contact between mother and child during foraging, a consequence of the acquisition of a bipedal posture. We welcome this attempt to incorporate evolutionary theory into the question of language origin, especially in the context of a still-widespread notion that some aspects of language may not have evolved gradually by a mechanism of natural selection.

We would like to contribute to Falk's hypothesis with a more neurobiological perspective. More specifically, our commentary is related to the neural substrates for the development of reciprocal, vocal interaction between mother and child and its relevance to the elaboration of increasingly complex, learned utterances that served for communication and eventually became language. Previously, Aboitiz and García (1997b) proposed a hypothesis for the origin for the neural substrate for language based on the noticeable similarity between the neural networks involved in language and the neural networks required for auditory working memory. The neural networks involved in language may have evolved as a specialization of widespread parietotemporal-prefrontal networks in the cerebral cortex, which were involved in, among other things, generating a working memory device for processing and learning complex vocalizations. A critical aspect of language origins is that language probably developed as part of a communicative system that was learned by imitation. The process of learning increasingly complex phonological utterances requires a specialized neural system based on the ability to internally rehearse a phonological template and to compare the output with the internal representation. For this, a sophisticated working memory system is needed, which is provided by parietotemporal-prefrontal networks connecting higher order auditory and multimodal association areas. The classical Wernicke's and Broca's language areas, which are supposedly connected via the *arcuate fasciculus,* may have evolved as a specialization of these original networks involved in phonological imitation.

Interestingly, recent findings (Chaminade et al. 2002; Iacoboni et al. 1999; Moo et al. 2003) indicate that parieto-frontal networks are involved in imitative learning of hand movements. As Falk mentions, mother and child interactions imply a complex, multimodal set of signals – phonological, prosodical, and gestural – which the child imitates, perhaps by using these complex parietotemporal-prefrontal networks. The physical detachment of mothers and their babies during foraging activities may well have put emphasis on vocal communication and the development of relatively complex phonological signals to help mother and child recognition. Therefore, we postulate that under these conditions, early human mothers engaged in reciprocal vocal interactions with their babies in which the parietotemporal-prefrontal circuits of mother and child became, so to speak, "locked" in such a way that the child incorporated the exaggerated gestures and vocalizations of the mother, generated a template and rehearsed these in the presence of the mother, who then produced new vocalizations or repeated the same ones.

The acquisition of complex phonological utterances probably occurs in ontogenetic stages somewhat older than those in which baby talk normally takes place. However, some of the elements of baby talk, such as the exaggerated gestures, prosody, and smiling, possibly serve to generate appropriate internal representations of social signals in the child and also to establish close contact between mother and child. These representations will permit the mother and child's locking of parietotemporal-prefrontal circuits that enable both of them to establish reciprocal, conversational interactions by which the child eventually masters complex communicational signals. Furthermore, this locking of parietotemporal-prefrontal circuits probably serves as the basis for the development of more complex reciprocal interactions between older individuals, which may be the precursors of true conversations.

The sequence of events we are proposing – an early engagement in baby talk between mother and child, which initiates the coordinated activation of parietotemporal-prefrontal networks in both of them and leads to the generation of increasingly complex communicative networks, which eventually result in conversational behavior between older individuals – is basically ontogenetic. In phylogeny, it may be that initially there was an ontogenetic limit to the development of these neural networks by reciprocal social interactions, but with the increase in brain size during hominin evolution, these networks may have become more complex and more plastic, gradually releasing the barriers which limited the development of reciprocal social, protolinguistic interactions. This opened the possibility of living in a world of conversations which transmitted internal, emotional states but also referred to the surrounding world.

Hemispheric dominance for language may have evolved as a consequence of the development of slightly different temporoparietal-prefrontal networks in both hemispheres, perhaps because these networks might not have been fully compatible within one hemisphere. In this context, the recent finding that the same stimulus can be processed by the left or the right hemisphere depending on the task to be performed (Stephan et al. 2003) suggests that hemispheric asymmetry might rely at least in part on differences in large-scale neurocognitive networks. It is thus conceivable that the neural network involved in some aspects of mother-and-child reciprocal vocal interactions was somehow biased to develop in one side of the brain. (An additional factor promoting brain asymmetry may have been the increasing transmission delay across the *corpus callosum* in large brains, which impaired adequate coordination of both hemispheres for certain tasks; Aboitiz & Montiel 2003.)

