. Johnson, ed. *Memoirs of the Society for*
American Archaeology 8:1-19.

Early compilation of C14 dates [not calibrated]. Including: Indian Knoll, antler, 5709 \pm 350, 4894 \pm 560, average 5302 \pm Leonard Rockshelter, NV, greasewood atl foreshaft 7038 \pm Nazca Valley, Peru, sections of 4 darts from graves, 1314 \pm Nazca Valley, Peru, 2 atl frags from graves, 1681 \pm 250, 2477 \pm [same grave, Bird suggests shaft wood shorter lived than atl wood, thus more recent date]

Jones, David E.

2007 *Poison Arrows: North American Indian Hunting and Warfare*. University of Texas Press, Austin.

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Surveys world uses of poisons. In N. Am., where armor was worn, enemies used poison arrows. In N. Am, most poison based on plants like Aconite, and snake venom, often used with decayed animal matter. Jones argues that poisons were common and effective. [It's hard to tell - little modern toxicological evaluation, and many "poisons" relied on

magical thinking, or were so processed by fire or decay that some venoms, like snake, would probably not survive. Lots of accounts are old, and infections seem likely to be as deadly as poisons in many cases and result in "poison" symptoms.]

Chapter on Paleoindians: Clovis points used on mammoth probably "equivalent to a pinprick on a human.... Too short and too fragile to be the sole killing force against a mammoth." Relatively few points found at kill sites. Contemporary Africans used poison against elephants. Ainu fluted bamboo points to hold poison. [He thinks Clovis flutes could be used this way, but ignores hafting realities of stone points]. If Paleoinds came to Americas through Asia, they would have "traveled through arrow-poisoning cultures." [Ignoring chronology of culture changes]. *Aconitum sp.* as used in Aleut whale hunting is likely Clovis poison. Bison hunted by Folsom are faster and still large, suggesting reason for longer flutes to hold poison on Folsom points, to prevent bison from running too far before dying. Also more efficient on atlatl darts, which needed to be thrown farther than spears for mammoth, so Folsom perhaps developed atlatl. As poisons got better, need for fluting diminished. [Suggestion of poison use is quite plausible, but much of his "evidence" is not.]

Jones, Jason

2006 Spear Pressure. The Daily Show/Comedy Central, January 5, 2006.

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Jason Jones interviews Gary Fogelman and an SPCA rep on legalization of atlatl. Plays for laughs: primitiveness, JJ inability to hit target or pronounce word. But Fogelman demonstrates effective accuracy on moving target.

http://www.thedailyshow.com/video/index.jhtml?videoId=11502
7&title=spear-pressure&to=4

Jones, Tim

2009 Vero Beach Ice Age Engraving - Mammoth Hoax or the Real Deal? Remote Central Blogspot, electronic document, accessed 9/25/09, URL: http://remotecentral.blogspot.com/2009/06/vero-beach-ice-age-engraving-mammoth.html

Most detailed article, quotes original news sources, remains skeptical for same reasons I am, see Picat 2009.

Jones, Philip s

2004 Boomerang: Behind an Australian Icon. Wakefield Press, Kent Town, Aust.

Nice small well-illustrated book. History and modern use in tourism, art, sport and nationalism, physics, manufacture, varieties and uses, type distributions in Australia. Not used in Tasmania, most of tropical N, and W central desert. Light returning boomerangs mostly bird hunting and sport, coastal SE and SW Aust. Common exchange blurs geographic patterns [as with woomera].

Earliest wooden b from Wyrie Swamp in S Aust, dates 8-10,000 yrs old, but mammoth tusk boomerang Poland 23 kya, boomerangs and throwing sticks of more or less

aerodynamic form all over from Egypt to US SW.

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Jones, Scott

2004 How to Make a Pretty Darned Good Atlatl. *Bulletin of Primitive Technology* 27:48-54.

Flat somewhat flexible "bow limb" shaft with Gt Basin-like notches and Basketmakerlike loops, plus a bannerstone weight attached by putting a separate rod through it and fixing rod to underside of atlatl shaft (allows bannerstone use with flat, more flexible atlatl). Antler tine hook. Weight more than halfway up shaft from handle is liability. Prefers unfletched, highly flexible forward weighted darts about 3 times atlatl length.

Jones, Scott

2006 Atlatl Darts: The Long and the Short of It. *Bulletin of Primitive Technology* 31:68-73.

Distance throws require lots flexibility, but that's a liability for target accuracy. Best dart ca 3 x atlatl length and properly spined. Shorter darts require fletching.

Jones, Scott o 2009 Atlatl Technology: Some Further Reflections. *Bulletin of Primitive Technology* 37:75-79.

Flexible weighted atlatls in N. Am. are advance over more common rigid forms, perhaps as competed with newer bows. [Unfortunately he continues to promote spring theories and atlatl as ancestor to bow.] Examples of modern symbolic use of obsolete weaponry.

Joyce, Christopher

2010 Armed and Deadly: Shoulder, Weapons Key to Hunt. *The Dart* September 2010:7-9. [Original source not given.]

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Evolutionary lowering of shoulder from high shoulder of apes allowed effective throwing. John Shea quoted on theories of importance of throwing, demos rock, spear, atlatl "a long flexible dart that attaches to the end of a rod strapped to the hand." Flexiblity stores energy in the dart. [Surely the horrible definition is the fault of the journalist!] [Photo of JS with what looks like Berg darts and SW inspired atlatl.]

Junkmanns, Jurgen

2001 Arc et Fleche: Fabrication et Utilisation au Néolithique. (Bow and Arrow: Manufacture and Use in the Neolithic). Editions Musee Schwab, Bienne.

In French. Booklet, well illustrated in color, large number of prehistoric European bows and points, information on experimental manufacture.

Short section on atlatl with photos of use [but showing bad form with low elbow].

Oldest found so far is Combe Saunière, SW France, 16-17,000 BC. Propulseur is a lever system, multiplying by 5 or 6 the force and velocity of a spear. Spear of 160 grams, 100 km/hr [62 mph] = 63 joules (46 ft-lbs) kinetic energy, more than twice an arrow from wooden bow, thus enormous penetration force allowing hunt of large Pleistocene animals. [He calculates with very heavy dart at upper range of realistic speeds]. Modern competitors score about 1/3 of archery scores on same targets. Long darts clumsy to carry in forest, deflected in flight, so ideal for hunting on steppe but poorly adapted to forest.

Early bow evidence: Parpallo, Spain small bifacial points, small bone pts, small pts on blades all suggest arrow pts ca 17,000 BC.

Stellmoor, near Hamburg Germany, Upper Paleolithic reindeer hunters, ca 10,000 BC. Arrows of split pine, with beveled foreshaft, stone blade pts. 70 cm long + 15-20 foreshaft, nocks for bow string.

Mesolithic longbows, several found Germany, Denmark, Sweden: All of elm, flat belly, rounded back, wide limbs + narrow handle, sophisticated shape. Arrow pts of wood, microliths, and transverse. E.g. Holmegard, Denmark, 2 bows, 1.50-1.70 m L, of elm, ca 6500 BC.

Many Neolithic bows known from Swiss Lake sites, Euro + UK bogs, others, mostly self long-bows often of yew. Variety of arrow point forms.

Junkmanns, Jurgen

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2012 Neolithic Bows (pp. 46-55)
2012 Prehistoric Arrows (pp. 57-73)
In *The Bow Builder's Book, Revised 2nd Edition*, Angelika Hörnig, ed. Schiffer Publishing Ltd., Atglen, PA.

Good archaeological details on Robenhausen, Bodman bows and others, details of replication. Likewise for arrows from Meso to Bronze age, photos of specimens from Stellmoor, Oetzi, Egolzwil, others. Replication with stone tools. Brief [unhelpful] knapping info. 'Bird arrows' Meso side-barbed bone points - killed brown bear in Medvedia Cave [parallel to US myth of the 'bird point'].

Jurmain, Robert

1978 Paleoepidemiology of degenerative joint disease. *Medical College of Virginia Quarterly* 14:45-56.

1999 *Stories from the Skeleton: Behavioral Reconstruction in Human Osteology*. Amsterdam: Gordon and Breach Science Publishers.

References and discussion of atlatl elbow. Discusses problems with interpreting osteoarthritis in terms of activities, doesn't feel there is good evidence for atlatl use in archaeological skeletal arthritis.

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Justice, Noel D.

1987 Stone Age Spear and Arrow Points of the Midcontinental and Eastern United

States. Indiana University Press, Bloomington.

[First of the series; background material limited, point drawings have flake scars outlined but not shaded. Justice's books, especially the two later ones, are tremendously impressive syntheses of all sorts of relevant info, even if you don't agree with all his typological groupings.]

Justice, Noel D.

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2002 Stone Age Spear and Arrow Points of the Southwestern United States. Indiana University Press, Bloomington.

[Pages 30-37 good summary of SW atlatls and references, although mechanics poorly explained. Good small drawings of Broken Roof Cave and White Dog atlatls, foreshafts, poor drawing of atlatl throw. Lots of discussion of atlatl dart point types. Info on bows is comparable.]

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Justice, Noel D.

2002 Stone Age Spear and Arrow Points of California and the Great Basin. Indiana University Press, Bloomington.

p 16 atlatl vs dart pts by size, Thomas, Fenenga etc refs.

p 32-39 foreshaft manufacture, dart evidence from caves - Leonard Rockshelter, Hogup, Danger, Gypsum caves summarized, good pics Hidden Cave, Humboldt Cave foreshafts w stone pts. Hafting mastics include pine pitch, asphaltum, others [some like jojoba seem unlikely].

p 41-45 almost identical descrip of atlatls to SW book, [adequate but his explanation of mechanics is poor: he seems to accept Webbs theory that weights on flexible shafts are "most efficient" but correctly notes in his own experiments that "adding enough weight to the atlatl to actually be felt when throwing a spear impedes the delivery of thrust." His diagram of throwing is poor.] Good small drawings and descriptions of Lovelock Cave, Hogup Cave, and Winnemucca NVWa197 atlatls.

p 55-59 transition from atlatl to bow: most evidence says ca 500 AD in west US, although there are some arguments from small points for earlier, and some suggestions of late atlatl survival.

Lots of discussion of points identified as atlatl dart points.

Kaeppler, Adrienne L. s (Vetter)

1978 "Artificial Curiosities" being an Exposition of Native Manufactures Collected on the three Pacific Voyages of Captain James Cook, R.N. at the Bernice Pauahi Bishop Museum January 18, 1978 -August 31, 1978 on the Occasion of the Bicentennial of the European Discovery of the Hawaiian Islands by Captain Cook - January 18, 1778. Bernice P. Bishop Museum Special Publication 65. Bishop Museum Press, Honolulu.

[Exhibit catalog with commentary of varying usefulness on artifacts. Kaeppler seems to feel it includes all available Cook material and pieces not in it are likely to be mis-

attributed, but the focus is on Pacific islands and interest fades as gets to N. Am., as exemplified by his listing of spear throwers, which is plainly incomplete, and shows only one very small picture, Aleut, in Edinburgh. Lists 5 others in Cambridge, Vienna, Gottingen, Berne, and Florence. Lacks the example I recorded in British Museum. No useful info on spear throwers.]

Kamei, Nobutaka

2005 Play Among Baka Children in Cameroon. In *Hunter-Gatherer Childhoods: Evolutionary, Developmental and Cultural Perspectives*, edited by Barry S. Hewlett and Michael E. Lamb, pp. 343-359. New Brunswick, Transaction Publishers.

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Children as subculture. Children in Mbuti imitate adult foraging and hunting activities, learn. Baka (another Pygmy group) in tropical Congo Basin. From 4-5 yo, in peer groups, little adult interference. Play = children activity undirected by adults, involving specific rules, tools, and purposes, not primarily intended to make a productive contribution. Of 269 play sessions observed, 50 related to hunting, including making traps and papaya stem guns, attacking animals with stones, hunting mice + lizards w bow or spear (girl participated once), target shooting with bow, spear, slingshot. Another 14 involved collecting insects or termites, and fishing, so total 24% play was subsistence-related. [Not stated whether any results were eaten.]

Karger, Bernd, Hubert Sudhues, B.P. Knewubuehl, and B. Brinkmann x

1998 Experimental Arrow Wounds: Ballistics and Traumatology. *Journal of Trauma: Injury, Infection, and Critical Care* 45(3):495-501.

Medical experiments, longbow, compound bow, crossbow. Pig carcasses, soap, gelatin targets at 8 m. Velocity 45 m/s longbow to 67 m/s compound bow. Penetration in nonbone tissue 17-60 cm, depending on velocity and type of arrowhead. Ribs always perforated, thick bone not, extraction from bone difficult. Although arrows are light and low velocity, much less kinetic energy than bullet, but they penetrate by cutting and stabbing, and have high sectional density, i.e. they are long so have lots of mass per cross-section area. Less tissue damage and bleeding than gunshot wounds.

Karpowitz, Adam

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2007 Ottoman Bows: An Assessment of Draw Weight, Performance, and Tactical Use. *Antiquity* 81 (313):675-685.

Compares favorably to longbow: similar draw weight 90-130 lbs, higher velocity with lighter arrow, good penetration of armor etc.

Keddie, Grant

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2003 The Atlatl Weapon. Royal British Columbia Museum, Victoria, BC. Accessed 1/12/05 URL: http://rbcm1.rbcm.gov.bc.ca/history/atlatl/atlatl.html

Public ed pamphlet. Illustrates antler atlatl 2000 yr old from bottom of drained Quiltanton Lake. Narrow shuttle shape ca 53 cm long, flat upper surface with groove but apparently no hook, and sharply narrowed prox end that should have had some kind of handle on it. Also drilled and carved weights mostly Frazer R.

Keddie, Grant

2007 Quiltanton Lake Atlatl (EcRg-Y:1). A Technical Report. Electronic document, accessed 1/10, URL http://www.bcarchives.bc.ca/Content Files/Files/QuiltantonAtlatlDraftWeb.pdf

C14 1950+100 BP. From bottom of drained Quiltanton Lake. Narrow shuttle shape ca 53 cm long, flat upper surface with groove, raised distal end has small hole [either female or] for attachment of hook, and sharply narrowed prox end that should have had some kind of handle on it. Caribou antler, 124 gms. Small geometric decoration on edge. He reconstructs like McClure atlatl with missing grip. Gives detailed measurements, good photos.

Keddie, Grant, and Erle Nelson x

2005 An Arrow from the Tsitsutl Glacier, British Columbia. *Canadian Journal of Archaeology* 29(1):113-123.

Found 1924, rediscovered in musem. Wooden (yew) shaft 86.2 cm long, broken off proximal end, any fletching missing. Basalt side-notched point, 4 cm long, secured with sinew. Compared to other arrows, too long, Comp to Yukon ice patch finds, more like darts, but ambiguous. Point also ambig by Thomas studies, neck width closer to mean arrow size, but L, W, T closer to dart pts. Form more like later arrowheads, not like known dart pts: assume it is an arrow. [I think balance of morphological evidence suggests dart, not arrow. But long heavy arrows are perfectly possible too.] C14 date on wood of shaft is 335 ± 30 BP, a calibrated span of AD 1480-1640. No other evidence of such late spear throwers in Brit Columbia, so presumably a long arrow. Comparative museum collections of arrows may not be good basis to judge archaeological specimens - they were mostly not made for hunting, but for 19-20C collectors and ethnographers. Do we fully understand sequence of pt forms and dating of atlatl/bow transition in this area? [Nice demonstration of how difficult it is to distinguish arrow from dart, *even when you have more than just the stone point*.]

Keeley, Lawrence H.

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1997 *War before Civilization: The Myth of the Peaceful Savage*. Oxford U Press, New York.

Anthropologists and archaeologists have "artificially pacified the past" for a variety of reasons, ignoring evidence of pervasive violence in tribal, non-western, and prehistoric societies, considering primitive war ineffective, childish, non-rational, driven by personal motivations such as revenge and theft, and not very destructive. He presents numerous

examples to the contrary, a picture of pervasive warfare in primitive societies, even more destructive and mortal given issues of scale, and evaluates reasons for warfare. Archaeology is important because it produces physical evidence for instance that warfare in primitive societies goes deep into the past in all parts of the world, long before Western colonialism which is often blamed by some anthropologists for bringing war to other cultures. [Often credited as the starting point for a revival of consideration of warfare in archaeology in the last couple decades. It's an argument, so it's often a bit one-sided, and many of the examples are not discussed in enough detail to evaluate them. E.g. discussing Weapons, p 51 atlatls get a paragraph: defined, effective range 40m to max 80 m, rate of fire unknown, quilted cotton armor protected against darts. But the only source referred to is an Australian ethnography. Shortly thereafter, he exagerates the inefficiency of muskets - his goal being to show that primitive weapons are just as deadly.] p. 52-52 + refs: poisons, common distinction between war and hunting arrows.

Kellar, James H.

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1955 *The Atlatl in North America*. Indiana Historical Society, Prehistory Research Series, Volume 3, Number 3: 280-352.

[Good summary of available reports, still useful. Focus on distribution. Experiment notably lacking.] "No objective analysis of the efficacy of a projectile thrown with the aid of the atlatl is extant." Cites a few ethnographic observations, including Nelson 1899 to support accuracy. Distributional discussion, begins with Old World. Earliest from Magdalenian, bow appears to be Neolithic. Archaeology is lacking where there is known ethnographic atlatl use. Distinguishes eastern (tapered, more specialized handles, undecorated) and western (more rectangular, finger grooves, decorated in Greenland) Eskimo areas. Archaeological evidence back to Old Bering Sea culture, surveys other finds. [Illustrations throughout are too few, mostly line drawings, clear but lacking detail.] One Tlingit specimen, puzzling Santa Barbara (short) example. SW, including Oklahoma, atlatls are relatively homogeneous – grooved, loop handles, thin, weights. Weights may be functional if not too close to the handle. Possible association with curved throwing stick. Great Basin atlatls differ. Gypsum Cave foreshafts associated with extinct fauna; Leonard Rock Shelter foreshaft C14 date 7038+350. History of interpretations of SE atlatl parts discussed, atlatl interpretation now considered conclusive. Six varieties of antler or bone hooks widely distributed: TX, OK, KY, TN, AL, GO, MS, IN, OH. Weights also, but antler handle confined to KY and IN. Suggestions of Hopewell atlatls by Moorehead. Cushing's Key Marco atlatls and SE ethnohistory. For Mesoamerica, follows Nuttall, considers SW connection, diffused from N to S.

Probably once all over continent; evidence lacking. Early introduction, possibly associated with one or more of the older physical types, but could be single introduction followed by regional specialization. Atlatl persisted after bow, sometimes together, especially in marginal areas. Dating transition is difficult – maybe beginning of Christian Era in SW. Association recently between canoe hunting and atlatl (Eskimo and Mexico), and Eskimo bird darts and atlatl. Atlatl good for one hand use, and not damaged by moisture. Mesoamerican and S. Am. warfare used atlatls, perhaps for penetration against

protective clothing, perhaps also ceremonial significance.

Kelley, J. Charles x 1950 Atlatls, Bows and Arrows, Pictographs, and the Pecos River Focus. *American Antiquity* 16 (1): 71-74.

Assoc of b+a w atlatl in some PRF [W Archaic period] sites is prob due to bad stratigraphy. PRF pictos show only atlatl, b + a only appears in succeeding phase rock art, red designs overlaying earlier polychromes, assoc with horse + other late motifs in some. Bow perhaps as early as 900 AD from other evidence elsewhere. Pictographs of hunter w atlatl, darts, rabbit sticks, staff, "bag-like" objects, express existence of "a wellorganized ceremonial hunting cult."

Kelker, Nancy L., and Karen O. Bruhns

2010 Faking Ancient Mesoamerica. Left Coast Press, Walnut Creek, CA.

Well written, covers lots of different fakes. No one should ever trust an unprovienenced ancient art work again!

Makes point of showing long history, well back into 19C for some things. Discusses complicity of museums and collectors, reluctance to recognize faking problem, political and economic motives. A few specific fakers named, often a bit too vague about naming museums and other supporters of faking and looting, sometimes needs more citations. Quotes museum experts as "40+ %" fakes. Good fakes appeal to modern ideas of "the primitive" and often use titillating elements like human sacrifice and sexuality. Faking "pollutes" the archaeological record - examples include p 146 fake incensarios supposedly from Teotihuacan interpreted to suggest influence on Guatemala. Ceramics most common, but also hard stone from ornament to monument size, Teotihuacan stone masks, crystal skulls, metal work, Maya codices and wooden lintels. Many fakes by adding to plain original, or dishonest reconstruction, or incorporate old material to foil dating tests.

Often humorous, sometimes too flip or superficial as in p164 discussion of flaked stone from Teotihuacan area, with unsupported suggestion that knapper learned from US university class. Photo of the "tumi" shaped obsidian axe heads and 3 lanceolate bifaces. My work on modern knappers not cited, and they don't discuss the current tourist use of knapped artifacts. pp. 205-207 Aztec atlatl - the photo + description of the fake in Rome [they say in Argentina ethnographic museum] that copies British Museum loops and Florentine specimen carvings (Bushnell 1905; Callegari 1934; Beyer 1934).

See companion volume Faking the Ancient Andes (Bruhns + Kelker 2010).

Kelly, Alexandra

1970 The Australian Spearthrower. Unpublished B.A. Honors Thesis, Anthropology Department, University of Sydney.

Compiled ethnographic accounts, typology using collection of Australian Museum.

Appendix of scale drawings [not great] of examples. Wommera or woomera is term used in Sydney area, but other groups had many different terms.

"The spearthrower works on the same principle as the sling. It adds an extra length to the arm and thus increases the veolocity of the spear thrown and makes the throw more powerful and accurate by concentrating the entire force of delivery behind the butt of the spear (5)." Comparisons between accounts of different forms of spearthrower and spears, and secondary functions.

Davidson (1936) types and distribution maps used. His theories on age based on distribution are not reliable, but his distribution info is. [Lengthy descriptions of each type, adequate illustrations, some ethnographic descriptions of use, accuracy, range].

Kelly, Everett

2004 *Everett Kelly's The Atlatl*. Virtualbookworm.com Publishing Inc, College Station, TX.

Novel. The Calusa encounter Ponce de Leon, brave warrior Asaha and tribe fights off Spanish and preserves their freedom. [Basic story is ok, but writing is amateur – Calusa often lapse into stilted Hollywood Indian English. Atlatl is mentioned briefly, as powerful weapon, but no details and is not important enough to inspire the title – Kelly probably just thought it sounded exotic.]

Kennedy, Kenneth A. R.

1983 Morphological variations in ulnar supinator crests and fossae as identifying markers of occupational stress. *Journal of Forensic Sciences* 28:871-876.

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Kennedy, Kenneth A. R.

1989 Skeletal Markers of Occupational Stress. In *Reconstruction of Life from the Skeleton*, edited by Mehmet Yaşar Işçan and Kenneth A. R. Kennedy, pp. 129-160. Alan R. Liss Inc, New York.

Much more detailed treatment than 2000, espec history of study, causes of markers, variation, long table of examples and citations, including scapular problems from Eskimo harpooning, longbow use by Mary Rose archers, clavicle marker of slinging with arms above head, humerus markers from sling, Neolithic javelin use, radius and ulna from throwing with spear, sling, atlatl, pitching; "atlatl elbow" from throwing and other activities in early CA and arctic.

Kennedy, K. A. R.

2000 Assessment of Occupational Stress. In *Encyclopedia of Forensic Sciences*, pp. 212-217. Academic Press, New York.

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Attributes beginnings of study to F Ronchese 1948, anthro beginnings from exam of fossil hominids, J.L. Angell most prominent. Bone remodeling to stress first described by Wolff 1892. Examples of Markers of Occupational Stress include: "hypertrophy of the

supinator crest of the ulna as a consequence of habitual supination and hyperextension of the arm in spear-throwing, ball pitching, and use of a slingshot (Fig 2)." But modern forensics recognizes that a marker may be attributed to a wide range of cultural practices and the skeleton registers a mosaic of activities over individual's lifetime.

Kennedy, Kenneth A. R.

2004 Slings and Arrows of Predaceous Fortune: Asian Evidence of Prehistoric Spear Use. *Evolutionary Anthropology* 13 (4): 127-131.

S. Asian Mesolithic (India) used microlithic tools, hunt big game, spear use evidenced by hypertrophy of supinator crest on right ulnae (but could be "due to other cares of daily life"), supported by cave art showing spear throwing, thrusting over and underhanded, atlatl, bow and arrow, bolas, slings. [Conclusion not clear – lots of different weapons in use – why assert spear as producing physical trait?]

Kennett, Douglas J., Patricia M. Lambert, John R. Johnson, and Brendan J. Culleton o

2013 Sociopolitical Effects of Bow and Arrow Technology in Prehistoric Coastal California. *Evolutionary Anthropology* 22(3):124-132.

Spread across CA ca 250AD-1200, first in Gt Basin, spread to coast. Intro of bow to N Channel Islands ca 650-900 AD predates appearance of hereditary inequality, did not immediately trigger inter-group warfare. Contributed to social instability on the rise as pop increased w unstable climate, which stimulated conflict + inequality. Thus consistent with hypothesis that social coercion via intra-group law enforcement contrib to increase in social scale + inequality emerging 900-1300 AD.

Archers 2-3X as accurate as atlatls (Bettinger), other advantages listed. S coastal adoption difficult to date, earliest pts leaf-shaped Malaga Cove pt, scaled-down version of earlier atlatl pts, 500-900 AD. N coastal later, 900-1100, smaller Malaga pts may = intro of atlatl rather than bow (Stevens). In San Francisco Bay area burial pts (Stockton form) dated AMS suggest intro 1050-1300 AD. In N CA, Gunther Barbed form ca 900-1050. So CA bow intro complex, atlatl persisted in some areas, along with bow.

Khlopachev, Gennady, Dmytro Nuzhnyi & E.Y. Girya

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2011 Results of experimental use of mammoth ivory projectile points of Upper Palaeolithic forms. Paper presented at Multidisciplinary Scientific Approaches to the Study of Stone-Age Weaponry, Mainz, 19-22 September 2011.

"Results of experimental use of mammoth ivory projectile points of Upper Paleolithic forms. Mechanical properties of mammoth ivory (Siberia) – it can be knapped like stone, even making blades at very low temperatures. In the second experiment, arrows and darts were shot with a bow into a body of a young cow. The good penetrative abilities of such "bipointe" arrow- heads and "sagaies a base recouci" were confirmed, the "bipointes" were more efficient than "sagaies a base recouci". [They also used atlatl, but looks poor.] Bone was only used after Mesolithic, because not as good as ivory.

Kidd, Kenneth E. o 1960 Review of Townsend, <u>Birdstones of the North American Indian</u>. *Ethnohistory* 7 (4): 419-421.

Favorable review, notes utility of such artifact studies. Includes "90% of known specimens, which probably represent more than half of all that were ever produced." [Doubt it!]. Warns of fakes.

Kidder, A. V.x1938 Arrow-Heads or Dart Points. American Antiquity 4 (2): 156-157.

Responds to Browne 1937 with reasons why small points are arrows: late in SW, vs large points early w Basketmaker and atlatls, common in Gt Plains bison kills, if Folsom etc were arrowheads, then why replaced by smaller points later?

Kidder, Alfred Vincent and Samuel J. Guernsey o + x part

1919 Archeological Explorations in Northeastern Arizona. Bulletin 65, Smithsonian Institution Bureau of American Ethnology, Washington, D.C.

[Classic report on Anasazi Pueblo and Basketmaker cave sites.] Atlatls: several fragments, 1 complete from BM cist with burial. Described pages 178-183: flat board, distorted by earth pressure, missing loops, limestone weight (elbow shaped, close to grip, 1 oz), groove with flush hook "mixed" type, L 28", W 1 3/8" at distal end. Describes grip and use. Weights might balance, add power, or be ceremonial. Darts: all broken, butts sinew-wrapped, fletched, foreshafts into socket.

Kidder, A. V., and S. J. Guernsey

1922 Notes on the Artifacts. In Nusbaum, Jesse L. A Basket-Maker Cave in Kane County, Utah, pp. 107-113. *Indian Notes and Monographs*. Museum of the American Indian, Heye Foundation. New York.

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Cave du Pont. No atlatls recovered, but darts. "A little more than 50 inches long," 3 fletches, cupped butt end, socketed for wooden foreshafts, seized with sinew. Box elder. Bundle of 5 probable dart shaft blanks. Wooden foreshafts slotted for points, 3.75-5 inches long. [illustrated]

Kidder, Norm

2006 An Atlatl Spur from the San Francisco Bay Area. *Bulletin of Primitive Technology* 32: 57.

Ohlone Indian site Fremont CA, 400 BC-1800 AD. Elk? bone. Notched lump shape to tie on. Tried replica. Photo.

King, Barbara J.

2017 Adoption of bow use in ancient hunting may have set off societal changes. NPR Iowa Public Radio 13.7 13.7 Cosmos & Culture: Commentary On Science And Society, April 6, 2017. URL: http://www.npr.org/sections/13.7/2017/04/06/522562042/adopt http://www.npr.org/sections/13.7/2017/04/06/522562042/adopt

societal-changes

Grund tracked learning curves from SCA and WAA to show that "biological constraints may preclude juveniles from wielding bows until later ages than atlatls." So less strong individuals may have been more likely to learn with atlatls than with bows. So bow's favoring of stronger, more skilled weapon users "exacerbated prehistoric social disparities and catalyzed emergent age- and sex-based social divisions." Shift to harder-to-use bows because diet breadth broadened, hunting smaller game. [Sadly, King has swallowed Grund's nonsense – bows are *easier*, not harder to use than atlatls, so Grund's argument is all wrong.] "For Grund, atlatls aren't merely academic. She threw her first dart back in high school, continued to experiment during archaeology fieldwork, and in 2011 took first place in the novice/"non-regular competitor" women's division of an informal atlatl competition organized by the World Atlatl Association and the Wyoming Archaeological Society." [But her ideas show a lack of real experience – no one with any understanding of both weapons would say atlatls are easier to learn than bows. She used ISAC data, but does not appear in any ISAC scores, so apparently has never participated in an ISAC.] See Grund 2017, Whittaker 2017.

King, J. C. H. x IL

1981 Artificial Curiosities from the Northwest Coast of America: Native American Artefacts in the British Museum Collected on the Third Voyage of Captain James Cook and Acquired through Sir Joseph Banks. British Museum Publications, London.

Pacific Eskimo spear thrower photo'd, also several harpoons, including fletched sea-otter "harpoon-darts" with blunt [male] proximal ends. Thrower has stylized sea-otter carved on underside, ivory hook, finger notches. [I photo'd this one at Brit Mus]. Info about voyage (1770s) and collections.

King, Ron

1989 An Archer's Notes. Society for California Archaeology Newsletter 24(4):8-9.

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Influence of Pope + Ishi on archery.

Point weights - archeols use 2g as dart/arrow distinction point, but Ishi and other ethnog bows around 45 lb draw, capable of "shooting through" deer, and modern hunting bows at 45lb also adequate, using points 110-150 grains = 7.1-9.7 grams, so need different

explanations of bimodal point weight distrib.

Bow more versatile, less movement, more positions possible, more shots, less exposure than atlatl. Points don't kill by impact shock but by bleeding, also leaves trail for hunter. So greater cutting surface of atlatl pt an advantage - greater damage. Atlatlist must be more selective about shots than archer, maybe earliest hunters with spears needed groups and drives, atlatlists smaller groups on trails, blinds and stands, and archers better as individual hunters.

Kinsella, Larry

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2013 The bannerstone: A prehistoric prey-specific artifact designed for use in the Eastern Woodlands of North America. *Ethnoarchaeology* 5(1):24-55.

Various theories: net spacer, silencer, ritual object, projectile weight, atlatl weight adding force to atlatl throw. Archaeol context: Green River Archaic of KY, Webb and other excavations of burials with atlatls. Webb's theory: flexible atlatl with weight at 'center of percussion' is like a bat hitting a ball, atlatl flex stores energy. "Not now widely accepted" [but he doesn't explain why or cite Whittaker and Maginnis.] Bannerstone on projectile (Bost 1991) unlikely too [but he doesn't explain why this is bad physics].

Manufacture experiment: drilling banded slate geniculate preform with cane and flint dust, drilling by hand - 10 hrs, 22 min, 28 mm deep hole = not so laborious that bannerstones must be ritual.

Function: Table of Indian Knoll and other bannerstone hole diameters - shaft could not have been as flexible as Webb envisioned. Weight counterbalances spear in 'pre-launch position' while ambushing game, specifically deer. Atlatl and dart should be compatible: light atlatl w light dart, heavy w heavy. Projectile weight + balance affected by point, foreshaft etc. Webb's Read Site photo shows betone near hook end of atlatl shaft. Bannerstone distribution is congruent with mid-continental deciduous forest, white tailed deer primary game. Importance of holding position without movement to startle wary deer. Counterbalance of bstone reduces strain on hunter, demonstrated by electromyography measures of muscle activity.

Kinsella, Larry

2016 Accessorizing your atlatl. Paper presented at Missouri Archaeological Society Fall Symposium, Van Meter State Park, MO, October 1, 2016.

Bannerstones are not necessary but are useful accessories – not found at all sites using atlatls. Bannerstone helps balance, necessary for ambushing deer, and birdstone is adjustable to make more effective for shots at waterfowl. Other weights could be attached in a hide 'bag' so removable.

Kinsella, Larry

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2017 Some personal observations concerning Indian Knoll-style atlatls. *Missouri* Archaeologist 78:49-62.

Antler hooks: natural curve of tine elevates tip which is neccessary to let the dart clear a large bannerstone. Easy to work common material. Can be attached to shaft after bannerstone is slipped on. Doesn't click as loudly as other materials when throwing [I disagree – the click is result of striking end of departing dart after it leaves the hook, and antler is just as loud as wood etc] Antler hooks associated with bannerstones in burial contexts, but many examples without.

Antler handles: atlatl with bannerstone more likely to be lost in throw by inexperienced thrower, breaking hook. Handles have larger holes than hook or bannerstone, indicating thicker shaft at proximal end. Many IK atlatls lacked antler handles (34/43), most would have been wooden.

Asphaltum: waterproof mastic good for E Woodland humid conditions. Used to glue shell segments together into compound bannerstone.

Bannerstone position: Two burials at Read and Indian Knoll have hook close to bannerstone, but Webb says many 'killed' broken before burial so position not helpful [and also natural formation processes in graves]. Webb (1957) reconstructed IK atlatls with bannerstone close to hook. Earlier from Chiggerville work (1939) he illustrated reconstructions with bannerstone close to handle. Not known who made them [or if he really tried them. Principles of leverage show that the proximal position would be more efficient in throwing, distal might have more balancing effect.]

Atlatl bar weights: common but largely ignored, easier to make, often crude, only a few assoc with other atlatl parts. Could be attached to atlatl in leather pouch allowing atlatl to be adjusted by removal or change for different game.

Kinsella, Larry

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2018 Atlatl World Open. Electronic document on Kinsella's Megalithics webpage, <u>http://www.flintknapper.com/Atlatl%20World%20Open.htm</u> accessed August 24, 2018

Pictures and short accounts from the 1982-86 Saratoga Springs events organized by Rod Laird. The beginnings of sport atlatl, participation by some noted archaeologists. [In spite of claims by a couple individuals to have 'invented' flexible darts at these events, photos plainly show flexible darts in the hands of many participants.]

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Kinsella, Larry and David Klostermeier

1993 *Indian Knoll Atlatls*. VHS, privately distributed, L. Kinsella, 645 Pleasant Ridge, Fairview Heights, Illinois, 62208

Detailed video documentation of all atlatl parts from Indian knoll – antler tine hooks, antler beam grips, stone and composite shell tubular weights.

Kirkland, Forrest, and W.W. Newcomb

1967 The Rock Art of Texas Indians. University of Texas Press, Austin.

Amateur Kirkland made watercolors between 1934 and 1941; archaeologist Newcomb produced text. Western Archaic, Pecos River (W TX). Atlatls common, sometimes
recognizable with loops like SW, one seems to have cross bar also. Darts common, fletched, some indistinguishable from atlatls. Figures identified as 'shamans' (broad shoulders, outline colored in + elaborated, arms raised) usually assoc with atlatl and darts, [but often atlatl just a line from hand to dart end] also often with prickly pear pad or fringed bag, fending or rabbit sticks, animals with darts in them. A couple of the atlatls have 2 darts loaded on them. [Some atlatls appear to have a weight or rest on them (like a New Guinea model). Original artists were not sticklers for careful detail, but Kirkland apparently called atlatl + dart "broken plants" so detail might be better if he had understood them.] Later "Red Monochrome" style has bow and arrow, no atlatls. Hueco Tanks (W TX panhandle) also late, lacking atlatl.

Kitch, Bob

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2014 Comparative Analysis of Atlatl Weights from the Mid-Columbia River near the Dalles, Oregon. *The Atlatl* 27(3):3-5.

2014 Comparative Analysis of Atlatl Weights from the Mid-Columbia River near the Dalles, Oregon. *Bulletin of Primitive Technology* 48:74-76.

2015 Comparative Analysis of Atlatl Weights from the Mid-Columbia River near the Dalles, Oregon. Primitive Archer 23(4):60-62.

Butler and Osborne types: 1 -longitudinally drilled, 2 -long bar, 3 -rectilinear grooved forms. [figures] Weight "aids in stabilizing the thrower at the critical start of the throw" Personal tuning of atlat to fit individual thrower is important. Pictures.

Kitchell, Jennifer A.

2010 Basketmaker and Archaic Rock Art of the Colorado Plateau: A Reinterpretation of Paleoimagery. *American Antiquity* 75(4):819-840.

The shamanic model [rock art depicts hallucinatory experience of transformation of shaman into the spirit world] is inadequate; cognitive model (cultural and historical symbols represent shared stories and ritual) is better. "Static" BM anthropomorphs with drooping hands and feet interpreted as 'shamans in trance state.' But this is merely an assumption, instead "science of visual art is devising metaphors [images] that capture essence of complex cultural narratives" i.e. imagination, no physical experience needed. "Nimbus" worldwide = supernatural made visible, not just entopic phenomena. So drooping feet etc = supernatural, doesn't touch earth. Supported by lack of "images from ordinary life, including depictions of most material objects ... and everyday activity." [But this last is not true at all, although objects and activities shown are highly selective].

Among other imagery, headdress types – not adorned humans representing territory (Robins and Hayes-Gilpin 2000) but see many more types. Emanations from ears on some not headdress or shamanic halluc, all 'headdress' indicate supernatural aural and other power. BM bird-headed figures - assoc with male gendered images like flutes and weapons, but not shaman transforming for spirit flight, rather show that bird depiction, by adding human, is "ensouled" or spiritual bird. Probably turkey, which is not a good bird to symbolize flight anyway, but became increasingly important in BM times.

Barrier Canyon style figures. Processional panels.

Kjellesvik, Timx2015 Exclusive Interview with Man that Downed 15-Point Missouri Buck with Atlatl.https://urldefense.proofpoint.com/v2/url?u=http-3A_www.wideopenspaces.com_15-2Dpoint-2Dmissouri-2Dbuck-2Dkilled-2Dprimitive-2Datlatl_-3Futm-5Fsource-3DFacebook-26utm-5Fmedium-3DPartner-26utm-5Fterm-3DGG-26utm-5Fcampaign-3DGG&d=CwIFAg&c=HUrdOLg_tCr0UMeDjWLBOM91LDRpsndbROGxEKQRFzk&r=rp9kUbrWWLp8sVSBBIyakfMbksNsBKEuiJUyOCS0Cps&m=o7v-A949qKwlTa4SGDs1AAGALCLimHPJ8TEfo7tD51k&s=fwX8aofFCI6jcLv71SzwpH16ublR_MOjRg0IUf6mMek&e=

Paul Gragg, Oct 24, from tree stand, with broadhead. Just started atlatl in August 2015.

Kjelgaard, Jim

1951 Fire Hunter. Scholastic Book Services, New York.

Novel. In Pleistocene America, Hawk, the tribe's spear maker and Willow, an injured young woman, are cast out of their tribe and survive encounters with wolves, sabretooths, and hostile tribes by wit and courage. In the course of their adventures they invent in rapid succession the spear thrower, fletching, bows and arrows, arrow poison, and domestic dogs. The David Drake (1990) re-issue adds chapters on the disasters that befall the tribe that kicked them out. [This is a classic boy's story that inspired me when I was a kid. The conception of prehistoric society is pretty 1950s tooth and claw stuff, and Kjelgaard didn't know a lot about prehistoric technology either. He thinks the flexing power of wood is what makes the atlatl work, which in turn leads to the invention of the bow. Fun, but not to take seriously.]

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Kjelgaard, Jim

1960 Boomerang Hunter. Avon Books, New York.

Novel. Australian Balulu and his dingo survive hardships to find a new territory for their tribe in time of drought. "Made of wood and laboriously fashioned to his personal taste, the spear thrower was about two feet over all. The grip was shaped to conform perfectly to the shape of Balulu's clenched fist. At the tip end was a spear rest, a cavity made with a burning brand and sand-polished to a glassy smoothness. When in use, the butt end of the spear rested in the cavity and the womera's effect was to double the length of the spearman's arm and permit a corresponding increase in the force and effective range of the thrown spear." [Actually, most Australian woomera have hooks, especially in the central deserts where this story is set. The rest of his ethnographic info is about on a par, despite a curious "American" way of looking at things: his heroes always solve their problems by inventing new technology, in this case water carrying gear.]

Kleiner, Kurt

1999 Stone Age Kalashnikov. New Scientist 162 (2186):40-43.

[Nice but basic description weak, focus on Bob Perkins, lots of small errors: "thousands" of atlatlists today (we wish!); most hunters abandoned atlatl 10,000 years ago; first atlatls N. Africa; Perkin's spring and wave theories and rather weird illustration of them. Does mention Baugh's work as counter to Perkins.]

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Kleiner, Kurt

2002 Neanderthals Used Both Hands to Kill. New Scientist 11/23/02 online www.newscientist.com

Reports Churchill's work, Neanderthal right arms stronger, bone denser, experiments confirm that thrusting puts much more force on dominant arm, so don't need throwing to explain. [But will occasional forceful use really create such differences, aside from the fact that N's used their arms for other things too? All he has really shown is that most N's were right handed.]

Klopsteg, Paul E.

x 1939 The Penetration of Arrows. American Bowman-Review 8:unknown.

"with a given bow, the velocity of the arrow varies inversely as the cube root of its mass." An arrow twice the mass of another will penetrate 26% further (shot from same bow) although its velocity will be 21% less. "The heavier arrow has 'accepted' more energy from the bow" and thus penetrates further [kinetic energy?]

For a given trajectory, if you double arrow weight, you need to double bow weight. So trajectory of 400gr arrow from 40 lb bow, would be same as 800gr arrow from 80 lb bow. But 80 lb bow would give its arrow twice the energy of the 400gr arrow, so penetration would be twice as great. So, compromises: low trajectory best with light bow and light arrow, but sacrifices penetration. Greater penetration with heavier arrow on light bow, but less flat trajectory. Increase both weights risks affecting accuracy if forces beyond archer's ability.

Klopsteg, Paul E.

1943 Physics of Bows and Arrows. American Journal of Physics 11(4):175-192.

Explains lots of stuff, much not relevant to atlatls. Measured arrow velocity, which decreases proportional to cube root of its mass on a given bow, from 175 fps with 250 grain arrow to 137 fps with 625 grain arrow. Bow geometry, changes due to mechanical understanding: up to 1932 tournament bows were English longbow style and inefficient, but articles at that time led to change to rectangular cross section bow limbs. Silk and sinew backing possible [fiberglass not yet considered]. Archer's paradox: arrow must flex as passes bow to maintain flight to target - it actually oscillates without touching the bow and continues to oscillate in flight. Oscillation begins because tip is flexed to left and also

nock to left by string, bending arrow to R in middle. Properly timed oscillation means that as middle of arrow passes bow grip, it is now flexing convex side to L and passes around grip. Depth of penetration varies directly as kinetic energy of arrow, heavier arrow better, takes more energy from the bow although less velocity.

Knapp, Wyatt o 2010 *The New Atlatl and Dart Workbook.* Onagocag Publishing Co., Winterhaven, FL.

Updated version of Knapp + Becker 2000. Rather good drawings, and detailed instructions for making several atlatl versions (all hammer grip types), including a modernized Basketmaker form, and several dart types using bamboo tomatoe stakes, river cane, and carbon fiber. Basic throwing instructions, info on possible games, ISAC, and WAA. Hunting and fishing tips, anecdotes of atlatl effectiveness.

Knapp, Wyatt, and Lou Becker

2000 The Atlatl and Dart Workbook. Onagocag Publishing Co., Allendale.

Detailed instructions on making atlatls and darts, and general information on throwing, contests, hunting, and other stuff. [Easy to read, generally good information. The atlatls are all rather modernized, but despite this, most are unnecessarily complicated for the beginner. Instructions are well illustrated. Suggests (incorrectly) that atlatl weight transfers its momentum to dart. Includes ISAC rules, list of sources (but lacking many important ones).]

Knecht, Heidi

1993 Splits and Wedges: The Techniques and Technology of Early Aurignacian Antler Working. In *Before Lascaux: The Complex Record of the Early Upper Paleolithic*. H. Knecht, A. Pike-Tay, R. White eds, pp 137-162. Boca Raton: CRC Press

Good description of Aurignacian technology - especially hafting split base points by wedging. [Not directly atlatl related. Combines archaeological, experimental, and use-wear approaches very effectively.]

Knecht, Heidi

1994 Late Ice Age Hunting Technology. Scientific American 271(1): 82-87.

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Different bone/antler points replicated and tested on carcasses. Atlatl assumed, but crossbow used in controlled experiments.

Knecht, Heidi

1997 The History and Development of Projectile Technology Research. In *Projectile Technology*, H. Knecht ed., pp. 3-36. Plenum, New York.

Good summary, excellent references, especially for European sources. Discusses atlatls:

little ethnographic information available, lots of experiments, gives summary of weight hypotheses. Cites earliest spear thrower date: $17,470\pm250$ on an antler hook from the Solutrean (Upper Paleolithic) of Combe Sauniere, France.

Knecht, Heidi

2000 Design Strategies of Early Upper Paleolithic Bone and Antler Projectile Technologies. In *La chasse dans la Préhistoire/ Hunting in Prehistory, Anthropologie et Préhistoire 111*. C. Bellier, P. Cattelain, and M. Otte eds., pp. 28-36. Societé Royale Belge d'Anthropologie et Préhistoire, Bruxelles.

Several simple manufacture and hafting systems described, for points that would have been used with atlatl darts.

Knoblock, Byron W.

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1939 *Bannerstones of the North American Indian*. Published by the author, LaGrange, Ill. Reprinted 1965? Quincy, Ill. Reprinted 2008 Gustavs Library Reprints, Davenport.

Huge 596 pp, mostly plates, a few color.

Primarily typology + illustrations, of perforated bannerstones only.

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Discusses manufacture, good illustrations of unfinished specimens, some experiments in drilling.

Prefers ceremonial or ornamental use theory, tribal symbols, but includes some others, e.g. section on Indian Knoll and Moore's theory that antler hooks were netting needles, bannerstones were mesh spacers, which he likes. Also letter from Webb arguing for atlatl part theory, which he questions, and says even if some were on atlatls, ceremonial importance was foremost.

Knoblock, Byron W.

1955 Bannerstones are Ceremonials. Central States Archaeological Journal 1(3):84-90.

X

Collectors see bannerstones as ceremonial, archaeologists follow Webb, see them as atlatl parts. Dismisses Webb because: 1. if b were atlatl weights, all men would have them but axes are more common and they occur in female graves too. 2. no arrowheads assoc w Webbs hooks + b [not true] 3. even if atlatl, could still be ceremonial 4. intentional destruction = ceremonial 5. too large and fragile, too pretty for use 6. not always assoc w hooks 7.if before bow, then whole east was occupied before bow 8 [it was]. [... missing page]. [Lots of bad reasoning, ignoring issues of archaeological context.]

Knudson, Ruthann

2015 We are all one: Anzick children reburied. Mammoth Trumpet 30(2):11-14, 20.

Basics on find, questions about whether stone tool cache is part of burial - 2 children of different ages + chemical profiles: Anzick 1 = 1-2 yo M, Anzick 2 = 6-8 yr old. DNA from A1 shows belongs to population directly ancestral to many contemporary Inds, but

closer to Central and S Am pops than N Am. Differing C14 dates but all in Clovis span. Ochre on bones and stones might = association. Anzick stone tools exempted from reburial by special clause in Montana "Human Skeletal Remains and Burial Site Protection Act" [ironic name as it promotes destruction as in NAGPRA]. Remains reburied in "Native ceremony" by Anzick family, Armand Minthorn and others, some archs attending. [Another happy-happy story celebrating how much we learned from Anzick along with the "moving" ceremony that "laid the children to rest". The children are dead, their bones don't care! This is the kind of bullshit that allowed the destruction of American archaeology under NAGPRA. One more important find gone.]

Knusel, Christopher

2000 Activity-related Skeletal Change. In V. Fioratto, A. Boylston, and C. Knusel, eds. *Blood Red Roses: The Archaeology of a Mass Grave from the Battle of Towton AD 1461*. Oxford, Oxbow Books., pp 103-118.

A

Asymmetry in arms of 14 men show right humerus larger proximal, left humerus larger distal. This may represent habitual archery – left elbow, right shoulder get most strain. Also one had healed avulsion fracture where epiphysis of left distal humerus (elbow) had separated at growth plate in adolescence.

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Koerper, Henry C., Adella Schroth, and Roger Mason

1994 Morphological and Temporal Point Types: Evidence from Orange County, California. *Journal of California and Great Basin Anthropology* 16(1):81-105.

Testing applicability of Great Basin and Mojave types to coastal CA. [Stimulated by silly arguments of Flenniken + Wilke]. 8 Middle Holocene (3500-6650 RCYBP) sites with 79 C14 dates, variety of dart points (>3.5 gm). Many types co-occur, so not good temporal indicators. Minimal OC spans: Pinto + Elko 3580-6535 BP, Northern Side-Notched 5227-5647, Gypsum 4400-6324, Humboldt 3580-6324, Silver Lake 3580-6535. [Dates mostly on aggregated marine shell, so not the best, although isotope-adjusted and calibrated. Also the stratigraphy in these sites is not good, all points are oddly in the top levels of the sites, and the sample of points is too small.] Rejuvenation accounts for much of the variability [Maybe, but that's partly Flenniken bs, and I don't think these guys can really tell.] 72% are < 7 gm, too small for efficient dart point [according to Perkins 1992 - nonsense]. Gt B temporal associations don't apply to OC [fair enough].

Koerper, Henry, Adella Schroth, Roger Mason, and Mark Peterson x 1996 Arrow Projectile Point Types as Temporal Types: Evidence from Orange County, California. *Journal of California and Great Basin Anthropology* 18(2):258-283.

Bow and arrow intro ca 500 AD but some argue as early as 1250 BC. Rose Spring, Eastgate, Rosegate types seen as downsized Elko pts as bow replaced atlatl (Heizer + Baumhoff 1961) in Gt Basin. Also found in OC, weights around 3.5 gm boundary between arrow/dart. Earliest Cottonwood series pts in OC also similar to earlier atlatl pts. OC site dates support intro of Cottonwood Triangular and Leaf-Shaped forms ca 600 ± 200 AD, earlier than in Gt B. The leaf form seems earlier, but basal configuration of triangular forms shows no temporal signicance. Long narrow flared base forms related to Hohokam, suggest a "Sonoran Series", terminal Late Prehistoric dates. Bow advantages: less movement, more ammo, in both war and hunt. Bow as temporal boundary between Intermediate Period and Late Prehistoric Period around 600 AD.

Koerper, Henry C., Jeffrey Couch, Joanne Couch, and Nancy Desautels x

2006 A Unique Atlatl Dart Bunt from CA-ORA-365, The Borchard Site. *Proceedings of the Society for California Archaeology* 19:132-137.

"Bunt" defined: a blunt point with rounded head and tapering stem. They protect shaft and balance for flight. Other forms more properly "blunts."

This specimen chlorite schist, flaked and ground, 66 mm L, 27 mm W, 24 mm T, weight 53 g. Flake scars from impact reground. Battering wear and striations on head. Surface find, undatable. Atlatl replaced by bow 400-600 AD. Atlatl and bow both springs, with dart being most important spring in atlatl system [Incorrect, and cites Farmer instead of Perkins].

Kolianos, Phyllis E. and Brent R. Weisman

2005 *The Florida Journals of Frank Hamilton Cushing*. University Press of Florida, Gainesville.

Edited incomplete journal, missing section where might have commented on atlatl finds. Appendix of comparative illustrations include birdstones reconstructed with gorgets as duck effigies or hair ornaments, shark tooth "swords" (possibly atlatls) among comparative war clubs. Cushing's sketches do not show any indication that he thought they could be used as atlatls, and no evidence that they would be.

Kolianos, Phyllis E. and Brent R. Weisman

2005 *The Lost Florida Manuscript of Frank Hamilton Cushing*. University Press of Florida, Gainesville.

Lengthy report in preparation when C died. Interest in survivals or "perpetuation of form." Atlatl finds apparently not mentioned.

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Korfmann, Manfred

1973 The Sling as a Weapon. Scientific American 229(4):34-42.

Historical records from classical times, archaeology (stone, lead and clay shot) and iconography. Extreme accuracy possible, range 200-400 m, so equal or surpassing bows. Ammunition 13-450gm, mostly 20-50 gm [seems remarkably light and small]. Sling and bow were apparently mutually exclusive and used at same time by different "culture spheres" between 8000-4000 BC in Near East [I'm not convinced, not enough evidence

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given.] [Interesting, but not much practical experience or experiment.]

Kornfield, Marcel, George C. Frison, and Mary Lou Larson o 2010 *Prehistoric Hunter-Gatherers of the High Plains and Rockies, 3rd ed.* Left Coast Press, Walnut Creek, CA.

Massive rewrite of Frison's Prehist Hunters book.

Typology and chronology of pts, p 50 value of experimental arch. P. 55 intentional burination reworking of pts vs impact fracture. Knives and resharpening.

Possible pre-Clovis sites with mammoth bone modified or oddly distributed. [Seems skeptical, as they should, for sites with no stone tools.] Cultural sequence Clovis to recent illustrated by point types and other info. P. 127 Spring Creek Cave atlatl, hafted pts, and shaft frag (photo), late Plains Archaic, [BM related form].

Modern animals as analogs, and arch experiments. Photos and info from Frison experiment with Clovis pts on culled elephants. P175-180 weaponry – pts delivered by atlatl to elephants survived well, but can't penetrate if strike rib, shafts must be straight and atlatl hook must engage base of cup [he's too sensitive about these details], individual gear requires practice, primitive hunter needs patience and close range shots. Butchering – experiments with stone tools.

P 269 bow and arrow replace atlatl at Late Prehistoric Period boundary ca 500 AD, more versatile and faster than atlatl.

Quarries and lithic raw material – Spanish Diggings, Barger Gulch (Folsom, CO). Caches – Fenn cache (drawings), Crook Co cache, Larson cache (Cody, >40 Scottsbluff pts), McKean site caches.

Kortlandt, Adriaan

2002 Neanderthal Anatomy and the Use of Spears. *Evolutionary Anthropology* 11:183-184.

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African ethnographic spears used in two ways: short spear for overhand shoulder-high stab, longer for javelin-like throw. Neanderthals' "sturdy build" perhaps an adaptation not just to cold but to "hunting large mammals with stabbing spears in dense bush and forest." [see Churchill 2002]

Kostiw, Scott

2000 Atlatl Use In the Siege of Tenochtitlan. Indian Artifact Magazine 19(3):31, 69.

[Brief info from Maudslay's version of Diaz del Castillo].

Koup, William S.

2002 Bannerstones...What Are They? Prehistoric American 36(2):3-5.

Short review of main theories, somewhat critical of Webb, but concludes probably atlatl weights, with special significance, and some "ceremonial" forms.

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Kozlowski, Janusz K. and Anta Montet-White

2001 The hunting-butchering tool-kit from Krakow-Spadzista: a Gravettian site in southern Poland. In *Proceedings of the International Conference on Mammoth Site Studies*, edited by Dixie West, pp. 109-116. University of Kansas, Lawrence.

fracture and impact on Gravettian points (shouldered blade pts). None embedded in bone but presumed projectiles [atlatls I should think]

Krakker, James J.

2018 Missouri atlatl weights as eight lessons in museology. *Missouri Archaeologist* 78L97-109.

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MO specimens in Nat'l Mus of Nat Hist (Smithsonian). All late 19- early 20 C, none from scientific excav, some important figures in Smithsonian history involved.

Krause, F.

1902 Schleudervorrichtungen für Wurfwaffen. *Archives Internationales d'Ethnographie* 15:121-155, plates 9-16.

[In German. "Sling Contrivances for Projectile Weapons." Presumably similar info to 1905. Plates have nice clear engravings of many types, favoring Arctic. Distribution maps.]

Krause, F.

1905 Sling Contrivances for Projectile Weapons. Annual Report of the Smithsonian Institution, 1904: 619-638.

"Spear slings" [he dislikes "throwing stick" and does not use "atlatl"].

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Works by "lengthens the arm and serves as a lever to thrust spear forward after it has flown beyond the reach of the hand." "same motion as in ordinary spear throwing" [footnote shows he expects a level motion as Howard 1974, which is not correct, despite calling it a lever].

Defines nock types: male = hook on atlatl for hollow spear butt.

Female = groove on atlatl, tapered end or hook on spear.

Mixed = hook at end of groove, hollow spear butt. [This is a misnomer – the hook is the effective part, so it really should be "male" with added groove.]

Efficiency (from ethnographic reports) "3-4 times as far as with bare hands" = 200-300 feet, Australians said to reach 150 yards, accurate to 40 paces.

Different types described by area: Australia, New Guinea, Micronesia and Melanesia; North circumpolar region, especially Eskimo and Aleut.

Central and S. America, including American west briefly mentioned, "probably in use till the end of the conquest (1530) in Utah, CO, CA, FL, Mexico, Yucatan..." [incorrectly conflating all these areas].

Small but clear line drawings of many types.

Projectile [spear] slings and loops briefly discussed. Short Santa Barbara specimen is considered origin of longer Mexican forms.

[Very old-fashioned distributional study, but confused by misunderstandings and probably translation problems]

Krajic, Kevin

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2002 Melting Glaciers Release Ancient Relics. Science 296 (5567):

Yukon ice field dung deposits with artifacts. Mentions others. Atlatl used until 1300 yr ago, then bow. BC Iceman was 550 yr old, atlatl also found in that area. Photo of stone point on foreshaft, and iceman's knife.

Kricun, Morrie E.

1994 Paleoradiology of the Prehistoric Australian Aborigines. *American Journal of Roentgenology* 163:241-247.

Spear thrower use mentioned as possible cause of elbow arthitis. [But no discussion, details, or even info on number of specimens examined – useless.]

Krieger, Alex D.

f

1956 Historic Survival of the Atlatl in the Lower Mississippi Region. *Bulletin of the Texas Archeological Society* 27:195-207.

Texas domesticated hog skull with large point, Spanish accounts of atlatl in Mississippi Delta. Pt is Gary type, lg, stemmed. Loosely in skull, which is filled w river sand holding it in. [Photo shows large hole, Archaic contracting stem point type. I'll bet this one is a fake. Wonder if it still exists?]

Kristensen, Todd, Brian Vivian, and Colleen Haukaas x

2016? Alberta's Record of Ancient Atlatl Hunting. Alberta Outdoorsmen October:48-50.

Atlatl 'gained dominance' around 8000 yrs ago, 300 generations, then replaced by bow 2000 yrs ago. Variety of game; bison kill at Everblue Springs, 7800 ya, unusual barbed + notched points may be earliest transition from spear to dart. Atlatl weights carved with animals = spiritual as well as perhaps balance or add velocity [the diagram of throwing correctly emphasizes the balance aspect]. Recent revival of atlatl hunting, allowed in Alberta because omitted from list of prohibited weapons.

Kroeber, Theodora

1962 Ishi in Two Worlds: A biograpy of the last wild Indian in North America. University of California Press, Berkeley.

Kuipers, Ludo

S

2013? Aboriginal hunting in the Northern Territory. Online photo essays at Images of the World: Oz Outback. <u>https://ozoutback.com.au/Australia/hunting/index.html</u> Accessed August 21, 2018.

Fine photos of hunting – a few with pikirri (spearthrower). Fish spear with 3 pts for crocodile, man with emu kill, boys with toy atlatls. Rifle has replaced for most hunting, now used mostly for "ritual fights and demonstrations of skill." Harpoons (hand-thrown) for turtle and dugong.

Kurten, Bjorn

1976 *The Cave Bear Story: Life and Death of a Vanished Animal*. Columbia University Press, New York.

Good popular account of cave bear paleontology, biology, and archaeology. Dismisses the "Neanderthal bear cult" as result of poor standards of early excavation, lack of knowledge of the oddities caused by natural processes in caves occupied by bears for centuries. Little real evidence for hunting cave bears at all.

Kurten, Bjorn

1980 Dance of the Tiger. New York City: Random House, Inc.

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Novel. Reconstructs Neanderthals as peaceful, intelligent, with gestural communication, brow ridges for facial expression, and pale skin, contrasting with the more organized and vocal modern humans who have dark skin [reflecting current theories of African origins of moderns]. Neanderthal extinction is explained as result of interbreeding that produced infertile offspring. Not a bad novel, some ok archaeological detail, but some that is wrong, eg. "granite" for Neanderthal spear points, "mammoth tongue with cranberry sauce," and other too-sophisticated cookery. Neanderthals have elaborate social rituals connected to the eyes and expression, which is plausible, but the (modern human) villains attempt to conquer other tribes, and some other aspects are way too complex for Paleolithic societies, even those of modern humans. The moderns use atlatls, but need heavier spears for mammoth (p5).

Kutscher, Gerdt

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1958 Ceremonial 'Badminton' in the Ancient Culture of Moche (North Peru). *Proceedings of the 32nd International Congress of Americanists*, pp. 422-432, Copenhagen.

Describes and interprets in detail several fine-line vase paintings [which are reproduced too small to examine well]. Spears and individuals with spear throwers depicted, but spears have not points, but cross bars and are "staffs" attached by strings to flowers or "shuttlecocks" which would break away and float down from the thrown staff in a 'ceremonial game' near and on the pyramids. Equipment seen in libation and runner scenes also present here.

Kwas, Mary L.

X

1981 Bannerstones as Chronological Markers in the Southeastern United States. *Tennessee Anthropologist* 6(2):144-171.

Uses modification of Knoblock's typology, excavated examples to establish basic chronology from Middle Archaic (6000-5000 BC) appearance to shift to 2-hole gorgets in Late Archaic (around 1200 BC). Generalized trend: begins with crescent forms (crescent, shuttle, reel, double-edge, double bit axe, knobbed lunate) in early Middle Archaic, then from 4000-3000 BC (late Middle Archaic) replaced by tubular, geniculate, humped, and ovoid forms which last until ca 2000. Meanwhile, hourglass and saddle-face forms (as at Indian Knoll) appear about the same time, and apparently last a bit longer. Finally the bottle and butterfly forms begin ca 2000 in the Late Archaic, and are ending sometime after 1000, with a shift to the 2-hole gorget around 1200 and a later shift to boatstones around 600-500 BC. Tables list all specific finds from sites with association info.

Kwas, Mary L.

1982 Bannerstones: A Historical Overview. *Journal of Alabama Archaeology* 28(2): 155-178.

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Name "bannerstone" assumed ritual or social function. Moorehead 1917 first systematic classification: lunate, bilunate, bipennate, geniculate. Knoblock 1939 major work, base for typology although his evolutionary scheme has no empirical support. Researchers tend to ignore bannerstones or inadequately describe.

Functional theories: 1) Ceremonial staff. NC find of 3 mounted on stone shafts a foot long (Baer 1921), and wear on only part of hole (Knoblock 1939), also fancy material, fragility. Carlson Annis find strung with beads around neck of burial.

2) Net spacers. Moore (1916) at Indian Knoll, association with net needles (hooks).
3) Atlatl weights. Webb, from finds at Indian Knoll and elsewhere, analogous to Basketmaker specimens (Kidder and Guersey 1919). Burial alignments consistent with SW examples – weight about 1/3 to 1/2 distance from hook. Problem with atlatl theory – hooks and bannerstones not always together, and found with female burials. Uses Indian Knoll data to demonstrate this. Also often not found with points.

Discusses experiments, which provide variable and sometimes conflicting results, partly because not systematic enough.

Precourt (1973) and Winters (1968) argue that could be both functional atlatl weights and social or status markers. Research should not assume the atlatl weight function is proven.

[Good literature review and critique up to its time. Many of the objections to atlatl weight interpretation are now less supportable, and most would now agree that symbolic as well as hunting uses are likely.]

Lahr, M. Mirazon, et al. [21 others!]

X

2016 Inter-group violence among early Holocene hunter-gatherers of West Turkana,

Kenya. Nature 159. doi:10.1038nature16477

28 individuals of all age + sex, marks of violence including blunt force trauma to heads and knees, possible binding, sharp club trauma to head, one obsidian bladelet lunate embedded in skull, 1 chert and 1 obsidian microlith in body cavity, both adult males. Interp as h-g group killed around lake margins, fell into shallow water, unburied but covered quickly by sediment. No signs of scavengers [which is weird - implies other humans prevented?] Dates around 10,000 BP, making "earliest evidence of warfare." Microliths interpreted as bow and arrow.

Lahren, Larry

A

2006 Homeland: An Archaeologist's View of Yellowstone Country's Past. Cayuse Press, Livingston, Montana.

Nice personalized illustrated narrative of Montana prehistory. Anzick Clovis site frequently referred to. Lithic archaeology includes projectile point chronology, knapping discussion featuring work of Ray Alt, Bonnichsen. Shoshone legend of how coyote stole knapping knowledge from wolf. Experiments with bow (Alt) and atlatl leave them skeptical of ability to distinguish points by size, and of penetrating ability of atlatl dart. [Stories about effectiveness of bow and arrow, and experiments with dart size points on arrows, but no info on any atlatl experiments.] Damage to points. Drawings and photos of Anzick artifacts, brief and not very clear discussion of events of find and study, including comments by "psychic" apparently accepted at face value. Mentions of "Clovis Hustle" and Woody Blackwell. Discusses relations between academic and contract and avocational archaeology; example of contract report on Dozer Rock Site. Bison hunting and kill sites. Spread of horse.

Lahren, Larry

2015 Making the shot. Bulletin of Primitive Technology 50:54-61.

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Pictures and scanty data on several shots into bison with 'atlatl size' points on arrows. Damage to many tho claims none hit bone. "...experiments have left numerous questions about the effectiveness of the atlatl in terms of penetration." [but no info given]

Lahren, Larry, and Robson Bonnichsen

1974 Bone Foreshafts from a Clovis Burial in Southwestern Montana. Science 186 (4159): 147-150.

Anzick cache, Montana, 2 subadults, ochre covered, points + bifaces, bone rods. Large mammal bone, possibly mammoth, beveled ends with hatching, possible resin. Postulated hafting with added splint of bone, could serve as detachable foreshaft allowing repeated thrust with rearmament.

Laird, Roderick D.

1984 *How to Make and Use the Atlatl: Ancient Weapon of the Ice Age Hunters*. Saratoga Museum Papers 1. Saratoga Historical and Cultural Association Atlatl Press, Saratoga.

Laird is school teacher, amateur arch, participant in World Open Atlat Contest since beginning. Prefers pronunciation at-latl but unable to find evidence. Aztec origins [from Nuttall – throughout he mentions "authorities" without citations]. Mechanics discussed, unclear. Some sketchy archaeology and designs. How to make section: recommends wooden spears 6-7' long. Optional weights serve as counterbalance to spear. Photos of manufacture, some design tips, including a forked antler proximal spear rest. How to throw section with photos, including clear sequence showing overhead flip motion and dart flex. World Open contest described. Winners 1981-1984 include Laird, B. Bradley, L. Kinsella. [notable that one of Laird's 6th graders beat adults1984 – skills not much developed then].

[Nice enthusiastic intro for kids and novices, 50 page booklet, now seems rather primitive and could use more scholarly info. Laird is one of the originators of modern atlatl study and sport.]

Laird, Roderick D.

1999 Experiments Confirm Likely Usage of Murray Springs Bone Tool. *The Mammoth Trumpet* 14(2):18-20.

Shaft wrench, not spinning tool as argued by Heite (MT 13(3)). Works well in pairs with heated wood shaft, has notches at ends of opening, necessary to keep from cracking shaft or letting it roll.

Laird, Roderick D.

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2011 The Atlatl Book: Everything You've Always Wondered About the Weapon of the Ice Age Hunters and Aztec Warriors. Privately printed.

[Father of modern atlatl sport reworks his earlier book, about 1990, self-published 20 yrs later. Chatty style, lots of good illustrations.] Beginnings of throwing, handaxes, Cushing theories. "Cro-Magnon" Paleolithic spear throwers and early recognition, but continuing ignorance. Paleoamericans, pre-Clovis, Clovis + other atlatl evidence: Jurgens site (Wheat) hooks, Agate Basin (Frison) and Warm Mineral Springs. Kennewick. Archaic period: abundant evidence. Webb + Indian Knoll. Drawings of numerous specimens with descriptions. California and odd Mexican atlatl spurs. [The Mexican ones represent a different type of antler hook related to Indian Knoll type but attached differently and more elaborate.] Selected bannerstones + weights, prefers Kinsella's balance theory.

Mesoamerica – Aztecs vs Spanish, pronunciation likely ah-tlah(tl). Mesoamerican depictions. Spanish accounts recapped. Australian, Arctic, misc atlatls. Aleut use atlatl for signaling – underside black = yes, hook side red = no. Considers Cushing's shark tooth club an atlatl.

Development of atlatl sport: encountered as boy, but didn't try. With friends,

discovered Caspar Site bison kill, made diorama, hunters wouldn't have been among animals with thrusting spears. Bradley made atlatl for Saratoga Museum. 1980 teaching 6th grade, replicating artifacts with students, including atlatls, first Kids' World Open Atlatl Contest and Primitive Technology Fair. Atlatls became dominant part, continued to 1994. Ada Jackson organized Camp Paleo events to bring scientists and public together, including knapping and Atlatl World Open. Book out in 1984. Leni Clubb tried atlatl at event 1983, first woman to enter contest [other than the kids], started recruiting at CO Arch Soc., began annual CAS Encampment events, organized WAA 1987, first meeting 1988, newsletter. First Valley of Fire event 1991. World Open continued to 1986.

Physics: "lengthened arm" idea not sufficient. Students developed many throwing styles. Carrere and Lepetz study measured dart velocity at 21 mps, hand thrown spear 12.5 m/sec, prim bow 30, English longbow 40, modern compound 65 mps. Dart lost 30% energy at 20 m. Baugh's findings: optimum length atlatl for every thrower + mass of dart. Weight reduces efficiency. Velocity affected by weight of dart. Flexible atlatl transfers more energy to dart. Dart flex does not add to kinetic energy of dart, but reduces 'kickdown' and improves accuracy. Increase in length from wrist to spur over just hand is the advantage.

Tips on making gear, lengthy discussion of different woods. He only considers natural materials with an emphasis on saplings for dart shafts. Simple hand tools, also tried stone with students. Various atlatl forms, some clever carved hook ends. Foreshafts, favors harpoon hafting of Clovis.

How to Shoot Your Atlatl. Adequate description of throwing motion, lots of pictures, dart flex doesn't add to forward velocity [but pics don't illustrate the flex of dart very well.]

Carryover to the Real World. Humor.

Laming-Emperaire, Annette

1959 Lascaux, Paintings and Engravings, trans by E. F. Armstrong. Penguin Books, Baltimore.

Interps Lascaux image w bison as spear thrower, see Irving 2000, Marshak 1972.

Lammers-Keijsers, Yvonne, Annemieke Verbaas, Annelou van Gjin, and Diederik Pomstra p

2014 Arrowheads without traces: Not used, perfect hit, or excessive hafting material? Chapter 38 in ???

Mesolithic Dutch arrowheads (microlithic, transverse, barbed + tanged) generally have few micro traces. Experimental results, show that differences in wear traces observed in points can be largely attributed to the shape of the points, their edge angles and the presence or absence of retouch. Rarity of traces is mainly caused by the abundant presence of hafting material-leaving "no room" for traces.

Microliths on 5 arrows, 2 spears, shot into goat carcass. All effective.

Transverse pts hafted with tar on 9 arrows (7 hits) in roe deer carcass. All effective.

Barbed and triangular pts hafted with tar shot into boar carcass, tree, ground. Most hits lethal.

Observed wear: linear streaks and polish from both animal and ground. Greasy polish with striations from animal contact. Micro edge removals. Varied by pt type. Some shots left no traces. Relative scarcity of traces because hafted with abundant tar.

Langley, Michelle

2011 Less to the Point: Curation of Magdalenian Antler Projectile Points. Paper presented at Multidisciplinary Scientific Approaches to the Study of Stone-Age Weaponry, Mainz, 19-22 September 2011.

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"Magdalenian osseous projectile points are carefully worked components of a technological system vital to the acquisition of subsistence resources, and as such, it is important to understand the entire *chaînes opératoire* of these artefacts. Recent studies focus on manufacture and use wear. Studies have established the durability and efficiency of osseous projectile points, but few consider the final phases of the *chaînes opératoire* – restoration, recycling and eventual discard with the embedded issue of curation. Archaeological material is largely trash in the view of the people responsible for its deposition. Issues surrounding the investigation of how Magdalenian osseous projectile points were restored, reduced and recycled - Can we determine if particular point types were curated or expedient? How much can we hope to learn about the curation of these distinctive projectile points?"

Barbed points were depicted on other antler pieces. Reduction of size + damage to decoration indicated reworking.

Lancy, David F.

2017 Homo Faber Juvenalis: A Multidisciplinary Survey of Children as Tool Makers. *Childhood in the Past* 10(1):72-90.

Surveys lithic archaeology, info on juvenile chimp tool use, laboratory studies of infant and child cognition and tool use, and ethnographic info on children's tool use and learning to generalize for application to early hominins and hunter-gatherers. In all, children learn most by direct observation and independent exploration rather than instruction, especially verbal. Adults often supply materials (often inferior) and tools (often miniature or sub-functional), or tolerate 'borrowing' of their own tools. [Implications not addressed: experimentation by children as source of innovation, and effective learning and passing of traditions in pre-verbal hominins. Early toy projectile weapon use (bows) mentioned, no details on age or use.]

Langley, Michelle

2016 More to the point: Developing a multi-facetted approach to investigating the curation of Magdalenian osseous projectile points. In *Multidisciplinary Approaches to the Study of Stone-Age Weaponry*, edited by Radu Iovita and Katsuhiro Sano, pp.229-244. Springer Science and Business Media, Dordrecht.

[see 2011] Discard occurs for both functional and cultural reasons interpreting damage

Lansac, Jean Pierre

2001 Discussion d'un cadre chronologique pour l'utilization du propulseur et de l'arc. Unpublished MA thesis, University of Bordeaux. Obtained on web <u>http://perso.wanadoo.fr/archeries/MEMOIRE.htm</u>, 8/20/01

["On a chronological framework for the use of the spearthrower and the bow." In French] Hunting weapons (spears) are known from at least Middle Paleolithic times, and common opinion is that spearthrowers begin at least by Solutrean, but bow not until Mesolithic. Two methods of evaluating this chronology: "direct" evidence of the weapons themselves, and "indirect" evidence of the projectile points compared to ethnographic and experimental information. Describes basic use, and male, female, and "androgenous" hook types.

First French Upper Paleolithic spearthrower finds by Lartet and Christy at Laugerie-Basse in 1862, recognized by analogy to Australian woomera by de Mortillet 1891. Finds now dated from late Solutrean (17,500 BP) to late Magdalenian (12,500 BP). First European bow finds from Swiss lake dwellings [Neolithic and Bronze Age] in 19th century. Now earliest bows from Mesolithic sites like Stellmoor (Germany, ca 11,000 BP) and Holmegaard (Denmark). Earliest arrows about same date, from Lila Loshult (Sweden) and Stellmoor.

Points are more difficult to deal with. Solutrean shouldered points have been shown to work well with spearthrowers, which are found in contemporary sites. Others, like Gravette points [small straight points made on retouched blades], were probably projectile tips, but we don't know whether for bow or atlatl. Experiments show they work with either. Some interpret as change to light point for arrow, but no direct evidence. Ethnographic Eskimo use both bow and atlatl for different purposes – why not an archaeological transition period in Upper Paleolithic? Evidence: Most known ancient bows already sophisticated, thus long ancestry likely. Magdalenian spearthrowers are close in date to Azilian microlithic industry – small stone tools suggesting bows. Bone tools become scarce, but atlatls could be all wood and not preserved.

[Brief, few details, but useful compilation of dates, bibliography].

Lansac, Pierre

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2004 Un cadre chronologique pour l'utilisation du propulseur et de l'arc durant le Paleolithique superieur europeen. *Bulletin des Chercheurs de la Wallonie* 43: 29-36. On web at URL: <u>http://perso.wanadoo.fr/archeries/articles/Lansac.pdf</u> accessed 10/25/05.

Similar to 2001.

Compiles velocity from other expers. His expers w Font-Robert points (Gravettian/Perigordian) – fractures show projectile use, but not distinguish bow from atlatl. F-R pts and Gravette pts prob used w atlatl before atlatl finds of Solutrean age, so prob perishable. Similarly, bow + atlatl should overlap even if not well documented, so for Paleolithic can say atlatl sure, bow possible; for Mesolithic bow sure, atlatl possible.

Lantz, Dennis

2005 Pensylvania Game Commission Hears Proposal to Allow Hunting With the Atlatl. *Indian Artifact Magazine* 24 (3): 12-13.

Lantz, Dennis

2006 Farewell to a Friend. The Atlatl 19(3):3.

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Obituary/tribute to Terry Keefer.

Largent, Floyd B.

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2004 Diving Into Florida Prehistory: The Paleoindian Record at Sloth Hole. *Mammoth Trumpet* 19 (4): 18-20.

In Aucilla R., dive excavs by C. Andrew Hemmings, lots fauna, worked bone and ivory, w Clovis pts. Ivory shafts and "points", bone pins. [But not clear evidence of Clovis atlat1].

Larsen, Jim

1998 Ancient Weapon Attracts New Island Following. *South Whidbey Record* (WA) Wednesday February 18, 1998:A7.

Duane Spangler featured, pics. Retired teacher, real estate salesman. Makes variety of forms. [OK basic description, but claim darts "can leave the atlatl at up to125 miles per hour."]

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Larson, Susan G.

2007 Evolutionary Transformation of the Hominin Shoulder. *Evolutionary Anthropology* 16(5):172-187.

Variability in the few shoulder fossils of early human ancestors and relatives. Neanderthals have longer clavicles, dorsally positioned scapulae, and laterally facing glenoid fossae compared to some ancestors, and less humeral torsion than modern humans, which would be advantageous for overhead throwing. In modern humans "reduced humeral torsion [correlates with] overhand throwing, which entails a high degree of external rotation of the abducted and extended arm during the cocking phase. Individuals with lower torsion values have...greater ranges of external rotation. Those who throw habitually have significantly lower torsion and a greater range of external rotation on their throwing side."

Larsson, Lars, and Arne Sjöström

2011 Early Mesolithic flint-tipped arrows from Sweden. Antiquity 85(330) Project Gallery. Electronic document, URL http://www.antiquity.ac.uk/projgall/larsson330/

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accessed 8/2013.

Rönneholm, former lake, modern peat cuttings reveal numerous finds and small sites dating Maglemose to Kongemose cultures (ca 7000-6000 cal BC). Find of wood + microliths with resin, assembled to reconstruct point of arrow 10.2 cm L, .9 cm diam. Hazel, v-shaped groove, 4 triangular microliths as barbs, 5th possibly tip [proximal end missing too], 7900-6600 cal BC. Another from Loshults Mosse 1951, 8900-7300 cal BC. Arrow find Vinkel, Denmark, 102 cm L, .7 cm diam, nocked, lashing for fletches, beveled tip, Early Boreal. Early Mesolithic arrow frags from Holmegaard IV, Zealand with microliths. Prejlerup, Zealand, Denmark auroch skeleton with 15 microliths, small arrow shaft frag w resin, 8410-7284 cal BC. [Resins not identified.]

LaRue, Chuck

2010 Looking Closer at Basketmaker Atlatls and Darts. *Bulletin of Primitive Technology* 39:12-21.

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[Good overview] Description of basic form. Gambel oak common material. Detail photos and drawings of LaRue replicas and originals form Sand Dune Cave, White Dog Cave, Broken Roof Cave (especially loops), small stone weights, darts – mostly willow and dogwood, short mainshaft, socket drilling with passive drill, hardwood foreshafts with pitch filler to seat stone points, bunts also, fletching with both whole and split feathers. Some rock art.

Lau, George F. o 2004 Object of Contention: An Examination of Recuay-Moche Combat Imagery. *Cambridge Archaeological Journal* 14 (2): 163-184.

Luhrsen stirrup bottle depicts pairs of warriors, one Moche (coastal Peru) one Recuay (highlands), ethnic diffs distinguished by costume and weapons (different maces). Moche are all winning, could be re-enactment or ritualized war, glorifies Moche. Recuay use slings and rocks as well as maces, Moche maces only, no atlatls shown.

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Laubin, Reginald and Gladys Laubin

1980 American Indian Archery. Norman: University of Oklahoma Press.

[Laubin knew lots of the old Sioux warriors of the 19th C in their old age] p 7 Pope and others were biased against Indian archery by fondness for glory of English longbow. Surviving native bows often inferior ones, or misused. p 116 No difference in shape of metal hunting and war points, although a few barbed war pts 'have been noted'. Flint war pts often triangular, loosely set in shaft with little or no binding so head remained in wound. [No attribution for any of this]. 'There are stories that war pts were set... perpendicular to the bowstring... to enter a man's ribs more easily...hunting pts set in same line of string to enter animal's rib cage more readily. If Indians ever had such ideas, they were impractical, because any arrow, no matter how it is fletched, will spin while traveling..."

p 118 "I once asked One Bull and other old-timers if they ever made stone arrowheads. The reply was no." Believed those found made by Iktomi or Little Spider People. Story of Crooked Neck who saw them working, tried to take point, was shot in neck with tiny arrow. After moving onto Plains, "proper stone was scarce or nonexistent." So made bone points. [I think his archaeology here is weak!] "Today there are more white men who know how to make stone arrowheads than there are Indians who can do it." Revived recently among Cherokee who learned from white hobbyist. Ishi last native knapper. Good modern knapper can make arrowhead in 20 min. Obsidian pts pentrate better on game than steel. Bone pts also not as good, but Plains folk had no choice. [again, no attributions for any of this].

p 120 Some think Folsom pts were for arrows [he must mean Brown] but so early must be on atlatl darts. 'Gem pts, bird pts' probably ceremonial "certainly they had no practical value" "no value in killing larger game." [Interesting that he devalues success of prehistoric archery thus.]

Laughlin, William S.

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1980 *Aleuts: Survivors of the Bering Land Bridge*. Holt, Rinehart, and Winston, New York.

Chapter on hunting: "Kayak hunting on the open sea is the most skilled and demanding form of hunting practiced by human beings." High reward, high risk. Long section on child training, which includes unusually specific exercises for particular skills, including for throwing harpoon with throwing board from kayak (p. 28), for which need to "stretch the ligaments and tendons of the knee, back, and shoulder early in life." Uncle, father, or grandfather pulls arm of boy "straight over the shoulder and back behind the head...to make the shoulder joint supple and permit greater excursion from behind with a straight arm, a valuable ability for casting harpoons with the throwing board." Also press down knees to lengthen hamstring muscles and small of back to allow you to sit comfortably in kayak.

(p 30) Throwing boards were personal possessions, tailored to size of owner. Children practiced on land before kayak hunting. (p 32) Maximum effective range for light harpoon (4 foot length, 1.2 m) thrown with throwing board is 120 feet (36.3 m).

(p 39) Throwing board illustrated. Wooden, wide board with groove and ivory hook, hole for index finger, shaped on underside for hand grip. Looks short. "Black paint on back represented fur of the sea otter, and red paint on belly represented blood. The various parts had anatomical names." Used with four foot harpoons, often for sea otter, but also against whale. "The spear was cast with a throwing board, assuring deep penetration." Tips "poisoned" but ingredients magical rather than effective.

Throwing board length was elbow to end of middle finger (p 148). Harpoon heads were barbed rather than toggling (p 84). Used bow drills for fire and drilling until Russians introduced pump drill (P 86).

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Laughlin, W.S., S.B. Laughlin, and S.B. Beman

1991 Aleut Kayak Hunter's Hypertrophic Humerus. *Current Research in the Pleistocene* 8:55-57.

Comp to 18 C Russian: Aleut shorter but much stouter, larger muscle attachments. Difference attributed to kayak paddling [atlatl not mentioned.]

Laurens, V., M. Raymond, and C. Faurie

2009 Why are some people left-handed? An evolutionary perspective. *Philosophical Transactions of the Royal Society, Biological Sciences.* 364:881-894.

Reviews all sorts of lit. L handedness occurs in all societies in low percent documented into prehistory, so a long-term polymorphism should have evolutionary forces acting. Difficult to define because no completely L or R handed individs. Influences include genetic component, but not a simple one, developmental and hormonal effects in utero, birth stress, birth weight, and other trauma/pathology, and cultural influences, espec for certain tasks like writing and eating. If no costs, expect 50%. Costs may include reduced longevity of L from prenatal/perinatal stress which is more likely in L babies, genetic + hormonal effects reducing immune effectiveness, and higher accident rate in societies dominated by R-hand technol (but also seems true in non-W soc). But benefits may include greater creativity in some fields, intermanual coordination. L do well in sports – a tactical advantage because they are more used to R opponents than those are to them. Possibly a marker of selective advantage in fighting – survival, mate acquisition, with a stronger effect the rarer L handers are. So that "frequency dependent advantage of lefthanders in fights" could balance negatives, and maintain polymorphism

LeBlanc, Steven

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1997 Modeling Warfare in Southwestern Prehistory. *North American Archaeologist* 18(3):235-276.

pretty much same info as others below

LeBlanc, Steven

1999 Prehistoric Warfare in the American Southwest. University of Utah Press, Salt Lake City.

[Excellent and readable book, arguing case for endemic warfare in SW, with changing patterns through time, but usually associated with climatic stress periods. Sometimes he pushes too hard with dubious arguments.]

Atlatl assoc with fending stick implies formalized combat p 96, p 106, 124. [But are S-shaped sticks in BM context really for fending? Talking to him in 2011, agrees this is not certain.] Arrow from self-bow 50% faster than atlatl dart (cites Bergman et al, Raymond velocity figures), can't fend, with bow, fending sticks disappear. Self bow intro ca 200

AD from N, recurve sinew-backed bows 1100-1400s. Mogollon settlement pattern shift as hills lose advantage with bow.

LeBlanc, Steven

S

2003 Warfare in the American Southwest and Mesoamerica. In *Ancient Mesoamerican Warfare*. M. Katherine Brown and Travis W. Stanton eds., pp. 265-286. Altamira Press, New York.

After period of neglect, archys again looking at warfare - data + reconstructions differ in SW and Mesoam but should be complementary.

Early period SW (to AD 900): standardized artifacts (fending stick + atlatl, basketry scalp stretcher) as well as iconography, site location, and a few mass victims indicate systemic warfare. Bow and arrow intro AD 200 in N SW. Mogollon hilltop sites (unfortified) from 200-600 sufficed against atlatl "hard to throw uphill" but abandoned with arrival of bow. Middle period (900-1150) less war but some sacrifice and Chaco-related cannibalism etc. Late period lots of evidence of warfare again. Warfare correlates with periods of environmental stress.

Data less for Mesoam, but also should include non-peaceful spread of agriculture in Formative. Classic warfare widespread in iconography, can't be just elites. New technology (bow) must have changed war here too - AD 600 collapse of Teotihuacan, and AD800 end of Classic Maya maybe because now could arm commoners with an "area weapon" that required less skill to saturate an area with projectiles - dangerous to elite warfare. But arrival time of bow uncertain. Atlatl survived and bow lacking in iconography because of elite emphasis.

Lechler, George

1951 The Interpretation of the 'Accident Scene' at Lascaux. Man 51: 165-167.

Usual interpretation: man speared bison, whose entrails are out and who is looking away, so no longer in action, then man was killed by rhino, who is walking away. [Unneccessarily complicated, and rhino is stylistically different from others, probably not part of same story, if Paleo images depict stories.] Short hooked object is a dart, with typical Upper Paleolithic bone point; bird on stick is not totem, but the spearthrower. Parallels in Larthet cave dart-thrower with monkey head and hook fragment carved with birds, which would magically aid flight of dart. "Entrails" are actually abstract magical signs, paralleled by others [more rectilinear] on other animals. Editor's note adds possible interp of bird as decoy, with short object as spearthrower, which would explain cross piece. [But all of these interpretations are debatable.]

Lee, Arthur

1991 Weapon Found at Marcos Island Combined Atlatl and Sabre. The Atlatl 4(1): 5-6

Excerpts from Cushing 1896 - apparent atlatl with bottom edge set with shark teeth. [Possible atlatl but probably not; see Kolianos and Weisman 2005; Whittaker 2012].

Lee, Craig

2010 Global Warming Reveals Wooden Artefact Frozen Over 10,000 Years Ago in the Rocky Mountains. *Antiquity* 84(325) Online Project Gallery. URL: <u>http://antiquity.ac.uk/projgall/lee325/</u>

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Alpine ice near Yellowstone. Foreshaft 1.07 m long of birch sapling. Conical proximal end, split out notch distal end, markings possible ownership marks. Comparison to Gypsum Cave material suggests use with 300mm dart [shorter than foreshaft ?] and atlatl. Calibrated AMS dates 10281-10497 BP = Cody Complex [later Paleoindian].

Lee, Craig M., and Kathryn Puseman

2017 Ice patch hunting in the Greater Yellowstone Area, Rocky Mountains, USA: Wood shafts, chipped stone projectile points, and bighorn sheep (Ovis canadensis). *American Antiquity* 82(2):223-243.

Wyoming and Montana, high elevation with valleys. Dates spanning last 4300 yrs of bighorn sheep hunting, also some bison remains. Permanent snow and ice shrinking under global warming, revealing ancient artifacts that were in stasis and now endangered. Most below 3200 m altitude. So far 9 unique shaft finds from 5 patches, another 9 patch sites have other artifacts like lithic points. Now above treeline but some contain stumps indicating higher trees in past. Lower elevation woods like birch more likely to be used in weapons. Illegal collecting problems now.

Shafts show ownership marks (simple parallel line incisions) on both foreshaft intended to remain with prey, and other, trampling damage. Table of dimensions, but most too fragmentary to be very useful except diameter.

Those identified as dart shafts include deteriorated frag of fir sapling trimmed of branches, beveled scarf joint, 4380 ± 20 BP, 19.8 mm diam.; three frags of a birch shaft with dates 6695, 6560 BP 17-18 mm diam. Birch foreshaft date 9230 + 25, 12.5 mm diam; a second prob foreshaft 2900 + 20, 9.9 mm diam. Three shaft frags with later dates 1393-215 BP, but also two willow frags id as 'possible arrow shaft', v-shape nock 'suggestive of arrow' 8 mm diam, 3985, 4130 BP, which is real early for arrow, mostly adoption placed at 1500 BP based on appearance of small points. But other early arrows reported in far north, Yukon, AK. Possible early appearance of bow, later abandoned as not more suited than atlatl.

Atlatl technology – dart more important than thrower form, especially flex. Indices of wood suitability allow comparison of shafts – all woods used had good index figures by this measure. Birch used over long span, so selected.

Diagnostic points at ice patches include Oxbow and Pelican Lake types used with darts – Archaic dates for these forms. Upslope benches near ice patches often have lithic debris from repeated camp site use. Fauna: bighorn, bison, elk, deer; first 2 most common. Bighorn most assoc with human exploitation, skulls most common, some isolated, intentional accumulation of skulls.

Leeth, Doug

2004 Spearthrower. DVD, 120 min, Ice Age Arts Inc. (privately distributed.).

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Starts with info on WAA and ISAC. Richard Lyons outlines prehistory with his board of different models, emphasizing Webb's Indian Knoll forms, with bannerstone toward hook. Also Eskimo models and Basketmaker-inspired form. Promotes atlatl leading to bow because both flex. DL: Throwing Techniques and atlatl construction, shows several modern models, 2 grips – forward (split finger) or to side, likes former and Bracken's version, blames closed fist side grip for tendon strains. Bob Berg: Hafting and Fletching, demonstrates use of bannerstone as spindle whorl on rested spindle for making cordage lashings. His theory to explain Webb's finds: spindle + atlatl stored + buried together in alignment. [Ingenious but not convincing]. Scorches wooden darts with propane torch to straighten and harden. The Younger Generation shows Ethan, 6, throwing. Mark Bracken, Tips on Accuracy, bannerstone as counterweight, dart matched to atlatl, 7' cane, keep tip still, arm up, wrist flick gives most energy. [Adequate info and demo. If step frame by frame, dart takes 9-10 frames = 1/3 sec to reach target at 20 m, which would = ca 60m/sec - but that would imply about 134 mph, which is unlikely, see Whittaker + Kamp 2007]. DL: Point styles – field pt, copper blade, copper pt or nail embedded in tip like pencil, antler cone. Bamboo and River Cane – DL shows harvest [but interestingly, he uses Berg wooden darts throughout]. Bracken discusses straightening: start with worst spots, over propane flame, does nodes first, then segments. Running Pig target on sloping cord with pulleys. Fletching and Coning Darts – DL, with modern jig. Dart Penetration Test on 5/8" plywood and truck door. Steel broadhead, Archaic Hillsborough, and Clovis points perform similarly, pierce but not transfix, stone tips damaged but not broken. Same broadhead on 1.2 oz arrow with 55 lb bow does similarly on plywood but less penetration on door. [Unsystematic but very effective demonstration - as he notes, since he has killed many deer with arrow and broadhead, the atlatl is just as powerful.] Spearthrowers in Action - random shots of different throwers from variety of angles at an event. [Overall a nice introduction to atlatls with good practical info for modern sport].

Leon-Portilla, Miguel

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1962 *The Broken Spears: The Aztec Account of the Conquest of Mexico*. Beacon Press, Boston.

p 77 After the Spanish attacked the celebrants at Feast of Toxcatl at the Templo Mayor, the Aztec retaliate: "Then the battle began. The Aztecs attacked with javelins and arrows, even with the light spears that are used for hunting birds. They hurled their javelins with all their strength, and the cloud of missiles spread out over the Spaniards like a yellow cloak." from Sahagun, originally written in Nahuatl. [the yellow cloak should be cane shafts of what must be atlatl darts. See Sahagun 1975]

Lepper, Bradley

2012 Mammoth Engraved on Bone from Florida. Mammoth Trumpet 27(1):1-5.

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Vero Beach. 2006 or 07, James Kennedy find, cleaned 'scrap of bone' 2009, noticed. B. Purdy, U FL and 'team of experts' including Stanford. Highly mineralized megafauna bone, no DNA, not C14 datable. Detailed mammoth image, 3x2". Bone chemistry consistent with other VB finds. Engraving shows same weathering as other surface, SEM backscatter shows same elements = weathering across surface and in cuts. Feder cited as skeptical. [I still bet it's a fake! No context, non-scientific collector, who noticed marks "2 years" after finding bone, and hopes to sell it at auction, cites Purdy study to increase value. And it is just too pat - like all good fakes, fits what some (including Stanford) want to find, totally unique in US and looks too much like Euro Upper Paleolithic engravings. See Pickard 2009; Purdy et al. 2011]

Lepper, Bradley

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2014 Clovis Child Answers Fundamental Questions about the First Americans. *Mammoth Trumpet* 29(2):7-12.

