

To appear in Daniel Dor, Chris Knight and Jerome Lewis (Eds.)  
*The Social Origins of Language: Early Society, Communication and Polymodality*  
Oxford Studies in the Evolution of Language. Oxford University Press.

**Niche construction and semiosis: biocultural and social dynamics.**

Chris Sinha  
Lund University

***Introduction: Paradox and problematic in human evolution***

The focus in this volume on the social origins of language could be construed as a theoretical counterblast to the predominance of biologically-based theorizing in many recent approaches to language evolution. This construal has some validity, inasmuch as the hypothesis, until recently widely entertained, that evolutionary modern language emerged as a result of a single genetic mutation, is now considered to be inconsistent with the archaeological evidence of early hominid evolution in Africa (Botha and Knight, 2009). It would, however, be a mistake to suppose that “social” and “biological” explanatory frames are fated to eternal opposition in our quest for the understanding of language origins and evolution. Ever since the question of language origins was first debated by Enlightenment theorists such as Descartes and Condillac, language and the language capacity have indeed been conceptualized as part of *either* unique human nature (nativism), *or* unique human culture (environmentalism). This opposition, however, has been effectively superseded, as a result of recent advances in biological and behavioural sciences, advances that confront us with a striking and challenging paradox.

The paradox is one of discontinuity in continuity. On the one hand, the biological characteristics of the human species display no dramatic discontinuities with those of other species; yet, on the other, human cognitive capacities, and human cultural constructions, appear from our current vantage point to be as exceptional in the living world as they did to Descartes. It can, of course, be argued that the cognitive and cultural discontinuity is merely a symptom of a gap in the available evidence—there are, after all, no living representatives of the human lineage since it diverged from the ancestors of our closest living primate relatives. If there were, the discontinuity would, perhaps, prove to be an illusion. Even so, it is hard to resist the conviction that, however extended the event, or sequence of events in evolutionary time, “something happened”, involving language, that radically transformed the evolving human mind, and this transformation poses a profound and complex problem for both biological and social theory.

To begin with continuity: Darwin’s refutation of the idea that the human species is *essentially* different, in biological constitution and evolutionary history, from other species received, in the closing years of the last century, strong confirmation in two very different domains. Succinctly stated, neither genes nor culture, singly, can account for what, if anything, makes humans different from other species. There is no evidence of dramatic genetic discontinuity between humans and their closest primate relatives, chimpanzees. The two species share, even on the most conservative estimate, about 95% of their genetic material (Britten 2002). Taken together with the results of the human genome project, this suggests that whatever cognitive capacities distinguish the human species from other closely related species are unlikely to be attributable to dedicated genetic material available for directly coding such capacities. This does not mean that there is no genetic component of

To appear in Daniel Dor, Chris Knight and Jerome Lewis (Eds.)  
*The Social Origins of Language: Early Society, Communication and Polymodality*  
Oxford Studies in the Evolution of Language. Oxford University Press.

specifically human capacities. It does mean that the ascription of differences between the cognitive capacities of humans and those of non-humans to interspecies genetic differences *alone* is likely to be false. This is bad news for nativist modularity theories.

The news for those who would argue that what is unique about humans is the capacity for culture, a favoured hypothesis for generations past of social anthropologists, is hardly better. Culture can minimally be defined as the existence of intra-species group differences in behavioural patterns and repertoires, which are not directly determined by ecological circumstances (such as the availability of particular resources employed in the differing behavioural repertoires), and which are learned and transmitted across generations. On this definition, there is ample evidence of cultural differences in foraging strategies, tool use, and social behaviours in chimpanzees (Whiten et al. 1999, de Waal 2001). Such a definition will also qualify, for example, epigenetically learned intra-species dialect differences between songbird communities as cultural and culturally transmitted behaviour (Marler and Peters 1982). Again, this does not mean that there is *no* cultural foundation for uniquely human cognitive capacities; rather, it suggests that human culture, from an evolutionary and developmental point of view, must be treated as *explicandum* as much as *explicans*.

What is needed, it seems, is a theoretical apparatus capable of integrating culture and biology. One version of such integration, in which culture is analyzed as quasi-heritable units (“memes” or “culturgens”) has been argued for by theorists such as Richard Dawkins (1976) and Edward O. Wilson (1998). Such accounts, however, have often been criticized for their reductionism, and more recent evolutionary theory suggests that the relation between biology and culture is much more of a two-way street than was ever envisaged by sociobiology. Far from eliminating culture by absorbing it into the genotype, some biologists are increasingly acknowledging the role of culture in shaping the evolutionary process *at the genetic level*, by the construction of new selective environments. Current developments in theoretical biology, amongst which *niche construction theory* (Laland *et al.*, 2000; Odling-Smee *et al.*, 2003) is particularly salient, significantly depart from the Neo-Darwinian synthesis that dominated 20<sup>th</sup> century biology, by incorporating an ecological dimension that, I shall argue, proves to be particularly important for understanding human linguistic and cognitive evolution.

### ***Neo-Darwinism and its discontents***

I begin by outlining the premises of, and the outstanding problems with, the Neo-Darwinian synthesis unifying Darwin’s theory of natural and sexual selection with modern population genetics. In the Neo-Darwinian synthesis, the *unit of selection* (*what* is selected) is the gene, or more specifically alternative variants (alleles) of the “same” genes. The *agent* of selection (*what does* the selecting) is the extra-organismic environment, including (a) the inanimate surround, (b) other species (a and b together being the basis of natural selection), and (c) (subpopulations of) genes of the same species (the basis of sexual and kin selection). The relevant *attribute* upon which selection works (*what is selected for*) is any genetically transmitted trait. The mechanism of selection determines the differential reproductive success of the gene (allele) within the population of interacting genes, and thus the frequency distributions of genes and traits in the population. This model, when appropriately formalized,

To appear in Daniel Dor, Chris Knight and Jerome Lewis (Eds.)  
*The Social Origins of Language: Early Society, Communication and Polymodality*  
Oxford Studies in the Evolution of Language. Oxford University Press.

can be extended, as we shall see, by including cultural traits in the environment, that act as “amplifiers” on the selection of genetic variation: this is known as the theory of gene-culture coevolution (Lumsden and Wilson, 1981).

