Beyond Developmental Compatibility
A Note On Generative Linguistics and the Developmentalist Challenge

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RESUMEN

El estudio de la adquisición del lenguaje en la tradición chomskyana ha pasado de un estadio en que el curso de desarrollo del lenguaje en la mente del niño era totalmente ignorado a un estadio en que los teóricos aceptan que sus propuestas deben ser compatibles con los datos del desarrollo, aunque sin necesidad de explicarlos. Este trabajo sugiere que la lingüística generativa ha alcanzado ya el estado de madurez requerido para superar viejas idealizaciones y afrontar la tarea de explicar cómo crecen en la mente de los niños las propiedades nucleares de los sistemas lingüísticos, en lugar de presuponer que éstas se encuentran directamente codificadas en el genoma de la especie. La transición que supone pasar de 'tener en cuenta el desarrollo' a 'tomarse en serio el desarrollo' es un paso necesario para que la lingüística generativa gane crédito como un enfoque biolingüístico.

PALABRAS CLAVE: *desarrollo, adquisición del lenguaje, lingüística generativa, biolingüística, minimalismo*.

ABSTRACT

The study of language acquisition within the Chomskyan tradition has moved from a stage in which the developmental path of languages in the mind of children was ignored to a stage in which theoreticians accept that their proposals must be compatible with developmental facts, yet without really explaining them. This article suggests that generative linguistics has now attained the degree of maturity required to surpass old idealizations and carry out the task of explaining how core properties of languages grow in the mind of infants, instead of presupposing them as directly given in the genetic makeup of the species. This transition from 'taking development into account' to 'taking development seriously' is a necessary step for generative linguistics to gain credibility as a biolinguistic approach.

KEYWORDS: *Development, Language Acquisition, Generative Linguistics, Biolinguistics, Minimalism.*

I. INTRODUCTION

There was a time when some generative linguists saw development as a problem, instead of a constructive element of the process by which children acquire their linguistic competence [Hyams (1986), pp. 168-71]. The logic underlying this idea was that children must possess an important amount of inborn knowledge, as the acquisition of languages defies any attempt to be explained as a normal case of learning [Chomsky (1959)]. So children would manifest an almost instantaneous readiness to speak, were it not for the fact that a set of language associated capabilities — perceptual, articulatory, conceptual, and so on — still need to mature before they can properly do it. Hyams' contention is nicely captured in the following quote, in which she presents development as a source of complications to the tenets of nativist oriented theories of acquisition, the aims of which can be divorced from the aims of theories of development:

> While the theory of grammar (UG) [Universal Grammar; GL] is intended to explain the apparent ease, rapidity and uniformity of acquisition (in the face of impoverish data), the developmental theory must also explain the apparent 'difficulties' which the child encounters and the various 'delays' which characterize the developmental process. In other words, the developmental theory is to explain those factors which make acquisition non-instantaneous [Hyams (1986), p. 168].

This literal interpretation of the idea that knowledge of language is instantaneously given — notwithstanding children's early errors and delays — was not however a consensual one. Other linguists — conspicuously Chomsky [(1975), (1980), (2000)] — accepted that the development of linguistic competence was a real fact, but that it would help to ignore it as a simplifying assumption in constructing a sound theoretical model of language acquisition; not an easy job. The following quote is representative of how Chomsky has traditionally introduced the question:

> One simplifying assumption is that L [a particular language; GL] is literally deducible from a choice of parametric values and lexicon, so acquisition is *as if instantaneous*. That needs not to be the case […]. It therefore becomes interesting to ask how close to true this assumption is [Chomsky (2000), p. 140].

With such a model already in place, the complexities of development could then be introduced and accommodated within the explanatory ambitions of the theory, as different authors have actually done by different means [Borer and Wexler (1987), Yang (2002)]. This paper argues that while these efforts have been crucial in allowing linguistic theory to take development 'into account' they are still insufficient if linguists aim to take development 'seri-

ously' [Robert (2004)]. The good news is that recent advancements in generative linguistics are preparing the ground for undergoing this task — even if somewhat unexpectedly for their proposers.

