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Language, Parameters, and Natural Selection[1]

Recent years have seen several attempts to explain the evolution of the (putatively autonomous) human language faculty, or Universal Grammar, with standard theories of natural selection (e.g. Hurford 1992, Pinker and Bloom 1990, Newmeyer 1991, also Bickerton 1990). This is clearly at odds with the traditional generativist view, which represents the transfer from non-linguistic to linguistic communication (or representation) as a qualitative leap (see e.g. Chomsky 1972: 70, also Piattelli-Palmarini 1989), which, of course, is problematic from the point of view of natural selection.

In their article, Pinker and Bloom (1990) make use of a computer simulation of the effect learning may have on evolution. The model was constructed by Hinton and Nowlan (1987; see also Maynard Smith 1987), and it demonstrates that something apparently parallel to Lamarckian development (the inheritance of acquired characteristics) is, in some cases, not totally impossible even within the standard conception of natural selection.

Hinton and Nowlan's model – which, as such, does not have much biological credibility (Maynard Smith 1987: 762) – simulates a population of sexually reproducing organisms equipped with a neural net consisting of 20 connections (which would correspond to gene loci in an actual organism). There are three possible prewired values (corresponding to alleles) for the connections, namely '0', '1', and '?', in which '?' means that the connection is variable, and is to be set to '0' or '1' by learning. If all the connections are correctly set, the organism's chances of survival and reproduction are increased. However, if even one of the connections is set wrong, there is no advantage whatsoever; it is not only useless to have all connections wrong, it is equally useless to have 19 correct. In the model, each simulated individ-

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ual had 5 randomly chosen connections preset to '0', another 5 to '1', and the rest were set to '?'. Their model had a simulated population of 1000, in which there is, on average, one individual with correct preset connections. Every individual made 1000 learning trials, so the organism with the 10 correct prewired connections should have a fairly good chance of getting the rest correct within its lifetime. Individuals were 'rewarded' for finding the correct set of connections, and their fitness was increased; the amount of the increase was inversely proportional to the time spent in learning.

What Hinton and Nowlan set out to prove was that natural selection can play a role even in the evolution of structures which bring some advantage to the organism when and only when they are fully formed. After their model had gone through 20 generations of simulated creatures, the frequency of correctly prewired settings was high, so there was an adaptive response in the 'genotype' of the simulated organism. The outcome of the model has been summarized as follows:

> If individuals vary genetically in their capacity to learn, or to adapt developmentally, then those most able to adapt will leave most descendants, and the genes responsible will increase in frequency. In a fixed environment, when the best thing to learn remains constant, this can lead to the genetic determination of a character that, in earlier generations, had to be acquired afresh each generation. (Maynard Smith 1987: 761)

How relevant is all this to the question of the evolutionary origins of Universal Grammar? An important fact to notice here in the quotation above is that, as far as language is concerned, the best thing to learn does not remain constant for humans *as a species* — in fact, it is never, at any given moment, uniform across different linguistic communities. It may, however, be constant (at least for a while) within a single linguistic community. Within the framework used by Hurford (1992), Newmeyer (1991), and Pinker and Bloom (1990), this has an unfortunate consequence: where Universal Grammar would posit a parameter with two or more possible values, a single linguistic community might develop a principle (a parameter with only one possible value). This, in turn, would make it theoretically possible that a child of,

say, Chinese-speaking parents might be fundamentally unable to acquire e.g. Finnish in a normal fashion. In other words, if humans store features of their grammars in their genes, there is nothing to prevent them from storing language-specific features along with (or worse, instead of) those claimed to be universal.

Another — and maybe even more important — problem is the question of how the things to be learnt came into existence. If we suppose that the evolution of Universal Grammar was guided by learning in the way suggested in the quotation, the grammatical features which were to be coded in genes *should have been in existence before the coding took place.* Remember that we are talking about "a character that, in earlier generations, had to be acquired afresh each generation" (Maynard Smith 1987: 761). In connection with language, this creates a mystery. How could properties defined by UG exist and be used prior to UG, when the most compelling and the most often repeated argument for the very existence of an innate, autonomous language faculty comes from the alleged fact that such properties cannot be acquired?[2]

There are at least two ways to answer this question while still holding on to the innateness argument. One could claim that grammatical features came into existence as products of genetic mutation, and that they did not exist before it. In this case, the mutation should be dated to a period when all our ancestors were living so close together that the mutation could spread freely; otherwise this leaves open the question of how an individual mutation could spread to the whole species. Moreover, this leaves open the possibility that other mutations of this kind might have occurred in the period when humans have spread all over the world; this would, again, give us the possibility that there might

