Cached, carried, or crèched

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Abstract: We believe that "caching" a baby would have been too great a danger in human prehistory, and thus could not serve as the context for prelinguistic vocalization. Rather, infants were most likely carried at all times. Thus, the question arises of why the cry of an infant is such a loud vocalization.

Many years ago, Blurton Jones (1972) did a comparative analysis of the physiology of mother-infant caregiving in mammals and distinguished between those that "cached" their infants, such as seals and ungulates, and those that carried them, such as primates (Jones 1972). He then looked at the physiological characteristics of the relationship between human infants and their caregivers and came to the conclusion that human infants were designed to be "carried" rather than "cached." Since that time, a consensus has developed (Barr et. al 2000) that intimate physical association between infants and their caregivers is an essential feature of human prehistory, an association that modern feeding arrangements contradict to the detriment of both infant and mother.

Dean Falk's theory of language evolution challenges that consensus. It is based on the novel premise that hominid infants were *less* physically attached to their mothers than either their australopithecine ancestors or their contemporary hunter-gatherer descendants. Sometime between the adherence to the feed-as-you-go strategy of our ape ancestors and our switch to the center-point foraging strategy of our hominin ancestors was a time when infants were less physically intimate with their caregivers, and this period has left its traces in language development.

Despite some very attractive features of Falk's arguments, we remain convinced that a human baby is not the sort of creature that can be long away from the physiological support and protection afforded by a human body. Nor do we think Pleistocene Africa was likely to have been the sort of place where caching a baby made much sense. Moreover, we doubt that putting a baby down would substantially increase foraging efficiency. Given that our ancestors were doing center-point foraging at that time, any food that was gathered had to be transported back to the home base. Therefore, at the point that carrying the baby would interfere most with foraging – when the fruits of foraging were being transported to the home base – the mother would have no choice but to put down whatever she was carrying and pick up the infant.

Finally, given what we know about tool use in chimpanzees and early hominins, Falk's idea that a primitive language would have evolved before a simple sling seems implausible. Wild chimpanzees use and sometimes carry tools as diverse as crushed leaves for soaking up water to drink, to simple stone hammers to open nuts (Beck 1975; 1980; Warren 1976). Basic Oldowan stone tools have been found in sites dating as old as 2.5 million years, associated with the fossils of *Homo habilis* (Klein 1999). These tools included rock tools that were carried to other sites, and hammerstones or rocks that were struck against other hard objects to make stone flakes. That tools were carried to other sites implies some form of carrying mechanism. Surely a creature that is carrying rocks could manage to create a simple sling, if only from vegetal matter (as Falk cites, Zihlman 1981). All these considerations lead us to prefer "carrying baby" to "putting baby down."

However, having admitted our allegiance to the carrying hypothesis, we also admit to having had nagging doubts about it, doubts arising from the nature of infant crying. Why should so loud a vocalization ever be deployed in so intimate a relationship as that between an infant and a mother who bears that infant pressed to her body 24 hours a day? One solution to the anomaly of loud human crying is that infants were crèched in the Environment of Evolutionary Adaptedness (EEA) as part of a group-selected (Thompson 2000; Thompson et. al 1996; Sober & Wilson 1998) co-rearing strategy that became available when humans made the transition to center-point foraging about 2 million years ago. In this account, infants are left in the charge of some mothers and juvenile females while other mothers join foraging partners in gathering for the group. Under these circumstances, infants are put down, but in the familiar surroundings of a home base, not in random points in the bush. This idea implies that mothers would have shared in the nursing of one another's infants, and it creates opportunities for an arms race amongst criers that would explain the loudness of human infant crying. It would explain the odd observation that crying in hospital nurseries tends to be contagious.

A compelling part of Falk's argument is based on Kawai's (1965) observations of the transmission of novel behaviors among Japanese macaques. After a juvenile discovered the benefits of washing sweet potatoes and wheat, this activity caught on among other group members, namely older females and siblings (the "Period of Individual Propagation"). Also observed is a "Period of Pre-Cultural Propagation," in which, as behaviors become fixed among a group, infants learn the behaviors from their mothers and pass the behaviors on to future generations. Following Falk's model, early language-like vocalizations of hominin mothers would have spread throughout the group via their infants and children.