In summary: mother-and-child reciprocal vocalizations, which in human evolution possibly increased as a consequence of a "putting the baby down" strategy, were probably based on interlocked temporoparietal-prefrontal networks between mother and child. These networks may have served as templates for the development of more sophisticated neural networks, which permitted acquisition of a syntactically based language.

Mothering plus vocalization doesn't equal language

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Abstract: Falk has much of interest to say on the evolution of mothering, but she fails to address the core issue of language evolution: how symbolism or structure evolved. Control of infants does not require either, and Falk provides neither evidence nor arguments supporting referential symbolism as a component of mother-infant interactions.

Falk has put together a very thorough and detailed account of child-rearing practices among humans and chimpanzees. This account sheds considerable light on the origins of speech. Unfortunately, it tells us nothing about the origins of language.

All too many researchers – Falk, alas, is one of them – still seem to regard the terms "speech" and "language" as synonymous and interchangeable. They are not. Speech, like signing, is a modality. Language is a system of expression, one that may function by means of speech, sign, Morse code, talking drums, smoke signals, naval flags, and, doubtless, modalities not yet conceived; or it may keep its productions within the individual's brain, not employing any modality at all. Until the distinction between speech and language is clearly grasped, little progress will be made in our understanding of language evolution.

It is highly likely that the exigencies of maternal care formed a significant factor in determining that the preferred modality for expressing language should be speech, with sign as a fallback for those with impaired auditory systems. If an infant is running away from you, a sound will work better than a gesture. It is even possible that the distinctive prosodic patterns of "motherese" evolved directly

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from the maternal calls of our prelinguistic ancestors. However, these are characteristics of speech, not of language. Had evolution proceeded by slightly different steps, language might have emerged with signing as its preferred modality, with speech as a fallback for those with impaired visual systems. Language has two major (along with many minor) distinguishing features that have nothing to do with modality and that persist regardless of the modality chosen: One, it employs referential symbols, and two, it assembles those symbols to form structured wholes. How symbols emerged and how structures emerged are consequently the two most basic questions in language evolution. Falk's work, although useful and thorough, entirely fails to address either of these questions.

Although referential use of symbols is basic even to a structureless protolanguage, Falk gives us no reason for supposing that mother-infant exchanges would have needed any referential content. Reassurance, disapproval, warning, and all the other types of messages required for such exchanges could have been – indeed, most probably were – conveyed by prelinguistic means: a quick grab and/or a quick slap are often preferred even by modern human mothers to "That berry is poisonous, darling, so don't eat it," and are certainly no less swift and efficient. Senseless, soothing sounds work far better at calming a fractious baby than the most persuasive of verbal arguments. Naturally, when language came along, those soothing sound patterns would have been co-opted to form part of the very specialized genre employed by mothers and other caregivers to address infants. There are two developmental histories here, however, not one; that these may now have become linked carries no implications whatsoever for their earlier phases.

We are all continuists nowadays – at least in the sense that nobody worth taking seriously believes that human capacities derive from anything but generally accepted evolutionary processes. The people whom I have called continuists in the past would be better described as genre continuists – they believe, with a certainty sometimes bordering on the dogmatic, that every human capacity developed from a similar prehuman capacity (if language communicates, it must have come from prehuman communication). Why don't they come straight out and deny the existence of exaptation? I see no support for genre continuism in the work of Darwin or any other leading evolutionist, but Falk seems to accept it without questioning either its basis or its antecedents.

