The evolution of language and languages

James R Hurford
Linguistics Department, University of Edinburgh

to appear in
The Evolution of Culture
edited by
Robin Dunbar, Chris Knight and Camilla Power.
To be published by Edinburgh University Press.

1 Languages and the human language faculty

Human languages, such as French, Cantonese or American Sign Language, are socio-cultural entities. Knowledge of them ('competence') is acquired by exposure to the appropriate environment. Languages are maintained and transmitted by acts of speaking and writing; and this is also the means by which languages evolve. The utterances of one generation are processed by their children to form mental grammars, which in some sense summarize, or generalize over, the children's linguistic experiences. These grammars are the basis for the production of a new avalanche of utterances to which the next generation in its turn is subjected. (This picture is simplified, of course, as generations overlap.)

Languages inhabit two distinct and separate modes of existence, which have been called (by Chomsky, 1986) 'E-Language' and 'I-Language'. E-language is the external observable behaviour — utterances and inscriptions and manifestations of their meanings. E-language is regarded by some as so chaotic and subject to the vicissitudes of everyday human life as to be a poor candidate for systematic study. (E-Language corresponds to what Chomsky, in earlier terminology, called 'performance'.) Out of this blooming buzzing confusion the individual child distils an order internal to the mind; the child constructs a coherent systematic set of rules mapping meanings onto forms. This set of rules is the child's I-Language (where 'I' is for 'internal'). No two individuals' I-Languages have to be the same, although those of people living in the same community will overlap very significantly. But there will usually be at least some slight difference between the I-language features prevalent in one generation and those prevalent in the next. This is the stuff of language evolution, in the sense of the historical development of individual languages, such as Swedish, Navaho or Zulu.

The evolution of languages in the sense just sketched is patently not biological, but socio-cultural. This kind of language-evolution is the stock in trade of the historical linguistics. Historical linguistics is a richly developed, relatively mature discipline. Its practitioners have accumulated vast amounts of theory and fact concerning how the languages of the world have altered and mutated over the last few thousand years. They have reconstructed in detail many of the protolanguages from which modern languages are descended. Examples are Proto-Indo-European, presumed to have been spoken somewhere in Eastern Europe about five thousand years ago, and Proto-Iroquoian, the ancestor language from which the modern American Indian languages of the Iroquoian family, such as Mohawk, are descended. Historical linguists have catalogued all the many types of language change that can occur in the evolution of individual languages, changes such as weakening and strengthening of the meanings of words, change of basic word order, loss of inflections, grammaticalization of lexical words (nouns, verbs, adjectives) into grammatical function words (articles, pronouns, auxiliaries), merger of phonemes, the emergence of novel phonemic distinctions, lowering, raising, fronting, backing and rounding of vowels, palatalization, glottalization, and so on and so forth. (See MacMahon (1994) and Aitchison (1991), for recent introductions.)

Generally speaking, the enterprise of historical linguistics has subscribed to the doctrine of uniformitarianism. This is the principle that any reconstructed Proto-language has to be recognizably of the same general type as observable modern languages. This principle was an important element of the discipline, acting as a methodological constraint on possible reconstructions. Clearly, any reconstruction, from modern evidence, of a language spoken thousands of years ago, is a speculative venture (as any science is), and the need for such a constraint is understandable. 'If it were true that language structure universally requires more than one vowel in a phonemic system, the fact that older Indo-European seems to reconstruct with only one vowel would be highly suspicious.' (Hoenigswald, 1960:137) But the constraint of uniformitarianism, while probably well-motivated for events within the last ten thousand years, is clearly, for speculation about the evolution of forms of human communication over hundreds of millennia, both false and an obstacle to research.

The prefix *Proto-* is viciously ambiguous. It is used, by historical linguists, to designate reconstructed ancestral languages which are cut from the same pattern book as modern languages. The Protolanguages reconstructed by historical linguists are emphatically not simpler than their modern counterparts. They are recognizably modern in all aspects except the date at which they happen to have been spoken. On the other hand, the term *protolanguage* has been used, influentially, by Bickerton (1990), to designate a different type of language from modern languages. Protolanguage, for Bickerton, was not blessed with the syntactic intricacies of modern languages, but onlyhad very simple devices for stringing words together.

We presume that, to a first approximation, all modern humans have (had) the same biologically given aptitude for language acquisition. All of the developments discussed by historical linguists, therefore, have taken place within a set of constraints imposed by the modern genome. To be a possible modern language (such as modern German, Classical Latin or the ancient Egyptian of the first dynasty), a system has to be acquirable by a biologically modern human. Modern humans were preceded by various (sub)species for whom different, more limited, classes of systems were acquirable as their 'languages'. Bickerton's term *protolanguage* is a useful attention-focussing device, postulating that the class of 'languages' biologically available to *Homo erectus* was the class of protolanguages, defined quite roughly as systems for concatenating vocabulary with none of the complex syntactic dependencies, constituencies, command and control relations characterizing modern languages. A *Homo erectus* individual, even if somehow presented with modern linguistic experience, could not make of it what a modern child makes of it, due to innate limitations. Bickerton likens this type of 'language' to that which intensively trained chimpanzees are capable of.

In the sense in which Bickertonian protolanguage has evolved into modern human language, we are speaking of evolution the human language faculty, of 'Language with a capital L'. The transmission of information relevant to the evolution of the language faculty is through an entirely different mechanism from the evolution of individual languages. The language faculty has evolved as other genetically determined traits have evolved, via selection over the millions of alleles that contribute to the human genome. The phylogenetic evolution of the language faculty must have been slower by several orders of magnitude (assuming one could even quantify such things) than the sociocultural evolution of individual languages.

It is instructive to compare the mechanisms of sociocultural evolution of languages with those of phylogenetic evolution of the language faculty. For biological evolution, we have a relatively well understood distinction between genotype and phenotype. In the case of Language, the genotype is the features of the genome relevant to language acquisition and use, while the phenotype is the brain and vocal tract and behaviour involved in actual processes of language acquisition and use during the lifetimes of individuals. One might be tempted to seek analogues of genotype and phenotype in the mechanism of sociocultural evolution of languages, in the constant cycle, over the generations, through E-Language and I-Language. But no analogy will hold satisfactorily. The E-Language of one generation is a necessary link in the chain of language transmission across generations, a necessary input for a child in the next generation to construct an I-Language. If a whole community became Trappists for a generation, the historical continuity of their language would be broken.

