Language as a biocultural niche and social institution

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> Grammars … refer to real structures, though not to psychologically real structures in the processing sense … a grammar is a description of our *knowledge of a social institution*—the language—and because of this basis in social or institutional reality, rather than in cognitive functioning, grammars and psychological processes have no more than the loose relationships they appear, in fact, to have. The role of grammar during speech programming is analogous to the role of other social institutions during individual behaviour. This role is to define and evaluate the behaviour of individuals. It is not to cause the behaviour (McNeill 1979: 293).

1. Introduction: language, culture and nature

The place of language in nature and culture is one of the abiding problems of all the language sciences, of which linguistics is but one. Language is at the heart of what it means to be human—indeed it has long been held that language is both *essential* to our humanity and *unique* to our species. Descartes famously argued that language is essentially human *because* it is an expression of uniquely human, universal reason. It is reason, he maintained, that distinguishes humans from animals, which are no more than merely complex machines:

> For we can easily understand a machine's being constituted so that it can utter words, and even emit some responses to action on it of a corporeal

> kind, which brings about a change in its organs … But it never happens that it arranges its speech in various ways, in order to reply appropriately to everything that may be said in its presence … For while reason is a universal instrument that can serve for all contingencies, these organs have need for some special adaptation for every particular action. (Descartes 1911 [1637]: 116).

The Cartesian position was the precursor of contemporary theories of the universality and innateness of the human language faculty, although Descartes would perhaps have questioned the conceptualization of this faculty in terms of modular "mental organs" (Chomsky 1968, Pinker 1994).

Later Enlightenment philosophers maintained, on the contrary, that language, as an attribute of social association, culture and civilization, was in large part *responsible* for human reason and for what came to be called the "higher mental processes." Condillac, for example, wrote that:

> The resemblance between animals and ourselves proves that they have minds, and the difference between them and us proves that their minds are inferior to ours … the mental operations of animals are limited to perception, consciousness, attention, reminiscence and imagination not under their control, while ours include other operations whose origin I am about to make clear … If contemplation consists in preserving perceptions, then before the use of institutional signs, it is merely outside our control; but if it consists in preserving the signs themselves, it has no function at all. So long as imagination, contemplation and memory are unused, or as long as imagination and contemplation operate outside our control, we cannot direct our attention as we please … But when someone begins attaching ideas to signs of his own choosing, we see his memory begin to form … Later, he acquires much greater control over his imagination as he invents more signs, for he has many more ways of using it. (Condillac 1987 [1746]: 459).

Condillac rejected the nativism of Decartes, and his ideas not only draw upon the empiricism of Locke and Hume, but also anticipate Vygotsky's notion that human higher mental processes are dependent upon their semiotic, and especially linguistic, mediation (Vygotsky 1978). Language, in his view, *makes* us human. As Condillac's follower Itard—educator of "Victor", the Wild Boy of Aveyron—wrote, "man is inferior to a large number of animals in the pure state of nature … the moral superiority said to be natural to man is only the result of civilization, which raises him above other animals by a great and powerful force." (Cited in Lane 1977: 129).

Descartes and Condillac agreed, then, that language distinguishes humans from other creatures; their disagreement was over whether it *expresses* or *enables* this difference, whether language is to be seen as primarily an expression of an innate faculty of mind, or as primarily a vehicle of social life and social interaction that enables and constitutes the uniqueness of the human mind. In this classical debate, one which defined not only the Enlightenment but Western thought about language down to the present day, we see the alignment of a number of dichotomous categories: human *vs* non-human; rational *vs* non-rational; culture *vs* nature.

Language, from this point of view, can belong *either* (following Condillac) to culture, making possible the "higher" faculties of human beings, *or* (following Decartes) to (higher, human) nature—defined in opposition to "lower" animal nature. Either way, the uniqueness of language is assumed to mirror the uniqueness of humans, interpreted in terms either of our unique nature, or, as we now would say, genetic make-up; or of the uniqueness of human culture. With the waning in recent years of the strong nativist program, it has become more usual to accept that the acquisition of language in children, like other aspects of development, is based upon epigenetic interactions between what is innate and what is available in the environment (Sinha 1988, 2004). In what sense might it also be possible to recast our ideas about the very *ontology* of language, in such a way that it comes to be seen as *both* a human socio-cultural form *and* intrinsic to human biology? And how, in its turn, might such a new, synthetic "biocultural" view of language affect our ideas about language processing and language learning?

