

# Minimizing the genes for grammar. The minimalist program as a biological framework for the study of language

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## Abstract

This paper examines the main ideas of the Minimalist Program (MP) with the aim of evaluating its virtues as a biological framework for the understanding of human language. Our conclusions are basically three. First, the MP favors a certain reconciliation between the abstract characterization of language and characterizations derived from other biological concerns. Second, the MP reduces the role of the genetic endowment for language and relies more on epigenetic processes, in clear agreement with other aspects of the study of the brain. Third, the MP favors an essential identification of the processes of ontogenetic and phylogenetic development of language, a rather controversial conclusion but also a very important one from a theoretical point of view.

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## 1. Introduction

Chomsky has declared many times that linguistics should be thought of as a branch of biology (see, for instance, Chomsky, 1975: 123, 1986: 27; and, more recently, 2000: 90). This observation is not to be understood as a sort of strategy directed to an a priori delimitation of the scope of the investigation, an obviously

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counter-effective constraint for it, or in order to somehow dignify the theoretical approach to human language, since dignity must be the prize for the results attained and not for the travel companions. Chomsky's contention in declarations like those referred to above are of a very different sort. On the one hand, he is trying to express the radical shift in the interests of many linguists during the last decades from the traditional, cultural, social or public aspects of language to the individual faculty that underlies the production and interpretation of the verbal signals ordinarily exchanged among the members of the same linguistic community. The object under investigation is thus conceived as an aspect of human psychology that can be reasonably attributed to both functional and anatomical specificity and be considered, literally and not metaphorically, as an 'organ', which "grows in the mind" of children (see Chomsky, 1993: 29) as other organs or organic systems of the human body do during a certain critical period. On the other hand, Chomsky is also calling the attention of practitioners of the disciplines traditionally framed within biology, offering strong arguments that invite them to think about a sort of 'biological necessity' ruling many aspects of the human capacity for language. The speed, efficiency and spontaneity with which children acquire a language under normal circumstances, as well as their capacity to overcome deficient stimulatory conditions, while developing a strongly internalized and richly articulate capacity, are all reasons to believe that crucial aspects of the faculty of language are a part of our biological inheritance and that they obey a genetically established plan. The labor of linguists may therefore serve to confirm, to widen and even to question the results of the overall investigation on the human species. It is actually a clear contention of Chomsky that given the evident community of interests there is no use in uncritically accepting academic distinctions usually established and perpetuated for reason of administration.

This determination to attract the attention of biologists has given place to the support of the main thesis of Chomsky by some distinguished scientists. Jacob, for instance, accepts that the essential uniformity observed among the different languages of the world points to the conclusion that they share a common grammar imposed by inherited aspects of the human brain (see Jacob, 1970: 338, 343). Jacques Monod claims that the human capacity for language is to be understood as a result of the 'epigenetic' development of the brain (see Section 4 below), somehow dependent on instructions fixed within the genome of the species (see Monod, 1970: 171–174). Maynard Smith and Szathmáry, in the end, accept Chomsky's proposal of a universal grammar with a strong innate component as a premise for their idea that the fixation of this feature within the genome is to be considered as the last milestone or transition of evolution, understanding as such those natural innovations that have been able to somehow hasten evolution by introducing a new system of storage and transmission of information (see Maynard Smith and Szathmáry, 1999: Ch. 13).

The immunologist Niels Jerne is also among the biologists more inclined to accept and exploit Chomsky's ideas on language. But he has also expressed his opinion on the matter of the scientific status of linguistics and, which is very interesting for us, has expressed with a conditional sentence his attitude towards considering the discipline as a branch of biology:

Biologically speaking, this hypothesis of an inheritable capability to learn any language means that it must somehow be encoded in the DNA of our chromosomes. *Should this hypothesis one day be verified, then linguistics would become a branch of biology*, (Jerne, 1985: 1059).