Competence in a particular language is an acquired characteristic of an individual. Biological heredity, as of an innate language faculty, does not provide for the inheritance of acquired characteristics. In theory, a modern human language faculty could pass intact through thousands of years in a totally silent community (assuming the community itself could somehow survive); with the lifting of the vow of silence, the children of the new generation would be as ready as any others to acquire any language they were exposed to. This last point assumes, perhaps too strongly, that there would be no significant decay in the language faculty due to lack of any pressure of natural selection through linguistic behaviour. I will return in a later section to the question of the contribution that linguistic performance makes to fitness.

Organisms survive and reproduce in antecedently given environments, which are the outcomes of factors and forces external to the organisms. But, to varying degrees, lineages of organisms also create parts of their environment. So it is with languages. A significant aspect of the environment into which a human child is born is the language of the community. The particular syntax, phonology and lexicon of the language is a historical creation of the child's cultural forebears. If the child is to prosper, he must be able to acquire this particular syntax, phonology and lexicon. But here we see an apparent paradox for the evolution of languages. Evolution means change, but it would seem that the requirement to acquire the language of one's community is a prescription for stasis, rather than change. The paradox can be resolved by invoking the ideas of tolerance and intelligibility. A child does not need to learn to speak exactly like (one of) her parents; if she acquires a syntax, phonology and lexicon permitting tolerable mutual intelligibility with the community she is born into, she will prosper tolerably well. Fitting this picture, languages do indeed change very slowly, as we have seen, and stay well within the constraints of intergenerational intelligibility.

Although languages change historically, they do so within the bounds of universal constraints on the forms of syntactic and phonological systems. So a child acquiring a language slightly different from that of the previous generation in the community still will not acquire a language that is different in type from that of the community. The capacity to acquire a modern human language is genetically transmitted. So, barring mutations and new recombinations, a child cannot acquire a language of a formal type that the parents were incapable of acquiring. To the extent that they share the same relevant genes, the qualitative language acquisition capacity of the child is identical to that of the parents. We assume that there were relevant mutations and recombinations in the evolution of the modern human language faculty. Accordingly, there must have been children who were born capable of acquiring a class of languages different from the class of languages acquirable by their parents. These 'transitional' children would have been presented with data (spoken utterances) produced from grammars of the old type, and internalized grammars of a new type, while still maintaining tolerable mutual intelligibility with the previous generation.

Something like this actually happens in the process of creolization. Take the extreme cases of plantation pidgins, which, according to Bickerton (1981), develop into creoles in just one generation. Here, the adult slaves share no common language, but make shift with a crude set of conventions for stringing together words mainly borrowed from the slavemaster's language. The adult slaves, though they have internal grammars of their native languages, have been forced into a situation where their native languages are of no use to them, or they are prevented from using them. Being adults, and therefore beyond the critical period for full grammar acquisition, the pidgin language they make do with is in fact of a different formal type from the creole language spontaneously created by their children. Bickerton's story of evolution from crude pidgins to fully modern human creoles in one generation may be an exaggeration, and has been contested (see Alleyne, 1980, 1986). But clearly there are in the pidgin/creole literature cases of new language creation within the space of a few generations. Perhaps the most compelling evidence is from Senghas (1997), who describes the formation of a new sign language creole in a single generation in a deaf school in Nicaragua.

Such pidgin-to-creole cases are presumably a kind of microcosm of what happened millennia ago, perhaps many times over, in many ancestral campsites. But the crucial intergenerational differences from those early times that are of interest to us are not the artificial differences such as are created by slavery, but biologically-based differences in what classes of languages the earlier and later individuals were capable of acquiring. At some point an individual must have arisen who was capable of internalizing a grammar of a type that none of her ancestors (no matter what data they were exposed to) could possibly have internalized.

The focus of the rest of this paper will be on the evolution of the human language faculty, and not on the evolution of particular languages.

2 Explaining a unique phenomenon

The human language faculty is unique in our experience. This poses problems for explanation. We like scientific explanations to be general, to account for wide ranges of data. Darwinian accounts of the evolution of the eye are convincing not least because they apply to many different convergent instances, from mammals to molluscs. If a professor throws a pile of essays down a flight of stairs, we can invoke an elegant general explanation of why they all fall — gravity, but any attempted explanation of why the one particular essay that lodged furthest down the stairs should have done so is, ipso facto, less general. Biological adaptationist accounts of the human language faculty face the difficulty that the initial conditions providing the platform for the adaptation must be presumed to contain some unique factor, or combination of factors. Otherwise, why should we only find language in one species? The focus of explanation shifts away from the general pervasive tendency of species to adapt to their environments, towards some specific one-off circumstance that has occurred only once in history.

Adaptation is still part of the picture, however. Selective pressure for individuals (or groups) to be better adapted to their environments undoubtedly played a part in the evolution of the language faculty, just as the force of gravity affects all the essays thrown down the professor's stairs.

Stay with the essays-and-stairs analogy for a moment; say a breeze blows through the house, so that essays sporadically get shifted from higher to lower stairs (as gravity always applies). After a while, there will be several, perhaps many, essays on or beyond the stair which was originally the furthest reached by any essay. We modern humans are the first species, but we not may not be the last, to acquire a language faculty. In retrospect, for each of the major transitions in evolution, there must have been a unique standard-bearer at one time. Only after each new phase became widely represented could any scientist (if one had existed!) propose explanatory mechanisms for it accounting for a wide range of data.

Scientists of our era are stuck, then, with the inevitability of less-than-general explanations for the evolution of the human language faculty. But there are still serious constraints on what can count as a satisfactory particular explanation. Any circumstances invoked as explaining the emergence of Language have to be argued to be true. Where special brain structures are proposed as the crucial *explanans*, for example, one has to be able to verify that humans, and no other species, have just such structures. Or where special social arrangements of humans are invoked as the crucial significant factor, one has to be able to argue that these social arrangements did apply to humans at the relevant time, and not to other species. And in general, more realistically and more eclectically, for any set of circumstances proposed as individually necessary and collectively sufficient to explain the emergence of Language, one has to show that this combination of circumstances applies (or applied) to humans and to no other species. We have a long way to go.

