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Supplementary Materials for

Paleolithic eyed needles and the evolution of dress

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Ethnographic insights

The use of ethnography in prehistoric archaeology has a long and controversial history. Nevertheless, a general consensus has emerged which stipulates that providing ethnographic data are not misused as an analogy or template for reconstructing prehistory, evidence from recent non-industrialized societies can offer useful insights and assist in generating and testing hypotheses (*139–141*).

Inuit clothing

The sophisticated clothing of the Inuit serves to illustrate the need for carefully tailored, finely-sewn garments in Arctic environments (*30*, *142*). The Inuit employed both awls and eyed needles, using awls on tougher hides (e.g., sealskins) and to initiate holes in softer skins (e.g., caribou hides). Awls were made from the bones of caribou, seal, and bear, and from the tusks of narwhal or walrus; larger awls were often decorated with intricate markings and engravings. Eyed needles were reserved for the final sewing of precisely cut hide pieces, and these fragile tools were stored in needle cases, typically decorated with elaborate cultural motifs. Thimbles were used in sewing, made from the tough skin of seal or walrus, or from a caribou toe bone, or musk-ox horn. Decoration of traditional Inuit clothing was achieved mainly by combining hides and furs of differing colours in varied patterns; less commonly, garments were adorned with sewn beads, bird beaks, or feathers. Durability was an issue: a

set of garments would usually last for only one year, with two different sets required, one each for winter (generally two layers) and summer. The manufacture and maintenance of these complex clothing assemblages was an ongoing daily task. In hunter-gatherer contexts where such complex clothing is mandatory for survival, any technological innovation—eyed needles, for instance—that increases the production efficiency of manufacturing fitted clothing is valuable, and the evident utility will justify the extra effort expended in its manufacture.

Ainu clothing

The Ainu of northern Japan typically wore two layers of clothing, with outer garments and underwear made from a wide range of mammal, fish and bird skins, as well as from woven plant fibres (e.g., nettle) and bark cloth (from the inner bark of the Japanese elm). Eyed needles were stored in decorated needle cases, and adornment of outer garments was exquisite. In addition to combining different colours in sewn skin garments, embroidery and appliqué techniques were applied to cloth materials. Beads were used mainly in necklaces and earrings. Tattooing of exposed skin areas (mainly hands, wrists, forearm, face and lips) was widespread, especially among females, using delicate obsidian-blade knives (*143*).

Tierra del Fuego

Simpler forms of clothing were employed in Tierra del Fuego on the southernmost edge of South America, where single-layered capes and cloaks—sometimes sewn from multiple skins—sufficed as portable insulation among the Ona and Yahgan peoples (*144*, *145*). Notably, eyed needles were absent, with the Yahgan using awls for sewing (*144*). In all likelihood, the Fuegians benefitted from enhanced biological adaptations to cold that had developed over millennia. To the astonishment of Charles Darwin when he visited Tierra del Fuego on the *Beagle* in 1832, the Fuegians often went unclad (*146*). Clothes functioned as

protection from colder temperatures and wind chill, while dressing was achieved mainly with body painting. In order to get properly dressed on ceremonial occasions, the Fuegians would remove any clothes and paint themselves (*145*).

Australian evidence

Eyed needles were absent on the Australian continent, where the Indigenous peoples usually wore no clothes routinely and adorned themselves with body painting, tattooing, scarification, beads, necklaces, and nose bones, among other decorative techniques. Clothing was limited to the cooler southern regions, employed on a pragmatic basis when needed for warmth (*147*, *148*). Garments were single-layered, worn loosely over the shoulders, made typically from a kangaroo or wallaby skin or, in the southern highlands, possum-fur skins sewn together with awls to make large cloaks; these skins served otherwise as rugs and blankets. Archaeological evidence indicates the earliest bone awls in Australia first appeared in southern areas as temperatures declined towards the LGM (*106-110*, *147*). Notably, thermal conditions during the late Pleistocene in Australia were milder than in mid-latitude Eurasia. Also relevant is evidence in Tasmania, which was joined to the southern margin of the continent when sea levels were lower during the late Pleistocene. Bone awls are documented in Tasmania from 31,000 cal BP, likely deployed in the sewing together of small wallaby skins to make larger cloaks. Intriguingly, bone awls (along with small stone hide-scrapers, known as thumbnail scrapers, which dominate Tasmanian lithic assemblages in the late Pleistocene) disappear from the Tasmanian archaeological record in the early-mid Holocene, as the climate ameliorated (*108*, *149*). Paralleling the situation in Tierra del Fuego (and, likewise, to the surprise of the first European visitors), the Tasmanians were routinely unclad during the late Holocene (*147*, *150*). Like the Fuegians, the Indigenous Tasmanians probably had developed biological cold adaptations over 35,000 years in the region, allowing them to manage comfortably without the regular use of clothing (*147*). Collectively, the evidence from

Australia is significant for several reasons: the presence of bone awls but not eyed needles, the continuing decoration of the unclad human body rather than using clothes as dress, the absence of fitted garments, and the failure of clothing to acquire social and cultural functions that elsewhere—particularly in the Northern Hemisphere—led to a decoupling of clothing from climate. In Australia, clothing remained coupled to climate and did not become dress.

Table S1

Contemporary clothing layer zones.

Contemporary global climates are divided into four zones for minimum clothing layer requirements. Shown also are approximate winter mean monthly temperatures and latitudes, the suggested clothing layer equivalents for non-woven materials (animal hides and furs) during the Late Pleistocene, clothing forms, and associated osseous technologies; based on Gilligan (2010) and Eicher and Evenson (2015) (*5*,*47*).

Clothing zone (layers)	Climate zone	Winter temp. (°C)	Latitude (°N)	Pleistocene clothing layers	Clothing form	Bone technology
0	tropics	> 20	0 to 20	0	none	nil
1	sub-tropics	20 to 10	20 to 30	0 to 1	none simple	nil nil
2	cool temperate	10 to 0	30 to 40	1	simple complex/ fitted	nil awl
3	cold temperate	0 to -10	40 to 50	1 to 2	complex/ fitted complex/ layered	awl eyed needle
4	subarctic arctic	-10 to -20	50 +	2	complex/ fitted complex/ layered	awl eyed needle

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