Languages and Species:
Limits and Scope of a Venerable Comparison*

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1. Introduction

Nowadays it is not unusual for linguists to use evolutionary theory in order to give their theories of linguistic change a scientific veneer, while in Darwin's time it was the prestigious historical linguistics of that period which was used to make the theory of evolution more plausible. The comparison between languages and natural species has, then, a long history.

The present contribution considers which are the limits and the scope for this old and fecund comparison in order to determine whether it is just a useful analogy or if, conversely, such a comparison can help us in achieving a better comprehension of both evolutionary processes.

I am going to review concisely the history of the comparison as well as some recent formulations of it and I will propose a different version with the aim of showing that the scope of the comparison is more relevant than its limits. I will also show that the possible limits of our venerable comparison are essentially a consequence of the medium in which both processes take place, and not because of the structure of the evolutionary process, which is exactly the same.

The hypothesis that the evolutionary process has the same structure in both contexts rests upon a deep and crucial implication: that the evolving objects (languages and species), although they belong to different domains, are both objects of the same nature.

In this sense, although with the indispensable update, I am not going to do something very different from what was done by August Schleicher, perhaps the first great linguist who wrote about Darwin's *Origin of Species*. In his 1863 essay he stated: "not a word of Darwin's need be changed here if we wish to apply this reasoning to languages" (Schleicher 1863: 64).

Although Schleicher's essay was entitled *Die Darwinsche Theorie und die Sprachwissenschaft*, it was polemically translated into English in 1869 as *Darwinism Tested by the Science of Language*. The aim of this paper is a similar one: to show that an adequate theory about what languages are and about how languages change can help us to choose the best among the diverse forms of evolutionary theory.

2. A short history of a curious parallelism

As Stephen Alter (1999) has cleverly related with a profusion of data, Darwin began using the analogy between languages and species as a defensive weapon against critics and his colleagues and friends, such as the botanist Asa Gray, the geologist Charles Lyell and the zoologist Thomas Henry Huxley, did the same.

The use of the analogy in *The Origin of Species* (1859) has two main motives. The first one was to impress the reader acquainted with the achievements of historical linguistics in that period in order to make the idea of the transmutation of species more digestible and to avoid ridicule (in Darwin's own words: "the utmost which I wish, is to deprecate mere ridicule"[1]). The second one was to justify one of his theory's weak points: the absence of intermediate fossils and species in his gradual and continuous vision of evolution.

Thus, Alter observes that Darwin (in a rough draft of a previous unpublished book) proposes that although the hypothesis that the resemblance between two organisms as distinct as a gazelle and a rhinoceros comes from a common extinct ancestor could be easily made appear ridiculous, so would be the hypothesis that the English word *bishop* and the French word *évêque* have the same origin unless we know the extinct word *episcopus*, an "intermediate link" between both words[2].

But in the years after the publication of the *Origins* our analogy was so powerful in discussions about Darwin's theory that, as is also related by Alter (1999: 50 ff.), the famous American zoologist Louis Agassiz, because of his urge to reject the transmutation of species, also denied (bordering on ridicule) that some languages could descend from others and that the resemblances between them could be explained by a common origin[3].

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[1] *Darwin's Natural Selection* (1856-1858: 384), *apud* Alter 1999: 22.
[2] The example was suggested by Darwin's brother-in-law Hensleigh Wedgwood, a philologist (see Alter 1999: 21).
[3] From a point of view that would resemble that of some modern relativists, Agassiz defended the idea that each language was "substantially primordial" and that the resemblances among related languages "arose not from community of descent but from a congruence of mental structure among the nations involved" (Alter 1999: 50).

The relevant point of this anecdote is that it reflects the important role the analogy was playing after the publication of the *Origins*. Perhaps historical linguistics was not a crucial factor in the rise of the theory of evolution (as Schleicher maintained) but it was crucial for its presentation and explanation, something that, as every sociologist of Science knows, is almost as important as the hypothesis itself.

Asa Gray had a good grasp of the role the analogy in the diffusion of Darwin's theory, as reflected in the advice he addressed to Darwin:

> "You may point to analogies of development and diversification of language, of no value at all as evidence in support of your theory, but good and pertinent as rebutting objections urged against it" (Letter from Gray to Darwin, 1862, *apud* Alter 1999: 55).

It is important to observe that Gray holds a realistic stance, as he does not attribute value of proof to linguistic facts and he focuses on the analogy's illustrative power. But, obviously, if the analogy was useful to rebut objections, it had to be something more than illustration.

Actually, after the publication of Charles Lyell's *Geological Evidences of the Antiquity of Man* (1863), the analogy is going to gain a new dimension in Darwin's thought. The great geologist's penultimate chapter was devoted to the comparison between the origin and development of languages and species, and comprised an argument against Darwin.

The first part of the chapter seems to support Darwin's position. The text admits the resemblance between both processes and in fact uses the analogy in order to convince the reader of the adequacy of Darwin's evolutionary theory. Furthermore, in doing so Lyell reverses the analogy's usual direction and using ideas from the German linguist Max Müller (well known in England at that time), Lyell poses that the equivalent of mutations is the proliferation of synonymous words or of phonetic variants and that the equivalent of natural selection is the limit to the powers of human memory (see Alter 1999: 58 ff.). Thus, the struggle for life of the fittest turns into the selection of the slightly more adequate words or the minimally more euphonic sounds.

But as everybody knew, the organisms' ability to transmit their heredity and to produce mutations was a mystery that Darwin's theory was unable to solve. Therefore, Lyell is not only saying that Darwin's principles are applicable to languages, but that the limitations of Darwin's model are applicable too. So, Lyell turns from using the analogy to make Darwin's theory of transmutation credible, to twist it in an opposite direction, that is, to show that a purely naturalistic model cannot explain everything. He bases himself on the sophistication of human grammars:

> "The savage and the sage, the peasant and the man of letters, the child and the philosopher, have worked together, in the course of many generations, to build up a fabric which has been truly described as a wonderful instrument of thought [...] [a] machine, the several parts of which are so well adjusted to each other as to resemble the product of one period and of a single mind" (Charles Lyell, *Geological Evidences of the Antiquity of Man*, *apud* Alter 1999: 61)

Of course, the reference to a wonderful instrument of thought so well adjusted and to a single mind clearly evokes William Paley's old argument about optimal design, which reveals a designer. Lyell was a theist that believed in evolution, but not in Darwin's blind and purely naturalistic version. So, he reversed the analogy to show that even the renowned historical linguistics of that time (that managed so well to explain present languages from remote states) failed to explain the grammatical organization of human languages[4].

This moment could be pointed out as a missing opportunity for historical linguistics. After all, Lyell had reached an adequate interpretation of linguistic change (if compared with the finalist versions that would succeed later). As we will see, it would take one hundred years for linguists such as Roger Lass or David Lightfoot to return independently to this blind and random vision of language change.

Nevertheless, not all readers were sensitive to Lyell's argumentative trap. Asa Gray, while also being a theist, had already informed Darwin about the argumentative power of the analogy with regard to design (but in favour of Darwin!):

> "I see also with what great effect you may use it in our occasional discussion about design; *indeed I hardly see how to avoid [a] conclusion adverse to special design*" (Letter from Gray to Darwin, 1862, *apud* Alter 1999: 56, emphasis added).

Darwin understood perfectly the deep implication of this use of the analogy. Lyell, contrary to what he was trying, had formulated a theory of linguistic change in which innovations were not designed, as far as the model, similarly to Darwin's model for organisms, provides that there arise a lot of innovations and that only some of them are selected, therefore the emergence of variations is not part of a supernatural design, nor is the outcome of prefixed laws of evolution, or a tendency towards progress or adaptation, but it is, in this sense, random. As Alter observes, "the natural

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[4] "When we have discovered the principal causes of selection, which have guided the adoption or rejection of rival names for the same things and ideas, rival modes of pronouncing the same words [...] –we are still very far from comprehending all the laws which have governed the formation of each language" (Lyell, *Antiquity of Man*, *apud* Alter 1999: 61).

development of language [...] presented a case in which selection acted upon variations that were themselves apparently as random and nonteleological as Darwin ever could have desired" (Alter 1999: 68).

Anyway, it was Schleicher who made the tightest identification between both phenomena. In a well-known passage he states:

> "Languages are organisms of nature; they have never been directed by the will of man; they rose, and developed themselves according to definite laws; they grew old, and died out. They, too, are subject to that series of phenomena which we embrace under the name of 'life'. The science of language is consequently a natural science; its method is generally altogether the same as that of any other natural science" (Schleicher, 1863: 20-21).