The core issues at the heart of the problems besetting the Neo-Darwinian synthesis can be briefly summarized. First, genes do not come singly, but as combinations (genotypes), packaged in organisms (phenotypes). It is this distinction that Dawkins (1976) recasts as a distinction between the “replicator” (that which is copied), and the “vehicle” (that which embodies the genotypic collection of replicators, and interacts with the environment). For Dawkins, it is only the gene that is actually copied, and therefore he identifies the gene (unit of selection) as the replicator, and the phenotype as a mere “vehicle” for the replicator.

However, it is *organisms*, not genes, that are subject to *direct* selection pressures in terms of those traits conferring fitness. The organism level of biological organization receives scant attention in population genetics but, even granted that the gene is the *unit* of selection, it is the organism that must be considered as the *site* of selection. Organisms, in most (though not all) cases, can be regarded as morphological individuals. However, the actual *process* of selection by an “agent” occurs in relation to the *functioning, behaving* organism. It was for this reason that Jean Piaget upheld the leading role of behaviour in evolution (Piaget 1979). In the light of this, it may be (and frequently has been) questioned to what extent it remains legitimate to identify the “replicator” with the genetic unit of selection.

Ecologists emphasize that animals, through their behavior, shape, as well as being shaped by, their niches. Organismic behaviours may eventuate in significant *transformations* of the very environment to which the organism must adapt. A simple example (from Sinha 1988: 136) is the following: “A ‘path’ may ... be an unintended consequence of locomotion from one place to another, but it is, nevertheless, a useful one ... such shaping ... can [however] introduce distal consequences—food shortage, erosion, pollution, competition with other species—which are outside the initial circuit of adaptation.” (See also Costall 2004). In many cases, however, a process of positive feedback will occur in which organism and environment are in a complementary relationship, each shaping the other. An oft-cited example is the hoof of the horse, and its adaptation to the grassland steppe whose ecological characteristics the horse, through its own motion through the landscape, reproduces. The horse is an agent in the evolution and reproduction of the steppe, just as the steppe is an agent in the reproduction and selection of the horse, and it is behavior that is the link between these agentive processes. Even if the DNA-based biochemical replicator, then, is the gene, the *evolutionary dynamic* of replication-plus-selection should, it can be argued, more profitably be identified with the entire complex of the *site of selection*, which is the *active, behaving organism in its ecological niche*.

In an important subset of cases, the niche resulting from from behavior can be seen not merely as a contingent consequence of behaviour, but as an *animal artefact*, inasmuch as phenotypic individuals are genetically, morphologically and behaviourally *adapted* to the *production* of specific niches which are integral to the survival and/or reproduction strategy of the species. Examples of such artefactual niches are the nests of bower birds, and the dams of beavers. The male bower bird builds and decorates an elaborate nest (bower) to attract

females, using attractive objects such as flowers, shells and leaves. The bower forms an integral part of the male's mating display, and sexual selection by the female is based upon the bower as much as upon the behavioural display of the male. Beavers construct, through coordinated and collaborative behaviour, dams that serve both as a defence against predators, and as a means to enhance the availability of food. The dams of beavers not only serve as a constructed, artefactual niche for beavers themselves, but also reproduce the wetland ecology in which many other species thrive. As a final example of the significance of animal artefacts, we can mention the termite mound, whose material structure is not only integral to the reproductive strategy of this species of social insect, but also constitutes the morphological structure of the colony as a "group organism".

Animal-made artefactual niches are just as much heritable as genes, and behavioural adaptations to artefactual niches are subject to natural and sexual selection just as much as any other behaviours. Furthermore, such behavioural adaptations are, in a very real sense, what artefactual niches are "made for". In the ecological psychology of James J. Gibson (Gibson 1979), a key role is played by *affordances*, properties of the ecological niche affording or supporting specific kinds of action made possible by the motor system and morphology of the animal. Such actions are both species-typical (though not necessarily species unique) and adaptive. Because affordances, Gibson maintained, are directly perceived, the phenomenal world of the animal is meaningful, in that it potentiates the activation of perception-action circuits: objects present themselves as edible, climb-able, graspable and so forth. Gibson neglected, however, to note the crucial importance of the fact that some affordances, in the case of artefactual niches, are *constructed* by the animal itself. Artefactual niches are adaptive precisely because of the behaviours and strategies that they afford—nests are for nesting, and burrows are for burrowing. In such cases, the *site of selection* is no longer just the organism, but the organism in its self-constructed niche: the organism/niche coupling or *organism plus artefact*.

What are the implications of this for the Neo-Darwinian synthesis, and for theories of gene-culture co-evolution? A conservative reading would be that the only modification required is that the phenotype, or "vehicle", be extended to incorporate the artefactual niche. This is, indeed, the interpretation favoured by Dawkins (1982), who employs the terminology of the "extended phenotype." Under this interpretation, the "replicator" remains the gene, and only the gene. However, it is not only the gene that is copied or replicated. In fact, the artefactual niche too is both reproduced across generations, and serves as a fundamental precondition for genetic replication. The artefactual niche is thus *both a consequence of and an agent in natural and/or sexual selection*, and must then be seen as a key ingredient of the evolution of the species-typical genotype.