2. Evolution, ecological niches and animal artefacts

A new synthesis is necessary because the assumptions guiding the thinking of both Cartesian, nativist and Condillacian, culturalist accounts are proving, in the light of

21st century research, to be fundamentally flawed. For the neo-Cartesians, human distinctiveness is to be sought in the genes, from which stem all human attributes, including cultural forms; for the neo-Condillacians, in the existence of human culture, a unique human attribute that, according to some, has rendered the very concept of a "human nature" invalid.[1] Both positions are predicated on an assumption of human uniqueness, of either genes or culture, and this assumption has motivated the traditional paradigm of language and its learning.

In the traditional paradigm, as we have seen, language is seen as part of *either* unique human nature (nativism), *or* unique human culture (environmentalism), and language learning is viewed as the exposure of the learner to an external "input" to be internalized. It is this model that, I argue, must be superseded, as a result of recent advances in biological sciences, advances that confront the traditional paradigm in the human sciences with a striking and challenging paradox.

The paradox is one of discontinuity in continuity. One 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 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

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[1] Malson (1972: 9) (in his Introduction to Itard's text) pursued the environmentalist direction of Condillac to its logical, if extreme conclusion, writing that "The idea that man has no nature is now beyond dispute. He has or rather is a history."

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 initial 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 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 sociobiologists such as Richard Dawkins (1976) and Edward O. Wilson (1998). Such accounts, however, have often been criticized for their reductionism, and recent biological theory suggests that the relation between biology and culture is far 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 the "niche construction theory" of Laland et al. (2000) is particularly significant, extend and modify the Neo-Darwinian synthesis that dominated 20th century biology by incorporating an ecological dimension that, I shall argue, proves to be particularly important for understanding human cognitive and linguistic evolution.

First, however, I outline (in a simplified fashion) 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.[2] 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, 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

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[2] As will become clear, there is no question here of challenging the overall Darwinian framework of evolutionary theory, but rather of questioning the premises and methodological stances of what is usually referred to as the Neo-Darwinian "modern synthesis".

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. Even if the DNA-based biochemical replicator 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 organism in its ecological niche*.

Ecologists emphasize that species 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.

In a subset of such cases, the resulting niche 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".

In each of these cases, the behavioural repertoire of the species includes behaviours that are specifically adapted to the making of artefactual niches, and these in turn support other behavioural strategies. 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 equivalent, as an indicator of fitness, to the tail of the peacock). Indeed, we can ask if it might be fruitful to consider certain species-specific behavioural repertoires, such as birdsong, to be kinds of animal artefacts, inasmuch the song of the adults provides a niche within which the singing behaviour is learned (see below). It can be argued that the designation of "artefact" should be reserved for more or less enduring, constructed material structures. Even if we accept this, it can still be argued that specialized behavioural repertoires constitute *biocultural niches* which are functionally analgous to animal artefacts. If so, human natural languages can also be viewed as species-specific biocultural niches.

3. Culture as constructed affordances and the human semiosphere

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 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-contructed niche: the organism/niche coupling or *organism plus artefact.*

What are the implications of this for the Neo-Darwinian synthesis? 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 Piaget's more general proposition that behaviour is the leading edge and motor of evolution, prompting the conclusion (anticipated above) that the identification by Dawkins of the "replicator" with the *unit* of selection (the gene, or its hypothesized cultural analogue, the "meme") 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). Such accounts presuppose a functional parallelism between units of biological replication and units of cultural replication ("memes" or "culturgens"); and treat the latter as being structured as human behavioural variants analogous to gene alleles. From this perspective, ethnographic variation is analyzable in terms of aggregate properties of human populations. The Lumsden-Wilson theory has 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" (Alper and Lange 1981: 3976), and for having no place for *emergent properties* of societies. To lend further force to this critical evaluation, I attempt in a subsequent section to formally specify, for human cultures, such emergent properties in terms of a semiotically defined ontology of the social. For the time being, we can simply note that the Lumsden-Wilson theory *presupposes* an ontological distinction between gene and meme, nature and culture, without either explaining this distinction, or theoretically motivating the functional parallelism that is proposed to exist between the units of selection in the domains of biology and culture. In summary, the reductionist inadequacy of Neo-Darwinist theories of gene-culture coevolution consists in their recapitulating the failure of Neo-Darwinism to adequately treat the emergent properties of organisms, in their failure to adequately treat the emergent properties of socio-cultural formations.