The article is organized as follows: section II presents the main goals and theoretical premises of generative linguistics as a biolinguistic project, section III explains how this trend has progressively incorporated the fact of development into its objectives, and section IV offers some hints as regards how linguistic development could be properly explained by benefiting from some theoretical innovations recently brought about by the Minimalist Program [Chomsky (1995) and subsequent works]. The conclusion of this paper is that, in doing so, generative linguistics will be ready to take up the developmentalist challenge that modern biology faces today [Griffiths and Knight (1998)].

II. GENERATIVISM AND THE BIOLINGUISTIC PROGRAM

Generative linguistics aims to characterize the Faculty of Language (FL) as a 'species-typical' trait of humans. In doing so, it relies on a basic set of foundational distinctions, which delineate what generativism presently has to offer to a better understanding of language within a naturalistic frame. They are synthesized below around three major themes.

(1) FL must be deconstructed into a core computational apparatus and a collection of associated peripheral systems. The former is in charge of creatively composing 'abstract' expressions, the component parts of which are symbols — sets of sensorimotor instructions associated with conceptual-intentional contents — to be 'interpreted' by the latter. So FL in a 'narrow sense' (FLN) consists of a computational system and a lexicon of abstract units, plus the interface connections to the interpretive components; in a 'broad sense' (FLB), it also includes the sensorimotor and conceptual-intentional systems themselves. Focusing on one or another concept of language (FLN or FLB) is simply a matter of research interests [see Hauser, Chomsky and Fitch (2002)]. This complex cognitive structure can be reasonably seen as directly given by the 'nature of mind' — using Chomsky's classical expression [as, for example, in Chomsky (1967), p. 9], so it may be thought of as subject to normal organic growth — given the Chomskyan 'mind=brain' equation [Chomsky (1980)] — and being uniform across the species in its essential aspects.

(2) FL so envisioned as an organic structure and, consequently, a result of human evolution must be distinguished from the particular linguistic systems known and used by the members of historical speech communities — say Chinese, English, Spanish and so on. These systems have socio-cultural ori-

gins and are subject to processes of rapid historical change, which are responsible for the important range of variability cross-linguistically attested. Generative linguistics is only concerned with these 'external' entities in as much as they become the content of the steady state of knowledge that members of a speech community (pathologies aside) acquire from their elders in childhood, thus transforming them into an 'internal' language [Chomsky (1985)].

(3) 'External' languages — in the sense of the previous point — manifest in transient utterances, the amount and representativeness of which can be extremely variable in different scenarios without affecting the uniformity of the learning path of new speakers. Furthermore, complex grammatical details can be acquired with scarce or even in the absence of relevant samples [Crain (1991)]. And in general, utterances are not transparent with respect to the structural principles of linguistic organization, as the former are arranged in a linear fashion and contain little superficial cues of the latter. So inductive or data-driven processes cannot be at work in the acquisition of at least important portions of the knowledge of 'internal' languages [Chomsky (1959), (1975), (1980)]. This motivates a distinction between a 'universal' — or innate-primed — and a 'language-particular' — or acquired — component within these internal languages. There belong to the former, for example, the structure dependent character of syntactic rules, the distinction between word and phrasal levels of structure, categories like noun or sentence, etc.; there belong to the latter, for instance, the relative prominence of the morphological or the syntactic component (i.e., whether word elaborations predominate over phrasal combinations or the other way around), the possibility of omitting sentential subjects, word order details (objects precede/follow verbs, adverbs precede/follow verbs), etc. [Baker (2001), for an introduction]. It also belongs to the acquired component of internal languages — of course — the particular collection of minimal sound-meaning associations previously referred to as lexicon.