Anzick, Montana, burial of 2 yr old boy with 84 biface cores + preforms, 8 fluted points, 15 frags of elk antler rods (=8 foreshafts), 6 unifacial tools, 2 flakes, all ochre covered, only burial assoc with Clovis artifacts. Found 1986, now DNA genome analyzed, both mitochondrial (mother) and Y-chromosome (father). Compared to 52 recent groups, more closely related to all Native Am. groups than to any Eurasian pop, and closer to S + Central Am groups than to northern N. Ams. Interp: "80% of all living Native Ams descended directly from this child's extended family" [Nonsense! Descended from individuals bearing same genes.] And because there are 20% non-related N Ams, must have entered continent "a few thousand years before Clovis". No evidence for European connections, Solutrean theory should be dismissed.

Privately owned by Anzick family, now to be reburied, but compromise - in capsule to prevent degradation, possible to open every 50 yrs for more samples. [A lot of stuff about 'emotional impact' but possibly adequate compromise - if it actually happens that way. And if it had been reburied before, we wouldn't know all this.]

Lepper, Bradley

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2014 Ancient Siberian Boy Reveals Complex Origins of First Americans. *Mammoth Trumpet* 29(2): 6, 12-15.

Mal'ta burial of 3-4 yr old, ca. 24000 cal BP. His group ancestral to mod W Eurasians, contributed ca 14-38% of genes in mod Am Ind genome. Indicates first Ams were amalgam of east Asians and western Eurasians, maybe explains Eurasian skull shape of Kennewick and other early Paleoinds, and how mitochondrial X haplogroup mostly found in Europe, got to Americas.

Site excav 1928-1958, clusters of artifacts interpreted as dwellings. Burials - boy + infant (teeth only) had fancy goods: 120 ivory beads, bird pendant, figure-8 pendants, swan figurine, engraved plaque, bone pt or dagger, bone bracelet, unifacial stone tools. Work by Kelly Graf and Eske Willerslev and S. Demishchenko, sampled humerus (0.15 grams) [and the US reburial activists would consider this 'destructive' and forbidden!]

"...demonstrating the wealth of info that can now be gleaned from a miniscule amount of bone. The worldwide scientific community owes a debt of gratitude to the Hermitage State Mus; if their staff hadn't curated these remains for all these years, these new genetic analyses wouln't have been possible." [Contrast with Anzick in same issue: Mal'ta proudly displayed and still teaching about his people; Anzick hidden and now silenced by reburial.]

Lepper, Bradley T.

2014 The People Who Peopled America. In *Kennewick Man: The Scientific Investigation of an Ancient American Skeleton*. Owsley, Douglas W., and Richard L. Jantz, eds., pp. 7-29. Texas A&M Press, College Station.

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Survey of info, tabulation of skeletal remains. Info on burial type + possible ceremony, violence and possible cannibalism evidence. Shows how much can be learned from the rare paleo skeletal evidence. Several important finds have now been destroyed by tribes. Explains the climate of fear and avoidance of skeletal archaeology produced by NAGPRA, while some tribes have a better attitude and see ancestral skeletons as the ancestors still teaching.

Lepper, Brad

2016 Kennewick Man's DNA reveals his ancestry. Mammoth Trumpet 31(3):1-5, 19-20.

Analyses by Willerslev et al. DNA poorly preserved. Mitochondrial haplogroup X2a, one of 5 founding AmInd lineages. X2a not European, close to C4c Asian lineage, not support Solutrean hypothesis. Skull shape resembles Polynesian/Ainu, but so do others; within range of early AmInds, no evidence of Poly/Ainu connection. Not as closely related to S Am groups as Anzick-1, but more closely than most modern tribes. Comp to modern tribes hampered because few participate in genetic sampling. Colville did, tests refute hypoth of direct descent with no subsequent gene flow, but show close relationship. Colville say "Ancient One is relative...bury him respectfully." Army Corps of Engineers says that now he is clearly Native Am, tribes can pursue 'repatriation' again. [Of course the Corps, which acted illegally and abusively in the past, has a stake in saying they were 'right' all along, and like the Colville, would happily see KM destroyed.] Nature editorial recommends US 'should use its broad-brush insights cautiously as it considers fate of remains." and Owsley says Kennewick "is just beginning to talk to us and we need to carry on that conversation." Lepper: "tools and techniques ... are constantly improving. Someday researchers may be able to recover DNA from KM bones that reveals his genome in much greater detail." [If we haven't allowed tribes to destroy Kennewick by then.]

Lerner, Jesse

2001 A fevered dream of Maya: Robert Stacy-Judd. *Cabinet* 4 (Fall 2001). Online: <u>http://www.cabinetmagazine.org/issues/4/lerner.php</u> accessed July 19, 2017.

R. Stacy-Judd (1884-1975) British born architect fascinated by exotic architecture, especially Maya, influenced by Catherwood illustrations, worked in 'Maya Revival' style in California, espec Masonic Temple 1951, and most famously Aztec Hotel 1924 (so named because public at the time didn't know Maya). S-J also wrote poetry and fiction, patented 'Hul-Che Atlatl Throwing Stick' derived from Maya prototypes [see Powell 1937]. Saw Maya as Eden, influenced by [crackpot] ideas of Donnelly, Churchward, Le Plongeon on various Atlantis origins of New World cultures. Part of colonialist fascination with ancient cultures before WWI and US imperialism in Latin American neighbors before WWII. Contemporary archaeology by Carnegie Inst at Chichen Itza (Sylvanus Morley, Earl and Ann Axtel Morris National Geographic publicity). S-J publicized Aztec Hotel, dressing in fanciful Maya lord costume.

Leroi-Gourhan, André

1967 Treasures of Prehistoric Art. Harry N. Abrams, Inc, New York.

Big coffee-table picture book on Paleolithic art, with good text. Includes good photos of a dozen of the nicest spear throwers.

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Letourneaux, Claire, and Jean-Marc Pétillon

2008 Hunting Lesions Caused by Osseous Projectile Points: Experimental Results and Archaeological Implications. *Journal of Archaeological Science* 35:2849-2862.

Upper Magdalenian (Upper Paleolithic) antler points, fork-based or double beveled, from Isturitz, France. Could be on darts or arrows - earliest definite bow evidence is Ahrensburgian arrow shafts from Stellmoor, Germany, ca 2000 yrs younger than Up Magd.

Replicated pts on foreshafts with hide glue and sinew, used (96) on arrows with self bow, and atlatl darts 2.5 m L, 157-193 gm, atlatls of Up Pal type 50-70 cm long, Chauvaux, Cattelain, Demoulin, and Rivere throwers. Two calf, 2 adult fallow deer carcasses at 10-13 m.

Three types damage to faunal bone: notches, punctures, and perforations (through and through), some with associated cracks, beveling, and embedded pt frags. Scapula most likely to be perf'd. Ribs most likely notched. Lighter arrows have less kinetic energy than darts, but similar bone impacts except maybe more deflection and thus fewer punct + perf, more notching. Notching and perf often with internal beveling [like concoidal fracture]. Weapon impact rarely recog in archaeofaunal assemblages - preservation and recognition problems.

[Also provides evidence that round-section antler points on atlatl darts are very effective, deep wounds into bone, sometimes even transfixing animal and perforating scapula from inside.]

Lewis, Darrell

S

1988 *The Rock Paintings of Arnhem Land, Australia: Social, Ecological, and Material Culture Change in the Postglacial Period.* BAR, Oxford.

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rock art chronology of spear throwers in Akerman and McConvell

Lew-Levy, Sheina, Rachel Reckin, Noa Lavi, Jurgi Christobal-Azkarate, and Kate Ellis-Davies x

2017 How do hunter-gatherer children learn subsistence skills? A meta-ethnographic review. *Human Nature* 28:367-394.

[Useful generalizations and refs, though 'meta-ethnog' is just fancy language for literature review] Used 58 studies of 34 different cultures. Broadly defined definitions of teaching are best, show that 'teaching' in various forms occurs even in simple societies. Broad skills are necessary for hunt-gath way of life, differnt skills learned at diff times of life. 'Vertical transmission' = parent to child. 'Oblique' = non-parent elder to child. 'Horizontal' = same generation. Often all these are same-sex. Teaching was most often non-active, i.e. allowing observation. Personal experience and trial + error valued. Overimitation (copying non-essential actions as well as functional) was common to all societies, possibly less so in h-g. Adults are most likely to innovate rather than children, and intro innovations to adolescents. Learning begins early, toys common, often miniature tools that become more functional as kid grows, and imitative play is replaced with useful work. Children spend much time in observation learning. Work-themed play is common. Foraging and small-game hunting learned early, big-game skills usually later, and with more direct instruction because it is complex. Learning to make technologies is mostly vertical transmission, but little direct instruction. E.g. San, Batek by ages 4-5 have made bow and arrows, hunt birds and lizards. Gidra parents give children well-made 'toys' as examples to imitate, but they don't skilfully make until 14 yo. San boys mostly learn from older boys. Hunting skills seem to peak later in life, and often strength is less important than these skills. Some activities require less experience. Research gaps are apparent in female activities, and horizontal transmission, and Africa is over-represented in available studies.

Lindsay, Alexander J., J. Richard Ambler, Mary Anne Stein, and Philip M. Hobler x 1969 *Survey and Excavations North and East of Navajo Mountain, Utah, 1959-1962.* Museum of Northern Arizona Bulletin No. 45, Flagstaff.

Report on several Anasazi sites including Sand Dune Cave, with Desha Complex (Archaic) and Pueblo I-III material but mostly Basketmaker II. Cache of dogskin bag with gaming pieces, turkey and other bird feathers, bone tools, uranium ore, 18 unfinished dart pts, 6 dart foreshafts with stone pts, 8 cylindrical "gaming sticks" of horn [flaking punches – see Geib], and other things. Also in cave, antler nubbin flakers, further dart and arrow fore and main shaft fragments, snares, sandals, basketry, a burial with Archaic points, etc. Isolated in fill, probably cached, was complete atlatl of classic Basketmaker type [on display, Museum Northern Arizona]. Described, photos, nice drawings + description of complex grip loops. Flat upper surface, convex lower, 59 cm long, 15-17 mm wide with distal flare to 26 mm, very short groove under spur, flexible

with marked bowing, notched for grip with loops of leather rolled around sinew, complexly bound, decorated with blue feathers. [see also Matson 1991, Hunter 1992; Whittaker et al. 2009; LaRue 2010]

Linné, Sigvald

1937 Hunting and Fishing in the Valley of Mexico in the Middle of the 16th Century. *Ethnos* 2(1):56-64.

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ca. 1550 map of Valley of M in Uppsala U. Library decorated with scenes of life, made for Emperor Charles V by Alonso de Santa Cruz. Similarities to codices. Shows blow gun, bow and arrow, nets, and hunting birds with 3-pronged spear + atlatl [probably, but atlatl not clearly shown] on Lake Texcoco.

Lipo, Carl P., Robert C. Dunnell, Veronica Harper, and John Dudgeon

2008 Beveled Bifaces and Ballistics Technology. Unpublished electronic document, "for submission to Journal of Archaeological Science." URL: <u>www.csulb.edu/~clipo/misc/BeveledBifacesAndBallistics-V2.doc</u> accessed: 7/12/11. No longer available 6/2015

Beveling of Archaic points as knife resharpening vs to spin projectile. Many citations, especially early American archaeology. Only Wilson (1898) experimented; he found that beveled points on unfletched shafts rotated when dropped, drawn through water, or in wind tunnel. But mostly ignored by recent interpretations. Evolutionary view: beveling only on post-Clovis; most common pre-bow, therefore should be a response to particular set of conditions or requirements.

Like Wilson's experiments, aerodynamic theory supports bevel as producing spin. "Computational fluid dynamics" allows us to model effect of air moving across different biface shapes to see if bevel would have effect in real world situation. Model shows that spinning forces should be created at wind speeds consistent with prehistoric projectiles. Wind tunnel experiments on bifaces mounted on a freely rotating axis show that they do indeed rotate. Rotation should improve accuracy and reduce drag of attached shaft, so should be selected for once it has been invented. Since not on all points, there must be certain conditions where it is advantageous. Mostly on larger points, thus larger shafts, whose rate of rotation will increase more slowly. Light objects at same starting velocity don't go as far, so rotation would have less effect [explaining why arrow points not beveled?] Smaller faster arrow need fletching to keep from tumbling, and it can also be used to rotate them more effectively than point bevel. So optimal payoff for rotation between 100-220 grams, dart + thrown spear weight.

Knife beveling likely too, distinguishable by wear patterns. Bevel/spin also should increase damage at impact.

[Is the rotational inertia enough to keep dart spinning after point hits solid material? Doubt it. Does rotation by point stabilize an atlatl dart? Doubt it very much. This whole paper is a good example of an experiment that does not apply well to real life, because it simplifies the variables too much. Like Wilson's experiments, Lipo et al. show

that bevels can rotate a shaft under ideal conditions. BUT: A straight, non-flexing shaft in an air tunnel is not enough like a flexing atlatl dart in flight. Pascal Chauvaux's videos of darts in flight shows that they do indeed rotate as well as flex - but they have neither a beveled point, nor spiral fletching. They rotate in uneven pulses because of the oscillation of the flexing shaft. Resharpening of knives and points remains the better explanation of beveling. Arrow points are not usually beveled because many are too small to make it worth while, or perhaps because unlike dart points on foreshafts, they don't get secondary use as knives.]

Lipo, Carl P., Robert C. Dunnell, Veronica Harper, and John Dudgeon

2010 Beveled Bifaces and Ballistics Technology. Unpublished electronic document, submitted to American Antiquity. Accessed Jan 2, 2012, URL: http://www.isu.edu/anthro/dudgeon/pubs/Lipo et al 2011.pdf

Pretty much the same as 2008, some rewriting, added caution that not all beveling must serve same purpose, discussion of point types: Why is beveling mostly in earlier Archaic? Clovis pts not beveled because they were "stabbing" and cutting tools. Beveling appears with Dalton pts, which are also more consistently pointed, thus more specialized as projectiles. Abrupt decline of beveling unlikely to be reduced need for the accuracy promoted by spinning projectile. Unless some incompatible invention is more valuable, or unless spin achieved by adding fletching, in which case points don't need to be so heavy. Can't resolve this now.

Lipo, Carl P., Robert C. Dunnell, Michael J. O'Brien, Veronica Harper, and John Dudgeon o,p

2012 Beveled Projectile Points and Ballistics Technology. *American Antiquity* 77(4):774-788.

Beveling of Archaic points as knife resharpening vs to spin projectile. Midwest + SE Archaic, including Dalton, Hardin, Thebes etc. Many citations, especially early American archaeology, pro + con rotation. Only Wilson (1898) experimented; he found that beveled points on unfletched shafts rotated when dropped, drawn through water, or in wind tunnel. Smith (1953) tried on arrows, [claimed no rotation] but his experiments irrelevant as only dart pts beveled [Smith is just as relevant as Wilson + this experiment!] But mostly ignored by recent interpretations of bevel as sharpening.

Aerodynamic theory supports bevel as producing spin. Drag forces no longer normal to shaft, generates torque. Spin converts curved path of unevenly curved shaft to helical path because bias is rotated in all directions. This is "free" because uses already existing drag of pt, vs fletching which adds drag [Only 'free' if point x-section remains same? And a point larger than shaft must also produce more drag than shaft.] Rotation rate is function of velocity, bevel surface area, and angle, up to a "terminal RPM". "Computational fluid dynamics" allows us to model effect of air moving across different biface shapes to see if bevel would have effect in real world situation. Model shows that spinning forces should be created at wind speeds consistent with prehistoric projectile velocities (5-60 m/sec, Hughes 1998) [=16-198 fps, or 11-132 mph. - i.e. to well above dart speeds]. Wind tunnel experiments at 30 m/sec [= 67 mph, better dart velocity but rather high] on bifaces mounted on a freely rotating axis show that they do indeed rotate. "Skin drag" on shaft relatively small, so not prevent rotation. Rotation should improve accuracy and reduce drag of attached shaft, so should be selected for once it has been invented. Since not on all points, there must be certain conditions where it is advantageous. Mostly on larger points, thus larger shafts, whose rate of rotation will increase more slowly. Light objects at same starting velocity don't go as far, so rotation would have less effect [explaining why arrow points not beveled?] Optimum payoff for rotation at about 100 grams, dart/spear weight.

Beveling originates with Dalton, from which [disputable] develop two lineages: notched e.g. Thebes and stemmed e.g. Hardin. Earlier Clovis pts mostly stabbing/cutting multipurpose tools, no bevel. Dalton more functionally specific projectile point. Beveling lost abruptly, signalling different technol solution to accuracy, perhaps fletching.

[See Pettigrew et al. 2015, and comments on earlier versions, but in final form, whole paper is a good example of an experiment that does not apply to real life, because it simplifies the variables too much. Like Wilson's experiments, Lipo et al. show that bevels can rotate a shaft under ideal conditions. BUT: A straight, non-flexing shaft in an air tunnel is not enough like a flexing atlatl dart in flight. Pascal Chauvaux's videos of darts in flight already showed that they do indeed rotate as well as flex - but they have neither a beveled point, nor spiral fletching. We (Pettigrew et al.) got the same result more systematically. Darts rotate in uneven pulses because of the oscillation of the flexing shaft. Resharpening of knives and points remains the better explanation of beveling. Arrow points are not usually beveled because many are too small to make it worth while, or perhaps because unlike dart points on foreshafts, they don't get secondary use as knives.]

Lister, Adrian, and Paul Bahn o

1994 Mammoths. Macmillan, New York.

[Nice illustrated popular book, but the artists needed more coaching when drawing prehistoric humans: Clovis hunt includes silly looking hunters using crude hand-thrown spears and boulders, and Upper Paleolithic camp scene has a woman roasting an unskinned deer and one of the worst depictions of flintknapping ever.] Photos include two Up Pal mammoth depictions on spear thrower parts, from Bruniquel and Canecaude.

Livingstone, Carl B. x 1932 Trailing Down the American King Tuts. *New Mexico* 10(5):-7-9.

Guadalupe Mts Basket Maker cave explorations, [unscientific, poorly written.] Broken fending stick [photo], "fragments of the dart-hurler, forebear of the bow-andarrow" [no details].

Lockett, H. Claiborne, and Lyndon L.Hargrave

1953 Woodchuck Cave: A Basketmaker II Site in Tsegi Canyon, Arizona. Northern Arizona Society of Science and Art, Flagstaff.

Brief report on excavations in 1933-34. Burials in cists/storage pits, mostly disturbed (all missing crania) in prehistory, but lots artifacts. Cist 7 included old man and young woman, flexed, with decorated wooden combs [showing kin connection?]. Above L shoulder of M, 4 pts, 6 stone drills and scrapers. Above head parts of 2 atlatls broken into 7 inch sections. Frags of another near head of woman but in fill so may not be associated with her. Stone beads, stone pipe with M, on F chest gopher, skunk, and prairie dog mandibles. M had lignite pendant, bag with seeds and pigments. [Rather well endowed burials.] Photo shows 2 pathetically rotted distal end atlatls, 2 possible grip ends, one hide finger loop.

Lockhart, James

1993 We People Here: Nahuatl Accounts of the Conquest of Mexico. University of California Press, Los Angeles.

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[Gives English translation by Lockhart parallel with Nahuatl original and sometimes Spanish - selections from several documents.]

From Book XII of Sahagun's General History of Things of New Spain (Florentine Codex): p136 after massacre at Toxcatl festival "The warriors quickly came outfitted, bunched togehter, carrying arrows and shields. Then the fighting began; they shot at them with barbed darts, spears, and tridents, and they hurled darts with broad obsidian points at them. A cloud of yellow reeds spread over the Spaniards."

p 225-226, chapter 37, as the Spaniards attempt to flee by the canals. Two versions, 1) from Spanish text: ... y los tlatilulcanos del barrio de atliceuhyan, y los del barrio de ayacac resistian por el agua no descansauan en la pelea erran tan espesas las saetas y los dardos que todo el ayre parecia amarillo. "The Tlatelolca of the districts of Atliceuhyan and Ayacac fought back on the water, never resting from the battle. The arrows and darts were so thick that the whole sky seemed yellow."

2) from Nahuatl, last line: ...in iquac atlatica quitlaca iuhquin cozpul ommoteca in impan iaume... "And the boatmen and archers of Atliceuhyan and Ayacac made great efforts to encounter [the Spaniards], they lost no time, they were equal to them. It seemed that barbed darts showered down; the arrows came in large bunches, (as when a serpent strikes). When they threw darts with the atlatl, a yellow mass seemed to spread over the enemy."

Lockwood, Douglas W.

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1980 I, The Aboriginal (first illustrated edition). Rigby Publishers Ltd, Adelaide.

Autobiography of Waipuldanya aka Phillip Roberts as told to Lockwood. First pub 1962. Born ca 1902 in N Australia, Roper River on Gulf of Carpentaria. As boy, "we fought with toy spears, the ends bound with rags so that anyone who was hit wouldn't be badly hurt." Hunting with woomera + 10 foot shovelnose spear frequently mentioned but not detailed. Mission school for a few years, then hunt with older man (his future wife's bro) for training, so at ca age 10-12. P. 80 'My spears were balanced in relation to my height, my weight, and the length of my arm.' Spear manufacture described, blood and ochre décor. Spear "fitted to woomera and test-thrown, spinning like a rifle bullet. If rear end oscillates too wide an arc it will whistle in flight, advertising its approach... must be trimmed and straightened until it is silent and perfect. ...Woomera is also made from Djindi-djindi with a wooden point bound to the shaft by wax made from roots of an ironwood tree.' Boomerangs of secondary importance, mostly for moving targets like birds.

Ultimately he went to school, met a doctor and became his orderly, had medical training.

Loendorf, Chris pdf, x

2010 Hohokam Core Area Sociocultural Dynamics: Cooperation and Conflict along the Middle Gila River in Southern Arizona during the Classic and Historic Periods. Unpublished PhD dissertation, Arizona State University.

Around 1000 pts from Gila River Indian Community surface surveys - Pima-Maricopa Irrigation Project.

Working with late arrowpoints, some info on earlier Archaic, assumed to be atlatl dart points, including damage info. Good discussions of arrow design elements, questions of style and function, chronology. Expect general trend through time to faster, smaller projectiles, thus smaller overall points. Assumptions that function is foremost, points for war should differ from those for big game hunting. War - un-notched or otherwise designed for separating from shaft and staying in wound. Provides some ethnographic and historical justification.

Chap 3. Point use-life: arrow pts unlikely to be reworked - better materials fragile, high speed impact destructive, too small anyway. Comps large (atlatl) pts to small (arrow) pts - lg pts have more use-wear and more reworking. Similar proportions 51%, 45% small, large recovered whole, or slightly damaged 17%, 18%. [contrasts w my Sinagua data].

Material source studies, obsidian sources - often smaller marekanite from S AZ.

Chap 4 Methods. Analysis by both attributes and point types. Classic points expected to be larger [STPC]; historic are smaller un-notched triangular types for O'Odham and narrower serrated concave based forms for Sobaipuri.

Point design theory - stone pts used mainly for big game or warfare; most arrows no stone point.. Penetration and wound size critical, but large pt hinders penetration, so compromise. Increased velocity improves performance - range and accuracy - ligher projectile better. Heavy point requires more stabilizing fletching. Thrown projectiles allow human compensation during throw, but arrow released, no adjustments possible, thus consistency more important, point size more constrained, reworking more likely causes problems. Ethnog arrows standardized. Expect through time gradual decreases in point weight, punctuated by major changes as propulsion changes (i.e. atlatl to bow). Self-bow to recurve also increases speed and thus decreases point size. So size reflects chronology, shape more likely functional and social effects.

Ethnog review suggests points for use against humans differ from hunting points.

For animals, lateral penetration is maximized; war points may be narrower to penetrate shielding, or wider for larger cutting wound. US military arrow wound data (Bill 1862) - ca 50% wounds in body or head, of which ca 50% fatal. Other 50% in neck or limbs, only 6% fatal. Ca 31% of all were fatal. Withdrawal damage, and points left in wounds.

Point design: expect hunt pts to have rounded tangs and notches, allowing withdrawal of arrow; war pts have pointed tangs, barbs or sharp corners, lack notches. Hunt pts more often broken, war pts more commonly whole.

Chap 5, Study area ethnog. B+A continued into 20C, stone + glass pts made into late 1800s O'Odham used club, hide shields, effective against arrows, and stone tips for war, but untipped arrow for small game hunt; in ethnog time very little big game hunting. Bourke (1891) notes Apache quivers contain many different shapes of point. Bill (1882) describes notchless glass points glued into foreshaft, break when strike bone. Apache use of glass points. In recent time frequent raids for plunder by Apache, revenge by O'Odham, who had to devise systems of signal and defense, practice. Hunter-gatherers Apache etc, maintained dispersed hidden population, including re-use of prehistoric sites, ephemeral dwellings, few ceramics - thus little trace; while sedentary agriculturalists concentrated for defense.

Point analyses. Distributions: Historic forms more on S of river, where settlements were, and access to game. Classic prehist more N side of river, espec mid-notch type [our high-notched]; while concave base serrated more on S, suggesting that these are actually historic. Historic types lighter than Classic [but narrow ranges overlap - almost all .5-1.0 grams. New recurved bow intro in Classic, recurved bow gains 20%+ in arrow speed over self-bow. Recurve intro maybe 1200-1450, sinew backing may be later or with, maybe assoc w Apache, unclear. O'Odham used unbacked recurve.

Historic Sacate site, 120 pts, almost all unnotched unserrated small triangles, including some made of glass. Two early historic Cienega Creek burials with over 150 Sobaipuri points in body cavities, ave .3 grams, over half broken.

War vs hunt point tests: unnotched pts more likely 97% to have sharp tangs [corners]; side-notched 42/58% sharp/rounded. SN pts more likely to have straight bases, UN more likely concave base (i.e. barbed). UN narrower (i.e. bodkins for piercing shields). Notched points more often broken (70%) than unnotched 34% as expect for retrieved hunting points. [But more likely just because they are more fragile, and larger than UN.] Chert most common material for all, but obsidian more for N pts, and basalt more common in UN pts (i.e. tougher material for war). [But more likely just because notching difficult in poor material.] Archaic pts mostly "hunting" design, Classic mixed, Historic almost all "war" design, corresponds to decrease in big-game hunting, rise of war. Serration rare in one area of survey, while common in others, from Archaic thru Historic, thus long term cultural style represented.

Loendorf, Chris, R. Scott Plumlee, and Shari Tiedens

2017 Projectile point design: flaked-stone projectile tip selection, function, and style. In *Projectile Point Analysis in the American Southwest*, edited by Todd W. Bostwick and Chris Loendorf, *Journal of Arizona Archaeology* 4(2):83-98.

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Functional features include serration and notching. Ethnohistorical info (Bill 1882) on wound location and effect. Experiments using fixed bow shooting arrows into foam: unnotched points detach sooner [marginally in my opinion] consistent with hunting expectations. Side-notched pts penetrate 6% deeper because lashing doesn't interfere. Both notched and un pts better than no stone point [differences actually small]. Serration doesn't reduce penetration much, so this attribute prob varied without functional selection.

Loendorf, Lawrence L.

2008 *Thunder and Herds: Rock Art of the High Plains*. Left Coast Press, Walnut Creek, CA.

A

Archaic mostly abstract motifs, pecked, a few quadrupeds. Possible Paleoindian under Archaic at Ancient Hogback site, CO. Incised abstract and linear elements underlying pecked Archaic abstracts. Includes a few possible dart depictions [likely]. Similarities to Gault Site abstract Clovis engravings.

Purgatoire Pecked-I Petroglyphs of Developmental Period (AD 100-1050, intro of bow with Scallorn pts, continued larger pts = atlatl, villages, pithouses, scattered evid of agric + pottery in some sites). Quadrupeds most frequent (deer, mt sheep, antelope, bison, elk) also anthropomorphs, abstracts, grid "nets". Some quadrups have protruding spear or arrow. [apparently no depictions of bow or atlatl]. Purgatoire Pecked-II Petros of Diversification Period (AD 1050-1450), much cultural continuity. More anthro petros, more active, quadrupeds with strike marks, or spears/arrows, rare depiction of figure with bow. Red-tail Site – anthro picto with spear/arrow/atlatl (Fig 4.3) [line with loop]. Others – some anthros hold looped end of line piercing animal, not how atlatl is used, prob not atlatl [also would be very late atlatl – more likely symbolic strike with arrow]. Ethnog examples of hunt magic by shooting petros with arrows.

P 148 "propensity of rock art researchers to identify any linear hand-held rock art implements as atlatls." Espec lines bisecting circles, but comp to Pecos, MN petros of atlatls [why not SW?] they are not convincing. More likely thrusting spears.

Lombard, Marlize

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2011 Quartz-tipped arrows older than 60 ka: further use-trace evidence from Sibudu, KwaZulu-Natal, South Africa. *Journal of Archaeological Science* 38:1918-1930.

Here and elsewhere evidence of hafting in form of mastic with ochre distrib on tools. Expers show microliths effective point components. Sibudu evidence wear and microresidue supports use of segments as hafted hunting gear, show diagnostic impact fractures, but "unable to distinguish between mechanically-projected and hand-delivered weaponry." Now add 16 quartz bits to previous 13. A couple hafted transversely and very small are best interpreted as arrow points. [Possible but not conclusive to me. Mostly <20 mm, very small pieces of ugly material, notoriously hard to interpret wear on quartz, but presents each piece with dozens of tiny notations of striations and residue, including blood, which others also find problematic. Some of the striations look more

like fracture features to me, and the organic residues are unrecognizable in the photos.]

Lombard, Marlize, and Justin Pargeter

2008 Hunting with Howiesons Poort Segments: Pilot Experimental Study and the Functional Interpretation of Archaeological Tools. *Journal of Archaeological Science* 35:2523-2531.

HP = Middle Stone Age, S Africa, ca 70-55,000 BP. Distinctive backed blade segments and blade tools. Use as barbs or tips on projectile weapons? Tested 4 configurations, look at fractures. Glued into slotted wood shafts [look real crude to me - dowels with saw cut ends, apparently taped to larger shaft]. Machine [not specified] launch, 10 per weapon, 27 weapons, 167 shots into impala carcass. 85% penetrated, 37% survived all 10 shots. Transverse hafted segments least effective. Bending fracture with step termination, or with spin-off flakes one or both faces, + burination considered diagnostic of impact. Also found notching [they seem unclear but photos show bending fract notches out of edges probably are impact]. Burination + bending fractures common in experiment + arch specimens. Location of residue traces suggests variability in hafting as in experiment. Tip cross-sectional area values (Shea 2006) in range of ethnog arrow points, some in range of darts or spears. So HP segments make effective weapon armatures and some were used that way.

Lombard, Marlize, and Laurel Phillipson

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2010 Indications of Bow and Stone-tipped Arrow Use 64,000 Years Ago in KwaZulu-Natal, South Africa. *Antiquity* 84(325):635-648.

Stone tipped hunting technology back 100k in S Africa, mostly small stone points, but hard to distinguish spear, dart, or arrow. Here uses geometric stone artifacts other than points, identifying direction of impact based on patterns of macro-fracture, micro-wear, and micro-residue. Suggest spring-snares as precursor - both use bent wood and strong cordage. Maybe bow drill, evidenced by drilled holes in hard material [not as good an argument, bow not necessary. Thankfully they do not suggest atlatl as spring. In fact, while they mention spearthrowers, they hardly discuss them, contrasting spear vs arrow. This makes the whole project problematic since atlatls are far more likely at this early date than bow and arrow unless they can demonstrate some ability to distinguish them. I guess their small microliths hafted as transverse points seem more likely on arrows than darts.] Another precursor technology is hafting, and fletching is possible evidence of arrow but not necessary as Ju/'hoansi show.

So suggested checklist for detecting bow use: long strong cords, formal knots, use of latent energy in flexed wood, fishing + fowling, snares, bow drills, formal hafting technology, broad + varied hunting, change in faunal assemblages, change in climate and vegetation -- none alone, but when assoc with morphological, use-trace, and contextual evidence.

Howiesons Poort (59-65,000 years ago), Sibudu Cave, 79 stone segments [microliths], dimensions fit arrowheads, but some larger could be on spears or darts. Of 318 from SC,
Klasies River etc, 21-24% have impact fractures. [Problems: these are microliths, presumably hafted as transverse arrowheads or side blades on organic points. They are little tiny pieces of quartz, crummy stone to see anything on, and I want to see more experiment before I accept all the little damage along fragile edges as "impact".] On 53 segments there are 971 occurrences of animal residue, mostly along edges. Little evidence in use-wear for cutting/scraping, and backed edges were hafted with compound adhesives. Some striations begin at impact scars on edges.

Further context: small fast game, fish, probable use of snares for small antelope, cordage for beads at least.

Lombard, Marlize and Isabelle Parsons

2011 What happened to the human mind after the Howiesons Poort? *Antiquity* 85(330):1433-1443.

If bow and arrow started 64,000, why lost later? Should not assume that technological evolution is "accretive and progressive." Populations adapt up and down the slopes of "rugged fitness landscapes" with more or less success, and to changing conditions, i.e. there are peaks and valleys of adaptation. Unstable demographic systems interupt build-up of knowledge; new behaviors may not be "fixed" (remembered and transmitted), or archaeologically visible unless successfully adopted by large population over long time. Technological simplification does not necessarily mean behavioral regression; post-HP populations retained other early modern traits, even though invented bow 64k and lost after 59k. Climate change concentrating people in refugias may have spurred development of technology and transmission, and amelioration may have spread and isolated the populations while allowing easier subsistence, or greater specialization on resources not needing bow and arrow. [Interesting theoretical discussion, but starts from poor premise: their evidence in earlier articles is NOT adequate to demonstrate bow and arrow presence.]

Lombard, Marlize, and Lyn Wadley

2016 Hunting technologies during the Howiesons Poort at Sibudu Cave: What they reveal about human cognition in KwaZulu-Natal, South Africa, between ~65 abd 62 ka. In *Multidisciplinary Approaches to the Study of Stone-Age Weaponry*, edited by Radu Iovita and Katsuhiro Sano, pp.273-286. Springer Science and Business Media, Dordrecht.

Longoria-Valverde, Arturo x

2012 Making Bone Arrow Points with Hand Tools. Texas Atlatl 3(2):9-15.

Triangular side-notched points from cow ribs with files etc; stronger than stone.

López Luján, Leonardo

2005 *The Offerings of the Templo Major of Tenochtitlan*, revised edition. University of New Mexico Press, Albuquerque.

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Central ceremonial district destroyed by Cortes, razed for construction of Metropolitan Cathedral. By 1700s, finding major statuary, and offerings reported through 19th C, also many unreported. Excavations to expose Templo 1979-82, 1980s. Dual shrines on top of TM to Huitzilopochtli and Tlaloc. Built in 1400s.

Analysis of 118 offerings, some from earlier finds, but most properly excavated undisturbed primary contexts reflecting "area of activity" i.e. repetitive rule-ordered religious ceremony, therefore we can interpret some of the rules. Numerical taxonomy analysis using artifact types as attributes to produce dendrogram interpreted as 13 "complexes" of associated artifacts, and 20 "complexes" or types of offering. [Unfortunately, this actually obscures patterns - it would have been better to work with object associations in the different levels of the offerings, and proximity of artifact types to one another.] For instance "representations of atlatls [none illustrated or described!] are clustered in Artifact Complex M with skull mask, beheaded skulls, personified sacrificial knife, tortoise, saw fish, sea urchin, sand, serpent, alligator, shark, rattlesnake, eagle, serpent form scepter, chicahuatzli scepter, bone bloodletter, brazier, hatchet and mace, epcololli, obsidian serpent head, turquoise mosaic, obsidian earplug, projectile point. [In other words, too many things to be usefully interpreted as a group - some refer to sacrifice, some to war, some to water/sea, some to fire, etc with many overlapping meanings. His "complexes" are not interpretively useful.]

Identifies statues with 2 knobs on head as Xiutecuhtli/Huehueteotl, the Old God of Fire, central to universe, associated with braziers and cardinal direction fires, shown in one codex at center of world armed with atlatl + darts. Of 118 offerings, 26 include these statues, may relate to annual New Fire ceremony, in 22/26 also a Tlaloc sculpture - so reflecting duality: X/H = male, hot, celestial paired with T = wet, dark, terrestrial, and female [? but Tlaloc isn't shown as female].

P 177, 178 drawings of atlatl wielding dieties [unidentified] on ceramic cinerary urns from offerings 10 and 14. [But he doesn't ID the gods, nor give proper descriptions of the Complex E offerings (those with cremated remains in a container]. They may "indicate death of an officer in battle" p. 83.

[Although there are supposedly atlatl representations (not described, but I think a miniature atlatl form scepter or the miniatures published in Saville 1928), and many things symbolically related, like serpents, there are NO recognizable atlatls in the offerings at the Templo Mayor, despite the frequent depiction of Aztec gods with atlatls as important part of their power + gear, especially Huitzilopochtli, to whom the temple is dedicated along with Tlaloc. A few dart points recognizable in crappy drawings figs 96, 109, apparently side-notched.]

[Much of the analysis is useless. I wish this had been a photographic catalog of the offering contents - they are not even enumerated or described in detail, and the drawings of the offering contexts are pitiful, too small, without enough detail. See McEwan + LLL 2009 for some pics, including the urn above, and Brumfiel + Feinman 2008]

Lorentzen, Leon H.

1993 From Atlatl to Bow: The Impact of Improved Weapons on Wildlife in the

Grasshopper Region. MA Thesis, University of Arizona, Tucson.

Small pueblos in central AZ, built 1260-1270s, abandoned and burned 1290s. Grasshopper Springs site dominated by larger corner notched points, neighboring Chodistaas site has more smaller triangular notched + unnotched points. Size differences, especially stem thickness and width, compared to surviving + ethnographic hafted points, suggest corner notched = dart, triangular = arrow. Shaft straighteners (work for reed arrows) 4 on floor at Chodistaas, 2 in fill (later reuse) at Grasshopper Springs. So transition to bow and arrow was late 1200s in this region.

After 1300 bow and arrow was improved by matching arrow sets - find perforated antler = arrow gauges [but why then is there so much diversity in size and form of points at Grasshopper 1300-1400?]. Population increase and better hunting technology resulted in destruction of game - some evidence in faunal remains and human skeleton isotope studies.

[Good try but late retention of atlatls is just not convincing: he shows definite differences in point assemblages, but points are still not direct atlatl evidence, larger points may be arrows too, why would some sites in central AZ still use atlatl long after all others there and in rest of SW had changed, why are there no late cave finds of atlatls or artistic depictions anywhere in SW? See Whittaker 2012]

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Lothrop, Samuel K., and Joy Mahler

1957 Late Nazca Burials in Chavina, Peru. *Papers of the Peabody Museum of Archaeology and Ethnology, Harvard University* 50(2). Peabody Museum, Cambridge.

Group of small adobe burial chambers, an important individual and retainers, so one point in time. Some mixing of contexts by amateur excav and subsequent packing, but all belong together. Body and head of a mouse interred in separate cists. Pottery dates to end of Classical Nazca, period B, no evidence of Tiahuanaco influence. Copper pegs on spearthrowers cast, not hammered, thus earliest known casting on coast of Peru.

Uhle's (1909) 18 published spearthrowers also came from this site area. Excav 1943 by the Mrss. E. B. Lothrop and A. McK. Thompson "in course of a few hours" [ref'd in Lothrop letters in Peabody. I recorded these atlatls Oct 2015]. Took notes and photos [few given, none of atlatls in situ]. Less than 1 m deep. Seven small cists, each ca 1x1 m, roofed w reeds, partly looted. Bodies flexed on R side, head to E, face to N. Cist 2 was looted but skull with elab hair indicated primary individual. Cist 3 had child in urn and decapitated body"presumably male" with gourd for head, accomp by 2 spear throwers, pots, cloth, spinning equipment. Cist 4 had 2 children,"presumably male, as spear throwers [3] were buried with them." Also jewelry, pots, cloth, frag of sling.

Pp 40-41 Throwing-Sticks: "well-known device, like a tennis racket, for increasing the leverage of the arm..." Museum has 5 excav plus 2 purchased, "presumably from the same site" [ambig - same site as Lothrop's 5, or just 2 together? – but Plate XXa shows 1692, the one on display 2015, which was one of the purchased ones.] Most have original lashings coated with tar. 3 parts: shaft, peg, and hand grip. Shaft usually of *chonta* palm, almost black, but other woods used, sometimes stained [I don't think these are palm

wood at all]. Uhle 1909 pub'd a bone one, probably whale, and other in Heye Mus Am Ind. [curiously he doesn't mention the purchased one in Peabody]. Pegs of copper with Tshaped base set in slot in shaft. Diff peg forms: simple bone point, ovoid bone [prob shell], solid copper animal [he shows 6828], solid cast copper bird form [he shows 6857]. Handgrips of bone or whale-tooth ivory, elongated head, inlaid with shell. One blocked out but features not inserted [he shows 6855; I think it was in fact finished, without inlays]. A second group just has a button [he shows 6858]. Another just rounded curved neck of wood. And some are eccentric [he shows the one on display 1692 which supposedly has feline + human head, but not clear in photo or display]. On central and N coast of Peru, hand grip usually omitted, may be hole for forefinger in shaft. In N Chile, some have loop on one side rather than hole.

Variable in size and balance. No added stone weights known. Paracas forms similar but shorter, earlier. Peg and hand grip not in same axis as stated by Uhle, but close to 90 degrees as in plate 19a [6827], for a right-handed individ. "One of the Chavina examples was made for a left-handed individ." [he doesn't say which]. No darts. Some from other sites, show fletching. Plate XIX also shows a pot with Nazca figure holding atlatl and darts, [not from this site].

P 47: Photomicrographs by Wm Flanagan of MIT show pegs were "cast with no subsequent treatment," sim info from Root in Apendix p 51 [means they cut one hook, not clear which, note in files refers to 6858, which was restored, but could be the missing tail on 6828. [Uncalibrated] C14 date of 1320 ± 60 AD 576-696 from Yale Geochron Lab on textiles.

Lotz, Mickey

2008 Arrows of the World. In *The Traditional Bowyer's Bible, Volume Four*. Pp. 213-254. The Lyons Press, Guilford, CN.

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Lots of arrow photos, including hafted stone pts from N. Am. With atlatl, longer distance possible, need fletching for stabilization. "Even earliest primitive arrows show evidence of spiral fletching." [but actually, of the many he shows from N. Am. and rest of world, very few have spiral.]

Loud, Llewellyn, and Mark R. Harrington

1929 *Lovelock Cave*. University of California, Berkeley. (republished 1991, Falcon Hill Press, Sparks, NV).

Pp. 99-100 spear thrower, notches for grip, no loops, groove but hook missing, 45 cm long, illustration of model of original which is lost. [See also Mildner 1974 - a very odd form with grip like Arctic but notched like BM, flat shaft like Oregon type, distal missing]. Also found were cane shaft fragments, and foreshafts, some bunts, some with stone points.

Love, Chad

2010 Take a Deer Aztec-Style. Field and Stream Blogs. Electronic document, URL: http://www.fieldandstream.com/blogs/hunting/2010/09/take-deer-aztec-style accessed h

quotes story in Columbia Missourian about J Garnett, legalization of deer hunt in MO. Nice photo of Garnett

Lowe, Pat

2002 Hunters and Trackers of the Australian Desert. Rosenberg Publishing, Singapore.

Personal accounts of tracking-related natural history, nice photos. Lowe married Jimmy Pike and learned from him and relatives in Walmajarri people. Female perspective, lots mention women hunting, including with spears and other weapons. Central desert depopulated since 1960s, nobody living old life now, but many hunt and visit and know old ways. Hunter's tools: digging stick, *coolamon* wood dish, *kana* probe or spear (*kularta*), spear thrower (*ngalpiliny*), hunting sticks. Male carried 1 or more spear, woomera, pair hunting sticks (throwing clubs, not boomerangs). Different spears - some of wood, some of bamboo. Hunting spear just sharp point, if weapon, add quartz point, barbed spears used in public punishment, spearing legs. Spear-thrower used with running start, "artificially lengthens arm and gives greater thrust." Only men used in Walmajarri, but women said to have used in past elsewhere. [Jimmy shown in two pics with atlatl. On cover using flat northern type with bamboo spear with "shovel" metal point. P 19 with long bamboo spear, very long northern type thrower. Not the desert "woomera" types.]

Casual and intentional use of fire, creates burnt off mosaic of niches, removes spiny spinifex grass, promotes plant growth and game.

Lowell, Julia C.

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2010 Survival Strategies of Gender-Imbalanced Migrant Households in the Grasshopper Region of Arizona. In *Engendering Households in the Prehistoric Southwest*. Barbara Roth ed., pp. 185-207. University of Arizona Press, Tucson.

Argues that large late pueblo of GH (central AZ, Mogollon/W Pueblo roots) incorporated migrants displaced by warfare in Anasazi areas to N: war kills more men than women + children, thus refugee populations imbalanced, evidence of conflict in late 1200s in Anasazi region leading to abandonment around 1300 as Grasshopper founded, more violent death there among men, GH burial pop has high numbers of females and subadults, low males, regional changes in pottery suggest immigration of women, not men.

At Chodistaas and Grasshopper Spring, small pueblo predecessors to GH, built 1270-1280s, Mogollon architecture in both, but at C, Anasazi pottery types, some imported, most made on local clay = influx of women. New triangular points may indicate some men, but more indicative of shift from atlatl to bow for warfare. Men would have introduced Anasazi kiva tradition. [she misuses Lorentzen, saying triangles are late at C. Actually, they dominate there, I see no good evidence of a change, and shaft straighteners that he considers also evidence of arrow use are on floor, not evidence of late intro. Bow was well established long before the period she discusses, and the large numbers of points at all sites does not suggest imbalance of women.]

Lowry, George o 2013 Renowned Burial Site Preserved. *American Archaeology*17(4):46-47.

Archaeological Conservancy in process of obtaining Windover Site, 8000 bp Archaic burial pond, skeletons with some soft preservation including brains, food remains in stomachs. Only 5 lithic artifacts, 100s bone, antler, organic, [including atlatl parts], and 'oldest fabric in the world.' Only half excavated, now 8.5 acres in a subdivision. [See Penders; Dickel, Doran, all 2002]

[How much has been thrown away under NAGPRA? No genetically related tribes, perhaps no political problems; at least analysis was allowed and 2002 Brevard Museum exhibit included skeleton <u>http://www.nbbd.com/godo/BrevardMuseum/WindoverPeople/</u>]

Lubbock, Sir John

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1890 Pre-Historic Times: As Illustrated by Ancient Remains and the Manners and Customs of Modern Savages, Fifth Edition. Reprinted 1971, Books For Libraries Press, Freeport.

"Although traditions and myths are of great importance and indirectly throw much light on the condition of man in ancient times, we must not expect to learn much directly from them. ... As regards the Stone Age in Europe, both history and tradition are silent, and here, as in all long civilized countries, stone weapons and arrow-heads are regarded as thunderbolts or "Elfin" arrows." p. 429 [He quotes some awful racist and often inaccurate comments by others on "savages" throughout.]

pp 443-444: "Throughout the continent [Australia] they were ignorant of slings and bows and arrows... The spear is their national weapon. These are about 10 ft long, and very slender, made of cane or wood, tapering to a point, which is barbed. They are light, and one would scarcely believe that they could be darted with any force; this however is effected by the aid of the wummera, a straight flat stick, 3 ft in length, terminating in a socket of hide into which the end of the spear is fixed. [Odd, and his figure of a 'spear-caster' does show socket but form of thrower is not really clear, perhaps a bad depiction of central desert form, which is definitely not socketed.] The wummera is gasped in the right hand by three fingers, the spear lying between the forefinger and the thumb. Previous to throwing it, a tremulous or vibratory motion is given to it which is supposed to add to the accuracy of the aim: in projecting the spear, the wummera is retained in the hand and ... adds greatly to the force given to the spear. They are well practiced in the use of these weapons. Capt Grey tells us that he has often seen them kill a pigeon with a spear at a distance of 30 yds, and Capt Cook says that "at a distance of 50 yds these Indians were more sure of their mark than we could be with a single bullet." Used by almost all Australian tribes except at King George's Sound.

Eskimo throwing sticks also mentioned, no details.

Luebbers, R. A.

1975 Ancient Boomerangs Discovered in South Australia. Nature 253: 39.

Wyrie Swamp peats date $10,200 \pm 150 - 8,990 \pm 120$ B.P. "Core-tool and scraper tradition" like Lake Mungo, wooden gear includes 3 complete boomerangs [but the dolt illustrated the fourth fragment instead], digging sticks, short simple spear, barbed javelin fragment.

Lukes, Anita

2018 In memory of Troy Helmick. The Atlatl 31(2):3.

1933-2018. Charter member of WAA in Montana, civil engineer, avocational archaeologist, knapper.

Lutz, David L. o 2000 The Archaic Bannerstone: Its Chronological History and Purpose from 6000 B.C. to 1000 B.C. David L. Lutz, Newburg, Indiana, privately published.

A massive and finely illustrated attempt to analyze chronological change in bannerstone styles. Examines associations of different bannerstone forms with projectile point types, C14 dates from excavations, and other chronological evidence, using museum collections, published excavation data, and non-archaeological collections. Reviews theories of function and history of study. Bannerstones are originally atlatl weights, but the ritual or social use is emphasized. [Usual weak arguments against atlatl function. I don't understand why people want to think that fancy stone objects actually used as atlatl weights could not also have ritual or social importance.] Recognizes a "3-Bannerstone Cache" trait in Middle and Late Archaic. Such finds often have stones of different form together, and different contemporary forms represent clan or tribal symbols. [Not a bad idea, although a bit simplistic. See Sassaman 1998.] Suggests antler atlatl hook chronology: short Eva type 4500 BC, longer Black Earth type with shaped hook end 3800 B.C., long simpler tine hook Indian Knoll type 3000 B.C., Terminal Archaic type with slotted attachment to atlatl 2200-1200 B.C. The bannerstone chronology is too complex to summarize here. [Useful study, and just what needed to be done, but some problems. Introductory sections are badly organized. Hard to extract the important chronology or check the reasoning. He should have given the gist in a chart or table. Non-professional collections are dangerous - fake artifacts and failures of documentation and finders' memories. Some of the associations claimed are probably not good, as when he argues that bannerstones found together on a site surface are contemporary, but points from same site are older "found" points. Although the photos are excellent, only outline size is measured, not hole diameter or weight.]

Lyman, R. Lee, Todd L. VanPool, and Michael J. O'Brien x 2008 Variation in North American Dart Points and Arrow Points when One or Both are Present. Journal of Archaeological Science 35:2805-2812.

There should be an increase in variability with introduction of new technology as makers experiment to find best combination of attributes, followed by decrease as less functional variations are discarded. Test when arrows are replacing darts, in stratig sequences in Verkamp Shelter, MO, Mummy Cave, WY, and Gatecliff Shelter, NV. Appears to work: "Diversity in dart-point classes should increase as artisans experiment with modifying dart points into effective arrow pts. Thus diversity in projectile points in general (arrow + dart) should be high ... when bow and arrow first appear but then decrease as some classes of dart points and less-efficient arrow points cease to be manufactured." [Plausible, but there are many problems in testing this interesting idea: 1) depends on assumption that can tell dart from arrow point, which is by Thomas weight + neck width in some cases, by typology in other -- neither of these is good enough. 2) assumes that variation is functional, ignoring style. If all variation is functional, one should not expect standardization anyway, since artifacts are seen as responding to changing adaptive needs. 3) The trends visible in the variability measures are very slight. 4) Both positive and negative trends are explained by "experimentation" plus "archaeological misclassification" allowing any trend to fit the model.]

Lyons, Richard B.

1999 The Spine Tester. The Atlatl 12(1):7-8.

Method of measuring spine, data from a number of atlatlists.

Lyons, Richard B.

2002 Atlatl Weights. The Atlatl 15(4):1-3.

Lutz book reorders bannerstone sequence. Webb had hook type going from long to short, so weight could be closer to end of atlatl. His final form bannerstones with hook are mistakes based on damaged specimens, but an atlatl with the weight out past the hook actually works well [but this decreases its efficiency].

Lyons, Richard B. 2003 Atlatl Weights. *The Dart* December 2003: 17-20.

Lyons, Richard B.

2004 Atlatl to Bow. *The Atlatl* 17 (2): 12.

Similar principle of flexing energy storage, bow has two limbs, atlatl one. No known archaeological intermediates, but Katharine Dopp, 1912, U Chicago fictionalized primitive Denmark in The Early Sea People with illustration of combined atlatl/bow. [Bow and atlatl are *not* similar principles, and Dopp's figure derives from Cushing and is quite implausible, although Lyons has made one. I tried it - it did work, but not great, no springing action advantage at all.]

Lyons, Richard B.

2010 A Reproduction Moche Atlatl. The Atlatl 23(3):1-2.

Nice simulacrum of specimen from royal tombs at Sipan. Color picture.

Lyons, Richard B. 0 2011 Dart Flex: Conversion of Stored Energy to Enhancement of Forward Propulsion. *The Atlatl* 24(2): 12-13.

Flex and oscilliaton makes feathers act like fishes tail to aid propulsion. Flex springs dart off hook before complete arc of throw. Thus flex adds to energy mostly from lever action. [Unlikely. See Henry 2011.]

Madden, James W.

1991 The Art of Throwing Weapons. Paladin Press, Boulder.

Simplistic basics for knives, tomahawks, spears, etc, and atlatl. None with enough detail to be useful. [Has he ever really mastered atlatl? - uses bad motion, poor atlatl, and apparently rigid heavy spear. Not useful.]

Madden, Rav

0 2007 Hunting Small Game in Missouri. The Atlatl 20(3):9-10.

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Ray's squirrel is first small game kill under new MO law legalizing atlatl.

Madden, Ray

2014 Ray's Lumber Yard Basket Maker Darts. The Atlatl 27(1): 2-3. Or electronic document http://basketmakeratlatl.com/wp-content/uploads/2014/02/Figure-1.jpg

Instructions for simple dowel darts.

Madsen, David B.

1992 An Atlatl From Snow Canyon State Park. Utah Archaeology 5(1):133-136.

In lava tube cave, probably associated with adult male skeleton, estimated date 1500-2500 BP.

Simple flat stick atlatl, 59 cm long, narrowed grip but no loops or weights, integral hook at end of groove - like Basketmaker but no evidence of loops or weights.

Madziga, A. G. хр 2003 Arrow Injuries in North East Nigeria. West African Journal of Medicine 22:106-109.

1989-99, .1% of ER at U of Maiduguir Teaching Hosp annually, N = 73. All males, 8 juvenile, rest adult, peak age 31-40. Farmers, cattle herdsmen, traders. Reasons: armed robbery 41%, communal clashes 20.5%, disputes btwn farmers vs herders 13%, cattle theft 8%. Arrows are barbed metal heads on wooden shafts, formerly poisoned for game, barb keeps in wound while poison works.[no good info on bow or arrow].

Head + neck 26%, chest 40%, abdomen 11%, arm 14%, leg 7%. No patients showed symptoms of poison. 7 developed infections. 3 patients died (4.1%). Transport in open pickup common, explains lack of leg wounds. Arrow should not be dislodged without surgical exploration - barbs cause further damage, hematoma forms at tip + muscles contract around arrow, reducing active bleeding while arrow in wound.

Magers, Pamela C.

1986 Miscellaneous Wooden and Vegetal Artifacts. In *Archaeological Investigations at Antelope House*, edited by Don P. Morris, pp.277-305. National Park Service, Washington D.C.

Large cliff dwelling, Canyon del Muerto.

many small offerings; pahos, corn ears, etc. Fragments of 15 bows, 1 nearly complete miniature 35.5 cm long. Uniform W .9-1.7 cm, T .5-1.3 cm [in other words, all these bows must be miniatures although she doesn't say so. Some other sources cite them as if they were functional, but I doubt it. None illustrated.] Materials oak, willow, poplar, mt mahog. Arrows all broken; 232 frags of compound arrows, 116 separate Phragmites mainshafts, 77 separate points [she means foreshafts, self-pointed]. Many damaged. Mastic on some tangs, various hardwoods used for foreshafts. None with stone pts. Shafts 3-fletched, nocks plugged, some painted bands red, black, green, magenta, white. Two yucca nets [fragments] 55x37 cm, 29x15 cm.

Malotki, Ekkehart

2001 The serpent: A shamanistic motif in the Archaic/Basketmaker rock art imagery of the Palavayu Anthropomorphic Style (PASTYLE), Arizona. *American Indian Rock Art* 27:237-252.

Palavayu = middle Little Colorado R drainage, E of Flagstaff, Winslow/Holbrook + Petrified Forest area, Winslow Anasazi.

Sinuosity of snake mentally connects with water. [He has a whole series of irritating chronological coinages]. PAS distinguished by anthropomorphs with interior linear body decoration, also zoomorphs, plants, curvilinear + rectilinear figures, some objects like atlatls, darts, lots of 'entopic' motifs. Forager cultures usually shamanic, concerned with healing, fertility, hunt, so assume same here. Entopics show drug use, probably datura. PAS differs from neighbors and later rock art, similar to distant Glen Canyon Linear style. Snakes more common later, unless include all wavy lines. Some headless, some with heads, some with interior body decoration, 'whiskerlike' or horn appendages, attached or incorporated with zoo/anthros. Sinuosities incorporated into 'rakes' which usually interpreted as rain. Underworld + rain connections of snakes, so snake is familiar

for shaman concerned with rain, or rain gods. Petros often in riverine environments, garter snakes common there. Hopi snake/rain connection. Too rare and no rattles so not totemic. [No suggestion of snake-projectile connection, although mentions heads like points].

Malotki, Ekkehart

2007 The Rock Art of Arizona: Art for Life's Sake. Kiva Publishing, Walnut CA.

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Another book of fine photos, more analytical than Malotki and Weaver. Good intros to basic rock art theory, useful discussions of chronology and style regions in AZ. Only a few atlatl-related images: p 31 "long vertical line bisected by a small ellipse or circle generally portrays an atlatl or spear-thrower, a diagnostic motif for Archaic imagery." [actually more common in later Basketmaker II "San Juan Anthropomorphic Style" rock art]. SJAS often large broad-shouldered anthropomorphs, often decorated, drooping hands + feet. Chinle Representational Style (BMIII) continuities but less spectacular anthros, diagnostic motifs = bighorn sheep, small anthros, fluteplayers, hunting scenes + "narrative content". Further W in N AZ "Snake Gulch Style" is also BM with painted + pecked anthros with broad shoulders + decoration, ungulates, turkeys, and atlatls. Dates on paint 400 BC - 400 AD.

Malotki, Ekkehart

х 2017 The good, the bad, and the ugly: Claims for proboscidian depictions in North American parietal and mobiliary art. Ms posted on Academia.edu, March 2017.

[Long and generally good review of many claims. EM is too eager to accept some, but

rightly dismisses a bunch of fakes and misinterpretations.]

Most paleoindian art is non-representational. Reasons suggested for so few depictions include Martin's overkill (megafauna killed too fast [but why no portrayals of any species]), but that requires "Clovis-first" and we now have good pre-Clovis; Haynes suggests low population density. Many mammoth images in Old World (>500).

Mobiliary art: Holly Oak fraud, Lenape Stone and derived Hammond Tablet frauds, Davenport pipe frauds, Flora Vista NM text slabs frauds, Montezuma Valley Anasazi jar (prob repainted), Jacob's Cavern MO humerus engravings (lost but probably fraud), Rocky Mountains CO stone pendant (possible) [No, almost certainly recent fraud on old pendant]. Vero Beach incised fossil bone - probable, passes scientific tests [doubt it, considering the context of dubious find by amateur with commercial interest in selling it! And its uniqueness, and similarity to European cave art.]

Parietal art: Birch Creek UT wooly rhino picto (fraud, wooly rhino not in North Am, mix of cave art imitations with Native Am motifs). Mojave CA, recent petro fake. Yellow Rock Canyon, NV, fake, metal tools [Clewlow, who should know better, apparently accepts. Malotki tried pecking nearby rock and found it too hard, although you should NEVER experiment in situ.] Van PA, and Dinetah NM both probably recent elephant depictions, not fake mammoths. Barnesville OH, 2 mastodon petroglyphs on large panel with other ancient pecked motifs, probable, not like recent graffiti,

morphology is clearly mastodon, not mammoth [or recent elephants, and/or bad artists]. Bednarik used his crystal microerosion technique and concluded they are not old, but this technique is unproven [true]. Pairing is considered by Clottes "unambiguous proof that they are not modern fakes." [Utter rubbish! He likes it because the Bluff images are also paired. But Barnesville images have been enhanced with paint, and 'documentation' is from the Midwestern Epigraphic Society, who are cuckoo followers of Barry Fell and think they are pre-Colombian European elephant engravings. These are almost certainly fakes]. Havasu Canyon AZ, wishful thinking, misinterpreted sheep petroglyph [or worse this is the 'Doheny Expedition' garbage with dinosaurs, creationism, petrified women, and other hallucinations or lies.] Moab, UT 'mastodon' petroglyph, vandalized, shows toes, more likely bear image [I agree]. A bear image 4 miles away is so similar could be same artist [He says that for a couple of things - no evidence, stylistic similarity is not that good for any of these low-detail images.] Argus Mt Range, CA, misinterpreted petros + grinding areas, not mammoth depictions. Lake Michigan boulder, probably natural cracks. Willow Gulch UT, Manila UT, Shay Canyon UT, Paradise Flats UT, Quitchupah UT, Lower Butler Panel UT - all misinterpreted sheep or bear images, none look like mammoths. NW of St George UT, same, petro clearly shows stylized sheep with horns, not mammoth tusk + trunk, being darted by atlatlist. [common confusion in his discussion about what is atlatl and what is dart, also cites Hutchings 2015 as evidence for Clovis atlatls, and VanPool 2006 as evidence of late atlatls, both poor information, and not relevant here.] Suggestion that could be oral transmission of memory of mammoths for thousands of years in some of these is implausible - medieval images show how quickly elephant was distorted by people depicting animal they had never seen [absolutely right]. Deluge Shelter UT, Fremont pictograph head gear misinterpreted as animal.

Conclusion: 5 acceptable – the 2 Bluff petroglyphs (Malotki + Wallace 2011), Vero Beach, the 2 Barnesville petroglyphs, and "still undecided" about the Rocky Mts pendant. [I would say ZERO demonstrated, with the 2 Bluff petros possible but unlikely, the others are rubbish.]

Why the imbalance with Old World's many depictions? Preservation – there in caves, here more in open. Or some taboo here on imagery - no evidence. [Maybe the different population sizes and time scales have a lot to do with it. Or if pre-Clovis, the entering population lacked the 'art' tradition. And the lack of good cases makes all the possibles at best anomalous and more likely no good at all. The only really good Clovis 'art' is the engraved pebbles at Gault – purely geometric designs.]

Malotki, Ekkehart, and Henry D. Wallace

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2011 Columbian mammoth petroglyphs from the San Juan River near Bluff, Utah, United States. *Rock Art Research* 28(2):143-152.

Other claims for Pleistocene mammal depictions – mostly mistaken or fraudulent, but now have Vero Beach mammoth portrayal [I doubt it!]. Upper Sand Island rock art site, ca 1 km upstream from Sand Island Site [which has many Basketmaker and Archaic images including atlatls]. Mammoth is ovoid body with vertical line divisions (like Archaic Great Basin Linear style animals), eyeless head with pecked top cap, diagnostic of mammoth not mastodon, short tusks, possibly young or female, and very long trunk ending in 'fingers,' proboscidian detail not likely to be known to later Indians. More weathered than nearby Ute horse images, so not recent fraud. Mammoth is both pecked and ground, and uses natural crack as part of face. Partly overlain by 'bison' which is less weathered but may be Pleist too. Several other obscure images of apparently same age along panel, plus later stuff, plus one other clear mammoth, rather similar to first. Very high on cliff, access on river gravels now eroded away.

Consider genuine and Clovis-age because: shows diagnostic mammoth features, more weathered than nearby historic and Puebloan petroglyphs, part of panel with other stuff, not similar to other known styles, *two* mammoths similar. [I find this plausible but unproven. As they say, not precisely datable by independent means. And there are many ambiguous images in the area's rock art – is he imposing what he wants to see? See Malotki 2017 above]

Malotki, Ekkehart, and Donald E. Weaver

2002 Stone Chisel and Yucca Brush: Colorado Plateau Rock Art. Kiva Publishing Inc, Walnut, CA.

Coffee-table book. [Splendid photos by EM, commentary by DW, no particular organization other than broad chronology, no depth of analysis of motifs or location, no maps or details of location. There are also unidentified sketchs on the side of some pages, often as interesting as the photos. And petroglyphs were made by direct pecking, NOT done with chisels, see Whittaker et al. 2000.] Many famous sites, including some atlatl depictions. Owl Spring: animal and human with dart in them. Butler Wash: dart or atlatl combined with yucca flower. "Atlatl Falls" + "Pinyon Perch": impaled animals including carnivores, anthros striking. "Lefthand": dart striking human. "Procession Panel": darts and impaled animals. "Duel Ground", Apache Co, AZ: 2 humans using atlatls against each other, holding spare darts in other hand. "Spear Rite", Coconino Co, AZ: ogre with giant dart, impaled by others.

Manley, Dave, Benjamin A. Bellorado, and William D. Lipe o

2016 Ancient Galleries of Cedar Mesa. Canyonlands Natural History Association, Moab.

Pretty picture book. Photos by AM, intro by BB, chronology by WL. Very nice photos include some famous panels and a few atlatl or dart or darted animal depictions. Sites not named, no locational info or analysis.

Manney, Tim

2006 The Effects of Cooking Time on the Strength of Pitch Glue made from Norway Spruce (Picea abies) Oleoresin. *Bulletin of Primitive Technology* 32:51-55.

Fresh "oleoresin" is composed of volatile terpenes which plasicize nonvolatile diterpenes, cooking drives off former. Tested resin "loaded" with ground charcoal. Glue cooked only 15 min stronger than glue cooked much longer. Simple test relates roughly to hafting

usefulness.

Manning, Steven James

x,p

1992 The lobed-circle image in the Basketmaker petroglyphs of southeastern Utah. *Utah Archaeology* 5:1-37.

67 examples, all petroglyphs. Distribution map [closely overlaps area of atlatl images in SE UT]. 'Mode'= culturally meaningful consistent image. Considers lobed circle related by associations to fertility, probably represents uterus. Occurs as paired images, some as heads of anthropomorphs, occasionally carried, a couple fetishes known, on anthro chests where possibly = female breasts. Pairing as concept, relation to Twin mythology. Associations on panels include flute player, erect phallus anthros, yucca plant – all fertility images. Atlatl associations too [he mis-identifies darts as atlatls]. Bird-head figures characteristic of BM III [probably not, given common assoc with atlatl images]. Possibly related to kivas, Procession Panel circle may be early great kiva, kiva is sipapu, place of emergence, circle with entry sim to lobed circle, uterus is also a place of entry. Possible that Broken Flute Cave circle is like that in P Panel.

Mark, Robert and Evelyn Billo o

2009 Pictographs at Hunters Shelter: Possible Extension of the Red Linear Style into the Guadalupe Mountains of Southern New Mexico. *Plains Anthropologist* 54(211):201-210.

Red Linear Style is Lower Pecos region 400km to SE, shows similarities. Probably Late Archaic, no bows. Hunting scenes with rabbits, nets, dogs, and butchering scene with hunters holding legs of prey, atlatls with darts and other tools laid around. Atlatls sketchy but look to have hook and crossbar grip on one, possible loop or weight on other.

Markley, Max C.

1942 Bow, Spear, and Atlatl: A Discussion of Progressive Relationships in these Weapons. *The Minnesota Archaeologist* 8 (1): 23-26.

Bow came with Athapascans, spread S, SW BM3 500-900 AD. Athapascans defeated Nahua in SW, who moved to Mexico, conquered Toltecs, who traded it to Maya, who took it to Inca. Folsom etc used spears, atlatl came later. [Almost all these ideas are now outmoded]. Atlatl has a hook or loop of thong to hold spear, acts as double length arm. Stone weights probably just ornamental.

Márquez, Belen, and Juan Francisco Muñoz

2008 Barbed and tanged arrowhead of extra-Cantabrian Solutrean: Experimental program. In *'Prehistoric Technology': 40 Years Later: Functional Studies and the Russian Legacy*. Laura Longo and Natalia Skakun, eds. pp. 379-382. BAR International Series 1783. Found as electronic document, URL:

http://independent.academia.edu/BelenMarquez/Papers/543326/Barbed_and_tanged_arrowhead_of_extra-Cantabrian_Solutrean_experimental_programme_accessed August 2012.

X

x,p

Small Upper Paleolithic points morphologically and metrically suitable for arrow points, so tested resin casts of such [couldn't find a competent knapper?] but weighted same as original stone specimens. 47 arrows 21-92 gr, shot from fixed bows, 40 lb elm Holmgard replica, 40 lb modern laminated, 50 lb mod laminated. Bow made most difference, more powerful bows, heavier arrows had higher kinetic energy at distance. [Orig measured velocity, but all confusingly transformed to KE, data presentation very unclear, not useful]. Points were satisfactory from ballistic point of view, thus origin of bow may be earlier than thought.

Marriner, Harry A.

2000 Estolicas of the Columbian Muiscas. The Atlatl 13(2):1-2.

Brief historical account, legends, encountered by Spanish. Hook at each end [not explained], stone hooks, and miniature gold offerings (illustrated) known.

Marriner, Harry A. o, x

2001 Dart-thrower Use in Colombia and its Representation in Colombian Rock Art. *The Atlatl* 14(2):1-5. Also on Rupestre/web URL <u>http://rupestreweb.tripod.com/marriner.html</u> accessed 1/28/06

Muisca culture (700-1600 AD) both atlatl (Sp."estolica," Muisca "Queskes") and bow and arrow represented on gold tunjo figures, as gold miniature offerings, and buried with mummies. Straight rod "Andean type" atlatl with hook and hook-like handle carved of stone or shell, 42-60 cm long, used with spear with barbed wooden points. Other estolica styles discussed, info on other parts S. Am. In rock art in Chiribiquete National Park. [Most photos are badly computer reproduced and useless in Atlatl, but ok on web].

Marshak, Alexander

1972 The Roots of Civilization: The Cognitive Beginnings of Man's First Art, Symbol, and Notation. McGraw-Hill Book Company, New York.

[Attempts to interpret Upper Paleolithic cave art in terms of calendars and counting. The basic idea that early humans were interested in symbols and in "time-factored" thinking is good, but the specific interpretations of artifacts are often unconvincing.] P. 279 Lascaux image of wounded bison, falling man, bird on stick and short hooked object: Dismisses Laming-Emperaire's (1959) interp as spear thrower: "The hooked stick does not look like the spear throwers of the Up Pal that have actually been excavated. These have a small notch to catch hold of the spear at one end, but contain no encumbrances along the face that would hold the spear, even at the other end, for this would make its use difficult or impossible." [Hard to know what he means, and in fact the specimens we have are only hooks, lacking the grip end, which could very well have had pegs or a cross bar.] Leroi-Gourhan's sexual symbolism also unconvincing [but in the end M has no idea, dismisses image as "perhaps the stick was a plant image" ie notation for time,

Feathered or barbed images could = male symbols (Leroi-Gourhan) or sympathetic magic killing animals. More likely some are plants, some weapons, but reflect "time-factored" and "storied" nature of the art, not simple magic.

[I find it curious that with many images of probable darts, there are few of spear throwers, and none of them in use.]

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Marshall, John

1974 *!Kung Bushmen: Hunting Equipment*. DVD, Documentary Educational Resources, Watertown, MA.

Bows, no atlatls.

Arrow components: triangular pt cold-hammered from wire with 3-4" shank ; 2" connector of Panicum grass ; tapered bone or wood joiner about 2" ; shaft of Phragmites communis, Panicum or another grass, nocked at a node, hollow other end. Overall arrow 18-23 inches long.

No magical properties or rituals in making. First 3 parts are securely gummed together. Man's own style is known, history of particular arrows in hunt and gifting may be known, owner of arrow has claim on meat. Two other arrow types: sharp bone foreshaft for bird/small animal, may be poisoned, and point of unpoisoned porcupine spine. Shaping bone with adze, collecting reed. Sinew wrap over black gum on both ends arrow shafts to prevent splitting. Long sequences of assembly - complex with 2 kinds of gum, sinew wraps. Metal point shank sinew-wrapped, then gummed so poison will adhere better. Men frequently examine and repair arrows. Straightening shaft with grooved stone and heat.

Long poison sequence. Larvae of 3 species of beetles, plus their similar-looking parasites. Beetles feed on leaves of a tree, pupate 2 ft in soil. [larvae shown, not adults]. Digging and collecting pupae. Application from live grub in pupa to arrow shank, a drop or two can kill a man, no known antidote. Poison on shank, not point - that would be too dangerous. Other poisons from a tree pod, a root, mixed with beetle poison, add a leaf juice to thin and bind [complex recipe]. Large animal not shot in heart or vein dies 2-3 days, gasping, paralysis, coagulation of blood.

Man carries 8-20, ave 15 arrows in quiver, plus shafts, plus gum sticks, fire sticks, sip stick (water straw). More points in separate horn. Careful retrieval of lost arrows. [Never says how long to make one, but with so many, can't be too valuable, although frequently exchanged.]

Assagais - wood, 12-18" metal point, thrown to finish poison-downed wildebeast in final sequences.

Bow, made from branches of several woods. Ca. 40 inch long, 1/3 inch diam. Bark peeled, ends tapered, knots cut off, smoothed, rubbed with grease [but still very plain and a bit assymetrical]. Sinew bindings prevent splitting. Sinew bow string, loop at one end, wrapp and tie at other above leather knot attached to bow with sinew. Allows tension adjustment, but bow not unstrung between hunts. [Draw weight never given.] Equip all carried in leather bag, but bow carried strung through straps of quiver. Held to shoot with thumb up, 1st finger holding arrow in place. Draw is 'primary" [but not quite: forefinger is crooked around string to pull, and pinch is ball of thumb over proximal or 2nd joint, and it looks like the 3rd finger also pulling string]. "Fair accuracy 30-40 yds, limit 65-75.'

[Interesting to see constant use of teeth as tools, toes for gripping].

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Martens, Richard

2016 Comparisons and findings: Breakage characteristics of the Martens Site Clovis points compared with those of the 2015 deer kill "Clovis" point. Paper presented at Missouri Archaeological Society Fall Symposium, Van Meter State Park, MO, October 1, 2016.

Compares fractures with the bending fracture on Eric Smith's deer kill point. A foreshaft reduces leverage on a point in the animal because flexes at foreshaft junction with mainshaft. He calculates amount of force needed to snap a point of chert - ca 4 lbs, not much.

Martens, Richard

2018 Determination of Clovis point bending breakage characteristics. *Missouri Archaeologist* 78:111-130.

Martin, George C.

1933 Archaeological Exploration of the Shumla Caves. *Southwest Texas Archaeological Society Bulletin* 3 (Big Bend Basket Maker Papers No. 3). Witte Memorial Museum, San Antonio, Texas.

Dry caves [apparently primitive excavation methods], with atlatl and related specimens pp. 24-25. Arrow shaft fragments "made for use with atlatl designed for throwing a light arrow" with deep flared nocks. Wooden arrow foreshafts 6-10" long, diameters 3/16" – 3/8", some with notches for stone points. Wooden "atlatl javelin" foreshafts also found, one 7.5" long, 1/2" diam. with stone head cemented in with gum. Distal end of atlatl, wood, flat, integral hook and groove. Bone or antler hook, shaped like end of flat atlatl with integral hook but no groove, hole for attaching, "a detachable device which would convert any stick of appropriate size into an atlatl." Proximal end of atlatl, with two finger notches each side, heavy form for casting javelins. Proximal end of atlatl with single notch each side, light form for casting arrows. No apparent loops on either. [I don't find his interpretation of flared arrow nocks as intended for use with atlatl very convincing, but the idea of light and heavy atlatls and projectiles is worth considering. No information on weights that would help evaluation is provided. Kellar (1955) points out that this is apparently the only place where SW forms overlap with SE antler hook forms.]

Five complete, fifteen fragments of grooved "rabbit stick" type clubs.

Martin, Larry D., Virginia L. Naples, and H. Todd Wheeler

2001 Did mammoths have nonhuman predators? In *Proceedings of the International Conference on Mammoth Site Studies*, edited by Dixie West, pp. 27-34. University of Kansas, Lawrence.

Large animals reproduce slowly, thus vulnerable to extinction by over-predation – Martin's overkill hypothesis. But if exposed to predators, less 'naive' and tend to adjust. In N. Am., proboscidians had a couple possible predators: Smilodon sabre-tooth cats and Homotherium scimitar-toothed cats. S has very large canines, short legs imply ambush hunting, jaw gape enough to cut throat of young but not adult mammoth. H more adapted to short run, shorter teeth but also a possible. Both lion size because any bigger too specialized, S more specialized, could not have hunted smaller game effectively. So both could compete with humans for mammoth. [Interesting consideration of variety of environmental and anatomical evidence].

Martin, Paul

1973 The Discovery of America. Science 179:969-974.

"Overkill" hypothesis of faunal extinction: models animal populations, human populations, and movement to support possibility that first humans in Americas (Clovis) wiped out Pleistocene megafauna - so fast that we should not expect many kill sites. [Classic article, but important to remember that this is a model, not evidence, and more recent information makes it much less plausible.]

Martinez, Jorge G., and Carlos A. Aschero x 2003 Proyectiles Experimentales: Inca Cueva 7 Como Caso de Estudio. *Cuadernos FHyCS-UNJu* 20:351-364.

[Spanish with English abstract. "Experimental Projectiles: Inca Cave 7 as a Case Study."] Site in Argentina, 4000 BP. Lanceolate point replicas (N=10), hafted, thrown at defleshed scapula, close range, simple Peruvian type atlatl, 15 throws, 10 breaks. But 8 throws missed the bone, some hitting rocks. [Poor accuracy, too small sample sizes].

Martin-Jones, John, and Robert Tonkinson dept

1966 Desert People. Australian Institute of Aboriginal Studies.

Film, classic ethnography, b/w with no sound except narration. Western Desert Australia, 2 families for one day [but probably composited]. Men and youths carry 2 to 5 spears and sometimes spearthrower and firestick as walk, women carry wooden trays and digging stick. Spears just sharpened wood, ca 2-2.5 m long. Spearthrower of tray-shaped woomera type, although one boy seems to have a narrow version. [You never get a good look and never see them in use.]

Man looks for waste stone around old campsite, finds and knaps old core, using simple hard hammer percussion with no platform preparation, takes a couple flakes, leaves core, hammer, and waste on site. Narrator says flake will be mounted in spear thrower. Women harvest grass seeds in wooden tray, winnow them with hands and shake in tray, grind on stone slab, mix with water and bake in coals.

Men, boys (15 + 5-8), and women and teen girl all run down or dig out lizards, and the man digs out a bandicoot, kill animals by striking against spear, minimal cook on fire and then by covering in coals. Woman's catch for day is about 8 lizards, from 10 cm to 30 cm in tray. Acacia root grub - dig out whole small tree for one finger size grub eaten raw on spot, with big smile.

Women dig for water with wooden tray in wells 1-2 m deep. Man collects bush tobacco, mix with ash for chew. Flies everywhere, on face, on food, mostly ignored but occasional hand waving.

Casually light grass fires to signal, for warmth and light, for fun, to keep fire stick smouldering - leaves behind a burning bush as group walks on.

Meet at camp, broken branches for windbreak, loosen soil for sleeping area with digging stick or metal hatchet, only Western artifact visible.

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Maschner, Herbert, and Owen K. Mason

2013 The Bow and Arrow in Northern North America. *Evolutionary Anthropology* 22(3):133-138.

Four waves of bow use: Phase 1: 12,000-8000 BP small bone pts slotted for microliths (Ackerman). End of Pleist fauna, but before expansion of bison + moose, so hunting sheep, caribou, elk. Also before N. Archaic Trad massive dart end-blades, which coincide w expansion of larger ungulates 7000-4000 ya. Early Holocene self-bow not powerful enough, need atlatl for bison + moose. So little evid of bow 8000-4500.

Phase 2: 4500BP Arctic Small Tool Tradition colonized entire arctic, using both bow and atlatl. Bow evid from microlithic end-blades, a few frozen bow frags in Greenland, assoc w caribou or musk ox. Wherever hunting sea mammals, also used atlatl. By 3500 BP bow not used in AK, reduction in terrestrial fauna, espec caribou, most sites on coast, hunting sea mammals, N Archai Trad replacing much of Arctic Small Tool Trad, no bows 3600-2400 in AK.

Phase 3: then fishtail pt developed - long narrow stone end-blade not useful for anything except war. Afterwards pts become small. By 1300 BP, defensive sites all over - intro of Asian War Complex - recurved bow, slat armor, straight narrow barbed bone points in skeletons. Interior AK now sees use of more powerful bow on moose, with loss of stone tech, pts made of bone or copper. [This seems to include Phase 4, but it's not clear]. [Abstract only] Aleutian use of both bow and atlatl characterizes difference: bow for war, atlatl for sea mammal hunt because can be used in kayak.

Mason, J. Alden

1928 Some Unusual Spear Throwers of Ancient America. *The Museum Journal* 19:290-324. University of Pennsylvania University Museum.

Older than bows, back to Paleolithic. Lengthens arm for greater speed and force. Requires only one hand so useful in boats or with shield. Describes specimens at U. Penn Museum:

Thule Culture, Point Barrow, Alaska - coniferous drift wood, odd angular shape, with hand grip and hole for index finger, male hook of ivory inset into groove, rigid, no weights, 14.5 inches long, 2.75 wide.

Basket Makers of Utah - specimen from Chicago Exposition, probably collected by Wetherills in Grand Gulch - split sapling, .75-1 inch wide, 25 inches long, groove with integral "spur", handle with twin finger loops of rawhide, wrappings include carnivore tooth, cotton yarn, fur, feathers, and 4 beads revealed by x-ray, limonite nodule, flaked point bound to it (See Culin 1898).

- specimen from Hazzard Collection - handle only, simpler loops of hard material wrapped in leather.

- specimen from Lukachukai, Arizona - complete but lacking loops, largest and heaviest of all, 23.75 inches long, .25 thick, .875-1.25 wide, notched at grip, shallow groove but elevated male "spur."

Key Marco, Florida, Cushings excavations of 1896 - 2 complete, "slender and graceful" - two finger holes, 16-18 inches long, dark flexible wood, groove, short raised hook, flared handle end.

- single finger hole, hook carved in form of rabbit, handle end with volute knob, 19 inches long, springy hard wood.

Ethnographic Tarascan, Mexico, "of slight interest" one piece wood, plain undecorated, two finger holes.

Prehistoric coastal Peruvian graves, Nazca - 10 specimens: straight round stick with grip and hook bound on, 46-56 cm long, handles carved bone (owl, flute player etc).

Mason, Otis T.

1885 Throwing Sticks in the National Museum. *Smithsonian Institution Annual Report for 1884*, part 2. pp. 279-290, plates 1-16. Washington: Government Printing Office.

Eskimo spear throwers, substitute for bow because can launch harpoon from kayak. Works by longer force application to spear, some leverage.

Discusses several Eskimo subtypes and geographic distribution, illustrates 22 specimens. [Basic "Eskimo" type is flat board with carved handgrip often with pegs and/or finger hole, mixed hook and groove, no weights].

Mason, Otis T.

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1891 Arrows and Arrow-Makers: Introduction. *The American Anthropologist* 4 (1):45-49.

Vocabulary of arrows. With articles by Holmes (Manufacture of Stone Arrow-points), Wilson (Forms of Ancient Arrow-Heads), Hough (Arrow Feathering and Pointing), Flint (Arrow in Modern Archery), Hoffman (Poisoned Arrows), and Bourke (Remarks).

Mason, Otis T. x 1891 Throwing Sticks. *Science* 18(456):246-247. Letter to editor, gratified that Mortillet, Uhle, Nuttall, others [lists refs] sent him papers after his 1885 Eskimo paper above, saying theirs were stimulated by his. There are Tlingit throwers, and now have a Patzcuaro specimen collected by John Bourke, [described], long cane spear, for killing ducks. "Problem now is to connect Alaska with Patzcuaro."

Mason, O. T. x 1892 The Throwing-Stick in California. *The American Anthropologist* 5(1):66.

British Museum Hewitt collection from Vancouver's NW coast voyage 1790-1795 published by Read has 3 T'linkit type throwers, plus one from Santa Barbara Islands, very short 5 1/8 inches, but otherwise like those from Patzcuaro, so throwing stick found arctic to Calif. to Mexico.

Mason, O. T. x 1892 Eskimo throwing-sticks. *Science* 19(488):332.

Note, almost all are right-handed. Most others known elsewhere are ambidextrous. Outside Eskimo, did other aborigines have non-ambidextrous gear? Invention of purely R-h implement points to southern origin for original invention [? non-sequitur with no supporting argument]

Mason, Otis T. x 1893 Throwing Sticks [letter Sept 15] *Science* 22(554):152-153. Reprint also in_*The Cast*, Spring 2001: 1.

[First notice of Basket Maker SW atlatls].

World Columbian Exposition, Colorado exhibit of Cliff Dwellers [Wetherill]. 2 examples, describes, BM type, groove + hook, finger loops, attached bundle of stone point, mountain lion tooth, and hematite.

"First finding of atlatl figured in codices...connects Cliff Dwellers with the Mexican people."

Mason, Otis T. x

1893 Throwing-Sticks from Mexico and California. *Proceedings of the National Museum* 16(932):219-221.

Pretty good engravings and brief descriptions of Patzcuaro atlatl and dart collected by Bourke, Santa Barbara short atlatl in British Museum collected by Vancouver, decorated Tlingit atlatl, bird + fish harpoon from Makah Indians of WA with duck-foot like proximal end that fits two fingers to propel.

Mason, Otis T.

1894 *North American Bows, Arrows, and Quivers.* Annual Report of the Board of Regents of the Smithsonian Institution to July 1893: 631-680. (Reprint 2007, Skyhorse Publishing).

Compilation of ethnographic accounts of b+a use and manufacture, numerous drawings of specimens in the Smithsonian, including many stone tipped arrows. Mentions "throwing stick" and his 1885 paper which "was the starting point of half a dozen others which well-nigh exhausted that subject."

Hunting and war at close range, 20 yards or less. Lengthy knapping info taken from others. Mentions "in Washington there are several men connected with the Bureau of Ethnology who are capable of producing the most beautiful arrowheads from bits of obsidian or glass" [Cushing, Holmes? - he doesn't say].

Skeptical of beveled points as making arrows spin: "There seems to be little testimony to the assertion that the savage had learned to bevel the sides of his arrow heads alternately, for the purpose of making his arrow revolve in the air. Mr. Cushing has shown that this alternate beveling of the edges was a natural result of holding the piece of stone in a certain way along the thumb during the operation of chipping."

Arrows made in standard sizes by each tribe, matching in quivers. Spiral fletching by an Apache simply to make feathers lie flat. "It is inconceivable that any savage should grasp the problem of the rifle bullet and construct his missile accordingly." Normally not spiraled [but he quotes several authors mentioning spiral fletching too].

Poisons known, septic and plant. Salish believe obsidian and glass points to be poisonous. A number of accounts of glass points quoted.

[Dozens of careful detailed drawings of arrows, bows, etc. Only SW bow is Navajo, sinew backed. A few SW arrows - Zuni, Hopi (2 reed shaft, one wood shaft), Pima, Apache]

Mason, Otis T.

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1895 *The Origins of Invention: A Study of Industry Among Primitive Peoples.* Walter Scott Ltd, London. Reprint 1966 M.I.T. Press, Cambridge.

Nice illustrations of hafted N. Am. stone knives. Chapter on stone working. Mention of "dart-slings" in chapter on "War on the Animal Kingdom" but more on bow and arrow, blowgun, etc. Atlatl common Aust, Eskimo, Middle + S Am. Adds joint to arm. "Inseparable from this weapon in N. Am. is the bird trident..." "Greenland Eskimo attach [the throwing stick] to the side of the great harpoon, which new device indicates that the throwing stick traveled from West to East.

In chapter on "Art of War" "The Mexican atlatl or throwing-stick or spear-thrower found in Aust, Melanesia, and Am from Point Barrow to the Argentine combines muscular force with prolonged effort. It is also a convenience for a man who has only one free hand." p 377. [He makes no connection between bow and atlatl, and subscribes to the extended impulse model of atlatl function, comparing it to amentum, which allows impulse after the dart has left the hand]

Massey, Lee Gooding

1972 Tabla and Atlatl: Two Unusual Wooden Artifacts from Baja California. *Pacific Coast Archaeological Society Quarterly* 8(1):25-34.

Tabla is a ceremonial board.

Atlatls - two ethnographic accounts, but confusion about weapons and their dimensions. Several Baja specimens known. One collected by locals from shelter near Buena Vista: 81.5 cm long, regular 4 cm circumference, distal end wrapped in palm fiber, integral large blocky "male" hook, bark loop at grip [apparently only one], carved geometrical decoration. From a burial cave [apparently Massey 1957] with other fragments.

Massey, William C.

1957 The Dart-Thrower in Baja California. *Davidson Journal of Anthropology* 3(1):55-62.

Isolated populations retained old traits.

Four specimens found bundled in cave, Las Palmas culture.

Round wooden shafts, integral male hook, single bark finger loop [poor drawing, no further details].

Mentioned in 17th C Spanish accounts, but after 1720 no mention - disappeared?

Massey, William C.

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1961 The Survival of the Dart-Thrower on the Peninsula of Baja California *Southwestern Journal of Anthropology* 17(1):81-93.

4 archaeological specimens with burial in cave, Las Palmas culture. Straight stick shaft ca 82 cm long, single fiber loop, fin shaped integral hook. Sees similarities to Caribbean S. Am. Spanish reports.

Massey, William C. and Carolyn M. Osborne

1961 A Burial Cave in Baja California: The Palmer Collection, 1887. *University of California Anthropological Records* 16(8). University of California, Berkely.

Associations with 7 burials included a cane dart shaft 92.5 cm [very short!] long, no foreshaft, with stingray spine point, and two compound pressure flakers, short wooden handles with lashed-on bone tips. Bull-roarer, pipe, feather cape suggest that one burial was a shaman. [No dates, precontact?]

Matarazzi, Frank

2003 Modern Outcast to Primitive Weapon. The Backwoodsman 24(3):52-53.

Making an atlatl out of old wooden clothes hanger.

Matheny, Ray T., Thomas S. Smith, and Deanne G. Matheny x 1997 Animal Ethology Reflected in the Rock Art of Nine Mile Canyon, Utah. *Journal of California and Great Basin Anthropology* 19(1):70-103.

Fremont area, NE UT. Bighorn sheep images show detailed knowledge of sheep behavior. Ethnographic hunting practices, uses, importance of sheep among Shoshone, Paiute, others. Ecology, subspecies, seasonality of sheep, elk, others. Nine Mile Canyon is type site for "Northern San Rafael Style" rock art. Sheep scenes include nursing, nosetouching, bird on back, details like split hooves, age/sex diffs in size and horns, linear herd travel but also non-realistic elements. Narrative scenes including hunts with multiple hunters with bows, and herds of sheep. Rare atlatls: one human figure throwing, one with looped grip atlatl beside [figures show probably right]. Comparisons to Coso Range art, (which has more atlatls). Hunting magic - maybe, but not all. Whitley: why did "people who principally ate seeds and nuts make art that emphasized mountain sheep and bows and arrows?" - rain shamans allowed males symbolic dominance while subsistence shifted from hunting. But why not shamanism more directly related to hunting success?

Mathien, Frances Joan

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2005 *Culture and Ecology of Chaco Canyon and the San Juan Basin*. Publications in Archeology 18H, National Park Service, U.S. Dept of the Interior, Santa Fe.

Major Chaco synthesis.

pp 78-84 descrip of Atlatl Cave, apparently not published previously but analyses in filed reports, excav before 1976. Large shelter with pictographs ("broad-shouldered" BMII anthropomorph + hands), organics, including atlatl fragment, assoc with yucca sandal, corn, and C14 dates 2220 ± 100 B.P = 2,275 BP cal to $2730 \pm 65 = 2900$ BP cal (Basketmaker II). Photo shows distal end of typical BM type *in situ*, short groove and slightly raised integral hook.

Mathieu, James R. x 2009? Time Travel, Trebuchets, and Atlatls. *Expedition* 45(3):6-7.

Teaching archaeology hands-on. Claims student experiment demonstrated that javelin technique more appropriate analogy to atlatl than baseball throw. Experienced javelin throwers did better at accuracy and distance with atlatls than range of others. [Not enough details given to evaluate this experiment.]

Matson, R. G.

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1991 The Origins of Southwestern Agriculture. University of Arizona Press, Tucson.

Summaries of Basketmaker research including sites with atlatl material such as White Dog Cave, Sand Dune Cave, etc. Some illustrations of foreshafts and points.

Matson, R. G., and Sally J. Cole

2002 Ethnicity and Conflict Among the Basketmaker II of the U.S. Southwest. In *The Archaeology of Contact: Processes and Consequences: Proceedings of the Twenty-fifth Annual Conference of the Archaeological Association of the University of Calgary*, edited by Kurtis Lesick, B. Kulle, C. Cluney, and M. Peuramaki-Brown, pp. 206-217. University of Calgary.

Evidence of 2 different ethnic groups in BM II: Durango (E) vs San Juan (W). House forms, perishables, diff basket weaving, projectile points. E atlatl points have broad corner notches, W (San Juan Dart Point) side notched. E BMII has similarities to Mogollon and San Pedro Cochise, supporting migration from S and probably Uto-Aztecan language.

Evidence of conflict - defensive sites eg N Road Canyon peninsula w 5 pithouses, Wetherill Cave 7 "massacre," scalps + body trophies, burials w missing parts. Rock art images of scalps + heads, figures w atlatls and darts, dart "arsenals," pierced anthros.

Wide similarity of rock art with continuity to Archaic, suggests immigrants to Colorado Plateau who became W BMII adopted a wider native tradition. Even with violence, groups maintain communication and common symbols. W BMII not linked to preexisting plateau Archaic, but to Fremont + Gt Basin Archaic further W, could have come with maize or earlier. The San Pedro origin E BMII also arriving, displace Archaic with hostility, copy W BMII patterns but continue hostility.

Mau, Clayton

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1963 Experiments with the Spear Thrower. *The New York State Archaeological Association Bulletin* 29:1-13.

Experiments with distance as criterion, 3,394 casts over 2.5 yrs [intended to seem a lot, but distribution among ca 75 darts + unfletched javelins, ca 25 atlatls not explained]. Points of copper tube, 1/8 to 1 oz, darts lengths 2.5-5.5 ft, atlatls 12-30 inches long - 24" best.

Best distance (180-200' usual) with unfletched 36", 3/8" diam, wt 2.5 oz, pt 1 oz, balance ca. 31% from tip.

Fletched shaft allows use of lighter points, balance less important, but fletching reduced range. Minimum pt weight for unfletched shafts 5/8 oz [19 g], so most archaeol pts too light, must have been on fletched darts.

Speculations on prehist point styles. Point weights in NY suggest that by 1200 AD throwing stick still in use, but completely superseded by bow by 1500 AD [Absurdly late, no supporting evidence.]

Bannerstones - pipe of different weights at different places on atlatls. Best was moderate weight, 47/8 oz [151 g], close to handle, which increases distance of throw 15-25%. Bannerstones are shaped so as to deflect a shaft instead of chopping it if it slips off the hook in a throw.

[Interesting but subjective, experiments and results not given in enough detail to see if supposed improvements statistically real, and his equipment is really poor - short heavy dowel darts. Throwing motion not explained, but if his darts were as rigid as I suspect,

throws can't be good].

Maudslay, Alfred Percival

1908 The True History of the Conquest of New Spain, by Bernal Diaz del Castillo, One of its Conquerors, From the Only Exact Copy Made of the Original Manuscript, Edited and Published in Mexico by Genaro García, Translated into English, with Introduction and Notes, by Edward Percival Maudslay. Hakluyt Society Works, Second Series, No. XXIII.