The critical considerations outlined above have led to a more radical formulation of coevolution, advanced by Laland, Odling-Smee and Feldman (2000).[3] A particular role is played in Laland et al.'s (2000: 144) theory by genotype/niche combinations labeled by "phenogenotypes." A phenogenotype can be defined as a class of organisms in a bound (though not necessarily genetically determined) relationship with some aspect of a self-constructed environmental niche.

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 in human evolution within the wider class of processes, outlined in the previous section, involving adaptation to artefactual niches such as nests, dams, mounds, and burrows. Laland et al.'s 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.:

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[3] Here it is important again to emphasize that the theory advanced by Laland et al., while radically departing from Neo-Darwinism, remains Darwinian in the wider sense.

133). I interpret this to mean primarily that human cultures are unique in some fundamental respect, that is they are different (perhaps discontinuously) 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. An alternative account, along the lines of the co-evolutionary theory of Laland et al. (2000), would view the human language capacity as phenogenotypic. Language, in this account, is an artefactual niche, and the capacity to acquire and use it involves the evolution and replication of a phenogenotypic "biocultural complex" (Laland et al. 2000: 144).

Such an account does not require 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 account is thus compatible with usage-based, cognitive functional theories of language and language acquisition (Tomasello 1998, 2003).

The artefactual 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. This biocultural complex we can, to use the terminology of the Russian semiotician Yuri Lotman (e.g. Lotman 1990), designate as the human *semiosphere*, the constructed, meaningful environment that is reproduced down the human generations along with the human organism itself. It is crucial to appreciate, in this context, that the semiosphere, like other animal artefactual niches, is not merely a constituent of *what* is reproduced, but is also the fundamental mechanism in the *process* of reproduction and transmission.

Because of its pre-eminence in mediating both cultural reproduction and individual cognitive processes, language is the primary and most distinctive constituent of the human semiosphere. 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 constructive cognitive capacities, also of a 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 (Piaget 1945, Deacon 1998, Zlatev et al. 2006); epigenetically developed from a suite of cognitive capacities largely shared with other species, but attaining higher levels of organization in humans.

4. The evolution of complexity: emergence and epigenesis

It was noted above that one of the criticisms made by Alper and Lange (1981) of the Lumsden-Wilson theory of gene-culture coevolution was its inability to account for emergent properties of human society. The term *emergence* is commonly used to mean the evolution and development of new properties and/or levels of organization of behavioural and cognitive systems as a consequence of the operation or cooperation of simpler processes. Emergence is a consequence of the evolutionary and developmental process of elaboration, involving an increase in the complexity of organism, behaviour and cognition. The adaptation of organismic behaviour to constructed, artefactual niches offers clear examples of phylogenetic elaboration leading to emergence. For example, the female bower bird’s behavioural repertoire for evaluating the fitness of a prospective mate has extended (elaborated) its scope from evaluating the ritualistic behaviour of the male suitor to evaluating the bower that he constructs, entraining a more complex organismic “level” with emergent properties (the bower as a constituent of the phenogenotypic replicator).

Emergence as an evolutionary process can be conceptualized as "locking" elaboration in new adaptive circuits, in a way similar to the "ratchet effect" discussed for human cultural evolution by Tomasello (1999). Indeed, from the biocultural perspective, Tomasello's ratchet effect is but one, albeit exceptionally dramatic, case of a wider, not specifically human, phenomenon of emergence. If it is elaboration that lends directionality (through complexification) to "local" evolutionary processes, it can hypothesized that it is emergence that underlies the global trend of evolution towards greater complexity. Although it is correct to reject teleological *explanations* for Darwinian evolution, a kind of teleology of process (as Piaget recognized) is a consequence of the locking and reproduction of elaboration through emergence.

Emergence is also characteristic of ontogenetic development, including cognitive development, and has been advanced as an alternative to nativist accounts of language development (MacWhinney 1999). The developmental biological (and psychobiological) mechanism underlying ontogenetic emergence is *epigenesis.* Contemporary theories of epigenesis in biological and psychological development build upon the pioneering accounts of Waddington (1975) and Piaget (1979). Epigenetic naturalism (Sinha 1988) proposes a constructivist account of the interaction between the genotype and its somatic and extra-somatic environment in organismic development. The claim that such an interaction exists is, as such, trivial and undisputed, since everyone agrees that phenotype is co-determined by genes and environment. There are, however, two particularly important characteristics of the theory of epigenesis that I wish to highlight.

