The individual and the species in the cultural evolution of language

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Abstract
The origin of language is a problem involving complex interactions between a number of different evolving systems. Language per se, regarded as a cultural/memetic entity, is one of the evolving systems, and its evolution is of major importance in the origin of modern human language.

Possible structural parallels between language evolution and biological evolution are discussed. Genes, organisms, and species are key concepts in biology, and an understanding of the corresponding levels in language is needed for any fruitful linguistic application of theoretical tools from evolutionary biology. I identify candidate linguistic 'genes', 'organisms' and 'species', and discuss implications for language evolution.

Keywords: Language evolution, cultural evolution, idiolect, species
1 Introduction

The evolution of language is commonly discussed exclusively in terms of the biological evolution of the human language faculty. This is a limited and problematic view, for at least two reasons. First, "the human language faculty" is not a well-defined and well-understood entity. Second, several other evolving systems are involved, evolving at different rates, and with complex mutual interactions (Mameli 2001). The most important evolving system here is language itself. Language is fruitfully regarded as an independent evolving entity of its own, and the cultural/memetic evolution of language has almost certainly played a major role in the biological evolution and success of *Homo sapiens*.

We shall return to the evolution of language per se in the next section. Other evolutionary processes and systems, apart from language and the human language faculty *sensu stricto*, that have an impact on language origins include:

- **Biological evolution of other human bodily and mental faculties**, as adaptations for primarily non-linguistic purposes. A feature may well be used today for linguistic purposes, even though it may have arisen as an adaptation for some other purpose. This is a matter of normal biological evolution, but their evolution need not be originally connected with the emergence of human language, and may well have taken place in our remote proto-ape ancestors. A substantial fraction of the biological equipment that we use for linguistic purposes today has likely arisen this way, which largely removes the timing constraints discussed by e.g. Worden (1995).

- **Evolutionary processes in ontogeny** The ontogenetic development of neural connections in the brain has some parallels with natural selection (Czik 1995; Deacon 1997; Sireteanu 1999; Chenn & Walsh 1999). In those cases that have been studied in detail, the neural connections are found not to be genetically preprogrammed. Instead, neurons at first form connections in large numbers, rapidly and to all appearances randomly. As neural input arrives, those connections which are heavily used multiply and are strengthened and those which rarely carry any signals wither and are eventually pruned. The result is a pattern of connections that is adapted to handle the type of input received during this sensitive period.

Unfortunately, our language acquisition system is not one of the cases that has been studied in detail, but there is no strong reason to believe that it is an exception to the general pattern of ontogenetic neural evolution. It is not entirely obvious how an innate language acquisition device with a genetically determined universal grammar, as suggested by Chomsky (1965), could arise through such a selection process.

- **Evolution of human social systems, both biological and cultural evolution** (Hill 1997;

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1 This paper is a small part of larger work, Johansson (forthcoming), a book (provisionally accepted for publication) where I critically review current hypotheses of language origins in the light of the available empirical evidence.
Laland et al 2000; caporael 1996). Humans, like most other mammals, certainly have a set of biological adaptations for social life, which have evolved in the usual Darwinian fashion. But the wild diversity of social systems in different human cultures demonstrates that our social system — unlike that of most other animals — is not genetically biologically determined in any strong sense. Instead, the most important evolutionary process in this context is cultural evolution, with our genetic adaptations for sociality as a more-or-less deeply buried substrate.

All these evolutionary processes have affected, to a greater or lesser degree, the evolutionary origins of our language capacity. A theory of language origins that neglects the interactions between different evolutionary processes is bound to be, at best, incomplete.

2 Evolution of language per se.

Language, as an abstract structure, is not some pre-existing essence, a goal for a teleological evolutionary process to strive towards, contra Bever (1982), but is instead an evolving entity of its own (Wilkins 1998; Keller 1989; Diller 1997), a huge and evolutionarily highly successful system.

The discussion of evolution-like processes in the history of language actually predates Darwin (1859), beginning with the conclusion of Sir William Jones in 1786, that Sanskrit, Latin, and Greek all were descended from a common ancestor through a process of gradual modification. These studies significantly influenced Darwin as he transferred the concept of descent with modification from linguistics to biology (Gatherer 1997). Within linguistics, the study of the phylogeny of languages has remained a vital field of research ever since, though usually purely descriptive, without explicitly invoking evolutionary parallels except at a very superficial level. For quite some time in the 20th century, biological metaphors were shunned by linguists (Deumert 2003).