3 Some suggested preadaptations or crucial steps

For a purposeful agent, assembling any set of individually necessary and collectively sufficient elements for some task poses the problem of keeping all the accumulating and yet still insufficient subsets together until the last key member is put in place, finally rendering the whole set sufficient. How much more unlikely it must be for blind, non-teleological evolution to keep subsets of circumstances together until the final key circumstance arises that makes the whole collection sufficient to give rise to some evolutionary development. This is why the term 'preadaptation' may at first seem to have a somewhat contradictory, or teleological, ring to it; the term might almost seem to suggest that evolution anticipates the adaptations it will have to make in future. In fact, however, the notion of preadaptation is not so problematic.

Although Darwin did not use the term 'preadaptation', it is clearly envisaged and defended in the *Origin*, especially in the 6th edition:

> I have now considered enough, perhaps more than enough, of the cases, selected with care by a skilful naturalist, to prove that natural selection is incompetent to account for the incipient stages of useful structures; and I have shown, as I hope, that there is no great difficulty on this head. A good opportunity has thus been afforded for enlarging a little on gradations of structure, often associated with changed functions. (Darwin, 1872:204)

In any environment there is scope for variation which has little or no effect on fitness. And genomes and cultures can wander randomly through the possibility space, so that many different neutral possibilities are represented. These possibilities may be genetic, or neural, or other physiological, or individual behavioural, or social. See Miglino et al. (1996) for an account of how preadaptations can accumulate in a system with multiple layers of organization — DNA, neural nets, behaviour, fitness. These authors also show how the accumulation of such preadaptations can lead to apparent discontinuities or phase-changes in evolution.

I give below a brief survey of some traits which have been suggested in the literature as preadaptations for language. The ideas briefly reviewed below are a small selection from many found in the literature (see Richards, 1987:246-273, for a good concise survey). For each of these, it has been suggested that its presence was a necessary precondition for the emergence of Language. There is seldom, if ever, any serious consideration of the relative chronology of the various proposed preadaptations. Thus, each of the 'preadaptations' reviewed below might be seen as the last and crucial step that gave us Language, or it might be one of an accumulation of necessary characteristics preceding that final step.

One must further always be aware that such talk of 'steps', whether 'final', 'crucial' or otherwise, involves idealization. Evolutionary steps are instances of normally continuous and gradual processes suddenly accelerating, or precipitating qualitative phase changes. In reality, evolutionary steps may take thousands, even millions, of years to complete. This should be taken into account when considering the relative chronology of any proposed preadaptations for Language. Many of the various necessary steps were certainly being taken simultaneously.

3.1 Cognitive preadaptations

Theory of Mind. A capacity to attribute to other individuals versions of ones own beliefs and desires is evident in much modern linguistic behaviour. There could conceivably be quite elaborate communication systems whose use does not require a theory of mind on the part of its users, but human languages, and especially the pragmatic systems of inference used with them, are not such systems. The acquisition and use of human languages requires substantial inferential machinery about the likely intentions of others (see Sperber and Wilson, 1986, for the tip of this iceberg). Control of complex grammatical structures per se does not presuppose a Theory of Mind. Heyes (in press) reviews the evidence for whether apes have any such theory of mind, and concludes that there is as yet no convincing evidence that they do, although he does not rule out the possibility of such evidence being found. (Heyes' article is a good introduction to the large literature on ape theory of mind.) My own reading of the literature leads me to suspect that it is a matter of degree, with normal adult humans having the strongest capacity for reading the minds of others, followed, in order, by normal human children, autistic people, chimpanzees, orang utans, gorillas, and monkeys. It is noteworthy that children's growing ability to make inferences about others' intentions lags behind their acquisition of quite complex grammatical structures. Literature on Theory of Mind is heavily interwoven with discussion of closely related concepts under rthe headings of 'social intelligence' (Worden, in press) and 'Machiavellian intelligence' (Byrne and Whiten, 1988). See also Sperber (1994) on human 'metarepresentational capacity'.

Bickerton's phonetics-to-theta-role link. Bickerton (1998) has proposed a single catastrophic event precipitating the emergence of the modern language capacity. This is the appearance of a connection in the brain between the (hypothetical) component that processes understanding of complex social relations between individuals (who-did-what-to-whom) and the symbol-processing machinery that can already handle isolated words, but not syntax. This proposal is one of the more extreme 'Big Bang' style proposals for the emergence of the language faculty.

Mimesis. This is an idea first put forward by Merlin Donald (1991), who sums it up as follows:

> Mimesis is a nonverbal representational skill rooted in kinematic imagination, that is, in an ability to model the whole body, including all its voluntary action-systems, in three-dimensional space. This ability underlies a variety of distinctively human capabilities, including imitation, pantomime, iconic gesture, imaginative play, and the rehearsal of skills. My hypothesis is that mimesis led to the first fully intentional representations early in hominid evolution, and set the stage for the later evolution of language. (Donald, 1998)

Evidence for such intentional and imaginative capabilities can also be gleaned from Paleolithic tools (see Wynn, 1991).

'Symbolic reference'. It is all too tempting to think of a language as consisting of a set (infinite, of course) of independent meaning-form pairs. This way of thinking has become habitual in modern linguistics, although there is also much in the subject which reminds one of its artificiality. Deacon (1997) emphasizes that in human language any concept which is the sense of some linguistic item (such as a word) is also enmeshed in a net of relationships with the senses of other words. This network of senses embodies a complex constructed world-picture in the mind of the speaker. The complexity and combinatorial productivity of modern languages arise from humans' unique facility for relating signals to coordinates in such complex abstract conceptual networks. (Deacon's terminology, especially his use of 'reference' in this argument, is likely to confuse, or at least to annoy, linguistic semanticists.)

3.2 Social preadaptations.

Altruism, cooperation. Communication may arise, as Dawkins and Krebs (1984) claim, from an arms-race between mind-reading and manipulation. A view (with versions which may be either complementary or opposed to this 'Machiavellian' view) is that a certain degree of altruism and mutual cooperation is a prerequisite for the rise of complex communication systems, in particular where these can be used by one individual to convey factual information to another. It would seem that there is usually little immediate benefit to a speaker in 'giving' declarative information to another. Classic references on the evolution of altruism, though with no reference to language, are Trivers (1971) and Hamilton (1964).