It has been a matter of much discussion whether the capability of relating features and functions identified as abstract entities by linguists (such as grammatical categories or phrase structure rules) with physiological correlates (such as brain tissue areas resulting from the proteins coded for by specific genes) is the threshold through which linguistic theory needs to pass in order to be considered as a discipline within a naturalist paradigm of investigation. Besides Chomsky, Lyle Jenkins is probably the author who has insisted more that the answer to this question is a negative one. According to his recurrent illustration, opting for the positive answer would imply denaturalizing Mendel's contributions to genetics, taking into account that his inherited factors were established prior to the discovery of their material basis (see Jenkins, 1979; Chomsky, 1995b). Perhaps Jerne's condition is to be read simply as a proposal for the kind of discovery that would definitely resolve the question and make unnecessary any further debate. Understood as such, the observation does not seem to prejudge that the contributions of generative linguistics are of no relevance for biology (Jerne's own work is actually a proof on the contrary) and they do not deserve the status of biological postulates. However, the sentence serves to make us understand the interest and the positioning that automatically motivates among linguists any new finding related with the genetic basis of language.

The recent publication of the discovery of FOXP2 (Lai et al., 2001), a gene whose mutation provokes Specific Language Impairment (SLI), has not been an exception to this interest. The mutant variant of this gene has been found in individuals that show an heterogeneous set of verbal disturbances: relative slowness in the process of acquisition apart from any perturbing factor (as deafness, autism or a low IQ), (reversible) orofacial problems, and (persistent) difficulties with the productive rules of word formation, the morphosyntactic requisites of feature agreement and the construction of complex phonological units. The high concentration of these individuals in family groups, the pattern of distribution within these families (50% of individuals affected, with no distinction between males and females), and the relative uniformity in the manifestations of the syndrome, are all factors that point to the conclusion that we are facing a problem due to a unique autosomic and dominant gene (see Gopnik et al., 1997; Pinker, 1994: Ch. 10; van der Lely and Stollwerck, 1996; for more information about SLI see van der Lely, 1996). This prediction has been born out by the finding of the mutant version of FOXP2 within chromosome 7.

This finding can be considered as good news for the defenders of the biolinguistic approach to language, using Jenkins' (2000) label. It seems to strengthen the belief that language is biologically specified by one or more genetic factors, which in turn seems to fulfill Jerne's conditional respecting the integration of linguistics within biology. However, it is also a finding somewhat upsetting for linguists, because the aspects of language whose development seem to be under the control of FOXP2 constitute, as we have noted, a heterogeneous class with no clear correspondence

with any single level of analysis or domain of rule application ever proposed by theoretical linguistics. We thus face a situation in which, on the one hand, recent discoveries in the field of genetics seem to support the biological approach to human language but, on the other hand, the results independently reached by linguistics and biology do not seem to fit each other.

Perhaps Cowie (1999) is correct when she points to one of the deficiencies of modern nativism as not having a clear idea about what makes a certain feature an aspect of a genetically codified plan. Perhaps this is also the reason why findings like FOXP2 are more confusing than encouraging for linguists. We believe, and this is one of the main proposals of this paper, that the Minimalist Program (MP) is an optimal framework for the clarification of all these questions. A biological interpretation of the MP points to the conclusion that a minimum of specifically linguistic genetic codification can suffice for the development of a robust, complex and richly articulate faculty of language. The key factor for this is the interaction of such a minimum of linguistic codification within the genetic program with other aspects of our inherited cognitive capacities, as well as with certain independently needed laws (of necessity and complexity). The result is that we should not expect that the development of the language faculty is meticulously driven from the genetic program, which does not invalidate the idea that we are confronting an inherited feature of the species. On the one hand, these ideas can also be understood as a justification for the mismatches between the grammatical properties of language directly conditioned by the genes and, on the other hand, the grammatical properties finally observed in the full fledged and steady versions of the faculty. Each of them is the result of a natural and (in its essential aspects) internal process of the organism, a thesis that has remained unchanged throughout the evolution of generative grammar.

In this paper we face all these questions and their implications both for the ontogeny and phylogeny of language. Actually we are going to defend the claim that the MP offers a framework in which both sides of the development of language can be essentially equated (against the influential point of view articulated in Pinker and Bloom 1990). This is the subject matter of Sections 4 and 5 of this paper. In Section 2 we try to clarify the conceptual grounds of minimalism and in Section 3 we explain that they represent an important economy in the demands of the faculty of language on the genetic program.