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Maxwell, James A. (ed.)

1978 America's Fascinating Indian Heritage. Reader's Digest Association, Pleasantville, NY.

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Muddled and confusing prehistory highlights in first chapter. At one point they seem to say humans in N. Am. by 40,000 but elsewhere it is mostly Clovis first, only not very clear. The big name 'consultants' were probably not very pleased at how crappy this turned out. The Yukon Old Crow scraper is featured as 'until recently believed to be the oldest artifact' but correct redate is noted. Sandia points accepted as 12,000 years old, with a terrible color drawing of one. It seems RDA and its artists may be responsible (these are not credited like other illustrations and therefor probably owned by RDA by unnamed artist) for some of the horrid stone tool drawings that spread to other publications, including some, like Fagan, that should have done better. P 20 a 'Folsom toolmaker'is shown striking off a flake and then a series of steps in production of a fluted point, drawn by someone who did not understand knapping or even flake scars, with a miserable interpretation of clumpy lashing on a shaft – and all the other point drawings are equally hideous. P 21 drawing of hunter aiming at caribou with atlatl, not too bad although he is unnecessarily balancing the dart with his left hand. Atlatl explained as 'lengthening arm.' Clovis point as 'new hunting weapon', p 23 'mystery of the disappearing mammals' describes fire drives and cliffs as 'such tactics are now called the Pleistocene Overkill.'

McConnell, Bill, and Craig Lee

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2013 Just the Tip: Replication and Use of a 10.400-year-old Cody-Age Foreshaft. *Bulletin of Primitive Technology* 46:25-26.

Rocky Mts find, see Lee (2010), conical proximal end, slotted distal, 12.5 mm to 8.9 mm diam, 107 cm long. Hafted Cody type pts in replica. Flew best with mainshaft equal or longer to foreshaft; total long and unwieldy but flew well at 8-80 yds, collapsible for transport.

McCourt, Tom

1975 Aboriginal Artefacts. Adelaide: Rigby Ltd.

Australian stuff. [Collectors book, but good illustrations, ethnography seems accurate].

Glass and stone flaking. Varieties of points. P.103 includes second hand "witness" of fire and water knapping! Almost nothing about spear throwers: p 39, photo 2 Kimberley area long forms with restricted handle, one shovel nosed spear point made of horseshoe, 1971 old folk still using these, and glass pointed composite spears for hunting.

McCreery, Patricia and Ekkehart Malotki

1994 *Tapamveni: Rock Art Galleries of Petrified Forest and Beyond*. Petrified Forest Museum Association, Petrified Forest AZ.

W central Arizona. Atlatl depictions rare in area, "only a handful" p 8. [photo + drawing of well-detailed petro of BM atlatl w loops, groove, hook depicted. One has assoc 2 darts w solid oval fletchings - but no locational info]. Basketmaker anthropomorphs of "Palavayu Linear BM (Archaic + early BM) and Majestic BM styles [related to San Juan Anthropomorphic and Turner's Style 5/Glen Canyon Linear style]. Some hold fending sticks or lines that may be atlatls [none clearly atlatls in his drawings]. P 35: atlatl may have continued an unknown time after bow. "Assoc w BM art, it is also sometimes present in rock art of seemingly earlier style and age." [But no examples shown.] Bird headed men occur [Fig 9.6 shows some with probable atlatl darts, but he seems to date them to PII.] P 152 "The atlatl image may have become ceremonially associated with the bird-heads in BM times, enduring as a ritual symbol into later periods." [Fine photos, serious discussion of chronology and meaning, though too fond of the shamanic interp of rock art, also talks about symbols' relation to rain etc].

McDavitt, Matthew

1995 Lean Back and Say A'tlatl. The Atlatl 8(4): 8

How to pronounce.

McDavitt, Matthew

1998 Papuan Spearthrowers. The Atlatl 11(3):2.

Described briefly, photo. Female type, carved spear rest, 28-31.5 inches.

McDermott, Alicia

2018 Archaeologists in the Yukon find a Remarkably Intact Dart Lost by an Indigenous Hunter 1,000 Years Ago. Ancient Origins webpage, URL: <u>https://www.ancient-origins.net/news-history-archaeology/indigenous-hunter-0010654</u>, accessed Sept 6, 2018.

Jennifer Herkes of the Carcross/Tagish First Nation with find team, near Carcross. Believed 'at least 1000 yrs old'. Intact, 1.52 m long [missing details, but photo shows 3 feather lashed-on fletching, and flaked stone pt of indeterminate form with probably sinew lashing. Two areas of lashing around shaft may indicate multiple parts.] [see Grohsmeyer 2017]

McDermott, Jenny

2006 Advocating Atlatl. The Columbia Missourian October 13, 2006. Electronic document URL: http://columbiamissourian.com/news/print/php?ID=22138 accessed 10/15/06.

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Vic Ahearn at Bass Pro teaches workshops, with R Mertz and R Madden lobbied MO, so now legal for small game. Atlatl basics, mentions WAA, ISAC, quotes Ahearn, Mertz.

McDonald, Josephine J., Denise Donlon, Judith Field, Richard Fullagar, Joan Brenner Coltrain, Peter Mitchell, and Mark Rawson

2007 The First Archaeological Evidence for Death by Spearing in Australia. Antiquity 81(314):877-885.

Narrabeen, N. Sydney, SE Australia, body, not burial, adult male, in dune sands, ca 4000 BP. With backed microliths, including 3 frags embedded in or between bones. Usewear consistent with hafted spear armatures. Anatomical, forensic, and artifact evidence consistent with death by spearing, ethnographically known as ritualized punishment using "death spears" barbed with stone flakes. [Spear thrower not mentioned, but likely used, see Gould 1970; also Fullagar 2011).

McEltree, K. B.

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2005 Bannerstone Talk: Southeastern Style, er, Make That SE Alabama Style. Indian Artifact Magazine 24 (3): 46-49.

Variety of forms illustrated, but not too useful.

McEwan, Colin

0 2009 Ancient American Art in Detail. Harvard University Press, Cambridge.

Picture book, brief context and info texts, fine artifacts, many from British Museum, excellent color photos. Aztec atlatl, page of Codex Zouche-Nuttall with atlatl armed warriors, 18-19 C Eskimo-Aleut spear thrower from Nootka Sound, Canada, with sea otter image + beads.

McEwan, Colin, and Lenoardo Lopez Lujan, eds. 2009 Moctezuma: Aztec Ruler. British Museum Press, London.

Articles on M, illustrated with catalog of BM display, some of the finest photos of Aztec art. Includes several atlatl-related: a cinerary urn from Templo Mayor with relief of Tezcatlipoca armed with two-hole atlatl and darts with fletching and triangular points (51) and several other depictions of gods with atlatls. The BM Aztec atlatl and the one in Ethnog Mus Rome (p204-205) [the Rome atlatl is the one that Beyer (1934) considers a fake - note that finger loop lashings are identical to those of BM specimen]. Figures on

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the Brit Mus atlatl - on back 4 serpents flank groove, often represent fired darts in Mexica iconography. On front, warrior entwined with rattlesnake, holds shield in one hand, thrusting a spear with other, probably held in an atlatl. Eagle feather headdress + face (deer hoof ear spools, vertical striped paint) identify as warrior god Mixcoatl (cloud snake). Mexica rather than Mixtec style narrative. Snake's head parallel to spear emphasizes weapon's supernatural power [or at least equates the two]. If read

iconography vertically as in other atlatls, both figures are shooting from the sky, celestial darts.

McFarling, Usha Lee

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2003 Treasures from Icy Tombs. *Los Angeles Times*, Jan 3, 2003. Reprinted in *The Cast* Spring 2003: 10-11. Reprinted in *The Dart* March 2008: 5-8; April 2010: 7-9.

Melting glaciers in Yukon and elsewhere exposed things like "Otzi," "Kwaday Dan Sinchi," Arctic animals, artifacts. Yukon darts with blood and caribou hairs, atlatl evidence from 7,300 to 1200 years ago, then bow dominates. [No details.]

McGee, W. J., W. H. Holmes, J. W. Powell, Alice C. Fletcher, W. Matthews, S. Culin, and J. D. McGuire x

1900 In Memoriam: Frank Hamilton Cushing. *American Anthropologist* n.s. 2(2):354-380.

Some wonderful stories about young Cushing: from Holmes, how he met Hartt at Cornell, staggering up the hill to deliver a bag of stone tools. From Powell: as boy built wigwam in woods ... "were indeed a scientific workshop in which young Cushing laid the foundation of a system of investigation which has since proved of marvelous efficiency and which has been successfully developed by other laborers. This new method of research in prehistoric archaeology I shall call the method by experimental reproduction." 361

McGuinness, Tim

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2009 Pre-columbian Atl Atl Spear Throwers. On web page The Online Museum of Weapons, McGuinness Publishing, electronic document, accessed 4/15/09 URL: http://www.precolumbianweapons.com/atlatl.htm

OK basic definition, Berg + Perkins theories of bannerstones. Photos of Aztec atlatl (British Museum) and others, Nazca atlatl, Moche copper dart points.

McGuire, Randall H., and Maria Elisa Villalpando

2015 War and defense on *Cerros de Trincheras* in Sonora, Mexico. *American Antiquity* 80(3):429-450.

Hills with lots of terrace walling in SW US and NW Mexico, Hohokam and Trincheras cultures, 700-1400 AD. Use GIS to evaluate – terracing increases difficulty of movement,

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therefor defensive. Two kinds: entanglements, which inhibit Yuman-type run-through surprise attacks to overwhelm a village, and generally protect habitations, and encircling redoubts, often protecting elite and sacred space, possibly refuges. Comp to Maori *pas*, and Colla (late pre-Inca Peru) *pukaras*. In all cases, defense seems to outstrip attack capabilities, since sieges impractical, projectile weaponry short range. In SW, light bows and possibly slings, warfare mostly hand to hand. [good article but no atlatls]

McNichols, Charles L.

1932 Indian Weapons: The Atlatl. *Street and Smith's Western Story Magazine*. 111 (3): 128-131. (March 12, 1932).

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[Ugly racism, and odd mix of fact and mistake in early popular article]. Large stone points are for atlatl darts. Bow introduced "a very few centuries" before Spanish "found highly civilized Mexican races did not use the bow" [not true]. Same as wommera. "It propels the dart after it leaves the hand...giving same advantage as if thower had an extra joint to his arm." [Motion and use not clearly described, doubt he's ever tried it, no illustration]. Invented all over world, "black fellow and Asiatic Negroids both developed it...races no more than 3 or four jumps ahead of gorilla..." "Unbelievable" that "civilized Maya" had nothing better. Extreme range around 275 feet, much less than bow, large dart meant can't carry many. But "bow people were savages, less intelligent and advanced than the atlatl men [he means Aztec and Maya] so they only wiped out the Northern atlatl tribes. So immediate replacement - SW sites atlatl in older, bow in newer, never together. But Aztecs kept because atlatl is good one-handed weapon. N. Am. tribes fight by "bushwhacking" for which bow is better. Atlatl dart "couldn't penetrate an object any deeper than its 6-8 inch foreshaft - enough to kill a man or deer, but insufficient" for large game. "It's doubtful if a buffalo could be killed with an atlatl dart." Still in use by Eskimo and on Mexican lakes because they need left hand to paddle canoes. Esk and Mex bird darts similar. Primitive S. Am. tribes use in jungle where greater range of bow not important, and S. Am tribes with bow still use long arrows same as their former darts.

McPherson, Robert S.

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2009 Comb Ridge and its People: The Ethnohistory of a Rock. Utah State University Press, Logan.

Pp 68-70 Navajo beliefs about arrowhead: Lightning, arrows and snakes all associated, important in Shootingway ceremonial curing people who come in contact with lightning. All are "objects that move in zig-zags." Some rock landmarks are giant arrowheads; e.g. Comb Ridge is made of arrowheads in a row, or is symbolically an arrow. The Twins wore flint armor when destroying monsters. When Big God was pierced by Monster Slayer's arrows, his armor shattered and scattered, so flint flakes for use can be gathered. Arrowheads, knives, other objects of flint are synonymous with protection and safety. "Flint's hardness, the sound as it rattles, and reflected light representing lightning give it power." "Horned toads use flint as protection against lightning and are able to fashion their own points." Arrowheads are prayed over and collected for protection, ward off

disease, must be powerful because have already killed enemies or dangerous animals. Lightning is an arrow. Humans are built as arrows, body as stick, head as arrowhead. Arrowheads also associated with bears, a powerful protective animal (74), although also can be dangerous and evil.

McTiernan, John, dir. o

1999 The 13th Warrior. Movie, VHS, DVD (2002). Touchstone Video.

From Michael Crichton novel *Eaters of the Dead*, with roots in a loose reworking of Beowulf's encounter with Grendel and his mother. Wandering Arab (Antonio Banderas) unwillingly becomes the 13th of a group of Vikings returning home to fight a great evil. These turn out to be Neanderthaloid monsters, but in a jumbled sort of way. They eat people, ride horses and use spear throwers and what appear to be metal weapons. They dress in bear outfits and use bear skulls as markers, but their symbol is an Upper Paleolithic "Venus" figurine, and their cave is decorated with Upper Paleolithic paintings. There are hundreds of them, but no idea of what they live on. Atlatls are not in the book and in the movie are mostly invisible. With stop action you can see them if you know they are there, but all you really see is spears zipping around in confusing, murky battle scenes. This movie had potential but ended up a mess. See Richard 1997, Crichton 1992.

Meeks, Nigel

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1992 Report on the Scientific Examination of the Gilding on an Aztec Spear Thrower. unpublished ms., British Museum, London.

British Museum atlatl AM5226 gilded with gold foil, 5-7 microns thick, slightly impure (8% silver and copper traces), consistent with prehistoric gilding, but not with European gold leaf.

Mehringer, Peter J.

1988 Weapons of Ancient Americans. National Geographic 174(4):500-503.

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Nice photos of Wenatche Clovis points – 19 found by irrigation workers. PJM directed excavs for landowners, Richey. Volunteers included M Aikens, R Daugherty, G Frison. Consulted with Colville Confederated Tribes [trouble later not mentioned]. Bison blood residue. "...will soon return" to the site.

Meltzer, David J.

2006 Folsom: New Archaeological Investigations of a Classic Paleoindian Bison Kill. University of California Press, Berkeley.

[A really nice the technical book with lots of good info and discussion, including readable summary of Folsom history and current interpretations.]

Re-excavations 1997-99, analysis of original material from Figgins and Cook's 1920s work. Good chapter on historical context: Cook and Figgins credited with discovery but were never credited with resolving question of human antiquity - in part because C + F not among elite scientists, and had backed several obvious losers before. Barnum Brown (AMNH) and blacksmith Carl Schwachheim did most excav. CS diary appendix mentions several pts broken by picks, and pick marks visible in photo [so poor excav even if just for bones, and you have to wonder how and if the famous point really was found in situ as claimed]. Chapters on geology, environment, bison bone taphonomy. Butchering thorough, bones disarticulated but not smashed for marrow, few cut marks. Seems to be immediate kill + butchery site, as almost only artifacts are points. Early archs did not consider fluting important at first [perhaps because didn't know enough about knapping?], but soon began to speculate about its purpose. "Bayonet blood groove," hafting improvement, technological evolution in non-functional direction? Figgins considered arrowheads, Kidder suggested atlatl. Possible cache near site probably work of McCormick [which would document his activity by 1930s]. Variety of stone used, including Alibates up to 256 km distant, Tecovas jasper 200-375 km, others. Good illustrations of points. Breakage patterns considered and how points break, but "I only consider hand-thrown vs thrust, as the presence of atlatls in Paleoindian times is unresolved" [which makes the whole discussion a waste of time as they were almost certainly on atlatl darts, although we probably can't tell the difference between thrown and thrust from the points, and bending breaks do NOT "imply someone had a firm grip when the point broke."]

Meltzer, David J.

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2009 *First Peoples in a New World: Colonizing Ice Age America.* University of California Press, Berkely.

[Generally excellent, I used it as a class text, detailed, readable, thorough coverage of state of the science. Meltzer conveys the two main stories, Discovery of America by Paleoindians, and Discovery of Paleoindians by Science in a nicely dramatic way with lots of stories of discovery and personality. He generally gives both sides of an argument and treats the controversies fairly, but his biases are perceptable too. He thinks Clovis Pleistocene overkill is an extinct theory, while making some strange and incorrect arguments against it, considers Monte Verde the pre-Clovis clincher in spite of multiple quotes about how strange it is, and scoffs snidely at any Solutrean connection.]

[Most of his technical information is very good, but his paragraph explaining atlatls (296) describes them poorly, and incorrectly claims that the spear 'flexes and stores energy, which is then explosively released, flying from the atlatl at velocities that can average 135 km/hr and exceed 200 km/hr" which is 85-125 mph – way too fast, outside atlatl capability which is under ca 90 mph. And repeats claim of 'throw a spear completely through a man armed with a coat of mail. No sources cited for any of this]. Atlatls don't preserve, "unknown from Paleoindian times." Circumstantial evidence from Hutching's fracture velocity studies.

Meltzer, David J.

2015 Kennewick Man: coming to closure. Antiquity 89(348):1485-1493.

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Brief summary of K and controversy, and the resulting study and book. Stone dart point in hip could reflect violence or hunting accident. Then discusses the DNA info in which he was involved. DNA clearly shows Native American ancestry, and similarity to Colville tribe, one of NAGPRA claimants, among very few modern comparative samples. Skeletal differences from modern NA populations probably reflect sampling problems of single individual. At conference announcing DNA, tribes stated intent to rebury. [Meltzer neglects to point out that if there had not been the lawsuit and subsequent study, K would have been thrown away immediately and none of this info would have been produced.]

Mendoza, Ruben G.

2007 Aztec Militarism and Blood Sacrifice: The Archaeology and Ideology of Ritual Violence. In *Latin American Indigenous Warfare and Ritual Violence*. R. J. Chacon and R. G. Mendoza eds., pp.34-54. University of Arizona Press, Tucson.

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Revisionist efforts attempt to refute accounts of Aztec sacrifice as "racist, colonialist" etc. But our understanding of large-scale sacrifice is not based only on Spanish accounts, also arch evidence of ritual violence - experiments in heart excision, serological study of deposits, forensic analysis of skeletal remains, including numerous sites with evidence of peri-mortem mutilation and cannibalism, 170 crania from tsompantli skull rack at Tlatelolco associated with stone tools used to prep heads, etc.

Mensforth, Robert P.

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2007 Human Trophy Taking in Eastern North America During the Archaic Period: The Relationship to Warfare and Social Complexity. In *The Taking and Displaying of Human Body Parts as Trophies by Amerindians*. Richard J. Chacon and David H. Dye, eds., pp. 222-277. Springer, New York.

Suggests a 'proximity model' for trophies – more taken if victim close to taker [a schlepp effect for human body parts! Cites Friederici 1907 Scalping in America, but doesn't acknowledge schlepp idea.]

Examples of burials with scalp or mutilation cut marks. Embedded proj pts mentioned but no pics or discussion. Indian Knoll and Carlston Annis burials show scalping and mutilation, decapitation, often assoc with violent death (proj pts or skull fracture) including child. No clear trophy specimens, but human bone artifacts. Other Archaic sites, including Frontenac Island and Windover. [Lots of evidence among Archaic groups all over].

Mera, H. P.

1938 Reconnaissance and Excavation in Southeastern New Mexico. *Memoirs of the American Anthropological Association* 51. Washington, D.C.

[Not very useful.] Sketchy report of finds in caves in drainages in Guadalupe Mountains. 1 whole, 1 fragment atlatl. Basketmaker type, loops missing, no evidence of weights, nock not described but looks like groove and flush hook mixed type. [Poor photo.] Dart foreshafts with and without stone point or slot.

Merbs, Charles F.

1983 *Patterns of Activity-induced Pathology in a Canadian Inuit Population*. Archaeological Survey of Canada, Paper 119. Ottawa: National Museums of Canada.

Reconstructing activity from skeletal arthritis and ethnography. Suggests elbow and shoulder joint damage from throwing harpoons with and without throwing board. Complicated by other activities such as hide scraping (females), bow and arrow use, and dog sled driving.

Meredith, D. R.

1986 The Sheriff and the Folsom Man Murders. Avon Books, New York.

Novel. Obnoxious archaeologist is killed with atlatl and Folsom point as he reopens "original Folsom Man site." Suspects include collector/hotel owner, the hero's deputy, a cult of Folsom imitators living in a cave with their charismatic leader, the senior archaeologist, his graduate student, and others. [Badly written incoherent mystery, with too much soap opera and little in the way of logic. The archaeology is not really wrong, just slightly off, eg. atlatls described repeatedly as "lethal up to 300 feet," no realistic idea of site or archaeological procedure, site as well as culture repeatedly called "Folsom Man site," etc. Meredith probably has no real experience of atlatls or archaeology, but has hit on one interesting question that figures in the plot - an atlatl "balance stone" is claimed as evidence that "Folsom Man" used atlatls. This passage p76-77 is characteristic]: "Dr. Hagan sighed...'It's a polished stone fastened to an atl-atl as either a weight or a fetish. Personally, I think it was used to give an atl-atl greater throwing power. Still, some belive it was a fetish stone, strictly for ceremonial reasons. Any time archaeologists can't decide the purpose of an artifact, they call it a ceremonial object. We've assigned so many ceremonial objects to the primitive American that he'd have had to spend twelve hours a day practicing his religion to use them all... If there is a balance stone connected with a Folsom Man site and found in the same stratum, then that would go a long way toward proving that he had developed the atl-atl.' Dr. Hagan looked aghast. 'Important! Young man, was the development of the atom bomb important? The atl-atl was its primitive equivalent. A tall, strong hunter may be able to throw a spear fifty to seventy-five feet. A dart thrown with an atl-atl may travel two hundred to three hundred feet and still be lethal...."

Merritt, Jim

1993 Atlatl Renaissance. *Field & Stream* September 1993. Accessed 2/2002 BPS Engineering web page http://www.atlatl.com.

Account of Montana Mammoth Hunt event, focus on Bob Perkins of BPS Engineering,

who has been making and selling atlatls for 7 years as his sole source of income. Says he makes "hundreds" every year. Describes his theory of atlatl weights as timing oscillation of atlatl and dart, and as silencer.

Mertz, Ron

2007 Hunting for Small Game with an Atlatl is Now Legal in Missouri. *The Atlatl* 20(2):7.

Official notice if changes to Wildlife Code appeared in Missouri Conservationist Feb 2007. [result of major lobbying and educational effort by Ron, Ray, and others].

Mertz, Ron

2010 Atlatl Deer Hunting In Missouri. The Atlatl 23(3):4.

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MO Dept of Conservation allows trial atlatl hunt during Fall 2010, in firearms season.

Mertz, Ron

2011 Results of Missouri's First Atlatl Deer Season. The Atlatl 24(1):12.

11 hunters reported, no deer taken. Hope to move from gun season to bow season next year.

Mertz, Ron

2011 Experiencing Missouri's First Atlatl Weapon Deer Season. *The Dart*, April 2011:15-16.

Mertz, Ron

2011 Report from Missouri. The Atlatl 24(3):13.

Events and publicity. MO Dept of Conservation approves atlatl for hunting during deer archery season starting Fall 2012.

Mertz, Ron

2012 Results of Missouri's 2011 atlatl deer season. Unpublished ms.

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From Ron's survey -2 of 15 known atlatlists who hunted the 2011 fall firearms season succeeded, L Boenker, S Rorebeck. Interview accounts from both. Survey of atlatlist dart material, length, head, and atlatl form for 15 atlatlists. Table also days hunted, stand or not, times deer were in range, number of throws attempted, narrative accounts.

Mertz, Ron

2012 Two Atlatlists Harvest Deer in Missouri. *The Atlatl* 25(1):12.

Luke Boenker (from stand) and Scott Rorebeck (on ground), during second legal season

in MO, first successes. 15 hunters replied to RM survey.

Mertz, Ronald E.

2012 History of Efforts to Legalize the Atlatl for Hunting Deer in Missouri. Electronic Document, World Atlatl Association webpage, URL:

Detailed history of lobbying efforts, with correspondance, leading to two hunters taking deer Fall 2011.

Mertz, Ron

2016 Missouri Atlatl Deer Harvest Fall 2015. The Atlatl 29(1):10-12.

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Paul Gragg got a record 15 pt buck from tree stand with broadhead [?], took up atlatl only this year. Eric Smith got doe with Clovis point from ground blind, has hunted with atlatl since first legal in 2010. Good pics of point on foreshaft – it broke in lung cavity, probably from fall. [Bending fracture.]

2016 A brief history of an ancient weapon and modern sport. Paper presented at Missouri Archaeological Society Fall Symposium, Van Meter State Park, MO, October 1, 2016.

Mertz, Ron

2017 The atlatl renaissance: a brief history. Missouri Archaeologist 78:27-481-9.

Rod Laird in schools WY 1980s, events led to WAA founding 1988, 1989 75 charter members. Major contests: ISAC, European Round, 3D animal targets, Moche Toss. Hunting, legalized in MO after long process. Still legal only in AL, MO, and NE. In MO at least 5 atlatlists have taken 6 deer – challenging. Research uses.

Mestas Camberos, Lorenza Lopez, and Jorge Ramos de la Vega s 1998 Excavating the Tomb at Huitzilapa. In *Ancient West Mexico: Art and Archaeology of the Unknown Past.* R. F. Townsend, ed., pp.52-69. The Art Institute of Chicago.

Unlooted shaft tomb under platform, 2 chambers, 6 burials, interp as ruler with family (shared congenital vertebral anomaly), not sacrificed, but died earlier and preserved. Lots of pots, shell, other goods. Principle burial in main chamber and another male in 2nd have atlatl loops and hooks at R hand [but no details, not visible in photos or plans. Interpretation focused on fertility symbols, neglecting possible war/sacrifice suggested by atlatl parts.]

Metcalf, Harlan G.

1974 Whittlin', Whistles, and Thingamajigs: The Pioneer Book of Nature Crafts and Recreation Arts. Stackpole Books, Harrisburg.

[This guy should get credit as one of modern atlatling's forefathers.] Brief introduction,
historical and ethnographic mentions. Considers Australian [central desert scoop woomera] form to be best type. Good photos of W. Australian throwing long spear. Kuikuru South American type recommended as easier to make [good photo]. Instructions for making simple cane spear and Kuikuru atlatl [but his are way too thick]. Recommends games, including atlatl golf. "With officially established dimensions for spears and spearthrowers of different groups and with official rules, this sport could become a popular and beneficial interscholastic and intercollegiate athletic event." Can use atlatl for fishing.

Cordage, basketry, slings, bow and arrow and other things also covered.

Metcalf, Harold

2002 Ancient Spear Slings in Brazil. The Cast Spring 2002: 18.

Wauru' and Karaya tribes, mostly sport and ritual now. Photos: hour-glass form handle with index finger hole, on rod, with lashed on hook, feather decoration. 22-24 inches long.

Metreaux, Alfred

1949 Weapons. In *Handbook of South American Indians*, vol 5, Julian H. Steward, editor, pp. 229-263. Bureau of American Ethnology Bulletin 43. Smithsonian Institution, Washington D.C.

Survey of types and distributions of bow, arrows, pellet bow, blowgun, sling, bola, club, axe, dagger, spear, shield, and spear thrower.

Spear throwers known in Peru from Inca and earlier. All South American spear throwers belong to male type. Three main categories known: 1) Ancient Peru and Ecuador, 15-24 inches, lashed on hook in groove, second hook at handle for index finger grip. Hooks of stone, bone, shell, copper in effigy forms. Similar in Argentina. Taino had similar: fish bone hook, braided loop at handle. Jivaro: straight stick with lashed on hook. 2) Round wooden stick with handle widened to allow hole for forefinger, attached hook. Ancient Peru, modern Caraja and Xingu River tribes. 'Amazonian ' type. Among Xingu, displaced by bow, but still used in games and dances. Upper Amazon versions seem to be thick boards with pit for forefinger or split bamboo, used for war and turtle hunting. 3) Tapering piece of wood with deep groove, horizontal peg hook attached to narrow end. One specimen, 17th C E Brazil. Mouth of Rio Plata probably southern limit of spear thrower. [No useful illustrations of any of this.]

Meyer, Hermann

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1898 Bows and Arrows in Central Brazil. Smithsonian Report for 1896, 549-590, plates LVI-LX. Reprint 2014 HardPress Classics Series.

Distributional interests. Defines 5 groups of bow types, several types of fletching, describes some specimens. Detailed drawings of bow string ties and arrow fletchings.

Michlovic, Michael G. and Dean T. Sather

2007 Lithic Artifacts from the Early Archaic Component. In *Archaeology and Paleoeinvironment at the Rustad Site (32RI775)*. Edited by M. G. Michlovic and Garry L. Running. *Plains Anthropologist* 50(196) Memoir 37:135-158.

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North Dakota site with some Woodland and Paleo, mostly early Archaic features with lithics and bison bone. Mostly Swan River Chert, possibly heated, some Knife River Flint, others. Size grading (after ¼ inch screens) show similar distribs for all materials. Sullivan and Rosen categories used [which of course they have to interpret with other information since they are useless. For example:] lots whole flakes = core reduction (cores also present) but also many very small, probably from pressure retouch and finishing of tools. Small mediocre points with wide side/corner notches, ovate blades (Logan Creek/Mummy Cave types), also some unnotched triangular points [which are likely to be unfinished]. Points small, Nasseny and Pyle 1999, Shott 1997, Thomas 1978 criteria would class most as arrow points. Hughes 1998 would interpret most as light pts for fletched atlatl darts, but some rather small.

Miklashek, Greeley G.

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2013 Gravettian Venus Figurines and Other Ice Age Artifacts. Electronic document, URL: <u>http://www.gravettianvenusfigurines.com/</u> accessed Feb 11, 2014.

Artifacts reputedly found in Germany and France before 1916, circulated among U.S. collectors including E. Townsend, G. Heye, and C. Caldwell, acquired by Miklashek. Some have apparent museum labels: AN 38 BERLIN GOTTIN [Göttin = goddess] and further labels with CC E2 VENUS EX HEYE or Townsend 1874 (or other number). Some supposedly found in railroad cutting near Berlin turn of century. Include 8 'Venus' figurines, some handaxes, and two atlatls, both complete.

1. Woomera shaped - but tapered to proximal point, with a single finger hole in center. Ivory? AN38 BERLIN and Townsend 1507 labels. Carved near distal end on underside with a reindeer [can't see antlers clearly] and upper side with auroch. Hook is a little nubbin. 2. Labels: GOTTIN AN 31 and CCE 122 Paleolithic Spearthrower Ex Heye Ex Townsend [or Johnson] Ex Lewin [?] Form is more like Upper Paleolithic spearthrowers, straight shaft with an oval hole in proximal end. Distal half is carved with two horses head to head, front feet laid on chest, hind feet of distal one up in air, its penis as hook. A tuft of "unknown animal hair" is attached as a tail [which would not have survived in any real Paleolithic archaeological context].

[These are all unquestionably fakes. They are all absolutely perfect and undamaged, and the Venus figurines have far more detail of hands and especially genitalia and breasts than on others. The atlatl carvings are rather clumsy, especially No 2. In other words, they look like what a good faker in early days of Upper Paleolithic archaeology would create to meet the expectations of the time, especially exaggerating the sexuality and the steatopygia of known finds. I think atlatl No 2 is also not intended to be an atlatl, but a handle, with the horses as grip, and the hole as tool or 'baton percé'. Miklashek's webpage defends all of these on the grounds that we don't have enough documented specimens to be sure that they

are not stylistically consistent, and perfect finds do occur. True, but they sure look fake to me. If it is 'too good to be true' it usually isn't true, and oddities like the hair tail are a pretty clear tip-off.]

Mildner, M. P.

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1974 Descriptive and Distributional Notes on Atlatls and Atlatl Weights in the Great Basin. In *Great Basin Atlatl Studies*, R.F. Heizer, M. P. Mildner, and L. Spencer eds., pp 7-28. Ramona: Ballena Press.

[Good compilation of 11 Great Basin atlatls with references, although some descriptions incomplete.] Atlatl weights also described. Considerable variability in forms, but many related to SW atlatls with "mixed" form of integral hook, often with groove. Also forms with attached "male" hooks. [He seems confused about "female" form of atlatl.] Roaring Springs I, Oregon: integral male hook, 2 finger notches, apparently no loops, 70.5 cm long, max W 7.2 cm., red ochre paint.

Roaring Springs II: integral male hook, 2 finger notches, apparently no loops, 57.2 cm long, max W 5.0 cm, max T 1.6 cm., red ochre and white dots.

Plush Cave, Oregon: integral hook and groove, finger notches, lacking loops, 54.5 cm long, max W 2.3 cm, max T 2.1 cm.

Lovelock Cave, Nevada: groove, missing hook (maybe attached type), finger notches, but unusual grip, 45 cm long, max W 4 cm. Similar to Potter Creek Cave atlatl. [but NOTE measurements taken from drawings and replica of now lost specimen] Also 3 fragments, all "mixed" type.

Lake Winnemucca, Nevada (Harrington 1959, Hester 1974): [BM type w strange hook] grooved and notched for attached hook, finger notches with leather loops, antler flaker on proximal end, 56 cm long, max W 2.5 cm, max T 1.25 cm.

Lake Winnemucca, Nevada, NV-Wa-197 (Hester 1974): male attached bone hook, unnotched grip, 58.1 cm long, attached large boat shaped stone weight. [This is the one Perkins copies, aka Nicholarsen Cave, see Allely 1992]. Believed >8000 years old.

Hogup Cave, Utah (Dalley and Peterson 1970): integral hook and groove, single finger loop of rawhide, 56.5 cm long, max W 3.5 cm, max T .45 cm, attached stone weight. Also 3 fragments, apparently mixed type with finger notches.

Council Hall Cave, Nevada (Hester and Mildner 1974): flush integral spurs with groove [he calls it female, but it's not.]

Kramer Cave, Nevada: (also at Lake Winnemucca), groove with raised integral hook, flattened spatulate form with two sticks bound along side the proximal half, [he thinks might have supported dart, I don't see from his picture how that would have been possible, they're just to strengthen or stiffen.] Missing handle of proximal end, 38.1 cm long, max W 2.0 cm, max T 1.1 cm. Associated with contracting stem point and several foreshafts, one 59.0 cm long, dated C14 to 3,720 + 100 B.P.

Last Supper Cave, Nevada: groove and flush integral hook, missing grip, notched to attach weight.

Discusses atlatl weights and spurs. Spurs w C14 dates back to 6360 ± 400 BC [uncal], foreshaft from Leonard Rockshelter dates 7038 ± 350 BP [uncal]

Milks, Annemieke, Stephen Champion, Elizabeth Cowper, David Parker, Matt Pope, and Debra Carr x

2015 Human performance trials in spear thrusting and throwing: the mechanics and biomechanics of early weapon systems. Unpublished poster presentation, posted on Academia.edu.

Trials described [but no resulting data]: 11 bayonet-trained thrusters with replicas of Schoningen II spear, 6 male javelin athletes. [No detailed results given] UC London, "Steve Backley National Throws Centre."

Milks, Annemieke, Stephen Champion, Elizabeth Cowper, Matt Pope, and Debra Carr x, p

2016 Early spears as thrusting weapons: Isolating force and impact velocities in human performance trials. *Journal of Archaeological Science: Reports* 10:191-203.

Thrusting replicas of Spear II from Schöningen into ballistic gel. 2 shafts joined to tips with aluminum caps containing load cell measurement device. Masses of 1204-1258g in range of 55 ethnog wooden spears in museum collections and other data. 11 males trained in military bayonet use, each thrust at least 3 times (N thrusts = 38), depth of penetration, impact velocity measured. Impact V 2.8-6.26 m/s, ave 4.65 m/s. Force 362-1120 N, ave 661 N. Some participants produced double-peak forces, because pushed with body at end of thrust. Impact V did not correlate well with peak force, or with body size. Some comps to a limited range of other stabbing studies, knife, one-hand spear, etc. Velocity documented here not good fit with experiments using calibrated cross-bows or estimates – all either too low or too high. Force sim to Conolly et al. 2001 (comparing diff spear grips) results for one-handed spear thrusting at plywood. Ours may be biased low by particips needing to avoid damaged areas of gel. Biomechanically complex, great deal of variability shown in previous stabbing, thrusting, slashing studies such as body mass, technique, learning curve, weapon form, material, target material. Thrusting spears are not projectiles, mechanics differ, so should be reflected in experimental replication. Body mass is behind thrust. Deceleration happens after contact, but pushing force continues. Velocity measure alone does not replicate thrusting mechanics, so cross-bow etc is inadequate, other mechanical means of experimental control may be better, this study provides V info.

Milks, Annemieke, Rob Dinnis, and Matthew Pope

2016 Morpho-metric variability of Early Gravettian tanged "Font-Robert" points, and functional implications. In *Multidisciplinary Approaches to the Study of Stone-Age Weaponry*, edited by Radu Iovita and Katsuhiro Sano, pp. 135-146. Springer Science and Business Media, Dordrecht.

Tanged tools on blades, usually assumed projectile points. But high variability does not support use with a 'complex' weapon system, rather multiple uses including simpler

throwing or thrusting spears, knives.

Miller, Doris I. and Carolyn F. Munro

1983 Javelin Position and Velocity Patterns During Final Foot Plant Preceeding Release. *Journal of Human Movement Studies* 9:1-20.

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For coaching feedback, 27 throws filmed at up to 200 fps.

Running approach 30-36 m or 10-12 steps, then 3-7 step transition; final step begins as land on R foot while leaning slightly back, L foot swings through as hips rotate forward, L foot plants, jav released. During L foot plant .12-.15 sec, jav given 60% of its final velocity. Release velocity ca 30 m/s [ca 67 mph or 98 ft per sec]; world record distances 94-96 m.

Miller, Doug

2002 Copper Tipped Darts. The Atlatl 15(3):1-2.

Old Copper Culture points from Midwest, probably used because more durable than stone. Two major styles: flat, shaped like stone points [with tang or notches] and conical (most common). Conical easier to make, protects end of shaft.

Miller, George 2017 Building an Atlatl and Dart. Ringbound book, privately produced and distributed.

Instructions for simple wooden atlatl with integral hook and attached handle with dart rest. Bamboo darts with antler insert at nock. Photos of family using atlatls, including Hunter Miller age 4 yr.

Miller, John J.

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2006 Throwing Sticks of the Stone Age. The Wall Street Journal January 18, 2006: D13.

Pretty good article, quoting M. Waters, G. Fogelman, M. Takoch, R. Vanderhoek. B. Perkins, J. Rowe, mentions WAA, possible PA legal hunting.

Miller, Michael J.

2000 A Study of Lithic Biface Manufacturing Traces in the MacCorkle Bifurcate Tradition of Ohio: Investigation into the Atlatl and Dart System. Unpublished paper for N. Kardulias class at Wooster College, available on net http://pages.wooster.edu/millermj/is/index.htm (Jan 2001)

Replicated MacCorkle points, tried deer hunt with atlatl, [limited experiments, rather vague conclusions]. Notes presence of "impact beveling" – beveled edges created or maintained by dart spin as strikes earth. [I think unlikely]

Miller, R., E. McEwen, and C. Bergman

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1986 Experimental Approaches to Ancient Near Eastern Archery. *World Archaeology* 18(2): 178-195.

Replicated Egyptian compound bows. Velocities for spear thrower (23 m/sec, African simple bow 35 m/sec, two E compounds with light reed arrows 43, 47 m/sec [51, 78, 96, 105 mph].

Mills, Tom o 2004 The Atlatl's Television Debut! *The Atlatl* 17(4): 1-4.

Mills consulted with Discovery Channel program "L.A. 10,000 BC" airing 10/31/04. Instructed 3 "stunt actors". Simple atlatls, bamboo darts, Clovis pts, penetration demo on side of beef and elephant hide.

Mills, Tom o 2007 Atlatl 3-D Hunter! *The Atlatl* 20(3):1-4.

Archery tournament with atlatl: fun, spread info, practice for hunting, recruit allies. How to persuade archery groups to let you in. Making atlatl equipment "archery friendly" (smaller points).

Mills, Tom o

2008 Making the Rivercane Dart. The Dart August 2008:7-10.

Good detailed instructions with photos.

Mills, Tom o 2009 Making a Rivercane Atlatl Dart. *The Atlatl* 22(2):1-7. Or electronic document <u>http://basketmakeratlatl.com/?page_id=534</u> accessed August 24, 2018

The online version in particular has lots of detailed good instructions and many photographs for straightening with heat, lashing, making foreshaft, fletching.

Milner, George R.

2005 Nineteenth-Century Arrow Wounds and Perceptions of Prehistoric Warfare. *American Antiquity* 70 (1): 144-156.

Do a few skeletons with wounds indicate pervasive warfare? Milner uses Indian War medical data, mostly reported by military surgeons. Problems with data include under-report of superficial bone damage, and individuals with minor wounds, although at least some are reported, as well as some victims dead before medical help. 248 injuries, 191 victims, mostly from the 1860s and 1870s, Plains and SW. Ca. 75% survival, 1/2 of actual deaths were immediate. Ca. 51% wounds in body, 12% head/neck, 27% arm, 10%

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leg. Compares to more recent Papua New Guinea info on arrow wounds; somewhat different proportions of body part distributions explained by circumstances. In Indian War data, ca. 30% struck bone. One CA skeleton had 4 of 16 associated points in bone, used by some to suggest a 1 in 4 measure; Walker estimates that arrows into front of human body have 50% chance of hitting bone.

Coues 1866:323 "when the [stone] head impacts on bone – and it generally transverses soft tissue until halted in this way – the chances of its shivering into bits vastly preponderate over the probability of its becoming fixed or glancing." Of stone points, 3/6 examples broke, 2 others detached from shaft. Most arrows reported had metal heads. Ca 11% of victims survived with pts remaining in bone. Milner data suggest ca. 3X as many deaths as observable skeletal wounds.

A few skeletons with injuries imply much higher rates of injury and conflict. Civil War also shows that relatively low casualties can reflect huge social upheaval.

Milner, George R., George Chaplin, and Emily Zavodny o,p 2013 Conflict and Societal Change in Late Prehistoric Eastern North America. *Evolutionary Anthropology* 22(3): 96-102.

Habitation and mortuary sites - palisades and victims of attacks indicate varying intensity of conflict thru time + space, attributed to changes in pressure on resources arising from changes in local pop density, technol innovations, and environment.

Middle Woodland peace, few injuries, reliance on native cultivars.

Rapid adoption of bow mid 1st mil AD - lots bodies with arrowheads, but shifts in hunting more important than war - aggregation > pressure on resources, so maize became important, bow allowed pick off small game in gardens to improve diet, and hunt further when local deer pops wiped out.

End 1st mil - Mississippian hierarchical groups, leaders involved in war, giving competitive edge over less complex groups. Palisades common. Elsewhere less centralized groups persist. Map distribs of palisades and victims 11-1200, 13-1400, and 15-1600, and pop at 1500. All areas suffered from climate changes at end of prehistory (1400-1500).

Usual patterns of warfare all over: common ambushes (e.g. Norris Farms burials), and occasional massacres (e.g. Crow Creek). Social change complex, can't just blame bow, wide use in L Wdlnd, but already end of peace in mid Wdlnd, bow adoption for many reasons - war, shift in subsistence and settlement. Bingham theory not work here: bow 2000 yrs after increase in native cultigen use, predated by several 100 yrs equally rapid shift to maize. Bow post-dates M Wdlnd complexity, and predates Mississip, so not responsible for either. Bow appearance followed by rise in bodies with arrowhds, but 500 yrs before such conflicts threatening enough for rise of defended settlements.

Minelli, Laura Laurencich

1993 I due antichi atlatl messicani del Museo Nazionale di Antropologia e Etnologia di Firenze. *Archivio per l'antropologia e la etnologia* 123: 391-403.

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"Two Ancient Mexican atlatls in the Firenze Museum" [Italian, English abstract] One 8040 is Aztec with Mixtec influence, depicts "mystical religious matters" other 8039 vice versa, depicts "history of Mixtec lords who lived from 1053 to about 1339". Appendix analyzes gilding, may be European addition. 8039 is a bizarre double atlatl with paired grooves and hooks. Drawings of design [too small] and dimensions given.

Miniter, Frank

2014 Chasing Speed. *Outdoor Life* online <u>http://www.outdoorlife.com/features/chasing-speed-fastest-compound-bow/</u> accessed June 2015.

Modern compound bow speeds - close to max possible without technological breakthrough: 330-350 fps, is 400 fps attainable? Not currently. Info on evolution of compound bows and speed, current hot brands.

Missouri Department of Conservation

2016 Frogging Season Begins June 30 at Sunset. *Conservation Federation: The Voice for Missouri Outdoors* 77(4):33.

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atlatl is listed for frogging with a fishing permit or small game hunting permit [I guess included because now officially legal for small game in MO]

Moctezuma, Eduardo Matos

1990 *Treasures of the Great Temple: Art and Symbolism of the Aztec Empire*. Alti Publishing, La Jolla.

[Fine photo book.] Good images of tzompantli, urn with Tezcatlipoca carrying atlatl, carved obsidian urn and other objects, personified tecpatl (sacrificial knife) chert biface with teeth and eyes glued on, skull mask with biface nose, carved stone deer head with solar dart and cloud - these three items found repeatedly associated [the dart point is similar to those shown in codices - triangular with flaring triangular stem]. And many more objects.

Mohapi, Moleboheng

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2007 Rose Cottage MSA Lithic Points: Does Technological Change Imply Change in Hunting Techniques? *The South African Archaeological Bulletin* 62(185):9-18.

Rose Cottage Cave in S Africa, two types Middle Stone Age points – broad thick points from post-Howiesons Poort layers, ca 50k BP; and narrow thin Dc points from final MSA layers 31-29k BP. Scrapers and points most common retouched tools, made on opaline.

Thick, broad pts 23-76 mm long, 4-11 thick, 15-32 mm broad [small Levallois and Mousterian pts in form]. Dc pts 12-27 mm L, 1-2 mm T, 5-10 mm W [ovoid unifacially trimmed flakes in form]. [He never gives weights].

Thick pts strong for repeated thrust or "hand-delivered" comparable to N. Am. spear pts like Clovis and other pts people think are spears. Larger than spear-thrower dart tips. Impact scars and bulbar thinning = hafting and projectile use. DC pts small like Euro Mesolithic arrows. Large pts imply large animals, group hunting. Small pts imply smaller game, more individual, less return but less risky. [Spear-throwers mentioned but not considered.]

Moholy-Nagy, Hattula, and John M. Ladd

1992 Objects of Stone, Shell, and Bone. In Artifacts from the Cenote of Sacrifice, Chichen Itza, Yucatan: Textiles, Basketry, Stone, bone, Shell, Ceramics, Wood, Copal, Rubber, Other Organic Materials, and Mammalian Remains. Edited by Clemency Chase Coggins, pp. 99-152. Peabody Museum of Archaeology and Ethnology, Harvard University, Cambridge.

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p 120 frag of carved shell atlatl finger loop, two serpent heads. Proximal attachment ends missing.

Montell, Gösta

1937 De etnografiska undersökningarna. Ethnos 2(4):300-318.

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[In Swedish. Mexican ethnology. Includes poor drawing of British Museum Aztec atlatl, Patzcuaro atlatl, others.]

Montoya, Donald G.

2008 Hidden Village (42Sa2112): A Basketmaker III Community in Montezuma Canyon, Utah. Unpublished MA thesis, Anthropology Dept, Brigham Young University.

Large villages [well, only up to maybe 20 families...] developed in BM III, earlier than often suggested. GIS info used to argue that HV is one: clusters + stone circles, probably pithouses, maybe up to 30, with assoc middens, and possible community pithouse. Close to 4 other sites. P 74: "Clustering of residences and presence of public structures at BMIII sites suggest complex social organization beyond band level." [He concludes from comparing layout to excavated large BMIII sites, but his data are weak here: only surface work on a looted site, number of pithouses poorly defined, no precise dating, etc. Important because at this site is fine petroglyph panel (not mentioned) including atlatl images - so either there is a BMII component, or atlatls continued into BM III, or...].

Moody, Bill o

2010 Some New England Bannerstones. Indian Artifact Magazine 29(4):74-75.

Photos, mostly slate, variety of forms, mostly winged.

Moore, Clarence B. xo 1916 Some Aboriginal Sites on Green River, Kentucky. *Journal of the Academy of Natural Sciences of Philadelphia* 16: 431-509. (Reprinted 2006 Gustav's Library, Davenport IA).

Reports on burials from "The Indian Knoll" and other sites. Most attention to antler hooks and bannerstones, interpreted tentatively as "netting needles and mesh spacers", experiment shows they work. Atlatl theory considered, but: 1) no definite evidence of atlatls in area 2) atlatl should be one-piece for strength, 3) no points associated [not true, he reports lots of points from burials, including antler point in bone] 4) some crooked or have too small a hole, 5) if hooks are atlatl hooks, what are the stone "spacers" that are found with them for? Full scale photos and plates of hooks and bannerstones, [but no burial photos showing position of atlatl parts.] Shell weight described [but not recognized as similar to bannerstones.]

Moorehead, Warren King

1899 *The Bird-Stone Ceremonial: Being an Account of some Singular Prehistoric Artifacts Found in the United States and Canada.* Allen I. Vosburgh, Saranac Lake. (reprinted 2003 by The Relic Room and Knife Shop, Pigeon Forge).

Pamphlet, 31 pages, apparently aimed at collectors. Describes and illustrates some specimens, speculates on distribution and assumes a ritual or decorative function. [Not very useful even in 1899.]

Moorehead, Warren K. s,B

1910 *The Stone Age in North America*, Vol 1. Houghton Mifflin Company, Boston and New York.

A large section on bannerstones and related forms, referred to as "problematical forms," "winged objects," and the like. Photos of unfinished specimens. Evidence that some were worn as pendants or gorgets. Not shuttles because "It has always seemed to me ridiculous to claim that the prehistoric peoples made use of objects, on which a great deal of time and hard labor were spent, for ordinary purposes." (410) Rare in burials and mounds, probably earlier than mounds. Probably used by shamans.

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Moorehead, Warren K.

1917 Stone Ornaments Used by Indians in the United States and Canada: Being a Description of Certain Charm Stones, Gorgets, Tubes, Bird Stones, and Problematical Forms. The Andover Press, Andover. (Reprinted 2005, Gustav's Library, Davenport, Iowa.).

[Title tells it: bannerstones etc viewed as ornaments and "problematical," but with a few more interesting notes. All outdated, but nice illustrations.]

C.H.Forbes produced Latin names like 'geniculate' for classif system. Manuf by peck and grind, drilling. Bar, bird, and boat forms = amulets. Birdstones mostly OH, NY, IN, MI, WI, Canada. Prob pre-mound. Winged objects [bannerstones] important because often repaired, well made, with dead. Unfinished 'bipennate' reused as hafted hammer by historic Inds. Bottle and tube forms = shamans' tubes.

A. C. Parker chapter: Bannerstone breaks p 193: some struck, others broken by "internal pressure of shaft" Experiments with bs on end of light spear as fletchings – added 25% to distance thrown [I don't believe it], breakage by jamming shaft in when struck tree. Purposes of bs p 194: "portions of more complex implements" works in expers as flywheel on drill or spindle, symbolic connections to fire drill and war club.

Moore bannerstone examples from Indian Knoll color plates. [Moore quoted at length on netting needle and spacer theory, arguments against atlatl theory.] But why make utilitarian objects so elaborate? Must be ceremonial.

Quotes G.B. Gordon (1916) – bannerstone as whale and axe symbol. G. H. Pepper communication p 379: Moore's bannerstone and hooks probably joined by shaft, found near head of burials, used as hair ornament (sketch).

Unique and fraudulent forms shown, but some, e.g. Powell and Mason expected copper, fine pipes, etc from mounds to be work of Euros. Now know better, so fine work and unusual forms not necessarily frauds.

Author's favorite theory: Bipennate or winged forms may be thunderbird effigy parts (sketch showing bannerstone on shaft with fancy [non-existent] bird head and tail added made of perishable material). More likely than whale, which would not be familiar to inland Indians. Thunder-bird is ubiquitous in Indian lore. Fewkes papers show combination of wood, stone, feathers was common in ceremonial artifacts.

Morel, Philippe

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2000 Impacts de chasse et archéozoologie: Quelques observations expérimentales. In *La chasse dans la Préhistoire/ Hunting in Prehistory, Anthropologie et Préhistoire 111*. C. Bellier, P. Cattelain, and M. Otte eds., pp. Societé Royale Belge d'Anthropologie et Préhistoire, Bruxelles.

[In French. "Impacts of the hunt and archaeozoology: some experimental observations."] Bow + stone pt arrow, and bone tipped atlatl dart damage on goat carcass bones, defining different types of damage.

Moreno, Enrique Alejandroo2016 Hunting technology and prepared landscapes in the south-central Andes. *Lithic Technology* 41(4):268-292.

Camelid hunting, points indicate weapons used, modification of the landscape with 'trenches' or small stone blinds to allow ambush or disadvantage hunting. Antofalla

Valley survey, 192 pts, only 13 complete. Basalt/andesite from valley sources or obsidian from next valley ca 15 km, and 60 km.Thomas/Shott model to assign pts to weapon type, modified by Ratto. Shift from thrown spears to atlatl ca 5000 cal BP, small triangular arrow pts much later, decreasing in size to Inca period.

Moreno, Teresa K.

2000 Accelerator Mass Spectrometry Dates from McEuen Cave. Kiva 65 (4): 341-360.

Rock shelter, SE Arizona, badly excav (Cummings) 1930s, then looted, material in ASM. Preceramic burials (Cienega Phase of Late Archaic-Early Agric period, 800 BC - 150 AD) plus Pueblo occupation.

Complete atlatl, assoc w adult burial in twined bag (also dated). Intact but very warped, possibly ironwood. Surface polished, red pigment traces. L 70.2 cm, W 2.4 cm, T 1.3 cm, slight taper distal to prox. Heart shaped groove 12 cm L, flush integral hook, rounded triangular dist end. Handle rounded, covered w pitch, notches w simple hide strip loops bound on w extensive wrap of yucca + human hair cordage. Small "charm" of skin + fur tied on w cordage. Sim to White Dog Cave specimen. Cummings also found a proximal frag [not described]. Refs for other SW + Gt Basin atlatls. Atlatl date on human hair from cordage $2355\pm65BP = 761-260$ cal BC. On twined yucca bag from same burial 2240 ± 55 BP = 400-180 cal BC.

Morris, Earl H. x

1925 Exploring in the Canyon of Death. National Geographic Magazine 48:263-300.

1923 AMNH expedition, Mummy Cave. Male burial with moccasins, buckskin sash, shell beads, spear thrower, flute, animal skin sack with pipe, bone tools. Basketmaker pithouses underlying masonry pueblo structures. Burnt cemetery pit. Much evidence of prehistoric grave robbing and disturbances.

1924 exped, "Burial of the Hands" severed arms with baskets, ornaments, and sandals. Old man with beads, baskets, sandals, pipe, flakers, "several spears, four handsomely wrought spear throwers, and three more flutes." "Basket Makers" preceded pueblos, "long headed people of medium stature...undergoing transition from nomadic to sedentary existence under the compelling influence of the cultivation of maize." "Three or more cultural periods intervened..." between BM and Chaco, including "roundheaded stock" beginning Pueblo culture. [Early outlines of SW chronology. Many photos, none of atlatls.]

Morse, Dan F. and Phyllis A. Morse

1962 A Critique of 'The Geniculate Bannerstone as an Atlatl Handle' by Orville H. Peets. *Tennessee Archaeologist* 19 (1): 20-24.

Experiments are <u>not</u> dead in archaeology. [Then gives trivial examples and acts as if experimentation is just to help classify artifacts]. How long did Peets spend on atlatls [Implying waste of time]. What did Peets prove? "Demonstrating an object can function

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does not mean a priori that it did so function." [The last is true but otherwise an obtuse discussion which misses the point of experimentation entirely]. Artifact names may be useful even if not reflecting function. European bow-guards differ from Am. gorgets, which are often found in chest area of burials. [Interesting example of early theoretical arguments about typology, function, and experiment.]

Morse, Edward S.

1922 Additional Notes on Arrow Release. Peabody Museum, Salem, Massachusetts.

A

Follow-up to his 1885 definition of 5 major holds for drawing and releasing arrows. Primary release: pinched between thumb and knuckle of forefinger like a child. Secondary: pinched, with addition of $2^{nd} + 3^{rd}$ finger drawing the string. Tertiary: As 2^{nd} , but with forefinger straightened. Mediterranean: no thumb, fingers pull string with arrow between 1 + 2. Mongolian: string pulled by thumb with ring, fingers bent over thumb. Surveys distributions: Mediterranean the usual modern form, goes back to ancient times, documented in medieval pictures, also occurs among American Indians and elsewhere. Form of arrow nock reflects release. Some ethnog accounts of shooting.

Morwood, M. J.

2002 Visions from the Past: The Archaeology of Australian Aboriginal Art. Smithsonian Institution Press, Washington D. C.

p. 164 illustrations of chronology of weapons in rock art, statement that prehistory of spears and throwers is known only from rock art. [Illustrations show a "spade-handled" woomera unlike anything I have ever seen.]

Mountford, C. P.

1941 An Unrecorded Method of Manufacturing Wooden Implements with Stone Tools. *Transactions of the Royal Society of South Australia* 65:312-326.

Pitjendadjara manufacture of woomera type atlatl using the adze stone which is often attached to the handle with gum. Stages: A. Cutting and splitting rough slab from living mulga (Acacia) tree, using local stones with natural sharp edges, and wooden wedges. The main stone was gneiss, weighed 7 lbs, abandoned after use. Took a couple hours, several men participated. B. Shaping and finishing. Removed bark and heartwood, using smaller unflaked stones (gneiss, 3 lbs), leaving it roughly finished. Then smoothed and flaked with adze stone in spear thrower handle, held and 30 degree angle and used with planing or scraping stroke, sometimes chopping. Adze stone retouched several times by "tapping with wooden blade of a spear to remove miniature flakes" while held in palm. Adze stone set into mass of spinifex gum with 1/8-3/16 " of edge projecting. Any flake of suitable size with a cutting edge, natural or knapped. Often stored in owner's hair! "Throwing peg" attached with gum and sinew, at about 30 degree angle. Whole spear-thrower rubbed with red ochre. Total time, 3-4 hours. [Diagrams and photos of process.]

Most important tool in their sparse material culture: serves as spear-thrower, cutting

tool, small dish, firemaking friction saw.

Movius, Hallam L.

1950 A Wooden Spear of Third Interglacial Age from Lower Saxony. *Southwestern Journal of Anthropology* 6(2): 139-142.

Summarizes German info. Site at Lehringen, valley of Aller River near Verden, in marls of mild interglacial climate. Yew spear, 2.40m long, tip sharpened and fire-hardened, found between ribs of extinct straight-tusked elephant. Also a few stone flakes. Pygmies hunt by spearing elephant and following until it dies; this could be similar. [Drawing of spear only, no details or photo of association with the elephant, or of workmanship – everyone accepts, but I wonder... For instance, why no other reported organic preservation?]

Mowrer, Kathy

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2006 Basketmaker II Mortuary Practices: Social Differentiation and Regional Variation. *Kiva* 72(2):259-282.

BM II 2000 BC - 500 AD. W concentration: Marsh Pass, Canyon de Chelly in NE AZ, Butler Wash-Cedar Mesa region SE UT. E concentrations: Navajo Reservoir NE NM, Animas R Valley near Durango CO.

Most burial goods reflect age, gender, economic roles, and personal achievement, as is consistent with band or tribal level of social organization. But some unusual burials known: 1. White Dog Cave female with atlatl + points (usually male goods) baskets, woven goods, digging stick (usually female), and dog, gaming piece, skin pouch, ceremonial wand (unusual). 2. Chief's Grave in Canyon de Chelly, male with 4 atlatls, antler wrench, flaking tools, shell necklaces, stone pipe, human hair, 4 flutes. 3. Cave 1 Kinboko Canyon SW of Marsh Pass, female with trophy head-skin on necklace thong, string apron, shell bead necklaces, stone pendant. But probably reflect achieved status.

Data from 391 burials [but problems of differential preservation and recording, for instance only 56 F and 81 M identified out of 180 adult burials.] Items grouped into subsets to counter this.

Results: gender not strongly marked by subsets, eg hunting subset (atlatls, bifaces, blades, snares, clubs, and proj. pts) not strongly assoc with males. Age however strongly marked (hunting subset with adults). [Works even worse when broken down by state, but of course each sample is smaller too, and only clear pattern seems to be AZ burials associate item subsets with age. This may be what creates the overall age pattern too]. Regionally W more likely to make multiple individual burials, randomly oriented, E favors single burials with head to E.

[Overall, this analysis is a good idea but the data just is too weak for strong conclusions.]

Moyer, Timothy

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2009 How to make a Good Dart with Easily Found Materials. *The Dart* Dec 2009:10-12. Also posted http://atlatl.timothymoyers.com/main.htm

Instructions for simple wood dowel darts.

Mujica Barreda, Elias Mujica, R. F. Jordan, C.G. Mora, Jeffrey Quilter, A. M. Cruz, C. G.de la Cruz, V.H.R. Cisneros, S. L. Alcalde, J. Verano, M. A. Merello

2007 *El Brujo: Huaca Cao, A Moche Ceremonial Center in the Chicama Valley.* Fundación Wiese, Instituto Nacional de Cultura.

[Text in Eng and Spanish. Huge book with color photos.] Chicama Valley, N coastal Peru. Cupinisque, then Moche ca 200-900 AD. El Brujo Complex on bank of Chicama River. [A huge mud-brick huaca pyramid complex with decorated plazas at various levels, burials under some.] Filling of top platform, 4 spear throwers with early Moche ceramics - wood covered and inlaid with gold and shell and turquoise. [Handle pieces of Peruvian form for 3 shown, one with recognizable fabulous carnivore Figures unclear whether they are mounted on original shafts, or incorrectly for display]. P 209: The tomb of the Señora de Cao. Woman under floor of small decorated top patio, with 3 others in individ graves. End of first building period, early Moche ceramics plus earlier Gallinazo and Salinar style pots - suggest contemporary groups [or heirlooming]. P 219 Senora de Cao grave: large grave with marker owl pot, sealed by floor on which burnt offerings and destroyed pots, sealed by another floor. Wooden warrior statuette armed with mace and shield. Over grave a cane and wood structure, body bundled with mat and blankets, 26 layers. A strangled retainer alongside. Pots, gourds, a pillow. One stirrup pot shows a medecine woman curing a child. Gilded copper sheets on cloth, gilded Cu bowl over face, two big ceremonial war clubs, gilded Cu 'tiaras'. Painted and embroidered dresses.Cotton and spindles. Necklaces - gilded Cu human face beads, quartz beads. 44 nose ornaments (12 shown) – depicting animals, captives, warriors, Decapitator deity, etc. P 235 "The body was resting on [actually they were wrapped in the bundle at the feet] 23 wooden ceremonial spear throwers, covered in gilded copper, with birds and characters' heads in the handles as decoration. According to the iconography shown in pottery, the spear throwers generally appeared in association with male characters and are linked to war rituals or deer hunting... reflect the high rank and status she must have had when alive." [Three are shown, multi-piece ornament on handle pieces representing eagle, warrior, warrior? Correctly positioned on shafts, but no hooks - not identified, didn't survive?] P 241 photo of work in lab shows 2 more atlatls.

J. Verano info on body: mid to late 20s, maybe died in childbirth but no fetal remains. Average height for Moche, typical braided hair, slight cradleboard flattening, good health most of life, one bad cavity.Well preserved but not internals. Elaborate tatooing.

Munger, Lynn

1967 Premature Conclusions Concerning the "Atlatl Weight" Theory as Applied to Forms of Stone Age Artifacts of the American Aborigines. *Central States Archaeological Journal* 12-14: 71-74. Questions blanket interpretation of "bannerstones" as "atlatl weights." Gives reasons why at least some specimens not functional as such.

Murdoch, John

1892 Ethnological Results of the Point Barrow Expedition. *Ninth Annual Report of the Bureau of American Ethnology, for 1887-88*, pp. 19-451. Government Printing Office, Washington D. C.

Expedition of 1881-83 to northernmost (top) of Alaska. Still some stone tools in use, although many heirloomed and slate knives etc now replaced by steel. Bow drill "universal among Eskimo." Muskets began arriving between 1837 and 1849, now old guns and modern Winchesters common, mostly superseding bows. Bows sinew backed, arrows fletched, points of flaked stone, metal, or barbed bone. "Hand board" or "throwing board" used to throw darts. Bird dart ca 5 ft long, .7 ft diam., unfletched, barbed bone tip or multiple tips, three barbs on shaft near base in case head misses. Considerable accuracy at 20 to 30 yards. Seal darts similar, although once used heavier ones, barbed bone heads attach to a float. [Seems odd that he describes darts before atlatls.] Throwing board is "flat narrow board 15-18 inches long with handle at one end and groove along the upper surface in which the spear lies with the but resting against a catch at the other end. The dart is propelled by a quick motion of the wrist, as in casting with a fly-rod, which swings up the tip of the board and launches the dart. This contrivance, which practically makes of the hand a lever 18 inches long, enables the thrower by a slight motion of the wrist to impart great velocity to the dart." [Fairly simple atlatl, two shown, like the one I made], spruce wood, hole for forefinger, groove, ivory hook "shaped like a flat headed [square] nail," long triangular shape with flared handle. [He describes the motion correctly too.] Metal also used for hooks, board usually painted with red ochre. Toggling harpoon heads with blades of stone or metal appear to be used only on hand thrown walrus or seal harpoons. Stone heads considered necessary for good luck in whale hunting, even when used in conjunction with metal or guns. Bird bolas also used. Still making stone tools, especially for sale to ethnographer. Pressure flaking into palm with short compound flaker tipped with ivory, iron, or stone. Bow drill formerly used for fire, now flint and steel.

Murdoch, John

1896 Dr. Nansen's "Throwing Stick." *Appletons' Popular Science Monthly* June 1896: 173-175.

Alaskan atlatl of Bering Straight type found on SW coast of Greenland 1886. Probably floated on current N through Bering St, then W across pole, then S between Iceland and Greenland, then N around tip of Greenland and up W coast. Inspired Dr. Nansen to think could do same thing in ship.

Murray, William Breen, and Hector Lazcano

2000 Atlatl Hunters of the Sierra Madre Oriental (Mexico). The Atlatl 13(4):3-5.

Rock art atlatls mark good spots for shooting at animals below in spring and similar areas. Tested several sites. Petroglyphs show "winged" atlatls, which may be transitional between bow and atlatl. [That makes no sense; maybe some sort of weight is what is shown.]

Mursell, Ian o

2013? Atlatl. Mexicolore: Aztecs. Webpage, accessed June 27, 2018 URL: <u>http://www.mexicolore.co.uk/aztecs/artefacts/atlatl</u>

[As of 2018, at some point this replaced my detailed article (Whittaker 2009) as the most findable atlatl info on Mexicolore. There is still a link to "our main feature on the atlatl" which works, and text giving another URL that does not.] Codex shows Ehecatl carrying atlatl and dart 'dart not actually same length as atlatl'. Some were ornate, shows image of British Museum one, [not as good as image in my article, and it was not exactly 'donated' to Cortez]. Serpents represent darts because they seem to spring into air as they strike. "tests carried out by friends of ours in Mexico who engage in experimental archaeology have put the range of the - highly accurate - atlatl at up to 150 metres, with the darts flying through the air at around 90 mph" [Usual slight exaggeration].

Naedele, Walter F.

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2006 Game Agency Staff: Ban Ancient Weapon, Atlatl Deemed Inhumane. *Philadelphia Inquirer* January 11, 2006. URL <u>http://www.philly.com</u> accessed 1/27/06.

Pennsylvania game commission staff recommends Board not vote to legalize atlatl deer hunt. Quotes Fogelman and Perkins.

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Nahanni River Adventures

1994 Glacier Yields 500 Year Old body of Ancient Person in Tatshenshini/Alsek Region. *Northern Currents*, Fall 1994. URL: http://www.nahanni.com/newsletter/archive/?page=1 accessed 9/13/06

Describes [Kwaday Dan Sinchi] find, Beattie involved, mentions possible atlatl but "further input from elders indicates that it may also be a tool used for snaring gophers."

Nalewajk, Robert

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2001 How the Length of an Atlatl Affects its Dart Throwing Abilities. Class paper for J Whittaker, Grinnell College.

Tried three lengths, longer atlatls get greater distance [but small sample, limited experiment]

Nassaney, Michael S. and Kendra Pyle

1999 The Adoption of the Bow and Arrow in Eastern North America: A View from

Central Arkansas. American Antiquity 64(2):243-264.

Regional survey of small point (= arrow) replacement of large points indicates likely earlier than previously thought - perhaps as early as 3000 BC in central plains with unifacial arrow points. Then some areas gradual transition with decrease in size of dart points, and transitional forms. In AR, abrupt introduction of arrow shown by bimodality of metric traits and different form of large and small points, and by different manufacture techniques, but long period of overlap, 700-1100 A.D. Suggest different strategies of adoption and transition with experimentation all over until wide use of small bifacial points by A.D. 700.

National Geographic Channel

2016 *The Great Human Race*. TV episodes. Bill Schindler and Cat Bigney. John Shea listed as advisor.

Throughout the series, atlatls get good play – the stars carry them a lot of the time, and many of the graphics – drawings "transforming" them into prehistoric people - show them in use, even if Kat and Bill don't actually use them. Most of the drawings are pretty good, although I noticed one where the flexing dart was leaving the atlatl well before it was vertical.

Overall, not a great series – human evolution in a 'reality show' format. Bill Shindler and Kat Bigney in each 5-day episode attempt to portray and experience some of the major challenges of the human evolutionary journey from origins in Africa to entering the New World. The live action is supported by imaginative graphics, artistic line drawing reconstructions of prehistoric life, maps, and high altitude photos, as well as slow-motion sequences of some of the action.

Bill Schindler is a good experimental archaeologist and imaginative teacher, and Kat seems to know what she is doing with survival skills, but 'reality' show producers are not really interested in educating people, so the archaeology gets dumbed down and the dangers to Bill and Kat exaggerated. The ancestral humans they are sort of portraying did have it hard and dangerous, but the film makers won't actually allow Bill and Kat to freeze to death or be eaten by hyenas, so comments about how "we could be in real trouble" sound silly. Some of the things they do are difficult and unpleasant, like wading in freezing water and sleeping out under harsh conditions. Both are good at making primitive gear with natural materials, although some of the things they "find" are plainly set-ups. The episodes are usually entertaining, and I don't doubt it was a great experience for both of them and they learned a lot, but it is 55 minutes of exagerated dangers with a spoonful of human evolutionary history and some outdoor craft which is usually not shown in enough detail to be instructive. I didn't see all of the many episodes. Does the "Season 1" label imply plans for another?

Season 1, Episode 6: "Cave." Bill and Kat have to cross the Caucasus Mts as *Homo* sapiens supposedly did, while Neanderthals did not. At low altitude (they complain of

heat and humidity and flies) they find a cave for shelter, Kat makes torches and they explore it for no apparent reason. Bill makes friction fire, Kat cuts a bunch of hazel to make atlatl and darts for hunting. Meanwhile, Kat kills a snake (a bit fearfully although it appears harmless) and they eat it. Like all these "reality survival" shows, eating disgusting things is a big part of the entertainment. Bill makes a simple but ok atlatl, and a nice dart point made of antler with microblades he knaps. They find the antler in the cave [yeah, right]. And the atlatls get decorated with snake skin wrappings, in the short time they supposedly have. Then they stalk a boar. Hard to see but it looks like it stands there for a missed shot each, then Bill gets a good one, and then they are sort of holding it behind some rocks out of sight while they let it 'bleed out''. Unconvincing hunt. And Bill lugs out the old myth of "pinned a Spaniard in his armor" while the narrator says "dart flexes and stores energy" and "speeds over 100 miles per hour." WRONG! For goodness sake! Since I was consulted and sent info about atlatls at early stages in planning this episode, there really is no excuse for continuing to publicize incorrect garbage, and Bill at least knows better. When archaeologists let the film makers have control, we get this hokey stuff about how dangerous it is, false time scales (they didn't make all the gear shown in the supposed 5 days), and cute people eating gross foods. In this episode (and others) you soon notice that Bill gives most of the orders and makes most of the tools, while Kat forages for food. He gets to take his shirt off and show muscles, and her attractive body is emphasized by wearing a dress with short skirt and one shoulder strap. He gets to wear trousers, which would be much more protective as they climb into the cold mountains, though neither of them in their buckskins is properly dressed for such a trek.

Season 1, Episode 9: "First Americans." Better than some others. The story here is that they are trying to cross the Bering Strait (Alaskan) tundra to reach the coast to get by boat to the rest of the continent. Good fire-making by bowdrill. They trap a beaver in cold water, break up and burn atlatl darts to melt pitch to glue bits of stone to bottom of their leather moccasins for traction to cross glacier. The usual overdramatization: "when the first people crossed the Bering Strait, the first thing they saw in the new continent was a wall of ice". 'Need' to find stone before they make tools – but they are wearing pretty good skin and fur outfits as indeed they would be, and carrying packs – prehistoric travelers too would have stone, although they would have to renew supplies .

Neal, Guy R. o

2011 Frozen in Time: The Iceman Quiver. Bulletin of Primitive Technology 41:31-38.

Replic w stone tools. No attachments survive, so speculate: hung on left shoulder, with cross strap to R underarm, so access allowed in front of archer, flap protects arrows.

Nebergall, Phil

2007 Modern Prehistoric Hunters. Atlatls'N More webpage, URL http://www.atlatls-n-more.com/IntroAtlatl/Default.asp?article=123 accessed 5/07.

Australian aboriginal cultural center demos. Light 7-foot spear. Atlatl not described, picture too small to see. Overhand motion like tennis swing. Aborigines making 50 yard throws with flat trajectory, high velocity, "spear drops 2 feet in mid flight and then rises back up and nails the target..." "Release spear with point 4-6 inches higher than tail end... spear thicker at front... no feathers to stabilize... getting aerodynamic lift to counter gravity..." Spears thus more effective than bow and arrow. [The "drop" and aerodynamic theory sounds really unlikely, so I'm not sure what he was seeing, maybe the dart flexing?]

Neely, Paula

2016 Scientists lose right to study ancient human remains. *American Archaeology* 20(1):10.

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Supreme Court declines to hear appeal by scientists who wanted to study 2 La Jolla skeletons 9,500 yr old from near San Diego. Claimed by Kumeyaay et al. U C San Diego refused to let Bettinger and others study, decided to transfer to tribe. Bettinger, Schoeninger and Tim White sued, UC argued Kumeyaay had 'sovereign immunity' so lower court had no jurisdiction, "a horrible precedent" contrary to Kennewick decision.

Nelson, Edward William

1899 The Eskimo About Bering Strait. 18th Annual Report of the Bureau of American Ethnology, for 1897-98, pp. 19-526. Government Printing Office, Washington, D.C.

Expedition to Western coast of Alaska 1877-1881, collected some 10,000 specimens, herein described, covering most of material culture. Still using some stone tools as well as metal, shows "flint flakers" [pressure], but no description of knapping. Drilling holes and friction fire using bow drill. Bow and arrow, sling, throwing board, and bolas all used. Seal spears 4-4.5 feet long, often fletched, barbed head attached to shaft by cord for drag, used with throwing board. Walrus and whale spears are about same length but heavier, unfletched, attached by cord to a float board or skin float for drag, more likely to have a toggling harpoon head. Bird spears are lighter, sometimes fletched, with two or three bone points. The "throwing sticks" have tapering shape with paddle handle, depressions and pegs for finger grips, sometimes a forefinger hole, groove with ivory peg hook. [Small photo shows 11 examples, similar but variable]. "The Eskimo are very expert in casting spears with the throwing stick. The small light spears used in hunting seals are cast from 30 to 50 yards with considerable accuracy and force." Practice "by the hour" at young waterfowl, very accurate. Bird spears generally cast overhand but sometimes with underhand throw to skim the water surface. "In using the throwing stick for casting the spear in a curve through the air by an overhand motion, the throwing stick is held pointing backward; the end of the spear shaft is laid in the groove on its upper surface resting against the ivory pin or other crosspiece, the shaft of the spear crosses the fingers and is held in position with the thumb and forefinger around the throwing stick." Variants described for peg grips. Length is point of right elbow to tip of outstretched forefinger, or for whale, plus one forefinger width. Seal spear length is three times elbow

to finger tip plus 2 left thumb widths plus width of left hand.

Bows are sinew backed. Muzzle loading guns becoming common.

Neuman, Robert W.

1967 Atlatl Weights from Certain Sites on the Northern and Central Great Plains. *American Antiquity* 32(1):36-53.

Interpretation of such artifacts as atlatl weights since Kidder + Guernsey finds. Data given on 60 weights of "boatstone" type, with measurements, weights, and some drawings.

Class I = loaf shaped, plano convex, often grooved across top center for attachment. Class II = end-ridged, like I but with bumps at ends. Class III = long elipsoid. Class IV = zoomorphic, like II but bumps at ends form ears of animal head.

Neusius, Sarah W., and G. Timothy Gross

2007 Seeking Our Past: An Introduction to North American Archaeology. Oxford University Press, New York.

p 209 good drawing of Skagit atlatl carving from NW coast

On accompanying CD, lengthy chapter D2 "Weaponry of Clovis Hunters at Blackwater Draw" by Anthony Boldurian accepts assumption that Clovis had atlatls, discusses hafting models for Clovis points and bone rods, and promotes idea of a socketed harpoon with C point as end-blade [for which the archaeological evidence is nil - model is based on one Archaic specimen and analogy to Inuit harpoons.]

Nevins, Jerryo, p2016 Carved in stone. The Atlatl 29(1):1-9.

Nice pics of his superb bannerstone and Hopewell pipe repros.

Nevins, Jerryo,p2016 Goose effigy platform pipe. The Atlatl 29(2):7-13.

Detailed description of reproducing Hopewell pipe, well illustrated. Modern tools.

Nevins, Jerryx,p2017 My Moche Birds. *Missouri Atlatl Association Newsletter*, April 2017:2-7.

Instructions, illustrated with photos, for making the 'bird' or 'shuttlecock' for 'Moche Toss' aka "Ceremonial Badminton."

Nicholson, Desmond V.

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1980 The Atlatl Spur: A Newly Identified Artifact from the Lesser Antilles. Eighth IACA pp. 394-405. Tempe, AZ. online at URL:

http://www.thudscave.com/npaa/nicholson/nicholson.pdf (accessed 3/3/04)

Indian Creek site, Antigua, from Terminal Saladolid levels, two "phallic" artifacts of shell and green stone, now identified as atlatl spurs similar to California types. Atlatl associated with hunting on water in several cultures, advantageous for Maritime Saladolid boat use. Provides some historic refs, other possible arch examples.

Nickell, Joe x 2011 Poking Into Atlatl Hunting Can Have Risks. *The Missoulian*, Thursday March 3, 2011. Online version, accessed 3/4/11. URL: <u>http://missoulian.com/lifestyles/recreation/article_ddac0536-4545-11e0-ab0d-001cc4c002e0.html</u>

Montana Senator Greg Hinkle proposed new state law legalizing atlatl for big game. Atlatl explanation from Bob Perkins, Jay Laber, artist and teacher ("Reservation Arts") at Salish Kootenai College. [Humerous, outcome of legislation not given.]

Nielson, Jesper, and Christophe Helmke o 2008 Spearthrower Owl Hill: A Toponym at Atetelco, Teotihuacan. *Latin American Antiquity* 19(4):459-474.

Mural in a residential barrio shows an owl superimposed on a stepped hill. Eyes and other features of owl probably represent double finger holes and hook of Mesoamerican atlatl, visible in other iconography from T and Maya sites. Common associations of atlatl or spear for atlatl, shield, owls or eagles, symbolic of warfare and warrior sodalities all over Mesoamerica. Argue that this should be read as a name for a place, perhaps the Pyramid of the Moon at T, and also known to be name of a ruler of Tikal, ultimately perhaps derived from a patron deity at T.

Nishi, Dennis

2015 "Paleo Hunters Bring Hunting Back to Its Primitive Roots" Playboy Magazine Online June 25, 2015, <u>http://www.playboy.com/videos/paleo-hunters</u>

Visited Osage Knap-in May 2015. Interviews with atlatlists: Brian and Dawn Wagner, talking about the challenge, makes you better hunter [though BW killed 2 deer so far, not 4 as stated by DN]. JW, antiquity of atlatls and comparison to bows. Steve Spencer, skunk as scent mask when hunting, fear of teasing by other hunters when see him with atlatl. Images of throwing at targets, DW at rabbit, Moche Toss at event [not named or explained]. Nishi: "instinctually more satisfying. No bionics, no cheats, just me using a stick to throw a stick." [A pretty good popular account even if (surprise!) they focused a bit on an attractive female, and info from point of view of 'manly men.' I passed it on to the Grinnell College publicity people, but somehow my only Playboy appearance did not get put up on the usual website...]

Nishikawa, Kiisa and Michael I. Ratliff

2001 The Mathematics of the Atlatl. In NSF CCLI Grant #9980883 Enhancing Quantitative Reasoning Using Visualization. Accessed 6/21/2003 URL: http://odin.math.nau.edu/~mir/ccligrant/Atlatl.html

Formulae and math excercises using atlatl. Velocity model, range, kinetic energy.

Noguera, Eduardo

1945 El Atlatl o Tiradera. *Anales* 5(3):205-238 plus plates. Instituto Nacional de Antropologia, Mexico D.F.

[In Spanish. "The Atlatl or Spearthrower" Fairly detailed summary of atlatl info at the time, but nothing new or really useful now. He doesn't cite sources properly or give full information in his bibliography, so it's hard to tell where all his info is from.] Background definitions, consider 4 ethnographic regions: Australia, Melanesia, Micronesia; Arctic; the Americas; and France during the reindeer epoch [Pleistocene]. Three forms of hook: male, female, and mixed. Basic dimensions of some atlatls given, especially Mesoamerican ones. [Plates also reproduce images from other scholars.]

Nordenskiöld, Erland

S

1919 An Ethno-Geographical Analysis of the Material Culture of Two Indian Tribes in the Gran Chaco. AMS Press, New York (reprint 1979).

S. America, trait distribution study, centered on Choroti and Ashluslay of central S Am. but covering whole continent [wildly optimistic attempt to see patterns in badly collected data over poorly explored continent.] Hunting Weapons + Equipment: C + A use bow and arrow, snares. Sling and bolo only for kids. Bow old, all over continent, only wanting on Upper Amazon or rare there "for in oldest books … we are told that on the upper part of this river the Indians fought with spears which they flung with the throwing stick, while lower down the river they used bow and arrow." Why preferred throwing stick since they knew bow: throwing stick carries as far and used one handed, so L can steer boat, possibly also some areas on coast wood rare.

Bows variable, often without nock. Animal hide, sinew, plant fiber strings. "Bird arrows" with thickened heads [bunts] distribution mapped – pretty much all over. Sling distribution mapped – mostly W coast. Clay pellet bow mapped – mostly central basin (Gran Chaco), probably introduced post-contact. [For no weapon is any really useful detailed info given.]

Nuttall, Zelia

Х

1891 The Atlatl or Spear-Thrower of the Ancient Mexicans. *Archaeological and Ethnographic Papers of the Peabody Museum* 1(3):171-198. Cambridge.

[This paper is probably why we use term "atlatl"]. Surveys Mesoamerican evidence: codices, sculpture, 3 specimens, Spanish chronicles.

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Small drawings from Aztec depictions. Recognized them because of Mason (Arctic) and Uhle (Peru) reports.

Aztec myth: Given by Huitzilopochtli, or invented during Aztecs' wanderings = perhaps required for aquatic hunting on lakes in Valley of Mexico.

Briefly summarizes Spanish accounts - most atlatl descriptions vague.

Linguistics - sorting out old Spanish terms and mistakes, "Atlatl" relates to verb "tlaca", to throw, aim, cast. But originally used by fishermen (=atlacatl: atl=water, tlacatl=men) - Atlatl synthesizes atl=water + tlatlacani=thrower, so atlatl = water thrower.

Usually depicted with spear and shield, which allows identification of stylized forms. IDs types: I1)one finger hole; I2) two or 3 holes; I3) 2 side loops or attached rings; II) opposed lateral finger pegs. [She probably should add type III - simple grip handle, which seems to be shown in a few cases.]

Extant specimens: British Museum, London, and Museum fur Volkerkunde, Berlin - not described, and Museum Kircheriana, Rome: grip rings missing, hardwood, groove and spur, 56 cm L, 19-37 mm W, carved ornament including serpents (on other 2 also), gilded.

Symbolism: Huitzilopochtli depicted with blue serpent atlatl (Xiuatlatl or Xiucoatal) turquoise ornamented atlatls in chronicles. Also with Xiutecuhtli, Tezcatlipoca, and Quetzalcoatl. Ceremonial atlatls depicted like bishop's crozier, associated with lightning. So associated with all important gods, war, serpents and lightning.

Nuttall, Zelia and Arthur G. Miller

1975 *The Codex Nuttall: A Picture Manuscript from Ancient Mexico*. Dover Publications, New York.

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Reprint of Nuttall's 1902 color reproduction, original in British Museum. Mixtec folding book, probably done in Oaxaca, slightly pre-conquest. Mythological history/geneology and biography of one lord "8-Deer Tiger Claw," second ruler of 2nd dynasty of Tilantongo, 1011-1063 AD. Warrior/deities depicted carrying shield with 2 darts and atlatl or thrusting spear. Hills representing towns are shown as captured by piercing with a dart. The atlatls are very stylized, but some clearly 2-hole type. Darts shown fletched and with large triangular stemmed points. Climactic scene has 8-Deer dressed as Death using atlatl to sacrifice captive tied to scaffold.

Nuzhnyi, Dmytro

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2011 Experiments with projectile points of Upper Palaeolithic and Mesolithic industries of Ukraine. Paper presented at Multidisciplinary Scientific Approaches to the Study of Stone-Age Weaponry, Mainz, 19-22 September 2011.

"Experiments with bow and arrows tipped with different microlithic projectile points hafted in various ways have been carried out by the author since 1977, using many kinds of targets (paper, wood, bones, freshly killed animals). Base data for recognizing diagnostic projectile fractures. Near three hundred lithic insets of composite and other projectile arrow tips were used." [He is old-stlye Soviet scientist, doing extensive experiments with little support or outside scholarly contact. Showed figures of dozens of damaged points on a page, carcasses bristling with arrows. Suggests using newspaper as standard for measuring penetration in number of pages penetrated.]

Oberg, Chris

2000 Atlatl Darts made with Gold Tip 75-95 Carbon Fiber Tube. *The Cast* Fall/Winter 2000:17-18.

Detailed instructions for light, durable but complex takedown dart. Weighs 2.25-2.75 oz (70-86 gm), about 66 inches long (168 cm), balanced at 31-38%.

Oberg, Chris

2001 New Guinea Spear Thrower. The Cast Spring 2001:6.

Short summary with pictures: bamboo thrower with female nock, used with long wooden pointed unfletched darts. [No references]

Oberg, Chris

2001 Darts for Carp. The Cast Spring 2001:7.

Carp with spear or bow legal in Michigan. Recommends practice on water filled plastic bottles in lake until refraction learned. Line on end of dart eliminates need for fletching, barbed point can detach with line also.

Oberg, Chris

2002 Woven Finger Loops: Why Knot? The Cast Spring 2002: 17.

How to make woven string loop. [But no info on attaching it to atlatl].

Oberg, Chris

2003 Home Grown Darts for Pleasure or Profit. The Cast Spring 2003:17.

Arundo donax, "Giant Reed," imported ornamental grass from Mediterranean and far East is easy to grow in wide range of conditions.

Oberg, Chris

2003 The Remarkable History of Michigan Copper. The Cast Spring 2003: 16.

Brief background, photos of making Old Copper dart point from copper wire.

Oberg, Chris

2008 Christopher L. Oberg Home Page. URL: https://www.msu.edu/~oberg/ Accessed 5/08.

Michigan Atlatl Association and other atlatl information.

Oberg, Christopher

2010 Evaluation of Atlatl Darts Made with Gold Tip 75-95 Carbon Fiber Tube. *The Dart* Dec 2010:13-17.

Detailed manufacture instructions.

O'Brien, Michael J., Matthew Boulanger, Mark Collard, Briggs Buchanan, Lia Tarle, Lawrence G. Straus, and Metin L. Eren o

2014 On thin ice: problems with Stanford and Bradley's proposed Solutrean colonisation of North America. *Antiquity* 88(340)L606-624.

Thorough critique, followed by rebuttal from Stanford and Bradley, with closing rerebuttal by critics.

O'Brien, Michael J. and W. Raymond Wood. o

1988 The Prehistory of Missouri. Columbia, University of Missouri Press.

General text, lots of info on point types, photos, other lithic info.

p. 93 Dalton pt functions - point/knife, resharpened by serration and beveling, reveals handedness, multifunctionality is why so many exist (Morse, Goodyear). More likely variability from different projectile uses, and "Dalton" is a lumped type covering lots of functional variation. E.g. large Sloan type Daltons hafted as spears, serrated type for different hunting. Beveled Daltons (most common) probably first atlatl points, beveling helped stabilize flight. Later in Early Archaic, around 6500 BC most beveling ends, prob because now added fletching to shafts instead. And points get smaller because don't need large heavy point to stabilize shaft once you have fletching. [Bad idea - beveling does not spin a dart, see Pettigrew et al. 2015]

p 112-117 discussion of hafting, following Musil (1988) design models - trend from fluted lanceolates to contracting or stemmed, to notched - increased efficiency of penetration and reduced damage to shaft and allowed more reuse of damaged points. Then organize Archaic points by hafting type. Mention R Madden and Virgil Hayes experiments with atlatl, cite Hayes (1994): bannerstone helps match spine of dart with force of atlatl, allowing most efficient recovery from flex; can adjust to accommodate different spears. [Nonsense.]

Ochsenschlager, Edward L.

1998 Viewing the Past: Ethnoarchaeology at al-Hiba'. *Visual Anthropology* 11(1):103-143.

[Unusually thoughtful and enjoyable discussion of problems and promises of ethnoarchaeology.] Biases in collecting data, relations with informants, differential

preservation, attitudes toward artifacts shaped by gender, social status, morality, skill, etc. Info on toys, bitumen, reeds, houses, slings, etc.

Slings as example showing that skill in artifact use is valued and practiced: 2 different tribal villages each had young man of unusual skill, and conducted public rivalry over which got more game. Boys accepted as men because of skill, experimented with different lengths, weights of clay shot etc to improve their skills.

Odell, George H.

1988. Addressing Prehistoric Hunting Practices Through Stone Tool Analysis. *American Anthropologist* 90:335-356.

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Use wear ID's unretouched flakes used as pts at Woodland sites & Archaic Mid W. Compare with experimental breakage of formal pts. Argues earlier use of bow and arrow than usually believed.

Ohtsuka, Ryutaro

1989 Hunting Activity and Aging Among the Gidra Papuans: A Biobehavioral Analysis. *American Journal of Physical Anthropology* 80:31-39.

Hunting records of 1633 hrs, visual acuity and grip strength measurements. Gidra tribe, Papua New Guinea. Productive hunters aged late teen to 45, in weight of animals killed per time, efficiency of elder married men (35-45) is almost 4X higher than unmarried (16-late 20s). Horticulturalists, but most meat hunted, adult males eat average 30-36 gm/day [that's not much!]. Hunt wallaby, bandicoot, cassowary, pig, and introduced deer. Bow and arrow, a few shotguns, dogs, communal fire drives. Efficiency: Shotgun 2.77 kg/hr, B+A 1.01 kg/hr, communal .79 kg/hr. Elder males most different in B+A efficiency, less in shotgun. In 10 yr interval, younger men improved, elder men declined, but each individ performance correlated, ie good hunters remained consistently good, worse hunters stayed low. Visual acuity correlated with hunting success but grip strength did not; oldest men reduce hunting time. Boys less grip strength, use lighter bows. Skill in finding and approaching animals is more important than actually shooting skill, thus increase in success with age, and B+A more difficult than shotgun. B+A range about 20 m, ideally 10. Unmarried and married men scored similar in standard archery test, but elders have more hunt success.

Okumura, Mercedes, and Astolfo G. M. Araujo x 2015 Contributions to the Dart vs Arrow Debate: New Data From Holocene Projectile Points from Southeastern and Southern Brasil. *Annais da Academia Brasileira de Ciências* 2015:1-25.

Collects a lot of references and data on the presence of atlatls and bows in prehistoric S. America. The authors use and compare several analytic methods (Shott, Bradbury, Fenenga, Hughes, Hildebrandt + King) for distinguishing dart points from arrow points, first application to S. America that I know, showing that you get different results depending on method applied. Appropriately conservative conclusions: there are lots of small points in some of these Early Holocene sites that could have been arrows, and thus there is possibly early evidence of bow and arrow technology. The points are mostly stemmed, or notched forms similar to N. Am. A few mentions of ambiguous early bows from mummy bundles.

[I remain skeptical that there really are early arrows here - at least until there is fuller evidence, because: most site contexts are mixed and unclear, all the methods used in this analysis rely on ethnographic + archaeol specimens that came from a limited sample, from a limited part of N. America, mostly the desert West and may not apply well elsewhere, distinction is complicated by the use of bifacial points for many purposes, including knives etc, but in these sites also including harpoons which may be heavy points on arrows or on darts. In general a good paper, and they recognize the problems. The very important implication of this data is that there may be very early bow and arrow technology in S. Am. Almost all of these sites are earlier than most accepted dates for arrows in N. Am., so this might mean a separate invention of bow and arrow in South America? I would want more evidence (preserved bow or arrow) before being sure. Interestingly the latest site in the sample has a similar mix of dart/arrow, large/small points as the early sites. What does that mean? Perhaps it is just that in the Umbu tradition, there are always small points and large points, and perhaps when bows are introduced (whenever that is), the small dart points then become arrow points, and we simply can't see that event.]

Ortner, Donald J.

1968 Description and classification of degenerative bone changes in the distal joint surfaces of the humerus. *American Journal of Physical Anthropology* 28:139-156.

Describes arthritic changes to the capitulum of the humerus where it articulates with the head of the radius in both flexing and rotating at the elbow. He calls this "atlatl elbow" throughout. Compares Peruvian and Eskimo skeletal remains, and finds higher frequency of elbow arthritis in Eskimo, but he is not arguing that it is caused specifically by atlatl use, just that the symptoms of "atlatl elbow" are probably caused by stressful use of the arm.

Osgood, Cornelius

1940 *Ingalik Material Culture*. Yale University Publications in Anthropology Number 21. Reprinted 1970, Human Relations Area Files Press, New Haven.

Inland S. Alaska Athapaskan (not Eskimo) groups on the Yukon River. Principle informant Billy Williams born 1884. [Complete entry p.201, atlatl apparently no longer used by 1939.] :

"Spear Thrower and Darts: te lakoi, water/to throw. The name apparently comes from the fact that the spear thrower is commonly used from a canoe on the water. [Fascinating parallel with "atlatl," see Nuttall]. Men make spear throwers out of spruce wood, birch wood, or bone. My informant recognized illustrations in Nelson's monograph on the Bering Sea Eskimo as being typical of those formerly used among the Ingalik. Darts associated with the thrower were also recognized. Darts are said never to be feathered nor to have points attached in the center of the shaft [like Bering bird darts]. The spear thrower and darts are used only for hunting ducks."

Bows and arrows had more use. Bows apparently not sinew backed. Fire drill usually with a cord, rarely with bow.

Oswalt, Wendell

1972 The Eskimos (Yuk) of Western Alaska. In *Modern Alaskan Native Material Culture*, edited by W. Oswalt, pp. 73-95. University of Alaska Museum.