There is a long history of discredit, even derision, to this attitude that today seems so suggestive to many of us. In a less-quoted later essay, Schleicher (1865) specifies what he meant when he said that languages are natural organisms. He states that speech must have material foundations, which he locates in the brain and the speech organs. Then he says that the very fact that these material foundations are not directly observable should not be used to deny their existence, an argument that may seem familiar to many attentive readers. As a matter of fact, Schleicher uses just the same argument Chomsky used in defence of his naturalistic approach to the knowledge of language:

> "Since we do not have the material foundations of speech immediately before us, we can only take into account effects of those foundations and to proceed with language more or less as the chemists do with the sun: they investigate its light, as they cannot directly take the source into their investigations" [...] "We therefore consider ourselves justified in considering languages as something with material existence, even if we cannot grasp them with the hand or see them with the eye, but only perceive them through the ear" (Schleicher 1865: 76-77)[5]

This naturalistic view is inadequate in many senses, as Schleicher poses that a given language would be a race's natural trait just as the shape of the nose or the colour of hair are. He also predicts erroneously a correlation between physical characters and languages (that is an even

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[5] "We might want to place a laboratory inside the sun to obtain more direct evidence, but being unable to do so, we must test and confirm our theory indirectly. One might argue that the evidence is inconclusive or that the theory is objectionable on some physical (or, conceivably, methodological) grounds. But it is senseless to ask for some other kind of justification for attributing physical reality to the constructions of the theory, apart from consideration of their adequacy in explaining the evidence and their conformity to the body of natural science as currently understood" (Chomsky 1980: 190).

more radical nativism than Chomsky's). Advancing current discussions on second languages learning/acquisition, Schleicher observes that the difficulties in learning and speaking a foreign language correctly are the consequence of an unnatural process (he compares it to walking on the hands or on all fours, something we can learn to do, but that is not natural to us), and suggests that the fact that a child that belongs to one race can learn another race's language as a native follows from the fact that his/her "brain and speech organs develop differently than they otherwise would have" (Schleicher 1865: 77). Nevertheless, interestingly enough he affirms that differences between languages should be explained as subtle differences in these "language organs".

It is precisely because of Schleicher's naturalistic approach (in spite of the obvious problems that it implies) that his formulation of the analogy is the most similar to the formulation I am going to uphold later as the most relevant and explicative. Schleicher's explicit formulation is the following:

> "The species of a genus are what we call the languages of a family, the races of a species are with us the dialects of a language; the sub-dialects or patois correspond with the varieties of the species, and *that which is characteristic of a person's mode of speaking* corresponds with the individual" (Schleicher, 1863: 32, emphasis added).

As will be shown, the more original and relevant point in this comparison is the level of the individual, as what Schleicher calls "that which is characteristic of a person's mode of speaking" is the most similar concept to the Chomskyan concept of I-language (Chomsky 1986) that could be formulated at that time.

But before we go over recent developments of the analogy, let us conclude this short review of the history of the analogy paying some attention to its culmination in Darwin's work. The maturity of the comparison is not to be found into his most celebrated book, but in *The Descent of Man* (1871). The most quoted text regarding the relation between languages and species comes from this book:

> "The formation of different languages and of distinct species, and the proofs that both have been developed through a gradual process, are curiously the same [revised edition (1874): "curiously parallel"]". (Darwin, *The Descent of Man and Selection in Relation to Sex*, 1871, *apud* Alter 1999: 100).

As pointed out by Alter (1999: 100) Darwin's 1874 revised edition changes "curiously the same" for "curiously parallel". Perhaps Darwin thought Scheleicher had gone too far.

Along the following pages Darwin offers what perhaps represents the most complete compilation of an analogy that, as he have seen, captivated

the most important theorist of evolution and the most representative linguist of the period. It deserves a long quotation (numbers inserted to highlight the different points of analogy):

> We find in distinct languages [1] striking homologies due to community of descent, and [2] analogies due to a similar process of formation. [3] The manner in which certain letters or sounds change when others change is very like correlated growth. [4] We have in both cases the re-duplication of parts, the effects of long-continued use, and so forth. [5] The frequent presence of rudiments, both in languages and in species, is still more remarkable. (...) [6] Languages, like organic beings, can be classed in groups under groups; and they can be classed either naturally according to descent, or [7] artificially by other characters. [8] Dominant languages and dialects spread widely, and lead to the gradual extinction of other tongues. [9] A language, like a species, when once extinct, never, as Sir C. Lyell remarks, reappears. [10] The same language never has two birth-places. [11] Distinct languages may be crossed or blended together. [12] We see variability in every tongue, and new words are continually cropping up; but as there is a limit to the powers of the memory, single words, like whole languages, gradually become extinct. As Max Muller has well remarked: "A struggle for life is constantly going on amongst the words and grammatical forms in each language. The better, the shorter, the easier forms are constantly gaining the upper hand, and they owe their success to their own inherent virtue." To these more important causes of the survival of certain words, mere novelty and fashion may be added; for there is in the mind of man a strong love for slight changes in all things. The survival or preservation of certain favoured words in the struggle for existence is natural selection. [...] [13] From these few and imperfect remarks I conclude that the extremely complex and regular construction of many barbarous languages, is no proof that they owe their origin to a special act of creation." (Darwin, 1871)

Perhaps this compilation is not as coherent as Schleicher's formulation, but it shows that in Darwin's mind the comparison is already more than illustrative analogy. Note that at the end of the 12th point, he says that the preservation of favoured words in the struggle for existence *is* natural selection, not *like* natural selection.

Alter (1999) suggests that Darwin, once he had declared that languages and species were curiously parallel (or the same), saw that each side of the equation served to explain the other: "the analogy gave the impression of internal sufficiency: in whichever direction it pointed, the comparison presupposed Darwinian evolution" (1999: 104). In this sense the quoted passage suggested that naturalistic mechanisms sufficed to produce both linguistic and biological evolution.

And this conclusion will now guide my analysis of the famous comparison.

3. Another curious parallelism

We have just seen how Darwin concluded that the evolution of species and of languages were curiously parallel (or the same). He hardly could have imagined that in the course of time there will be also a curious parallelism between the development of the theories of evolution and the development of the theories of language (and of language change).

It is not inaccurate to say that Darwin's compilation represents the zenith of the comparison and that from that moment it declined, till recently. One important reason for that decline is the change in the conception of language that would come along with the Neogrammarians and with European structuralism (especially the Prague School ideas). I refer mainly to the conception of language as a social institution in the service of communication and to the preference for teleological explanations of linguistic change. I am not sure there is a direct connection, but the revival of teleological tendencies in the explanation of language change coincides in time and in orientation with the emergence in the twenties and thirties in the 20th century of the so-called *Modern Synthesis* (consolidated in the *Origin of Species* centennial in 1959) and that yielded what Eldredge (1995) called *ultra-Darwinism*.

The new synthesis implies in essence a progressive inclination to consider natural selection as the only motive power of natural evolution, which implies putting the emphasis on the idea that every change must be gradual and adaptive. In my opinion, this trend corresponds to functional explanations of linguistic change and also, at least partially, to the more recent tendency to consider languages as complex adaptive systems (Kirby 1999) and to so-called theory of brain-language co-evolution (Deacon 1997).

It is known that from the modern synthesis compilation onward, evolutionary theory has been for decades a matter of controversy between two main models that, in terms as neutral as possible (and simplifying somewhat), we will call *neo-Darwinist* and *anti-neo-Darwinist*. Both models are well known as both have had excellent propagandists: Richard Dawkins for the former and Stephen Jay Gould for the latter. It is important to clarify to those who have not had the luck to read these authors that both are Darwinist models (in front of unscientific creationism) and that, therefore, as every linguist knows, *anti* in *Anti-neo-Darwinism* has not scope on *Darwinist*, but on *neo-Darwinist*. As Javier Sampedro (2002) has masterfully shown, and as Gould (2002) has, not only masterfully but also monumentally, anti-neo-Darwinism does not deny Darwinism, but only parts of it that neo-Darwinists insist on not reviewing, sometimes dogmatically.

The parts of the theory at stake are essentially three matters that have their curious parallelism in contemporary historical linguistics: the problem of the units of selection, the role of adaptation and natural selection, and the gradual character of changes. Let us see how this perhaps not so curious parallelism reflects on theories of linguistic change and on modern versions of our favourite analogy.

4. ¿Analogy or Homology?

Although I have not insisted on it during the short review of the history of the analogy, it is true that the analogy was applied vaguely, in such a way that at times it was languages that were identified with species (and then languages' components -usually words- were the individuals that would compete and that would be subjects of selection) while at times it was languages that were identified with organisms and which would compete for survival. It was vagueness (not to say inconsistency) in the determination of the terms of the comparison that was probably the more evident historical reason for the discrediting of the comparison and for it to be relegated into its former use as an illustrative matter. And this goes on being the problem of many present approximations.

When we state that a theory of evolution should be applicable to both languages and species, as numerous authors have done, we must specify clearly what are the terms of the comparison, or to use a classical terminology, between which entities of the two orders do correlations hold.

Using elegantly convenient terms in this context, López García (2001) has outlined that the analogy between languages and species fails when it is interpreted just as an *analogy* (correspondence in some respects between otherwise unlike things), and not as a *homology* (correspondence or resemblance of things belonging to the same type or series).