## **2. Minimizing grammatical competence**

The relationship between the faculty of language (FL) and the other specialized modules of human cognition has without any doubt been the main theme of generative linguistics from the beginning of the nineties. Such questions as the explanation of the grammatical judgements and intuitions of the speakers and even the development of the verbal capacities by children have receded to a secondary position. This does not mean that they are considered of no interest or that they do not attract the curiosity of linguists any more. It just means that the MP contends that the answers to those questions must be perfectly framed within the fundamental issue of the position and

connections of FL in the overall organization of the mind. According to the model developed by Chomsky (see Chomsky, 1995a, 2000, 2001a, b], FL is adjacent, on the one hand, to a module in charge of the perceptive and motor control of language exteriorization (Sensorimotor Systems; henceforth, SMS) and, on the other hand, to a module in charge of the formulation of thoughts and the elaboration of practical reasoning (in the spirit of Fodor, 1975), whose exteriorization is perhaps the central task for language (Systems of Thought; henceforth, ST). FL is thus, according to the model, a mediation mechanism between those modules, which Chomsky refers to together as the ‘performance systems’.<sup>1</sup>

As to its own organization, FL consists of two main components: on the one hand, a Lexicon (Lex), a collection of items, each one a minimal ‘sound–meaning’ association; on the other hand, a Computational System (CS), a recursive procedure that takes items from the Lexicon and transforms them into complex expressions (words, phrases and sentences). It must be understood that the expressions so created are abstract or internal, i.e., fixed in a mental code not accessible “from outside”. They are however ‘legible’ by the performance systems, supposedly in a selective fashion: some features of the expressions are legible by SMS and some others by ST. The possible residue of purely or specifically grammatical features are considered as ‘imperfections’. It is an aim of the MP to demonstrate that they have reserved some special tasks that the CS could not carry out without such resources. All these assumptions are the expression of the confidence of the MP in that FL is not only an ‘optimal’ solution to the demands of SMS and ST, but also an ‘inexpensive’ one: i.e., a solution that does not complicate the overall architecture of the mind in that it makes no use (or a use reduced to a minimum) of elements of design radically different from those of the performance systems.

We are now in a position to understand that the minimalist approach to natural language represents an important ‘lightening’ of specifically grammatical features on FL. Let us consider a lexical item such as Spanish ‘-aba’, that is found in words like ‘cantaba’ (“I/she/he sang”) or ‘caminaba’ (“I/she/he walked”). This item consists, on the one hand, of a phonemic representation (/ába/) that (in a somehow simplified way) works as a motor instruction for SMS. SMS impose on representations like this certain crucial properties, such as being made of units from a universal and limited inventory corresponding to possible gestures of the speech organs, or as the

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<sup>1</sup> The research conducted over the last years in the field of Sign Languages gives additional support to this view of FL as a “bridging” faculty. What these languages help us to understand is that FL does not foresee the type of exteriorization system of which it is going to make use (see, for instance, Petitto, 1997). FL will simply lexicalize and compute motor instructions from whatever happens to be the channel of exteriorization (oral–auditive, as a default option, or gestural–visual). What seems to be specific to FL, therefore, are the techniques of lexicalization and computation and not the format of the performance systems that it serves to bridge. Another source of empirical support for this view is the study of mental syndromes with dissociation of competencies. In some of these syndromes, FL seems to be spared in the context of severe intellectual deficiencies (as is the case with Williams Syndrome patients). In other cases, the complementary pattern arises: subjects show important difficulties with linguistic tasks while having normal intellectual capacities (as is the case of most cases of SLI). For a general view of the matter see Curtiss (1994), Jenkins (2000: Chs. 2 and 4), Smith (1999: 211–254) and Smith and Tsimpli (1995).



- b.           a    Juan lo           vi           muy desanimado  
               prep Juan ac.3p.masc saw-1p very downhearted

The second of these sentences shows a configuration that serves to express that the prepositional complement ‘a Juan’ has been promoted (in informational terms) as the “theme” of the sentence. But in order for this to happen, an item ‘lo’, whose content is only made of [–Interpretable] features, needs to be inserted preceding the verbal head. The conclusion is that the configurations attained by the operations of the CS are conceptually motivated (i.e., [+Interpretable] and not intrinsic properties of FL), while some of the elements involved in running these operations are not. It is a contention of the MP that these elements represent a minimum of the feature composition of any expression.