Still, the processes of language change may well be open to evolutionary interpretations. Language can be modelled in terms that closely parallel Popper’s (1979) evolutionary epistemology, with scientific hypotheses as evolving world-3 entities. “Language” in the abstract sense would similarly be a world-3 entity, and its implementations in human minds would be world-2 objects, and of course the communicative use of language encodes it into sound patterns and other world-1 objects. This view of language has considerable similarities with memetics as well, and may be analysed within a memetic paradigm, particularly since at least

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2 Karl Popper (1979) has proposed a framework for handling the ontology of both cultural, mental and material entities in a consistent manner. Popper’s three-world system distinguishes what might be called three different planes of existence:

- **World 1**: The normal physical universe, inhabited by everything from galaxies to gnats.
- **World 2**: Mental space, inside our heads, inhabited by our thoughts and emotions and memories.
- **World 3**: The world of disembodied abstract ideas, notably cultural concepts.
some of the objections against memetics do not apply to language. Dennett (1995) lists the following characteristics of memes that may cause problems in applying evolutionary theory in memetic contexts:

- Low-fidelity replication, does not apply to language, as language is clearly transmitted from generation to generation with only minor changes.
- Mutations may be purposely directed by humans, does apply to language, but does not invalidate an evolutionary approach (Wilkins 2002).
- Blending inheritance may apply at the phonetic level, but not at the level of the lexicon or grammar — if two parents use different words for the same concept, their children will learn one or the other (or likely both) but will not blend the words together.
- Independent invention of the ”same” meme is unlikely to be a problem, given the conventional and arbitrary nature of language.

Another common objection against memetics is that memes are not well-defined entities. This objection is at least partially valid, as it has been notoriously difficult to pin down the meme concept to something operationally useful. Language is easier to handle here, as the basic components and structure of language are much better understood than the corresponding aspects of other cultural entities. Individual words, individual grammatical and phonological rules, and so on, can all be operationalized with sufficient stringency for memetic purposes, certainly much better than e.g. components of a religion.

Within such a Popper-inspired quasi-memetic framework, language evolution can be considered on several different levels. Popper (1979) appears to regard ”language” not as just a world-3 entity, but as a major part of the framework for world 3, with a role much like the spacetime of world 1 (Einstein 1915; Johansson 1998): "Main thesis: our conscious subjective knowledge (world 2 knowledge) depends on world 3, that is to say on (at least virtually) linguistically formulated theories.” (Popper 1979:74, emphasis in original).

But ‘language-as-spacetime’ is not a tremendously useful perspective for language evolution. On less abstract levels, there are several linguistic entities in different worlds that are better candidates for evolutionary considerations.

- Meme level. Reductionistically, one may adopt the equivalent of the ”gene’s eyes view” of Dawkins (1976), which would be the smallest linguistic units that can be coherently replicated, the memes of language. Memes are notoriously difficult to pinpoint in many cultural contexts, but language, being both more coherent and more thoroughly analyzed, may offer some hope of success. A non-exhaustive list of plausible linguistic meme candidates might include:
  - Individual words or morphemes (Worden 2000).
  - Individual grammatical rules (or parameter settings in a Universal-Grammar framework).
  - Generic utterances (Zlatev 1997).

This would appear to be a useful level of analysis for the study of contemporary lan-
guage change, on a rather short time scale. The spread of a newly-coined word, for example, is about as clear an example as one can get of memetic evolution.

• "Organism" level. The organism level in biology may be regarded, following Dawkins (1976), as a coherent set of genes working together as a team, forming a common interactor. Individual genes of a human being do not do anything useful on their own — they are meaningful evolutionary units only in the context of all the other genes of our genome. Similarly, individual language memes like the words or rules or utterances mentioned above are not meaningful in isolation, only as parts of a coherent system with, at a minimum, a set of generic utterances and a set of words to fill the slots in them, and more normally consisting of a large battery of grammatical rules and tens of thousands of words as well as all the various other bits and pieces that make up a language. The lowest-level entity in which all these meme-level pieces are gathered together in a coherent whole would be the idiolect of an individual language-user (Mufwene 2002).

In biology, the lowest-level entity in which all human genes are working together as a coherent whole is an individual human being, as a biological organism. I will regard an idiolect as a "linguistic organism" in the same sense. It is quite accidental that the organism levels of biology and linguistics very nearly coincide, and perhaps unfortunate, as it may invite confusion as well as over-extension of biological analogies; this will have to be kept in mind.

This organism level may be the most fruitful for the study of the origin of the human language capacity. Very little interaction can be expected between individual language memes and individual human genes, so the meme/gene level is less likely to yield interesting insights into this issue. Direct interaction, and possible co-evolution, may instead be expected at the system level, between the human being as a system, with emergent properties beyond the sum of the genes, and the idiolect as a system of, but similarly beyond the sum of, language memes. This interaction will be discussed more at length in section 3 below.