Falk's ideas imply that motherese might not be a one-way street. We are exploring the idea that whining is a form of motherese that children use with their parents (Sokol et al., submitted). We are in the early stages of examining whining and find that it shares properties with infant-directed speech, specifically with increased pitch and slowed production. Further work needs to be done, but we are beginning to wonder if all human nervous systems, not just those of infants, are strongly affected by the properties of motherese.

Is it always really mothers' fault?

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Abstract: Falk's paper provides a nice cross-species perspective and an interesting background to formulate a theory of the evolution of human language. However, the author does not provide a complete overview and analysis of the origins of language and takes for granted the "continuity hypothesis." Also her "infant parking theory" is questionable, as it is not well supported by observations.

The target article by Falk addresses the important issue of the origin and the evolution of language. In order to investigate what counted as the origin of the process, one should delimit the phenomenon of language and assume that language can be recognised and distinguished from other forms of communication. Language is more profound than speech and its realisation may take different forms. Falk discusses the different communicative aspects of language, such as speech, gestures, and facial expressions including laughter, crying, and so on, without defining what she really means by language. Indeed, different people mean different things by the word "language": language can be thought of as the visual information conveyed in gestures and facial expressions, or as the tactile information exchanged by touch, or as the auditory information in speech (Gogate et al. 2000; Jouanjean-L'Antoune 1997; Meltzoff & Kuhl 1994). With Liberman (1996) a narrow sense of language, defining language as constituted of a sensory-motor system and pure linguistic computation, became available. Hauser et al. (2002) proposed two restricted conceptions of language: the faculty of language-broad sense (FLB), which includes sensory-motor system, conceptual-intentional system, and computational mechanism for recursion; and the faculty of language-

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narrow sense (FLN), which is the linguistic computational mechanism alone. The FNL plus the sensory-motor system would then correspond to Liberman's definition of language.

It is only after defining the distinctive characteristics of human language that separate us from all other species, including the other great apes, that we can try to understand the evolution of language. Indeed, it is not the ability to communicate that distinguishes us. Other species communicate and depend for their continued survival on successful communication. Linked to this issue is also the question of why, then, was the evolutionary move forward to language made only by humans, a question that Falk appears to address only superficially. If it is of value for the survival of a species, as it clearly is, then why has only one species succeeded in acquiring such a sophisticated and efficient language system? Falk's hypothesis about the prelinguistic substrates of human language is quite questionable. She proposes that human protolanguage might have evolved from "ID vocalizations similar to those of chimpanzees" (sect. 3.1). She suggests that these primitive forms of communication have progressed into a more complex linguistic system thanks to the evolution of bipedalism and the associated increase in human brain size. However, the brain evolution alone cannot explain these fundamental archaic changes in communication, which enabled the hominid brain to acquire a great vocabulary, to produce unlimited numbers of novel utterances, and to register millions of verbal memories. In addition, Falk argues that bipedalism and the increase in human brain size, the two characteristics of human evolution, can explain her "infant parking theory," which is interesting and entertaining. Bipedalism allows mothers to engage in other activities, parking the baby someplace. The evolution of the brain implies that human neonates at birth are not completely developed because mothers could not give birth to babies with huge skulls. The motherese, then, in this situation could be a substitute for mother contact and it could be selected for. Cooper et al. (1997), however, have found that neonates are able to recognize and tend to prefer the voice of the mother, even if she is not using the motherese. Therefore, the familiar sound of the voice, rather than the ID speech, seems to represent the most important factor for the child to realize that the mother is nearby. Furthermore, it is difficult to take seriously Falk's "infant parking theory" as it is not well supported by observations. The author herself mentions that "infant parking is extremely rare in anthropoids" (sect. 3.1) and "it is a rare event in monkeys, apes, and non-Western human cultures" (sect. 3.1.1). How can this theory explain the evolution of human language, if there are not enough observations suggesting an adaptive value of parking the baby and if the proposed relation with motherese is not so evident?