Up to this point we have reviewed only one of the strategies of the MP in order to reduce the linguistic component of the human mind. The other strategy explored by the MP with an identical aim consists of resorting to principles of simplicity based on the idea of conceptual necessity instead of to specifically dedicated grammatical mechanisms. Chomsky contends, for instance, that phrase structure can be fully derived without appealing to a particular grammatical module by the effect (see Chomsky, 1995c). In his opinion, every phrase is made by the linking of two pieces (i.e., the minimum required to speak of linking), resulting in a projection whose label is the same as that of the piece triggering the operation (to which is logically to suppose that the other is subordinated). More complex combinatory modalities (such as the linking of three or four pieces or modalities that result in the projection of something like the union or intersection of the pieces), while perfectly regulable by mechanisms established by the effect, do not seem to correspond with the ways natural languages use to construct phrases. This points to the conclusion that a phrase that contradicts any of the properties alluded to (binary linking and asymmetric projection) does not contradict any grammatical constraint, but the penchant of FL for simple solutions, i.e., those based on the optimization of the resources at hand and without the introduction of new elements of design. Again, these kind of solutions can not be seen as properties particular to FL (see Freidin and Vergnaud, 2001, for some interesting comments on this matter).

### 3. Minimizing the genetic program for language

This important diminution of what we must consider strictly or specifically grammatical (essential properties of FL) is founded on a crucial assumption by the MP about the nature of mind: the MP relies on the idea of a fundamental subordination of language to the performance systems. The defenders of the MP understand (against a strong philosophical tradition; see, for instance, Davidson, 1984) that thought and practical reasoning are not essentially “made of” language. It just happens that linguistic computations are capable of handling symbols whose source is not FL proper, but the performance systems. We can not delve here into this very important and interesting issue. We will dedicate the rest of this paper to explaining

the consequences of all this for the theories of language acquisition and the origins of language.

A very important consequence of the ideas explained in Section 2 is that neither the [+Interpretable] features and configurations nor the principles of simplicity and conceptual necessity need to be considered as acquired or fixed as a part of the development of FL. This much from an ontogenetic point of view. From the phylogenetic point of view, the conclusion is that none of those elements have evolved in the course of the evolutionary processes that implanted in the genome a program for the development of language. What else remains as possibly subject to genetic instructions directed to the development of FL? Well, first of all, the basic scheme of grammar organization based on the distinction between Lex and CS. The fact that all languages know the distinction and that they operate with it in the elaboration of expressions, looks like a very reasonable candidate for being the result of genetic programming.

From a lexical point of view, the inventory of [–Interpretable] features associated with lexical items is also a candidate for this programming. It is reasonable to think about it as a universal inventory, whose members are equally accessible to any language. An aspect of what happens to us when we acquire a language is that a subset of this inventory (the subset corresponding to that of the language spoken in the environment) is selected. This process, in which the environment plays a crucial role, can be thought of as an instance of what is known as “learning by forgetting” (see Mehler and Dupoux, 1990: Ch. V). Lex gets conformed when the [–Interpretable] features so selected become encapsulated within the [+Interpretable] features provided by the performance systems into lexical items.

As for CS, it consists of two basic mechanisms: on the one hand, a procedure for the selection of an array of items from Lex (Select LA); on the other hand, a procedure for the mapping of this array to a complex expression (Map LA to Exp). Another contention of the MP is that CS is unique, one and the same for all languages, and consequently that Lex is the locus of cross-linguistic variation. It is not our concern here to argue in favor of or against this idea, which has an overwhelming approval within the MP (but see Baker, 1996, as a defense of CS as the locus of typological variation). What interests us now is to observe that among the set of operations of CS it is possible to establish a distinction between those operations that can be thought of as specifically grammatical and those that maybe are not. Within the latter subset of operations must be included, in our opinion, the most fundamental of all: Merge. The properties that we explained in Section 2 regarding the minimalist conception of phrase structure are, actually, the properties of Merge. We devoted our comments there to clarifying in what sense these properties are not grammatical ones, but highly general properties of simplicity. Furthermore, it is reasonable to think that the computations of ST (i.e., the elaboration of complex thoughts from basic conceptual units) also make use of the very same operation (as defended by Lorenzo and Longa, 2001: Second Part; Ch. IV).