   Adherence to this computational (1), internalist (2) and nativist (3) view on language is what being a generativist basically amounts to. Generativism aims to conduct the study of FL so understood within the framework of a biolinguistic program of investigation [Lenneberg (1967), Jenkins (2000), Boeckx and Grohmann (2007)], which means — among other things — that its adherents are willing to accept the empirical import of these basic contentions and the requirement that they be subject to experimental tests [see Katz (1981), Katz and Postal (1991), and Koster (2007), for some 'inside' answering]. This requirement has already been carried out regarding certain aspects of the model — like in establishing the anatomical site of some parts of the computational machinery of FL [see Marantz, Miyashita and O'Neil (2000)

and Moro (2008), for some results] or the extent to which children's linguistic knowledge exists in advance of external stimulation [Crain and Thornton (1998)]. Other aspects, however, still wait for conceptual clarification before the attempt of conducting clarifying experiments can be seriously accomplished. It is the case, for example, of the question of the human and language specificity of FLN, a hotly debated issue in which positions are not sufficiently well defined [to witness, see Pinker and Jackendoff (2005), Jackendoff and Pinker (2005), Fitch, Hauser and Chomsky (2005), Corballis (2007), and Balari and Lorenzo (2013), among others] and experiments systematically put into question [Fitch and Hauser (2004), Perruchet and Rey (2005), Gentner et al. (2006), Pullum and Rogers (2006)].

Conceptual issues are certainly important ones, not just because they help to clear up what needs to be tested, but because they also serve to introduce previously unnoticed questions into the research agenda. For example, the clarification of the concept of FL along the lines of (1) above — a relatively recent achievement of generative linguistics — has served to put into a new perspective questions regarding the nativist contentions of the model — (3) above. Thus, certain universal properties of languages previously thought of as part of the innate component of the linguistic 'knowledge' of speakers are now understood as reflexes of the computational regime of FLN. It is the case, for instance, of the structure dependent character of the rules of syntax, which one doesn't need to conceptualize anymore as the propositional content of any state of knowledge, once it is recognized that the computational system of FLN is endowed with a power higher than that of a 'finite state automaton' — meaning that it compulsorily computes sequences in a structural rather than a linear fashion [see Balari and Lorenzo (2009), for an overview]. This particular aspect of language, therefore, is something that an individual doesn't need to have knowledge 'about' — or, needless to say, to learn. The effort to derive previously thought pieces of innate knowledge (3) from the architectural organization of FL and the automata-like properties of FLN (1) is now the subject matter of the Minimalist Program [Chomsky (1995), (2005)], a particular branch of the generative enterprise in search of the biologically most realistic image of FL, to which I will return to later on in this paper.

III. TAKING LINGUISTIC DEVELOPMENT INTO ACCOUNT

The previous section gives a hint of the basic conceptual premises and theoretical goals of a biologically oriented approach to language — namely, that of modern generative linguistics [see Givón (2002), for an alternative biolinguistic approach founded on a very different set of premises]. As noted, it shares with other biological enterprises its declared empirical orientation as well as the recognition that its theoretical contentions will reach true empiri-

cal content — rather than just being bold speculations concerning FL — to the extent that they can be experimentally tested and evaluated. Besides, generative linguistics manifests other typical features of theoretical efforts framed within the normal practice of science, like the recourse to certain heuristics that, while routinely used in other fields, have however been the target of strong criticism when employed by generative grammarians, like the 'homogeneous speaking community idealization' [Sampson (2001)] or the 'infinitude claim' [Pullum and Scholz (2010)]. In this section I focus on some of these heuristic procedures and explain how they have contributed to the advance of a particular aspect of the generative enterprise — namely, the resolution of question (3) above. The main aim of this section is to instigate a reflection on the proper treatment of this problem once the relevant heuristics have rendered their practical benefits and start to beg important questions instead, putting the theory at risk of offering a biologically distorted image of FL.