Finally, what is most obviously missing in Falk's review is a critical account of alternative schools of thought about the origin of the language. Falk does not even mention one of the most influential language-origin theories, the Chomskyan proposal of a uniquely human, biologically based, complex innate language capacity that cannot be explained through natural selection (Chomsky 1972; 1995). Instead, she briefly dismisses the "discontinuity hypothesis" by saying (citing Callaghan 1994) that it views "language backward through the lens of contemporary linguistic theory rather than in the context of how evolution operates" (sect. 1). Nonetheless, any language-origin proposal that fails to deal directly with the universal features of human language, such as its phonology, syntax, and semantics, is likely to be inadequate as it oversimplifies the evolutionary processes involved and neglects fundamental characteristics of human language.

Falk's paper brings attention to many interesting ideas related to the origin of human language and provides an interesting cross-species perspective for its evolution. Indeed, the evolution of language can be understood if researchers follow a cross-disciplinary approach as suggested by Hauser et al. (2002), who reminded us that the living apes, especially chimpanzees, are typically used as models or surrogates for our ancestors because they are considered the best referential models for early hominin behavior. By comparing apes to us, the author tries to identify which aspects of communication changed through evolution from the prelinguistic foundation of protolanguage to the human language. Falk, however, reads the behavior of nonhuman primates with anthropocentric eyes and she appears to take for granted that chimpanzees and bonobos have intentions. However, the question of whether nonhuman primates have intentions is still open (Byrne & Russ 1998; McGrew 1998; Povinelli 2000; Whiten et al. 1999).

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Putting infants in their place

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Abstract: The interests of mother and infants do not exactly coincide. Further, infants are not merely objects of attempted control by mothers, but the sources of attempts to control what mothers do. Taking account of the ways in which this is so suggests an enriched perspective on mother-infant interaction and on the beginnings of conventionalized signaling.

Falk's proposal, although promising, underplays the role of the infant. Both of the "fundamental premises" of the "putting down the baby hypothesis" concern the mother – one suggesting that "hominin mothers that attended vigilantly to their infants" would have a selective advantage, and the other that such mothers would "have had a genetically based potential" for the gestural and vocal demands of the distal comforting and control required in the absence of direct touch (sect. 3.2.1). Two reasons for placing greater emphasis on the contribution of the infant strike us as especially significant.

First, the interests of mothers and infants, despite the considerable genetic material and energetic investment of the former in the latter, do not completely coincide. Mothers must determine an appropriate trade-off between their own survival requirements and the demands of rearing, and also between the requirements of other actual or possible offspring and those of any single infant. This begins before birth (Haig 1993). Under conditions of severe scarcity, or when the relative viability of different infants varies significantly, the costs of getting the trade-off wrong could be high. Conversely, any given infant embodies interests that from its own perspective trump those of siblings and its mother, and stands to gain, within limits, from maximizing its share of maternal resources at their expense (Trivers 1974).

This noncoincidence of interests is important because, as well as being the subjects of maternal attempts at comfort and control, infants are the producers of various affective displays that coregulate maternal behavior. Thus, the attempts of mothers to exploit ways of calming their infants sometimes take place in competition with infant behaviors such as crying or smiling that influence maternal affective state (Wiesenfeld & Klorman 1978) and can motivate actions such as feeding and holding. Falk suggests that mothers who were good at vocal comforting may have been freed to forage more effectively, but it is also possible that infants whose cries were more effective at eliciting maternal care over and above distal comforting could have been fed more. *Both* parties, that is, stand to gain from producing more compelling vocalizations and from better ability to appraise those of the other. The appraisal in question is complex, because neither participant is able to rely on any invariably effective behavior – feeding or holding do not always calm an agitated infant, and a crying infant does not always secure immediate maternal attention. Factors such as fatigue, fear, hunger, and habituation to a recently repeated vocal action help explain why this is so.

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