Let us take as a point of departure some conclusions from the paper by López García:

> "We may conclude that B-evolution and L-evolution are homologous on structural, evolutionary, and functional reasons at the same time. They share a considerable amount of features and patterns, and the extended challenge of both dynamic processes has proved to be worth enough. *The question now remains whether the similarities that result from such an interdisciplinary approach are merely due to the evolutive formal nature of both processes or a consequence of some deeper structural affinities between them*. I'd like to pay close attention to the fact that, when applying the comparative frame to Dawkins' memes, many of the correlations stated above do fail in this case. For instance, the human groups that originate in a common forebear group never evolve following similar structural

patterns, but according to the environmental conditions each of them was exposed to. This is the reason why Indoeuropean languages look yet rather alike, whereas Indoeuropean nations are very different from each other, as British people in front of Iranian people, or Spanish people in front of Hindi people clearly manifest". (López García 2001, emphasis added)

As can be observed, López García reaches the conclusion that biological and linguistic evolution are not analogous but homologous, and points out that it remains to be solved if the resemblances are merely due to the similar structure of both evolutionary processes (roughly: replication, mutation and isolation) or if otherwise they are the consequence of some deeper structural affinities between languages and species. I think there is a case for this and the reminder of this paper will be devoted to suggest a proposal about it.

But we should first turn our attention for a moment to the end of the quoted paragraph, where López García suggests that Dawkins' model of *memes* does not fit into natural evolution so adequately as linguistic evolution does. He compares the evolution of the cultures of the inheritors of the first Indo-Europeans (which vary from British to Iranians) with the evolution of their languages that today resemble each other (actually, to such an extent that a reasonable reconstruction of the protolanguage has been possible).

It is of consequence to observe now that in order to show that our venerable analogy is really a homology we are going to need something more than the frequent and more or less sophisticated extrapolations from the biological model to social objects, what constitute most proposals on that score, such as those by Greenberg (1992), Steels (1997), Nettle (1999), Croft (2000), or Mufwene (2002), to mention just a few.

The proposal I am going to present has the characteristic of involving a conception of language that could be roughly called Chomskyan or generativist, that is, a stance that takes the naturalistic approach to the study of language seriously. My purpose is to show that it is only from this naturalistic point of view that the correlation has really the explanatory power we expect from a comparison that is more than mere illustration, and that therefore we do not need a model for the projection of the theory of evolution on social objects, as long as neither language nor languages are social objects in the relevant sense.

5. Schleicher *redivivus*

But before that I would like to mark as a relevant initiation of this way the contribution of the Germanist and theoretician of language change Roger Lass (1980, 1990 and 1997). Although this author's purpose is not to pose an explicit theory about the correlations between both processes but to develop a theory of linguistic change free of the logical traps that are characteristic of functionalist explanations, he pleads for a generalized theory of evolution in which species and languages are particular chapters, a generalized theory that would imply "imperfectly replicating systems".

In a few words it could be said that Lass reintroduces the Schleicherian model in which a language is an autonomous entity that evolves independently of speakers and their purposes and propensities. He argues - as opposed to theoreticians of language change such as Antilla (1989) and Keller (1990) - that explanations of language change in terms of "action" on the part of speakers, of "unconscious rationality" or of "cognitive objectives" are theoretically and empirically inadequate.

The logic behind his argumentation is quite simple: most linguistic structural changes (such as a change in word order or in case-system) unfold over long periods of time, most often beyond the lifetime of any individual speaker, therefore such changes cannot be attributed to individuals' intentions or actions. It is important to note that this is inadmissible even although we limit ourselves to say that the individual is unconscious and that he just acts as a trigger of the process (that later will be guided by an "invisible hand"). Keller, which supports an "invisible hand" theory of linguistic change, defines linguistic changes as "phenomena of the third kind", that is, a kind of phenomena that are not natural and that out of things that are really the result of human action, they are not intentional (as artefacts), but are "things which are the result of human action, but not the goal of their intentions" (Keller 1990: 56-57).

But one is not tempted to consider changes in natural organisms "phenomena of the third kind". The formulation of the analogy I am going to propose makes clear that including an *actor* (the speaker) in the explanation of language change not only renders difficult the explanation of the resemblances between the processes we are concerned with, but also compels the analogy towards the most intransigent direction of ultra-Darwinism.

Lass (1997) also observes that some other theoreticians would found the explanation of changes on certain universal tendencies that should affect "unbalanced" or "not optimal" systems yielding more "balanced", closer to optimal, more "natural", "simpler", "less marked" or "easier-to-learn" systems, to use a terminology more or less equivalent in different

approaches. But there is a huge problem if we seek to justify a change by the elimination of an undesirable or harmful redundancy, or by a trend towards more balanced or coherent systems: we should face up to the very fact that some previous change must have produced this "improvable state" and we will probably find languages whose similar (or greater) degree of *complexity* has remained the same for centuries. Let us have a language L1, that has changed, and a language from the same branch, L2, that has not changed (as it usually happens). If L1's state was unsteady or improvable we should explain why L2 has not corrected following these same tendencies. We cannot say that the outcome reached by L1 is "good" or "better" without meaning that the present state of L2 is "bad", "worse" or "undesirable".

But in addition, as we will see later in detail, the idea that linguistic change is adaptive (either with regard to communicative situation or with regard to processing requirements or acquisition devices) has an additional problem that cannot be solved calling on the frequent (and handy) "competing motivations", as is the problem that it implies an incongruent notion of languages (as E-languages).

Anyway, the basic line of Lass' argumentation against directed, intentional or adaptive changes is that, even if we were to admit that some linguistic innovation is functionally motivated, it is a well-known fact that the propagation of such innovation does not happens simultaneously, but through social channels. As Lass remarks, "unless a motivation is arbitrary, its implementation ought not to subject to contingent factors like age, sex, prestige, etc." (1997: 364).

One of the most striking points of this discussion is that it is reproducing, in up-to-date terms, the same model Darwin had introduced, with the help of Scheliecher, into his famous analogy between languages and species: linguistic changes, like genetic mutations, are blind, they do not point towards a functional or adaptive aim, nor follow laws of evolution guided by an "invisible hand".

Once we have got rid of the teleological prejudice in linguistic changes (a battle not over yet, one that is still raging) we can see that the blind and random model of classic Darwinism applies to language change, as Schleicher claimed, without the need to change a word.

What remains to be done, of course, is to explain or predict this behavioural parallelism and to derive a theory that is coherent with the two orders.

6. A proposal from Biolinguistics

Let us begin with a conclusion that follows from the recent discussion about the nature of linguistic change, a conclusion which Lass (1997: 366) also insists on: if language change has no cognitive or functional motivation, it does not really matter what the state of a language is, as every possible state of a language is "adequate" by definition, otherwise it would not exist[6].

This hypothesis is fully compatible with a conception of language such as that inspired by Chomsky, according to which part of what makes it possible for us to acquire, know and use a language is precisely *the faculty of language*, that imposes certain (historically constant and universal) properties on natural languages[7].

These properties, that we conventionally call Universal Grammar (UG henceforth), are themselves a property of our kind and they restrict the limits of "dispersion" of linguistic change and, therefore, the range of structural diversity of languages[8].

It is a well-known fact that the object of study of Generative Grammar is not language as a social institution or as a historical phenomenon, but the internal representation of that language in any speaker's mind, that is, in Chomsky's (1986) terms, an *I-language* (where *I* stands for *internal*), a natural object in so far as it is a state or a property of a person's mind/brain. In this sense, a person's I-language is what Anderson and Lightfoot (2002) call that person's *language organ*, what makes especially adequate their interpretation of Linguistics as a kind of *cognitive physiology*, what represents a more specific version of Jenkins' (2000) notion of *Biolinguistics*.

But this language organ, besides being a natural object, is also an historical object. The language organ of a person who speaks English is different from the language organ of a person who speaks Spanish: both

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[6] This hypothesis, which Hurford (2002: 51) calls "uniformitarian" may be questionable if we were referring to the evolution of (the faculty of) language in our species, but not, on rational arguments, when we consider linguistic changes, the evolution of languages over historical time.

[7] "I will assume here an approach to the study of language that takes the object of inquiry to be an internal property of persons, a subcomponent of (mostly) the brain that is dedicated specifically to language: the human 'faculty of Language' to adapt a traditional term to a new context" (Chomsky 2004: 104).

[8] The aim of this paper is not to address what the nature is of the principles that make up UG. Henceforth I will consider irrelevant whether those principles are language specific, purely grammatical or whether they are a part of the systems for language production and/or processing in real time. UG, for our purposes, can be defined as a set of (necessary, perhaps not sufficient) requirements that a human brain includes and/or develops in order to acquire and use any natural language.

organs share a fundamental code we call Universal Grammar, but they differ because of contingent events we can explain only historically. Migrations, divergent changes, borrowings and isolation produced two different natural objects (in fact, millions of them: as many as there are speakers of both languages). But it is worth stating at this point that the very fact that the I-languages of an English speaker and of a Spanish speaker are historically different should not make us think that they are purely historical objects, in the same way that a horse and a buffalo are historically different objects, but they are not purely historical objects, but also natural objects.

Of course, historical languages (such as what we call English or Spanish, that is, something about we can say that it is spoken in London and in Atlanta, or in Madrid and in Buenos Aires) are not natural objects in the same way. They are historical objects, but in this case they are also social objects, that is, one of the senses of the expression *E-Language* in Chomsky's terms (where *E* stands for *external*, as E-language is the external manifestation of I-language as utterances, texts, sets of sentences or social conventions). This definition of E-language will be immaterial to my formulation of the analogy.