Group size Robin Dunbar (1993, 1996) has argued that the typical size of human clans and networks of intimates hovers significantly around the number 150. Briefly, language evolved as a response to the necessity of servicing the enormous number of relationships with other individuals that a group of 150 presents. Bonding by physical grooming with so many other people is not practical. But words are cheap, and having a language capable of expressing quick gossipy messages enables humans to keep up their social networks. The argument does not say anything about the intricate grammatical structures of human languages.

3.3 Physiological preadaptations

Brain size. Everybody agrees that there is some connection between humans' abnormally large brains and their capacity for language, but nobody has been able to specify very precisely what this connection is. Deacon (1992) points out that in two-million-year period in which brains have doubled in size, no clearly new structures have been added, although there has been warping of the proportions of the parts, with the frontal areas of cortex becoming more prominent. It is these parts which handle 'verbal short-term memory, combinatorial analysis, and sequential behavioral ability' (Deacon, 1992:64). For other accounts, see also Eccles (1989) and Wilkins and Wakefield (1995).

Serial motor control. The complex gesture of, say, throwing a stone, can be likened to a phrase; it consists of a series of subgestures, which must be carefully coordinated with each other. One school of thought sees in the evolution of such complex gestures a basis for the mental organization of grammatical phrases and sentences. Such proposals do not go beyond such simple grammatical relationships as serial ordering of elements. Representative works in this vein are Calvin (1983), Kimura (1979), and Lieberman (1984). Interestingly, Chomsky's (1959) influential review of Skinner's *Verbal Behavior* also pointed to the relevance of serial order in behavior, specifically to Lashley's (1951) work.

Vocal tracts. Human vocal tracts differ significantly in shape from those of chimpanzees, allowing us to produce a range of distinct sounds that chimpanzees are not capable of. Lieberman (1992, 1984, 1975) is the most prominent exponent of this topic. Lieberman's work also argues that the Neanderthal vocal tract was incapable of articulating the range of modern human speech sounds. This view has recently been challenged by Arensburg and co-workers (1989, 1990) and Duchlin (1990). Aiello (in press) briefly surveys some evidence that the human vocal tract was an early preadaptation, motivated by dietary changes in early hominids. Although the range of sounds available to modern humans is, by definition, characteristic of human language, it can be argued that this is a less crucial characteristic than some others (e.g. syntax). If we were capable of articulating fewer phonemes, we would have to use longer words. Perhaps there is some ideal trade-off between the capacity to make fine articulatory distinctions and the size of short-term memory buffers.

4 Fitness and language

Preadaptations, such as those just discussed, are enabling rather than forcing. Having a particular preadaptive trait simply makes certain later steps possible; preadaptations for language are not in themselves selected for by any measure of fitness involving language. By contrast, (neo-)Darwinian accounts tend to stress adaptations, which, by definition, are selected for.

One must, of course, avoid the 'strict adaptationist' fallacy of assuming that every trait is adaptive; there are spandrels, accidental, non-functional aspects of morphology or behaviour (Gould, 1987, Gould and Lewontin, 1979). Lightfoot's (1991) position is that the formally interesting features of the language faculty, which give human languages their characteristic features, (e.g. the syntactic principle of Subjacency) are not particularly fitness-enhancing; the human language capacity is more complex than it needs to be, and even in places dysfunctionally complex. Such features as Subjacency may indeed be, Lightfoot argues, just accidents (spandrels); but scientific methodology abhors accidents, and a powerful theory predicting the occurrence of such features would be preferable, if one could be found. One cannot be happy with a general stance of classifying any interesting phenomenon as a spandrel. Lieberman has put it very well: 'Gould's (1987) 'spandrel theory' paper on the origins of language is nothing more than a restatement of Darwinian preadaptation with the added dubious claim that *no subsequent natural selection occurred.* This is most unlikely, all specialized organs appear to involve both preadaptation and natural selection.' (1991:63-64 [emphasis in original])

In this section I briefly explore questions which arise when trying to see in what ways aspects of the human language faculty could be adaptive, and might have been privileged by natural selection. I will also mention the alternative possibility that the search for adaptedness in humans is misplaced; this is the idea that it is not we humans who are adapted, but that languages, as socio-cultural constructs, have evolved and adapted to us.

The massive expressive power of human languages (not a topic centrally addressed by syntactic theorists) is, of course, fitness-enhancing. Fitness is not an absolute matter, but always relative to an environment. What is fit is one environment is unfit in another. Language was undoubtedly instrumental in conferring on humans fitness across an unprecedentedly wide range of environments. Many environments are still no-go areas for humans, but we can survive and reproduce in a range greater than that of any other species. Our ability to communicate precise and complex messages to each other must have helped. This much is a broad truism; we can explore the matter of fitness in relation to Language, and languages, in more subtle ways.

If we assume that the innate human language faculty, in all its specific detail, arose by natural selection, the central puzzle is the relation between intricate universal principles of grammatical structure and fitness. Clearly, the space between fitness and principles of grammar had to be bridged by some intermediate theoretical construct, such as expressive power. To take a specific example, a relatively robust principle, under modern grammatical theory, is Subjacency. Putting it informally,

> Subjacency, in effect, keeps rules from relating elements that are 'too far apart from each other', where distance apart is defined in terms of the number of designated nodes that there are between them.
>
> Subjacency accounts for the violations of grammaticality in the English sentences (4a-b):
>
> (4) a. *What$_i$ do you wonder where John put _____$_i$?
> b. *What$_i$ do you believe the claim thet John ate _____$_i$?
>
> In these sentences, two bounding nodes intervene between the gap and the word *what*. (Newmeyer, 1991:12)

Given the assumption under consideration, we have to explain how a creature innately disposed to internalize a grammar conforming to the principle of Subjacency has a reproductive advantage over one that doesn't. Newmeyer's (1991) paper makes a brave and worthwhile start at such an account. He cites the widely-accepted conclusion that the Subjacency Principle is a helpful constraint on the assignment of an understood grammatical role for displaced elements such as question words and relative pronouns (e.g. *what*), because a sentence not conforming to Subjacency is likely to put a heavy strain on working memory (Berwick and Weinberg, 1984). Then Newmeyer builds this and arguments relating to other grammatical principles into the following general conclusion :

> In sum, the innate principles of UG can be motivated functionally. As the language faculty evolved, pressure for more successful communication (and with it

the reproductive advantage that this would bestow) conferred an evolutionary advantage on those whose grammars incorporated them. (20)