According to Robert's (2004) definition, 'heuristics' are "simplifying strategies to be used in situations of cumbersome investigational complexity" [p. 2], the use of which is "absolutely necessary in biological science" [p. 3]. It is thus not blameworthy that generative linguistics has historically made use of some simplifying assumptions to transform some particularly complex problems into tractable ones. One such problem [known as 'Plato's Problem' from Chomsky (1985)] is how children are capable of attaining a steady state of complex linguistic knowledge — effortlessly, in a relatively short temporal span, and following rather uniform developmental sequences — in spite of the scarcity and opacity of the (sometimes degenerate) stimulus that they receive from adults in learning situations highly variable among individuals [Ritter (2002), for recent discussion]. Plato's Problem is a tough question indeed, which would still remain almost mysterious were it not for the fact that linguists decided to start working it with the help of a simplifying strategy: they gave up the ambition of trying to find a prompt and unitary answer to the different facets of the problem and, instead, they chose to put aside part of its complexity and to concentrate on a particular side of the question. Thus, they forgot — for the time being, so to speak — that language acquisition takes time and follows typical paths, and decided to focus on the question of what makes learning a language apparently so easy for children. This amounts to dealing with language acquisition 'as if' it were an instantaneous process, a heuristic strategy explicitly defended at length in, for example, Chomsky [(1975), pp. 119-22]. Thanks to this idealization, generative linguistics obtained one of its most important theoretical achievements — namely, the Principles and Parameters model [Chomsky (1980), Hyams (1986), Chomsky and Lasnik (1991)]. According to this model, children are endowed with inborn equipment for acquiring languages that consist of a number of universal principles that they know 'a priori', plus certain choices or parameters that are 'fixed' by the stimulus they receive. So, according to this theory, acquir-

ing their first languages is so easy for children because they have almost nothing to do, as most of the job is done either by their genes — which contain the basic design of any linguistic system — or by experience — which fixes the particular type of language that they end up knowing.

Principles and Parameters theory is customarily introduced as the current 'consensus view' on language acquisition among generativists [Hornstein, Nunes and Grohmann (2005)]. It is also a 'consensual' model in that it is fully compatible with the 'modern interactionist consensus' [Robert (2004)], according to which development in any organic realm is a dual function of genes and experience, with the latter just triggering basic designs already contained in the former. It cannot be forgotten, however, that it is a model based on the heuristic premise that development, while a real and interesting phenomenon [Chomsky (1980), p. 201], is not actually captured by the theory. But efforts to accommodate development as part of the *explanandum* of the theory of language acquisition actually do exist and deserve to be commented.

An early attempt to integrate development into the theory of acquisition consisted in the adoption of another biologically consensual idea, that of 'genetic program' [Robert (2004), pp. 48-54], according to which genotypes do not just contain a 'plan' of future phenotypes, but also a set of 'instructions' as to how to construct them. In the case of the development of languages, Borer and Wexler suggested an answer along these lines, contending that such intriguing facts like the very early fixation of the 'null subject' parameter by children acquiring Italian or Spanish or the 'adverb before verbs' parameter by children acquiring French, as compared to the relatively late fixation of the 'obligatory subject' parameter by children learning English, were but the reflex of a genetically codified schedule [Borer and Wexler (1987), Wexler (1990)]. An alternative explanation has been more recently elaborated by Yang [(2002); (2006), for an introductory overview], according to whom asynchronies like those above are to be explained as a function of the stimulus children are exposed to while acquiring a language. Thus, parameters are fixed early when data abound in the linguistic environment of children that unambiguously serve for triggering them; on the contrary, parameters undergo late fixation when unambiguously triggering data is scantier in the environment. In the case of the above examples, the rich morphology of Italian and Spanish verbs — from which information about omitted subjects can easily be recovered, and thus thought to be critical in fixing the parameter — is a prominent and abundant datum in children's experience; on the other hand, expletive subjects in English, as in <u>it rains</u> — a reliable indication that subjects must obligatorily be present even if devoid of reference, and thus thought to be true triggers of the corresponding parameter — are relatively scarce, so children acquiring English pass through a stage in which they freely omit the subjects before fixing the 'obligatory subject' option [see Yang (2002) for some precise quantifications]. The fact that children learning Italian or Spanish rapidly attain