One of a group of surveys of culture change in artifacts in 1970-71. Most other groups mention apparently not using throwing boards any more, but here: "It is something of a surprise that sealing and whaling harpoons based on aboriginal models continue to be important hunting weapons. Sealing harpoons have either a toggling head or a barbed head. In both instances the head is made from a solid piece of copper, brass, or aluminum which is hacksawed into rough form and filed into final form." Foreshaft is a nail, shaft is cedar with modern paint, head is attached with cotton or nylon cord. "These weapons are always propelled with the aid of a throwing board, which usually has a wooden peg and is painted with a commercial paint." Beluga whaling harpoons heavier, hand thrown. Harpoon still needed because shot seals sink, so they are harpooned and then shot, or if beyond harpoon range, shot and then harpooned as soon as possible. [Although the collections made in this project include throwing boards from several villages, there is no full description and no illustrations of any of the objects, which greatly lessens the value of this publication.]

Overstreet, Robert M.

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2013 Official Overstreet ® Identification and Price Guide to Indian Arrowheads, 13th edition. House of Collectibles, New York.

[Getting way too big.] Much of same info as earlier editions, illustrations vary in quality, larger section of color examples. Point types and examples are reasonably consistent and with normal usage, but some oddities. Organization by region means many types found in several; sometimes suggests regional variants.

Large new section at front: collections of David Root, Art Gerber, others. Root claims to have found as a boy a fluted point in Chesapeake Bay, 'whose style and green chert material are only found in Europe...some of most important evidence to support theories of an ancient land bridge between Europe and N Am." [Huh? and of course it is not shown, just page after page of slate, including some OH bannerstones and birdstones]. Gerber collection shows "famous Kentucky Green River banner cache found 30 miles from Owensboro KY."[9 bannerstones paired with 8 antler hooks, plus bunch of beads - but who can trust any of this.]

Owsley, Douglas W., and Richard L. Jantz, eds.

2014 Kennewick Man: The Scientific Investigation of an Ancient American Skeleton. Texas A&M Press, College Station.

Owsley, Douglas W., Althea A. Williams, and KarinS. Bruwelheide

2014 Skeletal Inventory, Morphology, and Pathology. In *Kennewick Man: The Scientific Investigation of an Ancient American Skeleton*. Owsley, Douglas W., and Richard L. Jantz, eds., pp. 139-186. Texas A&M Press, College Station.

The major skeletal analysis finally allowed in 2005-2006. Earlier examinations obstructed by absurd Corps of Engineers restrictions designed to prevent proper study: team not allowed to measure or use computerized notes; took a court order to allow use of an audio recorder, etc.

Skull: male features, less ante-morten pathology than assessed by Chatters, but two small healed depressed fractures. Only one tooth lost in life! But very heavy wear. Assymetrical arms show right-handed. Abnormalities in R glenoid cavity of scapula from throwing: "glenoid rim fracture can be linked to activity involving rapid, vigorous movement of the arm and shoulder, such as the swift, snapping motion of throwing a dart with an atlatl...this injury was undoubtedly a source of pain and discomfort that affected KM's ability to hunt and fish..." Time-lapse photo of Stanford throwing with atlatl.

Healed rib fractures from some sort of chest injury.

Wound: basalt or dacite point embedded in right posterior ilium (pelvic bone, at hip). Point tip damaged or missing, exact form hard to see on scans, appears serrated. Differing assessments of directionality of wound. They conclude point entered his right hip traveling front to back and downward about 29 degrees. Broke off part of iliac crest and embedded in back interior of ilium blade. "KM ... may have pivoted to narrow his profile in an attempt to dodge the dart." No evidence of chronic infection, they see healing with a fibrous encapsulation of the point, while bone around it partly remodeled and partly resorbed. No interior organ damage, missed major muscles too, and "analysis of the leg bones indentified no lasting or significant impact on his mobility or activity."

Some degenerative problems in knee. Squatting facet. Age: varying estimates, they give 35-39. Some wear and arthritis on other joints and vertebrae.

Pafford, John

2002 Back to Iowa After 65 Years. Prehistoric American 36(2):31-34.

Six large ferruginous quartz butterfly bannerstones found in field by workers in 1930's, acquired by Ben Nussbaum. ["Nussbaum Cache" – but who knows if they were actually together, or what information was destroyed by finders or circumstances.] Full size color photos.

Palencia, José Servin

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1977 Las Artes Menores. In *Esplendor del Mexico Antiqua*, edited by Carmen C. de Leonard, pp. 379-410. Mexico City, Centro de Investigaciones Antropolgicas de Mexico.

Matricula de Tributos codex gives idea of diversity. Mosaic, feather, bone, wood discussed. Seems to think the late fine work could only be done with metal tools. Drawing of Aztec atlatl from Bliss Collection in Museo Nacional de Washington. [missing pages].

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Palmer, Jay W.

2001 A Basketmaker II Massacre Revisited. *North American Archaeologist* 22(2):117-141.

Wetherill's Cave 7 site in SE Utah (see Hurst and Turner 1993). Ninety-six Basketmaker (ca 500 BC to AD 400) people killed with bone daggers, clubs, atlatl darts. Victims were Proto-Kiowa in conflict with recently arrived Penutian/Hokan/Dineh who later became Proto-Zuni. The killers are so identified in part by use of clubs and bow and arrow. [This is all a tenuous tissue of speculation based on very complex and problematic genetic and linguistic reconstructions. There are also problems with his understanding of Basketmaker in general, and with artifact information. In particular he considers some unnotched bifaces to be adzes used as weapons, and accepts the 19th century identification of two of the points in wounds as arrow points, which they almost certainly are not.] The site is notable for atlatl use in warfare, including one obsidian point reported to have "pinned the hip bones together" on one corpse [and thus an atlatl point rather than a "knife".]

Palsbo, S. E. pdf

2012 Epidemiology of recreational archery injuries: implications for archery ranges and injury prevention. *Journal of Sports Medicine and Physical Fitness* 52:293-299.

Hospital data over 10 years. 62% lacerations, mostly from mishandling hunting arrows. Puncture wounds 8%, foreign bodies 6%, mostly falling on hunting arrows, and driving broken shaft or feathers into hand.. Contusions + abrasions 6%, mostly from bowstring. 99% of cases treated and released. Overall injury rate is 4.4/10000. 8.5 million people do archery or bowhunting (3% of pop) more than many more visible sports. 50% target only, 26% bowhunting only, 24% both.

Palter, John L.

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1976 A New Approach to the Significance of the "Weighted" Spear Thrower. *American Antiquity* 41(4): 500-510.

No ethnographic weights, prehistoric North America only. Tests contradictory, his show distance decreases with heavier weight. Balance hypothesis: not necessary unless spear were heavy, why just N.A.? Weighted Basketmaker atlatls flat and flexible - Weight would augment flexibility. [Similar to theories of Perkins and Leininger 1989, Hayes 1994] Prehistoric specimens mostly less than 80 grams, rest may be non-functional.

Palter, John L.

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1977 Design and Construction of Australian Spear-Thrower Projectiles and Hand-Thrown Spears. *Archaeology and Physical Anthropology in Oceania* 12(3):161-172.

Ethnographic specimens: 33 hand-thrown and 293 spear thrower spears [unfortunately not illustrated].

Hypothesized diffusion after 10,000 bp, but thrower not used all over Australia.

Two length groups of spear thrower spears: 1) average 160 cm, 2) average 260cm. Hand-thrown spears average 267 cm.

Mass: Hand-thrown average 740 gm, thrower average 246 gm.

Decreased mass allows maximum velocity - led to composite reed spears, with hardwood points.

Balance: spear thrower spears: weight forward, 32-40% and 42-46% of length from tip, while hand-thrown spears typically 46-50%.

Palter, John L.

XO

1999 Slinging Spears: Recent Evidence on Flexible Shaft Spear Throwers. *SAA Bulletin* 17(2): 2-3, 16.

In 1976 believed bannerstone exploited flex of spear thrower. New evidence from communication with Strischek, who says flexible atlatl hurts his wrist less and gets more distance, and most modern US atlatlists use them. Europeans prefer rigid atlatls - will they change if flexible are more effective? [Interesting that older archaeologist has found non-academic atlatl community.]

Palter, John L.

2009 Slinging Spears: Recent Evidence on Flexible Shaft Spear Throwers. *The Dart* Dec 2009:19-20.

Sweatman 1840s observed Australian use of two types: broad rigid throwers for heavy spears, long light whip-like throwers for birds and small animals. Rigid atlatl strains wrist in throw, flexible less, allowing force to be applied longer, gives slight increase in distance from not losing momentum in throw. Flex acts as shock absorber, weight keeps flexible dart from causing wobble at spur, improving control and accuracy.

Pancoast, Henry S.

1929 The Origin of the Long-Bow. PMLA 44(1):217-228.

Welsh origin of English long-bow disputable, usually based on vague info from Giraldus Cambrensis.

Pargeter, Justin

2011 Assessing the macrofracture method for identifying Stone Age hunting weaponry. *Journal of Archaeological Science* 38: 2882-2888. http://dx.doi.org/10.1016/j.jas.2011.04.018

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Pargeter, Justin

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2013 Rock type variability and impact fracture formation: working towards a more robust macrofracture method. *Journal of Archaeological Science* 40 (11): 4056-4065. <u>http://dx.doi.org/10.1016/j.jas.2013.05.021</u>.

Parker, Arthur C.

1917 Notes on the Banner Stone, With Some Inquiries as to its Purpose. *New York State Museum Bulletin* 196: 165-176. Albany.

Found just before and after white man, in villages and mounds [incorrect info]. Experiment: winged form serves like fletching on spear, works also as spindle whorl in drilling.

Perhaps part of effigy bird forms associated with fire and lightning, maybe head ornament as on copper cut-out of falcon dancer from mound.

Moore's "mesh spacer" theory also possible, also idea of atlatl weight. Manufacture described from specimens.

Parsons, Allan C.

1909 Arrows and Arrow Wounds in Northern Nigeria. *The British Medical Journal* 1(2508):212-213.

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Dr with native troops. 19C language + humour. Iron points, mostly deals with poisons, made from plants and sometimes including strychnine or other poison, sometimes just 'using carcass as pincushion' to produce a more septic arrow. Treatment of poison arrow wounds with tannic acid, strychinine [ironically] if need to stimulate heart.

Native big game hunters fire stout arrows out of 'Dane guns' at close range, 'the hunter is often among the first to fall!'.

Arrows 'unwinged' [meaning unfletched].

Parsons, Elsie Clewsx1918 War God Shrines of Laguna and Zuni. American Anthropologist n.s. 20(4):381-405.

Ritual use of arrows and stone points in shrines, and miniature bows. At one Laguna shrine in extinct geyser, found a couple possible dart fragments. [Based on comparison with Pepper, and Kidder + Guernsey finds, but unlikely to be that old and not a positive ID anyway.]

Parsons, Jeffery R.

2008 Environment and Rural Economy. In *The Aztec World*, Elizabeth M. Brumfiel and Gary M. Feinman, eds., pp. 22-52. Abrams, New York.

P. 42 Aztec obsidian corner-notched dart point from lake basin survey

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Pastrana, Alejandro, and Kenneth G. Hirth

2002 Biface Production and Craft Specialization: A View from Sierra de las Navajas, Hidalgo. In *Mesoamerican Lithic Technology: Experimentation and Interpretation*, K. G. Hirth ed., pp. 197-207. University of Utah Press, Salt Lake City.

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Standardized manufacture of bifacial points for Aztec military use - large cores worked at quarry for large flakes, made into bifacial preforms, or tabular pieces ditto, stored until sent to city for finish work there. Point forms from Tenochtitlan, Texcoco, and Tlatelolco illustrated: [3-7 cm long, triangular forms with shallow side notches and usually concave bases, sizes suitable for arrow to dart, regular pressure flaking - these should be the form of Aztec dart points]. Article describes methods, but has little conclusion.

Pasztory, Esthers1983 Aztec Art. New York, Abrams.

Drawing from Saville and good color photo of carving on British Museum atlatl, color photo of another gilded atlatl.

Patterson, Alex

1992 *A Field Guide to Rock Art Symbols of the Greater Southwest*. Johnson Books, Boulder CO.

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[Generally good brief info on many motifs. P. 44-45 "Atlatl or Spear Thrower" adequate definition from Grant 1979, but illustrations mostly Coso Range, not typical of SW depictions.]

Patterson, J. T.

1937 *Boat-Shaped Artifacts of the Gulf Southwest States*. University of Texas Bulletin No. 3732, Anthropological Papers of the University of Texas Vol 1, No. 2. University of Texas, Austin.

Studied 359 boat-stone specimens from various collections from TX, AR, OK, LA. Typology of 38 varieties preferred to lumping into larger types. [Not a very useful typology - no meaningful spatial distribution of varieties, includes some things that plainly don't belong, and and fails to group things that are obviously similar. Many photos, but no two of same artifact, so can't see how some details relate to each other or replicate specimens. Dimensions given, but not weight, the most meaningful measurement if he interprets them as atlatl weights.]

Mostly bar, cup or boat shape in outline, and usually with concave base. Various different stones used, mostly local and soft - sandstone more often than any other, but also some chert or flint, and some quartz or quartzite. Sometimes notched, only rarely perforated for attachment.

Usually assumed charm or ornament. Source of "boat-stone": Wilson and Moorehead connect to Mohawk belief that witches use to cross rivers or as charm against witches. Other early interpretations. Rare use as container, rarely in graves. End notches and keel grooves suggest attachment to other object - suggest atlatl charm or weights as seen in SW. Hollowing base to regulate weight or allow large attractive stone. None yet found in association with atlatls in Gulf region, but older points are too large for arrow, so atlatls should have been in use, and some atlatl + dart finds from caves in TX.

Patterson, L. W.

1975 The Atlatl Function: Some Comments. *The Record* (Dallas Archaeological Society) 31(3):5-7.

Added leverage and increased angular momentum through a rotational motion is closer to the actual function than Howard's (1974) added force-time with a level atlatl. He diagrams, and calculates average 47% increase in leverage over hand throwing.

Patterson, L.W.

1977 Atlatl Functions: Comments on Howard's Views. *Plains Anthropologist* 22(76 pt 1): 159-160.

Critiques Howard 1974, 1976. Atlatl *does* work by adding rotational energy. Butler's idealized model is also wrong; functional length of atlatl is not complete arm + atlatl. Dart *must* rotate on spur, even for Howard's model. Question should be easily resolved by physics and high speed photography.

Patterson, Leland W.

2005 Additional Comments on Unifacial Arrow Points. *Houston Archeological Society Journal* 128: 7-9.

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Small flake pts with unifacial retouch by either raking or serrated pressure. Begin in Middle Archaic (3000-1500 BC) before bifacial arrow pts which are Late Prehistoric (post 600 AD), and contributed to pop increase in Archaic. [This would be very early for bow - why such a long gap before bifacial points since other Archaic pts were bifacial, and the b + a was successful and important?]

Patterson, Leland W.

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2007 Hunter-Gatherer Violence in Southeastern North America. *The Chesopaean* 45(4):21-23.

Ignoring evidence for bow and arrow in Archaic (refs) is like ignoring evidence of Pre-Clovis. H-G violence lacks size and organization characteristic of warfare. One of several possible responses to competition for resources.

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Pauketat, Timothy R.

2009 America's First Pastime. Archaeology 62(5):20-25.

Chunkee as widespread sport, possibly began at Cahokia, maybe used by elite there to unite regional system, express identity and membership. (See DeBoer 1993).

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Payen, Louis A.

1970 A Spearthrower (atlatl) from Potter Creek Cave, Shasta County, California. University of California, Davis, Center for Archaeological Research Publication No. 2: Papers on California and Great Basin Prehistory.

Cache in cave, with basketry, feathers, stone tools, shells.

Nearly complete but poorly preserved atlatl. One-piece wood, 35.3 cm L, 3.3-1.65 cm W, .8-1.2 cm T. Opposed finger notches, no loops, flat palm grip, single groove on hook side, 2 parallel grooves on other, but hook end is rotted off. [He is confused about dorsal and ventral – ventral, not dorsal is the hook side, but it is not clear if he can really tell which side had the hook anyway.] Very similar to Lovelock Cave atlatl (Loud and Harrington 1929).

Fragments of 3-part compound darts, tangential fletching on hardwood endshafts with socket, light wood mid shafts, hardwood foreshafts with and without stone points. Gives details of shafts. Points are small obsidian, stemmed or leaf shape, 2-3 gm weight, which is "arrow" size (Fenenga 1953).

C14 dates for darts from other sites: Gypsum Cave 950 BC + 80; Leonard Rockshelter 5188 BC + 350; La Brea 2500 BC + 200. Potter Creek should compare to Lovelock Culture, so suggest 1000 BC – AD 300 but no C14 yet.

[Atlatl, points, foreshafts illustrated]

Peabody, Charles [sic from Kellar]

1904 Explorations of Mounds, Coahoma County, Mississippi. *Peabody Museum of American Archaeology and Anthropology Papers* 3(2):?

Apparently first to suggest antler hooks from SE were part of atlatls.

Peck, Rodney M.

1989 Pick Type Bannerstones: The Atlatl Weight of the Stanly Culture. *The Chesopiean* 27(3):14-17.

Manufactured by peck, grind, scrape, drill, polish in that order, from a variety of materials. Drills solid or hollow. Broken specimens often reworked. Stanly Culture = Archaic VA and Carolinas, est 7000 BP, assoc with Stanly + Kirk Stemmed pts,
introduction of full grooved axes. [see Coe 1964]

Peltier, Martin

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1988 Au Mexique, J'ai Fete la Toussaint de Tous les Dieux. *Le Figaro* 451 (12 Nov 1988):134-142.

Tarascans of Janitzio, Michoacan, Mexico hunting ducks on Lake Patzcuaro with atlatl for Day of Dead, Nov. 30. [no detail, dark photo]. Decorate cemetery, feast, mixed Christian and pagan heritages.

Peets, Orville

1959 A Butterfly Bannerstone as an Atlatl Weight. Ohio Archaeologist 9(3): 83-87.

Fragile but functional, his replica survives atlatl weight/hook use.

Possible evolution from hand, throw with finger on end of dart, use short "palm" atlatl like Santa Barbara which adds force but is hard to balance, to lengthened atlatl or weighted atlatl to balance spear.

[No description of how he used his bannerstone, but photos show he put it on extreme end of atlatl and used edge of butterfly wing as hook for dart.]

Recommends a "brake" in motion as dart leaves atlatl rather than follow through [that is really poor form, no wonder he has no accuracy].

[No mention of flex, his atlatl seems rigid.]

"To attain accuracy I should have started 70 years ago" [He can't hit human-size target at 20-40 yards, so I would not judge experiment a success.]

Peets, Orville

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1960 Experiments in the Use of Atlatl Weights. American Antiquity 26(1): 108-110.

Weight makes no difference to distance of cast.

Weights probably for balance of spear on hand.

[Motion not described, but inaccuracy mentioned. Recognized problems of consistency in throwing, but sample size is not mentioned.]

Peets, Orville H.

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1962 The Geniculate Bannerstone as an Atlatl Handle. *Tennessee Archaeologist* 18 (2): 85-90.

"For several decades" experiments have been out of favor in arch. But "the most meaningful questions are not to be solved by using meaningless names" of artifacts. If we fail to recognize 'bannerstones' as atlatl weights, and 'gorgets' as wrist guards, we lose info on transition to bow. Geniculates are hook shaped with oval and oblong perforation. Thin shaft fits firmly in hole, hook up supports dart, held with either two–finger [split] or [hammer] grip. Similar to beak on birdstone atlatl handles. [His photos with geniculate handle and antler hook show additional bannerstone weight in between – no arch evidence of this]. Not a combined hook and weight as Webb suggests, and weights do not improve atlatl force. Weight might help balance, but not necessarily. [see Morse and Morse 1962].

Penders, Thomas

2002 Bone, Antler, Dentary, and Lithic Artifacts. In *Windover: Multidisciplinary Investigations of an Early Archaic Florida Cemetery*. Glen H. Doran, editor. Pp. 96-120. University Press of Florida, Gainesville.

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Atlatl "hook/cups" (5) of antler, short cylindrical with hook projecting from lip of cup. [So a "male" hook, cup is only to fit on end of atlatl shaft]. Hooks often reworked, worn. "Atlatl weights/handle/club heads" (5) of deer antler and 1 of manatee rib. All eliptical, transverse biconical hole for shaft. All but one have one splintered end from hammer use. Hole diameters average 17 mm. [There is no reason to call these "handles." They appear to be weights. At least one hook and weight are from same burial (155), another pair have same numbers, but incredibly, association not discussed, nor do any seem to have been connected by wooden shaft, although photo in Dickel shows the Burial 155 weight on its shaft. I can't believe this was not examined. No mention in chapter on wooden artifacts either]. Six antler tine projectile tips, 3 barbed points [I wonder if these are not atlatl hooks too]. Suggest "twisted on" for pts and atlatl hooks since no evid of adhesive [but could have been animal based glue].

Pepper, George H.

X

1902 *The Ancient Basket Makers of Southeastern Utah.* Guide Leaflet 6, American Museum of Natural History, New York.

Description of objects from collections of Wetherill, Graham, and McLloyd, mostly from Grand Gulch. Physical and cultural differences between "Basket Makers" and "Cliff Dwellers." Basketmakers had crude or no pottery, lacked bow, used throwing stick or atlatl similar to Mexican, "a form of weapon unknown in the SW, either in ancient or modern time, save in this restricted area." [No illustration of examples.] Baskets - include one with duck designs [similar to BM rock art.]

Pepper, George H.

1905 The Throwing-stick of a Prehistoric People of the Southwest. *Proceedings of the International Congress of Americanists*, 13th Session, 1905. pp. 107-130. American Museum of Natural History, New York.

Describes atlatls associated with Basketmakers, pre-Cliff Dweller, no bow and arrow. Comparisons - Mexico, Cushings Florida finds, others.

Several SW specimens described, mostly Utah, with some dimensions and a few illustrated.

Snake and lightning symbolism.

Spears - often cane, many wood foreshafts from Utah, with stone points, bone bunts, one

hardened wood in cranium.

Mentions some experiments with atlatl and fletching, but not described.

Péquart, Marthe and Saint Just Péquart

1942 Récente Découverte de Deux Oeuvres D'art Magdalénien au Mas D'Azil. *Révue Scientifique* 80:91-95.

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[In French. "Recent Discovery of 2 Magdalenian Art Works at Mas D'Azil"]. French Upper Paleolithic. 1937 Mandement found 3 chambers in the cave, one with mammoth and cave bear bones, one with engravings, one with a living area. Excavations by authors. *Baton de commandement* of antler with horse head sculpted on palm. *Propulseur à sagaies* (spear thrower) of reindeer antler, complete, faun aux oiseaux form, good photo. Holes in proximal end interpreted as allowing hunter to attach to self [but more probably to attach to longer shaft]. Fragile, beautifully made, no sign of wear in holes, 3 holes not necessary - probably not intended for use, a "propulseur d'honneur" made for an important person. Unique, only complete specimen, original subject - first prehistoric humor: probably a young chamois, looking back at rear, where it expels a dropping in the form of a bizarre sausage, with two stylized birds sitting and pecking on it, which forms the hook. [Two more pages of wordy description of the artistic brilliance of the piece.]

Peresani, Marco, Ivan Fiore, Monica Gala, Matteo Romandini, and Antonio Tagliacozzo x

2011 Late Neanderthals and the intentional removal of feathers as evidenced from bird bone taphonomy at Fumane Cave 44 ky B. P., Italy. *Proceedings of the National Academy of Science* 108(10):3888-3893.

From Mousterian levels, 660 bird bones, many different species. Cuts on bones of lammergeier, red-footed falcon, chough, black vulture, and wood pigeon. Focus on wings, suggest disarticulation and removal of skin and/or feathers, rare species with little food utility. Fletching for spears, darts, arrows? Probably not, not necessary for first two, too early for last two. Many possible uses of feathers for social and symbolic spheres; argue for developing behavioral modernity in late Neanderthals.

Perkins, William R.

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1990 Old and New World Atlatls: A Study of Similarities in Form and Function Centering on the Nazca Culture of South American and Tribes of Papua, New Guinea. *The Atlatl* 3(3):3-4

"Miscue" when dart comes off nock and is struck by atlatl can be prevented by "dart guard" on atlatl - found in both New Guinea and South America.

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Perkins, William R.

1992 Stealth Technology 1992 B.C. Bulletin of Primitive Technology 1(4):67-69.

Atlatl weights have 2 functions: 1) force flex of atlatl to store and release energy 2) silence sound of movement thru air [I don't find either convincing]. Dismisses argument that serve as counter-weight when aiming - arm goes to sleep. [He's

probably right, if you picture hunter crouched in aiming position for an hour!]

Perkins, William R.

1992 The Weighted Atlatl and Dart: A Deceptively Complicated Mechanical System. *Archaeology in Montana* 31(1):65-77.

Began experiments as engineering student 1984, presented this paper Montana Arch Soc 1989, Perkins and Leininger 1989.

Atlatl is to propel light flexible dart, not heavy spear, tip of atlatl moves faster than hand, so dart faster than hand-thrown spear. Force is applied at end and dart flexes, similar to arrow.

Flex of dart is essential to spring spear off hook before atlatl decelerates and swings down, or would just slip off hook [which *is* what happens, it doesn't spring away.] Dart flex stores and uses "harmonic oscillation and transverse waves" [a more complex explanation of concept of dart as spring]. Dart mass and distribution of mass affects flex, projectile point mass important part of this. "The dart is a missile which works very much like a spring."

Recommended darts: Red ossier dogwood saplings, 160 cm long, 1 cm thick, 100 grams mass.

Atlatl length affects arc length: longer atlatl better for long distance.

Weighting an "average" atlatl (= 1/3 dart length) compensates and allows adjustment for distance.

Atlatl flexes, influenced by weight, which by affecting flex, times separation of dart and atlatl, so tuning proper flex of dart to atlatl makes system efficient.

[This theory was quite reasonable at the time, but relies on a couple incorrect assumptions: 1. that the atlatl decelerates, allowing dart to release spring tension and jump ahead of atlatl, 2. that dart flex acts as compressing spring (in fact most of the available energy is released as side to side oscillations, not forward thrust). Accordingly, weights may or may not influence flex of the atlatl but that is irrelevant, and while a flexible dart is necessary, it is not a spring system, and to speak of the dart "propelling" its point is quite wrong. See Whittaker and Maginnis 2006]

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Perkins, William R.

1993 Atlatl Weights: Function and Classification. *Bulletin of Primitive Technology* 1(5):58-61. *The Atlatl* 15(2):10-11 (2002)

Confined to N. America. Theories: counter-balance, greater distance, hunting magic. Weights not heavy enough to influence speed of swing and thus dart velocity [not true, they often are, and depends on how placed]. No steadying effect. Flexible dart most important part of system. Purpose of weight is to resist acceleration, allowing atlatl to store more spring energy, and time release to spring of dart. Types: I - ca. 65 grams in one or two points, [where does he get this 65 gm?] II. 65 grams distributed by long weight, III. "stealth" weight or bannerstone. Mass ca 80 gm on atlatls ca. 40 cm, (shorter than 60 cm western weighted atlatls). Work mechanically like I, but silences noise of atlatl swing. Measured with microphone. [I want to see this replicated before I put much belief in it.]

Perkins, William R.

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1995 Effects of Stone Projectile Points as a Mass Within the Atlatl and Dart Mechanical System. *Bulletin of Primitive Technology* 10:69-72.

1997 Effects of Stone Projectile Points as a Mass Within the Atlatl and Dart Mechanical System. *Indian Artifact Magazine* 16(2):18-19, 65.

Dart is most important part of "spring mass mechanical system" - it flexes, and mass of point resists force, helps flex dart and store energy. Longer darts need bigger pts with more mass to flex efficiently.

Distance tests - variation ± 1.5 gm around a 9 gm mass is ok

Temporal trend to smaller points reflects faster darts, but more sensitive, so need more standardization of points in each local tradition [inadequate example given, and what about resharpening?]

Stone points preferred to other materials because more mass.

Really long darts like Australia - large points, or none if enough dart mass to flex without.

Ideal proportions of system: DartLength = Atlatl Length x Pi

[Dart flex is necessary, but he greatly exaggerates the importance of dart flex as stored energy – try flexing a dart against a stop and letting it spring forward. How far does it go? Does weight of point really affect flex, or mostly balance?].

Perkins, William R.

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2000b Effects of Stone Projectile Points as a Mass Within the Atlatl and Dart Mechanical System and its Relationship to the Bow and Arrow. *Indian Artifact Magazine* 19(2):8-9, 78-79.

Projectile advances all make smaller go faster, because Energy = $\frac{1}{2}$ Mass X Square of Velocity, and flatter trajectory more accurate.

Archaeological studies show arrow pts <3 gm, dart >4 gm.

Mass of points is important because in flexible shaft, energy is stored by flexing at launch, needs mass of point to resist push and cause flex, whether bow or atlatl. Also, to develop skill, need to use consistent points. Principles are same whether bow or atlatl, so bow evolved from atlatl. [Wrong!]. Foreshafts develop to tune system, and to minimize loss of length and thus flex with breakage.

Specific point masses are most efficient with a given dart length and flex, with limited (2-3 gm) range of variation possible. Tests at ca. 120 yds show a shaft designed for a 9 gm pt lost 3-7 yds of range when point varied by only 1.5-2.5 gm. [Given the variability inherent in the test, is a 2.5-6% variation really meaningful? – Highly unlikely.] Later

points are generally lighter, so need more sophisticated gear, and also lighter shaft materials. But small point needs shorter shaft, needs shorter atlatl, which reduces possible range. Bow makes such small projectiles work. Small points have even more limited possible variation, large early points much more. [This is really just a numerical effect.] Very large darts have enough mass without points.

[Perkins is looking at interesting variables, but he exaggerates the effect of flexing the shaft – as in bow and arrow, the shaft flex is necessary, but its contribution to the energy of the flight is very minor. He exaggerates the need for consistency too – human variability in each throw is so great that it far outweighs the effects of small changes in point mass, or dart mass or flex for that matter, both for accuracy and distance (see Couch et al 1999). Despite his archaeological example, point consistency is low, even in small arrow points – and my experience shows it doesn't matter. For instance, I have often broken a couple inches or more off a dart, re-pointed it, and used it with little change observable.]

Perkins, William R.

2000a Archeological, Experimental, and Mathematical Evidence Supporting the Use of the Atlatl as a Primary Big Game Procurement Weapon of Prehistoric Americans. *Bulletin of Primitive Technology* 20: 69-72.

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"Atlatl is not a spear thrower, it is a dart launcher." – requires flex of dart to spring off hook. [Unexplained concept of oscillations invoked too. And a bizarre and incorrect mathematical argument to show the atlatl is not a lever, and in fact "the force applied by the atlatl to the dart is inversely proportional to the length of the atlatl."] Flexing force proportional to length of dart, shorter dart requires less, thus needs smaller point. Most efficient is L Dart = L Atlatl x Pi, best at middle ranges, so shorter for closer, longer atlatl for longer distance [which demonstrates right there the lever nature of atlatls!]. Archaeological evidence of multiple lengths from rock art [not reliable]. Flexible atlatl adds efficiency, but hard to adjust by changing flex or length. Atlatl weight allows adjustment by influencing flex [contradictory], function same as dart point. Archaeological evidence and experiments show atlatl effective as hunting weapon. Eskimo use short, rigid harpoon thrower, not real atlatl – at short range ok to throw rigid dart from end. Eskimo effective at ranges less than 15 m, atlatl dart oscillation means it's not [not true]. [Perkins doesn't explain his physics well here, and is incorrect in many assertions.]

Perkins, Bob

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2004 Atlatl Archaeology: Precision Atlatl and Dart Systems. BPS Engineering webpage, URL http:/atlatl.com/archaeology.html, accessed 2/13/2004

Perkins, Bob

2004 Atlatl and Dart Mechanics. BPS Engineering webpage, URL http://atlatl.com/archaeology.html, accessed 2/13/2004

Perkins, Bob

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2004 Instructions for the Atlatl and Dart System. unpublished flyer sent by Perkins to accompany his darts and atlatls.

[Good throwing instructions, but strange drawings of sequence showing dart flexing with point going way up instead of staying on target while proximal end rises with atlatl.]

Perkins, William R.

2007 Throw This Article. Bulletin of Primitive Technology 34:91-92.

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Atlatl invention took humans "to the top of the food chain," differentiating us from Neanderthals. "The atlatl is the supreme expression of our natural ability to throw, it is the natural weapon of the human race." Then it all went downhill when we replaced throwing with the bow and arrow. [Amusing rant.]

Perkins, Bobo2009 The Key Marco Atlatl. Bulletin of Primitive Technology 38:21-22.

Brief compilation of accounts. [see Whittaker 2011 for more detailed info]

Perkins, Bob

2009 The Key Marco Atlatl: An Interpretive Reconstruction. *Bulletin of Primitive Technology* 38:23.

Effigy hook more likely bobcat than rabbit.

Perkins, Bob

2009 The Thames Atlatl. Bulletin of Primitive Technology 38:89-90.

Wood, no hook, from construction excavation in gravels. Similar in form to Lovelock Cave. [Unconvincing - no hook, no archaeological context, so unknown age, lots of other possibilities.]

Perkins, Bob

2011 BPS Engineering Webpage. Electronic documents, URL: <u>http://www.atlatl.com/</u> accessed July 2012.

Series of short pages promoting Bob's atlatl sales: "What about Bob?" (= biography and bibliog), "About the Atlatl and Dart", "Mechanics and Physics of Atlatl and Dart Systems", "How Atlatls Work", "Different Atlatl Weights", "Atlatl Flexibility", "Atlatl Archaeology", etc. [Lots of misinformation, especially his flex theories, though not detailed]: "Under acceleration by the Atlatl, the Dart flexes and compresses like a spring, storing energy to be used to push itself away from the atlatl and launching at velocities that easily exceed 100 mph." [speed exagerated]. Claims to have re-invented flexible

darts. "The only weapons Cortez and his Conquistadors feared because it easily pierced the Spanish armor." "So powerful and effective ... that it, along with overkill tactics so common to the human race, caused the extinction of the wooly mammoth..." With invention of bow "we began to deviate from our natural condition and take more from the environment than could naturally replace itself."

Perkins, William R.

2013 Travis Collection: A Study of Projectile Point Mass Consistency. *Bulletin of Primitive Technology* 46:17-24.

A

[Still promoting incorrect ideas about 'spring' nature of atlatl and dart, and similarity of atlatl and bow.] Point mass resists acceleration, bending dart or arrow and storing spring energy. Point mass is neglected by science. "The hypothesis here is that stone proj. pts of a particular tool tradition all weigh, within certain parameters, approx the same. The heavier the pts are within a tool tradition the more tolerable the deviation in mass." [Basic idea that point mass should be reasonably consistent is ok, but the tolerances are quite large, and mass + balance is also adjusted by such things as foreshaft.] 'Effective mass' is total mass of point including "adhesive, sinew, and wood on either side of the point," increasing overall mass by about a gram for atlatl points. [Confusing term, I guess he means the mass that he thinks affects shaft flex.] Then he looks at a handful of points of different types from a surface collection to argue that mass is consistent within types [but he has far, far, too few points to support that argument - this is not useful data. See Perkins 2000b and comments.]

Mentions that he made gear for *I*, *Caveman*, that killed elk: 6' darts with 20-25 gram stone pts. Foreshaft joints hinder penetration, solid shaft better.

Perkins, William R. and Paul Leininger

1989 The Weighted Atlatl and Dart: A Deceptively Complicated Mechanical System. *The Atlatl* 2(2):1-3; 2(3):1-4; 3(1):1-3.

see Perkins 1992

Pernter, Patrizia, Paul Gostner, Eduard Egarter Vigl, and Frank Jakobus Rühli

2007 Radiologic Proof for the Iceman's Cause of Death. *Journal of Archaeological Science* 34:1784-1786.

Arrow wound lacerated sublcavian artery in chest, head remained when shaft withdrawn, "deadly hemorrhagic shock" and "complete perimortem exsanguination." [In English: cut major blood vessel and he bled to death quickly.]

Perry, Jacquelin

1983 Anatomy and Biomechanics of the Shoulder in Throwing. *Clinics in Sports Medicine* 2:247-270.

X

Peters, Ann x

2000 Funerary Regalia and Institutions of Leadership in Paracas and Topara. Chungara (Arica), Revista de Antropologia Chilena 32(2):? Online version, URL: http://www.scielo.cl/scielo.php?script=sci_arttext&pid=S0717-7356200000200016&lng=en

Neighboring cultures (P + T) on S Andean coast, 200 BC - 200 AD. Funerary bundles with offerings. Patterns suggest institution for social, political and religious leadership among Topara leading to their dominance, beginnings of Nasca tradition. Bundles of embroidered textiles + cotton shrouds include tools and weapons such as slings, stone headed maces, and estolicas (atlatls). Large bundles of elder males with regalia clothing = high status specialists. Embroidered designs show supernatural figures carrying weapons, and heads (which rarely are found in bundles). Atlatls in both high and lower status bundles. [No illustrations or atlatl details, presumably the basic Peruvian form].

Peters, Brian, and Glenn Sykora

1998 Physics and the Atlatl, Part I. The Atlatl 11(3):3.

Dean Pritchard Type III atlatl vs hand throws, speed estimated from distance: Atlatl (60.1 m; 24.2 m/sec), hand thrown (16.9 m; 12 m/sec) which suggests atlatl stores and imparts elastic energy similar to bow and arrow. [No details, promised follow-up which never appeared.]

Petersen, H. C. x 1986 *Skinboats of Greenland*. Viking Ship Museum, Roskilde.

pp 69-97 section on harpoons and throwing boards with drawings. [Lots of descriptive detail, but remains rather unclear how things are thrown, and no photos of action] Also mentions hand grip and throwing strap as alternatives to throwing board. Knob and winged harpoons, bird darts and bladder darts mostly thrown with throwing board, sometimes the same, but sometimes each has own. Three types: 1) side-positioned [two bone pegs on harpoon fit holes in thrower, one prox, one distal], 2) with an end hook, and 3) combination of both. Made of wood, preferably same as harpoon. Flat, tapered shape, narrower at "forward" or "lowest" end [=distal], broader at "back" or "highest" end [grip, proximal]. "Top" [= underside] and "underside" [= upper] is grooved for harpoon shaft. Bone ends, decorative for proximal, necessary for distal. "Side-positioned" thrower used with knob harpoon and lance, which are held firmly in place on board by pegs and holes, also ensuring exactly same position each throw, can modify them to adjust throw. End hook throwers for winged harpoons, bladder darts, bird darts. No pegs, socket in bone cap on end of projectile, but there are some that use both together. Different sizes and details for different types. "Using a hook throwing board requires a different technique to the one used with a side-positioned one... When using a side-positioned throwing board the hand moves forward and down with the throw; with a hook throwing board it is extended

as far as possible forward." "When throwing with the throwing board, the arm and hand move in the same way as when throwing a stone, first forward and then down." [The projectiles all seem pretty rigid, although Petersen does not say. Is he describing a motion with less flip of the atlatl, less lever action for more rigid "side-positioned harpoons and more flip for more flexible lighter darts used with "hooked" board?]

Peterson, Jane

1998 The Natufian Hunting Conundrum: Spears, Atlatls, or Bows? Musculoskeletal and Armature Evidence. *International Journal of Osteoarchaeology* 8:378-389.

x

Advantages of bow, but not universally adopted. Jordan + Palestine, Natufian 12,500-10,500 yr ago, incipient agriculture, still rely on hunting, espec gazelle. No clear material evidence of bow and arrow, possible microlithic points w microwear and/or mastic, grooved shaft straighteners - but could be atlatl or spear rather than arrow. MSM musculoskeletal stress markers as independent evidence of habitual activities. Throwing and archery well described in sports and archaeol. 72 Natufian skeletons from 5 sites, 45 M, 27 F. Results: M participated in activities that stressed R side more than F did, espec for triceps brachii and estensors used in extending R arm, typical in overhand throwing but not in archery. Smith et al. study of cortical bone in humerus supports Natufian male right-biased stress consistent with throwing. Gazelle remains biased toward males, suggesting intentional culling. In drive and surround hunting using blinds and 'kites' atlatl motion would be irrelevant, dart high penetration good.

Pétillon, Jean-Marc

2012 La Chasse au Magdalénien. Pour la Science, Dossier 76: 70-77.

[in French, Magdalenian Hunting] Artistic conception of reindeer hunt with spearthrowers, photos of several of the carved Upper Paleolithic examples. Antler projectile points. Bow vs atlatl : arrow faster, easier to aim, harder to evade, rapid shots. Propulseurs become rare at end of Magd, but earliest arrows (Stellmoor) are later. Coexist? Research on fracture patterns, but for now uncertain. Other Magd info.

Pétillon, Jean-Marc

2015 Technological evolution of hunting implements among Pleistocene huntergatherers: Osseous projectile points in the middle and upper Magdalenian (19-14 ka cal BP). *Quaternary International* 2015:1-27. <u>http://dx.doi.org/10.1016/</u>

x

Old typologies didn't take account of manufacturing technique, came from sites where sequence jumbled by poor excav and old less-precise C14 dates. Now collect info, AMS dates on artifacts themselves, 61 dates from 39 assemblages. Material dominated by reindeer antler, cut by groove and split, some change thru time in parts of antler. Mostly sheds – seasonality of collection and manufacture? Peripheral parts cut off and abandoned off-site. Developments from simple beveled base points and few composit points to split base points, many elaborate barbed forms, with increase in non-functional

virtuosity in Late Middle Magd, same period as "androgynous" (groove and spur) form of spearthrower suggesting interest in new designs.

Pétillon, Jean-Marc, Olivier Bignon, Pierre Bodu, Pierre Cattelain, Grégory Debout, Mathieu Langlais, Véronique Laroulandie, Hugues Plisson, and Boris Valentin

2011 Hard Core and Cutting Edge: Experimental Manufacture and Use of Magdalenian Composite Projectile Tips. *Journal of Archaeological Science* 30:1-18.

Previous experiments mostly on lithic points. Many Upper Paleolithic points of antler or bone with groove for microliths along edge, this use of bladelets supported by finds and use-wear. Experiments 2008 to assess performance and produce use-wear examples. Lower Magdalenian: bladelets with retouched edge and sharp edge, microbladelets similar but often twisted. Reindeer antler points with "massive" [= thick round] bases or single-beveled. Upper Mag Pincevent Level IV20: small backed blades, long antler points with grooves and double-beveled base [i.e. thinned], one frag with microliths in place on both edges [but mastic not identified].

Experimental points: 10 no microliths, 24 with one or two edges of microliths, beeswax/resin/ochre or birch bark pitch mastics. Diameters (above 8=9 mm) and weights (above 15 g) of most are in range of spear, not arrow; Mag atlatl hooks known. Experimental spears of wood, 2700 mm long and 150-200 g. Two deer carcasses shot with atlatl thrown spears (throwers Cattelain, P + T Chauvaux, Demoulin) from 12 m. Crossbows used in other experiments don't duplicate dynamics of spear thrower lever action. 34 spears, 74 throws, 44 hits.

30/44 hits penetrated flesh + hide, 14 left impact trace on bone. Mean penetration for unbladeletted points was 148 mm. Little damage to antler, only a couple of crushed tips if hit target, but misses usually damaged. Penetration with bladelets varied, some stripped off the point and failed to penetrate hide; but mean depth for those with microliths was 283 mm. Microlith often detached at impact or within body. Microwear poorly developed. Probably need better setting of microliths.

Compound points are a good combination of toughness and cutting power. Adding flint edges doubles penetration. Interface between components (point/shaft, and antler/flint) are the weak spots. [good article]

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Pétillon, Jean-Marc, and Pierre Cattelain

2004 Nouvel examen de l'armature composite Magdalénienne du Tuc d'Audoubert (Montesquieu-Avantès, Arriege). *Bulletin de la Société Préhistorique Francaise* 101 (1):45-53. URL: http://usersskynet.be/fa057790/prehampetuc.pdf.zip accessed 10/25/05.

[In French. "New study of a Magdalenian compound weapon from Tuc d'A."] Antler foreshaft 344 mm long beveled and shaped to fit split-base antler point found nearby. Recognized by H. Begouen, excavator 1926. Associated with living floor, other artifacts including ornaments, parietal art, clay bison sculptures. Date on bone 14350 +160 BP or 15900-14600 BC. Study of 549 split-base pts shows great regularity of size. Foreshafts and points cut from hard exterior of antlers, roughly square cross sections with rounded corners shaped by scraping. Give greater weight and strength to most stressed part of spear than wood, simpler to replace parts than whole if damaged. Foreshaft is 14-9 mm diam, too large for arrow, although the points could be.

Pétillon, Jean-Marc, and Claire, Letourneux

2008 Traces d'impacts de projectiles sur le gibier : résultats comparés des tire expérimentaux à l'arc et au propulseur effectués au CEDARC (Treignes, Belgique) en 2003 et 2004. *Annales de Paléontologie* 94 :209-225.

In French. Projectile impact traces on game : comparative results of bow and spearthrower experiments at CEDARC. Two calves, 2 fallow deer carcasses. Antler tips like those from Up Magdalenian at Isturitz cave, 96 points, of which 78 were forked-base points. Half on arrows, half on darts because don't know which was in use. Cattelain, Chauvaux, Demoulin, and Rivère participated. [No info on draw weight of bow, weight of dart, etc] 618 total shots, of which 455 were hits, 127 of those contacted bone. Different types of bone damage : 1. Notches 2. Puncture, usually with cracking and embedding. 3. Perforation (through) usually with cracking and embedding. Bones of juvenile animals (calves) more easily damaged. More bone hits and more damage with the spearthrower [but since no info on equipment, can't compare power or efficiency]. A lot of damage, why is it rare in sites? The bones most likely hit are those most likely damaged by carnivores or later processing; differential survival. Can't distinguish damage by arrow vs dart.

[good methodology + record form]

Pétillon, Jean-Marc and Hugues Plisson

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2011 Thirty years of experimental research on the breakage patterns of Upper Paleolithic bone and antler projectile points: methodological problems and current perspectives. Paper presented at Multidisciplinary Scientific Approaches to the Study of Stone-Age Weaponry, Mainz, 19-22 September 2011.

Since the 1980s, replicative projectile experiments document the characteristic breakage patterns of Upper Paleolithic projectile points of bone and antler. Two main methodological problems: First, the most common type of impact macrofracture – beveled breaks, or bending fractures – is not diagnostic of projectile use, as it also occurs on other osseous tools used in a longitudinal percussion or pressure motion (e.g., needles, awls, and especially wedges). Second, the extent and level of damage on projectile points appears usually higher in the archeological assemblages than on experimental points used as projectiles. This discrepancy means that the Paleolithic points were subject to stronger stresses than the experimental ones, and/or that they were more breakable. Recent experiment shows that in previous experiments, the use of unrealistic experimental settings might have downplayed the amount of damage caused by missed shots hitting the environment around the target [they had a rocky background, damaged a

slightly higher rate]. But other possible factors – such as heavier projectiles, progressive fatigue of points used over long periods of time, greater brittleness of points under low temperatures, etc. [I suspect that struggling animals do more damage than carcasses.] [Bone points are very tough!] Most damage small tip crushing. Proximal fractures rare. Some shattering when hit bone.

Pétillon, Jean-Marc and Hugues Plisson

2016 Thirty years of experimental research on the breakage patterns of Stone Age osseous points. Overview, methodological problems and current perspectives. In *Multidisciplinary Approaches to the Study of Stone-Age Weaponry*, edited by Radu Iovita and Katsuhiro Sano, pp. 47-63. Springer Science and Business Media, Dordrecht.

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Pettigrew, Devin

2008 Light versus Heavy Darts: Hunting Strategies of the Basketmaker and Other Atlatl Wielding Indians. Unpublished senior thesis paper, University of Arkansas, Fayetteville.

Summarizes mechanics: lever action, not spring effect, needs flexible dart. Modern hunters using 8 oz (250 gm) darts, but BM equip was light.

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Penetration experiment on cow carcass. Wooden darts heavier than cane, but dart can be changed by different foreshaft + point combinations. Tried different woods to split, and saplings. Chose Dogwood with oak foreshafts for heavy darts (Berg 8 oz, Frison 12 oz) and box elder for lighter White Dog Cave dart replicas.

Distribution of BM atlatls. BM atlatls curve upward slightly, and hook clears dart better if they flex some. Experiment used 8 oz, 12 oz wood darts, and 7 foot cane darts. Experiment inconclusive because of weak hafting of points - so no conclusions on penetration.

Pettigrew, Devin

2008 White Dog Cave Darts. The Atlatl 21(3):1.

Replication of short Basketmaker darts, ca 55 inches without foreshaft: cane too stiff, box elder proper wood, worked better. Foreshafts tend to fall out in flight.

Pettigrew, Devin

2009 Throwing Rocks, Not Darts with Atlatls. The Atlatl 22(3):2-3.

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Replica White Dog Cave atlatl: "petite and strange" split finger grip with dart resting between index and middle fingers in loops. Natural throw like throwing a rock.

Pettigrew, Devin

2010 Bluff-Dweller Atlatls: An Old Find Rediscovered and New Interpretations. Electronic Document, World Atlatl Association webpage, URL: <u>http://www.worldatlatl.org/Articles/Bluff%20Dweller%20Atlatls.pdf</u> accessed 2012

https://www.scribd.com/document/45902928/Bluff-Dweller-Atlatls accessed November 29, 2017

Two forms from Ozark Bluffs: peeled stick with integral spur and peg in handle for grip; Basketmaker related type, represented by Montgomery shelters find.

Montgomery: in cist, no burial associated, proximal half. Eliptical cross section, flattened upper surface, broad finger notches with protrusions above + below for lashing loops. Narrow finger septum is flared thick to strengthen. Long slit on through shaft of atlatl. Distal end missing. Three distal dart fragments; drilled for conical foreshaft, sinew wrapped.

Atlatl comparable to SW and TX examples. Functional issues: flex of atlatl or dart does not propel dart. Difficult to test without having atlatl + the darts used with it. Uses White Dog Cave replica with short darts also from WDC. Experiments show good carcass penetration with light darts.

Origins of cross-peg grip, as on Ozark type found by Weimar/Harrington. Mexican parallels, and New Mexico rock art depictions.

Petttigrew, Devin

2011 Ozark Bluff-dweller, Alred Shelter, Arkansas: Reproducing the cross-peg atlatl from Arkansas. Electronic document, <u>http://basketmakeratlatl.com/?page_id=148</u> accessed 3/10/15

Dimensions, photos of replication, corner-notched point hafted in foreshaft with willow bark lashing. Alred atlatl works well with light dart. Cross-peg gripped with hammer grip, forefinger hooked over one peg, thumb pressed agains other, allows wrist to be more relaxed.

Pettigrew, Devin

2012 A Basketmaker Atlatl from the Ozarks. The Atlatl 25(1): 10.

Summary of above 2010.

Pettigrew, Devin

2012 Huck Atlatl, Utah? *The Dart* Oct 2012:5-8, and electronic document <u>http://basketmakeratlatl.com/?page_id=392</u>

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Complete atlatl minus loops and weight, Basketmaker form, notched for loops, "truncated" handle form. No provenience, probably UT [but who knows with a looted artifact]. Photo (thru glass case). L = 51 cm, Fulcrum L = 36.8 cm. Photos of reconstruction.

Pettigrew, Devinx2012 The NV-Wa-197 Atlatl; Boatstones, Grips and Fulcrum Points on Early ArchaicAtlatls. Electronic document, http://basketmakeratlatl.com/?page_id=100 accessed

3/10/15

Looted from Lake Winnemucca cave 1960s. Round shaft, long narrow boatstone, attached hook, slight curve, grip roughened. C14 7980 ± 610 BP – oldest intact atlatl in N Am. Dimensions, photo of replica. Small hook, weight work well with light dart. [this atlatl is model for Perkin's commercial atlatls]

Pettigrew, Devin

2012 Atlatl Weights: A function of preference for specific gripping and throwing techniques. Electronic document, <u>http://basketmakeratlatl.com/?page_id=418</u> accessed 8/23/2018

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Early experimenters mistaken, atlatl not an energy storage system but a lever. Balance theories. Tuning dart release angles, which may be responsible for changes in leverage measured by distance throws. Small SW weights as fetishes. N Am darts prob 4.5-6 feet, replications of whole dart + atlatl assemblage as for White Dog Cave show good balance effect. Garnett [2011] replics SW forms for split-finger grip but without lower handle for fingers, so can't use with fully engaged wrist, must rely on centrifugal forces – relaxed wrist flinging action rather than engaged wrist lever action. Former may assoc with lighter darts. Modern 'traditions' and personal preferences in atlatl use may bias our views.

2012 North American Atlatl Dart Mainshaft Materials List. Electronic document <u>http://basketmakeratlatl.com/wp-content/uploads/2012/04/NA-Dart-Mainshaft-Materials-List1.pdf</u> accessed 8/23/2018

Table of dart specimens with citations. SW mostly *Phragmites* reed and willow (*Salix* sp).

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Pettigrew, Devin

2013 Atlatl Flex Follows Form in Reproduced Basketmaker Systems. *The Atlatl* 26(2):1-3.

Cushing may have begun atlatl flex as spring theory, Whittaker and other high speed camera info show not correct, so what does atlatl flex actually do? Shaft curvature affects muscle alignment; necessary if short "loading groove." With short groove and long "headspace" distal to hook, flex needed to prevent striking dart. Variable combinations of details possible.

Pettigrew, **Devin**

2013 The Atlatl in Education and Research. Unpublished ms.

Pettigrew, Devin

2014 Reproducing the Atlatl from Hogup Cave, Utah: A Unique Great Basin Atlatl

Tradition. Electronic document. http://basketmakeratlatl.com/?page_id=949, accessed 3/10/15.

Pettigrew, Devin

2014 Flexible Atlatls Caught in Slow Motion. The Atlatl 27(1):10-11.

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White Dog Cave (very flexible) and Hogup Cave (only slightly) replicas. Photos show that as dart leaves atlatl, both dart and atlatl are still flexed.

2014 Flexible atlatls caught in slow motion, with video. Electronic document http://basketmakeratlatl.com/?page_id=1129 accessed August 24, 2018

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Pettigrew, **Devin**

2014 Experiments with Archaic Beveled Dart Points: Preliminary Results. The Atlatl 27(2):15.

Beveled points do not spin a dart. High speed photos showed oscillation with transverse waves (though dart leaves atlatl flexed, no spring action). Oscillation produces irregular spin as dart aligns spine with direction of flex. Spin can change direction during flight. Rotation also induced by lateral discrepancies in atlatlist's throw, producing crank-shaft effect. Planning to test effect when dart enters a body, following archery use of single bevel points.

Pettigrew, **Devin**

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2014 Experiments with Archaic Beveled Dart Points: Preliminary Results, continued. *The Atlatl* 27(3):13.

Penetration of melon and hog targets produced rotation with beveled points.

Pettigrew. Devin

2015 Ozark Atlatls and Darts: Old Finds and New Interpretations. Manuscript on file, Anthropology Department, University of Arkansas, Fayetteville.

Pettigrew, **Devin**

x,p 2015 Woodworking with a hatchet. The Atlatl 28(3):12.

Pettigrew, **Devin**

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2015 Moche Toss. Video of Moche 'Ceremonial Badminton', see Donnan 2015. Youtube https://www.youtube.com/watch?v=k99dR1UTqPM&feature=youtu.be http://basketmakeratlatl.com/?page id=1256 https://youtu.be/k99dR1UTqPM

Pettigrew, **Devin**

2016 Testing Atlatl Weights, more Machine than Man: A Response to Cain and Sobel

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(2015). The Atlatl 29(3):16-17.

Critiques Cain's mechanical thrower: not enough like human body for adequate test.

Pettigrew, **Devin**

2018 Ozark atlatls and darts: Old finds and new interpretations. *Plains Anthropologist* 63(245):4-25.

Pettigrew, Devin, and Justin Garnett

2011 Basketmaker Transitions. The Atlatl 24(3):1-6.

Basketmaker atlatls similar, but enough variation in details to affect function. Need to test complete systems: atlatl plus darts used with it.

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Variation in weights and handle length. 1) small or no weights, long handle. 2) functional weights, long handle retained. 3) weight, further from grip, short handle (not gripped in throw).

Broken Roof Cave as example of 3: short handle, loops only attached at upper lashing, large weight distal to center. So "loose wrist" throw [as I have seen JG do], which is easy and natural. Other examples are Spring Creek Cave and McClure atlatls without lower handle.

Experiment on weight function on BM forms: test accuracy, not power. Each author made and used weighted and un versions of same atlatl with same dart. Wt atlatl about +50% of unwt versions, darts 78 and 87 gm. Throw at 13.7 or 15 m, measure distance of hit from target center. DP 145 throws each atlatl, JG 210. Wt improved accuracy, but JG difference diminished with practice. So maybe weight is more for "customizing" atlatl to user than overall improving accuracy.

Pettigrew, Devin, and Justin Garnett

2012 Basketmakeratlatl.com: Exploring the Dart-Throwers of Native America. Webpage, <u>http://basketmakeratlatl.com/</u> Accessed August 24, 2018

Many articles mostly listed individually, also lots of pictures, commentary, links, other things not listed. Excellent resource.

Pettigrew, Devin, and Justin Garnett x

2012 The Persistence Hunter's Challenge: reviving an ancient atlatl hunting technique. Electronic document, <u>http://basketmakeratlatl.com/?page_id=213</u> accessed August 24, 2018.

Ethnographic support for running down game. Atlatl makes light multipurpose weapon, including detachable points on foreshafts make it easy to carry one shaft + replaceable points. Suggest sport now – run half or full marathon with atlatl and darts in hand, throw at standard FITA target. To try at 2012 Valley of Fire event.

Pettigrew, Devin, and Justin Garnett

2014 Reproducing the Atlatl from Spring Creek Cave, Wyoming. The Atlatl 27(2):3-5.

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Big Horn Mts, WY. 4 prox atlatl frags, 1 distal = 1 almost complete. Polished, ochre painted. Basketmaker similarities, but very light, small narrow grip with no loops surviving if ever present, rod-like prox end with small lateral projections. Bison were primary fauna in cave.

Authors independently tested replicas, light, throw well with BM darts of ca 70 gr, not abnormally light darts. Added hypothedical wooden loops based on McClure Gt Basin atlatl from OR, but there is no grip proximal to loops, so requires 'snappy' throw. Not ineffective, very light, maybe influenced by limited size of local material, i.e. *Rhus*.

Pettigrew, Devin, and Justin Garnett

2015 Atlatls and Darts of White Dog Cave, Arizona. The Atlatl 28(2):1-5.

Summary of archaeology of cave, dates ca 2000 BP, 2 complete atlatls from burials, one M, one F. Also atlatl and dart frags, 3 complete darts, allowing replication of compatible gear. Good photos Pettigrew replica of Cist 27 atlatl, and throwing. Willow dart replicas work well, detachable foreshafts roughened for socket. Complex prep of feathers for fletching. Rock art depictions of decorated fletching. Atlatl replication - distinctive loops, Gambel oak. Detailed measurements of C27 atlatl and darts.

Pettigrew, Devin, and Marvin Kay

2015 Atlatl Dart and Arrowhead Microwear from the Woo-Pig Experiment. Poster presented at 73rd Annual Plains Anthropology Conference, Iowa City, IA.

Microwear id of projectile impact scratches on points from our experiment (Pettigrew et al 2015), including faint curved or diagonal striations interpreted as from twisting of point in wound or motion of shaft.

Pettigrew, Devin, and John Whittaker

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2012 North American Atlatl Artifact List. Electronic Document, http://basketmakeratlatl.com/wp-content/uploads/2012/04/NA-Atlatl-Artifact-List.pdf accessed 8/23/2018

Fairly complete table of archaeological atlatl finds with summary of info for each

Pettigrew, Devin B., John C. Whittaker, Justin Garnett, and Patrick Hashman

2015 How atlatl darts behave: beveled points and the relevance of controlled experiments. *American Antiquity* 80(3):590-601. DOI: <u>https://doi.org/10.7183/0002-7316.80.3.590</u>

Beveling on stone points does not spin them in flight. Lipo's experiments are irrelevant to the way real projectiles behave. Observations of darts with and without beveled points

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and various forms of fletching, many throws and different throwers and equipment show that darts rotate because of their necessary flexibility. Our experiments with hog carcass show that stone points penetrate effectively, and bevels may turn a point in a solid medium, increasing wound severity, but unifacial resharpening remains the best explanation for most beveling.

Petzinger, Genevieve, and April Nowell

2011 A question of style: reconsidering a stylistic approach to dating Palaeolithic parietal art in France. Antiquity 85(330): 1165-1183.

Dating of art mostly stylistic, and assumed increase in sophistication. No sites are dated to Aurignacian (early) on stylistic grounds, i.e. art is only called Aurig if definite early dates, biasing view of development. Should base dating scheme on fewer, better "anchor" sites with good C14 and stratigraphic evidence. Example: Font-de-Gaume - well stratified Mousterian, Chatelperronian, and Aurignacian deposits, but all the art assigned stylistically to Solutrean + Magdalenian, despite lack of artifactual presence in cave. [May affect dating of some spearthowers.]

Pevny, Charlotte A

2012 What it Means to be Clovis: Part V: Bone Tools and Summing Up. The Mammoth Trumpet 27(2):7-14, 20.

Bone points for both thrusting and throwing, atlatls represented by hooks. Generalized or specialized adaptation? [good discussion of bone pts, summing up Clovis lifeways issues]

Phillips, Phillip, and James A. Brown

1984 Pre-Columbian Shell Engravings from the Craig Mound at Spiro, Oklahoma. Peabody Museum Press, Cambridge.

Mostly looted material, so dating imprecise. Plate 9 shows only depiction of atlatl in SE art, on a fragment of a shell cup with a scene of multiple warriors. Two fingerholes (although the hand is just gripping it below the holes), a boatstone lashed on in the middle, and hook are clearly shown. Probably dates around 1200 A.D., 2 centuries after atlatl weight evidence from other contexts at the mound, so could be very late use along with bow and arrow, or an antique. See Brown 1996.

Phillips, Wendell

0 2008 Inughuit: Hunters of Greenland. Sea Kavaker 124 (June 2008):36-42.

NW Greenland Narwhal hunting in kayak with throwing board and harpoon. [Kayaks described in some detail, atlatls not. Equipment visible in some photos - rigid harpoon with pointed bone butt end, thrower attached at middle; thrower is flat trianguloid rigid form with finger notch. One shot of a throw from kayak - harpoon is overhead, not flexing, with butt still behind the atlatl, which the thrower has flipped over into follow-through. So even

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though atlatl doesn't flex and hooks to mid of spear, it is still flipped - how much lever action is there?] Harpoon head is 4.5 inches long, 1.5 wide, fitted with metal blade, detach from harpoon on hit, connected to 25-yard nylon line [so that is max throw distance]. One hit reported - at 15 feet.

Philyaw, William L.

1972 The Atlatl. *Newsletter of the Missouri Archaeological Society* 254:7-8. Columbia, MO.

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[brief, mostly ok summary, but "atlatl gave a whip-like action and added push to the end of the dart" and "in addition to spears, atlatl was used to propel large arrows or darts" what distinction he implies is not clear. Describes Peets (1960) experiments to conclude that weights don't help distance, but might balance dart, bannerstones etc could be atlatl weights. Drawings of both "two finger grasp" and "pinch grasp".]

Picat, Iris

2009 Experts Declare Ancient Carving Genuine. American Archaeology 13(3):10.

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Mammoth or mastodon carving on Florida bone from Vero Beach - marks look weathered and carved when bone was fresh, date >13,000 ya. [I still bet it's a fake. No context, non-scientific collector, who noticed marks "2 years" after finding bone, and hopes to sell it for over \$80k. And it is just too pat - like all good fakes, fits what some want to find. Totally unique in US and looks too much like Euro Upper Paleolithic engravings. Stinks like a dead fish!]

Pickering, R. B.

1984 Patterns of degenerative joint disease in Middle Woodland, Late Woodland, and Mississsippian skeletal series from the Lower Illinois Valley. PhD thesis, Northwestern University, Evanston.

Compared skeletal populations using atlatl with those using bow, was unable to find significant differences in arthritis (atlatl elbow) or other markers attributable to weaponry.

Pickering, Robert B. and Maria Teresa Cabrero x

1998 Mortuary Practices in the Shaft-Tomb Region. In Ancient West Mexico: Art and Archaeology of the Unknown Past. R. F. Townsend, ed., pp. 70-87. The Art Institute of Chicago.

Since 1990s some unlooted tombs found, variable mortuary treatment becoming visible. Tomb at Huitzilapa (see Mestas Camberos and Ramos de la Vega 1998) contained 6 related individuals + many artifacts. One of adult male with healed R elbow fracture had 2 jade rings = atlatl handle, possibly atlatl injury. Jade hook and rings with a burial [same one or another?] [No illustrations of atlatl parts.] Exotic goods in form of tools include obsidian point and carved stone axe (photos). Discusses regional burial patterns. Mineralized fly puparia on ceramics may allow season of burial to be determined. Figurines may relate to individuals and their life cycles. Ca. 2000 bp.

Pine, Lloyd

1997 Pascal Chauvaux Best in the World. The Atlatl 10(1):1-2.

Reports International Standard Accuracy Contest scores for 1996.

Pine, Lloyd

1999 Garry Fogelman: Top Thrower. *The Atlatl* 12(1):1-2.

Top ISAC scores for 1998: G. Fogelman 93-2X, C. Birkett top woman 67.

Pine, Lloyd

2004 Target Backings for the ISAC. The Atlatl 17(1): 14-15.

Pitts, M.

1979 Hides and Antlers: A New Look at Star Carr. World Archaeology 11:32-42.

Plog, Stephen

2007 Ancient Peoples of the American Southwest, 2nd edition. Thames and Hudson, New York.

[Nice popular/text archaeology, lots of illustrations. Uses Driver drawing of atlatl throw from Fagan (p 45), drawing of Broken Roof Cave atlatl and hand holding dart + atlatl redone by Amy Elizabeth Grey from Guernsey 1931 and Woodbury and Zubrow 1979].

Pokines, James T.

1998 Experimental Replication and Use of Cantabrian Lower Magdalenian Antler Projectile Points. *Journal of Archaeological Science* 25:875-886.

Spanish Upper Paleolithic, transition from Solutrean to LM included intensification of deer, ibex, salmon, mollusc use and shift from lithic points to antler. Points are unbarbed, with beveled bases. Experiment to determine use-life factors. Used fresh N. Am. elk antler, 20 pts made with modern tools. Beveled, modern glue join to hardwood shaft, all used with same mainshaft, round, 31 mm diam, 2 m long. <u>Hand thrown</u> at 3-5 m at goat carcass. Total 249 throws, of which 51 were complete misses, 48 missed but penetrated soil, and 150 hit carcass [rather poor accuracy]. Point survival averaged 9.9 throws into soil or carcass. Only 2 pts snapped, others suffered only minor tip damage. Most carcass hits penetrated full length of pt + foreshaft, ca 25 cm to mainshaft. 1/3 of carcass hits penetrated rib cage, only 3 pts damaged, some broke ribs and penetrated.

Antler points more effective and durable than stone pts in other published tests. Shift from Solutrean stone to Magdalenian antler pts is shift from less costly but easier to

maintain kit to more costly but more reliable one, reflecting critical needs for a seasonal (short opportunity) but intense (long planned) focus on big game.

[No atlatls in experiment, but these pts probably were used with them, and could be - in fact, modern French atlatlists often do. Lots of refs to other point + some atlatl experiments.]

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Pomstra, Diederik

2011 A Quick Way to Make Mesolithic Archery Tackle. *Bulletin of Primitive Technology* 42:67-70.

Fast curing of wood for arrows and bow over coals. Plea for others to experiment with it.

Pope, Saxton

1918 Yahi Archery. University of California Publications in Archaeology and Ethnology 13 (3):103-152.

Hunting distance 10-20 yards p. 126.

Pope, Saxton

1923 A Study of Bows and Arrows. University of California Publications in Archaeology and Ethnology 13(9). Reprint 1962 Bows and Arrows, University of California Press, Los Angeles.

Extensive experiments, mostly flight distance using museum bows from all over. Velocity, measured by shooting 100 yds timed with stopwatch: Ishi, 45lb bow, 100 feet per second. English longbows 120-135 fps.

Striking force, determined by depth of penetration into parafin block, [clever but crude controls]: 50 lb bow, blunt 1 oz arrow, 1" penetration = 20 foot pounds. 75 lb bow, same arrow, 25 ft-lbs. 50 lb bow, 1.5 oz arrow, 22.5 ft lbs, so heavier arrow increases penetration.

Spine measures (lbs press on nock necessary to spring arrow 1" out of line) [= modern spine measurement not yet devised?]

Fletching: Native Am arrows lashed 3 feathers with sinew, usually no glue. Warped contour of 3 feathers from same wing forces rotation of arrow for stability. Spiraling fletching is "an unneccessary exageration and retards the velocity and striking force of the arrow." Experiment in parafin penetration shows. [also shows drop from 1 3/16" to 14/16" penetration from 10 yds to 50 yds, which contradicts statements in *Hunting* that arrow remains equally effective throughout range.]

Rotation: observed by shooting 2 arrows at once off same bow, attached by thread that wound. 50 lb bow, arrow rotates 6 revolutions per 20 yds or 15 per second, but lots of variation in individual arrows, fletching + weight affect rotation. A single feather from opposite wing may prevent rotation [in other words, it doesn't take much. He didn't try beveled points.]

Point penetration, tried bodkins, blunts, steel broadheads, Ishi obsidian points against

parafin, wood, and skin box filled with liver. Blunts need hard surface to penetrate; soft tissue needs cutting edge, obsid pts best on tissue because of serrated edges.

Pope, Saxton

1923 *Hunting with the Bow and Arrow*. James H. Barry Co., San Francisco. Reprint 2007, Digireads.com Publishing, Stilwell, KS.

[Reprinted several times, my copy done badly by parasites exploiting out-of-copyright works, no title page, poor photo reproduction.]

Pope, MD, treated Ishi, inspired by him. Describes Ishi archery. Equipment manufacture and shooting tips. Lengthy hunting stories. 19th century ethics: predators are bad, shoot eagles and hawks, target practice and hunting at ranges 40-150 yds, etc. Demostrated that longbow and steel broadhead could kill anything, including deer, bear, moose, mt lion.

Ishi hafted pts so edge was perpendicular when arrow nocked, "did not seem to recognize that an arrow rotates." Used straight, not spiraled fletching. Knapping described, but preferred steel pts. Carried 5-60 arrows in quiver. Shot off R side of bow [! used pinch grip with lower fingers actually pulling string]. Shooting range 10-50 yds for game. Comparisons: Pope and Young learned Ishi's archery, but preferred English longbow, scored much better than Ishi at target shooting.

Pope experiments: light arrow from heavy (65 lb) bow travels 150 feet per second by stopwatch. Rotates 6 revolutions per 20 yds or 15 per second, observed by shooting 2 arrows at once off same bow, attached by thread that wound. Steel bodkin through chain mail. Obsidian points penetrate flesh better than steel because of serrations. Mechanical bow and release experiments to test dispersion and consistency. Arrow wound cleaner and more humane than bullet wound.

Pope, Saxton T.

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1974 Hunting with Ishi – the Last Yana Indian. *Journal of California Anthropology* 1 (2): 151-173. Reprinted from Pope, 1923 *Hunting with the Bow and Arrow*. San Francisco: J.H. Barry Co.

First three chapters of 1923 above, detailing Ishi bow and arrow equipment, manufacture, and use.

Potter, B. A.

2008 Exploratory Models of Intersite Variability in Mid to Late Holocene Central Alaska. *Arctic* 61(4):407-425.

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ca 1000 BP loss of microblade traditions, a few copper tools, more organic tools, more storage + habitation features - transition from N. Archaic to late prehist Athabascan traditions. Explained by shift from multiseasonal large animal hunting assoc w high residential mobility to exploit seasonally abundant resources like caribou + fish with more storage and logistical mobility from home bases.

Flaked stone technol forgotten to Tenana informants in 1930s. Microblade vs bifacial traditions - some overlap. Ice finds show bow replace atlatl soon after intro ca 1300 cal BP - dart pts are bifacial stone w only one slotted antler, arrow pts are antler. But notched bifaces are hallmark of N. Archaic.

Statistical examination of attributes of sites. Notched bifaces assoc w caribou bone but not bison or elk. Microblades assoc w bison, elk, mammoth, moose.

TEC Technological and Economic Change models: before 1300 BP conservative ancient tradition of lg mammal hunt, using 2 systems - bifacial atlatl dart pts, composite bone + microblade pts on thrusting spears. After 1300, intro bow, replace atlatl as distance weapon, pts change to barbed antler, small stem + tanged stone pts, and copper pts, allowing overhunting of bison and extirpation - shift to broader spectrum hunting, espec seasonally abundant caribou + fish. Limited mobility > shift to less good lithic sources > more organic points, loss of microblades.

Potter, Ben A., Joel D. Irish, Joshua D. Reuther, and Holly J. McKinney p,x

2014 New insights into Eastern Beringian mortuary behavior: a terminal Pleistocene double infant burial at Upward Sun River. *Proceedings of the National Academy of Science* 111(48):17060-17065. DOI 10.1073/pnas.1413131111

Tanana River basin site in sand dune, 4 components dating 13,200-8000 cal BP. Cremated 3-yr old child in hearth in structure dates ca 11,500 cal BP. Beneath this, 2 more unburned infants in pit, ochre-rich matrix, no burning or charcoal, thin organic layer over infants and grave goods. Burial dates from charcoal adhering to antler rod, sim to overlying cremation dates, suggest nearly contemporaneous events, same hunter-gatherer group. Lithic activity areas, biface manufacture of chert. Fauna dominated by salmon and ground squirrels, some likely bison or elk.

Skeletons mostly complete, in anatomical position, flexed, poss shrouded.

Goods – 4 antler rods, beveled both ends, ca 28-53 cm long, 54-112 gm, wear consistent with hafting. 2 basalt pts at end of rods, earliest hafted bifaces in N Am, 83-93 mm L. 1 other rhyolite biface 86 mm L. All coated w red ochre. Rods incised with X patterns. Foreshafts in atlatl-dart or spear systems. Pts lanceolates w concave bases, edge-grinding 50% from base, Denali complex forms. Rods are antler, prob wapiti [Vanderhoek 3/2017 thinks caribou more likely, would make heavy dart for big game].

Same people, diff burial treatments – could relate to timing, age (naming, ensoulment, etc) or sex, but aDNA from cremation not successful.

Powell, Earl B.

1937 Hul-che: A Rediscovered American Sport. Popular Mechanics, July 1937:121-122.

"Copied from specimens dredged from Sacred Well at Chichen Itza." Instructions and diagrams for making Mexican style atlatl out of modern material, ½" dowels for darts 4-4.5' long. Brief instructions for use, "hit the target at 60 yards time after time." [I'd be real surprised if it worked that well! Is this earliest ref to modern sport use?]

Also a separate article + photo of unknown source, "Ancient Mayan Throwing Stick

Modernized by Bowmen" shows Mrs. Robert Stacy-Judd, "wife of famous archaeologist" [see Lerner 2001] demo a 2-hole atlatl with long darts in quiver, claims finds by S-J "given to EB Powell, nationally known archery expert, who developed them as a modern sports accessory."

Powell, Eric A. o

2017 Set in Stone. Archaeology 70(4):44-48.

Bannerstones. [Nice color photos, including replica atlatl with bannerstone, generally good article]. Anna Blume studying collections at Am Mus Nat Hist. Webb's ideas. Kinsella balance theory for deer hunting ambush. Sassaman chronological change, development of symbolic/identity aspects as move from Shell Mound Archaic area, hypertrophic giant forms. Blume: Archaic society egalitarian, so personal rather than status markers, a challenge in different, non-knappable stone for knappers [no real reason to assume knappers made them, but perhaps], ritual use as well as functional part of spearthrowers [all quoted here seem to agree, as do I]. After ca 1500 BC disappear, perhaps using nets for deer hunt, lost both utilitarian and ritual roles, complex stone pipes appear about this time, as do birdstone perhaps replacing bannerstones on atlatls.

Powell, James D.o1953 Throwing Sticks. Science and Mechanics, August 1953:112-114.

Instructions for making 2-hole Mexican style atlatl out of modern material. Use modern arrow or make one 4-4.5' long. "Throw with free overhand motion.... the throwing stick acts as a long lever..." [He understands how it works, although accompanying photo looks partly faked with dart in odd flight position and unflexed.] Also info for cord + whip stick to throw shingle dart, a more elaborate Maya atlatl [there is a drawing of a Maya warrior perhaps cribbed from National Geographic] and a [rather crude flat] Australian "woomerah." [These are all kind of ugly, but would probably work and his instructions are ok, although no mention of need for dart to be flexible, which was why my atlatls didn't work as a kid.]

Precourt, Prudence

1973 The Archaic Banner-Stone: A Social Category Marker. *The Lambda Alpha Journal of Man* 5(1): 1-26.

Banner stones were atlatl weights, but also symbol of social category in ranked society. Burial information analysed from Green River sites like Indian Knoll: few have goods, fewer have bannerstone, which is mostly with other goods as well, and with all age and sex, but mostly young adult males.

Possibly seasonal leadership [no evidence].

Prins, Harald E. L.

2010 The Atlatl as Combat Weapon in 17th-Century Amazonia: Tapuya Indian Warriors

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in Dutch Colonial Brazil. The Atlatl 23(2):1-3.

Tapuya were recruited by Dutch in colonial wars against Portuguese, painted by Dutch artist Eckhout. Famous painting [shown] now in Danish National Museum shows dancers with atlatl and darts. [Odd form atlatl: Straight, concave surface like hollowed cane (but it's hardwood), tapers slightly from prox to distal end, with fiber lashing and feather ornament at distal. The lashing and the taper makes it look like the hook is at the grip! Darts unfletched, with stone or more likely bamboo or wood points.]

Prins, Harald E. L.

2010 The Atlatl as Combat Weapon in 17th-Century Amazonia: Tapuya Indian Warriors in Dutch Colonial Brazil. Electronic Document, World Atlatl Association Webpage, URL:

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http://www.worldatlatl.org/Articles/Tapuya%20Atlatl%20Article%20by%20Harald%20P rins%2025%20May%202010.pdf

Expanded version of that in newsletter. Adds identification and photo of atlatl specimen in Danish National Museum, which may have come to Europe with group of Tapuya.

Proulx, Donald A.

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2001 Ritual Uses of Trophy Heads in Ancient Nasca Society. In *Ritual Sacrifice in Ancient Peru*, edited by Elizabeth P. Benson and Anita G. Cook, pp. 119-136. Austin, University of Texas Press.

Trophy heads part of shamanistic ritual controling natural phenomena, major goal of warfare. Examples from art and archaeological specimens. Atlatls mentioned as prominent in warfare, no detail.

Purdy, Barbara A.

1991 The Art and Archaeology of Florida's Wetlands. Boca Raton: CRC Press.

Photo of two atlatl hooks, short cylindrical sections of antler with tine as spur, from Bay West site, ca 6000 B.P.

Also photo of shell hook from Warm Mineral Springs, possibly PaleoIndian in date [see Claussen et al. 1975, Cockrell and Murphy 1978]. Skeleton [is this the one associated with shell hook?] dated 7140-7580 B.P. so Middle Preceramic Archaic.

Purdy, Barbara A., Kevin S. Jones, John J. Mecholsky, Gerald Bourne, Richard C. Hulbert Jr., Bruce J. MacFadden, Krista L. Church, Michael W. Warren, Thomas F. Jorstad, Dennis J. Stanford, Melvin J. Wachowiak, Robert J. Speakman x 2011 Earliest art in the Americas: Incised image of a proboscidean on a mineralized extinct animal bone from Vero Beach, Florida. *Journal of Archaeological Science* 38(11):2908-2913.

Details of analysis summarized in Lepper 2012. [Tests support likely antiquity, though they admit (and minimize) possibility of a hoax, describing finder as 'avocational archaeologist' and ignoring his monetary interests. They want it to be real; I'm still not convinced - see Pickard 2009, Lepper 2012.]

Putnam, John J. o 1988 The Search for Modern Humans. *National Geographic* 174(4):438-477.

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Upper Paleolithic in African caves and Europe. Cave art objects. Artsy reconstruction pictures of Paleo life, imitating cave art style, with sketchy depictions of hunting with atlatls.

Pyszczyk, Heinz W.

2003 Aboriginal Bows and Arrows and Other Weapons in Alberta: The Last 2,000 Years, Or Longer? In *Archaeology in Alberta: A View from the New Millenium*, edited by Jack W. Brink and John F. Dormar, pp. 46-71. The Archaeological Society of Alberta, Medicine Hat, Alberta.

Information sources: ethno-historical records, problems of analogy, artifacts, rock art. Inferring projectiles from points. Problems of point size, co-existence of different weapons. Mummy Cave (Hughes 1998) shows rapid replacement about 1300 years ago, but survived in Mexico, has good penetrating power. In Alberta, Avonlea pts ca 1800 BP believed to signal bow, but Dyck (1979) says variation in Oxbow (4500-5500 BP) and Pelican Lake (3000-1900 BP) pts might indicate bow with atlatl. Thomas, Shott methods applied by Dyck and Morlan to Sjowald site, Saskatchewan, support this. Besant and Avonlea overlap could represent diff ethnic groups with diff weapons. Children's toys possible too. Concludes point size ambiguous, but applies Shott formula to Alberta point assemblages, plots ratio of arrow to dart thru time. Back to 8000 BP pts small enough for arrows with those large enough for darts, general increase in proportion of small points thru time. [Seems to want early bow, but point size is just not good enough evidence.] Quotes Henday account 1754 mentioning "bows, arrows, spears, and darts" as possible atlatl survival [No, "dart" would have meant 'javelin' in Henday's time.] Pictograph Cave, MT shows both guns and atlatls, but chronology ambiguous. Writing-on-Stone site, Alberta shows one possible atlatl, but undatable. Also horsemen with long, fletched spears held or thrown from end - maybe hold-over from atlatl darts, also bows with spears on end. [Don't read too much into vague and stylized rock art images.] Bow might dominate because more versatile and especially suited to small game.

Quilter, Jeffrey

2002 Moche Politics, Religion, and Warfare. Journal of World Prehistory 16(2):145-195.

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Historical similarities of Maya and Moche study. Archaeological culture defined first by ceramics with relatively clear distribution limits. Several large valley systems along N coast of Peru. AD 50-800 or 950. Arid desert coastal river valleys. Agric included maize,

potato, avocado, beans, manioc, peanuts, fruits, cotton, gourds, guinea pig, dog, camelids, muscovy duck. Spondylus shell, gold. Irrigation. Balsa boat trade along coast. Conquest state or simpler organization on more local scale. Iconography – representational but selective – distinction between portrayals of life, history, myth, and iconic symbols not clear – so scenes of prisoners may history, archetype from myth, or just how prisoners were treated, and deities in such context may be gods or costumed human actors. Was warfare ritualized, for sacrificial prisoners and Moche polity theocratic, or were there political goals? Scenes of single combat may represent larger battle, not just ritual capture. Ritual + political need not be mutually exclusive.

Are main huaca (pyramid) sites centers with cities or more "empty ceremonial centers"? Productive land and resources. Elites buried in huacas – ritual or political leadership? [good survey of modern perspectives]

Quilter, Jeffrey

2005 *Treasures of the Andes: The Glories of Inca and Pre-Columbian South America*. Duncan Baird Publishers, London.

Coffee-table book, fine color photos, good short chapters cover regional archaeology with focus on art. Little on weapons: p 87 Moche ear spool with mosaic warrior with shield, mace, darts, and wielding atlatl [Sipan?]; p 171 Inca depiction of tropical tribesman with recurved bow.

Quilter, Jeffrey

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2008 Art and Moche Martial Arts. In *The Art and Archaeology of the Moche: An Ancient Andean Society of the Peruvian North Coast*. Steve Bourget and Kimberly L. Jones, eds., pp. 215-228. University of Texas Press, Austin.

Nothing to suggest coordinated formations, or attacks on fortification, most agree essence of M war was one-on-one combat for captures. Larco (2001) major source of info; in his museum distinguishes darts from lances (over 2 m long), no dart specimens. Darts always shown as compound weapons with long pt and thicker shaft. Lances or long spears rarely shown in M art. Copper spikes 25-50 cm long Larco thinks lance pts, but could be dart pts, would need counter weight on shaft to balance properly in spear-thrower. [Maybe, no weight info given unfortunately]. But perhaps too heavy, too expensive for expendable darts. No barbed ones found, no darts with copper pts found either. More likely these spikes were bottom of maces [good idea, but no photos, so far not found on clubs.] Hand combat depicted, but projectile weapons imply more. Best against massed enemy. "Experiments with replicas should help determine ranges of M spear-throwers and their darts" and types of combat. P 222 Deer hunt as symbolic of warfare. Art may depict only elite warriors and neglect masses of common folk, comp to Greek warrior art. [Excellent article].

Quilter, Jeffrey

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2012 The Fall of the Moche: A critique of claims for the New World's first state. Latin

American Antiquity 23(2):127-143.

many of same themes as in 2002 above

Quilter, Jeffreyo2014 The Ancient Central Andes. Routledge, New York.

General survey of Peruvian prehistory.

Quimby, George I.

1944 *Aleutian Islanders: Eskimos of the North Pacific*. Anthropology Leaflet 35, Chicago Natural History Museum.

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[Exhibit guide, general info, not too useful], "The spear-thrower is like a rigid sling...it acts as an extension of the arm and therefore enables the hunter to throw the spear with greater momentum and force. Modern experiments have shown that the spear and spearthrower lack the accuracy of the bow and arrow but possessed greater penetrating power...advantage in hunting tough-hided sea mammals. Other advantages...are its lack of recoil and fact that it does not require use of both hands." Different kinds of darts used [all apparently rigid], including multi-pronged bird dart. [no useful illustrations]

Whaling [not with atlatl?] using aconite root poison.

Railey, Jim A. m

2010 Reduced Mobility or the Bow and Arrow? Another Look at 'Expedient' Technologies and Sedentism. *American Antiquity* 75(2):259-286.

Parry + Kelly (1987) proposed that as people shifted to agriculture and sedentism from Archaic hunter-gatherer lifestyles, stone tool kit became more expedient, oriented toward flake cores. Mobile folk preferred bifacial formal tools because bifaces more versatile, resharpenable, biface blanks produce more cutting edge per weight, thus less to carry. Two main problems: 1. Temporal disconnects in shift to exped technol, agric, and sedentism. 2. Prascunias (2007) exper shows bifaces not more efficient cores.

Reviews arguments about antiquity of bow and arrow; supports general intro ca 500-700 AD, atlatl may have continued in places, point size not good indicator.

Expected technological changes with bow + arrow: 1. fewer biface thinning flakes if pressure flaking pts on flakes, and fewer biface failures because small point failure less [last not true, espec if overall # of pts manuf increases with arrows as he argues earlier] 2. recovery of pressure flakes low, assemblages thus proportionally more large ordinary flakes 3. proportionally poorer materials from emph on better stone needed for larger bifaces.

In S New Mexico sites, 1000 yrs of continuity with no change in mobility or subsistence, but lithics change anyway to more flakes, fewer bifaces, poorer materials. This correlates well with change to generally smaller points that class as arrow points by Shott's measures. So in this region at least, change in weapon technology seems more responsible for lithic assemblage change than changes in mobility. [Good paper, although some of the

overgeneralization evident in all large explanatory theories - nothing in complex systems is that simple or without exceptions.]

Ransome, Jay Ellisx1946 Children's Games Among the Aleut. Journal of American Folklore 59 (232): 196-198.

Current school policy to teach "American" games reduces traditional, but some survive. "Today spearthrowers have no value except to aid in the hurling of rocks and small handmade spears. In ancient times before the advent of the Russians the true spearthrower was in common use to give range and power to the harpoon. Fragments of old spearthrowers may be found in almost every old village site. Today they are badly made and serve only as minor playthings for children."

Rapaport, Matthew

1998 Review of the BPS Engineering Atlatl. MJR webpage, URL: <u>http://www.sonic.net/~quine/bpsrev.html</u> accessed 11/15/2005, but obsolete 10/2015

Ratzat, Craig o

1992 Atlatls: Throwing for Distance. *Bulletin of Primitive Technology* 1(4):62-63.

Need flex in both atlatl and dart.

Fletching not necessary if dart balanced, and not same diameter for its full length. Recommends short light dart, tapered and point-heavy, unfletched, and long light flexible atlatl. Achieved distances of over 500 ft.

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Ravines, Rogger

1967 A Pre-Columbian Wound. American Antiquity 32 (2): 230-231.

Peruvian lumbar vert w embedded obsidian point. Prob atlatl dart, but no good context.

Ray, Jim

1996 A Brief Coverage of Atlatl Styles, Construction, and Usage. Xerox pamphlet privately distributed. Also posted on WAA webpage, URL: <u>http://www.worldatlatl.org/AtlatlNewsletter.html</u> accessed 4/14/06.

Brief how-to make atlatl and darts, plans for his "Shooting Star" atlatl styles.

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Raymond, Anan

1986 Experiments in the Function and Performance of the Weighted Atlatl. *World Archaeology* 18(2): 153-177.

Experimenting since 1978; "comfortable and fairly proficient." Atlatl makes arc,

but <u>not</u> with the diameter = arm + atlatl as Butler says, i.e. nock and spear follow straightline, with handle going down while spur and dart do not rise higher than the hand, as Howard says. [Based on Howard's incorrect ideas, not a good throw, lacks power - he misunderstands normal atlatl mechanics, although he is right that Butler is wrong too. His drawing of the throw shows that he does in fact flip the atlatl, and that his dart flexes, but to keep to Howard's model, he bends his body forward at the waist, bringing the arm down – very poor form.]

Velocity of 70 gm dart consistently 20-21 m/sec measured with high speed photos, and 20-27 m/sec measured with radar speed gun, thrown with replica Basketmaker atlatl with/without 40 gram weight. Three trials of 30 shots with weighted/unweighted atlatl, throwing at 40 degree angle for distance.

Weights give some speed/distance advantage. [He claims 8.2% higher speed measured with radar gun, and 5-11% greater distance with weighted atlatl, but his means and graph show there is absolutely no statistically valid difference in mean velocity or mean distance thrown. Measured with photos, there is no velocity difference even to him.] Atlatl flexes and recovers during throw; film speed not enough to capture "acceleration of atlatl as it recoils in last few miliseconds of throw." Weight may affect recoil. [Reasonable at the time, but wrong.] Weight stabilizes by increasing angular momentum (gyroscope effect), improves accuracy. [This is probably the correct explanation for weights - but angular momentum, although a product of angular velocity, does not mean increased velocity.]

Atlatl survived against bow because produced more force than primitive bow and allowed one handed use in Eskimo fishing from kayak.

Red Hawk, Jay

0 2009 Itazipa Glogli: Bringing Back the Bow. Primitive Archer 17(2):23-27.

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Teaching values to kids on Chevenne River Lakota reservation using archery. Primitive skills as tradition and identity.

Red Hawk, Jay

2013 Plains Arrow Experiment. Primitive Archer 21(3):60-64.

Observed shooting at 10 yds, straight fletched plains arrows with metal broadheads oscillate, but do not spin.

Redmond, Brian G. and Kenneth B. Tankersley 0 2005 Evidence of Early Paleoindian Bone Modification and Use at the Sheridan Cave Site (33WY252), Wyandot County, Ohio. American Antiquity 70 (3): 503-526.

Bone rods, single-beveled and pointed, assoc with Gainey fluted pt and fauna espec Pleistocene peccary. Suggest slight impact damage on bone rod = projectile use.

Reed, Alan D. Х 1990 Evidence of Arrow Points from Basketmaker II Sites in Southwestern Colorado. *Utah Archaeology* 3:139-141.

Geib + Bungart (1989) identify arrow pts as early as 100 AD at Sunny Beaches site and Cowboy Cave in Glen Canyon, associate with Fremont occupation distinguished from BMII by arrow pts + single rod foundation basketry. But small pts of Rosegate form also in BMII at Tamarron site N of Durango, and SW CO, so b+a use should not be used to distinguish Fremont from BMII.

Reed, Paul F., and Phil R. Geibo,p2013 Sedentism, Social Change, Warfare, and the Bow in the Ancient Pueblo Southwest.

Evolutionary Anthropology, 22(3): 103-110.

[reviewed ms 1/13] Bow usually considered part of differentiation of Basketmaker II vs BMIII, 400-525 AD, but increasing evidence of SW bow use prior to 500 and maybe as early as 100 AD in Late BM II. Antelope Cave atlatl AMS date cal AD 20-340; [Sand Dune Cave bag with foreshafts cal AD 80-330 in ms] [implies also assoc with pottery and bows, but don't really say, and I don't think so, just in date range where they occur elsewhere?] Morris Prayer Rock cave bow + arrow frags from dendro dated pithouses AD470-520, early BMIII.

Shott + Thomas used small non-representative samples of darts + arrows, especially in that some dart points, like the Sand Dune Cave ones, are fresh + cached, not used, reworked, discarded as most in arch sites. Illustrated with SDC point compared to smaller rejuvenated BM pts. So many points where an overlap in size is expected are unreliably classified, e.g. Sliva's claim that small Cienega pts were arrow tips as early as 800 BC. Better early bow evidence from Cowboy Cave. AZ/UT border Mountainview site maize dates assoc with unmistakable arrow points + manufacturing sequence as well as pottery. Sandy Ridge nr Moab, UT, arrow pts in pithouse dated 200-300AD, no pottery. Other possibles. Distribution looks patchy, not all contemp groups in 4 Corners used bow. Some late BMII apparently did, others e.g. Cedar Mesa and Black Mesa show no evidence of bow. [In ms: Battle Cave (Morris) female burial supposed BMII age, with embedded arrow but collagen date cal AD 650-880, so PI.]

Significant warfare in BM times before bow: rock art, heads, massacres at Wetherill's Cave 7 in SE UT, and Battle Cave in N AZ, etc. "If anything, there appears to have been a decline in conflict during the first few centuries after the intro of b + a." No examples of BMIII massacres, or skeletal trauma, until PI times. Glassow (1972) suggests change in weapons went with change in storage = more dependence on agric, so less time for hunting, bow is more efficient by providing advantage of ambush, use in woods, and more variety of small animals possible to hunt.

Bow has 3 advantages: easier to learn, less movement in hunting, can use in smaller space - hunting in brush and shooting from defensive sites. Lambert (2007) says N. Am. increase in violence after AD500. Early bow not correlated with particular changes in environment or animals, thus more likely selected for warfare, when adopted by one group, others keep pace. [They make this conclusion despite arguing that in SW

there is less violence after bow adopted] - 'warfare theory' of bow adoption (war increases with bow) is not supported. Lag in war after bow, thus supports social coercion theory, which also says warfare follows other increased complexity, and 'intro of improved weaponry will be followed rapidly by increases in social scale and economic intensification.' [Rapid increases in social scale? Maybe, but I don't find compelling.]

Reeves, Joseph

2005 Naqaq Hunters on the Yukon Delta. The Atlatl 18 (3): 9.

Brief notes on interview with school board members. *Naqaq* still primary seal hunting weapon because prevents seal sinking in fresh water. Learn as children, throwing grass stems, catch first seals ca 12, women as well as men. No details on gear.

Reid, Jefferson, and Stephanie Whittlesey

1997 The Archaeology of Ancient Arizona. University of Arizona Press, Tucson.

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[Nice, readable prehistory, but they work a bit too hard with some bad evidence because they want to do social archaeology, and there are some odd gaps, including no mention of Chaco or its influence.]

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p. 154 Accepts Lorentzen's idea of bow not adopted at Grasshopper Spring site until after 1200, increasing hunting effectiveness. [That's absurdly late, R + W 1999 explains why they want this unlikely interpretation].

Reid, Jefferson, and Stephanie Whittlesey

1999 *Grasshopper Pueblo: A Story of Archaeology and Ancient Life*. University of Arizona Press, Tucson.