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[2]The ideas in the main text have obviously nothing to say on the question of how UG itself might have come into existence. Newmeyer (1991) tries to "deduce the selective advantage of autonomous syntax" (p. 8); his arguments are, however, far from convincing (cf. Lakoff 1991: 56 ff.). Of course, even if we could show that autonomous syntax confers a selective advantage, this would not automatically mean that syntax is autonomous. One could say that if natural selection worked that way, pigs probably *would* fly (just think what an edge this would give them when escaping from predators).

be languages a given infant could not acquire. The other possible answer is that UG principles were acquirable then but are not any more. The problems with this claim are probably too obvious to mention.

Implicit in this discussion has been the assumption (made more or less explicitly by Hurford 1992, Newmeyer 1991, and Pinker and Bloom 1990) that a 'better' grammar conveys advantages in survival and reproduction. The development of an efficient communication system like human language surely had positive effects on the lifes of its users, but it is not at all clear whether the advantage brought by a more versatile and complex grammar qualifies as a *selectional* advantage in the evolutionary sense (cf. Lewontin 1990, Fouts 1991). Furthermore, it is somewhat unclear what such advantages the geneticization of certain grammatical principles would bring (assuming that this is possible; as far as I can see, even this is still very much open for discussion). If we stick with the notion of a genetically determined Universal Grammar, it is not enough to say that a better grammar is a good thing to have, since evolution settles with properties good enough to get by on, and does not strive for a continuous series of improvements once the population has reached equilibrium (cf. Endler 1986: 5–7).[3] This should make perfect sense; there is no prize for being the fastest rabbit in the woods, but there is an obvious prize — survival and reproduction — for being faster than the fox. But accepting a functionalist or non-autonomist view of language gives us a permission to postulate teleological grammatical development (driven e.g. by unconscious rationality; cf. Itkonen 1983), in which grammar may improve just for the sake of improvement, not because of selectional pressures.

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[3]There is more to natural selection than just fitness differences. In order for selection to be possible, there must also be intrapopulational variation in a trait, and furthermore, this trait must be hereditary (Endler 1986: 4). Space does not permit a discussion of how current theories of language fit this picture. However, it is worth noting that the homogeneity of the initial state of Universal Grammar (and, of grammatical competence in general) is nearly a dogma in some linguistic circles (cf. e.g. Chomsky 1986; see Lieberman 1989 for discussion).

References

Bickerton, D. (1990) *Language & Species*. Chicago: University of Chicago Press.
Chomsky, N. (1972) *Language and Mind*. Enlarged edition. San Diego: Harcourt Brace Jovanovich.
—— (1986) *Knowledge of Language: Its Nature, Origin, and Use*. New York: Praeger.
Endler, J.A. (1986) *Natural Selection in the Wild*. Princeton: Princeton University Press.
Fouts, R.S. (1991) Dirty bathwater, innateness neonates and the dating game. *Language & Communication* 11:41–43.
Hinton, G.E. and S.J. Nowlan. (1987) How learning can guide evolution. *Complex Systems* 1:495–502.
Hurford, J.R. (1992) An approach to the phylogeny of the language faculty. In J.A. Hawkins & M. Gell-Mann (eds.) *The Evolution of Human Languages*. Redwood City: Addison-Wesley.
Itkonen, E. (1983) *Causality in Linguistic Theory*. London: Croom Helm.
Lakoff, G. (1991) Cognitive versus generative linguistics: How commitments influence results. *Language & Communication* 11:53–62.
Lewontin, R.C. (1990) How much did the brain have to change for speech? *Behavioral and Brain Sciences* 13:740–741.
Lieberman, P. (1989) Some biological constraints on universal grammar and learnability. In M.L. Rice & R.L. Schiefelbush (eds.) *The Teachability of Language*. New York: Paul H. Brookes.
Maynard Smith, J. (1987) When learning guides evolution. *Nature* 329:761–762.
Newmeyer, F.J. (1991) Functional explanation in linguistics and the origins of language. *Language & Communication* 11:3–28.
Piattelli-Palmarini, M. (1989) Evolution, selection and cognition: From "learning" to parameter setting in biology and in the study of language. *Cognition* 31:1–44.
Pinker, S. and P. Bloom. (1990) Natural language and natural selection. *Behavioral and Brain Sciences* 13:707–727.

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