Then, to sum up, we have three essential notions for *Historical Biolinguistics* (the field where the comparison has really sense): Universal Grammar, I-language and E-language. I-language is each person's language organ, that is, a natural object whose phenotype depends on the genotype and on development. As far as we are concerned, the genotype of an I-language is Universal Grammar (that will acquire different configurations according to environmental linguistic data). E-language, then, simply consists of a population of I-languages that allow their possessors to communicate each other[9].

What I would like to propound, then, is that the explicative correlation between natural and linguistic evolution is one that identifies both orders according to the tentative table in (1):

(1)   Natural evolution   Linguistic evolution
        Organism   *I-language*
        Species   *E-language*

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[9] Of course, there are other possible definitions of E-language, but the relevant one to this contribution is just this: the grouping or population of I-languages. It is especially relevant to exclude form our definition of E-language notions such as "the outcome of the use of the I-language", "a set of utterances" or anything that counts as behaviour. This is a crucial difference between the present proposal and some recent approaches such as that of Kirby (1999: 38) and others, who tend to identify I-language with genotype and E-language with phenotype.

As shown in (1) the equivalent to the organisms, to the individuals (animals or plants) that make up a species are not, as in usual analogies, the *components of a language* (such as phonemes, morphemes, words or constructions), but precisely I-languages, persons' language organs, that is, what Schleicher had felt as "that which is characteristic of a person's mode of speaking".

A linguistic species (that is, an E-language) will be formed then by a *set* of language organs, that is, by a set of natural objects historically modified, just as natural organisms themselves[10].

It is very important not to make the mistake of identifying I-languages (i.e., language organs) with entire persons, that is, with speakers, as Croft (2000) does in his proposal (to be reviewed further). The individuals that make up a linguistic species are not, then, speakers, but their I-languages, their language organs. So, the individuals that form linguistic species, like those that form natural species, have no kind of adaptive inclinations or evolutionary tendencies.

A linguistic species, like a natural species, is a population, a grouping of individuals similar enough as to allow viable interbreeding (in the case of species) or mutual intelligibility (in the case of languages).

This way, that fruitful point of the comparison, that identifies, on the one hand, the capacity to mate as a criterion for the delimitation of a species and, on the other, intelligibility as a criterion for the delimitation of a language gains more sense. And in both cases it is a blurred (and in some sense arbitrary) boundary (let us think of horses and donkeys or of Galician and Portuguese). In the case of species the capacity to interbreed with fertile offspring depends on a very pronounced genetic similarity between two individuals; in the case of languages, a fluid and mutual intelligibility rests upon a very pronounced grammatical similarity between two language organs.

It can be seen then that the proposal displayed in (1) embraces the achievements of the "high part" of the traditional analogy, the part that identified species with languages, but bearing in mind that we are using a strictly extensional definition of E-language (population of I-languages), and not a "traditional" notion of E-language as a set of utterances or as an external object, which are the notions that underlie other proposals, especially those based on the identification of languages with complex adaptive systems (Deacon 1997, Kirby 1999, Briscoe 2002). Such

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[10] Mufwene (2001) offers a similar interpretation of the notion of "linguistic species", and so does Lightfoot: "Languages, rather, are conglomerations of the output of various grammars, all represented in the mind/brain of individual speakers. They are not coherent entities themselves and, in that case, there is no reason to believe that languages are entities which 'descend' from one another" (2003: 100), something that can also be said about natural species.

proposals are questionable not only because they use such a fuzzy and weak notion of language, but also because they suggest as the analogue of natural species a kind of species (a language) that does not have clearly defined individuals.

But let us note that (1) does not reflect the "low part" of the traditional Darwinian analogy. The components of a language (roughly words, morphemes, phonemes, constructions) are not, then, the equivalent to the individuals that form a species, because the individuals that form a species, according to my proposal, are I-languages.

Thus, we could question what are the correlates to the components of a language. As a first approach it could be said that the components of a language would be the equivalent to *genes*. In fact, some authors including McMahon (1994), Croft (2000) and Mufwuene (2002) either suggest or openly propose it.

However, I think this correlation is as mistaken as the correlation that identified words with individuals in the past. In the present approach we are going to treat the components of a language as the analogues to genes in natural evolution, but in a very different sense of the notion of *component of a language*. To begin with, I am not referring to the components of an E-language, as the components of an E-language are the I-languages of the speakers in a given linguistic community.

Neither am I going to consider words, morphemes, phonemes, structures or constructions as the components of an I-language (in any case they should be the equivalent to the organs that form an organism). What I am going to consider as the components of an I-language are those principles that regulate the development of an I-language and that also express the structural differences amongst languages[11].

Of course, it is not easy to make this explicit, what proves that with regard to many areas Linguistics is much less developed than Biology.

The genes of an I-language could be conceived of as configurations of (phonetic, morphologic, syntactic or semantic) features that produce different "instantiations" of Universal Grammar. In this sense, broadly speaking, we can say that, for example, the realisation of morphological case is a "component" of language A and that it is not a "component" of language B, even though we know that all this is much more complex. In the sense we are interested in, and again simplifying, a "gene" of a given I-language would be, for example, the attachment of agreement features to the verbal root, what will lead to the movement of verbs out of the VP in

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[11] Henceforth I assume (simplifying somewhat) that two languages are different if they have different "parametric options", that is, if they have a different typological characterisation from a morpho-syntactic and/or phonologic point of view, although the issue is obviously much more complex.

this language, whereas a variation in that "gene" (or set of "genes") may cause that in another I-language verbs do not move in overt syntax.

Another more explicit way of conceiving this crucial part of the analogy implies the use of the notion of *cue* as used in the model of language acquisition proposed by Lightfoot (1999). As this author remarks, the idea is that children scan their linguistic environment for abstract cues about which properties their I-language will have:

> "Children scan their environment for abstract cues. Contingent changes in the distribution of those cues may trigger a grammar which generates significantly different sentences and structures. Change is not random, but it is unpredictable, a function of contingent changes in the distribution of cues" (Lightfoot 1999: 259).

In this sense the cues Lightfoot mentions are a more refined version of traditional parameters[12]. As Lightfoot observes, we are not free to postulate a vast number of cues because we do not want to have so many cues as there are superficial differences among languages. The basic idea is that a limited number of cues will provide a broad quantity of different grammars (all of them compatible with the principles of UG) according to how they combine among them.

This kind of approach to the correspondence makes the parallelism with a genetic mutation very clear: as it is also reflected in Lightfoot's quoted text, a contingent change in the distribution or the appearance of cues may imply the construction of a different I-language, and the change is not strictly random, but it is unpredictable insofar as it is a function of contingent changes in the cues, that is, in the genes, just as in natural evolution[13].

Let us call those aspects responsible for the structural differences among languages, comparable to genes, *parametric bundles of features* or, for shortness, *parametric features*. The basic idea is the same: children acquiring a language scan their environment for cues that allow them to fix

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[12] "On this view, UG specifies not only a set of parameters, but for each parameter a cue. I amend this view slightly and say that cues which are realized only in certain grammars constitute the parameters, the points of variation between grammars. A cue is some kind of structure, an element of grammar, which is derived from the input. The cues are to be found in the mental representations which result from hearing, understanding, and 'parsing' utterances" (Lightfoot 1999: 149).

[13] See Matthews (2003) for a misunderstanding of the difference between the change in I-language and the change in E-language. The mistake (common to all theories that handle a "traditional", external definition of E-language) lies in considering that there are changes that happen in the E-language and that then, somehow, reflect on I-language. But this equals saying that there would be changes in species that do not happen in individuals, something that the model reflected in (1) does not allow, as desired.

those parametric features allowed by UG or, simplifying even more, a given combination of the features included in UG.

Actually, as has been observed by many authors (e.g. Pinker 1994), a genetic mutation is the natural equivalent to a structural reanalysis, to a change in meaning or simply to the adoption of a new term or a new grammatical construction. As in natural evolution, a genetic mutation may be immaterial from an evolutionary point of view or, depending on external circumstances, it may be crucial. Thus, a lexical change may scarcely affect a language's general physiognomy, whereas a phonetic change may bring about a vertiginous transformation that gives rise to a new I-language.

In our analogy, a child's I-language will usually have some mutations and would be slightly different from her parents' one, but it will belong to the same species, whereas in some occasions we will have a distinct I-language (belonging to another species, although of course, very similar phylo-genetically).

We have seen that some relevant theories of language change invoke the notion of imperfectly replicating systems. In our analogy a person's language organ replicates itself when it is used to produce the input that will forge others' language organs. Thus, a variation such as a different pronunciation of a diphthong may become extinct along with who invented it or it may spread quickly to a group, as described in Labov's celebrated study about Martha's Vineyard (1963), and under very Darwinian conditions of insularity, give rise to a new dialect in a few years. Most important of all is that just like happens in natural evolution, the reason for the occurrence of a mutation is independent from the reason for the spreading of this mutation.