There is a difficulty with this explanation (unnoticed by any of the commentators on Newmeyer's paper). Recall from discussion above that the environment in which an alleged mutant must succeed is partly a linguistic environment. Imagine a stage in human evolution which we will call *Homo pre-subjacentia*, 'pre-Subjacency humans'. Now, a mutant child, who (ex hypothesi) is disposed to acquire a grammar containing the Subjacency constraint, is born into a community producing utterances that do not conform to this constraint. The pre-subjacentian linguistic environment would be full of utterances depending for their successful interpretation on assigment of co-indexing relations (as between *what* and its 'gap') which violate the mutant's innate principle. Surely the child would be at a disadvantage, rather than at an advantage. To put it concretely, the child's pre-subjacentian parent might say to it something along the lines of *What do you wonder where John put?*, intending to convey *I know you are wondering where John put something — what was that something?*. This interpretation would be barred for the child, who would have to conclude that its parent was talking gibberish. (The situation would be asymmetric, as anyone in the population would understand utterances produced by the mutant.) Only if the mutant child somehow survived his confusing childhood and procreated a brood of little post-subjacientians, who would be able to understand their parent perfectly, could the Subjacency mutation get a foothold in the population. It is not impossible, I suppose, but this is certainly a difficulty for Newmeyer's proposed adaptationist/nativist explanation of such grammatical principles. See Kirby and Hurford, 1997, for further arguments along these lines. The problem just noted is completely general; it will be hard for constraints to evolve.

Beside this objection, there is a more common one, expressed by several commentators on Newmeyer's paper, of which Fouts' version is typical: 'It seems critical to me that he [Newmeyer] demonstrate how a human male or female who uses Chomskian perfect grammar has a better chance of breeding than one who failed English 101 and is noted for ungrammatical monosyllabic utterances yet has bedroom eyes and drives a BMW. (Fouts, 1991:42)' We should, however, remember that conditions for *Homo erectus* or archaic *Homo sapiens* were very different from modern conditions with BMWs and English 101. Perhaps, way back then, better communicators really did have an advantage.

Two broad strands are apparent in arguments that effective communication enhances the reproductive chances of individuals. One strand emphasizes the successful receipt of informative messages by the hearer, such as 'Watch out for that falling rock'. This leaves any possible advantage to the speaker to be accounted for in terms of altruism – not an implausible move, in my view. The other strand emphasizes the successful use of a code by speakers to enhance their positions in a social group. Better talkers get more prestige, and therefore more mates. This view places less emphasis on the informative content of messages and more on the function of utterances to forge and maintain social relationships. While undoubtedly language is used for social 'grooming' purposes, this emphasis fails to account for the impressive and subtle referential power of language. Unfortunately, although it seems to be a truism that effective communication is likely to have been advantageous, when we get down to the level of individuals reaping that advantage on particular occasions, all stories that we can tell seem oddly inept. Perhaps this is just a measure of the temporal and cultural gap between us and the relevant ancestors.

Bickerton (1990, 1991) is among those who emphasize the role of (internal) representation over that of communication in any adaptive account of human language. 'In any account of the functional motivation of language, the question of whether it was the communicative or the representational aspects that contributed most to the adaptedness of language surely bulks too large to be ignored.' (Bickerton, 1991:37) Superior mental representational power has been listed as a necessary precondition to language. If communication is envisaged in Saussurean terms of a meaning in one head (speaker) being recreated in another head (hearer), the two heads involved clearly must have the power to represent these meanings. I cannot convey an idea to you that I am unable to grasp myself. Powerful mental representational capacity, without there necessarily being any means to externalize it in utterances, is very probably adaptive in itself.

But Bickerton's view that we can apparently compare the contribution of representation with that of communication is mistaken, because (internal) representation and communication achieve different goals, in different circumstances. Human languages are all public languages, elaborate systems for externalizing complex mental representations as essentially linear signals. The representation task just doesn't face some of the problems that the expression task faces. Take for instance the proposition represented by a reflexive sentence in English, a sentence such as *Kim hit herself.* The decision having been 'made' (presumably for purposes of regularity) that the verb *hit* requires an object, there arises the expression task of conveying that this object denotes the same individual as does the subject of the sentence. This task, indeed any task involving control over a relation between form and meaning, is something that a mental capacity for internally representing complex concepts never has to face. A creature (nonlinguistically) entertaining the thought corresponding to *Kim hit herself* need only have a single entity, Kim, in mind, not two — 'subject-Kim' and 'object-Kim'. When managing internal mental representations alone, there is never any issue of denotation; denotation is only an issue that arises when the externalization of concepts in public utterances arises.

Note that the examples of Subjacency given above involve an antecedent (*What*) and a subsequent 'gap' in the sentence. This anaphoric relation between antecedent and gap is no part of any plausible mental representation of the meaning of *What do you wonder where John put?* (unless you believe that one thinks in English). The movement rules that generative grammarians have concentrated on are motivated by apparent discrepancies between the needs of internal representations of meanings and the human language sentences that express them. Obviously, one cannot appeal to the properties of meaning representations to account for universal ways in which the surface sentences of languages diverge from such representations.

A radical alternative to the focus on the phylogenetic adaptation of humans to be better communicators or better conceptualizers is a focus on the linguistic adaptation of systems of communication to be replicable by human acquirers. This idea has been well expressed by Christiansen:

> Instead of sasying that humans can only learn a small subset of a huge set of

> possible languages, we must refocus by observing that *natural* languages exist only because humans can produce, learn and process them. In this connection, it is usefult to construe language as an *organism*, adapted through natural selection to fit a particular ecological niche: the human brain. ...
>
> In this sense, natural language is akin to an organism whose evolution has been constrained by the properties of human learning and processing mechanisms. It is therefore not surprisinmg that we, after all, are so good at acquiring language. ...
>
> What is often not appreciated is that the selective forces acting on language to fit humans is [sic] significantly stronger than the selective pressure on humans to be able to use language. In the case of the former, a language can *only* survive if it is learnable and processable by humans. On the other hand, adaptation towards language use is *one out of many* selective pressures working on humans ... Thus, language is more likely to have adapted itself to its human hosts than the other way round. Languages that are hard for human to learn simply die out, or, more likely, do not come into existence at all. Following Darwin, I propose to view natural language as a kind of beneficial parasite — i.e. a *nonobligate symbiant* — that confers some selective advantage onto its human hosts without whom it cannot survive. Consequently, the rate of linguistic change is far greater than than the rate of biological change. (Christiansen, 1994:125-126)

'Refocus' is the correct term to use here. Christiansen cannot deny that there are some special genetically specified characteristics in humans that enable them, and no other species, to act as hosts to complicated languages, so an element of innateness is not ruled out. Deacon (1997) has expressed a similar view to Christiansen's. The same general idea is now beginning to be explored by computational modellers, starting with Batali (in press) and continuing with Kirby (forthcoming). These researchers show how quite language-like systems can arise in populations of communicating agents starting, as our ancestors must have, from the total absence of any coordinated or structured system. Probably more will emerge from this line of research over the next few years.