[Another nice readable account of an important site and long project, but again trying too hard with some interpretations that don't really work if you know the data.]

p. 43 They accept Lorentzen's idea that different ethnic groups are indicated at Chodistaas and Grasshopper Springs sites, ancestral to Grasshopper Pueblo. At C, Mogollon people used bows and arrows, while at GH, Anasazi immigrants use atlatls. A nearby pictograph shows a woman with hair whorls (= Anasazi because Hopi, who dress hair that way, think they are Anasazi descendants), and a figure throwing a spear with an atlatl [probably not, it's way too vague to tell] is on same panel, so that must be Anasazi too, right? [This overwrought social archaeology is why they like Lorentzen's dubious conclusions. Why would Anasazi immigrants, who were not using atlatls anywhere else, retain them at Grasshopper? Nonsense. See Whittaker 2012 for full critique.]

Reinhard, K. J., J. R. Ambler, and C. R. Szuter

2006 Hunter-Gatherer Use of Small Animal Food Resources: Coprolite Evidence. *International Journal of Osteoarchaeology* 17:416-428.

Methodology reviewed. Small animal bone often digested, in coprolites preserved best in dry conditions. Better representation of small animals than midden remains. Archaic Hinds Cave, TX, diverse taxa of rodents, especially packrat, plus birds, reptiles; warm season occupation. Archaic Dust Devil Cave AZ (near Sand Dune Cave), cold season occupation, emphasis on cottontail. Vertebrae + rib common, also skull, all fragmented = pounding of complete body for consumption, perhaps after eating legs. Rabbit-consumed fungal spores in human coprolites = internal organs eaten too.

Renaud, Etienne B.

1925 Propulseurs et Sagaies Préhistoriques des Indiens 'Basket-Makers.' Bulletin de la Société Préhistorique Française 22:297-312.

[In French. "Prehistoric Spearthrowers and Spears of the B-M Indians."] Two chronological divisions in W N. Am.: Basketmakers followed by Cliff Dwellers, former with atlatl, latter with bow, parallels Paleolithic and Mesolithic in Europe. New tribes succeeded in part by superiority of long-range weapons. Simplified engravings of BM (Marsh Pass), Mexican, and Florida forms of atlatl.

Recent discoveries by E. Morris in Canyon del Muerto, now at U. CO Museum: 4 propulseurs, one so well preserved it looks new. L = 63, 65, 70, 75 cm, longer than other BM specimens, but all of similar form with individual variations. [Compares with others: Kidder + Guernsey specimens, Grand Gulch, Sayodneechee, Kinboko, many details of description and measurement, but no pictures of any]. Always a spur within notch or channel, grip notched with hide finger loops lashed on, hard wood, generally oak. CdM examples lack the weight of stone or bone found on some. Probably stabilized and balanced, maybe added to force of throw. Well-evolved, so sources probably in South. Primitive forms from Tenochtitlan Great Temple excavations, Ozarks, and far W US, also ethnog Lake Texcoco - simple stick with hooks and no grip or with cross-pegs.

Patzcuaro duck-hunting, Cushing Florida form both with 2 holes in wood. Also single-hole with rabbit, recalls Upper Paleolithic atlatls with tail as hook. For these, and the 10 known Mexican carved and gilded ones, "their beauty prevents all supposition that they were engines of war or for hunting" (306).

Canyon del M specimens dated by Morris 1500-2000 BC, but so evolved, more likely only 1000 years old [both these guesses are wrong.] UCM also has 4 'reed arrows,' L = 84 cm without point, painted decoration, sinew wrap to support fore-shaft, narrowed proximally, sinew tied on missing feathers. Not long enough for spears, lack socket for hook, thus arrows made after fashion of atlatl darts as two cultures came in contact. Kidder + Guernsey have atlatl darts, ca 1.4 m long [described].

Reyes, Tony

1999 West Texas Atl-Atl Cache. The Texas Cache 5(2):cover, 4-5.

Parts of 3 atlatls from looted TX cave. Poor photos and information, but looks like Basketmaker style with mixed type integral hook, finger loops. Some decorative marking, one drilled, slot on one for lashing weight, mark of weight on one. Supposedly with "paleo" points [but since it's a looted site, can't trust the information, date, or even be sure they are not fakes].

Reyes, Tony

1999 The West Texas Atlatl Cache. Indian Artifact Magazine 18(3):6-7.

Similar to above, but good photos. Parts of 3 atlatls from looted TX cave, bought by author. Description is brief, but with photos can tell that: "Paleo" points are concave base forms. Atlatl 1: complete but missing loops. Odd squared hook. 20.9 inch long, 1.25 W, .375 T. Two long slits through groove lengthwise. Handle grip carved. Atlatl 2: handle fragment, simple straight form, groove for hook, zigzag decoration on back.. Atlatl 3: handle fragment, simple straight form but hollowed. Loops are twig lashed on with cordage, rather flimsy. Two drilled holes. [Interesting, too bad they were looted].

Reynolds, Cerisa R.

2012 The artiodactyl index at the origins of agriculture in the northern U.S. Southwest. *Journal of Contemporary Anthropology* 3(1):39-59.

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Darkmold Site, Durango area. BM II. Comp'd to others. Has lots of artiodactyl, espec mule deer. Other BMII dominated by rabbit, including W BM but no site from right in our 4 Corners atlatl rock art area. Suggests some diff between E and W BMII – maybe E more local Archaic origins, still hunting more, W immigrants with more agric, though in both areas rely heavily on maize, don't yet have beans for protein. Poss some turkey, but prob not much or not for meat. [From her diss below]

Reynolds, Cerisa R.

2012 Meat at the origins of agriculture: faunal use and resource pressure at the origins of agriculture in the Northern U.S. Southwest. PhD. dissertation, University of Iowa, 2012. http://ir.uiowa.edu/etd/3373.

Rhodes, Jill A. and Steven E. Churchill

2009 Throwing in the Middle and Upper Paleolithic: Inferences from an Analysis of Humeral Retroversion. *Journal of Human Evolution* 56:1-10.

Humeral retroversion (measured as degree of difference between orientation of elbow and head of h at shoulder, i.e. twistedness of humerus) reflects evolutionary differences in activity, and also activities during life. Differences between Neanderthals and modern humans may imply diffs in tool use etc. But "... any increase in upper limb activity prior to skeletal maturity will lead to increases in humeral retroversion." Modern athletes tend to have higher retroversion angles in their throwing limb. Greater retroversion allows more external rotation of h at cocking phase, thus longer time to accelerate the projectile. Compare Neanderthals vs moderns (Upper Paleolithic) assuming: no bow and arrow, amount of throwing is enough to affect bone, begin throwing as juveniles, right handedness normal, males hunted (and females may have too). Expect if Up Pal used throwing spear/atlatl, and Neanderthals thrusting spears, then UP males to show R humeral retroversion angles more sim to athletes, more assymetrical than Neanderthals, similar to modern throwing groups. Small samples: N's: 6 males and 2 females (only 2 M have both humeri), Middle UP: 15M, 5 F, Late UP: 14 M, 7 F. Up Pal M not different from non-throwing modern pops, differs from Aleut (throwing atlatl etc), but M/F Aleut similar [so Aleut values may not relate to throwing at all]. Fossil humans all show assymetry sim to throwing athletes, while modern non-throwing pops less [does this make sense if fossils are not really different from those same mod non-throw pops?]. Sex diffs only in mod Euro-Am pop, LUP males (with archaeol evidence of throwing = spearthrowers) have low torsion angles, although even more assymetrical than athletes. [so is there *any* real effect of throwing in any of these pops?] "... data is equivocal..." [they say and show this several times, but then conclude Neanderthal pattern is consistent with no projectile weapons, Up Pal consistent with variable use of such. But in fact, this paper is a glaring example of interpretations pre-determined and based on biases, ignoring the lack of usable evidence.]

Rice, David G.

1972 *The Windust Phase in Lower Snake River Region Prehistory*. Report of Investigations No. 50, Laboratory of Anthropology, Washington State University, Pullman.

SE WA, Windust Cave and Marmes Rockshelter and others, primary report. Windust Phase is early occupation, Paleoindian, 10 C14 dates on shell from Marmes between $10,810 \pm 275 - 7,400 \pm 110$ BP, followed by Cascade Phase. Both sites since destroyed by damming river. Series of stemmed projectile points [probably equivalent to Eden, Hell Gap, Pinto], basal notched and lanceolate pts, flake tools, choppers metates, grooved bola stones. Three bone atlatl hooks – small flat pieces with flat beveled surface and projecting stubby hook. One from Marmes, 2 from Granite Point open site. Two drawn [not too distinctive, could be misidentified]. [Lots of point drawings and a chronology of styles, but not an interesting lithic analysis.] [Cited as early date for an atlatl part, but impossible to tell precise association or date of Marmes specimen, assuming that it is an atlatl hook (probably is)].

Richard, **Russell**

1997 In the Movies. *The Atlatl* 10(4):1-2.

On being atlatl consultant for movie "Eaters of the Dead" [released as "13th Warrior"], with fictional primitives using atlatl from horseback. Possibly the only time anyone has tried equestrian atlatl use. See Crichton 1992; McTiernan 1997.

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Richard, Russell

2011 Hello Friends of the Atlatl. The Atlatl 24(3):16-17.

Wyoming events, including Saratoga Museum event honoring Rod Laird as Grandfather
and Leni Clubb as Grandmother and Saratoga as Birthplace of the Modern Atlatl.

Richard, Russellx2011 Use of the Atlatl in Prehistoric Hunting in Wyoming. Wyoming Atlatl and Social
Club webpage, electronic document, URL: http://wyasc.com/home/knowledge/use-of-
the-atlatl-in-prehistoric-hunting-in-wyoming/

Weights, a few hooks, Spring Creek Cave finds, Frison experiments.

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Richard, Russell

2012 Historic Atlatls of Wyoming. Wyoming Atlatl and Social Club webpage, electronic document, URL: <u>http://wyasc.com/home/knowledge/historic-atlatls-of-wyoming/</u> accessed August 2, 2014.

G. Frison in 1950s working with Spring Creek Cave finds, "gained enough proficiency to hunt rabbits". Photos of Frison, an atlatl [Basketmaker-like hook but solid handle with multiple finger grooves, thin shaft, thicker distal with groove and hook] Rod Laird discovered Casper site, met Frison when he excavated, later taught atlatls in 6-grade class, inspired to begin annual atlatl meetings. Photos of Laird, Kornfeld, other WY atlatlists. Bill Tate first commercial atlatl ca 1985. Bob Perkins BPS Engineering "Mammoth Hunter". [large grip with leather loops, thin rod shaft with attached weight, rounded blade distal end with metal ball hook - only grip is much like his later form]

Richard, Russell

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2013 Ellsworth Jaeger and the Atlatl Quest. Wyoming Atlatl and Social Club webpage, electronic document, URL: <u>http://wyasc.com/home/knowledge/ellsworth-jaeger-and-the-atlatl-quest/</u> accessed August 2, 2014.

[See Jaeger 1961] *Nature Crafts* first published 1949, RR's is 1958 ed. E. Jaeger (1897-1962), New York state, knew E. T. Seton. Commercial art background, Buffalo Museum of Scince education curator 1941, traveled studying animals and tribes, prolific author, lecturer. Refs to a number of early pop articles with atlatl info that EJ might have known, or learned of it from academic circles.

Richards, Michael P., Sheila Greer, Lorna T. Corr, Owen Beattie, Alexander Mackie, Richard Evershed, Al von Finster, and John Southon o

2007 Radiocarbon Dating and Dietary Stable Isotope Analysis of Kwaday Dan Ts'inchi. *American Antiquity* 72(4):719-733.

C14 dating of bone collagen complicated by evidence of marine diet (which affects C14 concentrations) - calibrated range of 3 dates A.D. 1480-1850. Clothes and "hand tool" assoc w body also give wide range. Conclusion: 1670-1850 [more recent than previous estimates.] Date ranges for other artifacts suggest multiple use site. [Artifacts listed in table that were previously considered possibly atlatl and dart now labeled "throwing or

snare stick" and "arrow? shaft fragment"] Isotopic analysis indicates strongly marine diet, but also shift to terrestrial resources in year before death, although he also had fish + crustacean (coastal) food in stomach.

[Commendably, they were allowed to do analysis of the body before it was destroyed, but there is still no useful info available on the artifacts, see Beattie et al. 2000]

Richardson, Mike

2010 Other Types of Atlatls: Loop, Fork, and Cord. The Dart April 2010:5-6.

Richardson, Pat

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2007 Army Corps of Engineers Makes Important Archaeological Find. *The Atlatl* 20(3):15. (from electronic document http://www.army.mil/-news/2007/05/23/3311-army-corps-of-engineers-makes-important-archaeological-find/)

Nome harbor work, Alaska, finds Inupiat pit houses ca 300-350 BP. Inupiats not expected in this area until after gold rush. Finds include cache of hunting gear, atlatl [no details]. Margan Grover archaeologist.

Richardson, Thom

1998 Ballistic Testing of Historical Weapons. Royal Armouries Yearbook 3:50-52.

X

Reports velocity tests on variety of weapons including atlatl, sling, bow, crossbow, early guns. Atlatl velocity: average 15.82 m/sec (35.47 mph) max 17.9 m/sec. Compared to spear 12.5 m/sec, slings and bows in 30-40s m/sec, arquebus bullet ca 400 m/sec. [But no info at all given on the atlatl, or the thrower, and these velocities seem low, not enough better than hand thrown spear, see Whittaker + Kamp - our velocities 20-25 m/sec. So did they really know what they were doing with an atlatl?]

Richardson, Thom

1998 The Ballistics of the Sling. Royal Armouries Yearbook 3:44-49.

Range shorter than historic accounts: ca 100 m with stones, 115-150 m with lead slingshot or lead balls, velocities around 30 m/sec. [Sounds like his accuracy was low, he admits his may not be a fair test.]

Riddell, Francis A. and Donald F. McGeein

1969 Atlatl Spurs from California. American Antiquity 34(4):474-478.

Three types described, with distributions. All similar forms, with flat bottoms, rounded spur head attached to flat or grooved extension for lashing to atlatl. I)"Snakehead", usually stone. II) "Acorn" bone or antler. III) Variant of I?. [Type distinctions not explained, nor evident in illustrations]. Associated with Central CA Early Horizon - Martis Complex, Lovelock period in Great Basin, 3-4000 B.P. (Archaic). One with associated C14 dates ca. 7500 B.P.

Riede, Felix

2009 The Loss and Re-introduction of Bow-and-arrow Technology: A Study from the Northern European Late Palaeolithic. *Lithic Technology* 34(1):27-45.

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Large tanged Bromme pts + Bromme techno-complex sandwiched between earlier Federmesser and later Ahrensburgian, both with small points. Experiments by Fischer show Bromme pts usable as large arrowheads. Rozoy says bow allowed recolonization of N Europe. But B pts more likely reversion to atlatl with loss of cultural knowledge at population bottleneck after eruption of Laacher See volcano 12, 920 BP. Fischer experiments not quantified enough, show typical projectile fractures on B pts, but not whether arrow or dart. Studied 632 complete pts from L Paleo N Europe. Shott discriminant function analysis classes almost all B pts as dart, Federmesser + Ahrensburg pts as arrows [But it really does NOT apply here - Shott/Thomas samples too small and not European.] Ahrensburgian evidence - wooden arrowshafts and possible bow frags, faunal data suggest rapid fire techniques [?huh?]. Pt size ranges suggest bow + atlatl coexist in Federmesser. Atlatl may have been used against large game - elk (=moose) and giant deer Megaloceros because of greater impact power (Baugh) and effective distance (Churchill). But why lose the bow? Social disruption and loss of transmission of technology, only dramatic enough event is eruption of Laacher See at junction between Feder + Bromme periods - Bromme lithic tech simplified. [Interesting, possible - BUT it all relies on point size arguments - not good enough. For instance, we don't know anything about the bows - could they not have changed? And no finds of atlatl parts either. And even a small population of hunters is unlikely to unlearn bow technology.]

Riede, Felix

2010 Hamburgian weapon delivery technology: a quantitative comparative approach. In *Before Farming*, incomplete ref, posted on Academia.edu, November 2015.

Reindeer hunters using shouldered points. Spear-throwers known from Magdalenian sites before + after Hamburgian but not from H sites. C14 dates for H point sites ca 12k BC (11-13K), and for Magd layers with atlatl parts almost all 18-14 with a few later and a couple later than 12k [makes me suspicious of late dates]. Shape similarity with later prehist arrowpoints and shafts of Ahrensburgian, comp with tip cross sectional area TCSA and perimeter TCSP and Shea dimensional model, and ethnog suggests bow and arrow most likely. 106 H pts, 74 Ahren pts compared to Shott, Thomas, Shea data [from N Am and exper points, which should not be applied to Europe. A serious methodological flaw. These epipaleolithic points are small and slight, made on blades, not bifaces, so no surprise that they fall on the small "arrowhead" end of range for N. Am.]. H and A points metrically similar [a much more convincing comparison]. Stellmoor foreshafts from both H and A levels, long, notched one end, beveled other. Could be either dart or arrow. Made of pine, but now lost. Possible bow frags of pine too, perhaps of composite bows. One poss bow frag from Magdalenian Germany dated 14,680±70 BP. Little suitable wood for bows, could be composite bows of reindeer antler

and/or compression wood of pine. Hamburgian levels show resource scarcity in faunal remains – perhaps poor bow performance? So should test replications of H points and composite bows, to comp b+a vs atlatl, composite vs self bows, control many variables such as target type. [Would be huge project, but we don't have good evidence of H bows to replicate, so that part won't work.] Try use-wear too, so far not good on H pts [why

Riemersma, Len

not?].

2001 Practice, Perseverence, Patience, Provides Pork: An Atlatl Hunting Experience. *The Atlatl* 14(3):11.

Boar kill, private game farm. [No distance given].

Riemersma, Lenny

2010 Compound Atlatl. The Atlatl 23(4):16.

Atlatl with hook that pivots, thus staying in contact with dart longer, perhaps increasing dart velocity.

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Riemersma, Lenny

2012 President's Corner. The Atlatl 25(1):19.

WAA membership constant at around 325. R. Lyons retiring as Treas. World Atlatl Day introduced. Saratoga WY 30th anniversary of Rod Laird's World Atlatl Open, precursor to WAA.

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Riemersman, Lenny, and Ron Mertz

2014 A Tribute to Richard Lyons. *The Atlatl* 27(3):1-2.

A

d. 12/25/2013 – WAA treas since 2004, redesign of logo, educational efforts, his atlatl type board display pictured, gourds.

Rijksmuseum

2006 *Exhibition Guide: Australia: The Land, the People*. Rijksmuseum voor Volkendunde, Leiden.

Brief descriptions of a number of spearthrowers on display (no pictures) with my notes and refs to my photos. Also had a nice film of throwing and a distribution map on display.

Rios-Garaizar, Joseba

S

2011 Variability in the morphology of Mousterian Points: Testing the potential use of throwing spears among Neanderthals from a technological, functional and experimental perspective. Paper presented at Multidisciplinary Scientific Approaches to the Study of

Stone-Age Weaponry, Mainz, 19-22 September 2011.

"Use of complex weapons by Neanderthals including projectile weapons such as javelins is issue in debate of Neanderthal capabilities. Disputable statements made by paleoanthropologists against possibility of long distance throwing due to configuration of shoulder joint (Rhodes and Churchill 2009). Also some archeologists think Mousterian/Levallois points don't fit the standard of a projectile point or spear point. Actually, great variability of morphologies reflect different designs adapted to different uses. Some of these morphologies have been designed and are fully adapted to weapon use not only as spear points but also as projectile tips. This idea is not new (Galván Santos et al. 2007-2008; Moncel et al. 2009; Shea 2006; Villa et al. 2009; Villa and Lenoir 2006) but we propose multi-proxy approach to identification of Middle Paleolithic weapons: 1. morphological description including characteristics that are crucial from a ballistic point of view to discriminate between points and convergent or pointed tools (indices such as TCSA combined with tip plan and section angles, side edge angles, curvature, weight and basal thickness), 2. Technological analysis of point production processes (blank production, retouch, rejuvenation) leading to final morphology of point. 3. Experiment with ballistic features of different morphologies of points and hafts. 4. Use-wear analysis with special attention to impact scars

5. Experimentation to characterize impact scars and to discriminate between projectile vs thrusting impacts. 6. Collection analysis

We have IDd probable projectile points in Iberian assemblages (Axlor, Amalda), French (Combe Brune I) and in one Northern African site (Irhoud) and analyzed them with this protocol to compare them with indisputable Upper Paleolithic points (Chatelperronian, Gravettian, Solutrean)."

Spear throwing experiment with inexperienced thrower [bad idea], demonstrating that can be thrown on spears [so what, that's obvious]. Lateral deviation increased with haft length, distances up to 20+ mm, all sim but better with lighter shaft. No impact fracture [but weak experiment – what surface, how did it land with poor throw, what is balance point of his spears, etc.].

Arch record: M pts usually rare, but up to 8% of formal tools in W Pyrenean region sites. Some very light, basally thinned, impact flutes on some. Concludes: exper shows throwing possible, arch shows impact evidence common.

Rios-Garaizar, Joseba

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2016 Experimental and archeological observations of northern Iberian Peninsula Middle Paleolithic Mousterian point assemblages. Testing the potential use of throwing spears among Neanderthals. In *Multidisciplinary Approaches to the Study of Stone-Age Weaponry*, edited by Radu Iovita and Katsuhiro Sano, pp. 213-225. Springer Science and Business Media, Dordrecht.

[see 2011]

Ritzenthaler, Robert E.

1970 The theory of the birdstone as an atlatl handle grip, revisited. *Wisconsin Archaeologist* 51(1):31-34.

Similarity of Nazca atlatl 'handle-grips' in Mujica Museum in Peru to birdstones. An exper atlatl with birdstone grip worked with several different hand positions. Townsend found similarly. Breakage at neck or perforations suggests hard use. Occur in E Woodland and L Archaic horizons that have other evidence of atlatls (hooks) [but not actually in association]

Rivera, Mario, and Vjera Zlatar x

1982 Las estolicas en al desarrollo cultural temprano prehispanico del Chile. Actas del IX Congreso Nacional de Arqueologico, *Boletin Museo Arqueologico* 18:14-34. La Serena, Chile.

"The spear thrower in the early prehispanic cultural development of Chile." In Spanish. There seem to be 31 examples tabulated, with descriptions of specimens from a series of sites, to define a number of types. Poor illustrations show several forms: curved stick with raised integral hook, a straight shaft with short groove and hook missing and handle wrapped, a flat lath form with deep groove and handle both wrapped and notched. [These two are reminiscent of Gt Basin forms]. Another form is a flat shaft with raised integral hook and handle wrapped with a small cross stick. [this one looks BM or Ozark related]. And a couple incomprehensible drawings.

Roach, Neil T., Madhusudhan Venkadesan, Michael Rainbow, and Daniel E. Lieberman x

2013 Elastic energy storage in the shoulder and the evolution of high-speed throwing in Homo. *Nature* 498:483-487.

Our unique throwing capability results from anatomical features that enable elastic energy storage and release at the shoulder, appearing ca 2 mya in *H. erectus*. Throws are powered by rapid sequential use of many muscles, starting in legs, progressing through hips, torso, shoulder, elbow, wrist. Internal (medial) rotation around the long axis of the humerus makes largest contribution to projectile velocity. [i.e. swinging the forearm by rotating the humerus]. In cocking phase, joints torque beyond normal range of motion, storing energy in stretched elasticity of tendons and muscles. Tested with 20 baseball throwers, normal throwing, and throwing with braces reducing natural range of motion. *H. e.* shows long waist, orientation of scapula + humerus/scapula joint. [See Connor 2013 for layman's version]

Roberts, Frank H. H.

B

1929 Recent Archeological Developments in the Vicinity of El Paso, Texas. *Smithsonian Miscellaneous Collections* 81(7).

Short article, describes cave finds by amateurs, discusses SW connections, pictographs.

Finds include sandals, rabbit or fending sticks, netting, mosaic armband. Several atlatl darts described [with photo]: ca 5 ft long, socket at proximal end for hook,

at distal end for foreshaft. All had cordage and sticks tied to proximal end, making them unusable/ritual? Foreshafts mentioned but not described.

Roberts, Frank H. H. B

1936 A Folsom Complex: Preliminary Report on Investigations at the Lindenmeier Site in Northern Colorado. *Smithsonian Miscellaneous Collections* 94(4): 1-36 plus plates.

Detailed descrip of find by Judge Collins and other collectors.

Descrip of original Folsom find. 2 forms of Folsom pt - one short [classic, prob resharpened] one long. "Grooves" long flake removed by punch, after major shaping, shown by channel flakes.

P 21: "nothing to indicated whether the points were used in arrows or spears... Without evidence in the matter, archs concerned with the Folsom problem have gone on the assumption that the points were used in a shaft hurled from a spear thrower."

Roberts, Jeremy

2006 Atlatl. Conservation Media. Posted Youtube, accessed August 6, 2016: <u>https://www.youtube.com/watch?v=g88rSB9s4_E</u>

Short film of Bob Perkins explaining atlatl "put humans at top of food chain." "Not a spear, an arrow on steroids." Point resists force of throw, flexes dart, storing spring energy. Flexible atlatl also adds spring energy at same time. Over 100 miles per hour. [Scratches some nonsense equations on board]: "What this sums to is... a shit-load of groceries!" "Atlatl is truly the natural weapon system of the human race." We were in balance with nature, didn't take too much. "Where we really screwed up is the bow and arrow... strongly associated with agriculture, organized religion, taxes..." [Perkins is a good showman. Too bad all this is wrong.]

Robins, Michael R. x, di

x, disk

1997 Modeling San Juan Basketmaker Socio-economic Organization: A Preliminary Study in Rock Art and Social Dynamics. unpublished MA Thesis, Northern Arizona University.

Robins, Michael R. x, p

1997 Modeling San Juan Basketmaker Socio-economic Organization: A Preliminary Study in Rock Art and Social Dynamics. In *Early Farmers in the Northern Southwest: Papers on Chronometry, Social Dynamics, and Ecology*, edited by Francis E. Smiley and Michael R. Robins, pp. 73-120. Animas-La Plata Archaeological Project Research Paper No. 7, United States Dept of the Interior, Bureau of Reclamation, Denver. San Juan Basketmaker rock art developed a regional classic style of life-size anthropomorphs in contexts with areas suitable for subirrigated (high water table) farming in alluvial fans and cienegas. Tradition assoc with shamanic practices in White Dog phase (2700-1800 BP), but not just shamanic, spatially discrete emblematic headdress styles and variability suggest different participation in tradition throughout region.

Turner (1963) 5 styles in Glen Canyon region, Style 5 now called Glen Canyon Linear includes linear Archaic rock art at nonceramic sites. Followed by San Juan Anthropomorphic style in BM II, but spotty distribution. Map. Probable ethnic differences reflected in r.a. as well as in architecture, points, basketry. San Juan reflects San Pedro Cochise Archaic immigrants; Durango shows continuities with local Archaic groups. Following SJAstyle is Rosa Representational and Chinle Rep in BM III, characterized by narrative figures, fluteplayers, birdhead anthros. [I'm not convinced by the chronology, since atlatls are often in use by birdheads, and assoc with fluteplayers, and there are narrative scenes e.g. Hunt Panel. All this should be BM II].

Map, distrib of BM II site cluster areas. Focus on Comb Wash, Butler Wash, parts of Cottonwood Wash [E edge of the Cedar Mesa area atlatl art distrib].

Contexts: Open air sites, assoc with alluvial fans and cienegas, often fans now removed by erosion, destroying presumed habitation sites on them in assoc with rock art. A few high panels over wide viewsheds, but most less high. Rock shelters preserve pictographs sim to petros, but not always present. Roof fall blocks in shelters have grinding slicks, some with engraved figures [none of which are characteristically BM – I think they are later].

In Butler Wash area, consistent headdress styles start early, and overlay of figures allows chronology: Glen C Linear, early BM 2 which shows continuity [although his temporal chart shows a huge span of GCL, and/or huge span or gap to first BM II level.] Headresses: 'earmen' or 'bifurcated' start early. Early figures tend to be rectangular bodied, or narrower shoulder than hips, contrast to later 'classic' ones that are trapezoidal. Butler has more varied headdresses than C de Chelly or Grand Gulch area, suggesting Butler more integrated.

Hyder suggests Big Man panels = paired M/F, identify lineages, claim to territory. Butler Wash has lots of female images, prob BM III [those shown are eroded and incomplete, ID by 'apron,' late date not clear to me]. Headdress variability: bifurcate, tabular, stacked, plumed [last 2 are the same]. Variability in headdress styles distinguishes regions.

White Dog phase subsistence model, relying on corn, 'subirrigation'. Compares resource zones in 30 km radius for 4 areas. Butler more desert scrub, fewer resources espec pinon nuts than Grand Gulch, Marsh Pass, or Canyon de Chelly. But better potential corn surplus production. BW rock art more complex and varied, e.g. headdress variability greater, suggesting more 'socially integrated' to GG and CdC, than CdC and GG are to each other, reflecting territories and exchange as response to differential resources.

[Interesting analysis, and plausible, but do we really have enough of a sample to

see reliable patterns in the rock art distribution and small stylistic differences? How many images over 900 yr span were made, how many survive, were the patterns stable?]

Robins, Michael R.

2002 Status and Social Power: Rock Art as Prestige Technology Among the San Juan Basketmakers of Southeast Utah. In *Traditions, Transitions, and Technologies: Themes in Southwestern Archaeology*, edited by Sarah H. Schlanger, pp. 386-400. University Press of Colorado, Boulder.

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A "big-man" society with aggrandizing individuals who controlled best agric land in wash mouths, where large rock art panels occur - perhaps sites of feasting and redistribution. Status associated with control of agric, ritual, warfare. Rock art depicts individuals with elaborate hairstyle which relates to whole head scalps. Warfare as part of elite competition. "Differential" burials include atlatls, shafts, fending sticks.

Robins, Michael R., and Kelley A. Hays-Gilpin

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2000 The Bird in the Basket: Gender and Social Change in Basketmaker Iconography. In *Foundations of Anasazi Culture: The Basketmaker-Pueblo Transition*. Paul F. Reed, ed., pp. 231-247. University of Utah Press, Salt Lake City.

BM II (2000 BC-AD 200) rock art features "heroic" anthropomorphs, BM III (AD 500s-600s) more variable, narrative, frequent depictions of animals, birds, humans, ritual items, tools, including atlatl although "use as weapons prob diminishing due to intro of bow and arrow in this era." Spatial patterning of headdress types distinguish geog and cultural territories.

Robins, R. P.

1980 Wood Identification of Spearthrowers in the Queensland Museum. *Queensland Museum Occasional Papers in Anthropology* 10:50-62.

Material studies for conservation and research of 515 specimens, better documented than most of ethnographic collections. Very small clear sections cut across end grain of wood, 90% ID to some genus or better, listed by spearthrower type, date of collection, location, and wood ID. [Bulk of collection from around 1900] Lots *Eucalyptus, Erythrophleum* ["Red Ebony or Cooktown Ironwood"- very hard dense wood], *Acacia*. Documentation of collections by non-anthropologists leaves problems -e.g. do woods from an area represent varied past resources, transit of people, exchange, or collector choices and biases?

Rogers, Clifford J.

1998 The Efficacy of the English Longbow: A Reply to Kelly DeVries. *War in History* 5(2):233-242.

x,p

DeVries and other 'revisionists' doubt the effect of longbow in 14-15th C battles. Dozens

S

of sources support its lethal and demoralizing effects. [No ref at all to modern use or experimentation].

Rogers, Spencer L.x1940 The Aboriginal Bow and Arrow of North America and Eastern Asia. AmericanAnthropologist 42(2):255-269.

Typology and distribution maps for major bow types, self-bow, sinew lined [what we now call backed], sinew backed [twisted cordage etc] compound. Also for arrows and releases after Morse. [Old fashioned, not very detailed or useful.]

Romey, Kristin

2001 Aim, Fire, Thwock!: Atlatl Devotees Show Off Their Stuff. *Archaeology* 54(5):20-21.

Information from WAA annual meeting at Flint Ridge, C.Brown, L. Clubb. Good description of atlatl, [but it was not used by H. erectus, nor does it have force of .357]. WAA formed 1987, now 436 members. Mentions weights, dart flex, record of 848.56 feet, pleasures of society.

Rorabaugh, Adam M., and Tiffany J.

2015 Timing of the introduction of arrow technologies in the Salish Sea, Northwest North America. *Lithic Technology* 40(1):21-39.

Salish Sea, general agreement that arrow tech intro by 2500 BP, but not tested with large data sets. Apply discriminant function derived from Hildebrandt and King (2012) dart-arrow index to sample from 49 sites, spanning 5000 yrs.

A

Confounding issues include use of bone and hafted gound stone of similar forms to flaked, starting with Charles period, 4500-3200 BP. Not studied, need to develop different indices. Marpole phase 2400-1000 BP more diverse forms include stemmed and unstemmed medium and small chipped pts, some asymmetrical, also large hafted ground slate pts arming lances, spears, and socketed harpoons. End of M, transition toward small triangular forms, considered arrow pts. Social effects may include increased hunting autonomy, more warfare and social circumscription, rise of nucleated villages and chiefdoms. By Late period 1000 BP- present, only small, unstemmed triang chipped and ground pt forms.

Ames and others claim arrow by 8500 BP on plateau. Hare in Yukon ice material has atlatl dart dates 8400-1250 BP after which abrupt transition to arrow. H+K suggest arrows not on Columbia plateau until 2500 BP.

Apply H+K (pt T + stem W) to stemmed pts, but most pts unstemmed, so doesn't apply, so use as basis for a discrim function analysis for the unstemmed tools [does this make any sense at all?]. Curation measured using Andrefsky (2006) hafted retouch index (8 blade segments each face scored 0 = no retouch, 1 = lots, .5= medium, results summed). H+K index applied with cut-off value of 11.1 (lower than H+K original 11.8)

based on break in distribution [which is very 'normal' with too small a break to be meaningful. Almost all their pts class as dart]. Grouping pts by 500-yr interval, find that arrow pts appear around 2500 BP [but almost all the pts are still "dart"]. Created discriminant function for unstemmed pts using results of their index [not adequately explained, can't evaluate it, not clear how it relates to H+K index, which doesn't apply to these points]. Max T, blade W, Max W, Haft W are most heavily loaded attributes. When apply to both unstem + stemmed pts in 500 yr intervals, arrow forms appear at 3500 BP, prevalent by 2500. Of types, small triang usually class as arrows. [Note that the large points remain dominant throughout, even into proto-historic times equal numbers.] Curation measured by HRI may cause misclassification of darts as arrows [graph shows very slight tendency for high curation scores to be closer to dart/arrow cut-off, but only slight].

Both methods overestimate N of arrows, so 2500 probably better date, corresp with increased terrestrial mammal hunting. Small harpoon pts may misclass as arrows, or 'fletched atlatls' [repeated annoying mistake of talking about darts as if they are the atlatls]. Bow intro 3500, common 2500, dominant after 1000 BP [not what their data shows] which correlates with faunal data showing more terrestrial mammals. But atlatl may continue as "elites continue to promote group terrestrial mammal hunting" although bow favors individualism. [This nonsense comes from Angelbeck and Cameron 2014 and others who apparently don't know that atlatl is accurate.] Transition to bow and arrow was complex and gradual; darts and arrows often complementary. [I think the index approach doesn't work well here, and the situation is too confused by the use of harpoons and the importace of sea mammal hunting, which promote continued use of large points, and perhaps atlatl].

Rorebeck, Scott

2012 How Hunters Move Invisibly. The Backwoodsman 33(4):62-63.

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x,p

Move when something blocks an animal's vision. Photo of his atlatl deer kill, shot from ground [moved while deer's head behind tree]. Atlatl requires close range and motion, need good hunting skills.

Rosenberg, Daniel

2009 Flying Stones – The Slingstones of the Wadi Rabah Culture of the Southern Levant. *Paléorient*, 35 (2): 99-112.

Slingstones, among the most prominent weapons of the Hellenistic and Roman periods, first appear in Wadi Rabah culture of the Southern Levant (Late Pottery Neolithic/Early Chalcolithic). After short span, disappeared with end WR and onset of later Chalcolithic cultures. Studied over 365 slingstones, largest corpus of such ever studied in the S Levant, from excav + surface at Wadi Rabah sites throughout Israel. Mainly in sites in the north of Israel, implying cultural ties with cultures of the N Levant. First appeared when increased dependence on herding domesticated animals, may have been element of the tool-kit of herders. Producers of slingstones preferred specific raw material

(limestone, with a few basalt and flint) [surely for ease of working], shape [mostly biconical] and dimensions as well as weight (80% were 40-100 gm). Homogeneity may have helped the slingers to maintain better control of distance and accuracy. Shaping by flaking pebbles, pecking smoothing and/or polishing [but needs more detail]. Some possible impact damage [but hard to tell. Apparently no experiments.]

Rosendahl, Gaelle, Karl-Wilhelm Beinhauer, Manfred Loscher, Kurt Kreipl, Rudolf Walter, and Wilfried Rosendahl x

2006 Le plus vieil arc du monde? Une pièce intéressante en provenance de Mannheim, Allemagne. *L'Anthropologie* 110:371-382.

"The oldest bow in the world? An interesting piece from Mannheim, Germany." [In French]. Temporary lowering of water level in gravel pits, found pieces worked wood 1976-78. In old channel, other wood dating 15737 ± 165 cal BC. *Pinus sylvestris* branch fragment, curved, 37 cm L, 2-2.3 diam. Weathered, no tool marks left, but x-section modified to flatten possible belly side, and notched near one end = possible string nock. But not good bow wood, other end too weathered to describe break or be sure it was broken. If bow, was small – ca 110 cm, but possible in ethnog or toy bows. Power ca 25-30 lbs testing a reconstruction. Points from Up Pal sites suggest bow. This one uncertain but possible. [I think it is not a very good piece of evidence.]

Rosny, J. H.

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1982 *Quest for Fire*. Ballantine Books, New York. (Originally published 1967, Pantheon Books, but originally out as *La Guerre de Feu*, 1911.)

[The book that inspired the movie, but the movie is better in all ways. The book has poor plot and character, not much but blood and thunder, clunky writing style, no understanding of prehistory or attempt to use archaeological information even to provide vivid details. Atlatl description, p 100 is typical: "The Thin Men hurled short javelins, not directly, but with the aid of an object the Oulhamrs had never seen. It was a thick piece of wood or horn ending in a hook; this object gave the javelins a much greater range than when they were thrown by hand." No stone tool description whatsoever. No reason to believe the author knew anything about prehistory or early technology, even at the level available in 1911. See Anneau 1981.]

Roth, Barbara, Elizabeth Toney, and Leon Lorentzen o 2011 The Advent of Bow and Arrow Technology in the Mimbres Mogollon Region. *Kiva* 77(1):87-109.

Suggestions of early entry, few centuries BC (Geib, Sliva). Arrow smaller, more efficient. Advantages for war or subsistence? LL favors hunting.

Gt Basin bow by 200 AD, consistent with Geib early dates in N SW. Sliva claims earlier Cienega pts in S SW, but sample too small. Mogollon S. New Mexico bow later: Martin AD700 based on Tularosa + Cordova Caves; Lorentzen ca 1200 AD in

Grasshopper region, coexist with atlatl; Van Pool coexist into 1000s in S AZ [but for critiques of these see Whittaker 2012).

Mimbres pot scenes show bow by 1000-1130. La Gila Encantada pithouse site (67 pts) and Lake Roberts Vista site (101) S NM. Dockall (1991) pt types disting dart vs arrow [poorly defined, not very good typology. And no figures here - how can you talk about point types without illustrating them!]. Mostly trash contexts. One E Archaic pt on later pithouse floor as ritual "retirement" artifact.

To test distinctions used weight, neck width, thickness at min neck width, shoulder width. Types bimodal in all. Arrow pts mostly <1 gm, smaller than usual - small obsid sources. Principle component analysis also clearly distinguished arrow pt types from dart. Dart pts, earlier, usually cherts, arrow pts, later, usually obsidian. Pts from pithouse floors assigned phases for chronol test: by Georgetown phase (500-650AD) arrow present, dart dominant. San Francisco phase (650-750AD) houses have both = co-occurrence. Three Circle phase + Classic Mimbres arrow only. [No info on sample sizes, since most pts from trash, dating not very secure.] Applied to small sample pts from Mimbres Valley sites; similar results: bow introduction in Georgetown phase, period of co-occurrence. Early arrow pt variability = "guided variation" (adopt by diff individs from diff sources + modified, Bettinger + Eerkens 1991) followed by greater standarization in Classic. Coincides with increased agric, thus subsistence reasons for adopting. Unclear why atlatl would be retained. [Conclusions plausible, but the data does not really allow adequate chronological testing.]

Roth, Walter E.

1901 North Queensland Ethnography, Bulletin 3: Food, Its Search, Capture, and Preparation. Home Secretary's Department, Brisbane, Australia

Lots mention of spears in hunting various game, no details. One figure showing hunter in water to shoulders with brush on head and hand while stalking ducks with Queensland type thrower poised.

Roth, Walter E.

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1902 North Queensland Ethnography, Bulletin 4: Games, Sports and Amusements. Home Secretary's Department, Brisbane, Australia.

Little boys play war with reed spears and toy wommera made by selves or adults. Woomera shown is simple stick w hook type of "Wellesly Is + coastal blacks W of Burketown." Or a toy type made from reed with a knot to hold the spear instead of hook. Toy spears also thrown with string. "Prun" tournament/dispute settling event where groups meet to argue and fight, using boomerang, spear, shield, club. Spears usually thrown at legs.

Roth, Walter E.

Х

1904 North Queensland Ethnography, Bulletin 7: Domestic Implements, Arts, and Manufactures. Home Secretary's Department, Brisbane, Australia.

Wood work by stone or shell. *Ficus* leaves for sanding. Fire by twirling or sawing. *Canarium* brown cedar tree gum for hafting and woomera handles. Other resins include ironwood *Erythrophloeum* and spinifex grass *Triodia*. Lengthy descrip of knapping. Harpoons described, shown hand thrown. Wommera shown, leaf-shaped type with stone set in gum at handle, but manuf or use not described.

Roth, Walter E.

1909 North Queensland Ethnography, Bulletin 13: Fighting Weapons. *Records of the Australian Museum* 7(4):190-211, plates lviii-lxi, figure 12.

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Spears used with spear thrower or hand thrown may be made from bamboo, sapling, or split from tree. Some are compound. Points may be wooden, stingaree spine, tri-pronged for fishing, barbed with wood, bone or wire, or with multiple stone flakes fixed on each side of the shaft with gum. [Gives names of spears, wood, and supposed uses of different types in different areas. In some areas, no spear throwers are used.] Similar details for different types of wommera [his spelling; different native names also given]. Lacking in E. coastal districts and Brisbane. Most primitive form is hooked stick in Wellesley Islands and adjacent mainland, 2.5 feet long, round in section with raised flattened end forming hook. "Arai-i" is flat blade with attached peg hook and handle with shell. [Common N. Australia form, straight rigid vertical blade, quite long]. Used as spear guard as well as thrower. Localized variation in handle, peg, wood, names, decoration described. Bloomfield River area has a short curved or "moonshaped" version ("ballur") which is used for fish spearing, as well as the straight form. Grip on ballur: "blade rests in fork between the first finger and the thumb, instead of, as in the ordinary style, between first and second fingers." Two other types brought in, not local: plain stick with lashed on wood hook, tassel of hair at grip, and flat lath with attached hook, narrowed grip, usually painted.

Boomerangs, shields, throwing clubs, and wooden "swords" all given same detailed treatment. [Boring, long descriptions of minute details, but useful material].

Rothschild, Nan

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1979 Mortuary Behavior and Social Organization at Indian Knoll and Dickson Mounds. *American Antiquity* 44 (4): 658-670.

Archaic gatherers (IK) egalitarian "segmentary soc systs" vs Mississippian farmers (DM), hierarchical. As soc gets more complex, so do burial practices. IK 6100<u>+</u>315 – 4508<u>+</u>365 BP uncal, 880 Webb burials DM 850-700 BP, 1100 burials Mauss – presence of goods w dead implies social relationships Egalit expect low freq child goods (achieved status), relative lack of difference Heirarch – some goods cross cut age/sex, child w goods (ascribed status), major diffs among individs and grps Multivariate analyses – clustering (groups of burials) and factor analysis (recurring groups of goods). Scored 1. presence of each type of good 2. raw material type,

But NOT quantity of artifacts, which means only used 133 burials to form clusters, mostly children – only burials with multiple artifact types.

[Her clusters are thus worthless, contain very small numbers, mostly children, e.g. her two important ones (disk beads and pts),(disk bds and other beads) have 7M and 6M each, no F, 8, 14 kids]

Concludes: Status marked by multiple grave goods, open to men and chldrn but not women. [Nevertheless there are some F with multiple goods, including one cluster of 4 with pendants and disk beads, and the cluster of atlatl wts and disk beads has 3F,3M, 3 kids]

Rots, Veerle

2011 Projectiles and hafting technology. Paper presented at Multidisciplinary Scientific Approaches to the Study of Stone-Age Weaponry, Mainz, 19-22 September 2011.

"Hafting is an essential part of projectile technolog, has major impact on performance of projectile. Hafts adapted to the intended task, careful selection and manufacture of the shaft and fixation agent. Morphology of stone point adapted to hafting arrangement. A projectile can be identified based on macro- and microscopic use-wear traces, and characteristic hafting wear also forms, sufficiently diagnostic to distinguish between hafted and hand-held stone tools. Inferring hafting important to infer stone tool's use mode. For projectiles, identification of hafting adds to the use identification based on impact wear - no stone projectile can be projected without its attachment to a shaft. Hafting wear formed due to the counterpressure within the hafting arrangement at the moment of impact, and wear resulting from the direct contact with the shaft and/or fixation agent (e.g., bindings)."

Small detached flakes in hafting create bright polish spots on point, often assoc with originating microscar. Resin leaves residues, also friction spots from rapid detachment, but also protects areas from use-wear. Thrust spears show less wear than thrown spears. Levallois points show projectile type haft wear at Biache St-Vaast, 200 kya. Bettencourt L pts show impact wear, intentional base thinning, lashing wear on edges. Mousterians were systematically hafting all sorts of tools, and had both thrusting and thrown spears.

Rots, Veerle

2016 Projectiles and hafting technology. In *Multidisciplinary Approaches to the Study of Stone-Age Weaponry*, edited by Radu Iovita and Katsuhiro Sano, pp. 167-185. Springer Science and Business Media, Dordrecht.

see 2011, also evidence of Late Paleolithic arrow tips and barbs. No reliable diagnostic criteria yet to distinguish among projection systems.

Rousselot, Jean-Loup, William W. Fitzhugh, and Aron Crowell o

1988 Maritime Economies of the North Pacific Rim. In *Crossroads of Continents: Cultures of Siberia and Alaska*, edited by W. W. Fitzhugh and A. Crowell, pp. 151-181. Smithsonian Institution Press, Washington D.C. Discusses darts and harpoon heads. Two kinds: barbed, and toggling. Toggling common in ice areas because less likely to break off, freeing animal. Toggling harpoon was adopted by European whalers from Eskimo in 17th C. [Nice but small] color photo of 4 atlatls: Bering Sea Eskimo, Aleut, 2 different Koniag Eskimo, and three darts: Aleut light sea otter dart, Bering Sea seal dart (heavier) and multi-pronged bird dart.

Rowe, John Howland

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1954 Max Uhle, 1856-1944: A memoir of the father of Peruvian archaeology. *University of California Publications in American Archaeology and Ethnology* 46(1):1-134, plates 1-14.

Uhle in Berlin published on S. Am. archaeol before going there in 1892, including a volume that defined Tiahuanaco. Working in Bolivia and Argentina on native languages and arch, Nuttall got him support from U Pennsylvania Museum 1895. Prickly relations with Bandelier who was also in La Paz. In 1896 to Lima, work at Ancón and Pachacamac. Philadelphia 1898-99 working on Pachacamac, future wife translating. His supporter Pepper died, Phoebe Hearst took him up, so 1899-1905 worked for U of California. 1899 digging in Moche Valley, Huacas Sol y Luna, Chimu material, seriated cultural styles, discovered Nazca. Emeryville Shellmound excavs in CA 1902, early use of stratigraphy in US archaeology. 1903-1906 again in Peru working for UC sponsored by Hearst. 1905-11 working for Peruvian govt digging (all over but often in Lima area) and establishing national museum. p13: "In 1909 he also worked on the south coast, excavating a cemetery on the Hacienda Chavinia, which yielded among other things a choice lot of wooden spear-throwers." 1912-1915 organizing national museum in Chile. Unemployed WWI years, organizing Ecuador archaeol 1919-1933. Came to believe that all 'higher' cultures in the Americas came from Maya, and ultimately from China. 1933 retired to Germany but was in Lima and stuck there during WWII. Constantly failed to publish reports, and contemporaries did better work and kept better notes. Rowe had access to letter/notes in archives that are all that is known about all sorts of extensive digging and anthropological observations.

Rudyk, Mike

2018 'Amazing' archeological find in Yukon's melting ice patches — an intact atlatl dart. CBC News Canada, September 4, 2018, online URL: <u>https://www.cbc.ca/news/canada/north/yukon-atlatl-ice-patches-1.4809947</u>, accessed Sept 6, 2018.

Jennifer Herkes of the Carcross/Tagish First Nation with find team, near Carcross. Believed 'at least 1000 yrs old'. Intact [no useful details, but photo shows fletching, probably 3, and flaked stone pt of indeterminate form with probably sinew lashing. Two areas of lashing around shaft may indicate multiple parts.] Film clip of Ryan Grohsmeyer throwing replica Yukon spears at ISAC. [see Grohsmeyer 2017]

Rudyk, Mike

2018 Lucky find gives archeologists glimpse into early hunting technology in Yukon. CBC News Canada January 13, 2018 online URL:

https://www.cbc.ca/news/canada/north/archaeologist-ice-patches-copper-arrowheadyukon-first-nations-1.4485895, accessed Sept 6, 2018.

Barbed antler foreshaft with copper point, found 2016, dated 936 yrs old. Greg Hare archaeologist, Jennifer Herkes Carcross/Tagish First Nation. 99% pure, native copper. Bow and arrow replaced atlatl 1100 years ago. Photos of the arrow pt in situ, and out, and of dart shaft parts.

Rutter, Clark H.

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1935 Target Practice with Mayan Throwing Sticks. *Popular Science Monthly*, August 1935. Online 11/23/98 at http://www.crl.com/~mjr/stick5.html.

Simple atlatl inspired by Mayans, for sport, to throw arrow. Simple instructions, claims range 500 ft.

Sahagún, Bernardino de

1975 General History of the Things of New Spain: Florentine Codex, Book 12: The Conquest of Mexico. Arthur J. O. Anderson and Charles E. Dibble, trans. University of Utah Press, Salt Lake City.

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p 56 after the Spaniards massacre celebrants at feast of Toxcatl: "Thereupon there was shouting: 'O brave warriors, O Mexicans, hasten here! Let there be arraying - the devices, the shields, the arrows!'.... Quickly there was a marshalling of forces; it was as if the brave warriors each were determined; they bore the arrows and the shields with them. Thereupon there was fighting. They shot at them with arrows with barbed points, with spears, and with tridents. And they cast at them barb-pointed arrows with broad, obsidian points. It was as if a mass of deep yellow reeds spread over the Spaniards." [the original Nahuatl is given also. Surely the yellow reeds are the shafts of atlatl darts, although the word atlatl does not appear in the text. The illustrations, reproduced small, are ambiguous. I think some show atlatls in use, but you can't really tell, the warriors may just be grasping spears. See also Leon-Portilla 1962 and Lockhart 1993]

"Nima ie ic necalioa, qujmomjna in jca tlatzontectli, in jca tlacochtli, yoan in mjnacachalli, yoan in tlatzontectli, izpatlacio in contlaca: iuhqujn cozpul ommoteca in acatl, in impan Espanioles."

[Using Freelang.net Nahuatl dictionary, http://www.freelang.net/online/nahuatl selected words: tlacochtli = arrow/spear/dart; itz = obsidian; acatl = reed/dart/ arrow; quimina = shoot or spear (verb).]

Sahagún, Bernardino de

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1982 General History of the Things of New Spain: Florentine Codex, Volume 1: Introductions and Indices. Arthur J. O. Anderson and Charles E. Dibble, trans. University of Utah Press, Salt Lake City. Sahagun wrote the Conquest section probably in 1555, published a revised version in 1585. He used native informants and young scribes that he had trained in Latin and writing Nahuatl in Latin letters. Madrid Codices are his early drafts and revisions. The Florentine Codex is believed to be a bilingual version known as the Sequera manuscript of 1578-79.

Sala, Nohemi, + 8 morex2015 Lethal interpersonal violence in the Middle Pleistocene. PLoS-ONE 10(5),
electronic document, accessed March 12, 2016
http://journals.plos.org/plosone/article?id=10.1371/journal.pone.0126589

Cranium 17 from Sima de los Huesos in Spain, has two perimortem depressions on frontal = two blunt impact traumas, slightly different orientation, show two blows with same weapon in face-to-face combat. Dates ca 430 kya, skeletal remains from at least 28 Neanderthals in deep cave shaft. No carnivore chewing, or evidence of rolling. This is earliest evidence of lethal violence by hominins, and also strong evidence of intentional disposal of bodies. [No atlatls involved but important].

Salem, Paul E. and Steven E. Churchill

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2016 Penetration, tissue damage, and lethality of wood- versus lithic-tipped projectiles. In *Multidisciplinary Approaches to the Study of Stone-Age Weaponry*, edited by Radu Iovita and Katsuhiro Sano, pp. 203-212. Springer Science and Business Media, Dordrecht.

Wood and stone-tipped arrows fired into ballistic gelatin showed lithic tips did no better at penetration, but destroyed far more gel (= tissue damage), so that may be as important as penetration depth. [Crude gear – flakes and Mexican tourist points and conical wooden tip, with poor clunky hafting. No control for TCSA or other measures evident, several points broke, so too small sample of shots. Quite possibly right conclusions, but inadequate experiment.]

Salls, Roy A.

1986 The La Brea Atlatl Foreshafts: Inferences for the Millingstone Horizon. *Pacific Coast Archaeological Society Quarterly* 22(2): 21-30.

Four foreshafts: 1 bunt, 3 wooden points, [poor photo]. Found with extinct fauna but also Millingstone Horizon artifacts (ca. 6000 BC - 1000 AD), strata mixed, darts not with fauna, C14 on one 2500 BC. Confirms atlatl use in Millingstone Horizon.

Sanchez, Lynda A.

1998 The Atlatl:Weapon of Choice for the Ice Age. True West 34(4):28-29.

[Basics, nothing new, generally ok, but used Perkin's spring theories off his webpage.]

Sandberg, Sigfred

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1950 An Anthropological Investigation of the Correo Snake Pit. Unpublished masters thesis, University of New Mexico, Albuquerque.

[Geib 2017 has better analysis of atlatl, dart, and fending stick material]

Description of the pit as 'blown out spring', seems to be a hollow travertine mounded spring deposit. Crude field school excavation 1949.

Hundreds of dart and arrow shafts in varying condition on surface and in excavs. "obviously thrown in with atlatl' as they extend vertically through some strata. No atlatl found. Soft wood dart shafts with hardwood foreshafts [but I don't know that his wood IDs are any good]. Some binding for fletching or repair, some incised linear decoration. Some retain feathers. Arrows always reed shafts. No bows found.

Two complete darts, 61.5-65.5 inches long, with points hafted on foreshafts. 'Rabbit sticks' – round knob-headed, and flat single and double curved ['fending sticks'] 91 projectile points, [unusable old classification scheme] Hafted specimens show both small and large pts were used on darts. [Very poorly repro'd plates show what I would call Elko, BM, and San Pedro like pts, small triangular medium side-notched arrow pts] One 'Folsomoid' but from late levels [can't tell what it is from plate]. 15 pts hafted on foreshafts, all but one dart size. Pt Ls vary from 2-4 inches.

Polished stones, a few small pots.

908 prayer sticks, various forms including miniature bows.

Textile, basket bits, sandals. Necklaces and beads, many shells not described here. Conclusions: Laguna, Acoma use pit in historic times. Shafts = 2540 arrow, 2184 dart. Only 50% show binding at socket [distal] end to prevent splitting. All fletched with split feathers [number?] attached with binding (animal + vegetal) and pitch, sometimes up to 1/3 up shaft. Conical socket for foreshaft, tapered at fletched end. A few decorated. Variable foreshafts, some self-pointed. No atlatls found.

Arrows always bound to prevent splitting, fletched with 3 split feathers attached with binding and pitch, sometimes spiraled 'to act as brake'. Some painted designs. Some with 'tail weight' [plug] at nock. 16 varieties of foreshaft but in many stages of manufacture [really? doubt it]. As many self-pointed as with stone points. More arrows in upper levels, more darts in lower, so these are 'Modified Basketmaker'.

No stratigraphic change in rabbit sticks, function not clear without more work. Many bunts [treated separately from foreshafts], both for dart and arrow.

P 166: "The stone points exhibited no specific pattern as to use on either darts or arrows, both large and small types being used at random." [plates show not true, although the size of dart points are variable they are always the larger types, not STP.]

Sanders, Geoff, and Tom Walsh

X

2007 Testing Predictions from the Hunter-Gatherer Hypothesis - 1: Sex Differences in the Motor Control of Hand and Arm. *Evolutionary Psychology* 5(3):653-665.

HGH = sex differences in task performance arose from natural selection favoring

hunting-related skills in men and gathering related skills in women. Men should do better at throwing (arm muscles) and visual input from afar, women better at visual input from close, and fine hand manipulations. Test with computer cursor tracking test using hand or arm alone, and ball throwing and peg-board tests. As predicted males do better with throwing and arms, females with hands and pegs. These tests correlate with non-motor word association test favoring females, and mental rotation test favoring males.

Sanders, Geoff, Kamila Sinclair, and Tom Walsh

2007 Testing Predictions from the Hunter-Gatherer Hypothesis - 2: Sex Differences in the Visual Processing of Near and Far Space. *Evolutionary Psychology* 5(3):666-679.

Laboratory based puzzle task in which participants saw their hands and puzzles in far or near space. Women performed better in near than far, men vice versa. Far and near space processed in ventral and dorsal cortical regions also known as "what" and "where" visual systems, so potentially sexually dimorphic cognitive abilities favored by evolution.

Sano, Katsuhiro

2016 Evidence for the use of the bow-and-arrow technology by the first modern humans in the Japanese islands. *Journal of Archaeological Science: Reports* online http://dx.soi.org/10.1016/j.jasrep.2016.09.007

x,p

Complexity of bow and arrow tech implies dispersal of human groups with it, rather than multiple independent invention. First modern humans migrated into J, adapted to forest envir with possible megafauna, using edge-ground axes and small trapezoids assumed to be transverse arrowheads, in Early Upper Paleolithic 38-30 kcal BP. Macrofracture and morphomentric analyses.

Trapezoids assoc with backed points on small blades, and large pointed blades with limited basal retouch, made on siliceous shale. Diagnostic impact fractures, examined 116 EUP trapezoids and 93 pointed blades [large + small?]. 90% have fractures, 50% have DIF, confirming weapon use. Large DIFs on traps show high impact velocity, as comp to dart + arrow experiments. Size suggests bow rather than atlatl [comps TCSA and TCSP to Shott + Hughes data, but since wide cutting edge is forward, uses stem to calc, which confuses the comparison supposed to be of penetrating ability].

Bows in late glacial Europe, maybe earlier in Solutrean, and maybe 60 kya in Sibudu Cave S. Africa. So could have come out of Africa with early Homo sapiens. In Lateglacial Japan, see small barbed and bifacial points, shaft smoothers, as bow becomes predominant, but because bow good in forest, alread important for early hunters.

Sano, Katsuhiro, Yoshitaka Denda & Masayoshi Oba

2011 Experiments in fracture patterns and impact velocity with replica projectile points from Japan. Paper presented at Multidisciplinary Scientific Approaches to the Study of Stone-Age Weaponry, Mainz, 19-22 September 2011.

Recent studies indicate anatomically modern humans first to use long-range projectile

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hunting, while Neanderthals' hunt may have required frequent close encounters with prey animals. Study of tip cross-sectional area based on aerodynamics suggests possible to successfully shoot stone points emerging after 40-50 ka in Africa, Levant and Europe by using spearthrower. To confirm we conduct controlled projectile experiments with calibrated crossbow to accurately control loading conditions according to estimated impact velocities of thrusting, throwing, spearthrower, and bow respectively. A total of 280 lithic replicas including 40 trapezoids, 40 backed points, 40 leaf-shaped points and 160 microblades which are all representative Palaeolithic armatures from Japan shot against target of deer hide + pork flesh + deer scapula." Thrust too slow, mostly failed to penetrate hide, little fracture. Throwing speed – all penetrate to bone but not thru, more fracture, but small. Spear thrower speed – more + larger fracture, burin-like, impact energy greater. Bow speed – even larger fractures all with linear micro traces, burin fract etc. Longer fracture, >10 mm only with spearthrower and bow speeds. [Problem is that this is all with crossbow, not real weapon type.]

Sano, Katsuhiro, Yoshitaka Denda & Masayoshi Oba s

2016 Experiments in fracture patterns and impact velocity with replica hunting weapons from Japan. In *Multidisciplinary Approaches to the Study of Stone-Age Weaponry*, edited by Radu Iovita and Katsuhiro Sano, pp. 29-46. Springer Science and Business Media, Dordrecht.

Calibrated crossbow experiments with trapezoidal tranchet points. Used velocities from Stodiek, throwing spear 17.8 m/s, spearthrower 21.7, bow 31.4 m/s. Hard to compare tip cross sectional area TCSA and TCSP with ethnographic darts + arrows because trapezoidal points widest at tip. Impact fractures greatly increased from weapon to weapon; fluting, burination, crushing.

Saratoga Middle School

1981 How to Make an Atlatl/How to Shoot an Atlatl. Youtube, "The First Atlatl Contest. https://www.youtube.com/watch?v=FTWXdcv3DGI

"This is a historical document. During the 1981 school year the 6th grade class being taught by Rod Laird in Saratoga, Wyoming crafted their own atlatls and darts and then joyfully used their handiwork in the following spring. This was the humble beginning of the first atlatl sporting event in the modern world, the Kid's World Open Atlatl Contest, held at Saratoga from 1981 to 1994. It was this event that directly inspired a group from the Colorado Archaeological Society to form the World Atlatl Association in 1987 and the rest as they say, is history. This video (shot on VHS) was entirely the production of those kids, they are the young pioneers who created (and predicted) the current worldwide sport of the atlatl. For their pivotal roles in atlatl history Rod Laird and Leni Clubb were proclaimed by the WAA in 2011 as the Grandfather and Grandmother of the modern atlatl sport. To read a fine article detailing the history of the Kid's World Open Atlatl Contest go here: http://www.thefencepost.com/article/2..... To see great photographs of the early years go here: http://www.flintknapper.com/Atlatl%20....."

Video produced by Rod Laird's class, posted 2013 by Russell Richard. Rather crude. Shows kids' drawings of atlatl types, including one with cord across fork to engage arrow nock on dart, [so this idea has been around a while]. Made flake scrapers for working wood, knives but no power tools. [Some of the atlatls are pretty nice, others cruder, all look a bit heavy]. One shows an antler dart rest, [so that idea too is old]. Foreshaft making – [darts also look over-heavy for the kids.] Stone point on a couple, glass, made by Peter Allen. Split feathers lashed on with sinew. [Again, shafts look awful heavy].

How to Shoot second segment shows atlatls, at least 4 using dart rest. Motion 'is like throwing baseball overhand," step forward or shift weight. Wrist thong on many. Throwing – [darts are far too heavy and stiff.]

Saraydar, Stephen C.

2008 *Replicating the Past: The Art and Science of the Archaeological Experiment.* Waveland Press, Long Grove, IL.

[Nice short text on experimental archaeology.] Atlatl experiments mentioned, no details, some refs.

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Sassaman, Kenneth E.

1998 Crafting Cultural Identity in Hunter-Gatherer Economies. In *Craft and Social Identity*. C. L. Costin and R. P. Wright, eds., pp. 93-107. Archaeological Papers of the American Anthropological Association Number 8.

Even in egalitarian societies, crafts serve to delineate cultural boundaries and express identity and power relationships. Stallings Island Late Archaic in Savanna River Valley, GA and SC had earliest N. Am. pottery (4500 BP), large populations, relatively complex social order, including major split between coastal (with early pottery and shellfishing) and riverine groups (without). Left handed pottery decoration frequencies distinguish different subregions; failure of piedmont groups to adopt pottery suggests women and their crafts did not marry out (to neighboring ethnic groups). Bannerstones may be atlatl parts, but "elaborate and hypertrophic forms" suggest ceremonialism and prestige use. A few remote sites in piedmont zone have most of the manufacturing evidence of Southern Ovate bannerstones (starting 4300 BP), suggesting few craftsmen, but wide distribution of products. Marginalized from coastal centers of Stalling culture, piedmont sites used bannerstones in exchange outside, to other cultures. Change at 4000 BP when Notched Southern Ovate form appears, localized to middle Savannah R., but now manufacture evidence on many habitation sites. By 3800 BP all gone. Early maybe reflects acquisition of distant resources as route to social power, later more elaborate stones perhaps emphasize craftsmanship.

Sassaman, Kenneth E.

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2006 *People of the Shoals: Stallings Culture of the Savannah River Valley.* University Press of Florida, Gainesville.

Similar bannerstone info p 60-66 to 1998. Illustrations of unfinished specimens.

Sassmann, Bruce o 2008 Rabbit Hunting with an Atlatl. *The Atlatl* 21(1):18-19.

Small game now legal in Missouri. R Mertz, R Lyons, with beagles handled by Sassaman, and C McGeehan from MO Conservation Commission hunted rabbits, no kills.

Sassman, Bruce o 2011 The Art of the Atlatl, the Science of Frog Hunting. *The Atlatl* 24(3):14.

Hunting bullfrogs with 6' aluminum darts and deer points, at night with lights.

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Sattler, Helen Roney

1993 *The Earliest Americans, illustrated by Jean Day Zallinger*. New York, Clarion Books.

Childrens' prehistory, ok. But picture of Clovis hunter shows him trying to throw a dart with his hand wrapped around the atlatl and the dart, so artist didn't know atlatls.

Saunders, Ellen

2004 Nature's Freezer Yields Look at Ancient Hunting Grounds. *Mammoth Trumpet* 19(2):16-18.

Work by Greg Hare and others on areas of caribou dung melting out of ice in Yukon. Plant and animal remains and artifacts including arrows, atlatl darts, one dated 8,360 BP uncalibrated.

Saunders, Ellen

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2004 Are Climate Shifts Opening Mountaintop Time Capsules? *Mammoth Trumpet* 19(3):5-6.

Yukon ice patches. Hare says warming 10-11,000 RCYBP, then ice accumulation 9000, followed by more melt off, most ice began rapid growth after 5000 yrs ago.

Saunders, Ellen

2004 It Took Two Generations. Mammoth Trumpet 19(3):6-7.

Greg Hare and Ruth Gotthardt say 40 yrs for bow to replace atlatl and antler to stone points in Yukon ice. Atlatl 9000 RCYBP to 1260, first bow artifact dates 1300. Also one heavy projectile notched like arrow at 3600. Birch and other wood darts, ave 195 cm long, flexible, tapered and front-heavy. Foreshaft w stone pt illustrated. No atlatls found.

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Arrow pts all barbed antler.

Saunders, Jeffrey J. and Edward B. Daeschler

1994 Descriptive Analyses and Taphonomical Observations of Culturally-Modified Mammoths Excavated at "The Gravel Pit" near Clovis, New Mexico in 1936. *Proceedings of the Academy of Natural Sciences of Philadelphia* 145:1-28.

Two butchered Columbian mammoths associated with the "type" specimens of Clovis points (2). Cotter, the excavator, assumes atlatl use, bone rods as foreshafts. Reinterpret sediments to indicate butchery event occurred on erosional surface during dry period, not in wet (pond) conditions. Mammoths were adult, M + F, stood 12-13 feet tall. Bones show 2-3 yrs of weathering after death. Cut marks and other damage to bones at joints, including marks interpreted as from prying apart footbones using the bone rods (gouge + compression marks from beveled tips). One rib fragment has engraved lines interpreted as abstract design [but looks pretty unconvincing in the photos.] Smoothed gnaw marks interpreted as work of dogs. Elephant joints easy to dismember while fresh, so cut marks here suggest working with rigid (ie scavenged) carcass, as does the attention paid to feet. Points in upper front of body, butchery tools assoc with head and lower limbs also suggests scavenging of animals previously wounded and carrying points in their bodies.

Saville, Marshall H.

1925 *The Wood-Carver's Art in Ancient Mexico*. Contributions of the Museum of the American Indian, Heye Foundation, Vol. 9. New York.

Describes atlatls briefly, including 12 from Mexico (Aztec and Mixtec) plus 5 miniatures from Templo Mayor (Tenochtitlan, Aztec capital in Mexico City), and 6 from cenote at Chichen Itza (Maya). Forms are mostly like the British Museum specimen, flat slightly expanding shaft with deep groove full-length or to grip, all but a couple lack grips, which should be shell or stone loops sewed or lashed on. Hooks are integral, horizontal cylinder form lying in groove, sometimes decorated. Ornamentation usually on both faces, most elaborate on underside, several gilded as well as carved. A couple are in form of snake, with hook in feathers behind its head, and seem not to have loop grips. The miniatures are not grooved, have raised hooks, and two have cross bars instead of loops, others are just straight wood handles. A couple specimens in Mexico, several in Europe, a couple at Heye Foundation in New York. Adequate illustrations - engravings and mediocre photos of most. Mentions atlatls as part of loot Cortez sent to Charles V of Spain in 1519 (p42-43); he was crowned emperor in Germany, so some of loot distributed in Italy, Germany, Flanders, Austria. Cortez atlatls, described in original documents as "crooks" or "scepters" were turquoise mosaic. (P43) surviving specimens "being elaborately carved, unquestionably were not intended for hunting or use in actual warfare, but were for ceremonial purposes." Often depicted in hands of deities or priests. Bows often depicted in codices, but no authenticated specimens survive.

Atlatl List from Saville (pp43 ff):

1,2 Heye Foundation Mus Am Indian, recently discovered so details given: hard finegrain

wood like rosewood, no gilt

1. L = 21 3/8" good drawing of designs - some resemblance to BritMus, less elaborate but finer than Florence. 4 warrior/god figures carrying darts w shield and spear, with Tlaloc [or Earth Monster?] at bottom whose circular eyes may represent an "inverted atlatl", entwined serpents on sides of groove, undecorated spur. No loops or visible attachments.

2. different style [but same entwined design on upper], cruder figures on underside, with date glyphs for 10 calli, animal day signs, symbols of new year, probably 1489 L = 20 3/8"

Other 10 already published, few details given. Six recovered in 1890s from a family in Oaxaca - heirlooms: 2 to Ethnog Mus Berlin, 1 Dr. Lenck, 1 Consul Dorenberg then to Frankfurt, 2 to Nat'l Mus Mexico

3. Dorenberg - see Seler

4. Berlin

5. Berlin both similar, this one 24 3/8"

6. Nat Mus Mex L = 17 3/8" illustrated, carved end damaged

7. Nat Mus Mex [is this a slip - he implies 2, but maybe means only one, which would make the count right - only illustrates one, perhaps the second is the same as 13?]

8. Brit Museum, gilded, shell loop

9. Prehist + Ethnog Mus Rome - see Bushnell, gilded 24 ³/₄" dark wood like NY

specimens, gold mostly worn off, carving intricate, anthro hook w headdress

10. Florence Mus Nat Anthro + Ethnol - see Bushnell L = $23 \frac{3}{4}$ "

11. Florence ditto, both gilded, red-black wood L = 225/8", complicated carving, double grooved, hooks anthropomorphic

12. Lenck specimen L 22 5/8" serpent form

13 Dorenberg or Nat Mus Mex, but now missing, serpent form

[He repeatedly says 12, but this count is 13 !!]

Other atlatl forms in codices include expanded shaft w 2 fingerholes like current Patzcuaro, and peg-grip form. From Great Temple area in Mexico City, 5 miniature wooden atlatls, 3 have hooks, all have holes and 2 have cross pegs for grips. [Photo shows simple form with integral raised hook on rounded shaft, cross peg.

Schaafsma, Polly

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1994 Trance and Transformation in the Canyons: Shamanism and Early Rock Art on the Colorado Plateau. In *Shamanism and Rock Art in North America*, Solveig Turpin ed., pp. 45-71. Rock Art Foundation, San Antonio TX.

Time gap between San Juan Anthropomorphic and Barrier Canyon Styles to ethnog SW means generalized shamanic models better than detailed ethnog analogy. By ca 600 AD shamanic imagery phased out in Anasazi art, quality of work also declines. BCS long figures = shamans in hallucinogenic state transforming man-animal, ref death, spirit helpers, espec birds. SJAS = Basketmaker II, maybe early BMIII, no bow and arrow hunters depicted, bow arrived BMII-III. Dominant figs = static large human w drooping hands + feet - suggesting trance state, elab hddresses + stuff at L ear = communic w

spirit world. Duck or Turkey on head. Pueblo ethnog D = liminal travel sky + water, T = underworld, dead, clouds + rain. Some holding atlatl or darts, or speared = shamanic combat, ethnog shamans deflect arrows or spiritual projectiles. Death of animals = trance, access to power. Crook staves + med pouches depicted, found in sites.

Schaafsma, Polly

2007 Head Trophies and Scalping: Images in Southwest Rock Art. In *The Taking and Displaying of Human Body Parts as Trophies by Amerindians*. Richard J. Chacon and David H. Dye, eds., pp. 90-123. Springer, New York.

Long hist, interp by ethnog: in pueblos, scalps incorporated into village through ceremony as powerful rain-bringer, visible in myth and poetry. Basketmaker + Fremont, several types of head or scalp depicted in rock art. [map of distrib is strikingly similar to distrib of atlatl images – is there a 'war cult' or similar that we can suggest?] Colors, hair in bobs or female whorls, assoc with men with atlatls, lines under heads indicating blood/rain, carrying loops on top of some. [Green Mask is called BM]. Archaeol finds too: Kinboko, Marsh Pass head skin, w green + red stripes like GM, around neck of burial. Also scalps, some from Fremont area but with BM basketry supports. No ancestor worship tradition, so most likely trophies [also associated with weapons!] and arch finds of violent death. Rock art images also 'display' of heads – assoc with fields (Bluff) or with water (Grand Gulch), and shaman images, activity including hand prints.

400-1300 AD relative peace, few bodies, no display of trophies in rock art, until around 1150-1200. P IV no positive id of scalp images, but probable – assoc with esoteric images – clouds, rain, warriors, Knife-Wing in murals and rock art. "There is good fit between the P 4 imagery and contemporary religious ideology." (106) Supernatural entities including Knife-Wing ('the scalper') and other taloned beings (eagles, mt lions, Morning Star) assoc with scalping, + maize, lightening, clouds = scalp/rain/fertility complex. Warrior societies, prolific imagery, katsinas related to such. Archaeol - P4 evidence of war but little of scalping – Grasshopper + Chavez pass, bits elsewhere.

Navajo, hourglass figure, similar associations.

Schaefer, Jerry

1998 Building a Life-Size Mammoth. *The Atlatl* 11(3):6.

Atlatl target for Minnesota event - styrofoam over wood frame, fake hair.

Scheinshohn, Vivian x,p

2016 A hook on Patagonia: spearthrowers, bone hooks, and grips from Patagonia. *Cuadernos del Instituto Nacional de Antropologia y Pensamiento Latinoamericano – Series Especiales* 3(2):88-102.

Southern S. America. Not clear in older lit if they are describing hooks or grips, so call

them 'bone spearthrower hooks/grips, BSHG." [But this introduces unneccesary confusion - there are a few that might be Peruvian type handle pieces – but mostly she ought to be able to distinguish between hooks and grips.] One complete from Doncellas Site, N. Argentina, ca 1300 AD [so late. Fig shows flat board with narrow handle, no handle piece, attached hook of 'fox tibia']. Cites other finds, mostly incomplete, descriptive focus on hooks/grips, may have been wooden [integral] hooks but preservation problems, but attached harder materials had advantage of being more durable and more easily repaired. Some of piniped bone. Small sample examined (9) [with identification problems], but chronol suggests variable forms from E/M Holocene 9000-7000 BP, then gap in Patagonian record, then reappear with more standardized design from 2000 BP on. [Not really enough data to say. Her early examples look to be attached in socket or slot, the later ones are beveled on shaft with arced hook and could be confused with Peruvian type handle-pieces.] Late dates here and elsewhere in S Am, and point size distributions, suggest co-existence of atlatl and bow.

Schele, Linda, and David Friedel o

1990 A Forest of Kings. William Morrow, New York.

Maya. Atlatl introduced from highland Mexico in 4th C AD, led to new kind of territorialbased conflict.

Schiffer, Michael B.

2009 Ethnoarchaeology, Experimental Archaeology, and the "American School." *Ethnoarchaeology: Journal of Archaeological, Ethnographic, and Experimental Studies* 1(1):7-26.

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The "AS" developed among Smithsonian researchers in late 19C, focused on importance of ethno and exper info for interpreting prehistoric culture, with evolutionist roots. Prominent figures briefly profiled: Rau, Mason, Cushing, Holmes. The approach waned in 1900s with growth of "culture history" and diffusionism, which used artifacts as markers of cultures rather than evidence of activities, and many initial "what is it?" problems had been solved. Revived or reinvented with "processual" and "behavioral" archaeology in the 1970s.

Schmidt, Robert N.

1984 Another Look at the Bannerstone. The Wisconsin Archeologist 65(1):83-95.

Early crude forms not likely ceremonial objects (Knoblock).

Webb atlatl theory flawed because "no drilled stones actually found on an identifiable spearthrower assembly," some antler hooks "quite fragile...do not seem suited for atlatl service."

Battering and breakage of hole ends not from atlatl use.

New hypothesis: sliding hammerstone for flintknapping.

Indirect percussion easiest to learn, better yet if hammer and punch linked - hammer

slides down shaft to strike shoulder of punch at end of shaft ca 85 cm long. Some bannerstones wouldn't work; simpler ones would.

Polish in hole on experimental stone - but might be "erased by time" on archaeological specimens [how, without damage to exterior polish?] Damage to ends similar to experimental [but also mentions alternative sources, i.e. manufacture].

Photos of 18 points made, experimental bannerstone, device in use.

[Hard to tell how effective this really is, but I am highly skeptical that it is effective knapping tool. Most bannerstones lack hammer wear, and evidence of atlatl association is good.]

Schmitt, Daniel, Steven E. Churchill, and William L. Hylander

2003 Experimental Evidence Concerning Spear Use in Neanderthals and Early Modern Humans. *Journal of Archaeological Science* 30:103-114.

Argues that Neanderthal humeri are asymmetrical, with right more robust. They are wider front to back, compared to Upper Paleolithic humeri which are rounder, consistent with (tortional) throwing loads. Neanderthal asymmetry more likely to result from thrusting spears, and the Lower and Middle Paleolithic spears so far found are large and heavy, better for thrusting than throwing. In an underhand thrust, the strong hand is at the back, and takes most of the (bending) stress.

Experiment used 8 untrained subjects thrusting. Showed asymmetrical stress on trailing arm, high enough load to stimulate bone remodeling. So experiment and skeletal studies are consistent with belief that spear thrower did not appear until into the Upper Paleolithic.

[Probably right, but problems with conclusions include small sample of experimental subjects, small sample of relevant prehistoric bones, and the many other assymetrical things right-handed people do with their arms, including throwing. All this really shows is that thrusting affects trailing arm more than leading arm. Does a hunter really thrust often enough to affect arm strength? Aren't other things going to be much more important?]

Claims Neanderthal and early Up Pal "right-dominated strength asymmetry... prepared to withstand bending in the parasagittal (anteroposterior) plane." With lack of projectile evidence, best conclusion = "thrusting spear use one of principle sources of osteogenic stimuli" in humeri. But Late Up Pal humeri "more equally resistant to bending moments in multiple directions (and torsion, as generated during throwing) as well as right-dominated strength asymmetry." With evid of throwing weapons, so throwing in LUP was important.

Schmitt, Dave N. and David B. Madsen

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2005 *Camels Back Cave*. University of Utah Anthropological Papers 125. U of Utah Press, Salt Lake City.

Stratified rock shelter with Fremont and earlier remains. In regional summary p36: "...early Paleoarchaic Folsom, Clovis and stemmed pts were hafted on thrusting or throwing spears..." P 42: Fremont period, bow and arrow appear shortly after 1800 BP, rapid replacement of atlatl, more accurate, greater velocity projectile, multiple shots without spooking prey. Probably self bow first, with Rosegate points, Desert series points come later at Fremont/Late Prehist transition, maybe response to shorter arrows used with backed bows.

Good stratified series of local point types, well illustrated (R. Elston chapters).

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Schneider, Alan L., and Paula A. Barran

2014 The Precedent-setting Case of Kennewick Man. In *Kennewick Man: The Scientific Investigation of an Ancient American Skeleton*. Owsley, Douglas W., and Richard L. Jantz, eds., pp. 90-107. Texas A&M Press, College Station.

The disgusting story of how tribes and our government tried to prevent citizens from getting information from an archaeological find on public lands. "The safety of the skeleton was jeopardized, its discovery site ruined, and millions of dollars wasted before a series of court decisions forced the government to give scientists access to the skeleton." The Corps of Engineers was found to have mishandled every aspect of the case, and violated the law in several places (though they were never even fined); the skeleton was removed from Corps control, and after further obstruction by tribes and government, the plaintiff scientists were allowed to study – find made in 1996, finally studied 2006! [Unfortunately the concluding optimism about the precedents in this case is unjustified; I know of no other significant scientific challenges to the destruction of archaeology under NAGPRA.] [See also Neely 2016]

Schoville, Benjamin, Kyle Brown, Simen Oestmo, & Curtis Marean s

2011 The Potential of Pre-Howieson's Poort MSA Backed Blades from Pinnacle Point, South Africa as Projectile Armatures. Paper presented at Multidisciplinary Scientific Approaches to the Study of Stone-Age Weaponry, Mainz, 19-22 September 2011.

Microlithic backed blades from Pinnacle Point Cave 5-6 (Brown, et al. 2011) dated by OSL to ca 71kya. Backed blade technology is often considered composite, allowing for replacement of worn and broken components while maintaining the haft for continued use. Ethnographic observations of backed blades hafted as tips of arrows in southern Africa and occurrences of backed points within animal remains from later archaeological sites indicates backed pieces are effective in many contexts." Experiments using a calibrated crossbow and heat-treated silcrete, radar gun velocity measurement. > 110 experimentally reproduced backed pieces compared to the assemblage of pre-Howieson's Poort backed blades from Pinnacle Point. Location of >250 individual experimental shots at prey targets were combined into a preybody GIS model to model distribution of point breakage probability. Poor haft performance, large haft had little penetration, in thrusting did not get enough velocity. Simpler haft, one stone element, <100 g, arrow speed worked [but accuracy was pretty poor even with crossbow on stand]. Hits closer to vitals had higher breakage – more bone there. Experiment suggests pre-Howieson's Poort backed blades function effectively as projectile armatures. Arch specimens similar – 27%

show impact fractures. Bushman used 9 kg draw weight bow, crossbow was 18 kg. Bushmen used poison, maybe compensate for weak bow, not need to hit vitals. Earlier rock art shows more powerful recurve bow, which may be what was used in Howiesons Poort (aka SADBS).

Schroeder, Indira Montt x

2004 Elementos de Atuendo e Imagen Rupestre en la Subregion de Rio Salado, Norte Grande de Chile. *Chungara (Arica), Revista de Antropologia Chilena* 36, special supplement 2: 651-661. Online version URL: http://www.scielo.cl/scielo.php?script=sci_arttext&pid=S0717-73562004000400010&lng=es&nrm=iso&tlng=es accessed 2/08.

Chilean rock art includes anthropomorphs armed with atlatls and darts.

Schultz, Harold o 1966 The Wauru: Brazilian Indians of the Hidden Xingu. *National Geographic* 129(1):130-152.

Photos show men using atlatl against scarecrow in practice for intertribal game. [No mention of hunting or real warfare. Darts look a head taller than the men, with blunt "stone" tip. Thrower has flat flared handle with single central finger hole, feather tuft at hook end, hook not visible.]

x

Schuster, Angela M. H.

1999 Who's Buried in the Ice? *Archaeology Online* URL: http://www.archaeology.org/online/news/iceman.html accessed 9/13/06

News brief on Kwaday Dan Sinchi find, mentions body found with "a hunting spear and atlatl", photos of artifacts [from BC govt or tribal web page] include "a hand tool of unknown use" which is a short flattened piece of wood with a rounded handle end and a hook-like protrusion apparently lashed on the other, with hide pouch in which it was found. [Looks superficially like an atlatl, but too short - is this the "atlatl"? Other suggestions include snare tool, and I think it could as well be a pressure flaker, but you can't really tell from the photo. see Beattie et al. 2000. In the end, from other sources, it is clearly not an atlatl.]

Schwaller, John F. x pdf

2009 Broken Spears or Broken Bones: Evolution of the Most Famous Line in Nahuatl. *The Americas* 66(2):241-252.

Garibay translated original Nahuatl from 2 different related manuscripts, Leon-Portilla compiled those Spanish translations for his book titled *La visíon de los vencidos*, which was translated into English by Kemp as *Broken Spears*, and the passage as "Broken spears littered the road." But Nahuatl line speaks of *omitl*, bones, rather than *mitl*, which

actually means arrow, not dart or spear (if they had meant dart the word would have been *tlacochtli*, or spears *tepotzopilli*). Garibay translated as *dardos*, darts [and apparently *mitl* could be really generic for projectiles - so I think darts make better sense in context of other info than arrows]. So the passage describes the human remains and blood in the streets, not weaponry.

Response by Leon-Portilla: actually the Nahuatl reads *o mitl* with a space, the *o* being an abreviated *on*, "those spears". So Garibay did not make a mistake, or at least it is defensible interpretation.

Scolforo, Mark

2005 Penna. May Let Hunters Add Ancient Weapon to Arsenal. *Philadelphia Inquirer* November 24, 2005. URL <u>http://www.philly.com</u> accessed 1/27/06.

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PA Game Commission discussing legalizing atlatl deer hunt. Quotes Fogelman, Perkins, Carr (archy) and Lyons. Commission generally supportive.

Scolforo, Mark

X

2006 Hunters May Get to Go Stoneage. *Associated Press/Tampa Bay Online* January 8, 2006. URL <u>http://www.printthis.clickability.com</u> accessed 1/27/06.

Pennsylvania legalization proposal. Similar to 2005, generally supportive tone.

Scott, Jim x

2010 10.000 Year Old Weapon Unearthed in Ice Melt. *Futurity*. Electronic Document, accessed 7/3/10, URL: http://futurity.org/science-technology/ice-melt-unearths-10000-year-old-weapon/

In Rockies near Yellowstone, Craig Lee archaeologist. Birch sapling with notch for point. Similar to University of Colorado 2010, but with errors. Find is called atlatl at first, more correctly dart in caption, then "When it was shot, the 3-foot-long dart had a projectile point on one end, and a cup or dimple on the other end that would have attached to a hook on the atlatl." [But this appears untrue, the object is too short for a dart and lacks the "cup" and is probably a foreshaft. Photo shows that it was minimally worked, still has twig nodes unsmoothed, now broken in several places.]

Scott, Karen West

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1980 Antler and Bone Artifacts from the 1980 Season at Colha, Belize. In *The Colha Project Second Season, 1980 Interim Report*, T. R. Hester, J. D. Eaton, H. J. Shafer eds., pp. 317-326. Center for Archaeological Research, University of Texas, San Antonio.

Possible atlatl spur (drawn), Late Classic. [bipointed and grooved, unclear to me whether it is really an atlatl hook or not].

Seler, Eduard

X

1890 Altmexicanische Wurfbretter. *Internationales Archiv fur Ethnographie* Band III: 137-148. [plus plate]

"Ancient Mexican Spearthrowers" in German [so I can't read]. Illustrated mostly from codices. [Idiots at Evans Library interlibrary loan did not copy plate] but it should show Berlin specimen and others.

Seong, Chuntaek o 2008 Tanged Points, Microblades, and Late Paleolithic Hunting in Korea. *Antiquity* 82(318):871-883.

Tanged pts on heavy blades, some bifaces, back to 30 kya, interp as knives or spear pts. After ca 17 kya, microblade assemblages without tanged pts, interp as spear point inserts. Ca 10 kya, "arrowheads" (small triangular bifaces) appear. Early focus on large game with thrusting or hand thrown spears. Later shift to smaller game, with lighter microblade points, plus contemporary bifacial points for large game. Finally bow and arrow for small game, better in wooded environment. [Relies heavily on US lit, overgeneralization about functions and game. No atlatl suggested, but small pts probably do represent beginnings of bow.]

Serafin, Stanley, Carlos Peraza Lope and Eunice Uc Gonzalez x 2014 Bioarchaeological investigation of ancient Maya violence and warfare in inland northwest Yucatan, Mexico. *American Journal of Physical Anthropology* 154:140-151.

Middle Preclassic (600-300 BC) to Postclassic (1050-1542) changes, Mayapan and other sites in NW Yucatan. Cranial trauma frequency decreases before Classic collapse, increases in PC. Similar freq in other Maya regions but here males have more healed injury than females, concentrated on L side of front of skull. Some from small points hafted in wooden clubs. One scapula with embedded arrow point. Suggest flat open terrain compared to other Maya region allowed more open combat, though trauma on women suggests raids on settlements too. 116 crania from 14 sites, no details on post crania which are often poorly preserved [only Mayapan has a decent sample, 75, almost all PC, so temporal trends should not be taken too seriously]. Consistent healed oval, round wounds usually to L face have been considered arrow but are more likely a 'wooden club with protruding points' given position and orientation. One penetrating perimortem trauma to cranium of unsexed young adult from Mayapan is consistent with stone spear or dart tip from right front. Adult F Mayapan has embedded chert pt tip (arrow) in front of scapula, 11 mm wide, no healing plus possible projectile damage to L clavicle. Healed head wounds from unidentified weapons, but 'fending sticks' as depicted in art are 'good candidates' [not if you imply sharp points or stone spikes as in the following discussion].

Setzler, Frank M. x

1933 Prehistoric Cave Dwellers of Texas. Explorations and Fieldwork of the

Smithsonian Institution in 1932: 53-56.

SW TX, Chisos Mts, Sunny Glen Canyon, nr Alpine. Dug 5 caves [minimal info given]. No pottery or stratification [recognized, anyway]. Basketry and sandals differ from Basketmaker examples. Atlatl foreshaft notched for pt, bunt pt, prox frag of atlat [looks BM type in photo]. Maybe shows similar age to BM, but arrow shafts + foreshafts also, so maybe transitional [and maybe unrecognized stratigraphic differences]. [Useless list of other artifacts suggests interesting sites poorly reported.]

Shafer, Harry J. and Thomas R. Hester

1991 Lithic Craft Specialization and Product Distribution at the Maya Site of Colha, Belize. *World Archaeology* 23 (1): 79-97.

Good extensive info on lithic production and specialists. In Terminal Classic, making stemmed proj pts on chert blades, "presumably used on spears launched by spear-throwers (atlatls) and their intensive production could mark a period of warfare within the region." [Which is rather stretching the interpretation].

Sharer, Robert J.

2003 Founding Events and Teotihuacan Connections at Copán, Honduras. In *The Maya and Teotihuacan: Reinterpreting Early Classic Interaction*, Geoffrey E. Braswell, ed., pp. 143-165.

S

Temple complex over founder's grave, imported goods, burials with strontium isotopes indicating non-local origin, iconographic and architectural connections. In particular "Hunal" tomb p. 153 has flanking platforms, one "encased the burial of an apparently sacrificed male wrapped in bundle and accompained by Teotihuacan warrior paraphernalia including shell goggles [rep Tlaloc] and atlatl darts." [Photo of skull shows "goggles" but no info on darts, or indication that there was an atlatl to go with them.]

Shaw, Robert D.

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2002? *Carving a Traditional Chugach Throwing Board*. VHS, Chugachmiut Curriculum Development Project, Anchorage, AK.

Shaw (PO Box 233823 Anchorage, AK, 99523-3823, 907-345-5416). 1 hr 34 min. Begins with kids throwing (none very well) and lots of safety warnings. Then Shaw carves an arctic style throwing board, with spatulate grip, inserted bone hook, central first finger hole. Copies from a book (Murdock?) but doesn't give source. [He does nice work, speaks clearly, shows each step, but a very slow video with excruciating and excessive detail, sometimes necessary for teaching kids, but boring for experienced atlatl maker. Unfortunately, no information on the traditional dart, and no scenes of any competent throwers.]

Shea, John J.

Х

2006 The Origins of Lithic Projectile Point Technology: Evidence from Africa, the Levant, and Europe. *Journal of Archaeological Science* 33:823-846.

Pre-Upper Paleolithic projectile use is debated. Criteria for recognizing stone projectile points is subjective - tool shape and microwear. Tip cross-sectional area is ballistically important, discriminates N Am dart tips and arrowheads from spear points. Comparing TCSA values of ethnog N Am points to possible Middle + Up Pal points from N Africa (Aterian tanged points), Levant (Levallois and Mousterian points), and Europe does not support presence of projectiles before 40,000 BP - these points seem to have been on thrusting or hand thrown spears. In Levant and Europe, the L + M pts contrast with Up Pal Ksar Akil + El Wad, and Chatelperron + Font Robert + Solutrean pts, which do appear to be projectiles. In the New World and Aust, ethnog record of stone projectile points shows they are used in big game hunting and war. One or both of these may have played role in adoption of stone proj pts after 40 Kya. [Some problems: Neanderthals + kin certainly hunted large dangerous animals, so projectile not necessary. Some Australian ethnog stone blade points on woomera thrown spears are very large, like Levallois points.]

Shea, John J. and Matthew L. Sisk x

2010 Complex Projectile Technology and *Homo Sapiens* Dispersal into Western Europe. *PaleoAnthropology* 2010:100-122. Electronic Document, URL: http://www.paleoanthro.org/journal/content/PA20100100.pdf accessed 5/2010

H.s. expansion at 50,000 years ago with complex behaviors earlier seen only occasionally in Africa. "Complex projectile weaponry" is "niche-broadening" allowing new resources, reduced costs. P 102 CPWs store energy extrasomatically to propel low mass projectiles at high speeds: "bow and arrow stores energy in flexion of the bow. The spearthrower stores energy in the flexion of the dart." [Whittaker 2010 comment corrects this last]. Sites in the Levant with Late Middle Paleolithic and Early Upper Paleolithic assemblages. LMP points i.e. Mousterian and Levallois points, not suitable for CPW tips, but EUP lots of small narrow stone + bone pts. Tip cross-sectional area TCSA (.5x MaxW x MaxT) [which does not consider hafting additional to this] compared to ethnog + arch specimens of known use including Thomas and Shott examples of darts (ave 58 sq mm, N = 40) and arrows (ave 33 sq mm, N = 118). Levallois points much larger than either dart or arrow TCSAs, experiments show they bounce off animal targets as arrows, work as thrusting spear tips. EUP points [on blades] in range of ethnog points [all but Ksar Akil ElWad pts are in dart range], work experimentally as arrow pts. So are earlier Middle Stone Age pts in Africa, suggesting pre-50 kya development of CPW there.

Best model is that CPW came to Levant 50 kya with populations of early H. s. dispersing from Africa. Why not used by earlier Neanderthal and H. s. pops in Levant, although they were highly carnivorous? Big game most efficient; small game, and better CPW technology to take it, may have been too costly in time for Ns. High calory requirements of Ns left them no time to develop technology. CPW also promote aggression, which promotes communication and social organization to identify friends

and enemies. Ns may not have been good at symbolic behavior. CPWs gave H. s. advantage in exploiting more niches than Ns, and in violent encounters.