the same high percentage of omission of adult speakers — around 70%, while omission by children acquiring English shows considerably lower percentages — 30%, probably because they are still using more than one competing grammar, is according to Yang conclusive evidence in favor of the idea that linguistic development is mostly a function of the environment, rather than the reflex of a genetic program.

Yang's [(2002)] hypothesis is an interesting and sophisticated one, to which I will return in the next section. For the time being, suffice it to say that both Borer and Wexler's and Yang's theses exhibit two common features, worthy of some attention. First, both represent a step forward in relation to Chomsky's original idealization of 'development as if instantaneous'. In this sense, they try to fulfill the requirement that Yang [(2002), pp. 6-9] refers to as 'developmental compatibility':

> A model of language acquisition is, after all, a model of reality: it must be compatible with what is known about children's language [Yang (2002), p. 6].

And second, both offer answers to this theoretical constraint fully compatible with the interactionist consensus in generative grammar — and biology at large. They share the basic idea that the unfolding of a linguistic system is a matter of genes and environment interactions, while differing in the question of whether the time course of the process is a function of the former (Borer/Wexler Hypothesis) or the latter (Yang Hypothesis).

Regarding this question, it is however important to have in mind that — as clearly explained in Robert [(2004)], among other places — the interactionist consensus also relies on a set of simplifying assumptions, none of which can be taken as ultimate truths in explaining the development of organic designs: firstly, because genes do not contain 'plans' or 'schedules' but in a metaphorical sense — where 'metaphorical' means 'waiting for a better understanding' [see, for example, Oyama (2000)]; and secondly — and more importantly, because genetic sequences and environmental cues do not exhaust the manifold factors that actually intervene in the emergence of phenotypical features [see Griffith and Gray (1994), Oyama et al. (2001), Johnston and Edwards (2002), and Jablonka and Lamb (2005), among other sources].

So, while it is true that generative linguistics has attained a certain degree of maturity as a biolinguistic program by means of the hypotheses commented in this section — relative to the extremely idealized original image of language acquisition 'as if instantaneous', the effort to fully understand the developmental path of internal languages in the mind of children continues to be an open one. Generative linguists have already fulfilled the biological requirement of 'taking development into account'; however, generativism still waits to enter into the further stage of 'taking development seriously' — expressions borrowed from Robert [(2004)].

IV. TAKING LINGUISTIC DEVELOPMENT SERIOUSLY

'Developmental compatibility' [Yang (2002)] implies the incorporation of the time course of learning into the research agenda of the theory of acquisition, thus 'taking development into account' [Robert (2004)]. The requirement, however, does not compromise in any significant sense the theoretical conclusions reached over the last few decades by Principles and Parameters theory, which has simply adopted a more dynamic appearance than in its earliest formulations in order to reply to it: language acquisition is the unfolding of a genetically encoded set of universal principles in due time, orchestrated either by genetic instructions — as in the Borer/Wexler Hypothesis — or crucial environmental cues — as in the Yang Hypothesis. The key idea that principles are known by children in advance of experience and preformed under the guise of genetic information remains untouched within both hypotheses. In other words, principles are exempted from having a true developmental history, as they are given in advance in a linguistic genotype [Chomsky (1980)]. It is important to be aware that this is again a heuristic idealization that the theory should be willing to overcome once it has fulfilled its task. For one thing: no single organic trait escapes from having a developmental history — and there is no reason for exempting cognitive traits from this general law [Spencer et al. (2009)]. So generative linguistics' next step should be guided by the open recognition that positing that principles are 'genetically encoded pieces of knowledge' was an abbreviated way of thinking of them as 'not directly and exclusively derived from experience', and without temporarily dealing with the task of disentangling their exact developmental underpinnings. As I explain below, trying to overcome this theoretical shortcoming now is a reasonable way of interpreting the ongoing minimalist project within generative grammar [Chomsky (2007), Lorenzo and Longa (2009)] — one that, however, has hitherto received little attention from students of language acquisition [Longa and Lorenzo (2008)]. In this section I try to give a hint of how this project can be carried out and to show how it can help surpass old idealizations, as well as make clear what the new heuristics it needs to be constructed upon, are.