One might have considered languages, rather than idiolects, as linguistic individuals. If all speakers of a language had actually spoken exactly the same way, with no differences between idiolects, then languages would have been tenable individuals. Different idiolects in the same community are indeed similar — but not identical. We all know that no two individuals speak exactly the same way, even if they are members of the same speech community (Davis 2001). A fact that is less well known (and is often brushed aside in theoretical linguistics) is that there are considerable individual differences also in grammaticality judgements (Johnstone 2000). Given that there is no total unity among the speakers of the "same" language, it is not clear that a language exists as a coherent entity in any sense other than as a population of idiolects (Davis 2001).

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3The spelling ‘ideolect’ is sometimes seen, but ‘idiolect’ predominates in the scientific literature, and appears more etymologically reasonable, pertaining to ‘self-’ rather than ‘idea-’.
this way, languages more resemble biological species than biological individuals, and are relegated to the next level below.

- "Species" level. In biology, a species can be regarded as a set of organisms that are mutually reproductively compatible. Alternatively, from a gene perspective, a species is a gene pool within which genes can flow freely. A linguistic analogy of the species concept would then be either a population of mutually compatible idiolects, or a "meme pool" within which language memes can flow freely. With either perspective, a linguistic species concept is indicated that is quite close to our everyday notion of a language, an analogy that I will pursue in more detail in Johansson (in preparation). This level of analysis is relevant for the study of the historical development of languages and language families, and may well be useful for studying the "linguistic ecosystem" of multilingual communities, but is hardly applicable to the ultimate origins of language.

Wilkins (2002) reviews some further issues in this kind of linguistic evolution.

3 Co-evolution of linguistic and biological organisms.

Each human has an idiolect, his or her own version of language, and each idiolect has a human host. The idiolect is for this purpose regarded as one individual organism; the inner structure of this "organism" is presumably built from individual language memes, but need not concern us here. Idiolects reproduce whenever somebody acquires a language — language acquisition does not take place in a vacuum, pre-existing "parent" idiolects are always present as sources of language input. The resulting idiolect of the language acquirer is the descendant of the idiolects that provided input, in the Darwinian sense of "descent with modification" required for an evolutionary process — the "child" idiolect is normally very similar to, but not identical with, the "parent" idiolects.

Language evolution, in this sense, can be seen as a process of natural selection between our individual idiolects, with the most fit idiolects contributing the most to the idiolects of the

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4In biology, our intuitive "folk biology" notion of what a species is, across cultures, corresponds remarkably closely with the biological species concept, much more closely than the correspondence between folk and scientific concepts in other areas and on other levels (Atran 1998). Our intuitive "folk linguistics" might also be similarly reliable at the species level.

5Of course, historical linguists have been analysing the development of languages for a long time with a similar perspective — but the powerful theoretical and computational tools developed by biologists for the study of the relationships of biological species have only recently begun to be used with languages as well (Rexová et al 2003, Searls 2003, Gray & Atkinson 2003).

6Or several idiolects, in the case of bilinguals or multilinguals.

7Note that "parent" here does not imply that the hosts of the parent idiolects are necessarily the biological parents of the language acquirers, though in practice that is commonly the case, nor does it imply that the number of parent idiolects is necessarily equal to two. See Wimsatt (1999) for more on the complexities of memetic parenthood.
next generation of people. At the same time, the biological fitness of the human hosts depend
to some extent on the idiolects that they carry. This has close parallels with many situations in
biology, where one organism is the host of another, and both affect each other’s fitness.
Sometimes the interaction is harmful to the host, as with pathogens infecting us, and some-
times it is beneficial, as with the E coli that inhabit our gut and help our digestion. Biologists
have developed a substantial set of theoretical tools to handle this type of interaction between
organisms, reviewed by e.g. Hoeksema & Bruna (2000), some of which may be applicable
also to language. Comparative studies may also be of possible relevance, investigating parallel
s and differences between the human-idiol ect relation and cases from biology where two
complex organisms are strongly dependent on each other.

As idiolects evolve, the features of an idiolect that provides input to many language ac-
quiers become more common in the next generation, whereas the features of an idiolect from
which nobody acquires language disappear. These features correspond to the meme-level
components of an idiolect. These memes, entities in Popper-world 3, are instantiated in world-
2 idiolects, and the evolution of idiolects can reductionistically be regarded as a sequence of
changes in the frequency of instantiation of different memes. New linguistic memes are cre-
at ed in individual human minds, same as for other world-3 objects, in the context of the world
2 of that individual mind, including its resident idiolect, but may then spread (or not) in a so-
cial process establishing their conventionalized meaning in Popper-world 3.