The first is that the role of the environmental factors is *constructive* in addition to being *selective*. Nativist approaches to the developmental interaction between genotype and environment stress the role of specific input either in permitting a developmental process to unfold, or in parametrically selecting a particular variant of development. An example of the former would be phenomena such as "imprinting", where an innate and fully endogenous process of development is "triggered" by an environmental event during a critical developmental window. An example of the latter would be the role hypothesized by generative linguists to be played by typological characteristics of target languages in setting parameters and thereby permitting the child non-inductively to acquire the grammar of the target language (Chomsky 2000). In neither of these cases does the environmental information add any emergent *level of organization* to the genetically coded information. That is to say, the alternate pathways along which the behaviour develops, and its terminal structural complexity, are assumed already to be directly encoded in genes.[4]

By contrast, in epigenesis the developmental pathway and final structure of the behaviour that develops are a consequence as much of the environmental information as of the genetically encoded information. For example, the development of birdsong seems to involve reproduction by imitative epigenetic learning, rather than selection from amongst pre-established alternatives (Marler and Peters 1982). Fledglings not exposed to a model do develop birdsong, but it is impoverished or unelaborated relative to that of those individuals developing in a normal environment in which models are available.

The second key characteristic of epigenesis is, accordingly, that a genetically specified developmental envelope or window specifies an initial behavioural (or perceptual) repertoire that is subsequently *elaborated* through experience of a relevant environment. This process of elaboration is directional (see below), and once it has taken place the initial plasticity of the embryonic, or unelaborated, repertoire is lost. A typical example is the development in human infancy of speech sound perception, in which the “universal” initial processor is transformed into a “language-specific” processor in a process that is probably analogous with that of the development of birdsong. We can note here that an epigenetic account of this process differs from a nativist, parameter-setting process inasmuch as no assumption is made that the infant brain is innately equipped with an inventory of all possible natural language phonemes. Equally, however, it differs from a classical learning account, inasmuch as epigenesis depends upon the elaboration of an initial repertoire which itself is not

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[4] It is noteworthy that the Lumsden-Wilson account of gene-culture coevolution, though it employs a terminology of epigenesis, does so in a way that is more reminiscent of the Chomskian notion of parameterization. The Lumsden-Wilson theory envisages two (or, in principle, more) alternate traits distributed in a population, with the possibility of epigenetic “switching” between these traits, which could therefore be alternate expressions of the same gene(s). They hypothesize that an interaction of “epigenetic rule”-encoding genes, and environment (in particular, existing trait frequencies in the population), is responsible for the development in any given individual of one or other trait. Alper and Lange (1981: 3976), whose critical assessment of the Lumsden-Wilson theory I have already cited, claim that there is “absolutely no evidence that any genes of this type exist.” This author is not competent to pronounce on the biological facts of this disputed point. However, it should be noted that (a) Lumsden and Wilson’s “code-switching probability” genes are substantially different from the regulatory genes discussed below, and (b) their model continues to fix the stochastic space of possible developmental outcomes in the genes, rather than this itself being co-determined by genes and environment. Given these considerations, it could be said that the Lumsden-Wilson gene-culture coevolution model (intended as a substantial revision of standard sociobiological theory) severely circumscribes the role of epigenesis in such a way as to call into question whether it is really epigenetic at all.

learned, in a process which cannot be re-run—the initial, unelaborated capacity cannot be re-accessed after the epigenetic developmental process has taken place, as all second language learners come rapidly to realise. In other words, the process of developmental elaboration implies in epigenetic development a transition from relative plasticity and informational openness to relative rigidity and informational closure.

Epigenesis is a developmental process whose genotypic distribution can itself be selected, through the standard Darwinian mechanisms of natural and sexual selection. The onset and closure of periods of plasticity and informational openness is under the control of regulatory genes, which are responsible for the timing and sequencing of all developmental processes from embryonic to mature organismic stages. Although all mammals display epigenetic features in various domains of development, especially during embryogenesis, the "weighting" of behavioural and cognitive development towards epigenetic processes seems to be markedly greater in more complex organisms than less complex ones. As an example, we can cite the well-known difference between the capacities of human-enculturated vs non-enculturated apes for symbol learning. The enhanced learning capacity of the enculturated apes must be due to their developmental environment, but the developmental environment would not make a difference if its relevant features were not available for assimilation into epigenetic construction processes (and indeed in lower non-human primate species no such differences have been observed). Epigenesis, then, seems to be a key mechanism in enabling individual organisms to acquire and exploit emergent complexity in phenogenotypic couplings. It is epigenesis, and in particular selectively *augmented* epigenesis, that serves as the crucial bridge between parallel processes of emergence in phylogeny and ontogeny. Epigenesis, I would suggest, is the key stabilizing process through which cultural and cognitive elaboration are emergently, dynamically and concertedly locked.[5]