In the following paragraphs I will be using Yang's [(2002)] model as a reference point, which I consider the best answer to date to the demand of constructing 'developmentally compatible' theories of language acquisition. So far, no single genetic sequence has been identified which covariates with some milestone of the developmental path of a language, while Yang has been capable of quantifying quite precisely correlations between the amount of certain crucial data that children are exposed to and the rapidity — or slowness — with which knowledge about related grammatical rules became fixed in their minds. This fact makes Yang's thesis on the environment as the prime mover of linguistic development clearly preferable over

its geneticist contenders. The cost of this promising thesis is however very high, because it only works at the price of positing a huge amount of inborn knowledge in children's minds. Yang's explanation on how children acquiring English fix the rule that prohibits the omission of subjects in this language is a good example. The main point of Yang's argumentation is that until children fix this rule — a phase during which they freely omit subjects, they do not behave exactly as children acquiring, say, Italian do. As previously commented, children acquiring Italian attain the same percentages of omissions as adults very early on, while children acquiring English omit at very much lower rates. Besides, in the acquisition of English children show certain patterns that have no equivalent in Italian, but have equivalents in other languages in which subject omission shows other characteristics. For example, children learning English commonly omit the subject in adjunct questions — like *Why is (she) coming*? — but almost never in argument object questions — like *What is she eating?* According to Yang, this is a phenomenon that parallels the fact that in Chinese subjects can be freely omitted in sentences in which an adjunct is topicalized — adjunct questions being a subset of adjunct topicalizations, but not in sentences in which an argument is topicalized — object questions being a subset of argument topicalizations. So Yang's conclusion is that children undergo a process of grammar competition, along which they progressively forget grammars until they finally fix the target system [see Mehler and Dupoux (1990) for this idea of 'learning by forgetting']. In the case of the acquisition of English, children start the process knowing Italian-like, Chinese-like and English-like languages, they first forget Italian-like languages (i.e., the grammar-type that allows free subject omission) and finally they also forget Chinese-like languages (i.e., the grammar-type that allows subject omission in the context of adjunct, but no object topicalization) when the amount of sentences containing expletive subjects — *it rains* — attains a certain critical mass that allows them to become aware of the type of language English belongs to, given that this kind of input is an unequivocal signal (or 'signature', in Yang's own terminology) of grammars in which subject omission is completely barred.

Yang's idea is without doubt a charming one. However, the contention that children *literally* know every possible type of language prior to any experience seems rather radical — as it is indeed radical the underlying assumption that all this knowledge is literally encoded in the human genotype. So radical, actually, that it can only be interpreted as based on a bold simplifying assumption that asks for correction if the theory of acquisition is, as I defend, to go beyond the stage of 'developmental compatibility' and enter into a stage of 'developmental adequacy', with theorists willing to offer true explanations of developmental facts, instead of simply taking them into account. Let's see how an alternative to Yang's ideas could look like accepting this developmental challenge.