But for the "homology" to be complete something is missing. It is a well-known fact that all life on Earth is based on DNA. Which is the equivalent to DNA in historical Biolinguistics?

Javier Sampedro (2002) has remarked the role of DNA quite vividly:

> "All living beings are based on DNA [...]. All living beings use the same genetic code in spite of the fact that there are thousands of millions of possible genetic codes that would work as well [...]. The fact that the reader can feed on sugar is due to the same reason -the same in all its extremely complex details- as the fact that the most humble bacterium can feed on the same sugar. It is possible to imagine many different ways of storing genetic information and of translating it into useful things and of feeding on sugar, but it is the case that the dozens of thousands of millions of species on Earth do it just in the same way. It would be a great coincidence if all of us, bacteria, cherry trees and human beings would not have a common origin" (Sampedro 2002: 23, my translation JLMG).

It is not difficult to guess that the correlate to DNA I would like to propose is precisely Universal Grammar. If we permit ourselves an

amusement and modify the previous quoting exchanging references to DNA for references to UG, and references to bacteria, readers and other living beings for references to Russian, Chinese and other languages, the consequential text would seem extracted form Chomsky himself! (Altered fragments emphasised):

> "All *human languages* are based on *UG* (...). All *human languages* use the same *grammatical* code in spite of the fact that there are thousands of millions of possible *grammatical* codes that would work as well (...). The fact that the *European* reader can *acquire her language* is due to the same reason -the same in all its extremely complex details- than the fact that the most *remote Chinese* can *acquire her language*. It is possible to imagine many different ways of storing *linguistic* information and of translating it into useful things and of *acquiring a language*, but it is the case that the dozens of *hundreds* of *languages* on Earth *have the same structure*. It would be a great coincidence if all *of them*, *Russian*, *Chinese* and *Swahili* would not have a common *source*"[14].

The complete table of the proposed "homology" is presented in (2):

(2)   Natural evolution   Linguistic evolution
        Organism   *I-language*
        Species   *E-language*
        Genes   *"Parametric features"*
        DNA   *UG*

It could be said that if DNA offers some possibilities and a style of codification based on its biochemical properties –that could have been different (or not, that is quite another matter), in the same way, UG offers a range of possibilities –that perhaps could have been different (or not, something we are not going to discuss either).

Thus, depending on how genes are organized into DNA we obtain an organism or another, and, in the same way, according to how "parametric features" are organized into UG we obtain an I-language or another. DNA does not express in a single point the total design of an organism (for example, a dog), but each group of genes expresses the specific and relative design of the diverse organs that form a dog. In the same way, UG does not

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[14] I have substituted the word *origin* for *source* in order to avoid the reading according to which linguistic universals could be explained as a homology, that is, as the result of a common heredity from a protolanguage, as the hypothesis of the monogenesis of present languages sustains. See Pinker (1994) for a line of argument against the idea that the existence of universals should be seen as a proof of the monogenetic hypothesis. Pinker shows that a common heredity cannot be used to explain universals, although the monogenetic hypothesis might be right.

codify a language choosing this or that parameter, but there are "genes" that determine how the phonologic system of vowels (Spanish vs. Catalan) will be, whether there will be head-marking or not (Mohawk vs. English) or whether there will be overt movement of verbs or not (Spanish vs. English).

7. Advantages of the (historical) biolinguistic point of view

Once we have formulated explicitly the form of the "homology" from a "biolinguistic" point of view, it could be argued that the achievements of linguistic research that are coherent with the model reflected in (2) could have far-reaching implications for the elaboration of a generalized theory of evolution.

Actually, Croft's theory (2000), apparently similar to the theory just put forward, settles the correlations of the analogy in a different way and, in my opinion, it falls into two common mistakes: it uses an inadequate model of evolution (Dawkins' one, in essence) and it uses an inadequate conception of language (in which language is a purely historical and external phenomenon).

Of course, there is a common intuition beneath the two proposals, a certain superficial similarity, and the same conviction: that there is a "homology" and not just an "analogy". In the following comparative table (3) I have adopted Croft's neutral terms of that supposed generalized or medium-neutral theory of evolution:

(3) A comparison between two proposals

Generalized theory of evolution	Natural evolution	Linguistic evolution (Croft)	Linguistic evolution (Mendívil)
Replicator	*Gene*	*Lingueme*	*Parametric feature*
Structured Set of Replicators	*DNA*	*Utterance*	*Universal Grammar*
Interactor	*Organism*	*Speaker*	*I-language*
-	*Species*	*-*	*E-language*

Curiously, the comparative table proposed by Croft (2000: 38) in which he compares natural evolution with linguistic evolution does not include either the notion of species or the notion of language. But perhaps this should not sound strange, as he defines language as "the population of utterances in a speech community" (Croft 2000: 26), what can be considered incoherent with his notion of organism (the speaker), and as he is going to support a conception of evolution in which the species (and even the individual) is immaterial.

As shown also in (3), Croft stipulates that the correlate of the gene is the *lingueme*, a term he introduces in analogy with Dawkins' *meme*. At first

sight, the intuition is the same that has inspired my proposal in (2): a lingueme is a component of a language. In fact, Croft defines it as follows:

> "[linguemes] are embodied linguistic structures, anything from a phoneme to a morpheme to a word to a syntactic construction and also their conventional semantic/discourse-functional (information-structural) values" / "a unit of linguistic structure, as embodied in particular utterances, that can be inherited in replication" (Croft 2000: 28, 239).

But although superficially both proposals may seem very similar, they are deeply distinct. Such as it is defined, Croft's lingueme is not really a component of a language, but a component of an utterance, something external to the speaker and to her knowledge of language. And it is because of that that he considers the utterance as the equivalent to DNA. His definition of utterance is the following:

> "An utterance is a particular, actual occurrence of the product of human behavior in communicative interaction (i.e. a string of sounds), as it is pronounced, grammatically structured, and semantically and pragmatically interpreted in its context" / "an actually occurring piece of language, completely specified at all levels of structure, including its full contextual meaning on the particular occasion of use. (Croft 2000: 26, 244).

With these elements, Croft's analogy works as follows: speakers communicate emitting utterances (interchanging DNA) and some speakers sometimes replicate those utterances with slightly variations, departing from conventions. When these variations spread to other speakers, we are in front of a language change.

But the analogy, very interesting as a metaphor, has serious problems if it has to support (or at least reflect) a generalized theory of evolution. As we have seen, the role of "the linguistic genome" in the proposal put forward here has an analogous function to that of true DNA (that is, to regulate the structure and development of the "organism"), but this is not so in Croft's model. In Croft's model speakers interchange DNA sequences (that allows Croft wittily to identify sexual reproduction with communicative interchanges), but then "DNA" cannot regulate or shape the development of individuals or organisms (recall that in his proposal the individuals are the speakers, including their knowledge of language).

But the main difficulty that this proposal (as well as others, less explicit but that also assume an "external" notion of language as the analogue to species and natural organisms) must confront is that utterances would be the only and true notion of language, the speaker being just a simple receptacle of it. As reflected in the following text, Croft's formulation implies an inconsistent theory of language acquisition (as

repetition) and of knowledge of language (as a mere ability to replicate utterances in the adequate context):

> "The grammar -the speaker's knowledge about the language- is acquired through hearing other utterances embodying these linguistic structures. Knowledge of language is essentially the ability to replicate linguemes in the appropriate social-communicative contexts" (Croft 2000: 29).

If we were to consider Croft's proposal as a metaphor, I think it is fairly adequate. But this beautiful metaphor has a flaw: it implies a somehow outdated (and in my opinion incorrect) conception of language and, above all, it predicts a theory of change that must confront the same difficulties that the neo-Darwinist model of evolution must confront. Contrary to Croft's proposal, the present one supports the anti-neo-Darwinist model, and does it with regard to all three already mentioned matters in dispute: (i) the levels of selection, (ii) the role of natural selection, and (iii) gradualness.

Let us pay attention to them one by one:

7.1. Levels of selection

It is known that one of the most entangled discussions in evolutionary theory has to do with the problem of what are the units of selection. The model I have presented for language makes it possible to consider both the organism (I-language) and the species (E-language) as objects of selection or, to use Hull's (1988) more fashionable terminology, that both I-language and E-language are *interactors* at different levels, whereas the role of *replicators*, the equivalent to genes, would be played by the "parametric features" responsible of the structural diversity of languages together with UG.

In this sense I think it would hardly be an exaggeration to say that historical biolinguistics (as I understand it) gives more theoretical support to the anti-neo-Darwinist view than to the neo-Darwinist one. The latter has not only centred on the organism but also (in Dawkins' version) has turned it into a mere vehicle for genes. And this is what Croft's analogy does because of the inadequacy of its correlations.

Gould (2002: 614) observes that "the misidentification of replicators as causal agents of selection - the foundation of the gene-centered approach - rests upon a logical error best characterized as a confusion of bookkeeping with causality", a confusion that leads Croft to the same fallacy of *selfish genes*. In his model, linguemes are the entities that persist in time and end up by blurring the organism they make up. In Croft's model, linguemes are copied from language to language directly, whereas

in my approach, the "bundles of parametric features", although are obviously the replicators, are not simply copied, but imply a restructuring of the I-language, that is, a variation in the genome of the new organism, with effects in the phenotype that go from the immaterial to a radical structural change[15].