5 Dates

'The timing of the origin of language is anyone's guess' (Richards (1987:205). This assessment is near the mark, if not wholly right. The nature of the dating problem is to fit a series of vaguely and controversially hypothesized stages in the evolution of language around a handful of approximate (and also controversial) dates for key non-linguistic events in human evolution.

The three key dates usually mentioned are of two phylogenetic transitions and one cultural transition in *Homo sapiens*. The phylogenetic transitions are *habilis*-to-*erectus*, around 1.7m years ago and *erectus*-to-*sapiens (sapiens)* (between 200,000 and 100,000 years ago). The cultural transition is the Upper Paleolithic revolution in toolmaking (45,000-40,000 years ago), which I collapse here for convenience with the emergence of 'modern' art forms around the same time. The rise of agriculture about 10,000 years ago has also been mentioned, but this is generally held to be far too late to be relevant. The *erectus*-to-*sapiens* date is contested by multi-regional evolution theorists (see Wolpoff, 1988), who claim that there was no relatively sudden speciation event, but rather a long (perhaps 1m year) period of interbreeding between more modern and more conservative varieties, in various parts of the Old World. The revolutionary character of the changes in tool making around 40,000 years ago is also disputed by some.

As far as 'stages' in linguistic evolution are concerned, the most specific suggestion is Bickerton's, of a simple two-stage progression from protolanguage to full human language. Protolanguage is described as concatenation of vocabulary items according to pragmatic pressures (e.g. put the 'word' for the most salient idea first), with no level of grammatical organization involving phrases, or inflections, or grammatical words such as determiners, auxiliaries, or case-markers. It is like Tarzan-talk. Bickerton gives examples from pidgins, the efforts of trained apes, human children under two years of age, and language-deprived adults.

Bickerton suggests that *Homo erectus* spoke protolanguages. It is tempting to align Bickerton's step from protolanguage to full human language with the emergence of anatomically modern humans between 200,000 and 100,000 years ago. If there is a view which is held by more scholars than any other, on however flimsy grounds, it is probably that fully modern language came on the scene with the appearance of anatomically modern humans, between 200,000 and 100,000 years ago. But this currently conventional wisdom needs to be subjected to careful criticism as more evidence and arguments appear.

This 'catastrophic' two-stage model is in contrast to continuous models. Continuity models do not immediately appeal to linguists familiar with the modular structure of languages. Linguists analyze languages, with some reason, into components such as lexicon, phonology, syntax and semantics, all organized along rather distinctively different principles, like the separate but interacting organs of the human body. It is hard to see a differentiation between phonology and syntax as a continuous process; there must have been some kind of phase change. To a linguist, a statement such as that simple versions of modern language were used a million years ago is unclear, because it does not specify the sense in which 'simple' is intended, and seems to treat a language system as a kind of undifferentiated lump, that you can simply get 'more of'.

The Bickertonian picture of over a million and a half years during which *Homo erectus* used protolanguages is easier to envisage as a continuum, with perhaps gradually expanding vocabularies, gradually faster speech and comprehension, and steady compression of (proto)language acquisition into the critical period before puberty. Such gradual changes can be (intuitively) reconciled with the increase in brain size over the period.

Say, following the currently popular view, that anatomically modern humans were also the first humans equipped with a fully modern language acquisition device. What would they have done with it? The L.A.D. needs input, a language already spoken in the environment, or else it remains dormant. The first *Homo sapiens sapiens* would, according to the popular idea, have been born into a protolanguage-speaking environment. From here, it is a simple step, again following Bickerton's ideas, to full human language, via processes essentially like those of creolization witnessed in modern times.

Another view (e.g. Krantz, 1980) associates the emergence of fully modern languages with the sudden marked improvement in stone tool technology around 40,000 BP. It is argued that what explains this technological explosion was the ability to describe to others, in language, the more complicated procedures needed for making the new improved tools. The theory relies on an impression of what might be learnable by mere observation and what tasks require linguistic instruction. If one accepts this view of the later emergence of modern languages, one has to ask what anatomically modern humans were doing for the preceding 60,000 years. A possible answer is that the socio-cultural transition from protolanguages to modern languages took 60,000 years; but this seems unlikely in the light of modern evidence from creolization.

Appendix: Cultures and languages

In a volume on the evolution of culture, it is worth making the point that linguists recognise no interesting link between the grammatical and phonological structure of a particular language and any aspect of the culture that happens to speak that language. Culture is certainly reflected in vocabulary but hardly, if at all, in grammar or phonology. The changes in the English language from Old English to the present are causally related to the cultural changes that have characterized the history of the English speaking peoples, but only in uninteresting ways, from the point of view of a theory of language. For example, the Norman invasion of 1066 introduced a certain kind of possessive construction into English, **Head-preposition-Possessor** as in *the pen of my aunt*, which now stands beside the original Saxon **Possessor-Head** construction, as in *my aunt's pen*. But there is no significant connection between **Head-preposition-Possessor** and any properties of Norman culture or between **Possessor-Head** and any properties of Anglo-Saxon culture. It could just as well have been the other way around.

One cannot find a property of some culture (say, that it is exogamous), and from it make any prediction about the grammatical or phonological structure of its language (say, that it has dominant Subject-Object-Verb word order, or that it does not permit syllable-initial consonant clusters).

Apart from vocabulary, the grammatical and phonological systems of a language are bolt-on accessories to its culture. In one sense, a culture can swap its language for another with little significant effect on the culture, provided the adopted language has the necessary vocabulary to serve as vehicle for orally maintained aspects of the culture. The only thing that was lost from the core "culture of Roman Catholicism" when the Roman Catholic church switched its liturgy from Latin to modern vernaculars was its archaic associations; ditching Latin had a modernizing and universalizing effect on the religion. But the modern vernaculars now used are not in any linguistic sense "modern"; one can find among them languages with the same interesting formal characteristics as Latin, such as a rich case system, inflectional and fusional morphology, word order, vowel system, and so on.