Epigenesis may be analyzed at different levels, from the cellular to the cognitive. The neurobiological implementation of epigenetic processes at the cognitive and behavioural level is "Neural Darwinism", the selective stabilization of

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[5] This is something of an oversimplification, since the stabilizing role accorded here to epigenesis also involves the canalization of phylogenesis through "Baldwin effects" and genetic assimilation (Sinha 1988: 137-138). However, this detail is not crucial to the account presented here, and the precise status and nature of "Baldwin effects" is a strongly contested issue (Deacon 2004).

waves of periodically proliferating synaptic connections during ontogenesis (Changeux 1985), which is, as we might expect, especially marked in the developing human organism, extending through adolescence and young adulthood. Why should humans be, more than any other, the "epigenetic species", and how is this related to humans being the "symbolic species" (Deacon 1998)?

The answer to this question, I suggest, is that augmented epigenesis is advantageous for organisms in which phenogenotypic organism-niche couplings are both frequent and variable, which is a good enough 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 semiotic biocultural complex, in particular for language. Note, however, that in an epigenetic perspective, any developmental predisposition for learning language is unlikely either to involve direct coding of, or to be dedicated exclusively to, linguistic structure (Mueller 1996).

The account I have offered revolves around the proposition that the evolutionary elaboration and epigenetic stabilization of the phenogenotypic semiosphere introduced the discontinuity characterizing both 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 niche 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, bridging the biological with the social and human sciences in the evolutionary and developmental science of human cognition and language. It is to the social and semiotic ontology of language that I turn in the next section.

5. Language as a social fact and social institution

I begin by summarizing two theories of social ontology, classical and modern, separated in time by a century. These are the theories of, respectively, the sociologist Emile Durkheim (1895) and the philosopher John Searle (1995). Probably not by coincidence, the theories employ the same terminology of social facts and social institutions, although Searle nowhere cites Durkheim.

Durkheim, a founding father of social theory, attempted a theoretical and methodological clarification of social science and its object. This object he stipulated to be the domain of *social facts*, which he described as “a category of facts which present very special characteristics: they consist of manners of acting, thinking, and feeling external to the individual, which are invested with a coercive power by virtue of which they exercise control over him.” (Durkheim 1982 [1895]).

Social facts, for Durkheim, are not merely aggregates of the individual cognitive representations of them by the subjects that are regulated or “coerced” by the social facts, since for each individual subject the social fact presents itself as a part of an out-there, already given *objective* reality. The objectivity of social facts consists, for Durkheim, in the fact they are independent of any single individual’s thoughts or will. As Jones (1986: 61) puts it, “it is precisely this property of resistance to the action of individual wills which characterizes social facts. The most basic rule of all sociological method, Durkheim thus concluded, is *to treat social facts as things*.” Durkheim’s treatment of social facts consists therefore in, first, an ontological proposition, that social facts are irreducible to biological or psychological facts (or structures or processes); coupled with, second, an epistemological and methodological proposition regarding their treatment: as *objects* of a particular kind, whose determinate nature consists in their “coercion” of conduct.

Durkheim has often been criticized for the breadth and vagueness of his notion of “social fact”. A particularly problematic aspect of his theory is that, in counterposing “social facts” to “individual conscience” (or mind), he sometimes identified the former with “states of the collective conscience”. Some social psychologists (e.g. Moscovici 2000) have followed this direction in constructing a theory of “social representations”, but critics have claimed that Durkheim sympathized with a view of society as a kind of super-organic “collective personality”.

Whether Durkheim believed in a “collective mind” or not, such a notion is not only scientifically untenable, it is unnecessary. I propose that a social fact can most simply be defined as something regulating an aspect of conduct which requires the *participation* (Goodwin and Goodwin 2004) of more than one individual. This “something” may be a codified law, a norm, an institution, a rule in the

Wittgensteinian sense, or a canon of interpretation. A natural language, therefore, qualifies as a social fact (or institution) under this reading of Durkheim's theory. Social facts, for mature human beings, are objects of *common knowledge*; language is a prime example of this (Lewis 1969, Itkonen 1983, Clark 1996). However, the social fact itself is not the sum, average or common denominator of all the individual beliefs of participants (since it is, indeed, the *object* of these beliefs). Social facts, in this sense, are in some way prior to individual cognitions about them. Yet it cannot be claimed that social facts are *independent* of cognitions, in this case of social cognitions, since their normative status is dependent upon agreement in cognition. We shall return to this paradoxical problem in discussing Searle's theory of social facts.