Sheets, Payson

O

1991 Flaked Lithics from the Cenote of Sacrifice, Chichén Itzá, Yucatán. In *Maya Stone Tools: Selected Papers from the Second Maya Lithic Conference*. T. R. Hester and H. J. Shafer eds, pp. 163-188. Prehistory Press, Madison.

pretty much the same as Sheets, Ladd and Bathgate 1992, photos better.

Sheets, Payson D., John M. Ladd, and David Bathgate o

1992 Chipped-Stone Artifacts. In Artifacts from the Cenote of Sacrifice, Chichen Itza, Yucatan: Textiles, Basketry, Stone, bone, Shell, Ceramics, Wood, Copal, Rubber, Other Organic Materials, and Mammalian Remains. Edited by Clemency Chase Coggins, pp. 153-189. Peabody Museum of Archaeology and Ethnology, Harvard University, Cambridge.

Lots of typical Maya/Toltec dart points, mostly triangular with side or corner notches. Most corner notched ones very finely made of non-local chalcedony; Sheets thinks central Mexican connection.

Sheridan, Alison

1996 The Oldest Bow ... and other objects. Current Archaeology 149:188-189.

Dating organic objects in National Museum of Scotland. Longbow from bog C14 dated to 4040-3640 BC (Neolithic).

Shippee, J. M.

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1966 The Archaeology of Arnold Research Cave, Callaway County, Missouri. *The Missouri Archaeologist* 28:1-107.

Excav 1955-1958 of ca 40%. Sandstone cave 120 x 70 feet, some dry deposits with organics - cloth, sandals, wooden artifacts. Material from Archaic to L Woodland, no contact period artifacts, historic use for saltpeter extraction. Good quality flint in local limestone. Fill in cave 6' deep, much disturbed, excav in arbitrary 6" levels, screened ¹/₄" mesh [not bad for the times]. Talus deposits included mixed fill leached and discarded by saltpeter works, over loess suitable for local pottery.

Top of cave had burned wooden troughs of saltpeter leaching ca 1825. Process described. Cave deposits have Dalton, Graham Cave and unnamed thick lanceolate points, also some notched forms and Woodland forms [which are not described.]

P 18, fig 4, fig 12: Antler atlatl hook + 2 lanceolate points assoc with C14 date [on charcoal?] of 6,720 + 300 BP or 4761 BC [uncalibrated, also context is disturbed so association not perfect, and he consistently assumes C14 dates are precise to the year, a usage no longer accepted]. [The drawings show a hook socketed to fit end of atlatl shaft, and a thick broad lanceolate point, probably Sedalia type. Also in Fig 12, two antler atlatl hooks of conical form with grooves for lashing, and a socketed antler segment that is probably an atlatl handle.] Fig 10 shows segment of cane shaft with fiber wrapping. Fig 9 shows two dart foreshafts, one with side-notched point attached with lashing of flat untwisted vegetal fiber (p.23). Both apparently from disturbed fill with later artifacts.

Shoberg, Marilyn

2010 Functional Analysis of Clovis Tools. In *Clovis Technology*. Bradley, Bruce A., Michael B. Collins, and Andrew Hemmings, eds., pp. 138-156. International Monographs in Prehistory, Ann Arbor, MI.

A

Microwear analysis of various specimens. Points from Gault show projectile and butchery use. Gault adze shows wood chopping, small fluted point has striated impact wear from spear use. Different angles of striation could be multiple events, but Gault staff experiment showed C point propelled by atlatl into ballistic gell changed direction in wound as shaft flexed. Blade and flake tools from Gault show diversity of uses including butchery, hide scraping, wood and bone work, grass cutting.

Shott, Michael J.

1993 Spears, Darts, and Arrows: Late Woodland Hunting Techniques in the Upper Ohio Valley. *American Antiquity* 58(3):425-443.

Shift from notched or stemmed to generally smaller triangular bifaces in eastern N. America between 1500 and 1200 B.P. often interpreted as introduction of bow and arrow. Numerous theories of cultural change discussed: increased hunting and warfare efficiency, fall of the Hopewell, population dispersals, etc.

Test with data from two late Woodland sites. Childers site, 1295 B.P. wide range native domesticates and wild plants, mostly late notched point forms e.g. Chesser and Lowe. Woods site 950-1150 B.P., sharp increase in maize, mostly late triangular points like Levanna, Madison, Hamilton. Some overlap, but neither has small side-notched forms. Uses Thomas 1978 discriminant function to classify points as either arrow or dart. Discusses problems with this method. All of the triangular, and most of the notched points, especially from later Woods site, are classed as arrow points. Alternatives: at introduction of bow (somewhat earlier than believed), stemmed/notched points diverged into two uses, or Thomas model misclassifies some dart points as arrows (because based on small sample of darts), and because larger notched forms more likely to be reduced in size by damage and resharpening.

Ethnographic data questions assumption that bow and arrow is more efficient than spear hunting – more likely complementary. Hard to judge from experiments whether bow more efficient or effective than atlatl.

Shott, Michael J.

1997 Stones and Shafts Redux: The Metric Discrimination of Chipped-Stone Dart and Arrow Points. *American Antiquity* 62(1):86-101.

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Extends Thomas 1978 approach to classifying points as atlatl dart or arrow (using discriminant function based on ethnographic and archaeological specimens) by increasing the sample of darts to 39, almost all SW [plus 1 Aust, 1 Arctic, 1 Peruvian which should not have been included] (Thomas had 10). Cautions with sample: knive vs dart vs spear not perfectly distinguishable since no foreshaft was attached to original shaft, although most known knives flatter handled. Eliminated also possible modern hafts on old points, and darts for marine hunting. Some of Thomas arrows, eg. Menomeni, made after no one knapped any more, so may not be good examples.

Discriminant analyses tried using length, width (shoulder width), thickness, and neck width. All variable means significantly different. Shoulder width of points turns out to be the most important variable for discriminating between arrow and dart points. Formulae with shoulder width alone as good as multivariate; improve rate of successful classification to 89.4%, (33 of 39 darts = 84.6%). Independent test classified 81 of 83 Great Basin Numa arrows and 3 random darts correctly.

Cautions: may not work well in all areas, or at time of transitions.

Shoulder width threshold between dart and arrow around 20 mm - that alone classifies correctly 122 of 132 arrows (92.4%) and 30 of 39 darts (76.9%).

Neck width thresholds of 9 mm (Beck 1995; Corliss 1972) or 10 mm (Fawcett and Kornfield 1980:72) do OK for darts, but poorly for arrows.

Arguments by Odell for Archaic flake arrow points and by Amick and Patterson for Paleoindian bows briefly discussed - unconvinced.

(The Peruvian specimen was found with atlatl and apparently rest of shaft, made of reed, and all together 400 mm long)

Shott, Michael J.

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2002 Weibull Estimation of Use-Life Distribution in Experimental Spear-Point Data. *Lithic Technology* 27(2):93-109.

Statistical technique applied to distribution of failure rates in samples of experimental points suggest that in small points, failure rates are related to chance breakage, but heavier points with more obtuse angles survive better because they resist chance breakage and use-life relates more to cumulative attrition. Small sample of published data (3) with numbers of throws for individual points, varying techniques and goals, and differing materials.

Shott, Michael

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2011 Weibull and Gompertz-Makeham Analysis of Experimental Spear/Dart Data: Implications for Stone-tool Survivorship. Paper presented at Multidisciplinary Scientific Approaches to the Study of Stone-Age Weaponry, Mainz, 19-22 September 2011.

Many points show evidence of repeated use and reworking – useful to know use-life. Implications for curation, utility or value, distribution. Death-age distributions in faunal remains applicable to points as cumulative survivorship curves. Hunzicker 2008 Folsom replicas shot at carcass with calibrated crossbow – reusing and resharpening points with resin cast at each stage, up to 8 uses.

Shott, Michael J.

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2016 Survivorship distributions in experimental spear points: Implications for tool design and assemblage formation. In *Multidisciplinary Approaches to the Study of Stone-Age Weaponry*, edited by Radu Iovita and Katsuhiro Sano, pp.245-258. Springer Science and Business Media, Dordrecht.

[see 2011]

Shriver, Phillip R.

1983 The Expanded Center "Gorget": A Late Adena Bar Atlatl Weight. *Ohio Archaeologist* 33(4):4-8.

Contextual evidence from burials that these are not ornaments, but atlatl weights, diagnostic of Late Adena.

Shriver, Phillip R.

1990 Conventional Wisdom and Archaic Atlatl Weights. Ohio Archaeologist 40(4):8-9

Conventional wisdom is that E. Archaic saw introduction of atlatl and weights, which give much more power.

Brief summary of Webb's work at Indian Knoll - Webb reconstructed atlatl with tubular weight at hook end. Indian Knoll also had bar atlatl weights, as do other sites. Probably are weights, but our ideas change. [Point of this article is not clear.]

Sievert, April K.

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2011 *Artifacts from the Craig Mound at Spiro, Oklahoma*. Smithsonian Contributions to Anthropology 49. Smithsonian Institution Scholarly Press, Washington D.C.

Artifacts acquired from various collectors. [Very descriptive, little comparative or interpretive analysis.] Small points of various late midwestern types [but illustrated only as line drawings]. A few bifaces and large pts. Maces, including one spectacular one [but only small photo]. Four boatstones or atlatl weights 'usually assoc with earlier Woodland occups when atlatls were in greater use.' Mention of wooden fragments that may be bow or atlatl [but couldn't really tell, no illustrations]. [This was a NAGPRA inventory - has this material now been destroyed by some tribe?]

Sims, Toni S.

1987 Atlatl Weights from Intermountain Locales in Montana. *Archaeology in Montana* 28(1):69-71.

2 grooved oblongs, Neuman Class I, probably associated with Pelican Lake and Besant

points.

Sisk, Matthew

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2011 A critical assessment of simple proxies for projectile plausibility. Paper presented at Multidisciplinary Scientific Approaches to the Study of Stone-Age Weaponry, Mainz, 19-22 September 2011.

Determining the function of a tool type - direct data from use wear or residue analysis, not always preserved, hard to collect. Often compare morphological characters to recent tools for which use is known. With projectiles, simple measurement-based approaches can show whether a pointed stone object is physically capable of serving as a projectile armature. Ballistically significant measurements can then be compared to ethnographic or experimental data from functional stone points. Techniques range from relatively simple, like mass or tip cross-sectional area (TCSA) to more computationally complex, like tip crosssectional perimeter (TCSP) or convergence angle. No single measure can be used, but trend of these measures being applied without proper concern for their limitations. In reality, a suite of physical characteristics contributes to the efficiency of a stone projectile point. It is only through understanding underlying physics of stone projectiles and morphological controls on their use that we can begin to disentangle what relevant information each of these proxies can yield."

Simple weapons in Lower + Middle Paleolithic e.g. Um el Tlel, Schoningen. Up Pal Lascaux depictions of spears and spearthrowers. Ethnog points usually complex + variable – early forms may be simpler. Ideal pt cuts skin, penetrates, light in weight, durable. From experiments, Tip Angle of Levallois pts correlates little w penetration but a high angle is likely to break. TCSA correlates w force needed to penetrate, but in exper penetration correlates more w width than thickness. Perimeter may be better than TCSA – as increase W increase perimeter but increase in T does little to increase perimeter. Cautions on TCSA + TCSP = trade off between penetration and durability. Ethnog analogs from only small samples. Use together to ID plausible points, but not good for atlatl vs bow.

Sisk, Matthew L., and John J. Shea

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2010 Defining Complex Projectile Technology: A Reply to Whittaker. *PaleoAnthropology* 2010:L9. Electronic document, URL: <u>http://www.paleoanthro.org/journal/content/PA2010L0009.pdf</u>

refines definitions of complex projectile weapons to exclude throwing sticks and javelins, now: "composite, multi-part tools where human energy is mechanically enhanced or stored by a non-projectile part." [the first part now correctly including atlatls]

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Sizemore, Bob

2004 PVC Atlatl Design. The Atlatl 17 (3):12

Durable "synthetic bamboo" atlatl for <\$1.00

Sizemore, Robert

2014 Arizona World Atlatl Day. The Atlatl 27(2):9

Good publicity produced 325 visitors to Pueblo Grande Museum in spite of 104 degrees.

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Skov, Eric

2012 The Forgotten Weapon: Experimentation in the capabilities of slings and slingstones. Poster presented at 77th Annual Meeting, Society for American Archaeology, Memphis, TN, April 19-22, 2012.

Slings widespread in N. Am.: 22/42 societies in HRAF sample used. Only 4 previous experimental studies. 2 Yrs practice before exper. Golf simulator to measure velocity. Single sling, 4 techniques, 4 different clay projectiles. Velocities 32-43 mps. Calculated range for 32 g projectiles launched at 43 mps: Clay sphere 105 m, clay biconical 150 m, lead sphere 150 m, lead biconical 170m. [Demonstrating superiority of biconical form, but these are only calculated ranges, not experimentally verified.] Kinetic energy/impact area to assess damage using forensic info. Lead biconical projectiles would pierce skin, clay might at release velocity, spherical would not. Biconical leads would fracture any bone at all ranges, others some fracture capability but less. Slings more effective than previously thought.

Skov Eric T. x,p

2013 Experimentation in Sling Weaponry: Effectiveness of and Archaeological Implications for a World-Wide Primitive Technology. Unpublished MA thesis, University of Nebraska-Lincoln, Anthropology Department. Obtained online at <u>http://digitalcommons.unl.edu/anthrotheses/30</u> accessed October 9, 2013.

"With fluid-motion weapons it is difficult to separate capabilities of weapon from skill of user" p7. 2-yrs practice, admits not an expert. Sling gets some leverage advantage, but must control release and acceleration, primary advantage seems to be bipassing some biomechanical limitations of human arm and body.

Sling distribution, focus on N. Am. Humboldt/Lovelock Cave finds oldest. Possible rock art. Ethnog HRAF file info and Heizer + Johnson 1952 map of distrib in SW + Gt Basin, Am Mus Nat Hist photo record of slings, reviews accounts and various uses in ethnog times.

Previous study - sling ranges in literature and ethnog from Vega and Craig. Finney says exaggerated, but he and other experimenters lacked experience. Modern records from slinging.org: typically around 200 m, max 350-505m. Vega and Craig 2009 ethnog Quechua ranges 66-78 m. Richardson 1998 exper 82-145m.

Experiments: dried clay biconical shot 20-55 g, 4 diff slinging techniques: underhand, often first learned [why, it seems unnatural to me], and inefficient; sidearm, 'Balearic' sidearm with rotations behind the back; overhand; 23-43 throws with each, but more for the better overhand and side-arm throws. Higher velocities than previously reported (up

to 50 mps [110 mph] for overhand and sidearm.) Underhand and Balearic achieved lower velocities. Slight decrease in velocity as projectile weight increased, more for O and S but still not much. Range *computed* using velocity, assumed release angle 45 degrees, included drag. Lead biconical 170 m, L sperical 147m, Clay biconical 146m, C spherical 105 m. [This is good, but why did he not actually throw for distance and get measured experimental distances?]

Impact effects. Ethnographic accounts of lethality. Biomechanical modeling based on projectile velocity and bone/soft tissue models from forensics + military. Problems with models make comparison to slings difficult. Concludes that lethality dependant on projectile material and design. Expect to fracture wide range of human bone, including at long range. Dense lead expected to penetrate exposed human skin at all ranges, biconical clay at short range. Soft tissue blunt trauma potential inconclusive but likely. Thus slings would be effective weapons in warfare and warfare would likely lead to evolution of projectile design. Effective for small game hunting, unlikely for large.

Compares to velocity records for javelin, atlatl, and bows: Sling would outperform all but advanced Ottoman composite bows. Cheap easy to make child's weapon for training and hunting small game.

Slater, Donald A. x, pdf 2011 Power Materialized: The Dart Thrower as a Pan M

2011 Power Materialized: The Dart-Thrower as a Pan-Mesoamerican Status Marker. *Ancient Mesoamerica* 22:371-388

Basics described. Dart-thrower is best term, not local term for any region, flexible projectile, not throwing stick. Possible PaleoInd origins. Wide Mesoam distrib often explained as conquest by or imitation of Teotihuacan. Possible earlier Olmec period depictions are equivocal, earliest clear atlatl image is on greenstone figurine, Oaxaca, E Formative ca 400 BC, inscribed w costumed figure holding darts + atlatl. By end Formative (100 AD) atlatls in W Mexico tombs. Images become abundant in Classic + Post C times. Teotihuacan, early assoc with rain and lightning, deity and elite warrior garb. Only symbolically important to Maya after Teo influence, when rulers adopting atlatl could show access to exotic (in time + space) powers, including supernatural associations, and depict selves as warriors. End of Classic thru PostClassic - increase militarism in art, many atlatl depictions, Chichen Itza has many on architecture, objects from Cenote. Associations with serpents, sacrifice, war, Tlaloc and other rain gods, lightning. Dart-thrower was important symbol, but even elaborate specimens may be functional: elab Berg replica of Cenote specimen worked even though hook was off center. Also tested Nolf replica of Bushnell's double atlatl: it worked, close simultaneous hits on ISAC target. Should test replicas of Dumbarton Oaks greenstone atlatls. Uses Perkins' (2008) claim of 99 mph throws [too fast].

Slifer, Dennis

2000 *The Serpent and the Sacred Fire: Fertility Images in Southwest Rock Art.* Museum of New Mexico Press, Santa Fe.

Fertility connections with hunting magic mentioned. Only one good atlatl image shown, p 157 - Johns Canyon UT petroglyph, dart throwing and pierced animals.

Sliva, R. Jane

1999 Cienega Points and Late Archaic Period Chronology in the Southern Southwest. *Kiva* 64(3):339-367.

Late Archaic - San Pedro + Cienega points - refined typology.

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SP = large, corner to side notched. C = smaller, triangular, corner notched, expanding stem, pressure flaked. Cienega subtypes: C Flared, C Long, C Short, C Stemmed. Rework could make C Long become C short or stemmed, but average C Short not fit model.

Temporal seriation: C Short, C Long, Stemmed, Flared - C14 from 2800-1600 bp. Thomas/Shott discriminant analysis says all Short and Stemmed, some Flared and Long = arrow points.

San Pedro phase (early) - only large points, then starting early Cienega Phase, small points too. Larger SP points may have knife functions as they coexist with arrows. So folk were experimenting with bow and arrow by early Cienega Phase (800 BC).

[She thinks she sees fluctuations in popularity of bows and atlatls, but neither dates on sites nor point sample is adequate to say more than that large and small points coexisted after SP. Lack of small points in SP is also result of too small a sample of both points and sites. Suggests earlier bow and arrow than most would agree - possible but point size alone is not adequate evidence.]

Sliva, R. Jane

2015 Projectile Points of the Early Agricultural Southwest: Typology, Migration, and Social Dynamics from the Sonoran Desert to the Colorado Plateau. Archaeology Southwest/Desert Archaeology Inc, Tucson.

[Overall nice volume, well illustrated with point photos, lots examples of all her types. No general map with labeled city + river landmarks, just whole state unlabeled, and some close-ups. She is trying to do interesting things with points, but in many cases, her 'splitter' types are based on too little data, and her functional and social extrapolations are not convincing.]

p 8 problems with Justice (2002) variably defined clusters, misapplied by e.g. Mus of Am Ind display, spreading misinformation. [Defines many subtypes of common named forms like San Pedro and Cienega. On the good side her subtypes are well-defined with good pictures. On the bad side, often not that distinct, a very 'splitter' point of view from small samples. And distribution maps with site dots probably do not give a very good picture of distribution – not enough data available.]

Chapter 4 – San Pedro Phase, migrants and locals. Empire pts mostly stemmed, San Pedro forms notched = different hafting, SP secure, E needing mastic but similar size foreshaft, so similar propulsion. E stem tradition from N Mexico, SP notching from Colorado Plateau = long cultural associations maybe barrier to pops adopting new

designs. Variants of both forms show design for diff effects: stem pts detach in wound, notched stay on shaft, barbs rankle in wound etc. [Possible but all these design arguments are based on little real experience, Nelson's 1996 much overgeneralized data etc. More likely just small stylistic variability than functional.] E pts suitable for encounter hunting needing durable pts because may be at longer range, while SP more for intercept hunting of specific game needing penetration efficiency and recovery of points. [This is all dubious, based on no real experience or experiment, but 'common sense' assessment of attributes and anthropological models of how hunting 'should' be done.] At Las Capas, E points with SP-like notches but not elsewhere, suggesting limited adoption by locals. Flood and occupation gap, after which no more E pts in late SP phase.

Chapter 5 - Cienega Phase in Tucson Basin: Technological Revolution. Change from San Pedro phase (1200-800 BC) to Cienega (800 BC-AD 50) was new people bringing Cienega point type, integrated, C pts adopted. C pt smaller, diff manuf. At same time late SP pts get larger, allowing new role of handheld weapon or tool as C became dominant dart point. C pt smaller, lighter, narrow notch, finished pressure work, better stone acquired outside Tucson Basin. Functionality of introduced pt designs: C needs narrower foreshaft, if keep same kinetic energy with smaller pt, need longer or heavier foreshaft. If decrease dart mass, need greater velocity to keep kinetic energy same, so maybe longer atlatls. C pts could be on arrows but unclear – many below 3 gram threshold suggested by others. Narrow neck = break pt as in Basketmaker pts, which Geib suggests allowed recover and re-use, but C pts barbed, prob one use in longer distance prey. SP pts larger, could be for different game. [She applies my info from 2012 which was only intended to show that the small point – large point distinction is not very good, not to be used as quantified data, and W + K 2007 velocity data for my cane shafts which produce kinetic energy about what Tomka says is ok for deer.] Lithic assemblage data shows smooth increase in size of cores + debitage from SP to C phases, but BTF size drops abruptly, suggesting basic tools under control of steady population (females?) while point manufacture is different set of (male?) knappers influenced by outsiders. [Extrapolating pretty far from data - pt size/debitage size may reflect change in weapons/hunting while other tech stays same, does that really reflect on who does what?] p 152 C pts restricted variation = perfected introduced template, while SP pts then vary a lot = experimentation with older template in response to new C pt technol, for instance by adding C-like serrations. Floor assemblage in late C phase pithouse at Los Pozos with 13 pts in arrangement interp as sim to anthropomorphic rock art motifs.

Functionality comparison between C pts and SP pts they replaced p 161: assume SP pts on darts provide necessary killing power for large game, then C pts though smaller must meet that requirement with heavier foreshaft or faster propulsion, but people would not change to C pts unless they were functionally better. Smaller sharper C pts have higher sectional density, so at same dart weight would penetrate better. Comparable pts like Basketmaker required better material or knapping skill, thus more costly to acquire from outside or to make locally, so not adopted in numbers.

Sliva, R. Jane o

2017 Evaluating early agricultural period social dynamics in southern Arizona through

projectile point typology. In *Projectile Point Analysis in the American Southwest*, edited by Todd W. Bostwick and Chris Loendorf, *Journal of Arizona Archaeology* 4(2):99-112.

Part of above 2015

Sloan, Chrisx2009 Mammoth Art in America, or Mammoth Fraud? National Geographic NGM Blog
Central. Electronic document, URL:
http://blogs.ngm.com/blog_central/2009/06/mammoth-art-in-america-or-mammoth-
fraud.html

Vero Beach mammoth image. Hopeful but skeptical, see Picat 2009.

Smith, Arthur George

1953 Beveled or "Rotary" Points. American Antiquity 18(3):269-270.

Beveled points do not produce "rifling" effect or spin on dart or arrow. Most points too big for arrows. Experiment observing flight of unfleched arrows with beveled points showed no rotation [crude experiment but probably right]. Beveling easiest way to shape point of poor material, sharpened held between thumb and forefinger and flaked upward [doubt he was much of a knapper either.] Beveling is result of resharpening while in haft, shown by examples of same base form with blades from excurvate + lenticular to steeply beveled and incurvate edges. Personal experiments: in short haft beveled points work well for skinning, wood work etc.

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Smith, Eric

2016 Atlatl hunting tactics. Paper presented at Missouri Archaeological Society Fall Symposium, Van Meter State Park, MO, October 1, 2016.

One of the first to take a deer in MO, using a Clovis point he made, which broke with a flex fracture at hafting juncture. Use of blinds.

Smith, Geoffrey M., Pat Barker, Eugene Hattori, Anan Raymond, and Ted Goebel 2013 Points in Time: Direct Radiocarbon Dates on Great Basin Projectile Points. *American Antiquity* 78(3):580-594.

Direct dating of points by C14 dates on organic hafting material or organic bags containing points. N = 83 points from 9 sites and isolated finds, point types classified using Thomas (1981) Monitor Valley key. Most dates fit existing chronological schemes. But – one Elko Eared 7684 cal BP, 2 Large Side-notched [Elkos too] is early, suggests early emergence of those pt types in E Gt Basin. In W, 2 Rosegates with 1965 cal BP, older than usual ests. Humboldt 6707, 4565 cal BP also early. At Nicholarsen Site, NV (Hester 1974) bag contained 67 pts and 34 preforms including 21 Elko, 36 Rosegate, dates 1235 BP which is end of Elko range, beginning of Rosegate, so 2 sizes similar form in use at same time, either both bow and atlatl, or the size/type diff not very meaningful in this cache by one individual. Homogeneity suggests latter. [From photo of 67 pts, I agree – sizes are not bimodal.]

Smith, Geoffrey M., Pat Barker, Eugene Hattori, Anan Raymond, and Ted Goebel

2014 Identifying dart and arrow points in the Great Basin: A reply to Hockett et al. *American Antiquity* 79(3):566-569.

Their application of Hildebrandt and King (2012) method showed all Nicholarsen cache 101 pts were arrow pts, because all have same thickness, so probably no overlap between atlatl and bow. We made this point too. [Implicitly they accept the ID as all arrow points; I'm not sure, but agree size variation does not support 2 different technologies].

Further argument about Elko vs Large Side-Notched form.

Smith, Jackie

1999 Spears, Spear Throwers, Boomerangs, and Arrows. *Experiment in Archaeology* No. 1: 21-22. Newsletter for Experimental Archaeology, Lydney, Gloucestershire, UK.

Experiences of a class. Crude spears and spear throwers, achieved 30 m throw with 250 gm spear 130 cm long . [Not very useful.]

Smith, Julian o 2016 Artifacts for Sale. *American Archaeology* 20(1):12-17.

Alaska natives, St Lawrence Island, mining sites, 'subsistence digging'. Some communities prohibit, some turn blind eye, tensions within and among. Photos of carved harpoon socket, winged harpoon weight. Destruction of sites on tribal and federal lands, including burials. [Yep, this is how some tribes 'respect' 'their' ancestors. Is NAGPRA really different?]

Smith, Martin J., Megan Brickley, and Stephany Leachx2006 Experimental Evidence for Lithic Projectile Injuries: Improving Identification of an
Under-recognized Phenomenon. Journal of Archaeological Science 34:540-553.

Stone point wounds in bone hard to identify without embedded point. Experiments show can be done both macro and microscopically, and stone points often leave embedded fragments.

Used longbow + flint points, shot into bones with some soft tissue [carcasses would have been better]. Also points attached to mechanical striker calibrated in joules (kinetic energy) to compare penetration and tangential strikes on cattle scapulae (structurally similar to human cranium). Several characteristic damage types produced by both experiments; compared to arch specimens. Internal beveling - exterior slot, interior expands [like a

concoidal fracture in stone]. Embedded fragments - 14 of 32 impacts, sometimes only microscopically visible, deep and hard to remove, so likely to remain despite medical treatment. Internal striations - microscopic, inside cut, parallel to impact direction, not seen in metal slicing marks. Tangential strikes can produce wounds resembling cut or butchery marks.

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Smith, Michael E.

1996 The Aztecs. Blackwell Publishers Ltd, Oxford.

Describes warfare without mention of atlatls p.171: principle weapons were thrusting spears and swords (maquahuit) with obsidian blades... "bow and arrow used as offensive weapons also, and some groups made use of clubs and slings."

Smith, P., R. Bloom, and J. Berkowitz

1984 Diachronic trends in humeral cortical thickness of Near East populations. *Journal of Human Evolution* 13:603-611.

sic

cited in Peterson: humerus cortical thickness biased R in M Natufians, supporting use of arms for throwing but not net or archery hunting.

Snow, Dean

2013 Sexual dimorphism in Upper Paleolithic cave art. American Antiquity 78(4):746-761.

Human hand sizes and proportions are sexually dimorphic in distinctive patterns within populations. Measured 32 hand stencils, comp to stats from European populations. Up Pal sexual dimorph was greater than current. 75% of hand stencil sample was female, showing female involvement in Up Pal cave art; sub-adult male + female also represented as well as adult males.

Sophie13

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2008 How Did David Kill Goliath? With an Atlatl, Physicists Say. On heywood.com webpage, Electronic document, URL <u>http://heywoodgould.com/pages/?m=200805</u>, accessed 4/20/10. Printed in *The Dart* April 2010:13.

According to "physicist" Ken Gehagen-Verren of the Intelligent Design Institute of Military Science, David "reinvented" atlatl. Slings are just for small animals, couldn't kill giant in armor.

[Is this for real? It's nonsense, dumb enough to be a parody. He knows nothing of either atlatls or slings. No evidence of atlatl use at that time. R Madden posted comment: Bible clearly says slings, which are deadly and for which there is evidence.]

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Spangler, Duane

1998 The Broken Atlatl. The Atlatl 11(4):8-9.

Hinged a broken atlatl, expecting it to act as extra elbow for more power, but found no advantage, and discovered that "the dart left the atlatl before the hinge came forward." [Nobody, myself included, noticed that this was early evidence that atlatl does not work as spring, for same reason.]

Spangler, Jerry D.

2013 *Nine Mile Canyon: The Archaeological History of an American Treasure.* University of Utah Press, Salt Lake City.

Fremont, NW Utah, lots of history of explorations, good pics of rock art, but late, bow and arrow, no atlatl pics.

s.L

Spencer, Baldwin and F. J. Gillen

1938 The Native Tribes of Central Australia. MacMillan and Co. Ltd, London.

Old fashioned ethnography, focus on ritual life. Spear throwers [woomera scoop type] discussed. Hunting (p.20): skill varies, but "takes an exceptionally good man to kill or disable at more than 20 yards." Two blurry photos of throwing. Butchery: flint at end of spear thrower used. P.28 spear thrower described, "most useful single thing the native has." Hollowed out piece of mulga, 2 ft to 2'6" long, tapers to narrow handle with lump of resin holding sharp flint or quartzite, other end blunt point with sharp bit of wood fastened with tendon, fits into hole in end of spear. Ordinary spear 10' long, Tecoma wood, with mulga tip spliced on and bound with tendon, some with additional attached barb.

More details p. 574 ff. Different kinds of spears, some with barbed wood heads, or stone flake heads, some with reed shafts. Wood shaft, stone tip specimen 2.89 m, 538 gm. Cane shaft, stone tip specimen 3.13 m, 397 gm. Wood shaft, barbed wood point specimen 3.12 m, 340 gm. [Examples, others given, similar]. Three types spear-throwers among various central tribes (photo): 1. "Wanmyia" [lathe type] used by Warramunga and northern tribes, flattened stick 105 cm long, 4.8 wide at grip, finger notches, hook attached with resin and string. 2. Nulliga of Wambia tribe [stick type] smooth round stick 87 cm long, hook attached with resin and string, large tassel at handle. 3. "Amera" of Arunta, Urabunna, Luritcha, and Ilpirra tribes (whites call Wommera) as described earlier. Used for bowl, cutting tool, making fire (by rubbing edges on shield), musical instrument. Rarely decorated.

Spencer, Lee

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1974 Replicative Experiments in the Manufacture and Use of a Great Basin Atlatl. In *Great Basin Atlatl Studies*, R.F. Heizer ed., 37-60, figures 13-19. Ramona: Ballena Press.

Using stone tools, replicates a NV atlatl with weight. See Hester 1974 (site NV-WA-197).

Very detailed description and evaluation of manufacture, tools and materials. Some

throwing experiments – average 50-60 yards, feels good accuracy attainable, despite few trials and inexperience. [Good paper, early atlatl replication.]

Spencer, Lee

2015 The replacement of the atlatl by the bow and arrow tool system in the northern Great Basin: The case of the missing Eastgate precursor. *The Atlatl* 28(2):6-12.

Stylistic distinction between Eastgate and Rose Springs style contemporary early arrow points was conflated in Rosegate type. Elko forms (late dart points) seem precursor to RS, but what was precursor to Eastgate style? N of Gt B on Columbia Plateau was a form that suggests the Egt style adopted from there [he explains this is long ago idea and has forgotten the details]. So what is real relationship between RS and E - research project for someone. Lengthy discussion of things to observe, possible interpretations. E pts may be innovations for bison hunting. Overlap in GB with bow and Elko armed darts? RS pt style easier to make than E. [He has thought it out well - he should go do the research].

x

Spencer, Lee, and Eric Burke

1994 A Reanalysis of Four Northern Great Basin Atlatls. *Journal of California and Great Basin Anthropology* 16(2):271-285.

Plush and Roaring Springs Caves, Oregon, excavated 1940 (Cressman + Krieger 1940). Poor provenience, but associations with artifact suggest Middle Archaic age. Original measurements incorrect. Plush Cave - Basketmaker type, possibly willow, notched but no loops, groove and integral spur, 545 mm L, 10 mm T, slight flexibility "would not constitute significant energy storage." [So they believe the spring theory?] Roaring Springs 1: Large and wide, unusual form, 595 mm L, 61 W. Large integral hook with keel, not groove, groove on dorsal side, shaft widens toward distal, grip flares with wide notches [like half finger loops], handle wrapped with hide. Perhaps juniper, red pigment coating.

Roaring Springs 2: Smaller 447 mm L, 42 W. Similar form to RS1 but not as well preserved, perhaps juniper.

Roaring Springs 3: Spur fragment, probably from atlatls like 1, 2. [More detailed measurements and drawings]

Spencer, Steven

2015 Hunting the Harder Way. The Atlatl 28(3):2.

Atlatl hunting legal in MO, licence for non-resident only \$225. Practice at 10-15 yds, avoid urge to throw further, risking a bad hit. Atlatl even more challenging than bow.

Spencer, Steven

2018 The atlatl and the family. *The Atlatl* 31(3):1-3.

Works with children as young as 3 – natural skill at throwing, like a ball. Small

equipment: atlatl ca 12 inches between index finger and hook or socket. Dart ca 5' 10" with great flexibility. Splice 5/16" dowels. Shorter darts don't fly correctly. Hammer grip with dart rest because child lacks muscle skill for finger release. Groove to hook, or socket instead of hook helps child load. At 10 yds, 6 yr old hit ISAC target >50%, at 15 yds 30%. Family participation important for learning and incentive.

Speth, John D.

2012 Thoughts About Hunting: Some Things We Know and Some Things We Don't Know. *Quaternary International* (2012): 1-10.

Y

Confusing variables affect ungulate faunal assemblages and optimal foraging models: seasonality, the way herds arrange themselves when disturbed, human choice of prey and food practices, water needs of animals, hunter needs hide or prestige and other social needs rather than meat. [Why we need ethnoarchaeology]

Spranz, Bodo x

1956 Die Speerschleuder in Amerika. Veröffenlichungen aus dem Ubersee-Museum in Bremen. Reihe B, Volkerkunde 1(2):148-162.

["The Spearthrower in America" In German.] Typological distributions with maps for N Am + Mesoam, and for S. America. [Interesting but ignores differences in date of the many forms]

Squirra, Francois

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2012 Momentum vs Kinetic Energy for Dummies: How a Traditional Bow Kills. *Bulletin of Primitive Technology* 43:32-34.

[Explanations not clear enough.] Common kinetic energy (ft.lb) standards for game size are misleading - KE is not intelligent way to measure hunting effectiveness. $KE = \frac{1}{2}$ mass x velocity squared. Momentum = mass x velocity [he seems to think there is a difference between v as "speed" in KE and v as "velocity" in M.] Ashby info: As velocity increases, resistance increases by square, double velocity, you quadruple resistance, so projectile rapidly loses velocity, but not momentum because it doesn't lose mass. [but as you increase velocity, you also increase kinetic energy by square of velocity, same as you increase resistance.] Recalculates animal hunt standards using momentum. This doesn't consider other aspects of penetration like point shape and cross section. Table of arrow velocity (chronograph) [but you can't tell which of 3 bows], KE, and M. 130-180 ft/sec.

Stafford, Thomas W.

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2014 Chronology of the Kennewick Man Skeleton. In *Kennewick Man: The Scientific Investigation of an Ancient American Skeleton*. Owsley, Douglas W., and Richard L. Jantz, eds., pp. 59-89. Texas A&M Press, College Station.

Elaborate dating info, final conclusion for this report: 8358 ± 21 RC = two sigma

calendar age of 8690-8400 calibrated BP.

Stamer, Greg

2004 The "Finer Points" of Harpoon Throwing: For Accuracy and Distance. *The Masik: Quarterly Newsletter of Qajaq USA* 2(3):5-8. Electronic document, URL: <u>http://www.qajaqusa.org/newsletter/Masik_Fall2004_10043.pdf</u>

Elaborate harpoon technology and use described. Throwing for distance and accuracy included in current Greenland National Kayaking Championship events; harpoon must weigh at least 1 kg (2.2 lbs). Sealing "knob" (on end) harpoons hook to thrower with pegs on side of shaft ("side-thrown"); lighter "winged" harpoons (with bone wings on end) have socket on end ("end-thrown"). (See Baker 2004 for harpoon making.)

Throwing harpoon from kayak: lean back then forward, with little body twist [though the photo shows some]. Ca. 18 m is max throw for a strong man. Usually throw in an arc to hit seal from above. Correcting throws to R or L done by altering depth of socket (end-thrown) or angle of peg (side-thrown). Birket-Smith says knob harpoon originally thrown without board in 18th C. "you should not allow your throwing hand to drop on the followthrough. Rather, Maligiaq uses a short, powerful throw, without much wrist breakand he stops his hand abruptly at the end of the throw. The end of his throwing stick remains pointed upward at the end of the throw rather than becoming horizontal." [NOTE that even without much follow through, and with a heavy, rigid dart, the atlatl works as a lever, flipping up. His photos show this too.] Competition throws either as lob, or "line drive" at closer targets.

Target is a floating 2m diam circle with 4 concentric rings 25 cm apart, distance at least 10 m for men, 5 m for women + children.

Standen, Vivien G.

2003 Bienes Funerarios del Cementerio Chinchorro Morro 1: Descripción, Analisis e Interpretación. Funerary Goods from Chinchorro Morro 1 Cemetery: Description, Analysis, and Interpretation. *Revista de Antropologia Chilena* 35(2):175-207.

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[In Spanish with English abstract + captions.] 134 individual natural and artificial mummies with 301 funerary goods, dating 5400-3700 BP. Hunting gear (assoc with men) more common than fishing + gathering gear (assoc with women). Includes 5 estolica (atlatls) and 6 darts. [from illustrations, atlatls include simple stick form with single "security cord" loop one side and attached bone hook or integral carved hook, and a flatter grooved form (fragmentary). Darts are of wood, with harpoon points. One atlatl, bone hook, with adult male, dates on body 5160 bp. Two others assoc with women.

Stander, P., X. Ghau, D. Tsisaba, and X. Txoma

1996 A New Method of Darting: Stepping Back in Time. *African Journal of Ecology* 34:48-53.

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Darting techniques for tranquilizing animals now mostly rifles powered by CO2 or .22

blanks, using syringes. Ju/'Hoan Bushmen use light bow, unfletched poison arrows, small and compact for hunting in dense vegetation cover. Bow 1 m L, weighs <200 gm, "twine constructed from back muscles of large antelope" [he must mean backstrap sinew for bow string]. Arrow hollow grass shoot, 400 mm long, 3.3 grams, detachable arrowhead shaft 150 mm long covered with resin on which poison paste is placed, from larva of a beetle. [I omit Latin names]. Hunters can hit target over 50 m. Arrowhead replaced with dart syringe.

Five Ju/'Hoan hunters shot 5 arrow/darts each at targets 5-30 m at 5 m intervals, measured distance from centre. Radius of 25 cm consistently hit up to 30 m. Mean accuracy decreased from 5 cm radius at 5 m to 23 cm radius at 20 m. Normal hunting range 20-30, subjects felt uncomfortable shooting at less than 20 m. Then darted 6 lions and 17 leopards [but most were previously drugged or immobilized, though some were stalked on foot]. Good technique: cheap equip, involves locals using traditional skill in sustainable wildlife management.

Stanford, Dennis

1979 Bison Kill by Ice Age Hunters. *National Geographic* 155(1):114-121.

Multiple exposure photo shows Stanford throwing. [Appears to be a distance throw, starts with atlatl and dart down by hip, dart leaves at high angle. He uses full overhead motion with torso rotation and wrist flick. Other photos show an Arctic-like atlatl and long foreshafted dart.]

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Stanford, **Dennis**

1996 Foreshaft Sockets as Possible Clovis Hafting Devices. *Current Research in the Pleistocene* 13:44-46.

A socketed harpoon head could hold an Anzick Clovis point and fit on the end of one of the bone rods from Anzick, which would then be foreshaft. Richmond, Indiana bog surface find dates $7,990 \pm 120$ BP, so not Clovis, but maybe similar.

Stanford, Dennis, and Bruce Bradley

2002 Ocean Trails and Prairie Paths? Thoughts about Clovis Origins. In *The First Americans: Pleistocene Colonization of the New World*. N. Jablonski, ed., pp. 255-271. California Academy of Sciences, San Francisco.

Supposed similarities between Clovis and Solutrean, including blade technology, overshot biface thinning, etc. [None of these are illustrated, perhaps because they would be even less convincing.]

Stanford, Dennis, and Bruce Bradley

2012 Across Atlantic Ice: The Origin of America's Clovis Culture. University of California Press, Berkeley.

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[Well written, explains in detail their arguments for a Solutrean origin of Clovis, but unconvincing. Too much of the evidence is stretched, or suggestive but inconclusive and with problems.]

Starna, William A.

1979 A Comment on Curren's 'Potential Interpretation of Stone Gorget Function''. *American Antiquity* 44(2):337-341.

Curren makes "simplistic association between form and function" but there are chronological and contextual problems - gorgets are not pottery tools, but are associated with mortuary and status ritual.

Starr, Frederick

1898 Some North American Spear-Throwers. *Archives Internationales d'Ethnographie* 11:233-235, plate XV.

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Utah "spear-thrower" from "cave-house ruin" given him by Charles Lang. [Basketmaker form], 613 mm L, leather finger loops, heart-shaped groove, integral "peg," slightly curved, small white quartz "charm" attached.

Lake Patzcuaro, W of Mexico City, Tarascan Indian towns, some hunt ducks with "tsu-pakwu" spear-throwers, 2 m long cane spears with iron points. Thrower has round hand grasp with wide portion perforated with 2 holes for $1^{st} + 2^{nd}$ fingers, deep groove, peg for butt of spear, underside keeled with hook to retrieve floating spears. Light fine-grained wood, 550 mm L (short specimen) to 740 mm. Peg often broken out and repaired. [poor illustrations of all 3 specimens, and canoe on Lake P.] George Hyde says spear-throwers in use elsewhere in Mexico, Tenanpulco on Apulco R., Tecohitla and Nauhtla Rivers.

Starr, Frederick

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1901 Notes Upon the Ethnography of Southern Mexico. *Proceedings of the Davenport Academy of Sciences* 8: 102-198.

Expeditions of 1898, 1899, and 1900. Describes several tribal groups, including the Tarascans in the state of Michoacan, around Lake Patzcuaro, p111: "In hunting ducks, a spear-throwing stick is used, which is called tsu-pa-kwu. This is simple, about 2 feet long, with two holes for the fingers, a groove in which the spear shaft lies and a peg against which the butt rests; there is also a hook below the end for dragging floating spears to the canoe. The spears are made of long canes with two or three divergent iron points firmly bound in." Small photo of atlatl.

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Steckel, Nathan, and Chris Vincent

2006 The Physics of the Atlatl: Flex: Irrelevant...or not. The Atlatl 19(3):5-6.

Flexible atlatl with a "half throw" stopping at 2:00 with no follow thru allows atlatl spring to propel dart. 44 throws each way show 6.3% more distance and similar but

slightly better accuracy than full throw with follow through. [No details on equipment. Small sample, but difference in distance is statistically significant by t-test; difference in accuracy is not. Plausible, although accuracy measured only as distance from straight line, so not useful. This is not the right way to use a normal atlatl, but might be relevant for some long flexy ones as in Australia].

Stegmiller, P. F.

Х

1925 Arrow shooting and hunting of the Khasi. (Pfeilschiessen und jagdgerbr auche der Khasi). *Anthropos* 20:607-623.

[Not very good translation from German by E. Knight for HRAF 1956 so it appears partial, starting with 'Chapter IV' and I don't know what is missing. Many errors. Also the dates are screwy – many refs to observations in 2009, and citations in 2000s. Can't tell what part relates to old and what to recent work. No info on children or learning]

Bamboo bows and arrows. Harvest timing, qualities of bamboo, split for bow Different bow types for war, archery game, hunt + war. Now mostly just one for all purposes, about 5 feet to 5.5 feet long. Range 150-180 yds. Bowstring of bamboo. Bamboo arrows, 4 or 5 fletches, 3 types – barbed iron head for hunt + war, plain [conical] iron head for archery matches, similar but short for throwing without bow [these look like lawn darts in the photos]. "Usual height 780 centimeters" [must mean 78?]

Long description of iron smelting and smithing for arrowheads. Art of arrow and bow making is in decline. Men do most, but women lash on the fletching. Feathers obtained locally or from Bangladesh.

Meaningful in male identity, ceremony and festivals. Bow and 3 arrows used in naming ceremony for boys, basket for girls. Arrows rep his duty to protect self, family, village. Also used in funerary ritual, oath taking, etc.

Hunting now restricted by gov't. Always with dog, mostly individual men, pastime when not needed in farming.

Traditional competitions with betting, village against village. Various rules and participants described in great detail.

Releases and manner of shooting. Morses release types discussed; Khasi use "Mediterranean" type, i.e. like modern archers. Wear wrist guard. Lengthy irrelevant discussion of Indian legends, Greek Amazon story, world symbolism of archery, history, modern competitive FITA archery. Modern Khasi archery competitions have been commercialized some for gambling.

Stemp, W. James, Jaime J. Awe, Keith M. Prufer, and Ashley E. Sharpe o 2016 Design and function of Lowe and Sawmill points from the Preceramic Period of Belize. *Latin American Antiquity* 27(3):279-299.

Stemmed + Barbed Late Archaic points, often beveled, similar to Hardin, mostly surface finds. Comp to Thomas and Shott samples of hafted dart points in metrics: mostly longer and wider the overlap at lower end of range. Sawmill neckwidth overlaps, and so does tip cross sectional area, but Lowe points are much larger in these. TCSA suggests Lowe

suitable for thrusting spears, but has barbs (= harpoon?) or used in conjuntion with Sawmill points which are suitable for darts. Impact macrofractures common on both. Overlap in regional and apparent temporal distribution. Sawmill points as dart points + knives, larger Lowe pts thrusting/throwing spears/harpoons + knives.

Stevens, Nathan E., and Brian F. Codding x, p

2009 Inferring the function of projectile points from the Central Coast of Alta California. *California Archaeology* 1(1):7-28.

Central Coast Stemmed Series points were dominant biface form for 5000 yrs, assumed to be dart points. Later small leaf shaped pts assumed to represent adoption of bow Middle-Late Transition Period (ca. 1000-700 B.P.). Test functional differences: expect if assumptions correct, CCSS + leaf should compare well to known dart and arrow pts respectively; and both should show use-wear evidence (i.e. impact fracture, lack of cutting etc.). If not, then leaf pts may rep arrival of atlatl, not bow [this does not follow, as dart pts suffer impact fractures too].

Comp 213 CCSS and 25 leaf from 26 sites in S CA to known pts from Shott, Thomas, Shea data. [Problems here: 'Known' is not a great sample, not from CA, etc, and sample N of leaf pts is small]. Other measures: Tip Cross Sectional Area, geometric means of dimensions, PCA analysis.

CCSS points are smaller than thrusting spears [Shea Neanderthal data, so not a very good comparison], larger in Thickness and W, though not in L, than 'known' dart pts, and differ from smaller leaf pts in all dimensions, = technological shift. [The variation in CCSS is very large. This makes mean and 95% confidence very tight, and very similar to dart pts, though statistically different.] Leaf pts are signif larger than arrow pt sample, but only marginally diff from dart sample in PCA of size + shape, and in TCSA. Use-wear [again, small sample] suggests CCSS multi-functional, leaf more specialized proj pt.

CCSS are intermed in size between thrusting and dart pts, so probably thrown spears. [This does not follow at all. In particular the 'known' sample of darts from N. Am. is on the small side of what works, comp to e.g. Aust., and there is no javelin point sample to compare.] Supported by lack of evidence of atlatl in the arch or ethnog of region. Leaf pt may indicate late intro of atlatl, not bow, or, experimentation with bow points at intro. [The leaf points are small and clunky (the CCSS are also very thick). I think they give good evidence of technol transition, but support their last conclusion, as I thought throughout that leaf pts rep transition between atlatl and bow, as old manufacture techniques are applied to smaller points. And by knappers of no great skill!]

Stewart, Tamara

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2015 Searching for the Origins of Pueblo Culture. American Archaeology 19(1):26-31.

Crow Canyon excavations at Dillard Site, CO, great kiva, BMIII, ca 600 AD. Photo of Procession Panel, SE Utah, showing lines of small figures approaching a circle. [also 2 large atlatl darts, 2 more impaling a mt sheep. Other figures including large deer/elk. Dart feathers are elaborated, and darts show trianguloid points.]

Stirling, Matthew W.

0 X

1960 The Use of the Atlatl on Lake Patzcuaro, Michoacan. *Bureau of American Ethnology Bulletin* 173:265-268. Smithsonian Institution, Washington D.C. (also excerpted with good illustrations in *The Cast* Fall/Winter 2000;13-15)

1944 expedition, photos in article (also color motion-picture made). Tarascan word: "phatamu".

Atlatl survived in "most civilized regions" = Peru, MesoAmerica, because hunting less important, didn't need bow. Also maybe superior in warfare.

Like Eskimo, Tarascans use to hunt aquatic birds, throwing multipronged spear into rising flock.

Reed spear shaft, 9' long, steel prong tip.

Atlatl 24" long, wood, rigid, grooved with integral spur, hook on back for retrieving birds, two finger holes.

Stockel, H. Henrietta

1995 The Lightning Stick: Arrows, Wounds, and Indian Legends. University of Nevada Press, Reno.

Arrows and symbolism. [Collects some old, hard to find ethnographic accounts of archery, and medical accounts of wounds. Unfortunately, she doesn't have any understanding of how bows are made and used, and her atlatl knowledge is even worse. Page 41: "The atlatl dart – the forerunner of the arrow, according to Peckham - fit snugly, attached to a foreshaft, into a spear's mainshaft. Often these dart throwers were as much as fourteen feet long, especially in the SW, where Spanish influence was strong." Page 16: "The Commanches and Pawnees carried lances that resembled the atlatls of old – tips of swords inserted into wooden handles."]

Stodiek, Ulrich

X

1992 A propos de l'emmanchement des propulseurs au Paléolithique Superieur. In *Le Peuplement Magdalenien: Paleogeographie Physique et Humaine*. J-P. Rigaud, H. Laville, B. Vandermeersch eds., pp 317-331. Comité des Travaux Historiques et Scientifiques, Paris.

['Concerning the hafting of spearthrowers in the Upper Paleolithic']. Paleolithic spearthrowers are not complete, the antler hook ends were made to haft in wooden handles, in several ways. Some finely carved.

Dates from late Solutrean to Magdalenian V, most Magdalenian IV.

Eight complete specimens: 10-30 cm long, too short compared to ethnographic. Round perforated examples could haft in socket but too much work, more likely in groove, lashed on through holes.

Some short specimens merely beveled, glued and lashed to beveled wood. [Good photos of how he did it]. Trials show durability.

Stodiek, Ulrich

1993 Zur Technologie der jungpalaolithischen Speerschleuder: Eine Studie auf der Basis archaologischer, ethnologischer, und experimenteller Erkenntnisse. (The Technology of the Upper Paleolithic Spearthrower: A Study Based on Archaeological, Ethnological, and Experimental Data). Verlag Archaeologica Venatoria: Tubingen.

[A magnificent book, lots of information and illustrations of all kinds of atlatls, including famous Upper Paleolithic ones, and details of Stodiek's reconstructions and experiments. From my point of view, too bad it's in German, and now out of print. Someone should publish a full translation. See Street 1994 for information from his translation of the summary.]

Stodiek, Ulrich

2000 Preliminary Results of an Experimental Investigation of Magdalenian Antler Points. In *La chasse dans la Préhistoire/ Hunting in Prehistory*, Anthropologie et Préhistoire 111. C. Bellier, P. Cattelain, and M. Otte eds., pp. 70-78. Societé Royale Belge d'Anthropologie et Préhistoire, Bruxelles.

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from work for 1993: antler pts all that remain of darts assoc with Upper Paleolithic atlatls. Double + single beveled points show diameter around 10 mm, = shaft size, which works with shafts 1.3-2.2 m long. Tested using crossbow device, 30 m/sec velocity, at 15 m range, equivalent to velocity attained with spearthrower. Used gutted fallow deer carcass, 45 kg. Points attached with only resin/wax glue failed or split shaft, but lashing of sinew made the hafting strong enough. Body cavity penetration when no bone struck averaged 20 cm, and with flint side-blades 5-10 cm more. Bone hits often damaged both point + shaft. Glued-in flint inserts detached when struck bone.

Stodiek, Ulrich, and Harm Paulsen

1996 "Mit dem Pfeil, dem Bogen": Technik des steinzeitlichen Jagd. Isensee Verlag, Oldenburg.

["With Arrow and Bow: Stoneage Hunting Technology" In German.] Sections on spear throwers (Speerschleudern) with color pictures of reconstructions of Upper Paleolithic examples, and European competitions.

Stolpe, Hjalmar

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1890 Ueber Altmexikanische und Südamerikanische Wurfbretter. *Internationales Archiv fur Ethnographie* 3:234-238.

["On Ancient Mexican and South American Dartboards". In German.] Engravings of British Museum Aztec atlatl, a couple S. Am. forms.

Straus, Lawrence Guy

2005 The Upper Paleolithic of Cantabrian Spain. *Evolutionary Anthropology* 14(4):145-158.

Paleo envir N coast Spain = forest, lots game. Chronology. Few good Mousterian sites yet. Continuity, similarity, or confusion among late Moust, Aurignacian, and Chatelperronian. Gravettian scarce. Solutrean much more abundant, response to Late Glacial Maximum, which spurred technol developments including new foliate, stemmed, and shouldered pts, spear thrower, eyed bone needle, and toward end, antler pts edged with bladelets. C14s from 20.5 - 16.5 kya. Territorial differentiation in point types, with exotic materials, and finely flaked points moving, possibly by gift or trade. Climate moderation in Magdalenian leads to abandonment of 'expensive' Solutrean points in favor of more low-investment, reusable antler pts and replaceable bladelet edges.

Street, Martin

1994 Translation of the summary of the Doctorate thesis of Ulrich Stodiek, "Zur Technologie der jungpalaolithischen Speerschleuder." *The Atlatl* 7(4):1-5

Ethnographic survey, size ranges.

Australian info: successful hunting range 10-30 m.

Upper Paleolithic archaeological survey: 123 specimens of hook ends [which include the famous animal carvings, and some pieces considered by others to be complete]. Two hook types: hook, and hook + groove.

Surviving pieces are too short to be complete, would be part of more complex tool. Reconstructions and experiments performed: Needed fletching on pine shafts with antler points. Flexibility of spear affects system. Max distance with reconstructions 180.9 m. Bow vs atlatl experiments: arrow 40-50% more velocity, 1/17 the time to launch. Spear 60-70% more kinetic energy because heavier (90 gm).

Penetration of bison carcass poor with atlatl and antler point (10cm), better with lithic points. Bone points survive damage better than stone.

Strehlow, T. G. H.

1964 The Art of Circle, Line, and Square. In *Australian Aboriginal Art*, edited by Ronald Berndt, pp. 44-59. The Macmillan Company, New York.

Illustrates and explains designs on a woomera type spearthrower as example of Western Australian art. "The Central Australian curved and circular figures were stylized representations of marks or tracks on the ground...painted or incised as individual figures... with empty spaces left between them. The Western Australian angular and straight-line figures, on the other hand were combined into patterns that covered practically every inch of the surface. They do not seem to represent marks or tracks on the ground, but to be heavily stylized drawing of the actual objects themselves." Two 1933 Pintubi spearthrowers represent storms with wind and floods. [Why those designs on spearthrowers? Not explained]

Strischek, Ray

1995 Atlatl Elbow, or How to Kill Yourself Before You Kill Your Mammoth. *The Atlatl* 8(3): 2-3

A

Theories of atlatl weight use discussed, favors weights to reduce side-to-side wobble of atlatl during throw.

Got real sore from using heavy weights, recommends no more than 2-3 oz.

Strischek, Ray

1996 Atlatl Weight Function. Ohio Archaeologist 46(1):32-39.

[Useful article], considers many variables in accuracy and distance: theories of atlatl weight functions, body motion and casting styles, atlatl grip styles, problems affecting throws.

Experiments with lots of variables [not very systematically], concludes: Heavy weights no good, they slow throw, damage arm. Moderate weights increase accuracy by helping prevent spur end of atlatl from being pushed to side as dart flexes. On light flexible atlatls, small weight may increase flex of atlatl and stored energy, and tunes atlatl flex to that of dart.

Strischek, Ray

XO

1997 Dart Construction and Design. The Atlatl 10(2):7-8; 10(3):3-4, 10(4):8-10.

Recommends only slight flex to store energy, too much destroys accuracy, especially at distances where harder throw needed.

Uses bamboo or cane approximately 6 foot long.

Can shorten or stiffen to reduce flex, want weight a bit forward of center. Uniform diameter milled lumber darts with even flex not as good as weight-forward darts with larger forward diameter.

Strischeck, Ray

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1998 Aluminum Darts. The Dart 3(2):2-3.

1998 Strischek's Atlatl. The Dart 3(2):3-4.

Add dowl inside tip end - stiffens and weights so control flex.

Strischeck, Ray

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Describes + pictures his odd atlatl with dart rest and finger pegs. [Not like anything ethnographic or prehistoric, but works well.]

Strischek, Ray

xo

1999 Atlatl Spurs. *The Atlatl* 12(1):8-12. 1999 Atlatl Spurs. *Bulletin of Primitive Technology* 18:70-73. Recommends spurs for different purposes. Spurs at angle (30 degrees) to shaft provide initial lift to point of dart, as does curved-down end of atlatl. Horizontal spurs don't. Curved up atlatl end drives dart point down. End of dart "rides on" spur most of throw, need flat surface on spur to prevent slipping off to side or snagging of end of dart.

Strischek, Ray

1999 Atlatl Darts. Unpublished manuscript.

Basic dart principles and manufacture of cane, wood, and aluminum shafts.

Strischek, Rav

1999 Ray Strischek's Tips for Making A Good Dart for the WAA ISAC Contests. The Dart 4(1): 5-7.

Emphasis on importance of balance point being forward of center.

Strischek, Ray

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2000 Atlatl and Dart Do It Tips for the New Season. The Dart March 2000: 9-12. 2000 Atlatl and Dart Tips for the New Season. The Atlatl 13(3):3-5.

Useful basic instruction/tips on equipment and use.

Strischek, Rav

O 2000 Ray Strischek's Atlatl. The Dart July 2000:17-18.

Why Ray uses a flexible, weighted atlatl with an ergonomic peg grip.

Strischek, Ray

2001 The Pull, Push/Lever, Wrist Flick Action of the Atlatl in Motion. The Dart November 2001: 26.

Describes motion with schematic drawings: First, horizontal pulling of the dart, then hand pushes forward and levers atlatl spur up, followed by flick of wrist which accounts for 50% of force, after atlatl passes the vertical position. Spur contact only at beginning [but then how does atlatl apply force to spear, especially in wrist flick part of throw? Needs closer look at slow motion films].

Strischek, Ray

2002 How to Use the Atlatl and Dart. The Dart August 2002: 20-21.

"Pull, push/lever, flick." Don't bend over. Keep elbow above shoulder.

Strischek, Ray

2004 Atlatls. The Dart May 2004: 1-8.

Wrist flick gives greater force for penetration and distance from animals. Defines atlatl parts. Three grips: Hammer, Basketmaker II, and Single Hole. Changing from hammer to BM grip helped his atlatl elbow. Male, Female, and Neutral Hooks. Weight theories: increase velocity/distance (variable test results); tuning flex or oscillations (maybe gives greater efficiency, but accuracy is more important); centrifugal force (counters forces of flexing dart playing on atlatl spur, for smoothe throw and accuracy – his favor); counter balance (motionless hold while stalking); fetish. Probably some of all or many of above. Recomends no more than 70 grams or stress elbow. Dart rest – eliminates confusing extra actions of fingers in throw. Known from Peru and New Guinea. His atlatl flexes slightly, and he uses cane darts 8 ft long and 4-6 oz [124-186 gm].

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Strischek, Ray

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2004 Darts: How They Work, How to Make Them. The Dart August 2004: 13-22.

Dart flexes to "get out of the way of the oncoming atlatl" and springs off. Simple wag and bend tests to get consistent flex. Flex should be in rear 2/3s. Balance point should be 6-10 inches in front of center. Bamboo and cane are naturally like this, wood can be tapered. Bamboo straightens well, saplings difficult.

Strischek, Ray

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2004 How to Cast a Dart with an Atlatl. *The Dart* December 2004: 7-18; *The Dart* August 2009:9-19. also posted on Community Zero Atlatl web page 5/2004 URL: http://www.communityzero.com/atlatl

and on Thudscave page URL: http://www.thudscave.com/npaa/others/rs-dartcast.htm

Uses "end over end" [means overhand] rather than side-arm motion, right handed. Elbow level with shoulder, don't bend over, keep aiming until dart separates from atlatl. Build momentum slowly, don't overpower your throw. Limit movement as much as possible – Europeans tend to lean back but don't step forward, Americans tend to take a step with left foot.

Strischek, Ray

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2005 It's Like Fly Casting, Man! The Dart August 2005: 7-8, 13.

Compares to motion described in J. A. Henshall, Book of the Black Bass, Bass Angler's Sportsman Society, 1881. Similarity in gradual acceleration, final throwing motion with arm up and fully extended, but diffs in stance and other things.

Strischek, Ray

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2005 Article Review: Experiments in the Function and Performance of the Weighted

Atlatl (Raymond 1985). The Dart August 2005: 11-12.

Raymond concluded slight advantage in distance with weights (negligible), but important conclusion is weight increases angular momentum which contributes stability to the throw, improving accuracy. Why Ray uses weighted atlatl.

Strischek, Ray

2006 Aiming the Dart. The Dart March 2006: 7-9.

Align visually on target, develop consistent motion and especially force of throw.

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Strischek, Ray o 2006 Atlatl and Dart 'Parameters' as it Relates to Equipment and Throwing Technique. *The Dart* December 2006: 19-22.

Too many unaccounted variables in experimentation, it's only personal experience, so experimenters should describe details of relevant parameters and not expect too wide an application. Lots of variability present and past = no one right equipment.

Strischek, Rayo2007 Ohio Atlatl Association Atlatl and Dart Material/Tool Resources This and That.The Dart August 2007: 5-14.

Some sources and useful tips on manufacture, especially aluminum darts.

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Strischek, Ray

2007 The Big Change: 40,000 Years Ago, What the Heck Happened? *The Dart* December 2007: 11-14.

sort of review of Dillehay's *The Settlement of the Americas* with speculations on arrival of modern humans

Strischek, Rayo2008Atlatl Handle Grip Styles. The Dart August 2008:13-14.

Hammer, Basketmaker, and Single Hole grips. With hammer, elevation easier to control than direction. With BM, direction easier than elevation. SH splits difference, works best for him.

Strischek, Ray o 2009 Make A Cane Dart. *The Dart* April 2009: 9-11.

Bamboo or cane, 1 ft longer than you are tall, foreshaft with copper point, 3 fletches lashed on with fake sinew, no glue.

Strischek, Ray

2010 Straightening Cane. The Dart April 2010:17-18.

Propane stove heats cane much faster than stove or hot plate. Do nodes first, bending over half-round log top.

Strischek, Ray

2010 The Atlatl and Dart Throwing Sequence. The Dart September 2010:2.

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Hook should be like ball and socket because as atlatl flips, dart rides up on back of hook until pushed off the atlatl. [I want to see more film to check this. It is still not clear at what point dart and atlatl separate.]

Strischeck, Ray o 2011 Atlatl One In Ten Problems. *The Dart*, October 2011: 19-23.

Good tips, what RS thinks may cause a miss in 10 shots. 1. Dropping elbow. 2. Bad spur design. 3. Unstable grip, distinguish three basic types: hammer, basketmaker, and single finger hole. 4. Centrifugal stability – wobble at spur end; a weight helps prevent. 5. Hesitation at start of throw. 6. Aiming – keep aimed through throw. 7. Use a good dart – prefers dart a foot longer than you are tall, balanced 8-10" forward of center, 4-6 oz, 3 x 8" feathers. 8. Clutching – death grip on atlatl = loss of throwing power. 9. Saddle finger – on atlatl without rest, holding dart inconsistently with finger over it. 10. Diagonal thrust – inconsistent side-arming or letting dart wander to side during motion.

Strischeck, Ray

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2013 Review: Atlatl Flex: Irrelevant by Whittaker and Maginniss. *The Dart* January 2013: no page numbers.

Summarizes: atlatl still flexed as dart leaves, thus cannot provide stored energy to the dart velocity. Agrees that flexing atlatl may "buffer jerkiness of throw". In his experience, "flexing atlatl acts as shock absorber" easing strain on arm + shoulder; most atlatlists' problems come from using rigid thrower with hammer grip. Agrees with suggestion that springy dart (and atlatl) may allow longer contact with dart and thus greater time accelerating it.

Strong, Emory

1966 The McClure Atlatls. Screenings 15(5):1-4.

[Rather incoherent descriptions]. Two atlatls from packrat nest in looted cave, Columbia River area. Wood, integral mixed hook, 15 inches long, flat blade shape, attached double finger loops of antler or horn, stone weight 40.2 gm set in socket. Second similar, larger, >21 inches, missing both ends, socket but missing stone.

Struve, Edwin

0 2014 Kennewick Man and NAGPRA. Indian Artifact Magazine 33(4):41-44.

A New Jersey Indian opposed to NAGPRA gives perspective on NJ Indian politics - lots of individuals and groups creating dubious Indian identities. Belief of archaeologists and Inds caring about their history that NAGPRA was a compromise and would not destroy archaeology. OJ Simpson case 1994 radicalized many - showed potential for DNA that could test, might show many with high % Indian blood were not enrolled tribal members, while many who were had little Indian descent, so new push to destroy skeletal remains as fast as possible "where they could rot away quickly and pose no further threat to the hegemony of enrolled tribes." Unenrolled Inds usually took oposite position: "The unseemly haste with which the priviledged enrolled Indians wanted to destroy all DNA evidence was seen by unenrolled Inds as a self-serving and hypocritical use of religion as the last refuge of greedy scoundrels." [But sadly, we actually never did hear much opposition from Ind groups].

Struve, Edwin

2014 Kennewick Man and NAGPRA, part 2. Indian Artifact Magazine 34(1):41-45.

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More about secrecy of "New Jersey's hush-hush stealth repatriation program." Lost Nation Mohegan in Vermont wanted to preserve all bones, but Univ VT archy's were repatriating to VT Abenaki, not recognized by govt, destroying. Cases reported by Becker 2008 J of Mid Atlantic Arch. Sales of repatriated objects to Japan and Germany in secrecy. OK Lenape won't recognize VT Lenape (their homeland). "NAGPRA has proven yet another instrument that divides and conquers." Problems of documenting his own ancestry through mother's connections and documents. DNA tests 2002 showed mom with "Ainu" genes, so maybe connection to Kennewick. Mom also opposed destruction of evidence "only stupid people do that." "NAGPRA made us both ashamed of our ignorant fellow Indians." Roots of NAGPRA in "AIM's fundamentalist racism" and bullying of those who disagreed.

Stueber, Daniel O.

2017 Glass Buttes, Oregon: 14,000 Years of Continuous Use. The Atlatl 31(1):1-3.

Talk at WAA meeting, from 2015 publication. Plentiful source, many colors. XRF shows wide use, blood residue studies – table of results by point type, include some 'camel' possibly Pleistocene, and some 'chicken' [not explained]. Many other obsidian sources in OR. Limited protection of GB sites and sources.

Sudar, Anna

2010 Flint Ridge Knap-in Shows Off Tools, Techniques Used by Ancients. [original source info missing] reprinted in *The Dart* September 2010:17.18.

Flint Ridge knap-in, Strischek organizing atlatls.

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Sullivan, S.

1965 Certain Aspects of the Material Culture of the Aborigines of the Richmond and Tweed River Valleys. *Armidale and District Historical Society Journal and Proceedings* 8:4-17.

N New South Wales, Australia. Destruction of native culture since 1840s contact. By 1890s "young men do not climb or use spear or boomerang as their fathers did. Drink and gambling are their curses..." Rainforest environment, plentiful food. Hunting with net, club, spear, boomerang, paddi-melon (throwing stick). P 11: lack of woomera and barbed spear made fishing and hunting kangaroo more difficult, but perhaps not needed because food not hard to get. Simple wooden spear only. Ground edge axe, flint knife. Flint knife hafted with bark used for fighting, smaller ones for scarification. Lots of fishing, but no womera or specialized fishing spear.

Sunyol, Alain x,p

2015? Use of poison on darts and arrows/La flèche et le poison. Ms posted on Academia.edu October 2015.

In English + French. Ethnographic models for use of poisons by Mesolithic hunters. Needed if projectile too light, prey may escape, or may be dangerous. So poison should be powerful and fast acting [most ethnog poisons in N. Am. at least are certainly not]. Classical + medieval Euro refs. Mesolithic horsehunter camp under Lake Neuchatel ca 11,000 BP, using spearthrowers and microlithic points, which produce such 'feeble impact' that they must have been poisoned. [Not good reasoning – you can put microliths on a heavy point/shaft.] Mesolithic and Neolithic chisel arrowheads depicted on Gavrinis tomb stone [maybe] would cause bleeding and thus not good for poison. In S. Am, poison on blowgun darts, curare, frog poison. In N Am rotten meat + snake poison [but he doesn't have good info]. !Kung arrows [good photo] insect poison, central Africa plant poisons.

Sunyol, Alain x,p

2015? The small invisible bowhunters of the rainforest. Ms posted on Academia.edu October 2015.

Pygmies in central Africa. Baka gear – metal point, leaf fletching. Crossbow in Cameroon. M'Buti. [good photos, not his though]

Swanton, John R.

1938 Historic Use of the Spear-Thrower in Southeastern North America. *American Antiquity* 3(4): 356-358.

Spanish text and translation from Garcilaso de la Vega account of de Soto expedition of 1543 to Florida in area of later Chitimacha, mouth of Mississippi River.

Tiradera "(javelin)" or better, *bohordo* [currently a light javelin thrown by competitors on horseback] "a fathom long" made of "firm rush", shot with *amiento* "wooden stock" "like in Peru," 2 tercias long. Three-barbed dart went through thigh of Spaniard, shoots with "extreme force" to "pass through man in mail coat." "Spaniards in Peru feared this weapon more than any other the Indians had." [Probably source of myth of armorpiercing atlatl darts].

Swope, Bob

2010 Learning More About Youth Hunting and Hunter Safety: Handbook/Guide for Everyone. Jacobob Press, St. Louis.

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Includes section on atlatls, pp. 193-205. Introduction + definitions, [generally ok and illustrated]. Three style grips: knuckle, finger hole, and wrapping style. [Odd distinction, first is for hammer grip, a distinction used later]. Hunting points of stone, bone, and modern broadheads. Grip styles figure shows hammer, split finger and others, split finger and single hole allow easier rotation of wrist in throw. Safety tips: 100 m behind target [excessive], handling safer than for firearms, carry darts point down, pull with one hand on target etc, similar target basics as for other projectile weapons. Casting motion described, uses my photo sequence. Optional features include dart rests (modern), and weights (help balance atlatl at rest, help smoother cast).

Taçon, Paul, and Christopher Chippindale

1994 Australia's Ancient Warriors: Changing Depictions of Fighting in the Rock Art of Arnhem Land, N. T. *Cambridge Archaeological Journal* 4(2): 211-248.

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Theories of warfare reviewed, bias toward view of rarity in pre-agricultural societies. Australia. Three phases over 10,000 yr record. World's oldest depictions of fighting in Dynamic Figures period ca 10,000 BP, boomerangs and spears used but not atlatl. Middle period Simple Figures show "hooked stick" which may be spearthrower. Late Energetic Figures often have spearthrowers in combat. [Authors were not interested in atlatls, and photos are small and poor, so can't make out any details.] Comments by others mostly note the difficulty of interpreting – is depicted fighting real, common, ritual, mythical, metaphorical?

Tait, Lawson

1874 Feathering in Flint Weapons. Nature July 30:245.

Notices twist/bevel on points = "feathered". "... if the weapon was propelled with any great rapidity, its revolution would be a matter of necessity and would result in a greater

steadiness in its line of trajectory." Experiment: made plaster cast, cut sections to show symmetry of "spiral." Flint tends to fracture with "spiral" anyway, but often deliberate.

Talwani, Sanjay

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2011 Spear-Hunting Bill Flying Toward Passage. *Billings Gazette* online, January 11, 2011, accessed 1/14/2011. URL:

http://billingsgazette.com/news/state-and-regional/montana/article_978788a6-0dcb-52de-886d-af36ed7df0f1.html

Expect approval of Senate Fish and Game Committee bill to allow big game hunting with hand thrown spear, also allows atlatl "a spear thrown with a separate device to increase power."

Tankersley, Kenneth B.

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1994 Clovis Mastic and its Hafting Implications. *Journal of Archaeological Science* 21:117-124.

Amber used as hafting mastic, recognized on obsidian Clovis point, surface find, Hoyt Site, Oregon. Use of amber may be another trait shared by Clovis and Upper Paleolithic of Europe.

Insoluble in organic solvents except xylene, microscopically similar to amber.

Longitudinal scratches in flute - to improve grip of mastic and bone foreshaft, especially useful on slippery obsidian.

Amber is not as sticky as resin, but will melt, and can be found where there are no living conifers.

[But that shouldn't have been a problem. Much more likely this is resin that became "amber" in the 12,000 years since its use. See also Beck 1996: amber does not melt, won't work as adhesive. Helwig (see Helwig et al 2008) told me she was also skeptical, didn't think T's tests sufficient to establish material, but didn't think resin would become amber in that time either.]

Tankersley, Kenneth B.

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1996 Archaeological Paradigms, Provincialism, and Semantics: A Reply to Beck's Comments. *Journal of Archaeological Science* 23: 455-458.

Beck is too provincial and restrictive in his definitions of amber. "Amber is a tree resin that has lost some of its volatiles." Fossil resins [no age info given] from Plains area do indeed melt. [Tankersley still misses the point – he has never established whether the adhesive used on the Clovis point was fresh or "fossilized" (ie "amber" in his very broad definition) at the time of use. Occam's Razor suggests fresh resin: more common, widely used, easy to use.]

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Tankersley, Kenneth B.

2002 In Search of Ice Age Americans. Gibbs Smith, Publisher, Salt Lake City.

Personal account of some Clovis research (Crook County and other caches, Sunrise Ochre Mine) with background on Clovis. [Generally nice popular archaeology, well illustrated, but with way too many sloppy errors, misstatements, and too much fawning over collector/looter Forest Fenn.]

Atlatls (p.80): "Atlatl darts can be launched from either the side of the body or over the shoulder. An atlatl dart is an accurate and deadly weapon when launched with a snap of the wrist from the side, but only at a distance of seven to eight feet. While an over-the-shoulder throw significantly increases the dart's range, it loses accuracy, speed, and penetration power. Also, long distance throws require more release time and space. However the dart was thrown, hunting with the atlatl would have been done in open environments." [Almost all of that is wrong or misleading – why didn't he learn to use one, or consult someone who has?]

Tate, Bill

1987 Survival with the Atlatl. Aurora: Tate Enterprises.

Short general "how to" and description of manufacture.

Tate, Bill

1990 Atlatl Weights. The Atlatl 3(2): 3-6.

Long flattened weights from Colorado.

Tate, Bill

1995 Evidence for Atlatls at Rancho La Brea. The Atlatl 8(4): 1-3.

1 bunt, 3 fire hardened wooden points, references, [dark] photos. $C14 = 4450\pm200$ B.P.

Tate, Bill

1995 Long Distance Record Shattered. The Atlatl 8(3):1-2

July 1995, Dave Engvall 848'6 5/8" (258.64 m).

Tate, Bill

1996 The World Atlatl Association's International Standard Accuracy Contest. *The Atlatl* 9(3): 1-3.

First description and announcement of ISAC results

Tate, Bill

1997 Jeffers Petroglyphs, Bingham Lake, Minnesota. The Atlatl 10(2):1-2.

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Clear atlatl depictions with large rectangular weights - could be catlinite, large for weights, could be flat surface (bark, feathers) to slow cast - need tests. [Look like Indian Knoll style drilled weights to me, depicted exaggeratedly large.]

Tate, Bill

1997 Spear Hunting Legal in Alabama. The Atlatl 10(4):3-4

How Alabama got legal spear and atlatl hunting for deer and boar.

Tate, Bill

1998 First Contact. The Atlatl 11(4):1-4.

Eight Americans visited European atlatl events July 1998 (R.Richard, C.Brown, J.Ray, B. Tate, M. Tate, P. Pine, L.Pine).

Tate, Bill

2000 Y2K Elections. The Atlatl 13(2):5-6.

Biographical info on J. Ray, R. Strischek, R. Mertz, M. Takoch, D. Pritchard, A. Lukes, C. Judson, S. Brown.

Tate, Bill

2002 One of WAA's Founders Dies. The Atlatl 15(4):3

Charles Lilly of CO helped found WAA, organize Valley of Fire event, starting 1989.

Tate, Bill, and Marcia Tateo2007WAA Charter Member Dies. The Atlatl 20 (2):5.

Obituary for Hallie Cash.

Tate, Billo2007WAA 20th Anniversary. The Atlatl 20(4):2.

Origins in Rod Laird's Jr High school classes in Saratoga Wyoming organized World Atlatl Open, CO Archaeological Society inspired to organize WAA in 1987, Tate Pres, Leni Clubb VP, Charlie Lilly Sec-Treas.

Tate, Billo2016 Leni Gets the Last Word... The Atlatl 29(3):12.

Reminiscences of WAA founder Leni Clubb, died April at 101 yrs old.

Taube, Karl A.

1988 A Study of Classic Maya Scaffold Sacrifice. In *Maya Iconography*, edited by Elizabeth P. Benson and Gillett G. Griffin, pp. 331-351. Princeton University Press, Princeton.

Variations through Mesoamerica: scaffold complex, simple or even tree, symbolically = tree, victim pierced with spears, darts, or arrows. Assoc with fertility of field, and with royal accession. Maya practice less known than central Mexico. Maya assoc also with deer hunt, sacrifice of "deer-man" (= earth) on scaffold by burning back (= milpa clearing), spear (= digging stick, planting), and blood flow (= rain). [Maya images presented show spears, no atlatls.]

Taylor, Hannahx, pdf

2012 The Effectiveness of Spear Throwers. Unpublished paper for Biomechanics MA, University of Manchester.

Using dog ball-throwers to test atlatl principles: distance thrown is affected by length of the thrower, and mass of the projectile. Physical principles of "moment" applied to a lever (m = f x d) means that moment increases as either mass [force] or length of lever (d) increases [at end of lever to move mass at other end.] So longer thrower should throw farther, faster. But limits: longer lever stops being helpful when its mass is too great, requires too much effort. Bannerstones would increase atlatl weight and decrease efficiency. Expect that increasing ball mass would have positive effect on distance and velocity up to a point, then negative effect.

Five subjects threw with "Sharples 'n' Grant Serve'n'Sling" extendable dog ball thrower. Adjustable length of thrower: no thrower, thrown by hand; 15 cm, 30 cm, 38 cm, 54 cm. Four different mass tennis balls: 60, 100, 160, and 240 grams, all of same volume. So 20 possible combinations, each subject threw six balls for each combination, total 600 throws. Measured distance, filmed at 100 frames per second, analyzed for velocity of ball, wrist, and shoulder. Some problems with variability between subjects, and in consistent throwing.

Results: increased length of thrower = increased distance. Distance and velocity increases with thrower length for 60, 100 g balls, decreases with 160, 240 g. Heaviest ball (240g) not thrown as far as 160 g, and had least increase with longer throwers. Standard deviation of throws also increased with ball mass, suggesting heavier ball harder to throw. [For some subjects, 240 ball distance increased until it decreased with longest thrower, suggesting that limit of efficiency had been reached. To me it looks like wrist velocity is relatively flat with lots of error, and the old male, #4, has almost 0 wrist velocity, suggesting that he is stopping the throw and just flipping the thrower.] Shoulder velocity greater with 60, 100 g balls, decreases as mass increases, and also decreasing at middle thrower length, where less effort is needed to throw. Velocity ratios – wrist 2-4 times as fast as shoulder, ball 2-4 x as fast as wrist – consistent with idea of shoulder, elbow, wrist as lever pivots, and cooperating levers. The 2 young

male subjects threw farther than the 2 F and older male – taller, more muscled.

Applied to atlatls: expect optimum atlatl length and dart weight at which greatest distance will be achieved.

Taylor, Herbert C. and Warren Caldwell

1954 Carved Atlatl from Northwest Coast. American Antiquity 19(3): 279-280.

Dredged from mouth Skagit River, WA. Looks old, but not like NW art, resembles MesoAmerican, probably not fake, maybe lost, drifted in? Further tests proposed. [Were there any? Poor photo and minimal description shows what looks like one-piece wood atlatl with finger holes like Mexican, carving just forward of grip on bottom looks like dragon or feathered serpent holding mask.]

[Fladmark et al. (1987), Bruchert (1999), Borden (1969) accept as NW; Fladmark dated 1700 ± 100 B.P. and has best picture and description, also good picture in Ames and Maschner 1999:236.]

Terpstra, Kelly

2011 Lucas Yates: Excelling at a Unique Sport. *Ottumwa Courier*, Saturday March 26, 2011, p. 16.

9 yr old, grandson of Roger + Mary Granneman, Ottumwa, Iowa. [Adequate journalistic explanation of basics.]

Thieme, Hartmut

1997 Lower Palaeolithic Hunting Spears from Germany. Nature 385: 807-810.

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[see Dennell 1997] Stratigraphy and geology of Schoningen (Schoeningen, Schöningen) open pit coal mine sites. Lake shore deposits from Reinsdorf Interglacial have flints + fauna assoc w 3 pieces fir wood, 17-32 cm L, 3-4 cm W, with "diagonal groove cut into one end" 4-9 mm W, 10-47 mm L [depth not given] possibly "for holding flint tools or flakes...the oldest composit tools yet discovered." [No photo, description inexcusably vague, don't sound like tool haftings to me.]

Another channel, in organic mud under peat, temperate boreal pollen, horse bone + other faunal w butcher marks, flint flakes, points, and scrapers, "possible hearth" reddened sediment. Wooden tools (spruce): bipointed "thrusting spear or throwing stick", 3 spears, all sim, max weight and T at front, taper to tail like javelin "projectile weapons rather than thrusting spears". Est age 400 kya.

[Enlargements show nicely shaped sharp tips, but other photos are too small to see anything else.]

Thieme, Hartmut x Burling

2005 The Lower Paleolithic Art of Hunting: The Case of Schoningen 13 II-4, Lower Saxony, Germany. In *The Hominid Individual in Context: Archaeological Investigations of Lower and Middle Paleolithic Landscapes, Locales, and Artefacts*. Clive Gamble and

Martin Porr (eds.), pp. 115-132. Routledge, London.

Buried lakeside site with organic mud and peaty layers. Dates ca 400,000. Interp as hunting site with >20 horses, 8 wooden spears, stone tools other organics. Spears are fir + pine saplings, trimmed, point at base of tree, smoothed, 1.8-2.5 m long, weight 1/3 from tip, so throwing weapon. Shorter piece sharp on both ends .78m interp as throwing stick for bird hunting. Also burnt worked wood interp as spit, several hearths. Possible cleft haftings for stone tools [not detailed, no photo] from diff layer.

Implications : Complex hunting of herd of fast large mammals = complex society, communication. Specialized hunting technology, complex tools, variation = fit to individuals. But abandoned them, maybe symbolic reason? Control of fire, processing of lots of meat implies drying/smoking = storage. Hides = clothing, shelters. All abilities usually assigned only to more modern humans.

Thomas, David Hurst

1978 Arrowheads and Atlatl Darts: How the Stones Got the Shaft. *American Antiquity* 43(3): 461-472.

Looks at American Mus Nat Hist specimens of hafted points to determine relationship between shaft and hafting area of point, uses discriminant analysis to derive formula to separate atlatl darts from arrow points. 118 ethnographic arrows, 14 Pueblo Bonito arrows, but atlatl dart foreshaft sample very small (10, of which 9 SW, 1 CA) His equations classify the specimens about 86% correctly (7 of 10 for darts, 115 of 132 for arrows). Single variables show statistically significant differences between mean darts and arrows in most dimensions of point size and foreshaft diameter. [Problems : small sample, specimens from all over, so may not apply well to any one prehistoric site or time. Also, arrows all late, may not reflect transitional types well.]

Thomas, David Hurst

1981 How to Classify the Projectile Points from Monitor Valley, Nevada. *Journal of California and Great Basin Anthropology* 3 (1): 7-43.

Thomas, David Hurst

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1983 The Archaeology of Monitor Valley: 2. Gatecliff Shelter. Anthropological Papers of the American Museum of Natural History 59 (1).

Background for point typology.

Thomas, David Hurst

1986 Contemporary Hunter-Gatherer Archaeology in America. In *American Archaeology, Past and Future: A Celebration of the Society for American Archaeology 1935-1985*, edited by D.J. Meltzer, D.D. Fowler, and J. A. Sabloff, pp. 237-276. Smithsonian Institution Press, Washington, D.C.

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Importance of midrange theory to link concepts with observable phenomena. Discovery is overrated - facts useless without correct interpretation. Lots of praise for Binford. Too many simplistic interpretations in recent archaeol.

Mid-range theory in lithics particularly neglected. [He's very down on 'cognitive' lithic studies e.g Young + Bonnichson]. Experiments don't demonstrate reality of behaviour but only one possibility. [He's particularly critical of emphasis on technology + idea that reduction sequences or other patterns are culture specific - he's wrong here, since they plainly are]. Optional foraging theory discussed.

Thomas, David Hurst

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1986 Points on Points: A Reply to Flenniken and Raymond. *American Antiquity* 51(3):619-627.

Dismisses Flenniken's argument that because points can be damaged and reworked into different types, they are not good chronological markers, defends utility of temporal types.

- sloppy application of Thomas types to experimental points - a typology is only good if consistently applied

- 'phony logic of replication' = Flenniken + Raymond 'did not reproduce 'a tangible aspect of prehistoric behavior', they only 'demonstrated one possible way of accomplishing a task.' Notes for instance a point with base broken off that was rehafted without reworking.

- some types are not rejuvenatable into other types (e.g. Cottonwood Triangular) - so the wider claim that all chrono-types are unstable is wrong

- a morphological type, no matter how defined, if tested against stratigraphy, C14 etc, is still a useful chronological marker, even if use-life can modify its form. These types are 'heuristic, not explanatory'.

- 'flintknapper's fundamental conceit' that technol approach improves any typology - no, sometimes technol attributes will work chronologically, but that is independent of type.

Thomas, David Hurst

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2015 Review of *Kennewick Man* : *The Scientific Investigation of an Ancient American Skeleton*, edited by D. W. Owsley and R. L. Lantz. *American Antiquity* 80(4) :781-783.

General praise, especially for thorough scientific presentation with competing views. Notes that skull morphology interpretation of difference from modern Native Am pops is now contradicted by genetic evidence. Complains of lack of native voice in volume. 'Ironic that Colville Tribe among those protesting scientific study, but supported genomic studies and contributed their own DNA, '...involvement of descendant stake-holding communities... now commonplace..., heartening to see this sea-change finally reflected in study of Kennewick Man/The Ancient One.' [This last is bullshit – the Colville allowed their DNA to be collected for the purpose of claiming Kennewick, and the conclusion they reach is not that scientific study should be permitted, but that now it belongs to them and should finally be destroyed by reburial.]
Thomas, Elizabeth Marshall

1980 Reindeer Moon. Boston: Houghton Mifflin Company.

[Perhaps <u>the</u> best novel of prehistory. Upper Paleolithic hunters from the point of view of a young woman. Thomas knows what hunter-gatherers think about (she worked with San in the Kalahari), and her writing is creative and beautiful. She is weakest in technological details (no atlatls although there should be, flintknapping not well described), and strongest in details of animal life and behavior, another of her areas of expertise. This is a realistic Pleistocene world, where the dangers are not dramatic encounters with big beasts or human enemies, but the harsh realities of hunger, cold, childbirth, infection. The dramas are also small and personal, as families argue, marriages are made and broken, and lineages maneuver for access to game and shelter - the kinds of social issues that all human life focuses on.]

Thomas, Elizabeth Marshallo2006 The Old Way: A Story of the First People.Farrar, Straus, and Giroux, New York.

Reminiscences of her experiences among the San Bushmen of the Kalahari, starting with family expeditions in 1930s. The theme of the book, "the old way" is how humans evolved as hunters. P 105: "When Paleolithic people painted on the walls of their caves, they didn't paint grubs or baby birds, and they didn't paint nuts, roots, or berries. No, they painted large mammals, mostly ungulates, many with projectiles sticking out of them. They were big-game hunters, just like the Bushmen. They were artists who knew about hunting. They were hunters who knew about art." Some of her ideas are far-fetched or inaccurate, but there are some fascinating insights and observations. P 34 - a flight distance of 100' is enough to protect antelope from lion or Bushman arrow. Chapter on arrow poison - stories about how careful the San are with poison and arrows. [see Marshall, 1974]

Thomas, Jerry R., Jacqueline A. Alderson, Katherine T. Thomas, Amity C. Campbell, and Bruce C. Elliott x,B

2010 Developmental gender differences for overhand throwing in Aboriginal Australian children. *Research Quarterly for Exercise and Sport* 81(4):432-441.

Lots refs on gender differences in throwing in modern Euro cultures – in general girls at any age throw only 50-75% as far or as fast as boys. Compare to Aboriginals where girls may be more culturally expected to throw as part of hunting-gathering tradition. School children – 15 boys, 15 girls, each with 5 at each age level (6, 8, 10 yrs). None played modern throwing sports [but that doesn't mean they were or were not trained or used to throwing for hunting or play]. Maximum power overhand tennis ball throw at target 15 m away, slow motion video record. Age-size correlations. Consistent velocity within age/gender groups. Age + gender effects: boys av 3.36 m/s faster than girls, 10 yr olds av 2.94 m/s faster than 6 yr olds. Overall, girls' velocity 78.3% of boys'. Differences in kinematic variables of arm motion. Velocity differences between M/F less in Aust 6 and 10 yr olds than in US children, similar for 8 yr olds. Aust girls better than US girls. Nature and nurture influences on throwing may have been less for more recently Europeanized Australians than for Euro/American.

Thomas, Kaitlyn A., Brett A. Story, Metin I. Eren, Briggs Buchannan, Brian N. Andrews, Michael J. O'Brien, and David J. Meltzer x,p

2017 Explaining the origin of fluting in North American Pleistocene weaponry. *Journal of Archaeological Science* 81:23-30.

Fluting hypotheses : blood grooves (no), facilitate hafting (not necessary), stylistic/costly signalling (untestable). But risky – est 10.5-22.2% failure rate (Ellis and Payne 1995), so must have perceived advantage. Fluting as 'shock-absorber'? Stress relocated from tip to thinner base resulting from fluting. Analytical modeling. Experimental test of lapidary ground points (for consistency). Loaded until failed. Comp of fluted vs un for energy at failure, time at failure, and point length at failure showed no differences, but confused by occasions when fluted points failed to fracture, while unfluted crushed at base 'incidentally' receiving benefits of fluted base. Comp of all points that experienced damage relocation showed signif advantages in all 3 variables for fluted specimens. [It seems to me there is an archaeological implication that could be tested : fractured C points, correlations between fracture severity, location, nature of fluting, basal/fluted edge damage, etc. This experiment may be too artificial.]

Thompson, Marc

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2006 Pre-Columbian Venus: Celestial Twin and Icon of Duality. In *Religion in the Prehispanic Southwest*, edited by C. VanPool, T. VanPool, and D. Phillips, pp. 165-183. Altamira Press, Lanham MD.

Venus, morning/evening = twin, duality, also assoc with warfare, feathered/horned serpent imagery in Maya and Teotihuacan. Some of this symbology shared into American SW, especially star icons [although no good ethnographic case is made]. In Mexico, assoc with atlatl : finger loops = eyes of xiuhcoatl fire serpent or Tlaloc, serpent atlatl held by dieties, atlatl intro to Maya with Teotihuacan architecture and Venus war.

Thomson, Donald F.

1939 The Seasonal Factor in Human Culture. *Proceedings of the Prehistoric Society* 5 :209-221.

Coastal N Australia, Cape York, Queensland - Wik Monkan group moves with seasons from inland hunting-gathering to coastal fishing, uses different equipment depending on environment - if you didn't know the seasonal influences on location, food supply, and therefore equipment, you might think their sites were made by different groups. Little of a rich perishable culture would survive for archaeologists. Details of seasonal round and foods, gender rolses, some tools, but no info on spear throwers. [Inspiration for movie

Ten Canoes].

Thorpe, I. J. N.

2003 Anthropology, Archaeology, and the Origin of Warfare. *World Archaeology* 35(1):145-165.

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Summarizes theoretical stances, cites many early archaeological examples including some Upper Paleolithic that may be arrow, or dart wounds. Violence really becomes common in Mesolithic.

Tiesler, Vera, and Andrea Cucina, eds.

2007 New Perspectives on Human Sacrifice and Ritual Body Treatments in Ancient Maya Society. Springer, New York.

Articles mostly on skeletal evidence for extensive Maya sacrifice.

Timney, Mark

2012 Arrow Penetration. Electronic document, Bowsite.com webpage, URL : <u>http://www.bowsite.com/bowsite/features/practical_bowhunter/penetration/index.cfm</u> accessed 8/2012.

Kinetic energy is most important, but with modern bows, penetration is not a problem, our worries are hype by manufacturers. Similarly, broadhead type doesn't matter much if you have a good hit.

Tindale, Norman B.

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1928 Natives of Groote Eylandt and of the West Coast of the Gulf of Carpentaria. *Records of the South Australian Museum* 3: 61-134.

Observations 1921-22. GE + 3 small isles, ca. 1000 sq miles, occup by Ingura tribe, est around 300 pop in several local groups. P. 67 children and toys, "young boys are encouraged to play at spear-fighting using diminutive throwing sticks and lengths of cane-grass...often assisted and encouraged by young and middle-aged men." Initiation 10-13, circumsized with stone head temporarily detached from a spear. P. 76 avenging death by spearing trial, e.g. 36 spears thrown at man by 6 kin of dead, distance 30 yds, no hits.

P. 80 wallaby hunted with special spear, "Having approached to within 10 yards or less, the spear is hurled and seldom misses its mark."