Another, contrasting, example of the dissociation of linguistic structure from culture is the Hebrew-Jewish connection. One objection of the Israelis' Arab neighbours and fellow Semitic speakers to their reestablished presence in the Middle East is that they have imported an alien (typically meaning European and non-Muslim) culture into the region. Jewish culture, now associated, at least in Israel, with Hebrew, survived and evolved during the millennia of the diaspora through the vehicles of Yiddish, Ladino and other non-Semitic languages, and only recently revived Hebrew as its own (a conservative, rather than modernizing, step). Modern Hebrew adapts its vocabulary to international aspects of Twentieth Century culture, just as Modern English and modern Chinese do; but Hebrew weaves this new vocabulary into its grammatical system in a way which is formally quite different from English and Chinese.

A culture can, somewhat arbitrarily, 'decide' to express a proprietary interest in 'its' language, so that 'preserving the X language" becomes, politically, part and parcel of the 'preserving the X culture'. Basques, Celts, Catalans, Jews, Navahos and many other cultural groups have taken this path.

The relationship between language and culture, as the linguist sees it, follows from two axiomatic principles:

- The Arbitrariness of the Sign – The relation between a linguistic form and its content (meaning) is a matter of arbitrary convention. (Reservations would be expressed to account for certain cases of iconicity and sound-symbolism.)
- 'Effability'. The grammatical structures of any language are capable in principle (i.e. given the appropriate basic vocabulary) of expressing the same infinite range of meanings as any other language. (A reservation here would mention the relative 'neatness' with which languages may express the same thought; in some languages a single word may achieve what requires a circumlocution in another language. This reservation supports a (quite weak) version of the Whorf Hypothesis.)

The point just made is negative and sanitizing; the vocabulary of a language may track changes in its host culture, but the changes which affect syntax and phonology are generally independent of cultural change. This point, however, only applies at the level of individual languages and cultures, rather than at the level of the whole species and the human capacity for language. *Homo sapiens* is, above all, a culture-building animal, and this arises in large part from our capacity for language.

The phrase 'evolution of culture' is as ambiguous as the phrase 'evolution of language'. It could refer to the historical changes in particular cultures within the limits set by the genetically given capacity of individuals to acquire the systems of values and practices which constitute cultures. Or it could refer to the evolution of the biological base on which cultures are built, for example of the evolution from the class of 'cultures' in principle acquirable by a *Homo erectus* to the class of cultures acquirable by modern humans.

Acknowledgements

This research was partly supported by ESRC grant R000236551 'The Evolutionary Origins of Innate Linguistic Constraints' and by a Fellowship at the Collegium Budapest. I thank Simon Kirby and Bob Berwick for useful discussions on this topic.

References

Aiello, Leslie, (in press) 'The foundations of human language' to appear in Jablonski, Nina G. and Aiello, Leslie (eds) *The Origind Diversification of Language*, Memoir 24, California Academy of Sciences, Berkeley: University of California Press.

Aitchison, Jean, (1991) *Language Change: Progress or Decay?* (2nd edition) Cambridge: Cambridge University Press.

Alleyne, Mervyn C., (1980) *Comparative Afro-American* Ann Arbor, Michigan: Karoma Publishers.

Alleyne, Mervyn C., (1986) 'Substratum influences: guilty until proven innocent', in Muysken, Pieter, and Smith, Norval (eds) *Substrata Versus Universals in Creole Genesis*, Amsterdam: John Benjamins, pp.301-315.

Arensburg, B., Tillier, A.M., Vandermeersch, B., Duday, H., Schepartz, L.A. and Rak, Y., (1989) 'A Middle Paleolithic human hyoid bone', *Nature*, 338:758-760.

Arensburg, B., Schepartz, L.A., Tillier, A.M., Vandermeersch, B., and Rak, Y., (1990) 'A reappraisal of the anatomical basis for speech in Middle Paleolithic hominids', *American Journal of Physical Anthropology*, 83:137-146.

Batali, John (in press) 'Computational simulations of the emergence of grammar' in Hurford, James R., Studdert-Kennedy, Michael and Knight, Chris (Eds) *Approaches to the Evolution of Language: Social and Cognitive Bases* Cambridge: Cambridge University Press.

Berwick, Robert C. and Weinberg, Amy S., (1984) *The Grammatical Basis of Linguistic Performance*, Cambridge, Mass: MIT Press.

Bickerton, Derek, (1981) *Roots of Language*, Ann Arbor, Michigan: Karoma Publishers.

Bickerton, Derek, (1990) *Language and Species*, Chicago: University of Chicago Press.

Bickerton, Derek, (1991) 'Language origins and evolutionary plausibility', *Language and Communication*, 11,1/2:37-39.

Bickerton, Derek, (1998) 'Catastrophic evolution: the case for a single step from protolanguage to full human language' in Hurford, James R., Studdert-Kennedy, Michael and Knight, Chris (eds) *Approaches to the Evolution of Language: Social and Cognitive bases*, Cambridge: Cambridge University Press.

Byrne, Richard, and Whiten, A., (1988) *Machiavellian Intelligence: Social Expertise and the Evolution of Intellect in Monkeys, Apes and Humans*, Oxford: Clarendon Press.

Calvin, William, (1983) 'A stone's throw and its launch window: timing precision and its implications for language and hominid brains' *Journal of Theoretical Biology*, 104:121-135.

Chomsky, Noam, (1959) Review of B.F Skinner's *Verbal Behavior* (New York: Appleton-Century-Crofts, Inc, 1957), *Language* 35,1:26-58.

Chomsky, Noam, (1986) *Knowledge of Language: its nature, Origin and Use*, New York: Praeger.

Christiansen, Morten H., (1994) *Infinite Languages, Finite Minds: Connectionism, Learning and Linguistic Structures*, University of Edinburgh PhD thesis.

Darwin, Charles, (1872) *On the Origin of Species by Means of Natural Selection* 6th edition. Page reference to reprint edition, 1963, New York: Heritage Press.