Social facts, for Durkheim, are constitutive of the domain of human social theory. Given that non-human species also display social behaviours, should we regard social facts as being uniquely human? Ethologists have pointed to the evolutionary roots of norms, rules and conventions in the ritualized displays that many species exhibit in, for example, mating and agonistic displays. Ritualization, in turn, can be regarded as falling under the definition of a biocultural niche as discussed above. If so, we could argue that social facts are biocultural niches regulating and sustaining, supporting and constraining, the participatory behaviour of more than one individual. This definition is entirely consonant with Durkheim's view that social facts "consist of manners of acting, thinking, and feeling external to the individual, which are invested with a coercive power by virtue of which they exercise control over him."

Under this interpretation, social facts would be seen as no more unique to humans than culture. Yet there is clearly something unique about human social facts. This uniqueness consists, surely, in the way in which social facts are cognitively constructed as *objects* of intersubjective common knowledge (and common emotional investment), so that they can be *known* in the way in which the rules of football, the laws of the land, or a family history may be known.

To bring some order into the definitions employed here, I will stipulate that the concept of "social fact" pertains to those biocultural niches which are of a fully normative nature; that is, those which not only regulate behaviour, but are known to do so, and knowledge of which (whether explicit or tacit) is essential to their regulative status. Social facts, on this definition, can only be *constructed* by human beings with a certain level of cognitive development, although the institutions that they construct may be participated in by animals which lack this cognitive status (eg prelinguistic infants in language practices, racehorses in horse races etc). Social facts, then, constitute an emergent ontological level within the wider category of biocultural niches, and one which is uniquely human.

Searle (1995) situates knowledge and belief at the heart of his account of social facts: “There are things that exist only because we believe them to exist. I am thinking of things like money, property, government, and marriages … [such] Institutional facts are so called because they depend upon human institutions for their existence.” (ibid.: 1-2). In an unfortunate inconsistency of terminology, Searle regards “institutional facts”, which seem to be more less equivalent to Durkheim’s social facts, as a subset of what he (Searle) calls “social facts”, which are basically all activities which involve participation in joint action: “I will henceforth use the expression ‘social fact’ to refer to any fact involving collective intentionality. So, for example, the fact that two people are going for a walk together is a social fact. A special subclass of social facts are institutional facts … for example, the fact that this piece of paper is a twenty dollar bill is an institutional fact.” (ibid.: 26).

Searle’s account of social or institutional facts (such as money) is that they depend upon collective agreement and knowledge that, under determinate rules, something *counts as* an instance of a social object. Hence, the general form of such rules is:

1. “X counts as Y in context C” (Searle 1995: 28).

Although he never uses the term, Searle’s definition is in effect a semiotic one, in that the “counting as” relationship is one of *meaning* or *signification*. The twenty dollar bill, for example, signifies a certain monetary value or equivalence. However, the relationship between the bill and its monetary value is not a fully-fledged *sign relationship*. The bill does not *represent* or *stand for* twenty dollars: it simply *is* twenty dollars, it is self-identical to its monetary exchange value. To clarify this difference, we can point out that the numeral 20 printed on the bill *stands for* (represents) the number twenty, but the bill itself does not represent, for example, twenty one dollar bills, but rather is *equivalent* to them in the value that it possesses, or counts as having.

Sinha (1988: 37) defines the pragmatic and semiotic conditions on *representation* as follows: “To represent something … is to cause something else to stand for it, in such a way that *both* the relationship of ‘standing for’, *and* that which is intended to be represented, can be recognized.” (italics added). It must be emphasized that built into the conditions on representation is a duality of cognition, paralleling the duality of sign structure (the conventional unity of signifying substance and its signification). Two cognitions are necessitated: the recognition of the sign relationship, and the recognition of what is signified. The “counting as” relationship, by contrast, has no such duality: to know that something counts as a particular object, however abstract or complex that object may be, it is necessary only to recognize it as a token of that category of objects.