As Croft explicitly remarks, his theory implies a conception of language that would make language more similar to plants than to animals:

> "A language is a loosely coordinated set of linguemes that is relatively simple compared with a truly finely balanced and complex system. Likewise, a speaker's knowledge about her language is not as finely balanced and complex a mental structure as some contemporary grammatical theories make it out to be" (Croft 2000: 230-231).

As can be seen, an accumulative notion of I-language is implied, a notion according to which a grammar would be a mere processor and the language itself a more or less organised set of idioms that spring from language to language. In this sense Croft's notion of language reminds us of Dawkins's (1976) notion of organism: "a survival machine for its genes". According to this, a language would be nothing else but a survival machine for its linguemes. But linguemes are not the expressive elements that manifest themselves through those clumsy robots that languages would be at the end. A human language, as a machine for expression and thought, has properties that cannot be found in its elements or constructions, in the same way that organisms and even species have emergent properties not governed by genes or reducible to them.

According to Hull (by the way, an author very much quoted by Croft) a unit of selection must interact directly with the environment as a coherent whole with the result of differential replication. And, as Gould remarks (2002: 620), genes do not interact directly with the environment: it is organisms that live, die, compete and reproduce and, as a result, genes move differentially to the next generation. An I-language, as a person's individual and specific attribute, is an object of selection, but its isolated typological characteristics are not.

Gould pronounces clearly:

> "Thus, since genes interact with the environment only indirectly through selection upon organisms, and since selection on organisms operates largely upon emergent characters, genes cannot be units of selection when they function in their customary manner as faithful and differential replicators in the process of ordinary natural selection among organisms" (Gould 2002: 620).

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[15] Using Gould's (2002: 1134) descriptive metaphor, Croft's linguemes would be *Pharaonic bricks*, whereas our "parametric features" would be *Corinthian columns*.

The hierarchical theory of selection upheld by Gould and other authors for the natural world (and that includes demes, organisms, species and clades) is coherent with the correlations proposed here, as this kind of theory can accommodate much better the diverse selective units that this model permits: from the individual organism (I-language) to increasing groups of I-languages (styles, dialects, varieties, etc.), all of them susceptible of being the object of selection, as contemporary Historical Linguistics and Sociolinguistics have shown.

As Gould observes, species selection is probably the only type of selection that plays a role in the macro-evolutionary level, and that follows clearly from the proposal put forth here: a change in the organism (in an I-language) cannot produce the extinction of a language (at most it could produce a partition), but as has been remarked by Dixon (1997), the main cause of language extinction (in the sense of E-language) is, except for rare exceptions (as in the case of the sudden death or the extermination of all of their speakers), the competition with other languages.

Furthermore, Croft's model predicts an isotropic norm for linguistic change that does not appear. If each lingueme is independent and forms part of a relatively loose system (a "Pharaonic brick"), then we cannot explain chain shifts or some process of change that (usually) imply remarkable readjustments, such as, for example, the development of case markers. It is a fact that a language can acquire a system of case markers (for example by borrowing from a neighbour language), but this does not contradict the analogy I have established between DNA and UG or between genes and parametric options. As Dixon observes, it is often the case that when a language develops a case system it does so not gradually, but in a decisive manner: "There will be no cases at all and then - within perhaps a couple of generations - a system of half-a-dozen or so cases, rather than one, then two, then three, ..." (Dixon 1997: 55),

But as we will consider further with greater detail, this is very relevant, because it is not really implied that some "genes" have been added to this language's genome, something that would adulterate the comparison, but that the cues some generations of speakers have used to develop their language included stimuli that activated certain parts of UG that specify an I-language with case markers. In that case we could say then that the "genes" that have constructed the I-languages of these new generations of speakers are different from those that had constructed the I-languages of the former generation of speakers.

7.2. Natural Selection

The second point of conflict has to do with the prominence of natural selection. In the neo-Darwinist model the only possible explanation for evolutionary changes is the natural selection of slightly phenotypic variations, whereas in the anti-neo-Darwinist model natural selection has no such privilege, as far as evolution is also governed by certain "laws of form". One of Darwin's gravest difficulties, as he himself recognized, was that his model predicted a gradual transition among organisms, something that neither existing beings nor the fossil record seemed to support.

Gould, who devotes a detailed section of his *opus magnum* to this matter, states the problem clearly:

> "In what ways does the skewed and partial occupancy of the attainable morphospace of adaptive design record the operation of internal constraints (both negative limitations and positive channels), and not only the simple failure of unlimited number of unconstrained lineages to reach all possible position in the allotted time?" (Gould 2002: 1053).

This author argues decidedly in support of the former option, basing himself, among other arguments, on the interpretation of a revealing discovery of modern genetics: "deep homology", the fact that major phyla, separated by more than 600 million years of independent evolutionary history, today share substantial channels of development based on levels of genetic retention (for example of the so-called Hox genes) that "proponents of the Modern Synthesis had specifically declared inconceivable, given the presumed power of natural selection to modify any independent line in its own uniquely adaptive direction" (Gould, 2002: 1056).

Sampedro has highlighted the great relevance Hox genes have for evolutionary biology:

> "The whole dazzling animal diversity on this planet, from carpet mites to ministers of culture (...) are nothing but small adjustments in a detailed plan of design that evolution invented just once, about 600 million years ago". (Sampedro 2002: 98, my translation JLM)

This implies then that the task of natural selection has been really a labour of detail, of fine-tuning, so to speak, and that constrictions, historical in this case, are enormously relevant.

The amazing fact that the same regulator Hox gene is responsible for the construction both of the head of a fly and of the head of a human being is comparable to the surprise caused by Chomsky's hypothesis that all human languages have essentially the same structure and that the exuberant diversity they display is really rather superficial.

Of course, in addition to historical constrictions based on "deep homology", there could be physical constrictions, according to D'Arcy Thompson's model (1917), in which physical laws would impose a biomechanically optimal form to plastic organic material. This model would have a modern version in the work of Stuart Kauffman (1993) and his concept of "order for free", that is, in Gould's terms, "good design automatically generated by nature's laws, with no need for laborious constructions by a particular biological process by natural selection" (Gould 2002: 1054).

Chomsky has suggested on several occasions that the very evolution of UG in our species could be the outcome of this route and Uriagereka (1998) has dealt with that matter in more detail. But as far as language change is concerned, those formal or historical constraints that could have conditioned the emergence of the language faculty in our species are not, at least in principle, directly involved[16].

Anyhow, it may be asserted that linguistic change is in itself a typically constrained kind of evolution. It is constrained both by contingent historical factors and by purely formal aspects. Actually, as Lightfoot has suggested, the set of laws which determine the structure of organisms could be considered "the evolutionist's analogue to UG" (Lightfoot 1999: 267).

In such a case, it could be objected that the proposal settled in (2) identifies UG with DNA, and not with languages' "laws of form". But, in reality, this is just the role of UG in relation to I-languages. Perhaps considering DNA as the homological basis of every form of life is uninteresting or trivial in Biology, but in our context it is not so: that is precisely the matter, as UG can be seen as a purely formal and unhistorical constraint that restricts decisively the designed organisms (I-languages) and the paths they can or they cannot take in their odyssey in time. Or to put it crudely: it is possible that, as the effect of a phonetic change, a language's verbal morphology turn out destroyed, but this would not eliminate verbs. In this sense, UG is the equivalent to DNA, but not as a chemical code, but as a sequence of genes that have instructions for the design of an organism.

And in this crucial sense we can take our proposal even further and (in a non-original move) identify the ontogenetic development of animals with language acquisition. In both cases an organism (an animal or an I-language) is configured starting from some specific "instructions", with certain rates of growth and some possible epigenetic effects.

It is not strange that very different organisms have common patterns of design and a certain embryonic resemblance. And it is a fact that the

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[16] However, the limit between the evolution of language and the evolution of languages is nowadays becoming blurred in some approaches, as for example in the tradition described in Hurford (2002).

stages in language acquisition are relatively similar regardless of the structure or properties of the language acquired.

A fly that has lost the Hox gene that "makes" its head can "be cured" with a human gene, and what the fly obtains is not a human head, but a fly head, because these genes do not "know" how to do useful things, but only to order it spatially along an axis. With regard to languages, if we compare them momentarily with bilateral animals (that is, all but those with radial symmetry, like jellyfish), it could be said that UG principles are the equivalent to Hox genes, in the sense that these principles impose on all languages a uniform (although phenotypically diverse) structure. If we assume, for example, that Chomsky's Extended Projection Principle (EPP) is really universal, we should not expect it to be satisfied the same way in all languages. The "Hox gene" says that this principle must be satisfied, as says that a bilateral animal must have a head on the front part of the longitudinal axis, not in the middle or at the end of it. But there are many other genes - these ones deeply modified indeed by natural selection (i.e. by linguistic change) - that differentiate the head of a fly from the head of a minister, or the way the EPP is satisfied in one language or another.

In this sense, UG would work in languages as a constraint on fundamental principles of design, in this case as a kind of "deep homology" that in the historical perspective has the status of a formal restrictive principle.