Children are known to be experts in tasks of pattern finding and recognition from a very early age [Tomasello (2003), pp. 28-31, and references therein]. So we can suppose that in establishing the basic patterns of word combination they start capturing a very rough schema that I represent as [X X X] — *X*s being variables ranging over items children are capable of identifying as discrete pieces in the speech flow, which is to evolve into the [S V O] — Subject, Verb, Object — typical of English [see Bever (2009a) and (2009b), for some elaboration of this idea, as well as some sympathetic comments in Chomsky (2009)]. A well-known fact of English grammar — actually of configurational languages at large — is that asymmetries between objects, on the one hand, and subjects and adjuncts, on the other, abound, with reflexes in many different grammatical rules [Chomsky (1981), Huang (1982)]. This means, among other things, that 'object' is a more prominent category than the originally undifferentiated categories of 'subject' and 'adjunct', probably starting in development, where the former category differentiates from the latter two before these differentiate from each another. An obvious expectation from this set of premises is that, for some time, children learning English make an undifferentiated use of subjects — *She is coming* — and fronted topicalized adjuncts — as in adjunct questions; *Why is coming*? — in fulfilling the requirement that the first position of the [X X X] pattern be occupied. So according to this idea, it may be that it is not exactly the case that children omit the subject when acquiring English — as in *Why is coming?*, but that before capturing the 'non null-subject' character of this language they sometimes use elements other than subjects — like adjunct *wh*-words and other topicalized adjuncts — to satisfy the temporary requirement that the canonical position of subjects — corresponding to the first *X* of the [X X X] schema that they putatively hold — must be fulfilled, given the subject/adjunct affinity. In other words, they do not "use an English grammar in coexistence with a Chinese grammar for an extended period of time", as Yang [(2002), p. 119] defends, but a childish version of English that sometimes resembles some superficial properties of Chinese.

An advantage of this alternative is that, while being as developmentally compatible as Yang's proposal, it is more feasibly testable than the idea that children are directly — 'genetically' — endowed with knowledge about any imaginable natural language. Experiments have of course to be designed and carried out, but for the time being let us suppose that they corroborate the thesis that universal constraints on grammars have a developmental history, underlying which a multifarious system exists comprising, amongst other things, principles of 'data analysis' and 'structural architecture' not specific to FL — as Chomsky [(2005), p. 6] actually proposes as part of the factors that enter into the growth of language in the individual. An immediate consequence would be that important portions of formerly thought pieces of inborn knowledge could be conceptualized instead as the end-point of normal developmental processes, in which biology and psychology still have to do some

work besides simply mapping precise genetic instructions. It is my opinion
that this idea does not defy the nativist stance of generative linguistics in any
significant way [see Carruthers (1992) and Cowie (1999) for some congenial
approaches], but simply helps to surpass the simplifying assumption that genes
are the only source of organic form apart from environmental influences.

V. CONCLUSIONS

In the cases thus far discussed, the ideas of the previous section amount
to the following contentions. Children do not know in advance that linguistic
expressions are structured as 'sentences', sentences contain a 'subject' as an
obligatory component and subjects can be freely omitted in some types of
languages (like Italian) but not in others (like English). All this 'cognitive
stuff' is rather a product of their mental growth — a function of a complex
developmental system that includes, amongst other things, general principles
of data analysis (pattern recognition, statistical learning, and so on) respon-
sive to certain particularly informative features of the incoming data. Simi-
larly, children do not know in advance that syntactic rules have a structure
dependent character — 'form polar questions fronting the *main* auxiliary', in-
stead of obeying simpler constraints of linear character — 'form polar ques-
tions fronting the *first* auxiliary' [Chomsky (1975)], because this is principly
explained by (the ontogeny of) the memory regime of the computational sys-
tem of FL [Balari and Lorenzo (2008), (2009), (2013)]: as soon as the rele-
vant neural circuits attain the required size and connectivity as to assist a
memory regime equivalent to that of an automaton within the pushdown hi-
erarchy, children become, so to speak, 'linear-blind' [Longa and Lorenzo
(2012)], so they irreflexively reject rules based on linear constraints — corre-
sponding to a suboptimal use of such working memory potential — and as-
sume that the content of every rule refers to structure — corresponding to an
optimal use of such a memory power, which is to be understood as a side-effect
of this particular aspect of brain growth. So a reductionist project can be carried
out in which what was previously thought to be 'inborn knowledge' — i.e., the
innate propositional content of certain mental states — is putatively conceptual-
ized as deriving from the architectural properties and organization of FL
('principles of structural architecture') and the external systems that it inter-
faces with (as 'principles of data analysis' of a general sort).