P.92 weapons: varieties of spears – fish, dugong, hunting, fighting, all for spear thrower except dugong. Superior workmanship, split out of log, shaped with knives, scrapers, and rubbing stones. Some spears acquired by trade. Fish spears: hardwood shaft 9-11' long, 2-3 barbed wood prongs lashed on, 22 oz [very heavy!] and sink in water, but floating light wood used in deep water. Dugong harpoons: not for spear thrower, up to 16' long, 5 lbs. Hunting spear: 8' long, hardwood, one piece, sharpened and fire hardened tip, no

barbs, ca 9 oz. "young men often practice using low cycad palms as targets." Fighting spears: 4 types – one pc hardwood, hafted with barbed wood head, bamboo hafted, and stone headed, last 2 imported. On island 20-30 spear makers, each with own style spear and ornamentation. Made in sets of 3-12 similar. "Tests made by setting up a target (a drawing of a wallaby on bark, about 4 ft in height) showed that the effective range of the spears was 30 yds. At 35 yds only one man hit the target at a height of more than a few inches above the ground, whereas at the former distance, few failed to score a body hit." Several left handed throwers [including photo, but too small to see any details]. Manufacture detailed: split from stringy-bark log, barbs cut with stone knives on first visit, mostly metal on later, decorated with paint, or separate head spliced on with bloodwood resin. Averate L = 9', wt = 15 oz. Different styles of barbs. "Older men constantly employed in making spears and produce great numbers." Traded on mainland for emu plumes, ochre, stone tools; >300 sprs in possession of party of 30 men. Lighter bamboo shafted spears obtained from Balamumu on mainland, who are feared raiders, spears have longer range and break on contact so can't be returned, but heavy wooden preferred for fighting in brush. Raiding party of 26 had each 15-40 spears. All stone tools obtained by trade, stone tipped spears prized but not as well made by source. Throwing sticks: 3 types. 1) yumangala – flat, softwood, rect in section, wood peg attached on flat side with string and bloodwood gum in notch, handle indicated by notches or raised band of wood is often painted white while shaft is red ochred. Or may be all red, or with white and yellow patterns. [this is the familiar form]. 2) yukarupu – round in section, hardwood, sim to those of tribes S of Roper River, but decorated w bunch of fiber instead of hair, most common form on island. 3) mamuntunga – peculiar to

Titmus, Gene L. and James C. Woods

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1986 An Experimental Study of Projectile Point Fracture Patterns. *Journal of California and Great Basin Anthropology* 8(1): 37-49.

the island, like yukarupu, but expanded lanceolate flattened handle, usually decorated with paint but sometimes just incised. [this is probably what I have as the odd form, but mine is quite short and stout by comparison to those illustrated. I have never seen the long elaborate forms pictured]. "In use the yumangala and mamuntunga are held above the junction of the handle with the shaft, and thus the handle is purely conventional. In the yukarupu the grip is close to the end." [a high grip would reduce the enormous length of those I have seen]. P. 134 figure and description of grip of mamuntungu: spear is held between the first finger and thumb, and the throwing-stick between the first and second

fingers, above the flat handle, which is held edge-up [with hook to side too then].

[Note individual variation: L vs R patterns]

Use vs manufacture breakage of Elko corner-notched forms. Manufacture: perverse [and bending] breaks, mostly barb or stem in notching. Effects of hafting. [Not enough statistical treatment.] Surprisingly long survival of some points in use, but 70% damaged by 1 throw, average 2.1 throws. Bending fracture most common, especially at neck, espec in yielding material. Crushing - mostly distal and marginal [includes impact flutes] and hard materials. Shearing [burination] espec on barbs and in somewhat yielding material

eg wood.

Tokioka, Kenjiro

1992 Rock Art of Escalante Canyon: Quantitative Analysis of Rock Art Elements of Glen Canyon. unpublished MA thesis, Department of Anthropology, Northern Arizona University.

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Element inventory statistics show two cultural traditions: Fremont in the Escalante drainage, and Anasazi elsewhere. Fremont sim to Barrier Canyon Style L. Archaic, while Anasazi sim to Glen Canyon Linear Style. Anthropomorphs most distinctive. Glen Canyon area, middle of S border of UT, 99 sites used, mostly recorded during dam project [appendix shows all images, but records were probably not very well done].

Atlatls [looped sticks - he does not apparently distinguish between atlatls and darts] cooccur statistically with A-3 anthros (spread arms + legs, some lizard men [ambiguous + variable date likely]), dotted lines, bird tracks, ladder-like crosshatching, and a bit further statistically, with A-2 anthros (broad shouldered to square with headdresses and large hands [typically BM]), and hand prints.

A-1 hump backed anthros [often flute players] and some geometrics form another cluster; all kinds of sheep and some anthros (stick figures) another. In multidimensional scaling groups p88, p83 he says also A-10 anthros (triangular wide bodies, horns, Schafsma's S. San Rafael Style, Fremont) also assoc with atlatls, and atlatls also assoc strongly with sheep as hunting scenes. [All these clusters and groups are hard to interpret because mixed dates of elements, and for that matter, many elements have long or ambiguous use-lives. He doesn't associate his 18 atlatl images with either Fremont or Anasazi, but all but one are S of L. Colo. R. in Anasazi territory, and most are E, close to our Cedar Mesa area. There are notably few atlatl/dart depictions, few darted sheep, and no scenes of warfare compared to SE Utah.]

Tolley, Arthur Robert, and Jack Barnes

1979 Reinventing the Atlatl. *Journal of the Steward Anthropological Society* 10(2): 161-180.

Experiments with lots of variables [controlled and un]: fletched and unfletched darts, lengths 127-232 cm, compound elderberry shaft with hardwood foreshaft, lead points, 10 atlatls of different lengths, some modeled after several ethnographic and archaeological examples, stone weights 27-94 grams, mostly at balance point of atlatl. [All atlatls apparently not flexible.]

Lots of practice over 5 months, 10-60 meters.

High speed filming of throwing action, drawing presented.

Gauge for relative force [not calibrated].

Results: Dart construction more important in distance than length or form of atlatl. Any atlatl >30 cm worked, but not well if <2/3 dart length. Accurate, with practice, to 30 m. Dart flex important [but why is not discussed]. Dart released when atlatl is vertical, contra Howard 1974. Velocity ca 40 m/sec. Weights do not affect distance, or improve

control or balance, and don't add either to mass of spear or to its velocity, so they do not add force.

Tomihama, Nicholas

2014 Darts On Target: A Do It Yourself Guide to Building PVC Pipe Atlatls and Darts. Self-published online, <u>www.BackyardBowyer.com</u>, through Amazon.com.

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[Young guy, clever at making things out of pvc, writes clearly]. Atlatl and dart basics: lever system. Importance of balance point: with handthrown spear, most efficiently thrown from center, which balances push what is ahead, pull what is behind. With atlatl, hand is pulling atlatl, which is pushing dart. At height of throw, all switches to pushing. If too stiff [or heavy], requires too much energy. If atlatl +/or dart flexes, buffers some of the force needed. Compromises in variables – light stiff dart with flexy atlatl flies faster, heavy flexing dart with stiff atlatl retains more energy at target, etc. Most efficient system balances dart on atlatl at handle of atlatl, weights on atlatl help this.

Three basic grips: 'hammer' with dart rest or dart across fingers held by thumb; 'pinch' [hammer] grip but with finger and thumb holding atlatl; 'two-finger' [split finger] with finger loops. Grip affects throw. Throwing motion [illustrated and described, most of his advice is pretty good.]

Prefers ¹/₂" Schedule 40 PVC as basic material because can be tapered and shaped by heating. Then lots of detailed and illustrated instructions for making a variety of atlatls, some with rests, some with spur for dart, others with cross-twine system.

Tomka, Steve A.

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2013 The Adoption of the Bow and Arrow: A Model Based on Experimental Performance Characteristics. *American Antiquity* 78(3):553-569.

Advantages of arrow – mostly higher velocity = flatter trajectory = more accurate, less time for prey to move, greater penetration. Penetration affected by point form, kinetic energy, momentum. KE is work a projectile can do, influenced more by velocity. But bow enthusiasts see momentum as more important in penetration, = tendency of object in motion to continue. Archery standards for KE on particular game (Easton, African safari countries). Compare to traditional bows, draw weight, weight of arrows, average shooting ranges - from ethnog lit. Pope, Hamilton (1982) for draw weights of 17 bows [specifics not given], 10 were 40-50 lbs, 3 were <40, 4 were >40. Only one (Arctic, Pope) was 80 lbs. Arrow wts for 17 arrows from Pope, also 121 historic arrows from Grayson Collection – mean 23.2 g, all but one <40 g. Hunting range 25-30m (Cattelain, Churchill). Mechanical bow shooter with modern bow at 40, 45, 50 lbs. Three aluminum arrows, 23g, 28g, 33g; 30 shots with each. Arrow speed measured by chronograph 20 m from bow. Foam target penetration measured.

Velocities 42-56 mps [or ca 80-130 mph]. Increase velocity with draw wt, increase penetration with arrow wt, and with velocity, but velocity decreased at each bow wt with added arrow wt. [But what is trade-off?] All 3 arrows at highest draw wt meet recs for medium prey (e.g. deer), but none for large (e.g. bear, caribou), or very large

(e.g.bison, moose).

Atlatl heavier dart delivers more momentum and KE, more effective against larger prey than arrow. Few good velocity data for darts, lots variability. Hutchings and Bruchert 50.7 mps is outside range of others [right]; use 25 mps as normal [that's ok]. So arrow doubles speed, this may have encouraged its use for smaller game, but still not adequate for larger. Larger game less likely to elude slow projectiles. Ethnog hunting of large game like bison usually involves 'disadvantage' hunting, i.e. with drives, traps, impoundment, very close range – even when bow is used.

Model: Where large animals were primary prey, atlatl should be retained. Where medium + smaller animals, expect rapid shift to bow. Decline of large animals over time on continent led to dominance of bow. Some areas, e.g. N Plains, communal hunting compensated for weakness of bow against bison. Difficult to assess archaeologically from point size. Where both present, mixing or recycling often assumed.

Toner, Mike

2015 From Atlatls to Arrows. American Archaeology 19(1):19-25.

[Adequate popular account of the transition and its controversies: problems with using points as evidence, different models and evidence of timing, and of results but relies too much on individuals like Blitz who think effects of change were enormous because they incorrectly believe atlatls are not accurate.] Ackerman claims small bone pts with microliths = arrows 10000 BC. Maschner thinks 4 waves in N. N. Am: 1) 12-8 kya simple bows not effective enough against big game [so why did they last 4000 yrs?], 2) 4500 ya bow, plus atlatl for sea mammals; no bow in AK 3600-2400 ya, 3) 400 BC long narrow pts for combat; 4) 1100 ya, recurved sinew-backed bow, atlatl survives for sea hunt.

Ames thinks bow by 5000 BC on Columbia Plateau, Gt Basin, Snake R in W US, with 'lumpy' stone pts too small for dart. Blitz: pt size shows self bow in AL + MS by AD 400. Aguateca obsidian pts show Maya use by AD 800.

Yukon ice, Hare: dart to 750 AD, then rapid replacement [nice photos of dart and arrow finds].

Angelbeck in Brit Columbia: bow allows individual hunting, but more war; Bettinger in Gt Basin says triggered dispersal into family groups, no longer needed large communal hunts. Blitz: Hopewell "collapsed because the increased efficiency of the bow meant that large-scale game drives no longer required... with one of the major reasons for gathering lost, the culture disappeared." Small groups that resulted then amalgamated into Mississippian with defensive sites required by increased war with bow. Maschner: recurved bow correlates with war all over North. Vanpool: reached SW by 1200 AD, spread of defensive sites and warfare, destruction of Paquime.

Tonkinson, Robert

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1991 *The Mardu Aborigines: Living the Dream in Australia's Desert, second ed.* Holt, Rinehart, and Winston, Fort Worth.

General ethnography, most field work done in 1960s. Chapter on subsistence – men hunt with spearthrower and spear 8-10 ft long (p 48), wood with firehardened tip, occasionally barbed. "The spearthrower best exemplifies the multipurpose nature of Aboriginal artifacts. The Mardu version is 2-3 ft long, and 4" wide, with a concave, container-like shaft (some are flatter and usually have a geometrical snakelike design carved onto them), a barb [hook] at one end, and a stone flake set into the other with a lump of spinifex resin. Besides its primary use as a spear launcher, which enables a man to throw a spear 80 to 100 yds or hit a target with force and accuracy within about 40 yds, it has many other uses: as a tray in which to mix native tobacco and ashes or ochres used in body decorations; as a fire-making tool; as a scraper and knife for woodworking and preparing and butchering game, as a percussion instrument, when tapped in accompaniment to singing; and as a hook for obtaining fruits, berries or other objects that are out of reach." Also use returning boomerangs. p 152-157 disputes may involve semiformal fighting with thrown and jabbing spears, intent not to kill, aim at thighs. Women both restrain and incite men.

Torres, John A.

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2000 Changing Lithic Technology During the Basketmaker-Pueblo Transition. In *Foundations of Anasazi Culture: The Basketmaker-Pueblo Transition*. Paul F. Reed, ed., pp. 221-229. University of Utah Press, Salt Lake City.

Cove-Redrock Valley (near Prayer Rock) data to show distinctive Anasazi technology recognizable by BM-P transition, highly evolved and adapted to specific needs. BM II-III becoming sedentary agric. AZ-I-26-34 typical of hunt-gath technol at 585 + 190 BC: dart pts, bifacial cores for flake production, formal curated tools most common tools, exotic raw materials, = mobility. By later BM times, similar in dart pts, flake tools, some bifacial cores, but tool production trajectory diff - relates to sedentism. Mobility = bifacial cores of high quality curated material, which are too costly as become sedentary, shift to local prospecting embedded in other activity, and "expedient" reduction of cobble cores. Mean flake tool length constant thru time, but mass decreases [seems odd since biface core flakes ought to be thinner than ordinary flakes, but explains as follows:]. From BM III, multidirectional cores decrease, cores become more patterned and unidirectional = efficiency in reduction and make better expedient tools. [Still doesn't explain why trend begins in Archaic.] BM dart pts Elko + similar types, differ only in that II made from BTF and III made from cobble core flakes. Rapid transition to bow with arrow pts appearing 500-600 AD in BM III, made on core flakes, Rosegate + similar types, small forms of earlier types. Replaced by smaller side-notched pts by early P I, because smaller pts have longer range for big game.

Torres, Luis M.

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1931 Hallazgo de Ganchos de Propulsor en un Cementerio Indigena de la Cuenca del Rio Lujan. *Notas Preliminares del Museo de La Plata* 1:101-105.

[In Spanish. "Find of Atlatl Hook in an Indian Cemetery in the R.L. Basin."] Excavations

by Lothrop, find in Museo de La Plata. Peruvian types expected to be the "baton with 2 hooks [distal hook and proximal handle ornament]. Often hooks in form of bird. This is old form, later (ethnographic) forms have notch or ring at handle. This specimen of hook is bone, 5x3 cm [handle hook, crudely birdshaped but not effigy], first for Argentina.

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Torres Marzo, Ricardo

2014 Arte en Piedra Tallada: La Litica del Sentamiento Urbano May de La Blanca, Peten, Guatemala. PhD dissertation, Universitat de Valencia, Facultad de Geogafia e Historia, Programa de Doctorado en Historia del Arte, Codigo 3030.

[In Spanish. Lengthy dissertation with masses of the unneccessary theoretical and historical background that lots of institutions think should be in dissertations.] La Blanca seems to be a smallish center, a group of structures and associated areas excavated. Info on ground stone, shell, bone, flaked stone, which is mostly chert and obsidian.

Chapter 7 is 'War and weapons in Classic Maya.' p 411: spearthrowers and darts – a graffiti of person with hooked atlatl facing an odd fish or lizard-like animal. Vase painting of procession of male figures holding banners and elaborate 2-hole atlatls. Figures of stelae from elsewhere with depictions of atlatls and darts. Discusses possible dating of Maya atlatl use but nothing new.

Bifacial stemmed and leaf-shaped points are considered dart points [but his figures include some pieces that are clearly NOT points of any kind, or are unfinished indeterminate things.] Fair number of bifacial celts. A few obsidian small eccentrics, lots of blades, little manuf debris.

Townsend, Joan

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1983 Firearms Against Native Arms: A Study in Comparative Efficiencies with an Alaskan Example. *Arctic Anthropology* 20(2):1-33.

Technological "superiority" is usually not good explanation for conquest; until after ca. 1850 firearms were comparatively inefficient. Russian contact with Aleuts, Koniags, and Tlingits of S AK as example. Smoothbore flintlock musket of 18 to early 19th C was apex of development to that time. Arrow wound more survivable than bullet wound, but guns slow and innaccurate. [Lots of documentation, but perhaps overly pessimistic both in complaints of the time and how bad muskets seem to modern shooters - after all, they killed thousands of people in hundreds of battles over a couple centuries. See Harding, David F. 1999 *Smallarms of the East India Company 1600-1856, Volume III: Ammunition and Performance*. Foresight Books, London for a better assessment. In particular, muskets fired at close range at individuals (as in most combat with natives) are pretty effective].

Native arms: "In Florida, the Spanish discovered that their breastplates, which would stop musket balls, could be penetrated by Indian arrows." [Undocumented misinformation.] N. Eskimo bow and arrow, plus comparative info: wounding or killing power at 75-100 yards, accurate up to 67 yards. Aleut dart and throwing board: Darts 4-5

feet long with stone or bone points thrown >45 yards with great accuracy. Russian accounts stress accuracy and force; poison also used on darts; Nelson 1899 and other ethnog as added support, also Hill's (1948) experimental info. Details of the Russian fur trade and subjugation of Alaska 1741-1810. Guns rare, expensive, low quality, provided little if any advantages; casualties often equal on both sides.

Townsend, Earl C.

1959 Birdstones of the North American Indian. Indianapolis: Privately printed.

Huge collector's book. Enormously expensive now. I haven't been able to read it, but refs elsewhere show discusses theories about use of birdstones as atlatl weights and handles.

Townsend, Richard F.

2004 American Landscapes, Seen and Unseen. In *Hero, Hawk, and Open Hand:* American Indian Art of the American Midwest and South P. F. Townsond and P. V.

American Indian Art of the Ancient Midwest and South. R. F. Townsend and R. V. Sharp eds, pp. 15-35. Art Institute of Chicago/Yale University Press, New Haven and London.

Exhibition book, lovely photos, in this chapter bannerstones, but little real info on atlatls.

Trever, Lisa, Jorge Gamboa Velásquez, Ricardo Toribio Rodríguez, and Flannery Surette x

2013 A Moche feathered shield from the painted temples of Pañamarca, Peru. *Nawpa Pacha: Journal of Andean Archaeology* 33(1):103-118.

Southern-most Moche center. Re-excav of murals exposed in 1950s. Small nonfunctional shield left as offering, coiled reed basketry foundation with woven cover decorated with yellow feathers. Shields common in Moche iconography, e.g. weapon bundles and combat, shown small like this one, considered small for fending off club blows [but perhaps more effective against darts?]. Other finds small but made of cane with leather, some more functional?

Trinkaus, Erik

X

2012 Neandertals, early modern humans, and rodeo riders. *Journal of Archaeological Science* 39:3691-3693.

Berger and Trinkaus (1995) compared Neandertal trauma (disproportionate upper body and head injury, relative dearth of lower limb injury) to rodeo riders, suggesting "frequent close encounters with large ungulates unkindly disposed to the humans involved." Samples small; available early modern Upper Paleolithic specimens show similar pattern [actually even more head injury dominates]. Previous analyses (Shea, Churchill) suggested heavy, short range N weaponry used mostly for thrusting, supported by shoulder anatomy. However, some impact fracturing may indicate projectiles, and Up Pal skeletal anatomy similar to Ns. Since Up Pal developed throwing weapons, association of Ns with close-range hunting of large animals not as secure. Alternatively,

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lower limb trauma may be scarce because in mobile society, disabled were left behind where died and not preserved rather than buried in shelters. Also some of the injuries of Ns probably human-inflicted. So N trauma pattern shared by Up Pal, combines several probable causes, and we should avoid global explanations and look at cases individually.

Tucker, George

2007 Silence of the Stone Age. In *Miami Noir*, edited by Les Standiford, pp.48-64. Akashic Books, New York.

Short story, fiction. Murder at the Biscayne Bay Paleolithic PowWow involves an atlatl. Author knows some archaeology, at least some insider jargon, and something about atlatl events. Although some of the atlatl aspects are implausible, distorted a bit to make the story work, the plot includes accusations of academic dishonesty - stealing and publishing atlatl theories [probably taken from Bob Perkins' claims]: "Vernon had proven that the banner stone kept the atlatl from vibrating from the force of a throw, acting as a Stone Age silencer. Archaeologists theorized that only a heavy, rigid spear would have sufficient momentum to bring down an animal. Vernon and Eustace put the lie to that theory by proving that a slender, flexible dart was much more efficient." (50)

Tucker, Gordon C. Jr.

1980 Quantitative Affirmation of Intuitive Typology. *Tebiwa Miscellaneous Papers in Regional Anthropology* No. 22

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Quantitative typology of projectile points - size and hafting changes important in the transition from dart to arrow point in the Great Basin.

Tuggle, H. David, and J. Jefferson Reid

2001 Conflict and Defense in the Grasshopper Region of East-Central Arizona. In *Deadly Landscapes: Case Studies in Prehistoric Southwestern Warfare*. Glen E. Rice and Steven A. LeBlanc, eds., pp. 85-107. University of Utah Press, Salt Lake City.

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p. 93 accepts without question Lorentzen's argument that atlatls abandoned late, around 1300, because "bow is unquestionably a more effective weapon of war," and shift from atlatl to bow is itself seen as evidence of warfare. [None of these are arguments based on good evidence; other evidence of war in region is more persuasive.]

Tullos, Hugh S., and Joe W. Kingx1973 Throwing Mechanisms in Sports. Orthopedic Clinics of North America 4:709-720.

Tuni, Arriola Carlos and Louis Tesar

2011 The Pikillacta 2004 Eastern Gate offering pit. *Nawpa Pacha* 31(1):1-44. http://dx.doi.org/10.1179/naw.2011.31.1.1

Huari (Wari 600-1000 AD), Cuzco area Peru, in largest admin/ceremonial center, pit with

56 figurines of elites, warriors, deities, other artifacts.

Among the figurines of cast metal: "The last two figurines, Items 1A and 4A (each 87 mm high), represent Huari warriors with large rectangular–shaped shields in their left hands (Figures 16 and 19). The first is depicted holding an atlatl or spear–thrower with a dart in his right hand. His arm is extended as if ready to throw the dart, and his feet are properly placed for balance during such an action. Also, his mouth is open and his right cheek is distended. The second (Item 4A) is depicted holding a pointed rod with a knobbed base in his right hand. The basal portion of that object has geometric markings. He is wearing a conical cap with wing-like protrusions on both sides. He is also wearing knee–length protective clothing that covers his neck from front to back." These are interpreted as possible guardians for the rest of the offering.

[The atlatl warrior has also 3 darts held in L hand with shield. The dart loaded on the atlatl has been bent out of shape, but none appear to have fletching depicted. The dart pieces all appear to be separate pieces inserted through holes in the two hands, and butting up against the atlatl hook but not attached to it. The atlatl hook is large and shaped like a stemmed football, and there is a handle piece that might be a bird or animal with head upward, but unclear. Most important, a side view pretty clearly shows that the grip of the R hand is over the proximal part of the handle piece, with a finger extended upward to pin the dart to the side of the handle piece. Good photos]

Tuohy, Donald R.

1982 Another Great Basin Atlatl with Dart Foreshafts and Other Artifacts: Implications and Ramifications. *Journal of California and Great Basin Anthropology* 4(2): 80-106.

Material from looted SE Nevada cave: atlatl, foreshafts, 2 pts, snare parts etc. Complete atlatl, Basketmaker type with mixed groove and elevated hook, finger loops. Ca. 54 cm L, 2 cm W, 1 cm T, weighs 58 gm plus stone weight attached to <u>upper</u> side weighs 30 gm. Probably curved to let dart clear weight.

Discusses Elko point dates, atlatl maybe 100BC-400AD because similar to Basketmaker atlatls.

Elko point on foreshaft- stem is .9cm wider than shaft, so Thomas 1978 formula for arrow vs dart points not good.

Atlatl type distributions discussed.

Tuomala, Kris

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2000 The Atlatl: Primitive Weapon of the Stone Age. Privately published and distributed.

Booklet, 62 pages. Good detail and photos of building atlatl, although focus on Basketmaker type which is more difficult for beginner, dart making, useful tips on use.

Turnbow, Christopher A.

2009 Diagnostic Arrow Points of the Mimbres. *Newsletter of the New Mexico Archeological Council* 2009-4:10-16.

Defines several types, starting with Mimbres Corner Notched (550 to 1000s), small, narrow to broad notches, straight to convex edges, convex base. Diablo Corner Notched (550-700 AD) thin, deep narrow corner notches, wide blade, small stem, straight base. Some large enough for small dart points. [This is like the early arrow pts in Anasazi area, probably transitional, although dating early for bow.] Then three STPC types: Swartz (low side notches, narrow blade) Cosgrove (multi side notches or serrations) Hinton (low, wide side notches and concave base) go into 1100s and 1200s.

Turnbow, Chris and Ronald Fields

2004 Ancient Spearthrowers from the Museum of Indian Arts and Culture, Laboratory of Anthropology. *The Atlatl* 17 (3): 14-15.

Claims 61 SW specimens known, only 2 direct C14 dates. Three in mus Santa Fe, Mera excavs 1930s. Little Pine Cave #1, #2, and Rock Fall Cave. [No pictures] but apparently BM types. LPC 1 is whole, 50.3 cm long, but all lack loops. All have some resin and red pigment on them. AMS dates LPC cal 790-410 BC, RFC cal 1140-920 BC. Replication and trials mentioned but not described.

Turnbull, Ann

1984 Maroo of the Winter Caves. Clarion Books, New York.

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Juvenile novel. Upper Paleolithic Ice Age Europe. Adolescent Maroo and her brother adopt a wild dog, then lose their father in a hunting accident. As the family tries to make its way to the gathering at the Winter Caves, they are trapped by weather and Maroo and brother must cross the glacier and mountain alone to bring help. Pretty good story, and not afraid to be sad and scary. Some details are not correct or well thought-out: there were no wild dogs to be tamed, just wolves. Grandmother is always making hot water flavored with herbs by heating rocks and dropping into stone bowl. But you really can't make tea efficiently that way, or pass it around without small containers to drink from. The hunters use spears and slings, atlatls not mentioned.

Turner, Ann Warren

1987 Time of the Bison. Macmillan Publishing Company, New York.

Children's novel. Illustrations by Beth Peck (brown wash drawings) are nice but uninformed – no idea of what real Paleolithic carved art looks like. Well written, but the first scene (and accompanying illustration) shows the hero Scar Boy playing with a forked stick slingshot, a non-existent technology until invention of rubber. Likewise they smoke pipes, not present in Europe. Scar Boy is searching for a new, manly name. He feels the urge to draw, paint, create art, and makes a clay horse, but this is dangerous [a common theme]. His father is Bison Man, who killed a bison with one spear as a youth. The picture shows, crudely, him using a spearthrower, which is not in the story. They go to the summer meet to find out about Scar Boy's magic and name. There they find a trade fair, including horse races, though domesticated horses were not available in the Paleolithic. There is also a painter and painted cave, where "from these pictures on the wall, the animals are born," so Scar Boy may get his chance. Reasonable French Paleolithic painting is shown. Overall, a perfectly good children's story, but why not get the facts right?

Turpin, Solveig A.

1984 Prehistory in the Lower Pecos: An Overview. *Texas Archeological Survey Research* Report 90. University of Texas, Austin.

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fig 7 includes illegible photo of apparent distal end of "probable atlatl" from unnamed dry shelter. Atlatls Archaic age, not replaced by bow until Late Prehistoric after 600 A.D.

Turpin, Solveig A.o2005 Location, Location, Location: The Lewis Canyon Petroglyphs. PlainsAnthropologist 50 (195): 307-328.

Texas, Pecos R. area, petros on flat limestone bedrock covered by sediment. Excavation revealed natural bedrock pond = reason for use of site. Glyphs recorded in 1930s are geometrics w animal tracks, projectile pts, and anthropomorphs. Buried glyphs are older: nested sinuous lines, atlatls w exagerated weights, tracks, spirals, small anthros = "Serpentine Style," relates to Archaic "Red Linear" pictographs. [Atlatls figured are quite stylized, bar with bilobed or round very large weight and hook on end. Assoc w anthropomorphs].

Uceda, Santiago

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2008 The Priests of the Bicephalus Arc: Tombs and Effigies Found in Huaca de la Luna and their Relation to Moche Rituals. In *The Art and Archaeology of the Moche: An Ancient Andean Society of the Peruvian North Coast*. Steve Bourget and Kimberly L. Jones, eds., pp. 153-178. University of Texas Press, Austin.

Coca-taking scenes relate to warfare. p 158 seated warrior with captive holds shield in one hand, "javelin" in other [it's NOT, nor is it a dart, it's an atlatl]. Equipment seen in coca-taking scenes found in burials at HdlL.

Uhle, Max

1887 Ueber die Wurfhölzer der Indianer Amerikas. *Mitteilungen der Anthropologischen Gesellschaft in Wien* 17(7):109-114. Vienna.

On the Dartboards of Indian America. In German. S.American and Mexican info. Engravings of S. Am. forms, possible grips (including Panama form with turned down volute like Cushing's), Mex codex, Aztec atlatl Bliss Collection in National Mus of Washington [Smithsonian?].

Uhle, M. x

1888 Pfeilschleuderhaken? Internationales Archiv fur Ethnographie 1(1):209-211.

Arrowthrowerhooks? In German. Birdstones and other birdlike forms.

S

Uhle, Max

1903 Pachacamac: Report of the William Pepper Peruvian Expedition of 1896. Department of Archaeology of the University of Pennsylvania, Philadelphia.

[huge oversized format] Site complex, near Lima, so often visited [= looted]. Bandelier "explored vast cemeteries" in 1892, not published, finds in AMNH. Uhle excavated around various parts, including opening many graves, little description of the graves, plates and some description of artifacts, but NO atlatl pics or descriptions, so apparently not found although some of the time periods should be right.

Uhle, Max

1907 La estólica en Peru. Revista Histórica 2:118-128.

[In Spanish.] Describes several types, including Chimu and Moche, engravings of 3 stick-form Moche atlatls, without hook or handle attachments, and a group from Lima Valley that have a single center hole and an upright attached hook of Peruvian type. Also of several ethnographic S. American single-hole types.

Uhle, Max

1909 Peruvian Throwing Sticks. American Anthropologist, n.s. 11:624-627. (Reprinted in The Cast Spring 2001:14-16.

Eighteen atlatls from Chaviña, coastal burial site, "early Inca/Nazca". All similar, 44-53 cm, ornamented carved hooks of copper, bone, wood. In Museo de Historia Nacional in Lima.

At handle end, larger "hook" [= grip, deflection wing, dart rest??], generally points back toward distal end hook. This handle piece has human heads, or less interpretable wooden forms, and attached hooks often of copper with long 'tail'. [These are very similar forms and details to those from same site, now in Harvard Peabody Museum, see Lothrop and Mahler 1957]

Also an "arrow" for atlatl 66 cm long with triangular cross section wooden point. [Figure shows point about 20 cm long, shaft seems stout cane, would it be flexible enough, do we have the whole thing? Seems awful short.]

Uhle, Max

x, p 1917 Los aborigines de Arica. Publicaciones del Museo de Etnología y Antropologia de *Chile* 1(4/5):151-176.

[In Spanish]. 4 pre-Inca cultures. Chinchorro mummies, a bow a meter long and rectangular cross section, like those used today in Huallaga, oldest so far on coast. But first cemeteries on Pacific coast generally have *estólica* (atlatl), as also at Arica. Bows seem later, atlatl replaced in Tiahuanaco period. A figure on cloth of this period shows a hunter with bow and dog, opposite a deity with atlatl, which had then passed out of ordinary use. P162: Atlatls: defined, "a rapid movement of the arm, equal to that throwing a stone, gives a great velocity to the arrow..." Arica atlatls 44 cm long. The *tiradera* [word usually used for the thrower not the projectile] used with them was a rush 170 cm L with stone point and depression in other end. Harpoons of fishers in R Purus in Brazil are same form. Of S Am atlatl types known 1) stick with leather handle [grip] to hold finger of user, known only from Arica cemeteries, oldest burials at Pisagua, and a part of Mexico. 2) derived from first, has hole in shaft for grip, today from ther transandean region, cemetery of Nievería near Lima, and Colombia. 3) that of Peruvian civilizations, and equatorial and Colombian (Chibcha) is characterized by a hook in place of the strap or hole of the first two, seems later introduced to north.

[Then describes other traits of what I take to be now called Chinchorro culture, late Archaic coastal preceramic pre-agric. No figures]

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Uhle, Max

1922 *Fundamentos Etnicos y Arqueologia de Arica y Tacna, 2nd ed.* Universidad Central, Quito, Ecuador.

[In Spanish, a few pages Xerox only, Tiahuanaco area.] Plate shows wooden atlatl from Arica, first centuries AD, apparently inlaid or painted, with single side loop on flattish shaft, apparently groove and integral hook, [but copy is poor.]

Umberger, Emily

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2007 The Metaphorical Underpinnings of Aztec History: The Case of the 1473 Civil War. *Ancient Mesoamerica* 18:11-29.

[MS version: 2004 The Metaphorical Underpinnings of Aztec History: The Case of the 1473 Civil War. In Expression, Ideology, and Precolumbian Art History: Essays in Honor of Terence Grieder. J. Farmer and A. Rodman eds.]

Aztec mythological history was rewritten under Spanish to eliminate metaphorical and religious elements, survivals of which indicate pre-Conquest symbolic thought in staging of wars. Tenochtitlan fought a war against its neighbor Tlatelolco in 1473. Typically, victor was identified with Huitzilopochtli, and loser with his sister Coyolxauhqui. According to Spanish historian Duran's account, war followed ritual insults, including hunting ducks with atlatls to symbolize hunting the enemy. Cremated remains, probably of Tlatelolco leaders, with duck necklace, buried after their sacrifice near Coyolxauhqui stone (an insulting and threatening pre-war sculpture) at base of Templo Mayor in Tenochtitlan.

Underwood, Leon

X

1965 Le Baton de Commandement. Man 65(143):140-143.

[Odd article, not very useful. Begins with irrelevant and muddled rant on failure of science to recognize art and the subjective.] By labeling *baton de commandement* a "magic" object, its function was ignored. Not magic, not shaft straightener. Early cave art (Altamira) static, while later (Lascaux) dynamic, reflecting new weapon: baton as spear thrower. Holes comparable to grips on Eskimo versions, but Eskimo are wood, cruder, throw larger spear. [Illustrations show his reconstructions and possible grips. They probably would work at least some, but he added hooks for which there is no evidence, especially given that we do have clear and quite different Upper Paleolithic atlatls. It is not clear that he really experimented effectively or knew much about atlatls.]

University of Colorado

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2010 CU Researcher Finds 10,000 Year Old Hunting Weapon in Melting Ice Patch. Office of News Services, University of Colorado, Boulder, June 29, 2010. Electronic Document, accessed 7/3/10, URL:

http://www.colorado.edu/news/r/6f01e0cf192c909927c88da29caafdd8.html Reprinted <u>The Atlatl</u> 23(4):19.

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In Rockies near Yellowstone, Craig Lee archaeologist. Birch sapling with notch for point. Atlatls described, artifact called dart, but is probably a long foreshaft, ca 3 feet. Photos show that it was minimally worked, still has twig nodes unsmoothed, now broken in several places. Incorporates National Geographic video with similar info, better pic of atlatls + action scene, but with oddly extraneous stuff too, like unidentified ice finds and shot of Skara Brae to illustrate "hearths". Gives dates 10,300-10,400 years ago, presumably from C14.

See Scott 2010.

Urcid, Javier

2006 Antigüedad y distribución de la danza de los Voladores: Águilas que descienden, corazones que ascienden. *Arqueología Mexicana* 14(81):70-74.

[In Spanish.] "Antiquity and distribution of the Voladores" (costumed dancers swinging on ropes from high pole). Back at least to 600 BC, still performed by various Mexican groups. Philosophical principle of 4-part space and time. A recent article says late spread, 2 flyers, but better archaeol evidence and ethnographic context shows variation on common ideas, and original 4 flyer form. Early W. Mexico ceramic models and sites with quadripartite round platforms. Pole represents axis mundi between heaven and earth. Performance associated with tombs and sacred occasions. Codex Tepeucila 1540 Cuicatlan shows dance with 4 on pole, associated with images of war and human sacrifice - tied to a scaffold and struck with atlatl + darts or bow + arrow to produce abundant bleeding, then heart cut out. Teotihuacan 6th C AD figure of man bound and pierced by darts means voladores ritual probably practiced too. Graffiti at Tikal pre 9th C AD shows flyers in bird costume with ropes and possible atlatls, victim on scaffold pierced by long dart. Mixtec codex shows scafold sacrifice and skeletal deity with atlatl.

Dumbarton Oaks atlatl, finely carved, probably Mixtec 14-16 C. At distal end, warrior

with eagle helmet and atlatl + darts in celestial plane (descending from sun), then 4 sets of warriors alternating with captives and at bottom (proximal) a figure representing terrestrial plane. Link to voladores by bird + atlatl, with war + captives for sacrifice, top figure would be the one on top of pole, with 4 flyers. Top figure honors sun, another with rain god mask = prayer for rain. Quadripartite figures.

Urcid, Javier

2007 Effigy Vessel. Unpublished ms.

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Middle Formative vessel of unknown provenience, Maya or N. Mexico Colima? Man carrying deer, a motif with lots of parallels. Wide pre-columbian use of deer hunt as symbolic warfare and capture of deer/captives for sacrifice. Sacrifice by atlatl and dart in some instances.

Urcid. Javier

2010 Dart Thrower. In Ancient Mexican Art at Dumbarton Oaks: Central Highlands, Southwestern Highlands, Gulf Lowlands. Susan Toby Evans, ed., pp. 210-220. Dumbarton Oaks Research Library and Collection, Washington D.C.

[Most useful discussion of iconography on Mexican atlatls] Analyzing complete carved atlatl, (no finger loops) bought from Brummer 1947, probably Mixtec 1200-1520. L = 60.3 cm, W = 3.8 cm distal tapering to 2.7 proximal. No evidence of wear or finger loop attachment. Dark hardwood. Both sides carved, read top to bottom (distal to prox). Along groove on upper side, 4 darts, with eagle, serpent, and rosette décor, fletching, stone point depicted. Underside has 10 figures, top one descending personage armed with 2-loop atlatl, shield, darts, with eagle headdress and serpent at face, solar band identifies him as impersonator of Sun God. Figures below mostly carry atlatl, or spear, and shield with darts, 4 face R and appear to be vanquished, 4 face left (victors in aggressive postures), including one warrior with female dress. They wear masks or head dresses identifying them as impersonators of rain and other gods. Lower figures assoc w serpents. Bottom figure is Rain God impersonator with curled lip "buccal mask" and protruding fang. Eagle mask of descending figure relates the scene to "voladores" sacrifice.

Other atlatl examples similar iconography referring to voladores sacrifice, including British Museum atlatl with descending impersonator of Mixcoatl-Camaxtli with cloud serpent = rain, carrying dart, hoof earing = deer substituted for human sacrifice to sun. Atlatls part of insignia of many deities. Specimens assumed to be ritual use only, but functional size, and decorated atlatls are depicted in use. Could have been used in sacrifice, owned by high elite.

V

0 1891 Recent Literature. American Naturalist 25: 260-273.

Short review of E. Seler, Alt-mexicanische die Wurfbretter (1890) "a sliding aparatus from which darts and javelins were hurled" ... " from the amiento, by the later addition of the bow, the crossbow has evolved." [huh?]

Vail, Gabrielle, and Christine Hernández s Burling

2007 Human Sacrifice in Late Postclassic Maya Iconography and Texts. In *New Perspectives on Human Sacrifice and Ritual Body Treatments in Ancient Maya Society*. Tiesler, Vera, and Andrea Cucina, eds., pp.120-164. Springer, New York.

Codex and mural images. Bound captives, decapitation most common, assoc with year ending rituals. Spearing also common, assoc with appearance of Venus as Morning Star, god Kisin as agressor and merchant diety as victim. Fig 6.13: Dresden Codex 46, black God L with shield and raised atlatl represents Venus, victim image below is K'awil [not clearly visible].

Valla, F.R.

1987 Les Natoufiens connaissaient –ils l'arc? In *Le Main et l'Outil: Manches et Emmanchements Préhistoriques*. D. Stordeur ed., pp 165-174. Lyon: Maison de l'Orient.

[In French] Did the Natufians know the bow? Mid East Epipaleolithic/Mesolithic 10,500-8300 B.C. Older research skeptical, more recent receptive, oldest bow and arrow specimens Stellmoor, Germany, 8500 B.C. No proof possible for Natufian, but small flint armatures (lunate microliths), light bone points with and without flint edges, and grooved stone possible shaft straighteners are all what one might expect with bow and arrow.

Van Arsdale, Scotty

1999 Rookie Ramblings. Indian Artifact Magazine 18(1):10, 72.

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Experiences at atlatl competitions 1998.

Van Arsdale, Scot

2000 First Modern Day Atlatl Accident Reported. Indian Artifact Magazine 19(3):22

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Stupid 12 year old, only slight injury.

Van Arsdale, Scott

2007 Discovery Channel Show. The Atlatl 20(4):11-12.

SVA, B Perkins, M Waters, M Bracken, D Leeth, and B Berg participate in "Weapons Master" production, throw at Spanish armor. [Results not stated; in film you see it is a plate breastplate, and is not penetrated. The Spanish accounts probably refer to chain mail or leather, or quilted cotton - see Swanton 1938]

Van Buren, G. E.

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1974 Arrowheads and Projectile Points with a Classification Guide for Lithic Artifacts. Arrowhead Publishing Co, Garden Grove, CA.

[Most of the book is devoted to an eccentric and not very useful splitter typology scheme based on 35 attributes, with point names unused by anyone else and quite unnecessary.] Discusses design influences on points, including bows: N. Am. relatively weak, would use light arrows, thus average arrowhead should be 4 gm, although up to 17 gm possible. Various possible point hafting techniques.

Atlatls: darts depicted on pre-hispanic art (Nuttall) suggest lengths 26-50 inches [Too short. As he notes, art is not necessarily realistic.] Wormington says Basketmaker darts 5.5-6.5 feet. He measured 3 darts 'of unknown origin,' all with stone pts: 24, 27, 45 inches. Cites Brown on atlatl inaccuracy. [Mentions a lot of suspicious darts – his 3 – where from? - and darts "from Turkey, Iran, Israel, Syria and N. India" - what's with these? Atlatls were not used in these areas after Upper Paleolithic. Also San Diego Museum of Man collections darts 'tipped by either flint or steel pts' – historic US atlatl darts? I don't think he knew what he was talking about.] Experiments with different shaft lengths: 1 ft to 8 ft, made of different light materials. Used 2 atlatls modeled [sort of] after Mexican forms [both are short and stumpy – 24" L, but only 15" hole-tip]. "Each throw was designed to test maximum range and accuracy of a shaft of specific length, with proj pts of gradually increasing weight to determine point of diminishing return." Also observed effect on flight of center of gravity changing with point size. No fletching used. Over 3000 throws of the 8 dart sizes using over 300 proj pts, at least 3 throws for each dart averaged. 1 ft and 2 ft darts didn't work well, 3 ft poor, others ok, but 8 ft too long to balance well on atlatl. Max distance achieved was 138' with 5 ft dart with light pt. [He talks a lot about stability problems with most of the darts, and the distances are poor. He also cites Howard, so I guess he is not throwing with good form, and has too short an atlatl besides, and short darts are probably not flexible enough.] Four, 5, 6, 7 ft darts thrown for accuracy at a stake, landed "within the circle" "accurate enough for use as weapon." [But circle size not given, so can't judge.] Longer shafts and longer points tended to break more points. Projectile point weight had only minor effect on flight. Test points "copied only the outline" of various types and had "thick lateral ridge sometime exceeding 1/2 inch in thickness," and "little attention was paid to thinning of the base or stem." [In other words, these were not good replicas of any prehistoric points.] Also tried penetration tests with stone points on hay bales. [This was an ambitious experiment – in fact, he experimented with too many variables to properly control any of them. He gives lots of detail, but it shows serious inadequacies in his equipment and the whole experiment.]

VanderHoek, Richard

1998 In Search of the Optimal Dart. The Atlatl 11(2):3-6.

Some personal thoughts. Darts need forward center of gravity, center of pressure behind that (either adding fletching to rear or weight to front), and appropriate spine flexing. Stiff tip, flexible tail recommended. Need a standard measurement for spine. Proposes pressure on tail needed to bend dart, measured by standing vertically on postal scale. Suggests questionnaire to collect info.

VanderHoek, Richard

1998 *The Atlatl and Dart*. Unpublished MA thesis, Anthropology Dept, University of Illinois at Urbana-Champaign.

[A very good study, well written, the most thorough work in English. He covers the available literature in detail, and also relies on his own experiments and experience of Madden, Strischek, and Chauvaux.]

Begins with ethnographic information on Arctic and Australian atlatls with good references, distribution of types, reports of use. Chapter 4 is History of Experimentation, good summaries. Chapter 5: The Motion. Differences are between short range accuracy throw and longer throw for distance.

Short throw with light dart needs just arm and shoulder, cites Raymond film showing dart + atlatl tip move in straight line throwing at 20 m target, with slight raise of atlatl tip as atlatl handle rotated downward. Atlatl moves 90 degrees to the ground [he means straight over].

Heavy dart, longer distance needs torso rotation + weight shift, resembles baseball throw, atlatl moves 45-60 degrees [meaning sidearm motion as shown in his ethnographic photo]. Notes some Eskimo underhand/sidearm throw to skim water for birds (Nelson 1899). Dart moves in straight line (Stanford 1979 photos), except Engvall's distance throw with sidenock dart.Overhand throw reduces side to side dispersion of dart, while crossbody throw tends to disperse upper R to lower L. Sidearm darts strike in horizontal line across target [optimistically!].

Describes accuracy throw: atlatl and dart held horizontal at shoulder height, hand behind body, feet 30 degrees to target, L foot advanced. Atlatl drawn back, then propelled by torso rotation and weight shift to leading foot. Enough weight shift to forward leg to lower body slightly, allowing atlatl to rotate forward but maintain flat trajectory with spur end. [This is actually very bad form, and his major practical and theoretical flaw – a full overhead motion of the atlatl is much more effective, and not just for distance.] Start smooth, end with wrist snap. [Which implies proper form, not some version of Howard's extended force model, so he is a bit confused.]

Three handle styles: stick (Aust, N. Guinea, N. + S. Am., Up. Pal. Euro.), central hole (Arctic, N. Pacific, Carribean, Amazon), double hole (N. Am., MesoAm.) – affect wrist. Stick uses hammer grip, dart held by thumb + index or middle finger. Central hole is for index finger, thumb and opposing fingers around grip also hold dart. Two holes for index and middle finger – as some Basketmaker style. New Guinea and S. America also developed side piece to help hold dart by thumb pressure.

Chapter 6: The Atlatl. Longer atlatl lengthens throwing lever of hand and forearm for more energy to spear. Optimal relation of atlatl length to spear length is around 1:3. Rotation of the atlatl moves the dart base out of line of the dart's trajectory, and amplitude of oscillation should match time taken by atlatl rotation. So longer atlatl requires more dart flex. [I don't think the oscillation timing is important here, but greater length aids flex, so longer atlatl will be best with longer dart.]

Atlatl weights. Other theories cited, then flex of atlatl and tuning to dart flex. Actually

it most likely dampens sideways movement of atlatl shaft for increase smoothness and accuracy of throw. [Right] Atlatl flex is not important – ethnographic and experiments show. [Right again]

Chapter 7: The Dart Many variables affect performance: material, length, diameter, weight, taper, center of balance, center of pressure, mass distribution, locations of greatest stiffness and flex, spine weight, point weight and length, foreshaft, fletching type and location. Dart more critical than atlatl. Flex: spine should match thrust. [In summarizing experiments, he seems to accept idea that flexing dart acts as spring to increase dart velocity, which is wrong, but here he correctly discusses flex for accuracy.] Compare to bow: string pushes arrow toward center of bow, must flex around bow archer's paradox. Dart bent by atlatl rotation, in same plane as atlatl, spine should curve up or down in same plane too. Longer darts may be more accurate. Easier to aim, easier judgment of spine. Arrow balance point usually 25-35% from tip, Australian spears more often 40-48% (Cundy 1989). Center of pressure [not well defined] should be behind center of gravity. Fletching moves c of p back, but not all darts need fletching. Spine is important but hard to measure, and wide range appears to work. Location of flex is important – tail should flex more than tip. Modern parallel sided same-diameter shafts have poor center of gravity and bend uniformly along length. Tapered shaft is better. But oscillations can be simple or complex with two different nodes, which is why a spliced dart of two same diameter segments still works - splice isolates tail flex. Front third of dart should be stiff – if it oscillates, not accurate.

Chapter 8: Accuracy, Power, Speed. Accuracy is better practical measure of effectiveness than range. Cites ethnographic accounts ranging from 20 to 60 yards. WAA ISAC developed 1996.

Distance records. Ethnographic accounts and modern experiments variable, from 40-130 m. Wayne Brian record 1993 modern gear 210.31 m, 1994 primitive gear 177.17 m. David Engvall 1995 258.64m with "Off-Axis-Forward-Nock spear. Arrow flights: Ishi 183 m, British longbow practice at 200 m.

Penetration – affected by point as well as force of throw and weight of dart. Lists some experiments.

Speed: probably aim and throw almost as fast as bow and arrow. [I doubt it, much more complex motion] Velocity: cites various dart records.

VanderHoek, Richard

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2015 Overview of the Atlatl and Dart, and Atlatl Event Management. Atlatl Lesson Plan online at <u>http://dnr.alaska.gov/parks/oha/publiceducation/publicedlessonplans</u> accessed Feb 20, 2017.

Basic terminology, SW atlatl diagram. Historical overview, atlatl is lever. Photos Arctic forms. Dart making, too stiff causes hooking, "because dart is too stiff to spring away from atlatl".

Conducting events. Safety monitoring public demos, backstopping, range rules apply. Kids <8 yrs have limited coordination. Adults try to throw too hard. Good form. Arctic forms easy to hold and understand. Imaginative targets.

VanderHoek, Richard, Charles E. Holmes, J. David McMahan, Brian Wygal, and Randolph M. Tedor x

2006 Ice Patch Research and Monitoring in the Denali Highway Region, Central Alaska, 2003-2005. Ms. in prep for Alaska Journal of Anthropology.

Caribou favor ice patches for temperature relief and to avoid insects. Arrows and barbed antler arrow points 100-300 yrs old. Probable dart points and shaft fragment dated at 975-1175 AD. Hooked wooden stave dated 1437-1634 could be atlatl but dates later than Yukon evidence of transition around 700 AD, wear and ethnog suggests a stick for setting snares in ground squirrel holes. Summarizes Yukon dates: oldest unambiguous bow is fragment 644-876 cal AD, overlapping with a dart shaft dated 656-890 cal AD. One dart frag as old as 7194-7568 cal BC. One anomalous shaft (nocked but 100 cm long, with lanceolate stone pt) dates ca 1500 BC, suggests scaling down a dart to make an arrow, but other arrows all later. Shrinkage of wood may make difficult size distinction between arrow and dart shafts.

VanderHoek, Richard, Randolph M. Tedor, J. and David McMahan x,p

2007 Cultural materials recovered from ice patches in the Denali Highway region, central Alaska, 2003-2005. *Alaska Journal of Anthropology* 5(2):185-200.

3 seasons of ice patch survey, organic objects date within last 1000 yrs, stone points suggest ice patch caribou hunting for at least last half of Holocene.

Basalt Lake Ice Patch I: arrow shaft with barbed antler point slotted for stone or metal end blade, 2 pcs of fleching, sinew lashing, ca 52 cm long, nocked, spruce (most common ice patch arrow wood), 100-300 yrs old.

from others: barbed antler point, cut antler, rolled birch bark. Lanceolate stone points, edge-ground, 56-65 mm long, different morphologies = earlier atlatl dart points, similar to those from Yukon and Wrangell Mountains.

Delta River Ice Patch 5: 75.5 cm long wooden spruce stave with notch at end, originally ID as possible atlatl, but recent date, transition atlatl to bow from other info was ca 700 AD, proximal end worn, but not notch, so more consistent with gopher snare setting stick.

Faunal remains dominated by caribou, elements also found from wood bison, moose, sheep, elk, goat, lemming, vole, ground squirrel. None with butchering marks.

van Gurp, Gerald, Timothy J. Hutchinson, and William A. Alto x 1990 Arrow Wound Management in Papua New Guinea. *The Journal of Trauma* 30(2):183-188.

Mostly patients were tribal fighting victims; bush knife, axe, + arrow wounds, latter most common, so far no gun wounds. Two-part arrows, total L 1 m, bamboo with wooden points 10-30 cm L, no fletch. Black palm wood bows, bamboo strip strings. [Still fighting much as seen by Gardner 20 yrs earlier.] Government intervention "has become ineffective in recent years…relies on a mobile police riot squad that indiscriminantly burns houses and kills livestock of the warring

parties." Reviewed all arrow wound cases for 1987, N = 90, 83 adult male, 4 women, 3 boys. Orbit, thoracic cavity, popliteal fossa considered vulnerable favorite targets. Wounds to head + neck (16), arm (7), chest (40), abdomen (10), leg (37). Wood points not visible by X-ray. Only 4/90 died; several case studies detailed.

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VanPool, Todd L.

2006 The Survival of Archaic Technology in an Agricultural World: How the Atlatl and Dart Endured in the North American Southwest. *Kiva* 71(4):429-452.

SW atlatl background and refs. Most archs say bow intro SW ca AD 500, had replaced atlatl by 800. Bow advantages: lighter, faster, longer range, use in brush, don't have to stand, spook animals less. Atlatl advantages: heavy projectile = big wound, 1-hand use. But atlatl continued in many parts of Americas up to ethnohistoric times, so why not in SW? Similar reasons to retain: symbolic importance, 1-hand use + heavy dart good in warfare (lots of shield figures who couldn't use bow). Preservation may be why no atlatls from secure contexts after AD 700.

Examples: 1) Ventana Cave (his diss), long occupation, Archaic levels hunt more small game, later Hohokam larger. 9 Hohokam arrow shafts, no atlatl or darts, but using 3 gm limit, or Shott's formula, more than half of H period pts should be dart pts. [But a statistical trend based on pts from all over does not necessarily apply to interpreting a single assemblage.] Argues against mixing and curation. N. Sonora atlatl loops assoc w agric period relatives of Hohokam (Johnson1971).

2) Paquime, Chihuahau. Large center 1200-1400 AD, W Mexico and SW connections. 75/98 pts small triangular or stemmed arrow pts, but 13/21 larger pts class as dart pts using 3 gm or Shott. Five stone cruciforms that Johnson considers atlatl weights [but no stone/shell loops].

Why late atlatl with bows?: Ventana C became large game hunt camp. Paquime maybe bison hunting, also ritual significance as in Mesoamerica.

[Possible, but unlikely. Some counterarguments: eg deer hunters in much of SW did fine with small pts, no good info on whether atlatl advantages really outweigh bow for such hunt, NO datable late archaeol atlatl specimens, and all of the examples are based on ambiguous evidence of point sizes. See Whittaker 2007, 2012 for detailed criticism]

VanPool, Todd L., and Michael J. O'Brien

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2013 Sociopolitical Complexity and the Bow and Arrow in the American Southwest. *Evolutionary Anthropology* 22(3):111-117.

Bow present by 500AD, dominant by 700. Short self-bows until after AD1200 sinew backed. Self-arrows become more common thru time as needed to pierce shields. Self-tipped foreshafts and stone pts, usually small <5 g, variable shape, but self-tipped more common. Stone tips maybe tied to warfare.

SW complexity from irrigation agric, pop aggregation, and warfare. 3 major areas: Hohokam, Chaco/Aztec, and Casas Grandes. Hohokam irrig agric + complexity predates bow. 950-1100 re-organization - no evidence of warfare. After 1100, defensive + lookout structures. Chaco political power based in part on war. Before large C settlements, small raiding and massacres. During and after Chaco ca 900AD, war curtailed in favor of targeted killing of specific groups w possible cannibalism. Green arrows at Pueblo Bonito point to distinct Chaco ritual w bow and arrow [Holly 2010. Not nearly good enough evidence.] After 1250 regional system of warfare, destruction of villages, recurved bow became dominant weapon, war deadlier > migration of pops out of N SW to Rio Grande and central NM and AZ. Burning, movement, aggregation, defensive sites all over. Evidence of bow use in war [list a few sites; there are many many more]. After fall of Chaco systems, new social structures e.g. katchina religion established diffuse power structures rather than greater complexity.

Paquime area - L Archaic warfare with atlatl 1500BC-AD700 shown by [trinchera type] villages on hills. Settlements btwn AD700-1200 were small and dispersed, maize agric, no evidence of war. After 1200 large settlements with irrigation. After 1300, possible signal fire sites. DiPeso claimed Paquime destroyed in war - ambiguous, little other evidence of warfare.

N SW evidence not support 'warfare theory' that warfare led to increased complexity, and only limited support to 'social coercion' theory - in Chaco bow helped targeted killing and social control, but hierarchy not reestablished after Chaco, so bow effects differ in same area at different times - other factors important, true in the other areas too.

Van Slyke, Noel and H. Bill White

2012 The Desert Bighorn Sheep Motif. In *Rock Art at Little Lake: An Ancient Crossroads in the California Desert*. Jo Anne Van Tilburg, Gordon E. Hull, and John C. Bretney eds., pp. 118-131. Cotsen Institute of Archaeology, University of California, Los Angeles.

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288 depictions. Also common at Coso Rock Art Landmark 25 km E, diagnostic of Coso Representational Style in Gt Basin. Orig distribution hard to determine; reduced in historic times before records kept. Hunting prob at height in Newberry period 3500-1000 cal BP, coincides with Stahl and Pagunda sites.

Statistical analysis of variation. Horns most consistent and defining element of sheep. Used LL depictions + Coso + 2 more, total 877. Hunting magic vs shamanic interps - ethnog not helpful, too far removed in time.

Atlatl Cliff lacks sheep motifs, they occur at all other LL loci in varying numbers. So no assoc with weapons, contrasts with Coso Landmark. 'Classic' Coso form = boat or D-shaped body, front facing horns, but only 7% at LL. Oval body more common (69%). NO impaled sheep at LL, but some in Coso. Almost all solid pecked bodies. Most face to R. Raised tail common, but meaning unclear - some think = rigor mortis, more likely urination or defecation, but not often observed in living sheep, stylistic motif.

Others argue that sheep motifs = hunt magic and follow decrease in sheep. Faunal records at LL sites dominated by rabbit, very few sheep bones. Off-site consumption possible. No evidence to support shamanic model - raised tail 'death' of shaman/spirit no convincing, no 'patterned body' sheep that Whitley claims = shaman shirt imposed on sheep.

Van Tilburg, Jo Anne, Gordon E. Hull, and John C. Bretney eds

2012 Rock Art at Little Lake: An Ancient Crossroads in the California Desert. Cotsen Institute of Archaeology, University of California, Los Angeles.

Very fine and detailed large format book with excellent color photos. Atlatl motifs common; discussed in several chapters.

Van Tilburg, Jo Anne

2012 Introduction. In *Rock Art at Little Lake: An Ancient Crossroads in the California Desert*. Jo Anne Van Tilburg, Gordon E. Hull, and John C. Bretney eds., pp. xv-xxi. Cotsen Institute of Archaeology, University of California, Los Angeles.

A

Privately owned ranch with concentration of rock art and other sites, near Owens Valley. Brief info on history of research. Definitions and approaches.

Van Tilburg, Jo Anne

2012 Rock Art, Aesthetics, and Belief. In *Rock Art at Little Lake: An Ancient Crossroads in the California Desert*. Jo Anne Van Tilburg, Gordon E. Hull, and John C. Bretney eds., pp. 150-175. Cotsen Institute of Archaeology, University of California, Los Angeles.

A

Myth and religion in Great Basin changed through time, but an iconographic vocabulary was probably broadly shared between cultures and media. Rock art permanent, particularly intended to communicate across generations. Great Basin Numic religious practice included visionary shamanism. Can't assume all rock art is shamanic, or project beliefs back 9000 years with certainty. Numic beliefs and practices - spiritual powers from animate and non-animate environment, visions, some promoted by hallucinogens. Shamanic practices not confined to men. "Master of animals" and hunt magic important.

Motifs repeated suggest meaningful, from many sources defined as culturally important. PreNumic motifs best seen on scratched pebbles from Gatecliff Shelter (Thomas), simple lines, chevrons, circles and zigzags - these seem similar to the angular/curvilinear motifs on PreNumic atlatl dart foreshafts at Gatecliff (Harrington), so associated by connection to the hunting weapons with maleness, hunt success, food acquisition or increase.

Atlatl Cliff spatially removed from Little Lake, heavily patinated art there is PreNumic, at least 6000-3150 BP. Concetration around LL itself assoc with inhabitants of Pagunda site from c 2300 BP, curvilinear motifs generally predate rectilinear ones, possible connections to basketry motifs and other crafts. Basketry weaving structure parallels rock art: twining to scratched grid + rectilinear motifs, followed by coiling and curvilinear rock art. Rock art symbols - vulva, zigzag - linked to fertility, femaleness, and indirectly to prophecy, seen on cradleboards.

Specific images: rectangles with internal geometrics suggest cradleboards. Y-shaped elements also, heavy wooden Y frame of ethnog cradleboards [much more convincing than as atlatl dart foreshafts]. Atlatl and bisected circle motifs - conventional icons, stereotyped cultural meanings. "Weight" differs from attested 'boatstone' forms, is it

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actually a weight? "Weights" more likely charms. Atlatl from NC Cave (Tuohy 1982) with weight on dorsal shaft instead of proper ventral side, globular or round, shaft decorated, ca 400 AD, probably ceremonial atlatl, comparable to those depicted at Atlatl Cliff. Depictions at AC cover early (heavy patination) LL period, Newberry period (less patinated), with least patinated in narrow range of several 100 yrs overlap of bow and atlatl. [I don't think the sequence is that clear or well dated]. Original form and meaning of atlatl from PreNumic does not necessarily continue into later depictions. Upright atlatls - similar to various ritual staves. Isolation of site and distance from water, lack of animal motifs - removes from female domain and malevolent associations of water, but densely pecked atlatls similar in work to sheep elsewhere - meaning perhaps linked or interchangeable [that's a stretch]. Atlatl = male sexuality, group identity and leadership, longevity = durable symbol. Bisected circle often considered atlatl, but more complex: line to Numic = male, arrow, penis; circle = seasonal round, house, basketry, female. World is stacked horizontal planes pierced by vertical cosmic axis. Shaman capable of crossing all.

Van Tillburg, Jo Anne, and Clarus Backes

2012 Painted Rock Art and Stahl Site Pigments. In *Rock Art at Little Lake: An Ancient Crossroads in the California Desert*. Jo Anne Van Tilburg, Gordon E. Hull, and John C. Bretney eds., pp. 132-148. Cotsen Institute of Archaeology, University of California, Los Angeles.

Pictographs rare at LL. Paint sometimes co-occurs with pecked, occasionally overlays or added to it. Crayoning, painting with fine implement, possible stenciling. Mostly amorphous, some linear and curvilinear elements, objects portrayed if any not recognizable. Pigment analysis. Photo p145 of painted atlatl dart frags from Gypsum Cave (Harrington), finds at other caves show similar linear motifs to Numic rock art in Gt B. Painted zoomorphs very rare, no anthropomorphs. Green paint (celadonite) on objects, rock art in Newbury Cave = ritual use; suggest that green stone pendants at LL and elsewhere indicate 'ancient symbolic relationship' between them and atlatl darts.

Van Tilburg, Jo Anne, and John C. Bretney

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2012 Little Lake Environment and Archaeology. In *Rock Art at Little Lake: An Ancient Crossroads in the California Desert*. Jo Anne Van Tilburg, Gordon E. Hull, and John C. Bretney eds., pp. 11-33. Cotsen Institute of Archaeology, University of California, Los Angeles.

Basalt geology. Lake environment - an oasis situation. Obsidian (Coso) and hydration dates. Elaborate time-line. Rock art perhaps begins paleo or pre-Clovis, but clearly assoc by Silver Lake times (ca 10,000 rcyBP) 4 main sites: Stahl Site (Pinto, excav by MR Harrington in 1950s, hundreds of points, possible structures), Stahl Site Cave (later, Numic with some earlier stuff and a bit of rock art); and Pagunda (Rose Spring and later pts); Pottery Slope (pot find).

Van Tilburg, Jo Anne, and John C. Bretney

2012 Little Lake Ranch Rock Art Complex. In *Rock Art at Little Lake: An Ancient Crossroads in the California Desert.* Jo Anne Van Tilburg, Gordon E. Hull, and John C. Bretney eds., pp. 37-93. Cotsen Institute of Archaeology, University of California, Los Angeles.

9 discrete loci linked to situational and chronological contexts [actually their numbering is odd as it lumps together areas that appear quite distinct on map]. Rock art 'enriched social landscape' giving meaning to place. Early rock art studies in Great Basin outlined. Beginnings with Mallery + Steward. Campbell Grant et al Coso Range 1968; Heizer + Clewlow 1973 Prehist R A of CA.

Dating - obsidian hydration and motifs. Petros assoc w obsid suggest r a begins at least 4000-1000 BP (Mid Archaic). Intensification of ritual and art may be linked to change in subsistence and production of Coso obsid. 60 elements dated by cation-ratio + desert varnish lamination studies suggest late Pleistocene to Historic.

Situations variable - riparian (lake), desert scrub, close to habitation sites or further [but whole area is only ca 3 km]

1228 panels, 4112 elements - panels defined by rock edges etc, elements defined as "a single form or design unit. Only 67 painted panels; most pecked, a few scratched. Scratching tools not known; expedient available would include obsidian gravers or retouched flakes as found in excav [highly unlikely - obsid too soft]. Hammerstones hafted or not? Unknown. One find at Pagunda. Paint applied with fine tool and fingers. Two paint palette/grinder finds - Stahl in Pinto levels, Pagunda in 1300-1400 AD level.

Elements defined - mostly simple [many similar to our Sinagua area including snakes, zigzags, rakes, spirals] also paws but with many digits, zoomorphs (11%) include recognizable sheep, deer/antelope, canines. Lizard rare. Anthros rare (4%) usually simple, multi-digit, some "body patterned" some conjoined with other elements. Open curve 'hook or staff.' Atlatls - several forms defined (p52). All have large central round motif on line with hook on one end, sometimes hook or loops on other end, ca 4% of total elements. Some 'incomplete' or simple line with loop across it (p81). Amorphous random pecking ca 19%. Scratching common, may be 'entopic', but repeated patterns suggest meaningful, not necessarily linked to shamanic behaviors.

Two 'classic' motifs conform to an aesthetic canon in region: bighorn sheep with D-shaped body, and atlatl.

Loci described. L 4 has proj pt depictions, possibly Elko [vague triangular, don't think IDable or surely pts]. L 5 poss pt with hands + feet [again, I'm not so sure]. Atlatl Cliff locus on basalt cliff + boulder slope, 193 panels, 645 elements, atlatls 18% of total (99 complete, 19 incomp). Replaced in this area by ca 650 AD, maybe earlier (Yohe) ca 200-300AD, maybe assoc with depletion of big game. AC includes concentration of atlatls, but NO sheep. Some iconic meaning for atlatl and meaningful assoc with locus. See Bretney.

Another timeline [these are very nice] attempting to sequence cultures and "Little Lake Variant of the Great Basin Style.' Arch periods: Pre Little Lake >6000BP, Stahl site initial use, begin pecked art at Atlatl Cliff. Little Lake - 6000-3150 BP, Silver Lae and

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LL pts [pinto variant], AC atlatls. Newberry 3150-1350 BP Pagunda site use peak, SL+ LL pts. Haiwee 1350-650 BP Elko, Rosegate pts. Marana 650BP-1850AD, scratched patterns. Historic after 1850 Anglo incursion.

Vaughan, Thomas, and Bill Holm

1982 Soft Gold: The Fur Trade and Cultural Exchange on the Northwest Coast of America. Oregon Historical Society.

Artifacts from fur trade era (1700-1900) in Harvard Peabody Museum and elsewhere. Four Tlingit atlatls, wood, highly decorated, single central hole for forefinger, groove and "shelf" to engage butt of dart [this side not pictured, so can't tell what it's like.] "All highly decorated but uncomfortable to hold and use compared to the totally functional, no-frills throwing sticks of the Eskimo." [Not a good description of many Eskimo atlatls, but probably right about non-functional nature of these – thick and short (finger hole is almost in middle) with lots of carving on handle]. Ornament comparable to that on shamans' rattles, "not obviously related to hunting or the prey sought with atlatls, such as seals and sea otters." Collected in the early 1800s.

Vega, Margaret Brown, and Nathan Craig

2009 New Experimental Data on the Distance of Sling Projectiles. *Journal of Archaeological Science* 36:1264-1268.

Central Andes, Peru, ethnographic slingers asked to throw for distance. Variable throwing style [no details], irregular river stones 4-9 x 2.5-4.5 cm comparable to archaeol specimens, local wool slings ca 1.8 m long. Recorded 142 casts, men, women, youths. Adult men do best, youth may not practice as much now, women up with men except for longest distances. Max distance 130 m, mean 65 m. Finney experiments (novice slinger) at UK Iron Age hill forts underestimate possible range. This data shows would clear defensive walls in Peru. "Strong tradition of slinging among Andean women... some reported having used slings in battle during recent land disputes". Major use is in herding. [No info on accuracy].

Verano, John W.

1986 A mass burial of mutilated individuals at Pacatnamu. In *The Pacatnamu Papers, Volume 1*, edited by Christopher B. Donnan and Guillermo A. Cock, pp. 117-138. Museum of Cultural History, University of California, Los Angeles.

A

14 skeletons in 3 superposed groups in defensive ditch near primary entrance to Huaca 1 complex. Group 1, 4 young men with ankles tied, each with 5 to 19 penetrating wounds to ribs and vertebrae. Two sharpened bone fragments in assoc and similar larger elsewhere fit wounds, suggested to be spear or javelin "held in the hand could not have inflicted wounds of such depth." (Some passed through body.) Closely clustered suggest accuracy, multiple fatal wounds suggest victim tied upright. [So sacrifice rather than combat]. Decapitation and other mutilations, left ulnae removed. Group 2 seems to have

x,p

had chests cut open. Insect larvae indicate long exposure before burial (display). High frequency of healed wounds indicates likely prisoners of war. Chimu, after 1100 AD.

Verano, John W.

2001 War and Death in Moche World: Osteological Evidence and Visual Discourse. In Moche Art and Archaeology in Ancient Peru, J. Pillsbury, ed., pp. 110-125. Yale University Press, New Haven.

S

Detailed fine-line designs on pottery show ritualized warfare with clubs leading to capture and sacrifice. "Although individuals occasionally carry longer-range arms such as spear-throwers and slings, these are rarely shown being used against an opponent. This is in clear distinction to Moche deer hunting scenes in which the spear-thrower is the principal weapon used." (112) [reported injuries in article also are club, not projectile]

Verano, John W.

2001 The Physical Evidence of Human Sacrifice in Ancient Peru. In Ritual Sacrifice in Ancient Peru, edited by Elizabeth P. Benson and Anita G. Cook, pp. 165-184. Austin, University of Texas Press.

Inca et al female sacrifice by strangulation. Problems identifying sacrifices. Pacatnamu mutilated bodies (late) with earlier injury like parry fractures indicate sacrificed warriors. Bourget's Huaca de la Luna (Moche) repeated multiple victim sacrifices left exposed in plaza mud after rains all healthy young men, many with healing violent injury as well as perimortem trauma - throat slashing, skull bashing, decapitation + dismemberment, defleshing and possible cannibalism [but no projectile wounds].

Verano, John W.

2008 Communality and Diversity in Moche Human Sacrifice. In The Art and Archaeology of the Moche: An Ancient Andean Society of the Peruvian North Coast. Steve Bourget and Kimberly L. Jones, eds., pp. 195-213. University of Texas Press, Austin.

Plazas 3a and 3c at Huaca de la Luna. Lots of skull fracturing and decapitation, mutilation. P 201-202: 2 sharpened bone frags "similar in size and shape to bone points found in Pacatnamu mass burial and may represent the tips of atlatl darts. In M iconography, atlatls are weapon of choice in deer hunting, but rarely shown being used against human targets in combat scenes." Darts with barbed pts shown as part of weapons bundles and isolated elements in combat scenes" One individual, and isolated sternum with square puncture wounds may be from dart. Photo of bone point [but it is just a sharpened splinter, not square, not at all like barbed pts depicted, which I expect were copper.]

Verneau, R., and P. Rivet

1912 Ethnographie Ancienne de L'Équateur. In Arc de Meridien Equatorial 6(1):193-

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205. Paris.

[In French. "Ancient Ethnography of Ecuador." selected pages only xeroxed]. p 194 Spear thrower hooks. Figure 48 of a fancy atlatl of Peruvian type but with only one hook, stone, google-eyed bird form, [not clear whether it is the grip or the hook]. Fig 49 another, this with both hooks, cast metal birds, from Sigsig.

Veronese, Keith

2012 The Mayans' Deadly Wooden Gun. IO9.com webpage, URL: http://io9.com/5897768/the-mayans-deadly-wooden-gun accessed 9/2/2012

hul'che - "wooden shaft with burr at the end" "additional leverage gained from an overhand motion" "Due to the skill-based aspect, both Mayan men and women used the hul'che for hunting." "can fling darts over 250m, velocity over 150 m per sec." Similar to Aztec atlatl. [Weak article. 150 m/s = more than 300 mph - impossible. Where is the info about male/female from? Photos of P Chauvaux Up Pal spearthrowers]

Viegas, Jennifer

2000 Aboriginal Olympics: From Boomerangs to Woomeras. *Discovery Channel News* Sept 28, 2000. Accessed on web http://www.discovery.com/news/features

Aboriginal athletic "sports carnivals" include boomerang and woomera (or miru) competition. [Poorly described] but "spearthrowing skills are still highly valued in the aboriginal community." [No location given, but short film clip on web shows men using woomera Central Australia type atlatl with long spear, details not clear. They hold it flat, not sideways, use straight overarm motion at stuffed cloth kangaroo target maybe 20-30 m away. Hard to see, but accuracy doesn't look impressive, and at least one spear can be seen bouncing off target.]

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Vignati, Milciades Alejo

1936 El Uso del Propulsor en el Noroeste Argentino. *Notas del Museo de La Plata* 1(3):349-358.

[In Spanish.] Burial finds contain double hook type atlatls. Hooks differ: *gancho-talon* [heel-hook] propels dart, has *diente* [tooth] in center so base can be solidly attached, while *gancho anterior* is at grip, tooth is at one end. Examples from Museo - including a *gancho-talon* of copper in form of bird head [crude], polished, rectangular x-section, weight 375 gm. [related to Peruvian forms?]

Villa, Paola, Paolo Boscato, Filomena Ranaldo, and Annamaria Ronchitelli x 2009 Stone tools for the hunt: points with impact scars from a Middle Paleolithic site in Southern Italy. *Journal of Archaeological Science* 36:850-859.

Neanderthals hunted everything from large dangerous game to small critters, sometimes

specializing in a particular animal. Wooden spears even earlier. Form, damage, hafting residue, Umm el Tlel point in ass vertebra all show at least some Levallois points were used as spear points. In W Europe, less evidence because: conflation of convergent scrapers with points in Bordes typology and Dibble model of reduction, a few microwear studies showing woodwork and not point use for Mousterian points/convergent scrapers.

Six Mousterian points with impact damage from Oscurusciuto rock shelter [ca 50 kya or more], ungulate faunal remains. [All points are small (<60 mm L) and thick – clunky for hafting, but with bases usually thinned some. Comp to exper and arch impact fractures: burination, spin-off, and stepped scars diagnostic. Also tip crushing on 2 pts. Probably thrusting spears, expers show same kinds of damage as projectile. Low frequency of impact damage (6/59) similar to other sites. TCSA tip cross sectional area and tip penetrating angle falls in range of thrusting spears.

Villotte, Sébastien, and Steven E. Churchill, Olivier J. Dutour, and Dominique Henry-Gambier x

2010 Subsistence activities and the sexual division of labor in the European Upper Paleolithic and Mesolithic: Evidence from upper limb enthesopathies. *Journal of Human Evolution* 59:35-43.

Throwing weapon revolution at end Mid Pal, begin Up Pal – light blades in Aurignacian, spear thrower by Solutrean, bows by late Up Pal. Robust R humeri and asymmetry in Up Pal males reflects habitual throwing; but also some in females. Bony changes at entheses also good markers, examined here, upper limbs of 37 Up Pal and Meso individs. Suggest heightened activity levels in later Up Pal and Meso compared to Gravettian, and suggest divisions of labor early as 4 males show lesions confidently assoc with throwing, while no females do [but that's a very small sample of unknown statistical significance, from diverse specimens.]

x

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Villotte, Sébastien, and Christopher J. Knüsel

2014 "I sing of arms and a man...": medial epicondylosis and the sexual division of labour in prehistoric Europe. *Journal of Archaeological Science* 43:168-174.

HRAF sample and other cross-cultural evidence that men overwhelmingly more likely to perform projectile throwing and percussive activities. Epicondylosis of humerus from hammering, throwing, etc – lateral (tennis elbow) more common than medial (thrower's elbow) except in baseball pitchers. Compare L/M ratios in different populations to see div of labor. Samples [all mixed pops]: Prehistoric = Neo + Meso Europe; Pre-Industrial Historic = medieval and antiquity Europe; Modern = Spitalfields and other Euro early industrial. In all mod + hist, lateral more common for both sides and both sexes. Prehist is different: Right medial favored in male, indicating that males but not females preferentially used throwing motions, one or several strenuous activities linked to R side limb use in males such as slings, woodworking with axe or adze, etc.

Vivian, Brian, Amanda Dow, Janet Blakey and Jason Roe

2011 *The Everblue Springs Site and Early Transitional Bison Kill Sites of the Alberta Foothills 7,200 Years Ago.* Archaeological Society of Alberta Occasional Papers 11.

Three archaeological sites on the outskirts of Calgary, between 7,000 and 8,000 years ago. The Everblue Springs site (EgPn-700), the Gooseberry Kill (EgPn-625) and the Snack Site (egPn-633), all early bison kill sites with an assemblage of large corner notched projectile points, transitional between the early Palaeoindian and the Middle Prehistoric periods. [Atlatl used in the kills, nice reconstruction illustration of hunt by Dow]

von Winning, Hassox1958Notes on Mexican Spear-Throwers. *The Masterkey* 32(3):93-98.

Atlatl representations: Chichen Itza relief, codices, Teotihuacan sherds shown. Two atlatls found at Cuautla, Morelos (Leonard1956), 3-5th C AD, Teotihuacan related. A Patzcuaro atlatl described and figured.

Voosen, Paul x

2013 Under Melting Ice, Climate Change Reveals a New Kind of Archaeology. Chronicle of Higher Education Dec 1, 2013. Online: <u>http://chronicle.com/article/Under-Melting-Ice-Climate/143307/?cid=at&utm_source=at&utm_medium=en</u>

[online version includes photos of C. Lee with 10,400 yr old dart shaft, and 'part of 4300 yo dart shaft from Yukon] Comments on numerous finds but rapid loss as melt continues in isolated sites. Organics allow precise dating, for instance change from atlatl to bow in 50 yrs in Yukon, but stone tools 'a less-reliable indicator of time than researchers had thought.' Total loss of some ice patches as melt to levels not seen for 10,000 yrs.

X

Wagers, Charlie

1992 A Kentucky Atl-Atl. Prehistoric America 26 (2): 6.

Antler hook with "tube bannerstone" or handle of antler. Looted "many yrs ago" from shell mound, no context.

Waggoner, Curtis o 2011 Subject: Organizing an Atlatl Wild Boar Hunt. *The Atlatl* 24(3):15-16.

Looking for participants in good deal on TX hunting ranch.

Wagner, Dawn

2014 Wagners Hunting. The Atlatl 27(3):9.

Photos: DW 'likely first woman hunter in Missouri to bag a rabbit with an atlatl for 2000 yrs or so." Brian Wagner killed button buck on Oct 2. Also got deer in 2012.

Waguespack, Nicole

2011 The Role of Skill in the Production of Folsom Projectile Points. Paper presented at Multidisciplinary Scientific Approaches to the Study of Stone-Age Weaponry, Mainz, 19-22 September 2011.

S

"Manufacture of Folsom projectile points is notoriously difficult - high level of skill and risk of failure. Among foragers, craft specialization tends to emphasize the productive abilities of specific individuals and groups operating under specific technological constraints." Sports model – when game is easy, all play, when tough, only play best players. Likewise, in Folsom sites, when raw material is scarce, only best knappers make points, when plentiful, more knappers.

Waguespack, Nicole M., Todd Surovell, Allen Denoyer, Alice Dallow, Adam Savage, Jamie Hyneman, and Dan Tapster o

2009 Making a Point: Wood- versus Stone-Tipped Projectiles. *Antiquity* 83(321): 786-800.

Stone points widely used - must be advantageous. But also costly - cites experiments showing high breakage rates in use. Wooden tipped arrows very common ethnographically, even for large game or war, so must be effective.

Experiment - 6 wood tip, 6 stone tip modern cedar arrows (the stone tipped arrows would have been a bit heavier, but statistical tests say no correlation between mass and penetration [which there should be]) fired from fixed modern "compound" bow at ballistic gel target with/without hide cover, to test penetration and accuracy, at distance of 16.75 m. Stone penetrated 9-10% better, but all penetrated more than 200 mm. Accuracy virtually identical. So is slight stone tip penetration advantage significant? Ethnog shows most assoc with large game, so maybe. [and maybe penetrates bone better.] And also better medium for symbolic/identity signalling.

Walde, Dale

2013 The Bow and Cultural Complexity of the Canadian Plains. *Evolutionary Anthropology* 22(3):139-144.

Timing suggests often long co-use, so functionality not reason for change, recent research suggests no clear functional superiority of bow [but cites old stuff]. On C Plains, knowledge and low-frequency use of bow preceded wide use by 1500 yrs. Arrow pts (Thomas, Shott functions) as early as 3900 rcybp or earlier. Earlist dates for exclusive arrowhead assemblages 1700-1800 BP, Avonlea pts, Gull Lake etc sites.

Atlatl replaced by bow ca 500 yrs after communal bison hunting facilities, semisedentary tribally organized groups, appearance of Besant (dart pts) culture, and expansion of related Sonota mound-building culture. Increasingly intruded on cultures using Avonlea arrow pts after 2000 yrs ago, similar subsistence, probable conflict. Besant did not adopt bow so not just better. Avonlea pts superior knapping - may underlie rapid spread. Suggests pan-tribal point-making sodalities controlling skilled production. Increased social complexity, bow > improved military capabilities for subsistence competition, Avonlea users replaced Besant pt users. Bow and Avonlea pt = symbolic device unifying previously independent groups against intruding Besant groups, but low pop density kept process slow.

Walde, Dale

2014 Concerning the atlatl and the bow: further observations regarding arrow and dart points in the archaeological record. *American Antiquity* 79(1):156-161.

Hildebrandt and King (2012) dart-arrow index (neck width + thickness, because they change less thru damage than other measures). Tried in context of Saskatchewan – Avonlea pts universally accepted as first arrows, and exclusively arrows, introduced ca 0 AD. But neck width alone often exceeds 11.8 mm boundary. H+K based on distributions in unknown population of prehist specimens, and would imply atlatl survived until contact, but no oral hist or ethnog records of such. Test 310 pts from 3 sites, Besant (dart) vs Avonlea (arrow); dates of both similar ca 0-500 AD. Shott equations give slight overlap. Plot of neck W vs max T gives likewise 2 slightly overlapping but distinct clusters, but strong correlation of the two variables. H+K neck width suggests almost all darts, as does max T, but both are bimodally distributed. Similarly, Dyck and Morlan (1995) at Sjovold site using Shott suggest use of bow along with established atlatl technology began ca 3600 BP, continued to 1860 BP. H+K doesn't work well for Canadian Plain. Atlatl + bow apparently co-existed for almost 2000 yrs there. If bow manifestly better than atlatl, that would not be the case.

Walker, Edwin F.

1943 A Real Mexican Atlatl. The Masterkey 17(3):91-94.

A

SW Museum acquired Tarascan atlatl from Lake Patzcuaro through D.B. Cordry ethnographer. "Duck hunt is rapidly dying out.." With 10 foot cane spear w 3 iron barbs. "Doubles" the distance of hand throw with same spear, because of added leverage. Silent, one-handed, penetration of dense duck feathers. Atlatl 22 5/8" long 3/4" T. Weights or boatstones might impart greater force. Here small projection at distal end is weight, gives balance [he means the spear recovery hook that these atlatls all have, negligible weight.]

Walker, Phillip L.

X

2001 A Bioarchaeological Perspective on the History of Violence. *Annual Review of Anthropology* 30: 573-596.

Countering the view that prehistoric and non-western societies lacked significant violence requires bioarch evidence: "several flint arrow points embedded in a person's spine are not symbolic constructs." Technical and definitional problems of recognizing and interpreting skeletal injury. Modern trauma data for interp and demographic modeling. Modern assault as examples of culturally conditioned patterns – eg facial damage relates

to rise of boxing sport, Brits favor broken drinking glasses, etc. Only 16% of US assault injury results in bone damage. Early cannibalism evidence. Atlatl injury – Kennewick, up to 20% of some TN Archaic pops have embedded pts. Bow might have created short-term disequilibrium and added warfare.

Walker, Robert, Kim Hill, Hillard Kaplan, and Garnett McMillan x

2002 Age-dependency in Hunting Ability among the Ache of Eastern Paraguay. *Journal of Human Evolution* 42:639-657.

Ethnographic hunting abilities peak in 30s and 40s - peak performance occurs after physical peak. Arrow shooting contests - 25 cm target in tree 8.8 m distant for youth + women, 14.3 for men. Hits 2/344 women, 0/70 youth, 81/1934 for men. A few men up to 12% accuracy, improving up to age 40 then leveling off. Similar for hunting success -From age at highest strength (24) to age at peak return rate (40), return rate doubles.. Teenage boys hunt easy animals, are given bows, but only late 20s become full independent hunters, hunt monkeys (most difficult). Hunting accidents and lost arrows common, espec for young hunters. Skill more important than strength in success. Journals kept for 11 men age 14-37 (reservation born, with little experience) for 13.5 months, showed little improvement. Takes ca 30 yrs for hunters to reach their prime, from 12-15 to 35-40. Selective forces thus favor long development in humans.

Waller, Jonathan, and John Waller

2010 The personal carriage of arrows from Hastings to the Mary Rose. Arms and Armour 7(2):155-177.

Documentary, pictorial, and fragmentary material evidence of quivers, girdles (belts), knots, and other. Arrows issued in sheafs of 24, standardized size, heads, bowstrings etc. [Relevance to atlatls: we need to consider how darts would be carried, how many, extra foreshafts, etc.]

Walsh, G. L. and M. J. Morwood

1999 Spear and Spearthrower Evolution in the Kimberley Region, N. W. Australia: Evidence from Rock Art. *Archaeology in Oceania* 34: 45-58.

Rock art can provide technol sequence at better chronol resolution than arch. Oldest arch spears in Aust from Wyrie Swamp, S Aust, 'simple short spr + barbed javelin frag' dated 10,200 – 8,990 BP.' (Luebbers 1975). Kimberley rock art spans 40,000 yrs, lots human figures, visual specificity, four periods. 1) Irregular Infill Animal Period: rare, simple line spears, impaled women. 2) Bradshaw Period: Lots humans, mostly male, boomerangs common, sprs rare, no throwers early. Later more common, multi-barbed, thrower appears at end, shown as short hooked line assoc w barbed spr. 3) Clothes Peg Figure Period: Static style humans impaled by multi-barb sprs and hit by boomerangs. Throwers get longer, add spatulate handle still found on Kimberley spr throwers. [Shown as straight line with prominent hook and blob on end.] Long spr some shown hooked on thrower.

X

x.pdf
Sprs shown w red barbed head, white shaft = composite spear. 4) Clawed Hand Period: Add "spade handle" thrower [shown as looped end] and stone spr pts. Arch evid shows stone pts intro 5-3000 BP. Transition in Holocene to Wandjina Period.

Ethnog: Used until 1980s, long 'nungaroo' for war, short form 'yungari' for hunt, all N. Australia type, 70-150 cm long. Sprs composite, reed/bamboo shaft, hardwood foreshaft, stone, glass or metal point, also wooden barbed heads. Late glass pts considered "one shot" and more for fighting. Metal "shovel-nosed" pts made from shovels or other scrap replaced stone around 1930s as response to killing horse + cow. By 1970s few knew how to knap glass.

Earliest paintings Kimberley and Arnhem Land show hand sprs and bmrngs. Light wt composite sprs seem to follow appearance of thrower, stn pts even later.

Bradshaw dates suggest predate Last Glacial Maximum, [ca 16- 20,000 BP] so spr thrower unexpectedly early [but implies that this dating uncertain and controversial]. Arnhem Land has more diverse thrower paintings.

Wang, Regina

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2010 Atlatl Makes Debut for Missouri Deer Season. *Columbia Missourian* Sept 28, 2010. Electronic version, accessed Sept 28,2010, URL: http://www.columbiamissourian.com/stories/2010/09/28/atlatl-fall-season-hunting-legal-missouri/print/

Good photo and focus on Justin Garnett, quotes also R Mertz, J Whittaker, R Madden, and Tom Draper of MO Conservation Dept: Atlatl legalized for trial deer hunt season during rifle season - but could expand if there is demand. PA, WI, and NY tried to legalize, failed; AL legal since 1996.

Wang, Regina

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2010 The Atlatl's First Season in Missouri Comes to a Close. *Columbia Missourian* December 17, 2010. Electronic version, accessed February 7, 2011, URL: http://www.columbiamissourian.com/stories/2010/12/17/hunting-deer-atlatl-many-say-it-was-learning-experience/

No one got one. Problems with gun season. Eric Smith, J Garnett, R Madden quoted. Comments: one negative - not accurate, will wound. Responses from JG and D Pettigrew.

s, L

Warner, W. Lloyd

1958 *A Black Civilization: A Study of an Australian Tribe, revised ed.* Harper and Row Publishers, New York.

Fieldwork 1926-29, orig pub 1934. Murngin group of tribes, pop ca 3000, NE Australia, Arnhem Land, the peninsula NW of Groote Eylandt. Women produce most of food, but men hunt, which is more prized. [Vague mentions of spears apparently mostly used with thrower] for hunting emu and kangaroo, fishing, and harpooning turtles. Apparently lots variation in spears. P. 139-140: "A spear-thrower (mangel) is made by 1) cutting down

with a stone axe a branch or small tree, 2) splitting it with a stone axe and scraping it with a bivalve shell, 3) carving it into correct shape, and hafting with 4) fiber, 5) string, and 6) resin. 1) The mere act of cutting the tree down with a stone axe connects the spearthrower with an elaborate stone technique and system of trade. 2) Scraping with the bivalve shell connects the mangel with the sexual division of labor, for women gather the shells, this not being considered man's work. 3) Hafting it with resin takes in the whole process of preparing the sap of a tree and forming it into cement. 5) Hafting with fiber string brings in the process of using a digging stick to pull up the roots, breaking and cutting them up, soaking them in water and drying by a fire before a woman twists them into string. The spear-thrower presupposes a spear. If a stone spear is used, then the spear-thrower connects with the stone technique, the fiber string making, with the use of fire to straighten a shaft, etc." [His point being interconnection of all technology - the spear thrower and manner of use are never described]. 142: Spear thrower used as wedge to strip bark from ti tree. Ironwood tree root sap used to haft wooden spear points and atlatl hooks, beeswax to haft stone spear points. Warfare important, reduces young men and allows polygyny. Ests 200 deaths last 20 yrs. 152: When a man is killed, his soul approaches the killer and can be heard because the shaft of the spear which hangs from the stone head within him drags on the ground. The killer ritually allows the soul to enter him and gains strength from it. 156: Several levels of formal violence, using spearthrower, stone headed spr, club, stone knife, stone axe. No shields, ward off spears with thrower. Recognized fight types include brawls within camps, night attack surrounding

another camp (usually to kill particular person), *gaingar* arranged set battle (only 2 in last 20 yrs but killed 29); *makarata* ceremonial peacekeeping fight (throw spears at each other but try not to kill, vent feelings by insult, injured group spears killer in leg to signify revenge is over). Poor quality plates show elab wooden spr heads, 6 spr throwers. Four are typical Groote E types (mangels) other 2 are narrower, one with tasseled handle. P. 142 "The Murngin go to the interior for their spear heads and stone knives, or obtain them in trade."

P 166-179 lengthy account of a recent feud: Darlwongo and Warumeri clans compete for women of Djapu group, W man killed, D gets woman but also feud. There follows a series of killings by treachery and sneak attack, revenge, and *makarata*, in which occasional details of spear use. Man carries a 'big red stone spear' [meaning a particular weapon is recognized, or a favorite, or just a story detail]. Bones of a killed man cleaned, spear head that killed him kept, serves later as provocation/reminder. They are using stone or metal headed spears, also take (metal) head off and use to stab.

Watkins, Joe x

2000 Tribalizing Public Archaeology. Paper presented at the 99th Annual Meeting, American Anthropological Association, San Francisco. Session on Public Archaeology: International Perspectives, Debate, and Critique. URL <u>http://www.p-j.net/pjeppson/AAA2000/Papers/Watkins.htm</u> accessed 9/13/2006

Uses Kwaday Dan Sinchi find as example of good relations between "respectful" archaeologists and tribes who want scientific info. [But like many of these sunny views

of why tribes should control archaeology, this example is not honest: little info was actually produced or released, see Beattie et al. 2000, Richards et al. 2007, and the find was ritually destroyed by the tribes].

Watt, Steve

1994 Southeastern Rivercane Arrow Notes. *Bulletin of Primitive Technology*. 7(1):59-61

Cane arrow shaft making.

Weathermon, Rick L.

elec

2011 Late Archaic Hunter-Gatherer Perishable Technologies in the Black Hills: An Investigation of the Crystal Cave Location and Its Culturally Modified Wood. PhD diss. Dept of Anthropology, University of Wyoming.

[Overall, very useful, lots of data on dart shafts, evidence of manufacture techniques and repairs, but practical knowledge of atlatts is limited, and he failed to find WAA and much other recent info.]

Background: interested in hunting tool forms and chronology, usually obtained from stone points, but traps and shafts preserved here - analysis of Crystal Cave (South Dakota), and roughly contemporary Spring Creek + Daugherty Caves (Wyoming) Frison material, some comparative Great Basin material. NW Plains/Black Hills Late Archaic 3500-1500 BP (uncal) probably several cultural groups. P 27 bison kill sites with atlatl dart pts, Pelican Lake (corner notched) and Besant (low shallow side-notches) styles. At CC, called PLake, but preforms are basal-notched, then lateral retouch reduces sides until they appear corner-notched. [This doesn't work. From photos, I don't see why the basalnotched are called preforms. The notch angle is different, and can't be changed by further working.]

Research oriented to: cultural affiliation, resource orientation toward B Hills or from outside. So from wood artifacts: ID/sources, harvest age and seasonality, wood use and technology. Atlatl darts - technology, manuf or maintenance in cave, metric attributes to assess effectiveness.

Avocationals Nonast and Miller did salvage of looted areas in 1960s. Excav 2003-2005, single component L Archaic, organic remains + diagnostic points. Very detailed chapters on geology + sediment info, climate + climatic history, biogeography and woody plants, packrat middens and mountain sheep habitat, wood structure and identification, silviculture and plant manipulation.