It seems, therefore, that the integration of ecological considerations into evolutionary theory, and specifically the existence of animal artefactual niches, further undermines the hard and fast distinction between germ-line and soma, genotype and phenotype, "replicator" and "vehicle". In fact it makes better sense to say that, even granted that the *unit* of Darwinian selection remains the gene (allele), the "replicator" includes both the artefactual niche, and the niche-adaptive behavioural repertoire of the animal. Such considerations lead us back to

To appear in Daniel Dor, Chris Knight and Jerome Lewis (Eds.)  
*The Social Origins of Language: Early Society, Communication and Polymodality*  
Oxford Studies in the Evolution of Language. Oxford University Press.

Piaget's more general proposition that behaviour is the leading edge and motor of evolution, reinforcing the conclusion that the identification by Dawkins of the "replicator" with the *unit* of selection (the gene, or its hypothesized cultural analogue, the "meme", Dawkins 1976) is deeply flawed, and that replication can as well or better be considered as a property of the entire *site* of selection.

At this point, it is useful to make a brief critical detour to re-examine Neo-Darwinist theories of gene-culture co-evolution, such as that of Lumsden and Wilson (1981), as applied to human culture and society. Such accounts presuppose a functional parallelism between units of biological replication and units of cultural replication—memes, or "culturgens" as they were termed by Lumsden and Wilson (1981); and treat memes as human behavioural variants analogous to gene alleles. In this perspective, ethnographic variation is analyzable in terms of aggregate properties of human populations. The Lumsden-Wilson theory thus presupposes both an ontological distinction, and a functional parallelism, between gene and meme, nature and culture, without either explaining *either* the ontological distinction, *or* the functional parallelism, that is supposed to exist between the units of selection in the domains of biology and culture. The Lumsden-Wilson theory has also been criticized for making "the reductionist assumption that the characteristics of a society can be understood as simply the sum of the characteristics of the individuals of that society" (Alpert and Lange 1981: 3976), and for having no place for *emergent properties* of societies. Alpert and Lange's critique did not specify what these emergent properties are, but we are now in a position to do so: the emergent properties of human societies are those that are specific to human biocultural niches, and that cannot be reduced to the properties of the artefactual niche of any other species.

### ***Niche construction: language as a biocultural niche***

The critical considerations outlined above have led to a more radical formulation of human gene-culture coevolution, advanced by Laland, Odling-Smee and Feldman (2000) and Odling-Smee, Laland and Feldman (2003), in which a key role is played by genotype/phenotype combinations or "phenogenotypes". Odling-Smee *et al.* (2003: 365-366) write that "a phenogenotype can be thought of as a human with a package of genes and package of experiences", adding that this concept "re-establishes the organism as the central unit of human evolution, not as vehicle but as replicator. In fact, what is really replicated is a biocultural complex, with a composite array of semantic information ... and inherited resources." The concept of phenogenotype is not restricted, however, either to human evolution or to the experiences of a single individual, since it encompasses also the ecological niche constructed by, and adapted to, by the species and its subgroups.

In the cases discussed above, the behavioural repertoire of the species includes behaviours that are specifically adapted to the *making* of the quasi-artefactual niche, and these behaviours in turn support wider repertoires of behavioural strategies exploiting the niche. Artefactual niches are adaptive precisely *because of* the behaviours and strategies that they afford—nests are for nesting, and burrows are for burrowing. The artefactual niche in many cases can be regarded as an extension of either a behavioural repertoire (eg male mating display) or of the organism's morphology (eg the bower bird's bower as functionally

To appear in Daniel Dor, Chris Knight and Jerome Lewis (Eds.)  
*The Social Origins of Language: Early Society, Communication and Polymodality*  
Oxford Studies in the Evolution of Language. Oxford University Press.

equivalent, as an indicator of fitness, to the tail of the peacock). Indeed, we can further ask if it might be fruitful to consider certain species-specific behavioural repertoires, such as birdsong, also to be kinds of animal quasi-artefacts, inasmuch the song of the adults provides a niche within which the singing behaviour is epigenetically learned (Marler and Peters, 1982; Sinha, 2004).

Laland et al. (2000: 132) criticize the “human-centred” perspective of previous accounts of gene-culture coevolution, emphasizing that many *non*-human species behaviourally co-direct genetic evolution through niche construction. This point is important, because it situates the role of culture and language in human evolution within the wider class of processes involving adaptation to artefactual niches such as nests, dams, mounds, and burrows. Laland et al.’s niche construction model, then, is a general one, not confined to human culture and evolution. They acknowledge, however, that humans are “unique in their extraordinary capacity for culture” (ibid.: 133). I interpret this to mean primarily that human cultures are unique in some fundamental respect, that is they are different (and irreducibly, discontinuously so) from the cultures of other species; and secondarily that the capacity for creating, acquiring, and transmitting cultural forms is uniquely developed (though clearly not unique) in humans.

One evident discontinuity between human and non-human cultures is that human cultures are linguistic; and the capacity for human cultural acquisition and transmission is mediated by the unique human language capacity. The nativist modularist account of this capacity proposes its inscription in the human genotype, a hypothesis vulnerable to many objections, including the difficulty stated above of locating this profound discontinuity in the continuous landscape of the primate genome. The alternative account that I outline above views the human language capacity as phenogenotypic. Language, in this account, is a quasi-artefactual biocultural niche, and the capacity to acquire and use it involves the evolution and replication of a phenogenotypic biocultural complex (Laland et al. 2000: 144). My proposal, in a nutshell, then, is that although other species than humans may properly be said to display behaviours that can be regarded as both cultural and culturally transmitted (Whiten *et al.*, 1999), human culture is distinguished by the predominant place occupied in it by language as a biocultural niche (Sinha, 2009a).

It might be argued that the designation of “artefact”, even modified as “quasi-artefact”, should be reserved for more or less enduring constructed material structures. Pinker (1994), in keeping with his nativist and modularist view of the language capacity, denies that language is an artefact: he regards language as a part of the natural world, and the capacity for language as a part of human nature. We can counter Pinker’s view, however, not by insisting that evolutionary modern languages are cultural artefacts *tout court*, but by regarding language as the *biocultural ground* for what is unique about human symbolic culture. Culturally transmitted, specialized behavioural repertoires constitute not merely biological, but *biocultural artefact/niches* that are functionally analogous to animal artefacts. If this argument is accepted, it follows that *human natural languages* can also be viewed as quasi-artefacts and species-specific biocultural niches.