What is necessary to grasp the “counting as” relationship is knowledge of the rules and norms that constitute the category (for example money, or a language). In one fundamental (if limited) sense, then, knowledge of a language is definitionally knowledge of what *counts as* a token of the language, and in order to know this, the knowing subject must necessarily know (in some way and to some degree) the rules of the language. It is this level of knowledge that is considered to be primary in generativist and other formalist theories of language, which attempt to elucidate the rules that constitute the full range of tokens for which it is the case that:

2. X counts as (a sentence) S in L (a language)

This definition does not, however, encompass in any way the *representational* function of language, its capacity to represent things (situations, events, actions, objects) *outside* of the formal context of L, that is, the world outside language. The knowledge constituting this *semantic* domain is governed, not by the “counting as” relationship and its conditions, but by the “standing for” relationship” and its conditions. This “standing for” relationship can be notated, in a way parallel with Searle’s notation of the “counting as” relationship, as follows:

3. S (a sign) stands for M (a message) in context C

However, the duality inherent in the conditions on representation (above) requires that this preliminary notation be expanded, to include knowledge on the part of the subject that S *counts as* a sign, or, more accurately, that a particular object counts as a signifier. This expansion yields:

4. [X counts as S and S stands for M] in C
   Where X is a token of the class of signifiers in C

(4) is sufficiently general to cover all cases of sign use, including highly idiosyncratic and context bound cases, such as non-conventional gestures. We can now undertake a further expansion to specify cases in which a given sign is part of a sign *system*, shared by a particular community of users:

5. [X counts as S and S stands for M in C_s] for C_u
   Where:
   C_s = sign system
   C_u= community of users

In the specific case of language, we can reduce the notion of a sign system shared by a community of users to the simple term L, language, thus:

6. L=C_s for C_u

Now any grammatical and meaningful instance of language use can be annotated:

7. [X counts as S and S stands for M] in L

Note that, consistently with the approach of Cognitive Grammar (Langacker 1987), S (the signifier) is an expression at any level, sub-lexical, lexical or constructional; grammatical assemblies of signs are also signs.

The definition offered in (7) can thus be considered to be the notational reduction of the broader theoretical approach to language taken by cognitive and functional semantically based theories, and indeed by all linguistic theories that include representational meaning in the linguistic theory. It is clearly a more inclusive definition than the formal-sentential definition (2), reproduced here:

2. X counts as (a sentence) S in L

Defintion (7) is also, quite simply, more psychologically complete than (2): what we usually mean by “knowing a language” is the knowledge of *both* what counts as a token of the language, *and* what it means. In the concluding section, I will attempt to elucidate further just what is, and is not, necessary for such knowledge.

Before doing so, I pursue this formal-notational exercise further by exploring how the conjoint definitions of “counting as” and “standing for” can be employed to define the sub-systems of language as traditionally employed in linguistic theory.

Grammar (in the wide, cognitive grammar sense, including lexical form and phonology) can be defined as:

8. X counts as S in L

X is an instance of S, and S is a grammatical expression in L. The distinction between X and S is the distinction between, for example, phonetics and phonology.

Presupposing (8), **semantics** can be defined as:

9. S stands for M in L

This is the relation between, for example, word form and lexical entry or concept; or, more generally, between linguistic expression and linguist conceptualization.

Presupposing (9), **pragmatics** can be defined as:

10. S counts as A_s for Participants$_{(2 \ldots n)}$ in C_d
Where:
A_s=Speech act (including reference)
C_d=Discourse context

Under this description, pragmatics is the closest of the linguistic subsystems to the “counting as” relationship. This accords with the intuition that pragmatics is not “systematic” in quite the same way as grammar and semantics; that speech acts are specifically linguistic instances of more general communicative acts (such as “threats” and "invitations" in both human and non-human species); and that their interpretation is strongly dependent on gesture, prosody, posture, physical and linguistic context.

Having employed the notational formalism to distinguish the subsystems of language one from another, we can now re-assemble them to analyze the structure of particular utterances in their context.

> 11. [X counts as S and S stands for M] in L and S counts as A_s for Participants $_{(2 \ldots n)}$ in C_d

Such a re-assembly does not yet account for the *interaction* between semantics, pragmatics, extra-linguistic context and shared world knowledge in actual utterances. For example, if the utterance is "You really did well this time!", and it is clear from the context that the speech act is one of ironic praise, the contextual meaning is "You did very badly". Or, if the utterance is "The road meanders up the hill", the contextual meaning is that the road has a winding path, not that the road is itself in motion (Talmy 1996). How can we capture such facts of language?