Falk claims that "vocalizations of hominin mothers would have taken on less emotional and more pragmatic aspects as their infants matured." How? Why? No reason is given, no description or explanation of the process is offered – it is taken on trust. She claims that "prosodic (and gestural) markings by mothers would have helped early hominin infants to identify the meanings of certain utterances." This totally begs the question. For the infant to identify those meanings, they first had to be there, in mother's utterances. But how did she acquire them? Are we in for an infinite regress? Impossible to say, because the cited remarks in section 3.2.1 constitute virtually the totality of Falk's proposals about how meaning got into language.

In her conclusion, Falk expresses the hope that "readers will consider the ideas developed in this paper as possible alternatives to suggestions that language could not have emerged from an earlier primate communication system." However, those ideas cannot be alternatives because they address only the emergence of the speech modality and not that of language itself. Those of us who reject genre-continuist scenarios do so because none of those scenarios have come anywhere near explaining how symbolic units evolved or how syntactic structure evolved. Frankly, I cannot see why the issues involved should be as opaque as they seem to be.

When the obvious becomes invisible, ideological blinkers are often to blame. Usually it is those who reject genre continuism who are accused of ideology. For instance, in a recent *BBS* commentary, Crawford (2002) stated that our species has "a very strong desire to be special," a desire that "sometimes hinders our attempts to understand our nature." It wouldn't bother me one iota if it turned out that humans were as banal as grasshoppers. However, it remains a fact, not a desire or a conjecture, that humans do have one or two unique adaptations, which include symbolic, referential units and the ability to link these in rule-governed (and potentially infinite) structures. Some of us want to have those adaptations explained – not just explained away. What's so special or ideological about that?

Which came first: Infants learning language or motherese?

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Abstract: Although *motherese* may facilitate language acquisition, recent findings indicate that not all aspects of motherese are necessary for word recognition and speech segmentation, the building blocks of language learning. Rather, exposure to input that has prosodic, phonological, and statistical consistencies is sufficient to jump-start the learning process. In light of this, the infant-directedness of the input might be considered superfluous, at least insofar as language acquisition is concerned.

A topic of much speculation among researchers who study language acquisition is the observation that caretakers consistently address their infants with a unique tone and manner of voice. This form of speech has come to be known as *infant-directed,* or *motherese.* The apparent universality of this phenomenon only serves to underscore it as (possibly) a key factor in humans' easy passage through the early stages of language learning. Theorizing about the relevance of motherese to language acquisition began years ago (e.g., Ferguson 1964; Fernald 1984), and efforts to causally link the two phenomena have been a fixture in the language-learning literature ever since. In particular, as questions about the underpinnings of infants' remarkable ability to acquire language have become increasingly complex, appeals to universally available "guides" in this process have become increasingly common. Although there is still no consensus about the relative contribution of the way caretakers address infants to the total language-learning toolkit, there is general agreement that this strange way of talking to infants must serve some evolutionary purpose. In her article, Falk addresses a paradox that is often neglected: If motherese evolved to help infants acquire language, how did those who initially produced it learn to speak? The evolution of language itself is perhaps the more appropriate link between motherese and language learning, as suggested by Falk.

Learning to recognize spoken words is a difficult task. Instances of words vary phonetically and acoustically, depending on the discursive, syntactic, and phonological contexts in which they occur. This is in addition to variations introduced by changes in talker identity, speaker affect, and so forth. At the earliest stages, word recognition (e.g., grouping tokens according to type) must be guided by features of the tokens themselves. Although it remains unclear precisely which aspects of the auditory signal initiate recognition, acoustic prominence – an important characteristic of infant-directed speech – is one factor that has been considered influential in jump-starting this process. Data supporting this view indicate that infants generally prefer to listen to acoustically salient speech, where "salient" can mean either affectively or emphatically so. However, my own and others' recent research indicates that when it comes to recognizing a variety of tokens as instances of a particular type (e.g., a specific word), infants are more sensitive to the acoustic similarity among tokens than to their acoustic salience. Infants appear to preserve substantial memory for acoustic detail from one encounter with a word to the next, which in turn guides early word recognition. If word learning were predominantly guided by acoustic prominence, then we should not see this kind of sensitivity to acoustic differences.

Infants face another difficulty when it comes to speech segmentation. In fluent speech, words are not separated by pauses, and the

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