Treating language as a biocultural niche yields a new perspective both on the human language capacity (misleadingly identified with the structure of language itself by generative linguistics), and on the evolution of this capacity. First, it unifies, in a non-reductionist fashion, the evolutionary dynamics of human material culture and symbolic culture. As Boivin (2008: 190) has pointed out “Tools, technologies, and other aspects of the material world of humans and their predecessors have largely been seen as the *outcome* of evolutionary developments, and little attempt has been made to investigate their potential role as selection forces during the course of human evolution.” The same can be said of the biocultural niche of language, which is not *separate* from the other material and symbolic components or niche-structures that make up the human biocultural complex. The biocultural niche of language is culturally situated, that is, it is dynamically embedded within the entire semiotic biocultural complex that includes other symbolic and non-symbolic artefacts.<sup>1</sup> It is crucial to appreciate, in this context, that the human biocultural complex, like other animal artefactual niches, is not merely part of *what* is reproduced, but is also fundamental to the *process* of its reproduction and transmission, since it constitutes a self-made environment for adaptive selection.

Second, treating language as a biocultural niche means that theories of language learning no longer require, as do generative linguistic accounts, the organism to possess an internal model of the grammar of a language to account for language acquisition, any more than the building of a nest requires a prior internal model of the nest. The grammar of the language is *in the language*, just as the structure of the nest is in the nest. The capacity for language is thus a cognitive-behavioural relationship between language user and the constituents of language, just as the capacity for building a nest is a cognitive-behavioral relationship between the builder and the constituents of the nest; and it is this *relationship* that, in each case, has been selected for in evolution. This biocultural niche account of language and language learning is thus compatible with usage-based, cognitive functional theories of language and language acquisition (Tomasello, 1998; 2003).

Because of its pre-eminence in mediating both cultural reproduction and individual cognitive processes, language is the primary and most distinctive constituent of what the Russian semiotician Yuri Lotman called the “semiosphere” (e.g. Lotman, 1990): the universe of signs, or the semiotic dimension of the human biocultural complex. The self-constructed human biocultural complex both *favoured* the emergence and elaboration of language, as proposed by Odling-Smee and Laland (2008: 120); and, because language is co-constitutive of that niche itself, was fundamentally *transformed* by language into a symbolic biocultural niche or semiosphere continuous with what we might call the material-artefactual technosphere. The class of organisms with the language capacity (normally developing humans) can thus be theorized as a phenogenotypic replicator, systemically associated with a wider biocultural complex of symbolic and praxic-constructive cognitive capacities, also of a

---

<sup>1</sup> Whiten and Erdal (2012) use the term “human socio-cognitive niche” to refer (on one reading) to what I am calling (after Laland *et al.*, 2000) the “biocultural complex”; in both cases, a more general or transcultural meaning is implied than in many other usages of terms like “cognitive niche” (see also Clark, 2006; Magnani, 2009). An alternative reading of Whiten and Erdal’s notion of “socio-cognitive niche” would be more equivalent to Laland *et al.*’s “phenogenotype”.

To appear in Daniel Dor, Chris Knight and Jerome Lewis (Eds.)  
*The Social Origins of Language: Early Society, Communication and Polymodality*  
Oxford Studies in the Evolution of Language. Oxford University Press.

phenogenotypic nature; and individual language acquisition and use is situated in the contexts of actuation of these inter-related capacities. This account accords with the view that what makes humans unique is not an innate language acquisition device plus a variety of other species-specific innate cognitive modules, but a generalized semiotic or symbolic capacity, epigenetically developed from a suite of cognitive capacities largely shared with other species, but attaining higher levels of organization in humans (Piaget, 1945; Deacon, 1998; Sinha, 1988, 2004). This capacity is not inscribed in the human genome, but distributed across the practices and systems co-constituting (with the epigenetically developed human organism) the human phenogenotype.

### ***Phenogenotype, semiosis and the epigenesis of symbolization***

Epigenesis and epigenetics are terms referring to inheritance processes and mechanisms, at different levels ranging from the molecular to the organismic, that are controlled or modulated by factors other than those inscribed in the genome (Jablonka and Lamb, 2005). Epigenesis occupies a central position in Piaget's later work, which was strongly influenced by the theoretical biology of C.H. Waddington (e.g. Waddington, 1953), as well as in more recent "Evo-Devo" approaches integrating human evolution and development (see Dor and Jablonka, this volume). Piaget considered epigenesis to provide a "third way" between nativism and environmentalism, and to underpin his constructivist genetic epistemology. Sinha (1988) further argued that epigenetic processes provide an integrative bridge between biological and social processes in evolution and development, introducing the notion of *epigenetic socio-naturalism*. In this section, I outline the integrative relations between niche construction and epigenetic processes in human ontogenesis and its evolution, proposing that this dynamic coupling grounded the emergence of symbolic behaviors.

Epigenetic developmental processes in ontogenetic behavioral development are those in which the developmental trajectory and final form of the developing behaviour are a consequence as much of the environmental information as of the genetically encoded information. A genetically specified initial behavioural repertoire is subsequently elaborated through experience of a relevant environment, yielding an envelope of potential trajectories and outcomes. The process of elaboration is directional, and once it has taken place the initial plasticity of the embryonic, or unelaborated, repertoire is largely (though not necessarily wholly) lost. In other words, epigenesis involves a developmental transition from relative organismic plasticity and informational openness, to relative rigidity and informational closure.