Dislocation (the operation traditionally referred to as “movement”) is understood in the MP as the articulation of other basic operations. On the one hand, Agree, that is the matching of two identical [–Interpretable] features (or set of features), the first

one located within the element which will undergo dislocation (Goal) and the other one within an element (Probe) signaling the point of destination. Given the fact that [-Interpretable] features play a crucial role in Agree, we must conclude that it is a specifically grammatical operation. On the other hand, Pied-Piping, is an operation that marks the phrase containing the Goal [P(G)] as the piece to be dislocated. Again, this operation can not be considered but as a specifically grammatical one. Finally, Move locates a copy of P(G), taken from LA, in the position signaled by the Probe. Move has already been explained as a non-specifically grammatical operation, contrary to Agree and Pied-Piping.

The review of the previous paragraphs can help us to now reach a conclusion on the exigencies of FL to the genetic program. Let us begin by enumerating the catalogue of elements and operations that can be considered as not directly motivated by the performance systems:

1. A universal inventory of [-Interpretable] features (F);
2. An operation of feature selection from 1 [Select (F)];
3. An operation of feature encapsulation within lexical items [Select (Lex)];
4. The set of computational operations Select LA, Agree and Pied-Piping.

Within this catalogue, a further distinction can be established between 1 and 4, on the one hand, and 2 and 3, on the other hand: the latter can be characterized as aspects of the cognitive maturation of children, while the former are perhaps direct expressions of the genes. This distinction is a very important one because it allows us to understand 1 and 4 as a part of the genetic development of individuals, directly controlled by the genes,<sup>3</sup> and 2 and 3 as a part of their epigenetic development, thus not subject to the direct control of the genes. We turn to this distinction in Section 4.

As a brief conclusion to this section, let us consider again the different linguistic deficiencies associated with SLI in light of the picture of FL developed within the MP. In our opinion, the MP offers a descriptive vocabulary that serves to save the mismatch between problems such as those manifested by the carriers of the mutant version of FOXP2 and the grammatical factors hypothesized by linguists. Remember that people affected with SLI exhibit difficulties with inflectional morphology and that the morphemes expressing [+Interpretable] inflectional values (like tense or aspect) are typically encapsulated within lexical items also containing [-Interpretable] features. Note that these people do not show problems with the interpretation of the conceptual import of temporal and eventive distinctions. So the deficiency can not be attributed to the interpretive side of the operations involving these items (but see Johnston, 1997, for another opinion). Actually, another salient feature of SLI

<sup>3</sup> It could turn out to be true that there are no [-Interpretable] features, either because the distinction [±Interpretable] is conceptually unmotivated (as Brody, 1995, contends) or because [-Interpretable] features happen to be properties of E-Languages (not of I-Languages), whose mission is that of simplifying (from the externalized object) the mental processing of utterances (as Lorenzo and Longa, 2001, defend, very much in the spirit of Smith, 1989: Ch. 17). This possibility would simply have the effect of radicalizing the contentions of the MP, in that the genetic program would also be freed from controlling the development of those features.

patients is the difficulties that they have in establishing agreement relations (see Gopnik et al., 1997: 128, 137; Clahsen and Hansen, 1997), which crucially imply the identification of [–Interpretable] features. We propose to see this as an indication that the MP offers a promising framework in which the abstract study of linguistic competence (sometimes called “representational” or “computational”) can finally be integrated into (and potentially unified with) the study of the biological basis of language, its genetic foundations and its pathological manifestations.

#### 4. The minimalist approach to language development and the notion of ‘epigenesis’

As explained in the previous sections, the MP envisages a conception of the initial state ( $S_0$ ) of FL far less articulate than the one defended by the GB Model, with all its rich articulation of grammatical modules, principles of grammaticality, grammatical levels of representation and grammatical categories of all sorts. Consequently, the genetic plan required in order to implant this  $S_0$  within the mind of an individual is supposed to be less strong or more abbreviated. However, it is very important to keep in mind that both the MP and the GB Model are alternative approaches directed to the theoretical characterization of the same phenomenon: the specifically human capacity for the development and use (for the purposes of thought and communication) of a rich, complex and firmly interiorized linguistic system. This means that the preference of the MP for an  $S_0$  lighter than it was supposed to be by previous versions of generative grammar points to the introduction within the theoretical framework of a specially rich and productive notion of ‘epigenesis’, defined by Douglas Futuyma as “the processes that intervene during the development of an organism (its *ontogeny*) between primary gene action and the phenotypic traits” (Futuyma, 1998: 651).