The debated process known as "abrupt creolisation" (as discussed in Bickerton 1998) will be useful to illustrate this point and to get around some difficulties. Although simplifying somewhat, the process of abrupt creolisation can be seen as a process of naturalisation of an early-state pidgin, that is, a jargon with little if any grammatical structure. In these cases, as Bickerton observes, "children are required to build a language out of input materials that contain no complex structures and in which grammatical morphemes, in particular, are reduced well below the minimum required by natural languages" (1998: 49). But the I-languages created by children (in the space of a single generation), creole languages, are fully and perfectly normal human languages, comparable to any "historical" language. The crucial fact now is that the work of new language creation can be attributed largely to children (of course, with the help of linguistic stimuli).

We know that without external stimuli UG does not construct a normal I-language[17], but we also know that unusually degenerated evidence is enough for an I-language to be consistent. As shows DeGraff in his thorough synthesis, "it is adults [...] who would [...] introduce

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[17] Let us bear in mind the famous case of Genie, a girl deprived of normal linguistic interaction since childhood and who developed a deficient language (see Curtiss 1977).

overwhelming variation and instability into the linguistic ecology [...], giving rise at some point to inconsistent and somewhat reduced pidgins [...] But it is children who - with their specific cognitive makeup, unimpeded access to UG and its markedness hierarchies, and/or cue-seeking dispositions - would force the pidgins' underlying tendencies (as influenced by the various languages in contact) to crystallize into stable, fully UG-consistent creoles" (DeGraff 1999: 526-527).

In this sense the process of mutation and replication is obviously different to that of natural evolution. In the process of the acquisition of a language, be it a creole or any other language, the mind constructs an I-language guided by fixed information from UG, that would determine its essential architecture, but guided also by information supplied by the cues discovered in the environment. In this way, the "genes" of UG will work as regulatory genes of the Hox type which determine where is the head to be located, but not how this head should be, whereas those genes that would give a specific form to that head will be provided, so to speak, by the cue-seeking devices, that may be part of UG, if we take up again its interpretation as a "Language Acquisition Device" (LAD)[18].

It seems then that, in contrast to real embryology, the components of mind that construct an I-language use information from the environment (although we should not forget the relevance of epigenetic processes for organic development). Anyway, the LAD uses this information in a selective manner rather than in an instructive one. Besides, it is proper to point out that this divergence (this limit in our comparison) is expected, as far as the duplication of a linguistic organism (an I-language) is not a purely biological process, but a double process: there is a true genetic transmission (what makes that as human beings we are able to acquire any human language) and there is a cultural transmission (that specifies what particular language we are going to acquire). Or, to put it in Kirby and Christiansen terms, "whereas frogs store their communication system in their genome, much of the details of human communication are stored in the environment" (2003: 272). In this very sense, the complete "genome" of an I-language is *distributed*: part of it is in the specific and fixed instructions of UG and part of it is in those "design cues" obtained by UG form the environment.

But we could even find a further interesting parallelism. Let us bear in mind so-called "Baldwin effect", a phenomenon Biologists call *genetic assimilation* and that seems to reconcile Lamarckian theory of inheritance

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[18] This is one of the virtues of Lightfoot's model. He explicitly states that UG is the only algorithm we need, that is, that it includes the cues: "Gibson and Wexler's TLA and Clark's genetic algorithms are learning algorithms quite distinct from the grammars assumed. However, the cue-based approach suggests that there is no relevant learning algorithm beyond the information provided specifically by UG" (Lightfoot 1999: 174).

of acquired characteristics with Darwinism[19]. Calvin and Bickerton (2000) or Briscoe (2003) have proposed that Baldwinian evolution is relevant for the explanation of (at least part of) the evolution of language in the species, insofar as this effect happens when an acquired ability (or, better, an ability to learn something easily) becomes innately determined and part of the hereditary legacy of a species[20].

If we review former formulations of the analogy between languages and species we will find that a common flaw is precisely the assumption that linguistic evolution, contrary to natural evolution, allows the inheritance of acquired traits[21]. This is a remora of the inadequate identification of genes with the "elements of a language" or linguemes.

In our case the analogue to *Baldwin effect* has to do with cue selection. During the process of mental construction of an I-language, the LAD incorporates structural options captured in the environment by "cue-detectors". But the environment reflects the behaviour of the producer of the input. If this behaviour varies (for instance as a consequence of a new fashion of using passive constructions more profusely or of aspirating some sounds), the new speaker incorporates it into her "distributed genome". Consequently, in our context, we have a (non-Lamarckian) genetic assimilation.

7.3. Gradualness

The third main point of disagreement in the arena of modern Darwinism concerns gradualness and it is directly related to the former two. Darwin himself pointed out it first in his often quoted chapter on difficulties of the theory of the *Origin of Species*:

> "Why, if species have descended from other species by insensibly fine gradations, do we not everywhere see innumerable transitional forms? Why is not all nature in confusion instead of the species being, as we see them, well defined?" (Darwin 1859)

He have already seen that Darwin used philological analogues in order to justify his explanation basing himself on the imperfection of the

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[19] Baldwin observed that changes in behaviour could change selection pressures, but of course, genetic assimilation does not support the inheritance of acquired characteristics, but the "apparent" inheritance of such traits through a strictly neo-Darwinian process.

[20] A context that may be compatible with the "morphological infection" suggested by Piattelli-Palmarini and Uriagereka (2004).

[21] Recall Croft's proposal or consider Mufwene's more explicit one: "I also submit that linguistic species are more like parasitic than like animal species, and they are more of the Lamarckian than of the Darwinian kind" (Mufwene 2002: 46, ft. 3).

geological record and, also, on the current view (then and now) of linguistic change as a gradual process.

Nevertheless, modern historical linguistics, facing up to not little opposition, has concluded quite successfully that structural linguistic change is not gradual, regardless that certain phonetic and semantic changes may be so. And this is true on both macroevolutive and microevolutive levels.

With regard to the macroevolutive level, that is, the level of linguistic species (or E-languages) I would like to point out Dixon's (1997) model as a relevant advance. He has obtained notable results applying the model of punctuated equilibrium (first formulated by Eldredge and Gould 1972) to the evolution of languages.

Dixon shows convincingly that the application of the family tree model of Indo-European historical linguistics to all known linguistic families is inadequate as far as it cannot explain the linguistic situation in many parts of the world and makes erroneous predictions. The key to the problem is that the classic family tree model implies a constant and steady speciation. The punctuated equilibrium model adapted by Dixon to the evolution and split of languages states that during a period of equilibrium languages do not split or proliferate, but that, on the contrary, tend to be stable in their areas for a long time and, in any case, to converge on a common prototype because of the diffusion of linguistic features.

From time to time the states of equilibrium are punctuated. The punctuation may be due to natural events (volcanic eruptions, floods, etc.), to the emergence of a dominant political or religious group, to migrations, invasions, or to technical innovations like the invention of new weapons, agriculture or the development of writing. According to Dixon's model, during these short periods of punctuation (short by comparison with periods of equilibrium) new languages will develop at a steady rate in a process of "split and expansion", and many others will become extinct. Only as the period of punctuation comes to an end, it can be appropriately modelled by a family tree diagram. As Gould (2002) has shown extensively, this pattern reflects clearly what happens in natural evolution.

In fact, Nichols (1998) holds that the faculty of language may have arisen in a group of speakers large enough to present a high degree of linguistic diversity from the beginning, what would represent a similar scenario to what evolutionists call the *Cambrian Explosion*, a (geologically) short period of time between about 570 and 530 million years ago in which most of the major *Baupläne* of animal design first appeared in the fossil record. One might reasonably suppose that if the lineages of almost all animals living today appeared as a burst 530 million years ago, the evolutionary rise of the language faculty could have witnessed the rise of the diverse linguistic *phyla* that today still refuse to be

uncontroversially grouped. Anyway, the fact that the field of historical linguistics lacks fossils (documents) for the period between about 150.000 and 8.000 years ago, as well as the asymmetric pattern of stasis-change, may have obscured the scene definitively.

As far as the microevolutive level (i.e. linguistic change) is concerned, Lightfoot (1999) has shown that an approach to the study of linguistic change using a "biological" notion of language (that is, conceiving a language as an I-language) can prove that the change in mental grammars is not continuous or gradual, but abrupt (or to be exact, catastrophic). On the contrary, if we work with an external notion of language and pay only attention to written records form successive epochs, we will conclude that linguistic change is gradual.

In fact, this consideration of gradualness will allow us to reflect more properly the theoretical advantage of equating the organism with the I-language and not, as Croft does, with the speaker. This is so because the identification of the organism with the speaker poses a problem that might go unnoticed: we could not account for the relevant phenomenon of the coexistence of two (or more) I-languages into a single mind[22]. But such coexistence is crucial on many occasions to explain linguistic changes. It would be an instance, to use Lightfoot's expression, of "competing grammars", that is, a direct analogue to the old and relevant Darwinian struggle for life. Whether competition takes place between two persons or inside a single one's mind is immaterial (in fact, only the second case is really possible, as only into a single mind can two i-languages interact).