Augmented epigenesis is therefore advantageous for organisms in which phenogenotypic organism-niche couplings are both frequent and variable, which is an appropriate general description of the human cultural organism. Regulatory genes augmenting epigenetic openness can therefore be expected to have been phenogenotypically selected for in the human genome, permitting further adaptive selection for domain-specific learning in the biocultural complex, in particular for language. As yet, we know too little to accept or reject hypotheses regarding the innateness of a specifically syntactic component of the human language capacity. I certainly would not wish to reject the possibility that the epigenetic



To appear in Daniel Dor, Chris Knight and Jerome Lewis (Eds.)  
*The Social Origins of Language: Early Society, Communication and Polymodality*  
Oxford Studies in the Evolution of Language. Oxford University Press.

processes selected in the evolution of the human biocultural complex include a predisposition for learning syntax, but this does not necessarily imply that any such predisposition is or was “dedicated” from the start exclusively to language, and it certainly does not imply anything resembling an innate Universal Grammar. In an epigenetic perspective, any adaptive developmental predisposition for learning language is unlikely either to involve direct coding of, or to be dedicated exclusively to, linguistic structure (Mueller, 1996). Rather, we may hypothesize that epigenetically governed adaptations initially evolved in response to proto-linguistic socio-communicative and symbolic processes, later capturing and re-canalizing behavioural adaptations (such as serial and hierarchical constructive praxis) initially “targeted” to other developmental and cognitive domains.

*The transition from signal to symbol.* Sensitivity to signals is as basic a property of life as the ability to reproduce. All organisms are able to detect signals indexing the presence of conditions hospitable to survival and reproduction. The more complex the organism, the greater the range of signals to which it is sensitive, and the more complex its behaviours both in response to, and in the active search for, life-relevant signals. Signals, in social animals, may also be used to communicate. Communicative signals are not conventional, although (as in the case of the vervet monkey alarm calls studied by Cheney and Sefarth, 1981) they may involve systematic encoding: that is, the same communicative modality may support a variety of coded instructions, and it is even possible for them to support a simple “code-syntax”. The social exchange of signals does not, however, depend upon a socially shared world of joint reference, and there is no shared convention of a sign “standing for” a referent or class of referents. The mechanism underpinning the social exchange of signals is neither intersubjectivity nor social convention, but co-ordination of individual organismic behaviour.

Symbols, by contrast, are conventional, depending upon shared understanding that the symbol is a token representing some referential class, and that the particular token represents a particular (aspect of) a shared universe of reference and, ultimately, discourse. Conventional symbol systems are grounded in an intersubjective meaning-field in which speakers represent, through symbolic action, some segment or aspect of reality for hearers. This representational function is unique to symbolization, and is ultimately what distinguishes a symbol from a signal. A signal can be regarded as a (possibly coded) instruction to behave in a certain way. A symbol, on the other hand directs and guides, not the behaviour of the organism(s) receiving the signal, but their understanding (construal) or (minimally) their attention, with respect to a shared referential situation.

The centrality of reference as a criterion for symbolization has been pointed out by several authors, including by John Searle in his famous “Chinese room” thought experiment (Searle, 1980). Reference, however, is only the first of two criteria for fully developed, or “true”, symbolization. Joint reference is the criterial basis for the emergence of symbolization, while the second criterion, which I shall call following (Langacker, 1987) construal, constitutes the set of cognitive operations which underpin the elaboration of proto-symbolic joint reference into linguistic conceptualization proper (Sinha, 2004).

To appear in Daniel Dor, Chris Knight and Jerome Lewis (Eds.)  
*The Social Origins of Language: Early Society, Communication and Polymodality*  
Oxford Studies in the Evolution of Language. Oxford University Press.

It is possible to envisage an evolutionary scenario for the phylogenetic emergence of symbolic communication from signal communication involving the following steps:

1. The receiver comes to pay attention to the sender as the source of communicative signals.
2. The sender comes to pay attention to the receiver as a recipient of communicative signals.
3. The receiver comes to pay attention to the evidential reliability of the sender's communicative signals as a source of information, by checking what the sender is paying attention to, or doing.
4. The sender comes to pay attention to the receiver's readiness to reliably act upon the information communicated, by paying attention to what the receiver is paying attention to, or doing.

The first two steps of this sequence do not involve intersubjective sharing by the communicating organisms of a referential world, but they do require orientation towards, or social referencing, of a communication partner either as a source of information or as an actor whose behaviour can be influenced. This level of communicative capacity is probably widespread amongst mammals, underpinning complex signal-mediated social behaviours. Not only communication between conspecifics, but also communication between humans and domesticated or working animals often seems to involve an understanding on the part of the animal that the human can both send and receive signals. Communication, with the achievement of Steps 1 and 2, remains signal-based, but it implies the establishment of a first or primary level of intersubjectivity, consisting of a recognition by each communication partner of the other *as* a communication partner, and the recognition by each partner of the other as an agent capable of acting as initiator or mediator of goal directed action.

Primary intersubjectivity appears to be innate in human infants. Caretakers (usually mothers) and infants engage from a very early age in episodes of communication in which the bodily movements, facial expressions and vocalizations of the two participants provide the signals necessary for the maintenance of the communicative channel or intersubjective "we" formed by the dyad. The real time temporal meshing by the mother of her actions with those of the baby is of fundamental importance to the maintenance of intersubjectivity (Trevarthen and Hubley, 1978), indicating the emergence of a psychologically real "ontology of the social".

