

Clothing, fibres and environmental adaptation

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Core question

How did humans begin to construct portable micro-environments around the body and convert fibres, skins and cordage into adaptive technology?

Historical and evolutionary context

Clothing is difficult to study because hides, plant fibres and cordage decay. Its history is therefore reconstructed from rare preserved fibres, tools associated with hide working and sewing, and indirect biological evidence such as the evolution of clothing lice.

Genetic studies of human lice have been used to estimate when habitual clothing use became established. One multilocus analysis placed the divergence of clothing lice from head-lice ancestors at least around 83,000 years ago and possibly substantially earlier, while emphasizing wide uncertainty. Such estimates are indirect and should not be treated as archaeological dates.

Direct fibre evidence is rare but not restricted to *Homo sapiens*. At Abri du Maras in France, a three-ply cord fragment made from inner-bark fibres and adhering to a stone tool was reported from a Neanderthal context dated to roughly 41,000-52,000 years ago. This is currently among the oldest direct evidence for cordage technology and shows that sophisticated fibre processing cannot be assigned exclusively to our species. Later, wild fibres from Dzudzuana Cave in Georgia, dated to Upper Palaeolithic levels around 32,000-26,000 years before present, were reported as spun, dyed and knotted. The identification of some Dzudzuana fibres has been debated, which is itself instructive: perishable technologies often rest on thinner evidence than stone tools.

What could communities know before clothing systems?

Humans could seek shelter, use fire and move seasonally. Clothing introduced a portable and adjustable layer between body and environment. Unlike a cave or hearth, garments move with the wearer.

Cordage and fibre technologies also make possible binding, hafting, baskets, nets, bags and sewn structures. Their epistemic importance therefore exceeds clothing.

What changed?

Fibres and skins require multi-step processing: selecting materials, cleaning, scraping, twisting, joining, cutting, fitting and sometimes dyeing. The final product often gives little indication of how many operations produced it. Such technologies therefore depend strongly on transmitted procedural knowledge.

Clothing also externalizes thermoregulation. Instead of relying only on biological adaptation or local shelter, humans can alter insulation, wind protection and moisture management through artefacts. This expands the range of habitable environments.

Why could this capability emerge?

The necessary ingredients include sharp tools, hide-working techniques, cordage, knowledge of fibres and social transmission. Climatic variability created strong selective and practical incentives, but no single cold event can be identified as “the cause” of clothing.

What later forms of knowledge did it enable?

Fibre technology contributes to composite tools, fishing nets, sails, containers, architecture and eventually textile industries. It also introduces modular design: fibres become cords, cords become nets or fabric, and these become higher-order structures.

New limits and risks

Textile and hide knowledge is especially vulnerable to archaeological invisibility. Histories based only on preserved artefacts systematically undercount technologies made by groups whose material culture was predominantly organic.

What changed in the architecture of human knowledge?

Humans learned to create **portable engineered environments** and to build complex structures from flexible components. Knowledge of materials became increasingly procedural, layered and difficult to reconstruct from the finished object alone.

Loss, exclusion and uncertainty

Textiles, cordage, hides, basketry and wooden implements decay far more readily than stone. The archaeological record therefore systematically undercounts flexible technologies and the procedural knowledge needed to select fibres, prepare them, twist or weave them and maintain finished garments.

Dates inferred from lice depend on evolutionary models and sampling assumptions. Fibre identifications can be contested. PIO therefore treats clothing as a long, multi-source technological transition rather than a single invention.

Dependency map

- INDIRECT ← PIO-002 Stone tools and cumulative design
- INDIRECT → PIO-006 Rivers, coasts and early navigation
- INDIRECT → later textiles, sails, rope systems and transport

References

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