By ‘epigenesis’ we understand the set of developmental episodes (in our case, of the brain) that, without being directly or explicitly specified in the genes, are however biologically determined by those initial conditions. On the one hand, epigenetic development is the result of the exposure of the initial conditions to the environmental circumstances (see Wilson, 1998: Ch. 9). The process that selects a set of features from the universal inventory provided by  $S_0$  [Select (F)] is epigenetic in this sense, then, in that the resulting set is that one corresponding to the set of features employed by the language spoken in the environment (Chinese, English, Spanish and so on). The aspect of Select (Lex) that consists in establishing particular Saussurean (i.e., arbitrary) connections between phonemic and conceptual features is also epigenetic in this way.

On the other hand, the set of developmental processes due to the confluence and interaction of other more basic processes independently guided by the genes is also epigenetic. When processes of this kind occur, the results can not be said to also be a direct expression of the genes (see Futuyma, 1998: Ch. 23 for an overall view). This latter sense of epigenesis is of the greatest interest for the minimalist explanation of the attainment of the final or steady state of FL ( $S_S$ ), in that it crucially implies the overlapping of the independently developed performance systems and the adoption

(both by Lex and CS) of elements coming from these systems. It is reasonable to understand this as an epigenetic aspect of the development of language, without burdening the genetic program with the duty. It goes without saying that these epigenetic processes are conceived as brute-causal, non-rational and non-intentional.

In all this the MP can be said to reach conclusions convergent with those independently attained in the field of neuroscience, in which it is a generally accepted idea that such a highly complex and convoluted system like a mature human brain can not be the result of processes meticulously guided by genetic instructions. The genetic program is supposed to provide the different types of cells characteristic of the nervous system. The genetic program is thus considered as a possible source of the functional specialization of brain tissues. But this specialization can also be the expression not of the genes themselves, but of relations of vicinity between cell lineages and complex processes of “negotiation” and “in situ accommodation” between them. It is unquestionable that the system of genetically coded instructions acts as the backdrop of the whole process, but it is also clear that as it moves forward the developmental episodes are gradually less dependent on the genetic instructions and more based on the phenotypic conditions already reached (see, for instance, Changeux, 1983; Singer, 1986). This places us at the doors of the explanations based on principles of self-organization typical of complex systems, which certainly seem very adequate to underpin the image of language development that the MP points to.

## 5. The minimalist approach to language development and the sciences of complexity

One of the recurrent themes of Chomsky’s works is the idea of an essential identity among the languages of the world, an idea that he has recently given the name of the ‘uniformity principle’ (Chomsky, 2001a: 2). All languages share, in his opinion, a common CS and their Lexicons are made of features coming from universal inventories. As for his ideas concerning the development of particular languages, Chomsky approaches the process as dependent on three different kinds of factors (Chomsky, 2001b: 1–2):

1. The initial state ( $S_0$ ) of FL, uniform across the species, a contribution of genes and a product of natural evolution;
2. The primary linguistic data fragmentarily and asystematically offered to children by the linguistic community in which they grow up;
3. General properties of organic systems (laws of self-organization).

In tune with his aim of minimizing the inherited component of FL, Chomsky shows himself as a defender of reducing the role of evolution by natural selection in explaining the phylogenetic development of language. In doing so he adheres to an important naturalist tradition (D’Arcy Thompson, Alan Turing, etc.) and to an emergent paradigm of multidisciplinary investigation known as the “sciences of complexity” (see Goodwin, 1994; Kauffman, 1993, 1995). Like the theorists of complexity,

Chomsky thinks that the role of natural selection in the origins and evolution of complex features of living organisms must be thought of as a sort of channel for the designs provided by laws independently capable of bringing about the self-organization of complex systems. This idea fits pretty well with a picture of FL like that provided in the previous sections.