In taking Steps 3 and 4, the sender and/or receiver develop the further capacity to understand that a signal indexes an intention, rather than the action intended. With this, the possibility is opened for deception and suspicion regarding intentions. The most basic level of understanding of the communicative partner not just as a potential agent, but as an experiential subject within the intersubjective field, is the ability to follow gaze, as evidenced by human infants from about 6 mo. of age (Butterworth and Jarrett, 1991) and by a number of other species. From around nine or ten months of age human infants "begin to engage with adults in relatively extended bouts of joint attention to objects ... In these triadic interactions infants actively co-ordinate their visual attention to person and object, for example by looking to an adult periodically as the two of them play together with a toy, or by following the adults

To appear in Daniel Dor, Chris Knight and Jerome Lewis (Eds.)  
*The Social Origins of Language: Early Society, Communication and Polymodality*  
Oxford Studies in the Evolution of Language. Oxford University Press.

gaze. Infants also become capable at this age of intentionally communicating to adults their desire to obtain an object or to share attention to an object, usually through non-linguistic gestures such as pointing or showing, often accompanied by gaze alternation between object and person.” (Tomasello, 1996: 310). The achievement of joint reference in human infancy establishes the “referential triangle” referred to as “secondary intersubjectivity” (Trevarthen and Hubley, 1978).

The emergence of the “referential triangle” marks the emergence of the first criterion for symbol usage, namely reference in an intersubjective field. From this point until about 14 mo. of age, infants increasingly mediate the manipulation of the field of joint attention by manipulating objects in give-and-take routines, and early in the second year of life they begin to demonstrate active mastery of the conventional usage of objects in play situations, their usage of such objects being dominated by objects’ canonical functions until well into the third year of life (Sinha and Rodríguez, 2008). It seems to be a well-founded conclusion that by early in the first year of life, the basic foundations of symbolization in intersubjectivity and in an understanding of conventionality have been laid. The elaboration of symbolization into grammar involves the mastery of natural language subsystems that functionally permit flexible construal (Sinha, 2004; Tomasello, 2003).

*Infancy, evolution and culture.* There is a common developmental logic to the phylogenetic and ontogenetic development of symbolization. The logic is one of process, from signals to the emergence and elaboration of symbols. The logic involves the following sub-processes, which significantly temporally overlap but which emerge in the order of mention below:

1. Intentionality and intersubjectivity.
2. Conventionalization based in intersubjectivity.
3. Structural elaboration yielding flexible construal.

This shared developmental logic does not, however, imply that “ontogenesis recapitulates phylogenesis.” Instead, I suggest that ontogenesis—and in particular the biocultural niche of human infancy—played a crucial role in the evolutionary development of the human symbolic capacity and, therefore, of the biocultural niche of language within which infancy itself is embedded. Human infants, as has often been pointed out, are extraordinarily well adapted to the demands of enculturation and the acquisition of symbolic communication. This is because, once established, the emergent social ontology of intersubjectivity and conventionalization set up new parameters for the selection of context-sensitive and socially situated learning processes. This phenogenotypic account differs significantly from hypotheses focusing on the evolutionary selection of innate, content-dedicated cognitive mechanisms, including a putative innate Universal Grammar or “language instinct”.

### **Conclusion**

The account outlined above revolves around the proposition that the epigenetic stabilization of the phenogenotypic semiosphere introduced the evolutionary discontinuity characterizing human culture and human cognition. Signs are both transformative cognitive tools, and constitutive of specifically human cultural ecologies. The semiotic capacity is hypothesized to

have triggered transformative effects across all or most cognitive domains, thereby potentiating human symbolic cultures, which constitute the biocultural complexes in which human cultural innovation and transmission occur. The semiotic capacity is the explanatory link binding what is unique to human cognition with what is unique to human culture. In conclusion, I offer the following reflections on the role of the human semiotic capacity in integrating development, evolution, language and cognition.

1. Understanding the transformative role of signs presupposes understanding the evolutionary logic of the sign itself, and in particular the distinction between signals (ubiquitous in non-human communication systems) and symbols, icons, and other signs possessing referential value in an intersubjective field, the capacity to use which is strictly limited in non-human species. Pavlov's insight that human cognition was distinguished by a "second signal system" can only be further developed by recognizing that the human symbolic capacity is an evolutionary and developmental acquisition which builds upon, but is fundamentally different from, the capacity to exploit signaling.

2. The proposition, derived by extension from Laland *et al.* (2000), that signs and sign systems are artefacts/niches, can be complemented by the proposition that *all* human artefacts (that is, material as well as symbolic cultural products) are situated, and can be re-situated, in semiotic fields; and are thus to be considered as having semiotic value (Sinha 1988, 2005; Sinha and Rodríguez, 2008). A particular case is that of the "material anchoring" of cognitive processes dependent upon symbolic notations in instrumental artifacts (Hutchins, 2005). Frequently, the human body itself serves as such a material anchor (Enfield, 2005); to this extent, the body itself can be viewed as an artifact with semiotic value, that is, as *embodying* semiotically mediated cognition (as well as aesthetic value).

3. It is increasingly recognized, in theories of distributed cognition, that human cognitive processes extend "beyond the skin," and involve intersubjectively shared mental states and cultural-cognitive technologies. This presents a conceptual problem not only for psychology, with its traditionally individualist assumptions, but also for biology, which assumes by default that the organism as a behavioral and morphological individual is identical to the organism as bearer of genetic material. It is this general problem that the notion of "phenogenotype" (Laland *et al.*, 2000) is designed to address and resolve.

4. However, a further step, specific to human evolution and development, can and should be taken. The human organism, by virtue of the semiotic status of the body and the normative shaping of its activities in a cultural field, has a "dual ontology," both culturally constituted as a constituent of the semiosphere and, at a purely biological level, a genetic individual. The body is part of the system which extends beyond the body, as well as being the originating *sine qua non* of that system. While non-human organisms are simplex, the human organism is duplex, and its phenogenotypic coupling with constructed niches involves a developmental process of auto-construction. Language has a dual ontology, as part of biological human species-being, what it means to be human, and as the foundational social institution in the Durkheimian sense (Durkheim, 1895).