Dawkins, Richard, and Krebs, John R., (1984) 'Animal signals: Mind-reading and manipulation' in Krebs, John R., and Davies, N.B., (Eds) *Behavioural Ecology: an Evolutionary Approach* (second edition), Oxford: Blackwell Scientific Publications.

Deacon, Terrence, (1997) *The Symbolic Species*, New York: W.Norton and Co.

Deacon, Terrence, (1992) 'Brain-language coevolution' in Hawkins, John A., and Gell-Mann, Murray, (eds) *The Evolution of Human Languages*, Redwood City, California: Addison-Wesley, pp.49-83.

Donald, Merlin, (1991) *Origins of the Modern Mind: Three Stages in the Evolution of Culture and Cognition*, Cambridge, Mass.: Harvard University Press.

Donald, Merlin, (in press) 'Mimesis and the executive suite: missing links in language evolution' in Hurford, James R., Studdert-Kennedy, Michael, and Knight, Chris (eds) *Approaches to the Evolution of Language: Social and Cognitive Bases*, Cambridge: Cambridge University Press.

Duchlin, L.E. (1990) 'The evolution of articulate speech: comparative anatomy of the oral cavitry in *Pan* and *Homo*', *Journal of Human Evolution*, 19:687-698.

Dunbar, Robin I. M., (1993) 'Coevolution of neocortical size, group size and language in humans', *Behavioural and Brain Sciences*, 16:681-694.

Dunbar, Robin I. M., (1996) *Grooming, Gossip and the Evolution of Language*, London: Faber and Faber.

Eccles, John C., (1989) *Evolution of the Brain: Creation of the Self*, London: Routledge.

Fouts, Roger, (1991) 'Dirty bathwater, innateness neonates and the dating game', *Language and Communication*, 11,1/2:41-43.

Gould, Stephen J., (1987) 'The limits of adaptation: is language a spandrel of the human brain?', Unpublished paper delivered to the Center for Cognitive Science, MIT.

Gould, Stephen J., and Lewontin, R.C. (1979) 'The spandrels of San Marco and the Panglossian program: a critique of the adaptationist programme' *Proceedings of the Royal Society of London*, 205:281-288.

Hamilton, W.D. (1964) 'The genetical evolution of social behaviour', I and II, *Journal; of Theoretical Biology*, 7:1-16, 17-62.

Heyes, C.M., (in press) 'Theory of mind in nonhuman primates' to appear in *Behavioural and Brain Sciences.*

Hoenigswald, Henry, (1960) *Language Change and Linguistic Reconstruction*, Chicago: University of Chicago Press.

Krantz, G. (1980) 'Sapienization and speech', *Current Anthropology*, 21:773-792.

Kimura, D. (1979) 'Neuromotor mechanisms in the evolution of human communication', in Whitaker, H., and Whitaker, H.A., (Eds) *Current Trends in Neurolinguistics*, New York: Academic Press.

Kirby, Simon (forthcoming) 'Language evolution without natural selection: From vocabulary to syntax in a population of learners', unpublished paper, Department of Linguistics, University of Edinburgh.

Kirby, Simon, and Hurford, James R., (1997) 'Learning, culture and evolution in the origin of linguistic constraints', In Husbands, Phil, and Harvey, Inman, (Eds) *Fourth European Conference on Artificial Life*, Cambridge, Mass.: MIT Press, pp.493-502.

Lashley, K.S., (1951) 'The problem of serial order in behavior' in L.A.Jeffress (ed) *Hixon Symposium on Cerebral Mechanisms in Behavior*, New York: John Wiley and Sons.

Lieberman, Philip, (1992) 'On the evolution of human language', in Hawkins, John A., and Gell-Mann, Murray, (eds) *The Evolution of Human Languages*, Redwood City, California: Addison-Wesley, pp.21-47.

Lieberman, Philip, (1975) *On the Origins of Language: an Introduction to the Evolution of Human Speech*, New York: Macmillan.

Lieberman, Philip, (1984) *The Biology and Evolution of Language*, Cambridge, Mass.: Harvard University Press.

Lieberman, Philip, (1991) 'Preadaptation, Natural Selection and Function' *Language and Communication*, 11,1/2:63-65.

Lightfoot, David, (1991) 'Subjacency and Sex', *Language and Communication*, 11,1/2:67-69.

MacMahon, April M.S., (1994) *Understanding Language Change*, Cambridge: Cambridge University Press.

Miglino, Orazio, Nolfi, Stefano, and Parisi, Domenico, (1996) 'Discontinuity in evolution: How different levels of organization imply preadaptation', in Belew, Richard K., and Mitchell, Melanie (Eds) *Adaptive Individuals in Evolving Populations: Models and Algorithms*, Redwood City, California: Addison-Wesley.

Newmeyer, Frederick, (1991) 'Functional explanation in linguistics and the origins of language' *Language and Communication*, 11,1/2:3-28.

Richards, Graham, (1987) *Human Evolution: An Introduction for the Behavioural Sciences*, London: Routledge and Kegan Paul.

Senghas, Anne, (1997) *Children's Contribution to the Birth of Nicaraguan Sign Language* PhD dissertation, MIT.

Sperber, Dan, (1994) 'The modularity of thought and the epidemiology of representations', in Hirschfeld, L.A., and Gelman, S.A. (Eds) *Mapping the Mind: Domain Specificity in Cognition and Culture*, Cambridge: Cambridge University Press.

Sperber, Dan, and Wilson, Dierdre, (1986) *Relevance: Communication and Cognition*, Oxford: Basil Blackwell.

Trivers, R.L., (1971) 'The evolution of reciprocal altruism' *Quarterly review of Biology*, 46:35-37.

Wilkins, W.K. and Wakefield, J., (1995) 'Brain evolution and neurolinguistic preconditions', *Behavioral and Brain Sciences*, 18,1:161-226.

Wolpoff, M.H. (1988) 'Multiregional evolution: the fossil alternative to Eden' in Stringer, Chris B. and Andrews, F. (eds) *The Origins and Dispersal of Modern Humans*, Cambridge: Cambridge University Press.

Worden, Robert, (in press) 'The evolution of language from social intelligence', in Hurford, James R., Studdert-Kennedy, Michael, and Knight, Chris, (eds) *Approaches to the Evolution of Language: Social and Cognitive Bases*, Cambridge.: Cambridge University Press.

Wynn, Thomas (1991) 'Tools, grammar and the archaeology of cognition', *Cambridge Archaeological Journal*, 1:191-206.