When confronting the origins of a component of the cognitive organization of a species, as is the case of FL, Chomsky considers that the laws in question are principles directed to the attainment of the most efficient computational mechanism given certain initial conditions (in this case, the evolutionary states independently reached by the performance systems). What is peculiar about this approach is that the search and fixation of that mechanism is conceived as a process of spontaneous development, neither directed by the environmental conditions (which is the position of the adaptationist approach explicitly rejected by Chomsky) nor necessary to be coded in the genetic program of the species.

It is very important to note that within this framework of biological explanation the two sides (ontogenetic and phylogenetic) of the development of FL become essentially equated. We now have the idea that the interaction of a minimal  $S_0$  (an aspect of the genetic inheritance of the species) with the (independently developed) performance systems was (phylogenetically) and is (ontogenetically) enough for the attainment of a complex and strong FL (transformed into a particular language under the pressures of the environment). Well, if all this proves to be true we will be in a position to conclude that natural evolution has not had to worry about coding FL in the genome of human beings and that FL has emerged in the species for the very same reasons that it emerges once and again in every individual: i.e., as an effect of the interaction of a minimum linguistic  $S_0$  with two independently evolved performance systems, giving place (via general laws of efficiency) to a powerful cognitive tool (see Longa, 2001, for a monographic treatment of this question).<sup>4</sup>

This position is in overt conflict with the position headed by Steven Pinker, who contends that the processes of phylo and ontogenetic development of human language are of a very different nature and must not be equated in any event (see Pinker, 1994: Ch. 10; 1997; Pinker and Bloom, 1990). As for phylogeny, Pinker defends a strict application of the paradigm offered by natural selection. The evolution of human language was, in his opinion, a long, gradual and meticulous process by which our minds became progressively shaped by the environment. As for ontogeny, however, he understands that individuals can spare the effort that evolution has made for them by implanting a rich and complete program for the development of language in their genes.

Chomsky's ideas on phylogeny seem to be much more congenial with the overall framework of the MP, in that the simplification of the initial state of FL seems actually in accordance with the lightening of the task entrusted to natural selection (and thus to environmental factors) and with a strengthening of epigenetic episodes (internal to the organism) both in the development of the species and of individuals

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<sup>4</sup> We must acknowledge that this position still asks for an explanation, on the phylogenetical side, for the evolutionary development of this minimal  $S_0$ , a question that we leave aside for future research.

(see Piattelli-Palmarini, 1987; Otero, 1990, for two early approaches along these lines). An in depth evaluation of the confronting positions is outside the scope of this paper. Let us conclude only by observing two things about the Chomskyan point of view on the matter. First, that the MP so interpreted as a story of the evolution of language is a conceptually clear and perfectly formulated position, which makes specially unfair (if not completely misled) the accusation of Calvin and Bickerton (2000: 198) in the sense that evolution is a matter that Chomsky has always tried to keep under a veil of mystery. Second, that other things being equal, a single and unitary explanation for the developmental issues (like the one proposed by Chomsky) is preferable to independent explanations (like the two proposed by Pinker). It seems that, on metatheoretical grounds, the burden of proof is on Pinker's side.

## 6. Conclusions

In this paper we have tried to clarify the biological implications of the MP. It is our opinion that the MP is a very adequate framework for achieving a fruitful integration of theoretical linguistics within a paradigm of biological research. The reasons we have offered here are basically three:

1. The conception of the MP regarding the architecture of FL favors a certain reconciliation between the abstract characterization of language and other characterizations derived from other biological concerns, such as the description of inherited impairments such as SLI.

2. The reduction in the role of the genetic endowment for language as well as the reliance on epigenetic processes of development is in clear agreement with the advances in other aspects of the study of the brain (such as vision).

3. The MP offers itself as a tool for the conceptual clarification of a very interesting position on the origins and evolution of language, which lessens the role of environmental factors and relies on general laws of development (a sort of physics of the biology), a position that is attaining very interesting results in many domains.

Therefore, we can only conclude that the MP deserves all our attention as a promising vehicle for the understanding of language as an aspect of the natural world.

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