5. This dual ontology of the human body (individual-biological and socio-cultural) is, in modern humans, incorporated in the genotype, and expressed, in the very early stages of post-natal epigenetic development, in the responsiveness of the human infant to the communicative actions of caretakers in the primary intersubjective semiotic circuit (Trevarthen, 1998). More generally, ontogenesis, and the niches of infancy and childhood, played a crucial role in the evolutionary development of the human semiotic capacity. Human infants and young children, as has often been pointed out, are extraordinarily well adapted to the demands of enculturation and the acquisition of symbolic communication (Tomasello 1999). Once established, the emergent social ontology of intersubjectivity and normativity set up new parameters for the selection of context-sensitive and socially situated learning processes. The species-specific cognitive capacities of young humans are often conceptualized in terms of “mind reading” or “theory of mind.” Such an internalist-mentalist perspective can be criticized for neglecting the epigenetically constitutive role of the semiosphere, and of material culture, in the development of this capacity (Sinha, 2009b). Internalist theories also pay insufficient attention to the emergent social-ontological property of *normativity* (Itkonen, 1983), which characterizes human artefacts and institutions at both micro and macro levels.

7. The characterization of language as a biocultural niche emphasizes the biological continuity of the human semiosphere with the constructed niches that we find in many other species. Language is also, however, following the logic of dual ontology, a normative social institution (Sinha, 2009a), and as such emergently discontinuous with non-human constructive niches. Although frequentist strategies may play a role in the learning of specific norms, the norms themselves, being in principle negotiable, are irreducible to frequency of occurrence. The evolutionary emergence of normativity was fundamental in the construction of the human semiosphere, which encompasses ethical and aesthetic, as well as cognitive values. Norms and conventions, governing the use of both symbolic and material artefactual resources, were fundamental to the social origins of language.

8. The account of the social origins of language that I have offered in this Chapter is consistent with that of the previous Chapter by Dor and Jablonska, drawing on many of the same theoretical and empirical sources. I completely concur with their assertion that “We evolved *for* language”, as well as with the slogan coined by Arbib (2012: ix) that “[o]nly the human brain is *language ready*”. Niche construction theory, in which language is viewed as a biocultural artefact/niche, is the theoretical articulation of the dialectical and dynamic unity of these two apparently opposing propositions. I have emphasized process dynamics in this Chapter, leaving unanswered the key question: When, then, did language emerge in the course of human evolution? There is no compelling reason, however, to suppose that evolutionary modern languages co-emerged with the speciation event giving birth to a biologically modern human population. I offer the following tentative and revisable timetable. *Multimodal protolanguage* (holophrastic speech+gesture+mime) very likely has a time depth of 1- 2mya. It was almost certainly possessed by *H. erectus*, given that species’ dispersal range. *Early language* (Heine and Kuteva, 2007), involving lexically-based constructions and

To appear in Daniel Dor, Chris Knight and Jerome Lewis (Eds.)  
*The Social Origins of Language: Early Society, Communication and Polymodality*  
Oxford Studies in the Evolution of Language. Oxford University Press.

differentiated participant roles, can be hypothesized to have emerged as the first original biocultural semiotic artefact of the “language ready brain” 200 kya to 100 kya. I more or less concur, again, with Arbib (2012) that *evolutionary modern languages* (grammaticalized, morphosyntactically more complex, and with elaborated functional differentiation) probably date from 100 kya – 60 kya. Their emergence can be hypothesized to be associated with social and kinship differentiation (clan/moiety structure) and with the emergence of mythic and collective narratives, expressed also in other semiotic media, including rock art, song and dance.

## References

- Alpert, J. and Lange, R. (1981). Lumsden-Wilson theory of gene-culture coevolution. *Proceedings of the National Academy of Sciences USA* 78: 3976-3979.
- Arbib, M. (2012). *How the Brain Got Language*. Oxford: Oxford University Press.
- Boivin, N., (2008). *Material Cultures, Material Minds: The role of things in human thought, society and evolution*. Cambridge: Cambridge University Press.
- Botha, R. and Knight, C. (2009). *The Cradle of Language*. Oxford: Oxford University Press.
- Britten, R. (2002). Divergence between samples of chimpanzee and human DNA sequences is 5%, counting indels. *Proceedings of the National Academy of Sciences USA* 21: 13633-13635.
- Butterworth, G. & N. Jarrett (1991) What minds have in common is space: spatial mechanisms serving joint visual attention in infancy. *British Journal of Developmental Psychology* 9. 55-72.
- Cheney, D.L. & Seyfarth, R.M. (1981) Selective forces affecting the predator alarm calls of vervet monkeys. *Animal Behaviour* 76: 25-61.
- Clark, A. (2006). Language, embodiment and the cognitive niche. *Trends in Cognitive Science* 10: 370-374.
- Costall, A. (2004). From Darwin to Watson (and cognitivism) and back again: the principle of animal-environment mutuality. *Behavior and Philosophy* 32: 179-195.
- Dawkins, R. (1976). *The Selfish Gene*. Oxford: Oxford University Press.
- Dawkins, R. (1982). *The Extended Phenotype*. Oxford: Oxford University Press.
- Deacon, T. (1998). *The Symbolic Species: The Co-Evolution of Language and the Human Brain*. Harmondsworth: Penguin.
- de Waal, F. (2001). *The Ape and the Sushi Master*. London: Allen Lane.
- Durkheim, E. (1895). *Les Règles de la méthode sociologique*. Paris: Alcan.
- Enfield, N. (2005). The body as a cognitive artifact in kinship representations: Hand gesture diagrams by speakers of Lao. *Current Anthropology* 46: 51—81.
- Gibson, J. (1979). *The Ecological Approach to Visual Perception*. Boston: Houghton Mifflin.
- Heine, B. and Kuteva, T. *The Genesis of Grammar: A reconstruction*. Oxford: Oxford University Press.
- Hutchins, E. (2005). Material anchors for conceptual blends. *Journal of Pragmatics* 37: 1555—1577.
- Itkonen, E. (1983). *Causality in Linguistic Theory*. London: Croom Helm.