The evolution of idiolects (and individual language memes) is in several respects as much
Lamarckian as Darwinian:

• Idiolects can acquire new features during their lifetime, and pass on those features to
their offspring. New words are being acquired throughout the entire lifespan, and
changes in grammar and phonology are not rare either. A complication here is that there
is no clean demarcation between features acquired ”at birth” à la Darwin and features
acquired later à la Lamarck, but it is nevertheless quite clear that the latter process plays
a more prominent role here than in biological evolution.

• ”Mutations” of an idiolect are not necessarily random, but can be directed towards in-
creased fitness. This includes both failure to acquire features that are difficult to learn,
and the addition of features, e.g. new words, that enhance communication.

The fitness of an idiolect is to some extent determined by the biological fitness of its host,
i.e. the host’s reproductive success, since your biological descendants commonly have your
idiol ect as a major source of language input. High biological reproductive success means hav-
ing many surviving children, which indirectly also means that your idiolect will be a primary
source of input data for language acquisition for as many new idiolects as you have children.

Apart from the reproductive success of the host, a large number of social and cultural fac-
tors will also likely influence the reproductive success of an idiolect.

More interesting in a linguistic context are factors that are intrinsic to language, and that
may affect the reproductive success of an idiolect (beyond the reproductive success of its
host). Some selection for communicative functionality can be expected (Bates & MacWhinney 1982; Nettle 1999), largely because an idiolect that’s more efficient for communication enhances the biological fitness of its host, but also because others may be more likely to adopt memes from a communicatively superior idiolect, and language learners may be more likely to learn from (and get a larger fraction of their idiolect from) a better communicator. But since mutations of idiolects may well be in the direction of increased functionality as well, due to human design, it is difficult to distinguish selection effects from design effects.

In the transmission process itself, there will be severe selection for learnability (Deacon 1997) — an idiolect that is difficult for children to acquire, will not be passed on effectively; either the children will acquire some other idiolect (from the other parent or from someone else) or they will acquire a modified idiolect that’s not identical to the parent’s, presumably modified in the direction of improved learnability. Creole formation may be an extreme example of such modification, with the pidgin of the parents being modified into the creole of the children.

This selection for learnability applies regardless of whether the children have an innate language acquisition device or not — the evolution of idiolects will be driven towards learnability with whatever cognitive equipment children happen to have (Newport 1982). Johansson (1997) presents a computer simulation of such evolution towards learnability.

At the same time as idiolects are subject to learnability selection, children are subject to selection for the ability to acquire an idiolect, and parents for the ability to ensure that their children learn an idiolect. Language is so vital in human society that failure to acquire an idiolect that is communicatively usable will severely reduce biological reproductive success, both directly, and through other learning being hampered by the lack of communication.

Within modern human societies, with well established languages, selection relating to language, both biological and memetic, may be expected to be largely stabilizing, since our idiolects are already quite well adapted to their ecological niches, and humans are likewise well adapted to language acquisition. This means that the main effect of selection is to gradually weed out “failures” — such as SLI children on the biological side, or functionally detrimental inventions on the idiolect side. Ordinary diachronic language change over the few thousand years for which we have solid data, basically resembles a random walk around roughly the same level of functionality — there is no support either for claiming that the fitness of Italian idiolects is higher or lower than that of Latin ones, or for claiming that modern Italians are better or worse at language acquisition than Romans of imperial times.

Significant directional evolution today is observed mainly in the formation of new creole languages from pidgins. But in the distant past, before either language or the human language

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8No relation to the author.
9Note that I am not implying here anything with respect to innate language acquisition devices à la Chomsky, an issue to which I will return in my next book (Johansson, forthcoming). That humans are adapted to language acquisition means only that human beings have (and have acquired through evolution) what it takes to acquire a language, whatever that may be.
capacity had attained their modern level of refinement, significant idiolect evolution can be expected to have occurred. As soon as our species-unique capabilities for cultural transmission (in which I include idiolect transmission) had reached the threshold needed for cumulative cultural evolution (Tomasello 1999), this cultural evolution of language would pick up speed as well, growing from whatever primitive communication systems were in use at the time (which must nevertheless have been non-trivial, or cultural transmission would be ineffective) towards modern human language.

The general "cultural explosion" would have both provided the cognitive tools for rapid idiolect evolution, as well as considerable selection pressure towards improved communication concerning more and more complex issues. Rapid growth of the size and complexity of idiolects would result, straining the abilities of learners and speakers, and placing selective pressure on our biological language equipment as well. But which effect is strongest — how much have we biologically adapted to language, and how much has language mimetically adapted to us? The answer to that question has implications for the innateness debate in linguistics — for example, does the “Red King Effect” (Bergstrom & Lachmann 2003) apply to the human-language system?
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