P 162 - 102 wooden artifacts, 43 ID to at least genus, mostly willow and wild cherry. Chap 5, Prehist Woodworking: from all sites, 208 dart frags (189 Plains, 19 Gt Basin) 5 fire drill tips, 47 split+notched sticks (deadfall parts), 100 misc worked wood pcs.Woodworking techniques listed + IDd. Green wood easier to work but harder to control shaping. Ochre helps prevent degradation through exposure (203). Standardized methods used in CC replicated by experiment. Saw + snap as dominant technique.

P 194-219: atlatl darts, 59 mainshaft frags from CC, DC, and SCC. Proximal

mainshaft frags - 41 from Plains, 5 from Gt B. Some statistical diffs in measures between Plains and Gt Basin: GB has wider proximal shaft, wider + deeper sockets. Prox (socket) diameter 5-10 mm [pretty small]. Prox shafts planed to remove bark and reduce diameter, sometimes sinew wrapped, some burnished + with ochre. 59% intentionally cut off, others burned or broken. Rim of socket shows use-wear, often all around, indicating dart not used in consistent orientation [that's hard to imagine, given biased flex of all darts - his good photos do show diffs in wear, but high wear all around may actually be intentional finish]. 8 prox shafts from CC, 4 were willow.

Distal mainshafts with deep drilled socket (14 Plains, 5 Gt B), no metrical diffs, 10-18 mm diam. A number intentionally cut off, probably shaft rejuvenation after damage to socket. At CC, 6 distal shafts, hazel and Phragmites.

Three mainshaft repairs or joints, (CC2, SPC1) with bi-pointed wooden insert into opposed sockets. One CC specimen *Phragmites* + chokecherry + willow, with resin mastic in socket.

Shaft frags up to 510 mm, regular taper. Shorter pieces less regular, probably from repeated maintenance. Assuming constant taper, shaft was 135-155 cm long, estimated weights 47-76 grams.

Foreshafts - 134 frags, 6 complete, 3 w stone points. 96 prox frags, tapered by whittling, scraping or abrasion. 40% taper down from socket to point. No statistical diffs between Plains and Gt B. Some show heavy impact battering [really heavy in some cases - multiple uses against hard target, presumably indicates practice throwing since they are too damaged for hunting use. He suggests use of shaft + battered fore as walking stick -NOT a good or likely use for an atlatl dart. They are splintered into a broom, also not walking stick wear, maybe even hammered into something - fig 5.21]. 10 of 19 from CC tested for wood ID: 1 serviceberry, 9 Prunus, probably chokecherry. 36 "distal spatulate" foreshafts - narrowed, then left wider at distal to hold stone point. These only from Plains CC, SCC, DC, not from Gt B. Opposed cut to remove tenon to form slot for point, often burnished, with ochre. Often sinew wrapped [or to hold point] and split from impact driving back point. From CC, 4 examples, one willow, one Prunus. Three complete from Spring Creek Cave - two with stone pts - longest is 149 mm long with 32 mm long stone point [illustrations also in Frison]. Others 78, 57 mm long. Estimated lengths for others 220-336 mm, weight if Prunus ca 12 grams, add stone point av. 6.5 grams + sinew = ca 18-19 gm at 300 mm long.

Figures - 5.12: distal mainshafts - DC rasped and sinew wrapped, CC sinew wrapped, but splintered with foreshaft fragment jammed in so tightly that the mainshaft was cut off in order to renew it. Measurement details given in tables.

Conclusions (296 -). Discusses theoretical concepts, maintainability vs reliability. "The compound dart, with its detachable foreshaft, isolates breakage into several different segments that can be replaced or refurbished individually, without taking the entire dart out of the system (312)." So atlatl works as both maintainable, for encounter hunting, unpredictable, and reliable, with redundant replaceable parts possible for mass specialized hunting. Seasonality of wood and size suggests non-growth season, possible manipulation of trees, and evidence of maintenance in sites like CC.

Reworking of stone points: "If the atlatl and compound darts are considered a balanced system, changes to one part of the system would require changes in others. This is especially true of the darts. If all of the darts were matched to a particular atlatl (see Frison 2004:209-214) and were originally within a set of required parameters, even small changes in length and/or weight would affect the performance of that dart when compared to the unchanged darts. Darts comprised of two or more segments, as in a mainshaft and a separate foreshaft, together with the projectile points, would likely have required interchangeability between all the different components." [This overestimates the effects of dart component variability - a fairly wide range gives similar results.] No evidence of fletching from these sites; balance point of 32-48% from proximal end reported by Hughes and Cundy likely needed. Using previous estimates of weight + length, model dart would be 174 cm, weight 65.6 gm, balance would be 46% from prox end. If rework broken pt + foreshaft by 15.5 cm and -8 grams, shifts balance, need to remove 7 cm of prox mainshaft to return to same balance. [Series of interesting calculations, and a good argument for looking at repair and discarded parts. The other thing affected by changing length is the flex.] Reworking a point is one way to maximize weight change without losing length.

Spring Creek C atlatl ca 48.3 cm L, wt ca. 16 gm. Atlatl and dart should be matched, consistent proportions of specimens suggest 1:3 to 1:4 length and weight. "Ratio of the reconstructed dart to the reconstructed atlatl from Spring Creek is 1:3.98." Recovered darts often reworked, lower ratios may be for discarded reworked darts, or darts to use with shorter atlatls that were not found.

Three hook types: male (above ungrooved board), female (groove with level hook), mixed (groove with hook above it). Male just wears interior of socket, others edges, as in these darts; SCC atlatl is "female." [Misused terminology, and it's not that simple.]

(307) Experimental info: arrow flight comparable, but not "archer's paradox" - arrow flexes side to side, dart up and down. Experimental dart speeds range from 19 to 20 meters per second (Van Buren 1974, Raymond 1986) to 65 meters per second (Hutchings and Brüchert 1997). Hand thrown spears and javelins have recorded speeds 13.7 and 25.5 mps (Hughes 1998:352), so atlatl must do significantly better to be efficient. Velocity affects impact energy: Hutchings + Bruchert 222 gram dart thrown 43.2 mps = 152.75 foot pounds of kinetic energy - heavy atlatl dart delivers more force than even modern bow. [But I doubt the velocity claimed by H+B]. Model Plains atlatl and dart (65.6 gram dart), 25 meters per second, = 15.12 foot pounds of energy. Same dart 50 meters per second = 60.48 foot pounds. Speed doubled, impact energy increased four fold. Weight of the dart doubled to 131.2 grams, speed held at 25 mps, the impact energy = 30.24, doubled. Increasing the speed of the projectile is more efficient increasing energy than increasing the weight of the projectile and maintaining or losing velocity. Bow has set velocity, but atlatl thrower can vary power of throw [only some - I don't think he has much practical experience.]

Expense of manuf and frequent breakage make atlatl inefficient for small game. Atlatl delivers within modern recommended foot pounds for even large game (311). Atlatl + dart may encode social, ethnic identity info. Experiment (313) springy dart on floor jumped sideways, fixed and flexed atlatl propelled 50 gram arrow 5.5 m, so atlatl flex could add force. Flex of dart or atlatl may reduce likelihood of breakage.

Manufacture of Plains darts: no mastic to haft point, sinew only. Point neck width greater than spatulate foreshaft width. Spatulate foreshaft head gives added support, point notches are weak point. Foreshaft unlikely to detach when hitting target, requires force. Wound depth needed for different animals calculated. Higher mass and thicker stone point make atlatl more likely to penetrate ribs than arrow. Stone point cuts larger wound than wood. [He makes elaborate calculations, which might be useful for comparison of projectiles. But you can't tell whether he has any actual hunting or experimental experience.]

Caves lack the discarded tenons indicating foreshaft notching, probably more used for maintenance and repair (330).

Faunal remains in CC include bison, mt sheep, deer, duck, small mammals.

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Weaver, Muriel Porter

1981 The Aztecs, Maya, and their Predecessors, 2nd ed. Academic Press, New York.

fig. 4h small drawing of Brit Mus atlatl

p. 215 at Teotihuacan, Late Classic, armed dieties and priests, shields, spears, atlatls appear in murals for first time. p 216 Classic no longer seen as peaceful; trend to warfare in art, with weapons including sling + atlatl, bow after AD 500, but no mural scenes of battle

p 235, photo 35 - Mural painting Cacaxtla, Tlaxcala - victorious men in jaguar costumes with atlatl + dart raised, defeated Maya men in bird costumes, Teotihuacan like Owl overlooks battle, reflects central Mex/Maya relations.

p 286-7 Stormy Sky stela and burial at Tikal, Mexican influence on Maya; plate 10d drawings of Stela 31, Tikal, showing Stormy Sky flanked by 2 warriors with atlatls + shields [no darts]

p 407: mid 13th C Mayapan became capital of Yucatan. Itzá lineage name of Cocom with Mexican mercenaries from Tabasco seized control. Mercenaries intro'd bow and arrow into Yucatan.

Webb, Alf

1999 Prehistoric Archery – Some Considerations. *Experiment in Archaeology*_No. 1: 6-9. Newsletter for Experimental Archaeology, Lydney, Gloucestershire, UK.

Mesolithic bows of two types: stick bow, bends in complete arc, breaks at grip; handle reinforced bow, bends in restricted arc, breaks at end of limbs. Both found archaeologically in Mesolithic. Tend to have archaeological finds of heavy bows from wet lowlands sites, light arrows from upland sites – they should not go together.

Webb, Alf

1999 The Design, Dimensions, and Weight of Spear-Throwers and Spears. *Experiment in Archaeology* No. 1: 30-32. Newsletter for Experimental Archaeology, Lydney, Gloucestershire, UK.

Experimented with French Paleolithic and Inuit forms. Double the throwing distance of hand throw. Suggests 3:1 ratio of spear length to atlatl length. [He had information from Musee de Malgre Tout 1994, nothing new].

Webb, S. David

1996 Museum Receives Ancient Spearthrowers. Aucilla River Times 9(1). Aucilla River Prehistory Project, accessed 10/12/06, URL: http://www.flmnh.ufl.edu/natsci/vertpaleo/aucilla9 1/spearthrowers.htm.

Two antler hooks from Santa Fe river donated by amateurs. White-tail deer, possibly Paleoindian, submitted for C14 dates. Photo of one, drawing of Key Marco atlatl, and of atlatl in use [dart not flexing].

Webb, Stephen

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1995 Palaeopathology of Aboriginal Australians: Health and Disease Across a Hunter-Gatherer Continent. Cambridge University Press, Cambridge.

Willandra Lakes hominids: WLH3 in dune sands, 28-32,000 years old, extended burial with ochre, M, >50 yr old. Very severe osteoarthritic involvement of all bones of R elbow - major loss of function. P 47: "Regular and continuous loading of the elbow joint associated with spear thrower activity produces a distinctive set of degenerative features which together have been termed "atlatl elbow" (Angel 1966:3). These include erosion of the capitulum which, together with the head of the radius, undergoes a double stress action when the spear thrower is used. It is precisely these parts of the bone that have been affected in WLH3, together with the head of the ulna which bears the most stress during rotation. Moreover, the large exostosis formed at the origin of the lower arm. It has been suggested that certain types of degenerative features around the shoulder joint help define osteoarthritis caused by using a spear thrower (Angel 1966; Ortner 1968)." But shoulder is missing in WLH3 [and apparently L arm?]. Other causes possible, this one is uncommonly extreme. Possible evidence of infection. [Right, no reason to blame this on atlatl].

P 165 survey of osteoarthritis: "basic pattern among Abo groups ... affected males more than females, elbows more than knees... The most affected parts are left knee and right elbow, the latter not surprising given predominance of right handedness." [In other words, altho atlatl used all over, he doesn't blame it for common R elbow problems - which makes sense given all the other activities that might affect them].

Webb, William S.

1946 Indian Knoll, Site Oh 2, Ohio County, Kentucky. *University of Kentucky Reports in Anthropology and Archaeology* Vol. IV, No. 3, part 1:115-365. Reprinted 2006 as *Atlatls and Bannerstones: Excavations at Indian Knoll*, by Gustav's Library Reprints, Davenport, IA.

Classic report of Archaic shell mound. Webb excavated partly to deal with problem of atlatl parts.

Many burials (male, female, and children) with atlatls or parts. Compound atlatl: antler handle + hook, stone or shell weight on wooden shaft. Found in alignment in burials, some intentionally broken before deposition. Bodies with points in them common, also mutilation, other evidence of violence. [Many photos of both the artifacts, and of burials with atlatl parts in situ. However, although some show hook and handle or hook and weight in alignment, most were displaced by decay of body, or were broken and placed side-by-side in grave. None of the photos is clear enough to provide the completely convincing clincher evidence of a complete atlatl with all parts in position, so skeptics can still argue that bannerstones might not be atlatl weights, although I think the pretty plainly are.]

Webb, William S.

1950 The Read Shell Midden: Site 10, Butler County, Kentucky. University of Kentucky Reports in Anthropology 7(5):358-401.

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Shell mound on Green River. Plowed, planted, exploited by stupid locals for shell for chickens [!]. 247 burials recorded. B66, young adult M with 3 conch gorgets, broken atlatl weight, flint + bone artifacts. B 94 y adult M with shell necklace, antler hook + stone weight in alignment under L leg. Several others with atlatl weight or wt and hook, one with wt, hk, and handle, several burials with points in body or points in grave. Weights mostly prismoidal stone, some shale bar.

The Atlatl Complex = antler hook, antler handle, perforated prismoidal stones + flat stone bars, in 13 graves. Sometimes in alignment, sometimes broken before burial, under or over body, different places, usually not all parts - e.g. 5 wts without other parts here. Three geniculate (L-shaped, knee-shaped) bannerstones, not in graves, but broken. Most grave bs are intentionally broken, but there are also repaired examples. Points are large stemmed or corner notched forms with convex edges.

Atlatl Mechanics - like bat and ball, atlatl changes momentum of projectile. Weight moves center of percussion (most efficient place to strike or propel from) closer to hook. If shaft is elastic, it stores energy to be transferred to the projectile. On Basketmaker atlatl, hook is not at extreme end. Archaic antler hooks are, so they need even larger weight, close as possible to the hook. In some late forms, the hook is formed on the stone weight; the geniculate form allows part of the weight to extend under the hook. Their elliptical perforation prevents rotation on shaft. [None of this is correct; his reconstruction with the weight out by the hook is enormously inefficient - neither the weight nor the flex transfers force to the dart in a lever system].

Webb, William S.

1957 The Development of the Spearthrower. *University of Kentucky Occasional Papers in Anthropology* No. 2. Reprinted 1981, Program for Cultural Resource Assessment, Department of Anthropology, University of Kentucky.

Reviews world atlatl types: most forms rigid, they increase length of arm. Paleolithic "weighted" forms (large carving with hook) are as inflexible as straight "unweighted" ones, so no advantage.

Atlatl's importance in Archaic explains why is treated ceremonially in burials, but weights are not "bannerstones". "Enormous" numbers of fakes made 1890-1930 and on. Changes from 4000-1500 BC led to greater efficiency.

Archaic and Basketmaker atlatls are "elastic devices for transferring momentum to projectile". P27: "the action of an elastic atlatl in casting a spear, and the action of a bat striking a ball are dynamically equivalent operations. ... During most 2 of the sweeping forward action of the arm, the spear is gaining momentum, but at the same time the shaft of the atlatl is being heavily flexed transversely, i.e., at right angles to the length of the shaft and is thus acquiring potential energy. ... When the arm has completed its swing, the hand holds firmly the grip of the atlatl shaft and at once the atlatl shaft begins its recovery, thus giving an added impulse to the projectile, quite comparable to the action of a bat on a ball. As has been shown, this additional impulse is most efficiently transmitted, that is, gives the projectiles the largest increment of velocity, when the projectile is seated at the 'center of percussion of the atlatl.' This is another way of saying that atlatl weights of convenient size should be so attached to the shaft as to bring the center of percussion of the hook as possible."

Atlatl physics compared to pendulum or bat and ball - weight brings "center of percussion" (mass for most effective transfer of energy) as close to hook as possible. [Webb seems to consider length or flex of spear irrelevant. No mention anywhere of him experimenting with actual atlatls, and the weight as he reconstructs it at end of atlatl near hook is very inefficient – his center of percussion idea makes no sense – an atlatl is not a club, and more weight on the end does not transfer force to the dart. He feels a rigid atlatl works only by lengthening the lever arm, but a flexible one is better –allows "transfer of momentum" an idea that leads him to put the weight at the end, when really the atlatl increases velocity, which is different.]

Associations in Archaic graves indicate atlatl shaft some 25", with hook and handle >30", weights indicate flexible atlatl.

Antler handles flare for good grip necessary as transfers force to spear.

Earliest shell midden levels have only bone points, assume all-wood atlatl.

Basketmaker atlatl weight 56 grams near middle, loops for grip.

Archaic: Bar weights earliest, most through time, often in graves with no other atlatl parts (= wooden atlatl). Four examples L = 9-13 cm, Wt = 65-87 gm.

Later add antler hook, several types and attachments, some too long for efficiency - remove hook too far from center of percussion.

Then drilled prismatic weights to go with short antler hook. Temporal order: straight sided, constricted centers, expanded centers, shell section weights, butterfly winged

forms.

Indian Knoll area center of development, site dates C14 5300+300 B.P.

Later hooks - short conical antler segments with spur on rim, also "geniculate" weights, and prismoidal weight with hook cut in stone - all to get weight + center of percussion as close to hook as possible [My own experiment with Indian Knoll type atlatl with stone weight convinced me that weight near hook was not good - it made motion far too slow. It does provide more counter-balance (see Kinsella) but makes lever less efficient. But others, like Richard Lyons, like the weight out there.]

Prismoidal weights usually 7-8 cm long, 50-85 grams. [Seems too light for size of weights.]

Depth distributions of atlatl parts to indicate chronology at Indian Knoll and Annis Shell Midden sites [but stratigraphy too crude to trust this info].

Complains that "bannerstone" idea from collectors interested in objects, not knowledge, complains about looting and faking back to 1930s and earlier.

Grave associations, parts drilled similarly and in alignment prove weight theory [but he doesn't illustrate any or compare hole diameters of any sets].

Webb, W. S., and W. G. Haag

1939 *The Chiggerville Site: Site 1, Ohio County, Kentucky*. University of Kentucky Reports in Anthropology Vol 4, No. 1. University of Kentucky, Lexington.

Green River shell mound, WPA project, inspired by Webb's interest in Moore's Indian Knoll finds, especially "peculiar hooks made out of deer antler" etc [which are mentioned as problem in very first paragraph.] Of 114 burials, only 1 with stone bar atlatl weight, 1 with shell weight, and 1 with antler hook + bannerstone.

Skeletons (Skarland) poorly preserved, hard to sex. [No info on injuries.]

Pp. 50-59 "The Problem of the Atlatl." Moore finds interpreted as netting gear, but M argues against atlatl theory, and assumption that hooks and bannerstones are related. Willoughby (in Moore) suggests atlatl, Pepper hair ornaments. In both Moore's work and C-ville, assoc with all age + sex classes, = wide use? SW info since 1915 provides better atlatl info. [This, and his work in Alabama mounds, seems to be what convinced Webb, but it is not clear why atlatls became such a focus for him.]

1. Hooks = end of atlatl, wide use pre-bow and pre-pottery. 2. relative rarity = most atlatls made of wood as in SW. 3. Many as in SW had stone weights of bar or bannerstone form. This theory accounts for 1. co-occurrence of hooks + bannerstones, 2. asphaltum in sockets, 3. variety of form (because utilitarian), 4. agrees with SW weighted atlatls before bows 5. wide occurrence of hooks 6. winged bannerstones not work as net sizers 7. many hooks not suitable as net weavers, 8. cultural similarity of SE sites, 9. don't need one-piece atlatl for strength and some hooks both asphalt and lashing for strength [but he hasn't actually tried them] 10. composite shell forms explained 11. new common trait between SW + SE, 13. explains fragments as accidents in midden or sacrifice in burials 13. explains repairs, 14. explains large size of points - better for darts than arrows. Photo of hypothetical reconstructions [so he at least made usable equipment.]

Webster, David

2000 The Not So Peaceful Civilization: A Review of Maya War. *Journal of World Prehistory* 14(1):65-119.

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[Long but unusually readable review]; history of thought, social, political, economic conditions, documentary evidence, fortifications, strategy + tactics. Change thru time, not all should be assumed to follow model of Contact documents. Bow, cotton armor, possibly sling are Post-Classic innovations. Atlatl may be from highland Mexico in 4th C AD. (Schele + Friedel 1990). Archaeological finds of Classic weaponry rare [and little info here]. Both ritual and materialistic interpretations of war apply.

Webster, Gary S.

1980 Recent Data Bearing on the Question of the Origins of the Bow and Arrow in the Great Basin. *American Antiquity* 45(1):63-66.

Conventional date for Fremont introduction of bow and arrow is 1500 BP. Dry Creek Rockshelter stratigraphic info shows Rose Spring/Eastgate [assumed to be] arrowpoints as early as 3300 BP, mixed with atlatl points (Elko, Pinto etc), so bow early, did not immediately supplant atlatl. [Point sizes should be considered only weak evidence, these are probably small variants in a group of related types].

Weder, Dennis G.

1980 Lithic Artifacts and Debitage. In *Cowboy Cave*, Jesse D. Jennings ed., pp. 39-48. University of Utah Anthropological Papers 104.

Sequence of Archaic point forms, distinguish larger old dart points (Gypsum, Elko, N. Side-Notch forms) from later arrow points (Rose Springs, Desert Side-notched, Cottonwood Triangular). Arrow pts incompletely flaked, made on small flakes. Dart pts more intensive flaking, visible use-wear, which implies dart points were more formal tool also used as knife, but with more pressure flaking and equal likelihood of wear to knives as well. p 44: "...the dart pts, with and without wear polish, continued to be used even after the arrow pts appeared in the arch record at CC."

Weidman, Bruce

2015 A New Game in Town: Atlatl Poker. The Atlatl 28(2):12-14.

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Square target, 10, J, Q, K only, with point values.

Weitzel, Celeste, Nora Flegenheimer, Jorge Martínez and Mariano Colombo 2014 Breakage Patterns on Fishtail Projectile Points: Experimental and Archaeological Cases. *Ethnoarchaeology* 6(2):81-103.

Fishtail projectile points (Fell 1), dated 11,000-9,500 14C yr BP in South and Central America, traditionally considered diagnostic of the early peopling of the continent. Experimental observations of impact breakage patterns on fishtail projectile point replicas compared with archaeological points from the Cerro El Sombrero Cima site, in the Argentinian pampas, which exhibit a high breakage ratio and suggest that impact was a major cause of breakage in the assemblage. The position of these fractures is also briefly compared to patterns described by J. Bird (1969) for fishtail projectile points from Ecuador and Southern Chile. FTTP experiments briefly described - local orthoquartzite, atlatl dart, thrusting spears against sheep carcass. 297 shots, one point survived 103 [making it too large a part of the sample] others showed variable survival, often breaking at stem/blade juncture, which is similar to archaeological specimens. Extensive table of fracture type definitions and distributions on specimens. Most of the types of damages known to result from projectile point use were observed, with the exception of impact burination. Considered diagnostic of impact: impact flute, step terminating bending fractures and spin-off fractures. Points on both hand thrown spears and darts broke during use, but darts propelled with the spearthrower exhibited more damage, a combination of fracture types related to impact and a higher frequency of fracture types usually considered diagnostic of impact. The most frequent type of fracture was bending.

Wells, Noel o GRO

2006 *Small Arms of the Spanish Treasure Fleets*. Rock Bottom Publications, Dallas.

NW was conservator for Mel Fisher Treasure Museum. [Useful info, espec photos of recovered arms with pristine ones from collections, but also many errors, and writing not great. Individual artifacts shown rarely have specific provenience info. It would have been better to have many more photos of recovered specimens with details of them and their proveniences].

P ix: Spain did not equip its fleets well, mix of arms from all over, captured and traded. P x: fleets + ships providing material come from discoveries of losses in 1554 (TX), 1622 (FL, Atocha), 1656 (Bahamas, Las Maravillas), 1715 (FL), 1733 (FL Keys) [so a long span].

Mostly info on firearms, swords, etc. Dogs, horses, guns, disease.

Chap 4 'Indian Weapons' info from conquistador sources [but not great, includes exaggerated power of atlatl 'could punch through a conq's armor at a great distance'.] Drawing of 2-hole Cushing atlatl, photos 2 atlatl hooks. Bows, slings [exag assessments of their power too]. Native weapons fired faster, more accurate than Spanish.

Wendorf, Fred s, B

1968 A Nubian Final Paleolithic Graveyard near Jebel Sahaba, Sudan. In *The Prehistory* of *Nubia*, edited by Fred Wendorf, volume 2, pp. 954-995. Southern Methodist

University Press, Dallas.

58 burials, est dates 12,000-10,000 B.C. Many (40%) have stone weapon point fragments embedded in bone or in chest, back, arm, and head regions. These are usually truncated or backed flakes and microliths. Usual type system not useful as many different "types" formed parts of points or barbs. Violence affected males, females, children, often with multiple wounds. Several multiple burials, cut marks on other bodies also suggest. [No evidence or argument about whether bow or atlatl in use. These would be light compound points, suitable for either. At this early date, could be either.] Anderson, J.E. "Late Paleolithic Skeletal Remains from Nubia" pp. 996-1040 in same volume adds that several skeletons have parry fractures of lower arm.

Wenke, Robert J. and Deborah I. Olszewski

2007 Patterns in Prehistory: Humankind's First Three Million Years, 5th ed. Oxford University Press, New York.

[Good general archaeology + human evolution text.] P. 176 fig 4.29 "The atlatl or spearthrower was important new technology in the Upper Paleolithic. John Whittaker demonstrates how an atlatl is used."

Wenmohs, Roy

2007 First Official ISAC in Texas. The Atlatl 20(3):10.

Gradual spread of WAA and ISAC.

"organizers disqualified themselves for disruptive behaviour." [Swearing. A high ethical standard!]

Wenmohs, Roy

2010 Birth of the Texas Atlatl Association. Texas Atlatl 1(1):1.

New group, logo of Pecos R Style petro superposed on TX outline. Bylaws. Feral hogs are legal atlatl game in TX.

Werner, Angela, Andrew Kramer, Crystal Reedy, Michelle R. Bebber, Justin Pargeter, and Metin Eren p

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2018 Experimental assessment of proximal-lateral edge grinding on haft damage using replicated Late Pleistocene (Clovis) stone projectile points. *Archaeological and Anthropological Sciences*, Springer-Verlag online: <u>https://doi.org/10.1007/s12520-017-0594-2</u>

Used ground Clovis-shaped flint blanks, some with dull edges, others with edges flaked sharp. Hafted all same, fired from fixed compound bow into blocks of clay as proxy for meat (10 times each), and then at moose antler, which usually destroyed the point. Velocity measured by chronograph, used velocity around 24 mps to conform with atlatl

experiments by Whittaker et al. Negligible damage to lashing or loosening of point, and what little damage occurred was slight fraying on face lashing, not edges. So edgegrinding may not be to protect lashing during use of point. Need more experiments – knife use instead of shooting, or different lashing, or different mastic. Grinding may allow grip while fluting point in manufacture, or while hafting. [In my experience grinding prevents cutting the lashing when pulling it tight around a point whose edges protrude from the haft.]

Wescott, Daniel J.

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2014 Reconstructing Habitual Activities by Biomechanical Analysis of Long Bones. In *Kennewick Man: The Scientific Investigation of an Ancient American Skeleton*. Owsley, Douglas W., and Richard L. Jantz, eds., pp. 232-248. Texas A&M Press, College Station.

Cross-sectional geometry of bones compared to that of known populations. KM was a relatively large man; ca 173 cm tall (5'9") and 73 kg (150 lbs). Strong bones overall, especially powerful legs, relatively stronger than arms. Legs indicate "intense terrestrial mobility" but stronger femur than tibia suggests maybe in water, or less rugged terrain. Left femur stronger than right, from "ground force reaction supporting his weight during the rapid deceleration following a throw."

Humeri are too asymetrical to indicate rowing. Right handed. Strong humerus and assymetry consistent with spear throwing, atlatl, or throwing stick [and probably lots of other activity – too much of this seems too specific to me, too many opportunities for equifinality, surely even a habituatl atlatlist (like myself) does not stress one leg more than the other enough to show in bone].

Wescott, David

1992 Crashing the Unreachable 500 Foot Barrier. *Bulletin of Primitive Technology* 1(4):76.

Distance records by Wayne Brian: 616'11.5" on record, personal best 664'. Whippy flyrod atlatl, "tuned" with weight, unfletched 50" aluminum dart.

Wescott, David

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1994 An Introduction to the Atlatl. In *Woodsmoke: Collected Writings on Ancient Living Skills*, edited by Richard Jamison and Linda Jamison, pp. 176-189. Menasha Ridge Press, Birmingham, AL.

[OK intro, but too many errors]. He has an interesting concept of different kinds of atlatl systems: "throwing board" = rigid, heavy harpoons; "spear thrower" = some flex, long heavy spears [but atlatls probably don't go back to Neanderthal times]; "flexible system" = SW, flexy light atlatls and darts with weights and other tuning; "casting stick" = baton de commandment and other thong-using throwers and very flexy atlatls [not the same].

[His explanations borrow too much from Perkins' incorrect ideas of flex and "tuning" and his diagram of throwing shows the atlatlist leaning forward and an unflexed dart.]

West, A. L. x

1978 Aboriginal Material Culture: No. 2 On Spearthrowers and Paddle Steamers. *The Victorian Naturalist* 95:88-91.

Variable forms; in Victoria and nearby S Australia and New South Wales a slender form with hook carved out of the wood. [figure shows single piece thrower with rod-like handle expanding to narrow flat blade which tapers distally to large raised integral hook] Specimen acquired 1891, Casuarina wood, 143 gm, 66.3 cm L, 4.3 max W, 1.3 thick. Decorated with incised designs of steamers. Wood + steamers suggest manufacture by Murray R tribes in NW Victoria. Unusual decoration probably from Euro influences.

West, Constance F.

1996 Trail Creek Caves, Seward Peninsula. In *American Beginnings: The Prehistory and Paleoecology of Beringia*. Frederick. H. West ed., pp. 482-484. University of Chicago Press, Chicago.

Alaska. Slotted bone arrow points, assoc w faunal bone dated 9070 ± 250 BP. [drawing shows ca 10-20 cm long, pretty thin, beveled base on one. Would be very early date for bow, could work on atlatl tho small]

West, Robert C.

1948 *Cultural Geography of the Modern Tarascan Area*. Smithsonian Institution Institute of Social Anthropology Publication No. 7. United States Government Printing Office, Washington DC.

[Another old ethnographic survey, see Foster 1948]. Pp. 51-52 Hunting: "Today only duck hunting on Lake Patzcuaro has economic importance," limited to fishermen, 9 varieties of duck. Customarily starts Dia de los Muertos fiestas Oct 31 and Nov 1, when as many as 100 ducks killed by a single hunter. Continues to March when ducks leave. "The p'atamu, or spear propelled with the throwing stick, tsipaki, is still employed by many hunters." Spear has 3 pts, called fisga or k'encheta (figure). Also flintlocks and modern shotguns. Island of Janitzio has most fishers.

Wheat, Joe Ben

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1967 A Paleo-Indian Bison Kill. In *New World Archaeology: Readings from Scientific American*. E.B.Zubrow et al. eds. pp.213-221. San Francisco: WH Freeman and Co. (*Scientific American* January 1967).

[Classic Paleoindian kill site.] Olsen-Chubbuck site, almost 200 bison killed, drive into arroyo, some completely butchered, others partly, a few at bottom untouched. Systematic butchering, leaving piles of sorted parts. Calculations of meat quantity - some 60,000 lbs

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meat, could support 150 people for ca 1 month, depending on assumptions. Cody Complex [Plano] points: Scottsbluff, 1 Eden, Milnesands - demonstrate contemporaneous cultural variation as one type grades into another.

Wheat, Joe Ben

1972 *The Olsen-Chubbuck Site: A Paleo-Indian Bison Kill.* Memoirs of the Society for American Archaeology 26. *American Antiquity* 37(1): part 2.

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[The detailed professional publication of this site.] Here the points are called Firstview (new type) and San Jon after extensive review of "Yuma" aka Cody aka Plano point typology. [His earlier designations are more consistent with modern usage.] [He speaks of "spears" but not of atlatls, not clear how he thinks points were used, but in my opinion, they were certainly on atlatl darts.]

Wheat, Joe Ben

1977 Technology, Typology, and Use Patterns at the Jurgens Site. *The Museum Journal* 17:126-139.

Colorado, Paleoindian Agate Basin and Kersey Complex cultures [No C14 dates cited]. Bison butchering and other animals, base camp, chipping floors. Lithic analysis emphasis.

Kersey points [= Scottsbluff/Eden related]. Finished pt use-life often included break + resharpen. Use-wear shows secondary butchering use, so probably mounted in short foreshafts on atlatl darts.

Two kinds atlatl hooks recovered [illustrated but not described]: 1. cut antler - hollow cylinder with nub for hook on perimeter [like some SE forms], and 2. curved piece of bison molar core, which could be lashed on shaft with curved tip up for hook. [Both plausible, but no details given to confirm.]

Wheat, Joe Ben

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1979 The Jurgens Site. Plains Anthropologist 24 (84 part 2, Memoir 15):1-153.

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As for 1977, but better illustrations, including reconstructed hafting of atlatl hooks, and descriptions. Four specimens of bison molar core form, flattened on bottom, grooved for lash to haft, with naturally conical root converted by grinding + polish into hook. C14 date 9070 + 90 B.C. [sic, uncalibrated, does he mean BP?] on combined charcoal frags, agrees with geological estimates of 9000 BP.

White, Laura Smith

1989 Atlatl Spurs of California: Their Cultural and Technical Implications. Unpublished MA Thesis, San Diego State University Dept of Anthropology.

Probable antiquity > 8000 in Gt Basin. At least 11 atlatls from GB sites outside CA, but only 2 in CA. 1. Potter Creek Cave in Shasta Co - finger notches, u-shaped dorsal groove,

missing spur. Assoc wooden dart shaft C14 AD 50. 2. Yol-13 near Verona, Yolo/Sutter Cos. - 2 finger hole type resembling Tarascan form [no fig] assoc C14 AD 1135-670. Ethnog atlatls in CA: short problematic form from Vancouver exped, 2 Chumash specimens also not native. Dart frags from several sites: Newberry Cave over 1000 wood + cane frags w C14 dates 1110-1600BC to 2120-2480 BC. Boat-shaped stone weights in CA + NV. Large pts = darts, Fenenga suggests > 3.5 grams. Coso Range petroglyphs, over 14000 drawings recorded, some 350 representing atlatls as vertical line with hook at one end, often transecting circle (= possible weight). Figs from Grant, also of Valley of Fire panel, NV.

Spurs [attached hooks] are best evidence of atlatl use in most of CA. Early spur finds considered possible arrowpoints for stunning birds, fetishes etc. Associations with weights (interp as fishline sinkers) at Mayer collection sites, Tulare Co.

1969 R+M recognized function, proposed typol based on specimens from collections: Type I: Snake Head. Central CA Early Horizon, Martin Complex, and Lovelock affinities, made of stone, oldest type based on spur assoc with deposit dates 6250 BC. Engaging head angles upward, with flat or notched stem for attachment. Type II: Acorn. Mostly of bone or antler, a few shell or stone, Central CA Middle Horizon. Type III: large aberrant snake head form or ambiguous

Located 269 specimens in collections. 22 bone examples have traces of asphaltum, 8 decorated with punctate designs, and 4 of these have red ochre. Unsystematic and unprofessional collection doubtless biases sample; no wooden specimens survive, nor atlatls with integral spurs.

Variation reflects different ways of attaching spur to atlatl and elevating the "engaging head" of spur. New Typology of 4 types: 1. Snakeheads. Stem to lash to atlatl. Unkeeled stone only, keeled, stone and bone. Keel (on stem) fits into groove when lashed to atlatl. Some stems drilled, grooved, or curved up. 2. Acorn - thick acorn shaped head, stone or bone, short or long stem. Offset Stem, Central Stem, Grooved. All apparently hafted by setting end of stem into socket on thickened atlatl end (plus lashings). 3. Bossed - like acorn head but stem has raised boss or collar for lashing, sometimes with grooves. 4. Harpoon Thrower Spurs - like acorn head, but very large, ave 10 cm L, all of whale tooth ivory, often flat decorated stem, low head of spur suggests used on grooved atlatl. [Hafted this way, such a large spur would have a very long distal end of atlatl distal to the spur.]

Date info poor, from 29 sites yielding 55 spurs, but not directly on spurs. Reviews all evidence. Type 1 Snakeheads probably earliest type in CA, up to 8000 BP, but acorns also about that old. Acorns most frequent type between 2000 BC and first millennium AD, Snakeheads may have ended 2000 BP but Acorns persisted in Late Prehistoric after 1000 AD. [I don't think the dating info provided supports ANY useful chronological distinctions.]

Distributions also reviewed. Most spurs from central CA and S coast. Biases result from location of past archaeol work. Coast + island use may relate to bird hunting, while absence in N Coast and Desert may relate to low intensity of arch work and salmon subsistence, desert could have used wooden integral spurred atlatls. Type 4 known only from Chumash area, possibly associated with sea mammal hunting.

Lack of spurs after 1000 AD, sudden abundance of stone arrowpoints, prob indicates replacement of atlatl, but evidence not sufficient, possible late survival not documented.

White, Randall

1992 A Spearthrower Fragment from Laugerie-Haut, Commune des Eyzies (Dordogne). In *French Paleolithic Collections in the Logan Museum of Anthropology*, edited by Randall White and L. B. Breitborde, pp. 259-276. *Logan Museum Bulletin* (new series) 1 (2).

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Small hook frag bought 1926 by Pond from Hauser, so provenance unproven. *Faun aux oiseau* form. Antler palm, doubts bird intended. [Also not enough left to tell what if any animal depicted]. Hook polished, wear suggest L handed user [how can you possibly tell?]. Overall polish from binding or use, breaks prob from use.

White, Randall

2006 The Women of Brassempouy: A Century of Research and Interpretation. *Journal of Archaeological Method and Theory* 13(4):251-304.

Excavation history - some criminally bad even for 19th C, but Piette and others with attention to stratigraphy. Cave produced lots of ivory, much worked, some oddly "melted" by humid conditions. Piette focused on female figurines, worried by resemblance to Egyptian art, and interpreted them in light of contemporary fixation on racial categories: steatopygous women related to African origin of Paleolithic ancestors, and especially French fascination with the "Hottentot Venus" Sartje Baartman who was exhibited in Europe and dissected by Cuvier 1816. So the figurines became evidence of two races in Paleolithic: a dominant slender hairless one (famous Dame a la Capuche head with hair or cowl) and conquered primitive steatopygous hairy race (some torso fragments, and La Femme au Renne from Laugerie-Basse), conforming to 19th C colonialist attitudes. Early use of "venus" label referred more to race and Baartman than to later "Venus" fertility interpretations of Up Pal figurines. [At least one piece of ivory, not discussed in detail, a "bouchon a outré" could be a spearthrower hook.]

Whitehead, Ralph H.

1936 The Birdstone and its Probable Use. American Antiquity 2(2): 134-136.

Miscellaneous theories noted: womans headgear, shaman's gear, hunt fetish. Common in lake states, near water, so how about canoe prow ornament? Iroquois/Algonkian? - not in earlier moundbuilder graves. [W.Ritchie in letter next issue correctly dismisses Iroquois idea, says birdstones are earlier.]

Whittaker, John

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1994 *Flintknapping: Making and Understanding Stone Tools.* University of Texas Press: Austin.

Figure 3.18 mediocre illustration of a generic atlatl, dart, and thrower.

Whittaker, John

1997 Translation of a Late Basketmaker Rock Art Panel. The Atlatl 10(2):5.

Illustrated humorous poem.

Whittaker, John

1998 The Meanings of Atlatls? Robert Hall's <u>Archaeology of the Soul</u>. *The Atlatl* 11(2):2-3.

Hall (1997) in one chapter argues that atlatls are symbolically connected to courting flutes and calumet pipes, but bases his arguments on vague, ambiguous, and widely separated examples of symbols used by a variety of cultures.

Whittaker, John

1999 Why the World Needs WAA. The Atlatl 12(4):13.

Errors in a book by Stockel (1995).

Whittaker, John

2002 Coaching the Atlatl. Posted on Grinnell College Faculty Webpages at http://web.grinnell.edu/anthropology/Faculty/faculty.html

Photo essay and discussion of the throwing motion, good form

Whittaker, John

2003 Atlatl Elbow: Anatomy and Archaeology. The Atlatl 16(1):16-18.

Describes shoulder and elbow anatomy and injury from atlatl use, and archaeological attempts to interpret skeletal pathology as resulting from atlatl use.

Whittaker, John

2003 Mid Paleolithic Crisis. The Atlatl 16(2): 9.

Humorous doggerel.

Whittaker, John

2004 When Atlatls Are Designed by Computer Companies. The Atlatl 17(1): 17-18.

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Humor.

Whittaker, John

2004 A Peruvian Atlatl. Bulletin of Primitive Technology 27: 55-57.

Peruvian specimen in U. Penn museum described, replicated.

Whittaker, Johno2005 Review of Survival by Hunting: Prehistoric Human Predators and Animal Preyby George Frison. The Atlatl 18(2):11-12.

Whittaker, Johnx2005How to Throw with an Atlatl. World Atlatl Association webpage. URL:http://www.worldatlatl.org/WhatisAtlatl_HowtoThrow.htmland printed 2009 The Dart August 2009:20-22.

Whittaker, Johno2006 Atlatl Use on Moche Pottery of Ancient Peru. The Atlatl 19(3):1-3.

Whittaker, John o 2007 Late Survival of Atlatls in the American Southwest? *The Atlatl* 20(1):10-12.

Criticizes Vanpool (2006).

Whittaker, John o 2007 Clovis Atlatls? Hemmings' Evidence from Florida Rivers. *The Atlatl* 20(3):14.

Atlatl hooks made on proboscidian ivory and a *Paleolama* phalanx (photos) associated with Clovis technology. Clovis seen as a unique adaptation with broad spectrum resource use but focused on big-game with specialized technology.

Whittaker, Johno2008 Review: Poison Arrows: North American Indian Hunting and Warfare, by David E.Jones. (2007, University of Texas Press, Austin. ISBN 978-0-292-71428. \$29.95.) TheAtlatl 21(1):13.

Whittaker, John o 2008 Atlatl Artifacts at Indian Knoll. *The Atlatl* 21(2):1-3.

Reviewing reprints of publications by Moore and Webb, photos of antler hook and handle with bannerstones in burial contexts not completely conclusive of atlatl explanation, although that is still the best.

Whittaker, Johno2008 Ten-Minute Atlatls. The Atlatl 21(4):13.

simple atlatl design

Whittaker, John

2009 The Aztecs and the Atlatl. Aztecs at Mexicolore webpage, URL: <u>http://www.mexicolore.co.uk/aztecs/home/aztecs-and-the-atlatl</u> accessed June 27, 2018

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Atlatl basics. Atlatl use against Spaniards during conquest of Mexico. Could not penetrate steel plate armor, but was probably more effective than bow against leather, padded cotton, and maybe chain mail. Lots of pictures. Promoting WAA and modern experiments as source of knowledge. [the links on these Mexicolore pages keep changing and there are several others that lead to 'atlatl' and show pictures of them.]

Whittaker, John C. o 2009 Atlatls in Mexican Codices. *The Atlatl* 22 (4):1-3.

Whittaker, John C. o 2010 Australian Atlatls. *The Atlatl* and posted at http://www.worldatlatl.org/Articles/AustralianAtls2010/Australian_2010.pdf

Distribution of different types (maps from Stodiek) and illustrations from my collection

Whittaker, John

2010 Weapon Trials: The Atlatl and Experiments in Hunting Technology. In *Designing Experimental Research in Archaeology: Examining Technology Through Production and Use*, Jeff Ferguson, editor., pp. 195-224. University Press of Colorado, Boulder.

Review of past atlatl experimentation, explanation of how they work as levers, not springs.

Whittaker, John C. x 2010 Comment on Shea and Sisk's "Complex Projectile Technology."" *PaleoAnthropology* 2010:L0007-L0008. Electronic document, URL: http://www.paleoanthro.org/journal/content/PA2010L0007.pdf

Corrects S + S: atlatl works as lever, not by storing energy as spring like a bow, but still can be considered "complex projectile weapon" for purposes of S+S argument.

Whittaker, John C.o2011 Cushing's Key Marco Atlatls: Reconstructions and Experiments. *Ethnoarchaeology*3(2):139-162.

Documentation of history, Cushing's publications, surviving specimens in Univ Museum, U of Pennsylvania. Single hole atlatl with rabbit effigy hook, two-hole atlatl. Both finely made. Problems of reconstructing archaeological finds for experimentation. Two different possible length reconstructions of 2-hole atlatl compared; longer works "better" but is it closer to original?

Whittaker, John C.

2011 Levers and Springs: How a Spearthrower Works and Why it Matters. Paper presented at Multidisciplinary Scientific Approaches to the Study of Stone-Age Weaponry, Mainz, 19-22 September 2011.

"A spearthrower, or atlatl, works as a lever to propel a light spear or dart, but there are still alternative theories about spearthrower mechanical principles. Howard proposed that atlatls work by extending the time force can be applied to a spear. Others suggest that the flex of the atlatl or the dart, or both, stores energy to spring the projectile away. Both of these theories can be demonstrated to be wrong by a variety of evidence, including slow motion images. Those who believe that spearthrowers work by spring power often see them as ancestral to bows. Because they work by different principles, this is highly unlikely. Understanding how a spearthrower works is important in examining its capabilities and place in the evolution of technology, and both practical experimentation and theoretical understanding are necessary."

Whittaker, John C.

2012 Experiment Meets Recreation: Throwing Spears with the Public. SAA Archaeological Record 12(2):15-17.

Atlatls are a good way to connect with an interested public for education and potential to find skilled non-academic collaborators.

Whittaker, John C.

2012 Lithic Scholars and the "Other" Knappers. Lithic Technology 37(1):51-56.

Whittaker, John C.

2012 Ambiguous Endurance: Late Atlatls in the American Southwest? Kiva 78(1):79-98.

Critiques VanPool (2006); Lorentzen (1993), and others. There is no good evidence for late survival of atlatls in the SW; point size distributions are not good enough, and site assemblages have various problems. No good late iconography, no late specimens among the many known, despite 100+ years of work in 1000s of SW sites. Table of C14 dates for atlatls and associated material: all available dates are early.

Whittaker, John C.

2013 Review of <u>Slings and Slingstones: The Forgotten Weapons of Oceania and the</u> <u>Americas</u>, by Robert York and Gigi York. *American Antiquity* 78(1):199-200.

Whittaker, John C.

2013 Dart Speed Measurements. The Atlatl 26(11): 9-12.

Whittaker, John C.

2013 Comparing Atlatls and Bows: Accuracy and Learning Curve. *Ethnoarchaeology* 5(2):100-111.

Bows are inherently more accurate and consistent than atlatls, but record of 800 throws by Douglas Bassett compared to 800 bow shots by Whittaker, shows both that mediocre archer can outshoot expert atlatlist, and that skilled atlatl can be almost as accurate as archer at primitive hunting ranges. Adequate accuracy with bow can be learned much faster than atlatl. Other advantages of atlatls and bows.

Whittaker, John C.

2013 Review of <u>Across Atlantic Ice</u> by Dennis Stanford and Bruce Bradley. *Journal of the Iowa Archaeological Society* 60:35-36.

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I remain skeptical of Stanford and Bradley's theory that Clovis in N. Am. has origins in the Solutrean of Upper Paleolithic Europe. Much is based on insecure evidence like the Cinmar biface found offshore by dredging, allegedly like Solutrean bifaces, possibly associated with datable mammoth bones, but Etc. I remain very skeptical but they have now assembled enough evidence to be taken seriously, although all the individual pieces of that evidence are arguable.

Whittaker, John C.

2014 Clovis Atlatls. The Atlatl 27(2):13-16.

My reconstruction made for filming with Metin Eren represents evidence (reproduction of a hook from FL rivers, which shows also that it was lashed on) and imagination (size, shape of grip etc) typical of archaeological reasoning in replicative experiments. Worked well with heavy cane dart and Clovis point.

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Whittaker, John C.

2014 Atlatls are Levers, Not Springs. Bulletin of Primitive Technology 48:68-73.

Whittaker, John C.

2014 Arrowheads, Folklore, and Documentary Evidence. *Plains Anthropologist*, submitted July 22, 2014, accepted Jan 2015.

Whittaker, John C.

2015 Fire-and-water knapping: Origins of a lithic folk tale. *Lithic Technology* 40(1):40-51.

Whittaker, John C.

2015 The Aztec Atlatl in the British Museum. Ancient Mesoamerica 26(1):69-79.

Detailed measurements and description of famous atlatl with stone or shell finger

loops, gilded carving of deity with snake and darts. Discussion of iconography of mesoamerican atlatls. Experimental replica shows that it was functional, but evidence of actual use on the specimen is ambiguous.

2015 Review of *Rock Art at Little Lake: An Ancient Crossroads in the California Desert.* 2012. Edited by Jo Anne Van Tilburg, Gordon E. Hull, and John C. Bretney. Cotsen Institute of Archaeology, University of California, Los Angeles. *The Atlatl* 28(3):3-5.

2015 Review of *Rancher Archaeologist: A Career in Two Different Worlds*, by George C. Frison, 2014. University of Utah Press, Salt Lake City. *The Atlatl* 28(3):5-6.

2015 Forward. In Justin A. Garnett, *Practical Atlatlry of the Four Corners: A Complete Guide to the Basketmaker Atlatl.* Self published, J. A. Garnett, Kansas City.

Whittaker, John C.

2016 Arrowheads, Folklore, and Documentary Evidence. *Plains Anthropologist* 61(238): 177-187. <u>http://dx.doi.org/10.1080/00320447.2015.1138032</u>

A lot of what we think we know about arrowheads and arrows is based on weak ethnographic evidence that has become archaeological folklore.

Whittaker, John C.

2016 Levers, Not Springs: How a Spearthrower Works and Why it Matters. In *Multidisciplinary Approaches to the Study of Stone-Age Weaponry*, edited by Radu Iovita and Katsuhiro Sano, pp.65-74. Springer Science and Business Media, Dordrecht. DOI 10.1007/978-94-017-7602-8_5

[see 2011]

2016 Atlatls in Ancient Peru: Warfare, Burial, and Status. Paper presented at Missouri Archaeological Society Fall Symposium, Van Meter State Park, MO, October 1, 2016.

Whittaker, John C.

2017 Deadly Flight: Birds and Atlatls. Missouri Archaeologist 78:27-48.

Bird symbolism is not surprising in projectile weapons like atlatls. Examples from Moche Peru and the American Southwest are clear, and support the suggestion that birdstones and bannerstones in the midcontinent also have bird symbolism.

Whittaker, John C.

Whittaker, John C., and William D. Bryce

2017 Hunting Technologies. In *The Oxford Handbook of Southwest Archaeology*, edited by Barbara Mills and Severin Fowles, pp. 627-643. Oxford University Press, New York. Published electronically in Oxford Handbooks Online, DOI:10.1093/oxfordhb/9780199978427.013.33

Considers atlatls and shift to bow, projectile point forms.

Whittaker, John, Byl Bryce, and Chuck LaRue o 2008 Atlatl Hunting with the Basketmakers. *The Atlatl* 21(4):4-6, and posted URL: http://www.worldatlatl.org/art/Album/Southwestern RockArt.htm

SE Utah rock art depictions of atlatl gear, hunting, and warfare.

Whittaker, John, Phil Geib, Byl Bryce, and Chuck LaRue

2009 Sand Dune Cave Atlatl. Electronic document, URL: http://www.worldatlatl.org/Articles/SandDuneCave/SandDuneCaveArticle_2010.pdf

Context and photos of complete atlatl and dart foreshafts.

Whittaker, John C., Yujing Caa, and Annie Leverich

2017 Atlatls are NOT easier than bows: rebuttal to Grund. Posted to Academia.edu https://www.academia.edu/32369956/ATLATLS_ARE_NOT_EASIER_THAN_BOWS_ REBUTTAL_TO_GRUND

Grund (2017) suggests that atlatls are easier to learn and use than bows, and thus allow more members of a population to use them. Atlatls are seen as "exacerbating" social differentiation, while bows are "equalizing." She uses data from ISAC scores and from Society for Creative Anachronism archery competition to compare – neither is properly cleaned, and the competitions are different, so this is misleading at best. Her weak ethnographic information also does not support the suggestion that atlatls are easier to use than bows. No one with any practical experience with the two weapons would come to this conclusion. In fact, I have already presented data showing that atlatls are not as accurate for experienced users as bows (Whittaker 2013), and here present data that beginners in bows become more accurate faster than beginners in atlatl use, so data shows the opposite of Grund's claim, and her social conclusions must be rejected.

Whittaker, John and Kathryn Kamp

2005 ISAC Sport and Science. The Atlatl 18(2):1-4.

Whittaker, John and Kathryn Kamp

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2006 Primitive Weapons and Modern Sport: Atlatl Capabilities, Learning, Gender, and

Age. Plains Anthropologist 51(198):213-221.

13,500 ISAC scores over 8 years show growth of sport, suggest that modern atlatlists are now at level of skill equal to prehistoric and can thus be fair test of atlatl capabilities

Whittaker, John and Kathryn Kampo

2007 How Fast Does a Dart Go? The Atlatl 20(2):13-15.

With a radar gun, measured JW throws using Whittaker, Berg, and Perkins equipment. Velocities from 45 mph (20 m/sec) to 57 (25 m/sec) with Berg gear slowest. Comparisons to other experiments.

Whittaker, John C., and Kathryn A. Kamp o

2011 Long and Short: Reconstructing Key Marco Atlatls. The Atlatl 24(1):21-22.

Atlatl works as lever, longer is more efficient, but that doesn't show which of two possible reconstructions is more correct.

Whittaker, John C. and Kathryn Kamp

2016 Peruvian Atlatls I: Golden Atlatls of the Lady of Cao. *The Atlatl* 29(3):1-4. July 2016.

Moche atlatls. Elite woman buried in Huaca Cao at El Brujo site, including 23 atlatls of wood wrapped in gilded sheet copper. Oversized and made without usual detail, for show, not use.

Whittaker, John C. and Kathryn A. Kamp

2016 Flint from the Ancestors: Ritualized Use of Stone Tools in the Prehistoric Southwest. In *Archaeological Variability and Interpretation in Global Perspective* edited by Alan Sullivan and Deborah Olszewski, pp. 267-290. University Press of Colorado, Boulder.

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Whittaker, J., S. Koeman, and R. Taylor

2000 Some Experiments in Petroglyph Technology. In 1999 International Rock Art Congress Proceedings, Volume 1: Papers Presented at the 12th International Rock Art Congress, Ripon, Wisconsin, May 23-31, 1999. P. Whitehead and L. Loendorf, eds., pp. 155-167. Tucson: American Rock Art Research Association.

Controlled timed experiments show most petroglyphs would require little labor. Pecking works well even for details; no need for 'chisels' or indirect percussion techniques, and they do not in fact work well.

Whittaker, John and Andrew Maginnisso2006Atlatl Flex: Irrelevant. The Atlatl 19(2):1-3. Online at URL:

http://www.worldatlatl.org/Articles/Atl%20Flex%20for%20TheAtlatl_files/AtlFlexforTh eAtlatl.pdf

Physical modeling of flexing atlatl as a cantilever spring suggests could add ca 10% to velocity of dart, but strobe photos show atlatl is still flexed after dart leaves: there is not time for atlatl to rebound like spring, so atlatl flex does not add to dart velocity. Tests of 3 atlatls identical except for flexibility confirms: no difference in velocities of throws.

Whittaker, John and Ron Mertz

2002 Atlatls for Teaching and Sport. *Anthropology News* 43(4):26.
2002 Atlatls and Public Prehistory. *ACPAC Newsletter*. July 2002:1.
2003 Atlatls and Public Prehistory. Unauthorized reprint in *Ancient American* 7(48):18.

Atlatls are good for hands-on teaching of primitive technology, and interaction with an interested public.

Whittaker, John C. and Ron Mertz

2011 Introducing the Missouri Atlatl Association. *Missouri Wildlife* 72(3):10-11.

Explains atlatl and organization; accounts of MO first atlatl deer hunt season.

Whittaker, John C., Devin B. Pettigrew, and Ryan J. Grohsmeyer

2017 Atlatl Dart Velocity: Accurate Measurements and Implications for Paleoindian and Archaic Archaeology. *PaleoAmerica* 3(2):161-181. DOI: 10.1080/20555563.2017.1301133

Projectile weapons affected the human evolutionary trajectory and propelled social and subsistence changes throughout our history. Archaeologists interested in such relationships must overcome two obstacles: How to recognize ancient weapons from fragmentary remains, and the difficulty of understanding their capabilities through experiments.

The history of change in weapon systems shows a shift from relatively slow, heavy projectiles propelled by human strength to lighter, faster, mechanically propelled projectiles, which resulted in various effects on social institutions, subsistence, and evolutionary developments. Thrusting spears, hand-thrown javelins, and atlatls are all cited by various researchers as the weaponry used by Paleo hunters to bring down Pleistocene megafauna. A change from thrusting spears and javelins to effective atlatlpropelled projectiles would have made hunting large game substantially safer and increased the number of people in a group who could have participated. The subsequent replacement of atlatls by bows is another issue of wide debate. However, the dynamics of change in these complex systems are frequently debated and before we can compare prehistoric weapons in any meaningful way, we need accurate measurements of performance characteristics.

Velocity is one important measure of projectile effect, directly influencing

momentum and kinetic energy and thus the damage a projectile can do to its target, but accurate measurements of atlatl dart velocity are rarely reported. Atlatl dart velocity must be measured with naturalistic experiments involving human throwers, and while the problem of assessing discrepancies between the skill and strength of past and modern throwers cannot be fully circumvented, it is addressed here by measuring numerous well-practiced individuals using a variety of atlatl equipment, and comparing the results. We present several different series of experiments with radar gun, film, and chronograph to measure dart velocities. The atlatls used in hunting and warfare probably did not accelerate darts much beyond 35m/s (78 mph). This information is briefly applied to two issues: 1.We discuss Hutchings' use of fracture velocity measurements on stone points to distinguish Paleoindian projectile systems, which seems promising but needs better experimental support. 2. Using velocity and mass we can calculate kinetic energy and momentum of various projectiles as measures of weapon effect, and consider, for an example, Southwestern atlatls and bows.

Wilbur, C. Keith

2001 Indian Handicrafts, revised edition. Globe Pequot Press, Guilford, CT.

[All sorts of crafts, emphasis on New England, simple cultural info but generally ok, dozens of drawings, attempts to show traditional techniques as well as how to make today. Some of the instructions are pretty good, others, despite lots of detail, are ... optimistic. For example the flintknapping info is rudimentary, not very accurate, and the drawings of pressure flaking are ludicrous.]

Book begins with atlatl – origin in Early Archaic 7000 BP, propels spear by centrifugal force, bannerstones "add heft for greater control and power". Dr. Maurice Robbins at Bronson Museum claims 1973 find of point on foreshaft in marsh, point in socket in split shaft (gives instructions). Making shaft – suggests steel nuts instead of foreshaft, uses notch that fits under hook [instead of socket – would this work well?]

Willging, Robert C.

2008 On the Hunt: The History of Deer Hunting in Wisconsin. Wisconsin Historical Society Press, Madison.

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[Generally nice detailed narrative from hunter/wildlife manager. Deer populations through time, affected by settlement, logging, and market hunting until rise of sport hunting and conservation in early 1900s after deer largely extirpated in S WI. However, his prehistory is sketchy and naïve, and he uses too many old secondary sources and web pages, so some things, like his atlatl info is poor: Perkin's dart-as-spring nonsense, sliding bannerstones, otherwise ok basics]. Lots good photos of early hunters with deer, depicting attitude of thoughtless slaughter.

Wilhelm, Neil o

2009 The Fluid Art of Fletching with Pitch. Primitive Archer 17(3):18-23.

instructions for making birch pitch by "dry still" and fletching arrows with it

Wilhelmsen, Kris H.

2001 Building the Framework for an Evolutionary Explanation of Projectile Point Variation: An Example from the Central Mississippi River Valley. In *Posing Questions for a Scientific Archaeology*, edited by Terry L. Hunt, Carl P. Lipo, and Sarah L. Sterling, pp. 97-144. Bergin and Garvey, Westport.

Evolutionary principles to test expectations based on design and Newtonian physics. Otherwise, explan of proj pt form usually circular: "activities inferred from p pt form are also considered the causes of the form." Functional attributes are selected if successful, but may be shared because of same ancestral origin or because of convergence, same selective forces in different locations. Stylistic attributes are neutral and change by drift – error in transmission. Engineering design analysis identifies functional traits. Similarity in style (non-functional traits) reflects common ancestry, so chronological point types should be defined by those.

Used 37 surface assemblages from MO + AR spanning 11,000 yrs. Considerations of surface assemblages and amateur collection [he's very optimistic!]. Proj pt = "Pointed Lithic Biface" defined by engineered traits for piercing: sharp tip, less pointed other end, longitudinal axial symmetry. [Lots of big words for simple concepts in this.] e.g. "repeated appearance of serrated blades... may be tied to changes in biface technology...that periodically reduced projectile velocity" because serration improves penetration [questionable, physics explained later but hard to understand]. Physics concepts explained: improve proj equilibrium by adding weight to front, or light surfaces like fletching to rear. Oblique fletching imparts rotation to reduce wobble. Faster proj stabilizes sooner. Blade surface area + x-section also influence flight – greater blade surface area moves center of pressure forward [acts like fletching at front], increasing instability. If longitudinal axis not symmetrical, unevenly pulls proj away from flight path because of differential air pressure on each blade surface.

Penetration is function of velocity, mass, tip sharpness, blade-edge design. Prehist projs velocity from 18-50 m/sec. Kinetic energy = mass times velocity squared over 2 so increasing velocity does more. Tip sharpness opens hole, perimeter or x-sect affects drag as point cuts and enters, expers say arrow 18-24 cm [we know they can do better than that!]. Shape of blade ensures entry of edge at an angle, improving cutting.

Impact fractures longitudinal on stable high velocity p pts which strike straight on, but oblique or burination on slower because they're more likely to hit at angle [doubt you can tell, also shafts flex, affecting angle of impact].

Manufacturing cost as well as performance acts to select for or against functional traits. Here, performance assessed by 1. Effectiveness of penetration, measured by max pt perimeter, max shaft perim [from stem?], blade edge sharpness [angle], and serration. 2. "retrograde resistance" [jargon meaning ability of point to stay in wound, which increases damage] measured by angle of barbs, depth of barb, angle of stem edges. 3. Angle of impact assessed by tip fracture [this is not workable].

[Some of these discussions are useful, but all are couched in masses of wordy jargon, not

all of the engineering assumptions are well-based in practical experiment, and after 40 tedious pages he has just set up the research, not produced any analysis of points.]

Wilke, Philip J. x

1988 Bow Staves Harvested from Juniper Trees by Indians of Nevada. *Journal of California and Great Basin Anthropology* 10(1):3-31.

Little Gt B archery info, few specimens of sinew backed form, but male crafts lost earlier than female, ethnographers lacked archery knowledge or interests. Bows mostly wood, but antler or horn too, short, ave around 1 m, reflexed and sinew backed. W NV, 47 examples of Utah juniper with old cuts or scars from bow stave production, probably going back several centuries as some have sequence of use. All near game traps or camps, in mts, 6000-7000'. Few trees have straight clear trunk. Peeled, cut above and below to stop growth, left to season on tree. Pryed out [implausible technique suggested]. Could be for export.

Wilkins, Jayne, Benjamin J. Schoville, Kyle S. Brown, and Michael Chazan

2012 Evidence for Early Hafted Hunting Technology. Science 338:942-946.

Kathu Pan 1, S. Africa. Fauresmith late ESA or early Middle Stone Age, dates ca. 500kya.

Points [Levallois or Mousterian type]. Damage is symmetrical, mostly to tips, diagnostic impact fractures ["distal step-terminating bending fracture" = flute; burination], tip cross-sectional perimeter values – all compare well to experimental spear, known Holocene proj pts. Basal modification for hafting. Interp as thrusting spear, poss assoc with *H. heidelbergensis* common ancestor of *H. s.* and Neanders.

Wilkins, Jayne, Benjamin J. Schoville, and Kyle S. Brown x 2014 An experimental investigation of the functional hypothesis and evolutionary advantage of stone-tipped spears. *PLoS ONE* 9(8): e104514. Electronic document d0i:10.1371/jounal.pone.0104514

Controlled experiment to test poss advantage in penetration of stone-tipped spear. A significant technol advance in Middle Pleistocene, possibly reps origin of new cognitive and social capabilities. 'Working memory' holding multiple tasks in production, use, combination of different materials, or 'constructive memory' imagining future scenarios and planning for them. Complex tool like hafted spear reps social learning, cumulative over time, not individual one-time invention. But costly, breakable – what advantage would select for hafting? Various penetration experiments and ethnog cited – results often unclear, lots cultures use just wood. Salem + Churchill 2016 used ballistic gel, wood penetrated more but stone points disrupted more tissue = more severe wound.

Two standardized spear sets, tipped and untipped, calibrated crossbow, gel. Modeled after Schoningen spears, assumed thrusting. Poplar dowels 1 5/16", conical tips, or quartzite flake pts glued on shoulder. Velocity of 8.9-9.4 m/s [= 20-21 mph] measured with radar gun. Measure inner cavity and outer, equiv to permanent [tissue damage, wound] and temporary cavities [bruising] in wound. Penetration depth greater with untipped, but larger inner wound track, so greater damage, from tipped. End of cavity also much larger for tipped spears. Contradictions with other's studies. Gel imperfect proxy for animal, but is consistent, able to examine wound cavities. Other proxies of wound size – Holmberg pt width x pentration, or pt TCSA x penetration (Salem + Churchill) agree with our results. So stone-tipped spears have evolutionary, functional advantage.

Wilkins, Jayne, and Benjamin J. Schoville

2016 Edge damage on 500-thousand-year-old spear tips from Kathu Pan 1, South Africa: The combined effects of spear use and taphonomic processes. In *Multidisciplinary Approaches to the Study of Stone-Age Weaponry*, edited by Radu Iovita and Katsuhiro Sano, pp. 101-117. Springer Science and Business Media, Dordrecht.

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see 2012. Quantitative comparisons to objectively ID use vs taphonomy

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Wilkison, Kermit

1993 Bannerstones: Two Cents More. The Atlatl 6(3): 4-6

Annecdotes, metal weights taped on for experiments, weights behind fletching work well.

Willer, James

2013 Research Study: Quantity of Sound Produced by Type of Arrow Construction. *Bulletin of Primitive Technology* 46:27-34.

Shot different types from wooden bow with pin-style arrow rest (for least contact with bow), sound recorded with Apple iPad. Bowstring produced more sound than arrow, about 2/3 of sound. Stiff fletching, nodes on cane, etc produced some noise, but human observers were not able to separate arrow noise from string noise. Heavy arrows reduced string noise (overall decibels).

Williams, A. R.

2006 Mystery of the Tattooed Mummy. *National Geographic* 209 (6): 70-83. (June 2006).

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Moche female mummy at El Brujo. [Disappointing article. A few nice photos, little useful info - fluff stuff. News reports mentioned atlatls with mummy as some of unusual male goods with important female, but no mention here.]

Williams, Victoria M. E., Alban Burke, and Marlize Lombard

x,p

2014 Throwing spears and shooting arrows: preliminary results of a pilot neuroarchaeological study. *South African Archaeological Bulletin* 69(200):199-207.

Possibility of very early bow and arrow in Africa raises issues of pre-modern human cognition. Lack of projectiles in Neanderthal stage could be cognition or energetic + time-budget constraints. But bows should be more cognitively complex than spears because require extended sequence of thought + action, modularization (discreet steps) in production and use, mental capacity to focus on and manipulate at least 2 separate but interdependent technologies simultaneously.

Use ERP (event-related potential) to directly test for neurological indicators of cognitive challenge comparing bow and spear, levels of neural energy. Recording electrical activity in brain with electroencephalography. 2 M, 2 F 23 yr-old participants, throwing small spear, shoot small bow [both toy-size]. Shooting with a bow was consistently more cognitively complex (more neural activity). More working memory, and other 'executive' functions of brain (attention, context updating, reinforcement learning, memory rehearsal) enhanced to assist.

Willoughby, Charles x

1902 Prehistoric Hafted Flint Knives. The American Naturalist 36(421):1-6.

Illustrates specimens from SW caves, mentions others in various collections. Flaked blades in slots in wooden handle, most with mastic "probably *Larrea mexicana*" [creosote bush - probably not]. A few with lashings too. One 'saw' one double-bladed, a couple at odd angles. 3 probable foreshafts for atlatl spears, compared to Mexican depictions. [No provenience info of course.]

Wilson, Thomasx1898Class A, Beveled Edges. The American Archaeologist 2:141-143.

Beveled pts [like Thebes] - experiments to show they give rotary motion – put museum specimens on unfletched shafts and dropped from Smithsonian tower. Also tried mounted and moved through water and simple wind tunnel using a fan. All showed rotation. Considers them arrow points. Most beveled to produce counter-clockwise rotation. "Whatever may have been the intention of the maker of the arrow-heads… in their flight through the air the beveled edges produced a rotary motion." It would be easier to use twisted fletching, but of 1000 arrows in Smithsonian, not more than a dozen have such. Since you can turn arrowhead in making, bevels do not indicate handedness.

Wilson, Thomas

1898 Prehistoric Art: or, the Origin of Art as Manifested in the Works of Prehistoric Man. Report of National Museum for 1896, U. S. Government Printing Office, Washington D.C.

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front plate of stone celt in wooden handle from MI. "Bannerstones" and birdstones, unknown use, prob ornamental. p.355-356 footnote defines flake, flaking as relatively large pieces struck by blow, while "all other methods of striking off pieces of flint" should be called chipping, chips,

"preparing the nucleus, or transforming the flake or other material into the object desired" [i.e. retouch. He seems to use chipping as the general term too. Note that he does not use the term knapping at all, though he shows a Brandon gunflint core with the 'flakes' arranged in place (from Evans).

p. 422: distinction between Paleolithic and Neolithic tools is that in Neo flint implements made by flaking + battering were then finished by secondary process of grinding or polishing.

p 425: "the art of flint chipping, so far as it applies to small flint or glass arrowheads... is well known and is or has been practiced by many persons in the U.S." mentions a couple modern knappers, no names. TW warned against fakers 1888, "which warning seems to have been acted upon by both makers and purchasers, and the industry in that part of the country has practically died out. It is continued in Oregon." But large leaf-shaped thin implements have never been reproduced.

Paleolithic carvings [illustrates some spear throwers + parts he considers "poniards"] Musical instruments.

Wilson, Thomas

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1899 Arrowpoints, Spearheads, and Knives of Prehistoric Times. Report of the United States National Museum for 1897:811-988. Washington DC. (Reprinted 2007, Skyhorse Publishing, New York).

[Reprint has one of the ugliest covers ever put on a book of archaeology: totally bogus "arrows" by some ignoramus designer.]

Superstitions about arrowheads all over Europe, Asia, Africa, reflect long disuse. Source in thunder/lightning, protects against. "Elf-darts" in Britain, protect/cure magical attacks. [Many good refs and stories]. Such superstition not in US because we know Indians. Indians use arrowheads as talismans, but transition to metal very rapid.

Mines and quarries in Europe, describes Grimes Graves and Brandon gun flint industry. Strike-a-lights still in use in Paris. Quarries at Flint Ridge.

Material - [early use of thin sections to distinguish.] Flint, chert, quartzite, argillite.

Early knapping demos to learned societies by Evans, Capitan. Percussion, hammerstones. Pressure, ethnog tools of bone and antler, hafted, and prehistoric European of flint [probably a strike-a-light.]

Classification: triangular, oval, stemmed, peculiar. Class IVA "peculiar, beveled" [mostly Archaic Thebes pts etc, some huge]. P. 168-169 Experiments: haft and drop from tower, in water, in wind from fan, to show bevel spins projectile. Why, when it would be easier to spin by fletching - but only a few of 1000s of arrows in National Museum have spiral fletching. "Curious" forms, for "art" [plate of small effigy forms supposedly from CA and midwest includes many that look fake to me.]

[He mentions arrows, spears and javelins frequently, but never atlatls, although he must have known of them at the time from Nuttall, Cushing, and others at the Smithsonian.]

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1990 The Amazing Atlatl. Black Belt August 1990:66-69.

"One of Asia's oldest martial arts weapons...." Uses leverage, darts "resemble arrows on steroids", over 95 miles per hour, mammoth hunting, "one atlatl master demonstrated power of the weapon by throwing high-tech steel dart through a car door from 15 yards away." Aztecs threw 100 yds, out of musket range. Darts could penetrate armor "pin conquistador inside his breastplate." Replaced by bow. Dave Holladay holds distance record of 426'. BPS Engineering sells. [Quotes, hype, story, and many errors show info must be from Perkins. Photos of a guy in karate gear throwing.]

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Wincer, Simon, director

1997 Quigley Down Under. Movie, VHS, DVD. MGM/Ua Studios.

Western set in Australia. Quigly (Tom Selleck) is a sharpshooter from the US, hired by evil rancher (Alan Rickman). The job turns out to be exterminating Aborigines, which Quigly refuses to do. The bad guys beat up Quigly and the mad woman he befriends (Laura San Giacomo) and leave them to die in the desert, where they are rescued by aborigines and recover to return and wipe out the baddies. Not a bad movie, although a silly fantasy atonement for American guilt over our treatment of the Indians. The aborigines are shown using Central Desert type woomera against the ranchers and teaching Quigly – short sequences and hard to examine for info, but looks like they know what they're doing.

Winters, Howard

1968 Value Systems and Trade Cycles of the Late Archaic in the Midwest. In *New Perspectives in Archeology*. S. Binford and L. Binford, eds., pp. 175-222. Aldine, Chicago.

[An archaeological classic, early attempt to be explicit about how we can get social information from burials, but long and laborious.] Indian Knoll, Archaic site in KY, 2500-2000 BC (see Webb 1946, 1957) is one of main sites considered. Why are atlatls, which are predominantly associated with males, also in female graves at Indian Knoll? Probably not just ceremonial artifact – they show use-wear. Probably not "a platoon of Amazons." Possibly "transfer of corporate estate" having nothing to do with sex of individual. "Or perhaps some women were hunters of one type of game or another." "All that can be concluded is that the roles of females overlapped those of males in some way, leading to occasional association with them of a weapon one would expect a priori to be a symbol of male activities." [Winters assumes 'maleness' of some activities and artifacts based on modern prejudices. See Doucette 2001]

Witthoft, John

1960 Review of <u>Birdstones of the North American Indians</u>, by Earl C. Townsend. *American Anthropologist* 62 (5): 915-916.

Praises - includes virtues of collector's literature eg. discussion of fakes, and archaeological typology.

Withrow, Rob

2018 Personal reminiscences at Osage Knap-in

Says he was at one of the first CO atlatl events, brought a light whippy atlatl, everyone else got idea from him. He still talks about flex imparting energy and need to tune dart and atlatl together.

Wolfe, Scott W., Joseph J. Crisco, Caley M. Orr, and Mary W. Marzke pdf 2006 The Dart-Throwing Motion of the Wrist: Is It Unique to Humans? *Journal of Hand Surgery* 31A:1429–1437.

Kinematic analysis has shown a near-stationary proximal carpal row during the dartthrower's motion, which is believed to provide a stable platform for the generation of force and accuracy during certain power and precision grip activities. This is consistent with evidence in the human hand of adaptations that enabled effective manipulation of stones, cylindric wood, and bone tools for throwing and clubbing. There are at least two possible explanations for the observed human proximal carpal row kinematics: 1. retained from previous common ancestor with great apes and previously adapted to some form of foraging or locomotor behavior involving the hands, but was recruited for tool use after we diverged from the apes, or 2. evolved after our divergence from apes, in synchrony with adaptations in the human hand to the manipulation of tools, and central to the development of the human's unique ability to aim and accelerate tools and weapons. Observations of wrist motion complex + difficult, many small bones act in columns or rows or both, in "dart-thrower's arc" motion common to almost all sports (throwing, hitting, etc) [many refs]. Understanding motion important for surgery and rehabilitation. "The common denominator in effectively using either the precision 3-jaw chuck baseball grip (when holding a stone) or the power squeeze grip (when grasping a hammer or a spear) is a smooth arc of motion from an extended wrist position that is combined with radial deviation to a flexed wrist position that is combined with ulnar deviation-the dartthrower's motion." Evolutionary changes in hand include shorter fingers, improved power and precision grips, but fully modern "modified power grip" ("squeeze grip") as in hammer appears relatively late, and is only useful if also have smooth power swing "generated by a cocking phase of wrist extension and radial deviation, and a swing phase of ulnar deviation and flexion." The cocking of the wrist generates acceleration of tool and power [applies to atlatl throw too of course]. Early hominin wrists more similar to knuckle-walking apes than arboreal apes, so less mobile, more stable, and suggests later development of throwing adaptations as hands freed by bipedality. E.g. chimp can use simple power grip, but can't throw or hit effectively because short thumb not as good, and lack "cocking" ability of wrist.

Wood, Janice, and Ben Fitzhugh

2017 Wound ballistics in experimental archaeology: The prey specific implications of penetrating trauma injuries from prehistoric projectile points. Posted Academia.edu August 2017.

Three major types of penetrating trauma injuries affect wound severity of a projectile point into hard or soft tissues: incised, lacerated, and puncture. Experiments conducted to better understand wounding mechanisms of three prehistoric projectile point classes: bifacially flaked stone, polished bone, and composite antler with microblades. Each launched into horse carcass and ballistics gelatin, explore relative performance of each tip form in terms of penetration, wound infliction, and tool durability. Measurement of projectile attributes before and after, wounds compared using tip-metrics, cavitation width, penetration depth, and total interior wound area. Wounding characteristics differed significantly between projectile point classes and strongly influenced wound severity. We infer that point mechanics may implicate a "prey specific" prehistoric hunting strategy.

Arctic focus, Denali style microblades, Nenana Complex tear-drop Chindadn bifacial points of similar age; different cultures or complementary tool kits. Also plain antler points. Replicas (N = 3, 3, and 2) using modern equipment, hafted with modern glue + artificial sinew [which covers shoulders of C pts] on aluminum arrows, 40 lb bow, 30-35 mps. Cutting edge length and mass measured [varies some, espec mass for C pts ca 10 g, others ca 20 gm]. 17 shots into horse carcass, varying distance [making it hard to do any stats]. [Very poor penetration – only 1 with C pt 57 cm, four others 9+ cm, all others less or rebounded. Try to evaluate 3 different angles, but results are not valid for this, not enough data.] Bifacial point more incised wound, composite points often damaged.

Five pts each shot 10 times into gel. The 2 bone pts penetrated deepest but cavitated least. The 2 stone and 1 microblade pts made bigger wounds. Wider pts create more damage but penetrate less and may rebound. "Narrower points with long cutting edges (microblade composites) will penetrate most tissue types, have greater potential to cut arteries in their path, and create secondary damage as broken fragments extend the interior wound area. Plain bone points have the narrowest tip angles with no cutting edge, create puncture type wounds that are more likely to get past the rib cage and penetrate more deeply, but inflict more limited internal wound areas and less potential for blood loss." So possibly suitable for different game: bifaces for larger, quartering away shots, higher velocity projectiles; microlith best, smaller animals with more limited target area, more difficult shots, or lower velocity projectile; plain bone for smaller game, stunning. [Maybe, not a bad experiment, but need much more - there is not enough experimental data here to give good support, and the really poor results on carcass makes it all questionable].

From faunal remains, Potter suggests composite pts for bison, bifaces for caribou. But wide bison rib space should allow bifaces better. Since composites performed best, need more explanation why use bifaces on largest game like mammoth. Variation in animals (seasonal fur, fat, etc) also important.

Woodbury, Richard B. and Ezra B. W. Zubrow o

1979 Agricultural Beginnings, 2000 B.C.-A.D. 500. In Handbook of North American
Indians, Volume 9, Southwest, edited by Alfonso Ortiz, pp. 43-60. Smithsonian Institution, Washington D.C.

Discusses transition from atlatl to bow. Nice illustration of Basketmaker II atlatl from Broken Roof Cave, AZ. Assumes Clovis + Folsom use. Projectile point size not sure indicator of use. Bow and arrow evidence rare in SW pre 500 A.D., but 500-1500 yrs earlier in Gt Basin, where coexist for several 100 yrs, atlatl abandoned about same time as bow reached SW. [Supposed evidence for this overlap + early GB bows not detailed.]

Woodward, Arthur

1937 Atlatl Dart Foreshafts from the La Brea Pits. *Bulletin of the California Academy of Sciences* 36(2):41-60.

Man now proven to have existed with Pleistocene mammals – how late did they survive? Pit 10 human skull and pit 61-67 artifacts – how old? Most artifacts of late types, except 4 foreshafts. One "bunt" with conical end to fit shaft, thick blunt point, 5 inches long. Three fragments of foreshafts for stone points, 3-6 inches, notch for point broken off, pointed proximal ends [photographs]. Compares others, with photos: 6 San Juan Co. Basketmaker with stone points, 4 more unfinished foreshafts – La Brea are heavier. No stratigraphy, but foreshafts suggest early atlatl using folk, other artifacts later. Describes Santa Barbara (1792) atlatl – "odd, stubby, 6-inches long" with bone hook, compares to Tarascan type. No Spanish historical record of atlatl among CA Indians. Also a 1792 foreshaft, but appears to be harpoon, not for atlatl. Maybe "memory" or "vestigial remnant" of older atlatl use in California.

Wray, Donald E.

X

1945 The Historical Significance of the Murals in the Temple of the Warriors, Chichen Itza. *American Antiquity* 11(1): 25-27.

Murals record subjugation of Maya by Toltec, stereotyped outfit of Toltec warriors includes round shield, atlatl, and bundle of darts.

Wright, W. Davis

X

1923 *Canberra*. John Andrew and Co., Sydney. (Reprint 1977 Library of Australian History, Sydney.)

Old-timer reminisces. P 58 Natives carried their weapons until at least 1850, usually 2-6 spears, some barbed, thrown with "considerable force and accuracy" with "thrower", nulla nulla club, shields, tomahawk of polished stone.

Yaroshevich, Alla, Daniel Kaufman, Dmitri Nuzhnyy, Ofer Bar-Yosef, and Mina Weinstein-Evron x

2010 Design and performance of microlith implemented projectiles during the Middle and the Late Epipaleolithic of the Levant: experimental and archaeological evidence.

Journal of Archaeological Science 37:368-388.

Improved hunting, decrease of game possible cause of shift from foraging to agriculture in Levant. Prehist "cultures" and temporal change marked by different types of microlith, representing changes in weapon points. Tested a variety of microlithic points, single + multiple, main, side barbed, transverse. 102 arrows using 265 microliths made by Dodi Ben Ami for performance and diagnostic damage. Each shot at goat carcass, 13-8 m, 35 lb modern bow, until damaged, then at skinned sheep torso at 5 m. Compared to microliths from Kabaran and Natufian sites. Simple points penetrated best, including oblique points, barbs at right angles to point did worst [expected, but fairly small sample, and high freq of misses and richochets at close range suggests not very skillful archery.] Diagnostic fractures [complex types = mostly bending initiations with "spin-off" pressure languettes, and burinations of pointed ends]. Fractures varied somewhat according to how the microlith was hafted [but their attempt to quantify and specify suffers from small samples]. Longitudinal microstriations also indicated impact. Cutting a hole with blade wide enough to ensure passage of shaft is why transverse points work. Many microliths lost and would not be returned to site. [Overall good study, lots illustrations, but testing so many types of haftings diluted their sample sizes too much.]

Yaroshevich, Alla, Dani Nadel, and Alexander Tsatskin x

2013 Composite projectiles and hafting technologies at Ohalo II (23 ka, Israel): analyses of impact fractures, morphometric characteristics, and adhesive remains on microlithic tools. *Journal of Archaeological Science*, in press.

Backed microliths IDd as side elements of compound projectiles by morphology, diagnostic impact fractures, and adhesive remains. Ohalo II = late Upper Paleolithic, 23,000 yr old submerged campsite, some organic remains including seeds, cord, wooden artifacts, brush hut floors and walls. Adhesives: black carbonaceous, white calcareous (= marl?). [No microliths assoc with their haftings, weapon type not discussed, could be bow or atlatl].

Yaroshevich, Alla, Yossi Zaidner & Mina Weinstein-Evron

2011 Evidence of Hunting Weapon Variability in the Early Middle Paleolithic of the Levant. A view from Misliya Cave, Mount Carmel. Paper presented at Multidisciplinary Scientific Approaches to the Study of Stone-Age Weaponry, Mainz, 19-22 September 2011.

Middle Paleolithic of Levant: Tabun sequence: Early MP unknown hominids using Levallois pts on blades. Mid MP ovoid points. Late MP Levallois pts. EMP of Misliya Cave, Mount Carmel, Israel, near Tabun, L pts, Mousterian points (elongated), and Hummal pts (retouched on large blade). Do different pts = different weapons? Two lines of analysis: ballistically important morphometric attributes and analysis of projectile damage. Correlations between point type, morphometric characteristics and frequencies of fractures diagnostic of projectile impact (DPIF). Levallois points and elongated Mousterian points have tip cross sectional areas similar to efficient thrusting spears, highest frequencies of DPIF, about 20%. Difference between these two types in W, T, and angle of the distal tip may indicate that L and M points were designed to meet two different objectives of spearhead efficiency, namely, depth of penetration and durability. Another group of newly defined Misliya points and some Hummal points were statistically similar to ethnographic dart tips in terms of TCSA and perimeter. These types exhibited less than half the frequency of DPIF observed for L/M points. Ratio of Levallois/Mousterian versus Misliya/Hummal points correlates with ratio of large versus small size game hunted at the site – suggests point types represent different kinds of hunting weapons. Blade production, a characteristic feature of the Levantine EMP is closely associated with hunting weapon technology: elongated M points identified as spearheads, as well as Misliya and Hummal points interpreted as possible tips of composite projectiles, are produced predominantly on blades.

Yaroshevich, Alla, Yossi Zaidner & Mina Weinstein-Evron

2016 Projectile damage and point morphometry at the Early Middle Paleolithic Misliya Cave, Mount Carmel (Israel): Preliminary results and interpretations. In *Multidisciplinary Approaches to the Study of Stone-Age Weaponry*, edited by Radu Iovita and Katsuhiro Sano, pp. 119-134. Springer Science and Business Media, Dordrecht.

Yohe, Robert M.

X

1998 The Introduction of the Bow and Arrow and Lithic Resource Use at Rose Spring (CA-INY-372). *Journal of California and Great Basin Anthropology* 20(1): 26-52.

Bow and arrow uses smaller points than atlatl - what is impact on use of lithic resources? Bow arrival in Great Basin estimates from 4500 BP to 1300 BP, based on small points, and bow fragments (none directly dated [!!!]). Cites cave strata dates suggesting bow by 1800 BP, concurrent with small corner-notched points (Rose Spring/Eastgate, Rosegate types).

Rose Spring site 8 miles from obsidian sources, deep strata, C14 dates. Bimodal pt size distribution with stratigraphic separation supports RS/E pts as arrow vs Elko as dart. RS pts appear ca 1600 BP. Bifacial cores, biface thinning flakes as debitage and blanks, should become smaller with shift to smaller points. Biface thickness however shows only slight decrease until 600 BP, BTF size increases slightly at 1600 then slowly declines until very late in time = pre-bow reduction strategies continue, perhaps because continued use of large Humboldt Basal-notched forms = thrusting spear or knife. Or atlatl continued in use - small numbers of dart pts throughout sequence until AD 600. However, obsidian hydration values fairly constant, suggest mixing of early material to upper levels of site.

Yohe, Robert M., and Alan P. Garfinkel

2012 Great Basin Bighorn Ceremonialism: Reflections on a Possible Sheep Shrine at the Rose Spring Site (CA-INY-372), Rose Valley, Alta California. *California Archaeology* 4(2): 201–224.

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1987 excav, partial skull with horn cores on top of tall rock in a rock cairn or altar, set in fire pit. Skull at ca 90 cm deep. Hearth C14 cal about 500 AD. Complete fine Humboldt Basal Notch point appears to be offering. "thought it unusual at the time but was reticent to conclude it was ceremonial" [!] Ethnog mentions of large caches of bighorn and antlers. Cached bighorn headdress find ca 1050-1150 AD. Other arch examples of sheep skull finds in ritual. Coso Representational rock art style depictions. Newbury Cave split twig figurines. Petro possibly shows skull on pole, man reaching for weighted atlatl. Numic bighorn hunting traditions, communal with net, individual with bow, bighorn a symbol of hunting success and manhood. Shamans charmed sheep for successful hunt, etc.

Yost, James A., and Patricia M. Kelley s

1983 Shotguns, Blowguns, and Spears: The Analysis of Technological Efficiency. In *Adaptive Responses of Native Amazonians*, edited by Raymond Hames and William Vickers, pp. 189-224. Academic Press, New York.

Field work with Waorani, E Ecuador, manioc + plaintain growers. Most research says shotgun more efficient, but others disagree, note that large groups of animals can be killed with bow but scared off by gun. "Mentalist" explanations too: gun makes "beautiful noise" an artifact and power not in rest of native culture etc.

Small population, but warfare common, up to 58% of male deaths [!!!].

A weapon is not just technical capabilities, but associated behaviors.

Blowgun: Child training "for arms, lungs, cheeks, eyesight, hearing and endurance." By 5 target proficiency, by puberty lots animal behavior knowledge. Pet keeping as training. Blowgun 2.75 m long, 2.5-3.2 kg, need some strength to hold. More accurate toward vertical than toward horizontal. Palm leaf rib darts ca 40 cm long. Range, including monkey kills, 12-30 m, accuracy up to 41 m but less after 25 m (overhead targets, horizontal accuracy less). Poison for larger animals + low cost of darts means willingness to risk longer shots.

Spear: Only for larger terrestrial animals, peccary, tapir, deer. Spear 2.5 m long, 1.5 kg palmwood. Usually thrust, not thrown. Dogs help get game in range, but only acquired in last decade.

Shotgun: Expensive, becoming more common, but poor quality. Potential extended range not attempted; use at ranges of blowgun or spear depending on game.

Most game carried home, very little discarded, 70% of carcass is edible meat and organ. Recorded 867 hunts, 18,781 kg meat acquired, 3165 animals, 64% animals with blowgun, 3% spear, 33% gun but blowgun only 36% meat, spear 13%, gun 51% because blowgun only for small arborial animals. Compared to bow hunters, use blowgun on small game much more than bow. Only 7.4% hunts unsuccessful, no shortage of meat protein.

Yu, Pei-Lin x

2006 From Atlatl to Bow and Arrow: Implicating Projectile Technology in Changing Systems of Hunter-Gatherer Mobility. In *Archaeology and Ethnoarchaeology of*

Mobility, Frédéric Sellet, Russell Greaves, and Pei-Lin Yu eds., pp. 201-220. University Press of Florida, Gainesville.

Transition from large to small points indicates change from atlatl to bow, should be subject to adaptive pressures. Test with Coastal Spain (Solutrean-Magdalenian), Japan (late Paleolithic to Initial Jomon), N.Am. Great Basin (Archaic to Early Prehistoric). Attempts to generalize about lithic tool density, to claim that "post-transition" sites have greater density, more intense occupation, more diversity. [Overgeneralizations ignoring too many variables, data not given.] Cundy (1989), Cattelain (1997) ethnog + experimental data manipulated [simplistically] to argue that spearthrower delivers twice as much force on impact. Heavier projectile more effective on larger game [again some meaningless "data"]. Atlatl is "shock weapon" that rapidly debilitates prey, useful if chance of escape is high as in watery environment. Bow more versatile, lighter ammo, more shots etc., more accurate at smaller game, needs less space to use. Bow reflects use in more vegetated areas; earlier transition in Japan and Spain relates to temperature and vegetation changes - little change in Gt B. Bow use also likely to reflect reduced mobility/smaller territory because allows more efficient hunting of broader resources. [His conclusions seem mostly reasonable although they are derived from poorly understood ethnographic and experimental work by others - but he then tries to rationalize them into gross overgeneralizations that ignore all sorts of interesting complexity. Not very useful.]

Zarlenga, Dan

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2011 St Louis Conservation Connection: Deer Season Missouri. KPLR Television interview with Dan Zarlenga, online at http://www.kplr11.com/news/noon_show/conservation-connection/ December 8, 2011.

First atlatl deer in MO since atlatl legalized for deer in rifle season. Interview with successful hunter Luke Boenker and Ron Mertz. LB said he had only been atlatling ca 4 months. Shot from tree stand, small buck. Looks like simple atlatl and synthetic darts.

Zeanah, David W. and Robert G. Elston

2001 Testing a Simple Hypothesis Concerning the Resilience of Dart Point Styles to Hafting Element Repair. *Journal of California and Great Basin Anthropology* 23(1):93-124.

Flenniken et al. "rejuvenation model" - experimental knappers show it is possible that prehist hunters reworked points into different forms, making them poor chronological markers. This is not supported by stratigraphy, obsidian hydration, etc. And since dart points were curated, often of non-local high-utility stone, the lack of archy evidence for bases changing form is odd. Examine N Nevada site assemblages. Each dominated by single point type, also contradicting Flenniken model.

Consider points as part of more complex artifacts: interchangeable component parts - foreshaft with point to go on shafts, notched points expected to break to increase

effectiveness by staying in wound, hunter carrys several foreshafts and few main, can repair darts in field, point is less work than foreshaft + attaching also time-consuming [all of these have some supporting citations but are arguable assumptions]. Different haft styles not compatible. For all these reasons, often not economical to salvage a point. "Rehafting hypothesis": More likely worry about foreshaft, make multiple points to fit them, so consistent point forms. Refitting repaired points to existing foreshafts constrained modification. Thomas found little correlation between point and foreshaft dimensions, Shott's sample showed some. Using 46 hafted dart points from literature point L, W strongly correlate with foreshaft diameter. Point-dominated site assemblages represent short term occup with few users, limited point variability. Longer term palimpsest assemblages much more variable.

"Rejuvenation model" is example of replicative experiment that showed something could be done, not that it was, and fails because not supported by other tests. Rehafting model does not explain why one type was preferred to another, but economic constraints explain why they were stable within a time/culture. "Stylistic" differences may exist, but often can be explained by function and economics. [Generally good article, good rebuttal to Flenniken].

Zeh, Erich

2005 The Atlatl (At-latl): The Most Primitive Weapon. *Indian Artifact Magazine* 24 (2):28-29.

Brief atlatl history and basics, info on WAA. [OK, except for dart spring idea.]

Zollikofer, C., M. Ponce de Leon, B. Vandermeersch, and F. Leveque x

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2002 Evidence for interpersonal violence in the St. Cesaire Neanderthal. *Proceedings of the National Academy of Science* 99(9):6444-6448.

A French find of a Neanderthal partial skeleton, associated with Chatelperronian [early Upper Paleolithic] tools, thermoluminescence dated to ca. 36,000 B.P. Shows a healing cranial injury, consistent with an impact wound from a sharp instrument. Could be accidental, but on top of head, so unlikely. Most ethnographic violence takes place within the group. Most likely shows 1) conflict among Neanderthals 2) using tools (presumably hafted hunting spears, which we know they had) as weapons, and 3) care of severely injured members of the group. [I include this because although it is earlier than any known spear thrower finds, it is during the period of coexistence of Neanderthals and Early Modern Humans, and someone will surely use it to argue for conflict between them, even though we can never really know. Unfortunately written in unnecessary awful jargon.]