- To appear in Daniel Dor, Chris Knight and Jerome Lewis (Eds.) *The Social Origins of Language: Early Society, Communication and Polymodality* Oxford Studies in the Evolution of Language. Oxford University Press.
- Jablonka, E. and Lamb, J. (2005). *Evolution in Four Dimensions: Genetic, Epigenetic, Behavioral, and Symbolic Variation in the History of Life*. Cambridge, MA: MIT Press.
- Langacker, R.W. (1987) *Foundations of Cognitive Grammar Vol. 1, Theoretical Prerequisites*. Stanford: Stanford University Press.
- Laland, K.N., Odling-Smee J. and Feldman M.W. (2000). Niche construction, biological evolution, and cultural change. *Behavioral and Brain Sciences* 23: 131-175.
- Lotman, Y. (1990). *Universe of the Mind: A semiotic theory of culture*. (Transl. Ann Shukman). New York: I.B. Tauris and Co. Ltd.
- Lumsden, C.J. and Wilson, E.O. (1981). *Genes, Mind and Culture: The Coevolutionary Process*. Cambridge, MA: Harvard University Press.
- Magnani, L. (2009). *Abductive Cognition: The epistemological and eco-cognitive dimensions of hypothetical reasoning*. Berlin: Springer.
- Marler, P. and Peters S. (1982). Developmental overproduction and selective attrition: New processes in the epigenesis of birdsong. *Developmental Psychobiology* 15: 369-378.
- Mueller, R-A. (1996) Innateness, autonomy, universality? Neurobiological approaches to language. *Behavioral and Brain Sciences* 19: 611-675.
- Odling-Smee, F.J., Laland, K.N. and Feldman, M.W. (2003). *Niche Construction: The Neglected Process in Evolution*. Oxford: Princeton University Press.
- Odling-Smee, J. and Laland, K.N. (2009). Cultural niche-construction: evolution's cradle of language. In Rudolf Botha and Chris Knight (eds.) *The Prehistory of Language*. Oxford: Oxford University Press, pp. 99-121.
- Piaget J. (1945). *La Formation du symbole chez l'enfant*. Neuchatel: Delachaux and Niestlé.
- Piaget, J. (1979). *Behaviour and Evolution*. London: Routledge.
- Pinker, S. (1994). *The Language Instinct*. London: Penguin.
- Searle, J.R. (1980) Minds, brains and programs. *Behavioral and Brain Sciences* 3: 417-424.
- Sinha C. (1988). *Language and Representation: A Socio-Naturalistic Approach to Human Development*. Hemel Hempstead: Harvester-Wheatsheaf.
- Sinha, C. (2004). The evolution of language: from signals to symbols to system. In D. Kimbrough Oller and Ulrike Griebel (eds.) *Evolution of Communication Systems: A Comparative Approach*. Vienna Series in Theoretical Biology. Cambridge, MA: MIT Press, pp. 217-235.
- Sinha, C. (2005). Blending out of the background: Play, props and staging in the material world. *Journal of Pragmatics* 37, 1537-1554.
- Sinha, C. and Rodríguez, C. (2008). Language and the signifying object: from convention to imagination. In J. Zlatev, T. Racine, C. Sinha and E. Itkonen (eds.) *The Shared Mind: Perspectives on intersubjectivity*. Amsterdam: John Benjamins, pp. 358-378.
- Sinha, C. (2009a). Language as a biocultural niche and social institution. In Vyvyan Evans and Stéphanie Pourcel (Eds.) *New Directions in Cognitive Linguistics*. Amsterdam: John Benjamins, pp. 289-310.
- Sinha, C. (2009b). Objects in a storied world: materiality, narrativity and normativity. *Journal of Consciousness Studies*, 16 (6-8): 167-190.

- To appear in Daniel Dor, Chris Knight and Jerome Lewis (Eds.)  
*The Social Origins of Language: Early Society, Communication and Polymodality*  
 Oxford Studies in the Evolution of Language. Oxford University Press.
- Tomasello, M. (1996). The child's contribution to culture: A commentary on Toomela.  
*Culture and Psychology* 2: 307-318.
- Tomasello, M. (ed.) (1998). *The New Psychology of Language: Cognitive and Functional Approaches to Language Structure*. Mahwah, NJ: Erlbaum.
- Tomasello, M. (1999). *The Cultural Origins of Human Cognition*. Cambridge, MA: Harvard University Press.
- Tomasello, M. (2003). *Constructing a Language: A Usage-Based Theory of Language Acquisition*. Cambridge, MA: Harvard University Press.
- Trevarthen, C. & P. Hubley (1978). Secondary intersubjectivity: confidence, confiding and acts of meaning in the first year In A. Lock (Ed.) *Action, Gesture and Symbol: the emergence of language*. London: Academic Press.
- Trevarthen, C. (1998). The concept and foundations of infant intersubjectivity. In S. Bråten, (Ed.) *Intersubjective Attention and Emotion in Early Ontogeny*. Cambridge: Cambridge University Press, pp. 15-46.
- Waddington, C. H. (1953). Epigenetics and evolution. In R. Brown and J. F. Danielli (eds.), *Evolution* (SEB Symposium VII). Cambridge, Cambridge University Press pp. 186–199.
- Whiten A., Goodall J., McGrew W.C., Nishida T., Reynolds V., Sugiyama Y., Tutin C.E.G., Wrangham R.W. and Boesch C. (1999). Cultures and chimpanzees. *Nature* 399: 682-685.
- Whiten, A. and Erdal, D. (2012). The human socio-cognitive niche and its evolutionary origins. *Phil. Trans. R. Soc. B* 367: 2119-2129.
- Wilson, E.O. (1998). *Consilience: The Unity of Knowledge*. New York: Knopf.