

## Does cultural evolution need matriliney?

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**Abstract:** Cetacean cultural transmission is associated with lengthened postmenopausal life histories and relatively stable matrilineal social structures. Although *Homo erectus* was not marine adapted, broadly comparable selection pressures, life history profiles, and social structures can be inferred.

My field of research is human cultural evolution. Palaeoanthropological strategic modelling (Tooby & DeVore 1987) requires generalised, cross-species research into how and why animals might pursue cultural strategies. With their excellent overview of the cetacean literature, Rendell and Whitehead (R&V) have contributed significantly to this endeavour.

Inevitably, definitions of culture have been rooted in anthropological rather than biological problems and concerns. Attempts to model the earlier phases of human evolution have correspondingly been plagued by conceptual habits and assumptions derived from theoretical linguistics, semiotics, hunter-gatherer ethnography, and similarly non-Darwinian fields. Contemporary human patterns have typically been projected back as explanations of supposed counterparts in the Plio-Pleistocene. A well-known example from the 1970s was the claim by archaeologists that Oldowan lithic traditions indicated modern hunter/gatherer-style food sharing, cooperative hunting, cultural kinship, and even language (e.g., Isaac 1971; 1978). Although such ideas have since been repudiated within archaeology, in disciplines further afield, the damage was done. Evolutionary psychology to this day postulates an Environment of Evolutionary Adaptedness centred around a vaguely defined cooperative hunter-gatherer lifestyle stretching back several million years (Bowlby 1969). Human cognitive architecture is said to have been irreversibly forged in this setting (Tooby & Cosmides 1992). The Chomskyan Language Faculty is correspondingly viewed as a Plio-Pleistocene adaptation enabling cooperative pooling of environmental information (e.g., Pinker 1994; Pinker & Bloom 1990).

Nonhuman cultural studies enable us to avoid working back from modern humans in this way, and instead work forward on the basis of generalised behavioural ecological principles and constraints. Human abilities for vocal imitation and learning lack plausible primate antecedents, but may be matched in songbirds and cetaceans. The cetacean literature documents complex group-on-group social dynamics and correspondingly flexible, sophisticated signature systems involving a measure of syntactical, combinatorial creativity – ‘phonological syntax’ in Marler’s (1998) terms. If signal evolution theory can elucidate the underlying principles and constraints, we may better appreciate how complex group-on-group signature and display strategies among our ancestors spurred the evolution of distinctively human phonological competences, without having to assume speech (Knight 1999; 2000). Cetacean greeting rituals and similar performances apparently serve group-bonding, trust-generating functions; it seems unlikely that syntactical speech – a low-cost, intrinsically unreliable system of communication – could have evolved in our own species independently of comparable confidence-building strategies and displays of social commitment rendering such signals worth listening to (Deacon 1997; Knight 1998).

In the case of killer whales and sperm whales, cultural transmission of dialects maps closely onto matrilineal social structures. We may well ask whether such elaborate vertical cultural transmission could occur at all if females were dispersing from natal groups, as happens among chimpanzees. Of course, evolving humans were at no stage adapted, as cetaceans are, to marine environments. The transition to

*Homo erectus*, however, arguably brought with it analogous challenges and solutions. In the case of cetaceans, cultural transmission is associated with high levels of mobility, in turn resting on low travel costs. In *Homo erectus*, lowered travel costs and increased mobility were made possible by larger body sizes (McHenry 1994) and obligate, efficient bipedalism (Walker & Leakey 1993). It is plausible to suggest that in both cetacean and *Homo erectus* populations, reduced territorial restriction led to novel requirements for behavioural flexibility in response to habitat variability, this in turn prompting an increasing reliance on cultural transmission of key subsistence strategies.

In humans, post-reproductive females may enhance their fitness by provisioning daughters' offspring (Hawkes et al. 1997; 2000); cetaceans, too, have evolved long post-menopausal lifespans and pass on cultural knowledge within stable matrilineal clans. In their 'grandmother hypothesis,' O'Connell et al. (1999) argue that human-like life history profiles emerged with *Homo erectus*. As climate change in the Pleistocene deprived juveniles of accessible resources, senior females acquired novel responsibilities in provisioning children. A shift of foraging strategies toward carbohydrate-rich tubers enabled female-based kin-coalitions to congregate more densely and colonise a wider range of environments. Life history parameters in killer and pilot whales appear comparable to those of humans, but from the cetacean data it is unclear what role is played by senior female kin in helping offspring to survive. It would be instructive to know more about cross-species variability in cetacean life history parameters, enabling us to explore the conditions under which long postmenopausal life spans evolve.

This raises the question whether cultural transmission in the human case could have reached take-off point without the emergence of stable, female kin-bonded coalitions. Twentieth century social anthropologists (e.g., Lévi-Strauss 1969) have tended to assume male philopatry and female dispersal as the default human hunter-gatherer configuration, despite considerable variability among extant foragers. Some palaeoanthropologists (e.g., Foley & Lee 1989; Rodseth et al. 1991; Wrangham 1987) have made this the basis of their evolutionary models. Such writers typically invoke African ape precedents. But under wild-living conditions, and especially when compared with cetacean achievements, ape cultural transmission is puzzlingly patchy and restricted given these animals' impressive cognitive capacities. My own view (Knight 1998; 1999) is that the major obstacles to ape cultural transmission are political, the patchiness reflecting not cognitive deficits but the relative instability of male philopatric coalitions. In the light of the grandmothers explanation for the evolution of long postmenopausal lifespans, it seems likely that sophisticated cultural transmission in *Homo* evolved, as in the cetacean case, within female philopatric social structures (cf. Dunbar 1996; Knight 1991; 1997; Power 1997).