Let us consider a schematised example based on Lightfoot (1999: 93-94). Suppose, as shown in (4), that we have (i) texts from language L1 in which basic word order is Object-Verb (VO), (ii) more recent texts, from language L2, in which there appear sentences with both (OV, VO) orders, and (iii) even more recent texts, from language L3, which show only VO order.

(4)   Epoch 1: L1 ⇒   Word Order: OV
        Epoch 2: L2 ⇒   Word Order: OV, VO
        Epoch 3: L3 ⇒   Word Order: VO

Basing ourselves on this evidence we could say that there has been a change of word order from L1 to L3 and that it has been gradual, through L2. But this is not the only option, and it is problematic, whether we could not explain what kind of data have produced L2 grammar out of UG (with contradictory evidence) or we should postulate that L2 grammar has some kind of optional rule. But as Chomsky (1995) suggests we should discard

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[22] And see Yang (2004) for a "variational" interpretation of child language as an alternative to pre-Darwinian "typological thinking".

optional principles (among other reasons because they pose serious problems for models of acquisition).

The hypothesis of an *internalized diglossia* (again in Lightfoot's terms) offers a more adequate view of the process. As it is shown in (5), L1 speakers have grammar G1 that specifies OV order, L2 speakers have two grammars coexisting in their minds, G1 that specifies OV order and G3 that specifies VO order (or more probably, only certain L2 speakers would have access to both grammars in an internalized diglossia), and, finally, L3 speakers would have access only to G3.

(5)   L1 Speakers   = G1 → Word Order: OV

                            ⌈ = G1 → Word Order: OV
       L2 Speakers   {
                            ⌊ = G3 → Word Order: VO
       L3 Speakers   = G3 → Word Order: VO

Thus, we find *three* types of speakers, but only *two* grammars without any gradual and inconsistent transition between them. And this is just what we find in nature.

Darwin used the apparent perfection of the linguistic record to justify gradualism in nature alleging the supposed imperfection of the fossil record. But what we observe in fact is that the linguistic record seems to be continuous but hides a discontinuity similar to the discontinuity the fossil record accurately reflects.

8. Complex adaptive systems and co-evolution

The neo-Darwinist claim that the methodology of evolutionary theory is applicable whenever any dynamic system exhibits random variation, selection among variants and differential inheritance (see Dennet 1995) is probably adequate and clearly applicable to languages, but, as we have seen, it does not follow from this that there is only one manner of conceiving the methodology of evolutionary theory or only one manner of conceiving languages as dynamic systems with random variation and differential heredity.

Thus, in the relevant tradition inaugurated by Hurford (1989)[23], when investigators conceive a language as a dynamic system, in fact they are

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[23] See the works in Briscoe, ed. (2002) for an updated view. Hurford (2002) refers to this tradition as *expression/induction models of language evolution*, that is, "E/I" models, a term that Hurford (2002: 303) admits is deliberately reminiscent of the Chomskyan E-language/I-language distinction, but using a wrong interpretation of the notion of E-language (that is, as if E-language would have really linguistic structure).

using the notion of E-language (understood as a phenomenon of the third kind), whereas I-language is a mere reflection of E-language in speakers' minds that they limit themselves to transmit with variation. The analogy formulated in this recent tradition is adequate as far as linguistic structural change happens mainly through processes of "iterated learning". The main flaw of this general approach is that again the object of study is placed *out of* the speakers. Again E-language is identified with species, but there is not any clear equivalent to the natural organism, the individual that makes up a species. And this takes us to a paradoxical view in which the entity that really exists is the species, whereas the individuals who constitute it, or are enigmatic *manifestations* of the same species, or are dimly identified with *agents*, or are identified with the components (constructions) of the language. The main problem, of course, is that it is assumed that E-language has linguistic (syntactic, morphological, phonological) structure, but this is clearly false. It is I-language (a speaker's language organ) that has linguistic structure, not the poorly defined and incoherent object referred to as E-language.

Actually, in order to consider languages as complex adaptive systems (in addition to as phenomena of the "third kind"), as it is done in this tradition, it is necessary to stipulate that there is a (natural) selection among variants (in this case in relation to acquisition/processing requirements), but then we find again the traditional analogy in which the components of E-languages (the variants) are the individuals or organisms, the only novelty of this tradition being then the (profuse) use of computer simulations.

A conclusion shared by the authors in this tradition is that languages evolve adapting to the human learning procedure (Briscoe 2002: 10), an intricate way of conceiving the matter and that again reveals that they are using an external (and incorrect) notion of language (as E-language, be it an external social object or a set of utterances somehow produced) but not a true population of I-languages.

This is clear in Deacon's theory, which explicitly places the source of linguistic complexity, of linguistic structure, not inside the brain/mind, but outside it, that is, in a necessarily external (third-kind) notion of language:

> "the extra support for language learning is vested neither in the brain of the child nor in the brains of parents or teachers, but outside brains, in language itself." (Deacon 1997: 105)

Although some results of these studies are really interesting (and probably correct, something not to be discussed here), it is not easy to understand why, if human learning procedures do not vary, should languages evolve historically across generations to adapt to those

requirements, or why have not all languages converged to a single superficial form. The frequent reference to "competing motivations" or to different "adaptive landscapes" that would make languages *complex* adaptive systems again recalls the frequent Panglossian solutions in traditional functional explanations of language change, and has the same logical problems.

For instance, some conclusions reached in this context of explanation of linguistic change in terms of evolutionary theory may have to face up to similar problems to those we have seen that neo-Darwinists must cope with in the light of modern genetics:

> "In the framework advocated here, we can recognize that such historical pathways can be stereotypical responses to similar pressures arising in unrelated languages, *in much the same way that eyes and wings have evolved independently in different lineages many times*, without the need to posit a substantive theory of such changes or to see them as deterministic" (Briscoe 2002: 13, emphasis added)

Briscoe himself admits that this way of reasoning fits well with Deacon's (1997) theory of co-evolution. Deacon proposes that languages evolve to adapt to children's general learning systems[24]. According to this approach linguistic universals would not follow from a supposed UG, but would be the outcome of the parallel evolution of diverse languages in their adaptation to acquisition mechanisms:

> "Grammatical universals exist, but I want to suggest that their existence does not imply that they are prefigured in the brain like frozen evolutionary accidents [...] they have emerged spontaneously and independently in each evolving language, in response to universal biases in the selection processes affecting language transmission. *They are convergent features of language evolution in the same way that the dorsal fins of sharks, ichthyosaurs, and dolphins are independent convergent adaptations of aquatic species*" (Deacon 1997: 115-116, emphasis added).

Although it is not an argument in itself, perhaps it is not irrelevant to return to the role of regulator genes in natural evolution. As Sampedro shows (2002: 119 ff.), Gehring's group demonstrated in 1994 that the gene *PAX-6* (*eyeless* in Drosophila) is just the same regulator gene that controls the dozens or hundreds of genes that form the eyes both in arthropods and human beings. It is evident again that although evolution and selection have modified many of these genes to produce eyes as incredibly different

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[24] "Human children appear preadapted to guess the rules of syntax correctly, precisely because languages evolve so as to embody in their syntax the most frequently guessed patterns. The brain has co-evolved with respect to language, but languages have done the most of the adapting" (Deacon 1997: 122).

as a crustacean complex eye and a human eye, it is really a question of a "deep homology", with a role similar then to UG, that determines (at least) some of the universal properties we find in languages.

In a curiously non-trivial way, the same can be said in general terms about the rest of appendices mentioned in the preceding quotations: together with eyes (which have been protagonists since Paley's time), wings, legs and fins have been used traditionally as examples of evolutionary analogy, of convergent evolution, as clear exponents of how the environment shapes the adaptation of organisms, but all of them have been demonstrated to have been, so to speak, invented - in its deep logic - just once in nature:

> "The legs (and other appendices) of all bilateral animals are constructed following a complex design system that already existed in Urbilateria [the first postulated bilateral animal] and that all bilateral animals have used without exception, and that natural selection has not altered fundamentally during the 600 millions of years that have passed since its emergence" (Sampedro 2002: 128, my translation JLM).

Perhaps similar historical paths or linguistic universals themselves are the consequence of convergent but independent adaptive patterns, but the lessons taught to us by modern evolutionary biology do not seem to advise us to relinquish the idea of an (historically) invariable UG as the unavoidable source of such patterns.

9. Conclusion

It is quite possible that the proposed "homology" between the evolution of languages and the evolution of species is nothing but one more metaphor, that is, mere alternative analogy, more useful to captivate the reader's attention than to advance in scientific knowledge.

But I wish I have convinced the reader that even in such a case it is a more adequate analogy than the usual ones. In order to do it I have made clear that the coherent confluence of (i) a given conception of language (as a natural object), (ii) a given conception of linguistic change (as an undirected and unpredictable catastrophic process) and (iii) a given conception of evolutionary theory (the anti-neo-Darwinist one) strengthens all three conceptions as opposite to contrary (and essentially erroneous) conceptions of language, linguistic change and evolution. And I think that this is in fact an argument on behalf of a generalised theory of evolution further than curious parallelisms.

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