It seems impossible to do so without appealing to psychological processes such inference, default and prototypic reasoning, subjectivization and perspectivization. This is the fundamental insight which drives cognitive linguistics. If we wish to formalize this, it would look something like this:

> 12. [X counts as S and S stands for M] in L and S counts as A_s in C_d
> => S counts as (having) M_c for H in C_d
> Where:
> M_c = Contextual meaning
> H = Hearer

This brings us back, in an intriguing hermeneutic circle, to Seale's original definition of a social fact, and emphasizes the truism that, in the end, all meaning is contextual and situated. This does not, however, mean the same as saying that there are no institutionalized, relatively stable, relatively autonomous and systematic social facts; indeed, it is precisely this very relative stability and autonomy which constitutes the objectivity of social facts emphasized by Durkheim.

This objectivity is not to be confused with the *objectivism* of formal, truth conditional semantics. Amongst the advantages of the simple notational definitions developed here are:

(1) The account of semantic meaning is underdetermined by this formulation. The semantic theory need not be truth-functional, but *is* (necessarily) conventional and normative (as indeed are all the subsystems).

(2) Semantics is distinguished from pragmatics without necessitating a truth functional semantics.

(3) Contextual dependence characterizes all subsystems, as well as the interactions between them, but does not erase the distinctions between them.

(4) Language as a social institution has its own proper structure which necessitates, but is irreducible to, the intentionality of its users. Language, like all social facts, is an objectification of intersubjectivity, with an emergent structure relatively autonomous from the intentional states (such as mutual knowledge of the language) which are possessed by its users and "subjects". It is in this fact, and this fact alone, that the objectivity of language inheres.

6. Conclusion: restricting the need to know.

Biocultural niches are integral to the evolution of many species, including the human species. Radical nativist hypotheses of strong discontinuity between human and non-human genome are neither necessary nor plausible, if we view biocultural niches as constituents of phenogenotypic sites of Darwinian selection. The human semiosphere can be viewed as a species-specific biocultural niche, whose distinguishing feature consists in the elaboration and emergence of the semiotic function. This function, in turn, is constituted by the interplay and developmental interlacing of its two constituent semiotic relations, "counting as" and "standing for". It can be hypothesized that these two semiotic relations are evolutionary derivatives of, on the one hand, ritualization and, on the other, the evolution of symbols from signals (Sinha

2004). In both of them, the conventionalization of intersubjective participation in niche-regulated activities plays a central role (Sinha and Rodríguez in press). Current evolutionary biological theory, including niche-dependent evolution and epigenesis, accounts for the continuity between human and non-human culture and cognition. The evolution of the human semiosphere, in which language as a biocultural niche is developmentally and processually interdependent with other artefactual supports for human social interaction and social practice (Sinha 2005), is what accounts for the discontinuity dividing human from non-human cognition and culture, and the evolutionary emergence of human social facts and social institutions. This discontinuity has been amplified by the consolidation, through language, of human culture as a fundamentally symbolic order.

From a biocultural perspective, the human language capacity, although it is almost certainly supported by genetic adaptations to maximize exploitation of the human biocultural niche, is not innate, but epigenetically developed. Language as a social institution comes to be known by language-acquiring infants, but the knowledge required is not that of a grammar as a formal object divorced from its semiotic function. Although there can be no scientific objection to the study of language as a purely formal system, insistence on the disciplinary autonomy and full explanatory adequacy of formal theories leads to a distorted picture of the human language capacity, and to unnecessarily constrained theories of language acquisition. If "knowledge of language" is restricted to knowledge of what counts as a grammatical sentence, not only is language itself as a semiotic system truncated and reduced, but the process of its acquisition is rendered incomprehensible. To fill this conceptual vacuum, innate knowledge of Universal Grammar is invoked.

The biocultural theory of language and its acquisition restores, quite literally, life to language, for far too long reduced to formal structures and operations. It suggests a picture of "knowledge of language" that is both richer, in one sense, and poorer, in another, than that to which we have become accustomed from generative linguistics. It is richer because it incorporates meaning and context, the fundamental pillars supporting both language acquisition and language use. It is poorer because there is no longer a compelling reason to attribute a knowledge equivalent to the results of formal analysis to the learners and users of language. Simply stated, in the biocultural theory, *there is no mental grammar* isomorphic with autonomous grammar. Rather, grammar is *in language,* as a biocultural niche and social institution, just as the structure of the bower bird's nest is in the nest as a biocultural niche. The learner need not internalize a formal description of the structure in order to acquire the ability to *act* in it. Language is not an "input" to a processor or device, but a structured niche affording complex and semiotically mediated communication and cognition. Grammar is a social institution, normatively regulating linguistic practice, and it is the practical ability to adhere to its constraints and supports that is acquired by the language learner.

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