As commented in section II, such a project is the natural extension of
the Minimalist Program [Chomsky (1995), (2005)] into the realm of ontog-
eny, which however cannot be naively seen as the last word in explaining the
developmental origins of internal languages. The Minimalist Program has its
own limitations — or, in other words, its own simplifying assumptions that in
due course should be surpassed, very probably with major revisions of the

theoretical picture previously obtained. The project has until now concentrated on a reductionist approach centered on principles of structural architecture and data analysis, as well as general laws of form — some of which still need to be more accurately defined, that surely does not exhaust the range of ('third factor') effects that interact with ('first') the genetic and ('secondly') the environmental factors in shaping FL [Chomsky (2005), p. 6]. Furthermore, it is clear that the level of abstractness of these said effects is so high that they will very soon ask for a further reductionist effort directed to clarify their ultimate materialistic bases. However, this theoretical horizon is exciting enough to make one enthusiastically try and fulfill the more modest minimalist agenda for the time being.

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REFERENCES

BALARI, S. and LORENZO, G. (2008), 'Pere Alberch's Developmental Morphospaces and the Evolution of Cognition', *Biological Theory*, vol. 3, pp. 297-304.
— (2009), 'Computational Phenotypes: Where the Theory of Computation Meets Evo-Devo' *Biolinguistics*, vol. 3, pp. 2-60.
— (2013), *Computational Phenotypes. Steps to an Evolutionary Developmental Biolinguistics*, Oxford: Oxford University Press.
BAKER, M.C. (2001), *The Atoms of Language. The Mind's Hidden Rules of Grammar*, New York, Basic Books.
BEVER, T.G. (2009a), 'Minimalist Behaviorism: the Role of the Individual in Explaining Language Universals', in Christiansen, M.H., Collins, C. and Edelman, S. (eds.), *Language Universals*, Oxford, Oxford University Press, pp. 99-125.
— (2009b), 'Remarks on the Individual Basis for Linguistic Structures', in Piattelli-Palmarini, M., Uriagereka, J. and Salaburu, P. (eds.), *Of Minds and Language. A Dialogue with Noam Chomsky in the Basque Country*, Oxford, Oxford University Press, pp. 278-295.

BOECKX, C. and GROHMANN, K.K. (2007), 'The *Biolinguistics* Manifesto', *Biolinguistics*, vol. 1.1, pp. 1-8.

BORER, H. and WEXLER, K. (1987), 'The Maturation of Syntax', in Roeper, T. and Williams, E. (eds.), *Parameter Setting*, Dordrecht, Reidel, pp. 123-172.

CARRUTHERS, P. (1992), *Human Knowledge and Human Nature*, Oxford, Oxford University Press.

CHOMSKY, N. (1959), 'A Review of B. F. Skinner's *Verbal Behavior*', *Language*, vol. 35, pp. 26-58.

— (1967), 'Recent Contributions To the Theory of Innate Ideas', *Synthese*, vol. 17, pp.2-11.

— (1975), *Reflections on Language*, New York, Pantheon.

— (1980), *Rules and Representations*, New York: Columbia University Press.

— (1981), *Lectures on Government and Binding*, Dordrecht, Foris.

— (1985), *Knowledge of Language. Its Nature, Origins and Use*, New York, Praeger.

— (1995), *The Minimalist Program*, Cambridge (MA), MIT Press.

— (2000), 'Minimalist Inquiries: The Framework', en Martin, R., Michaels, D. and Uriagereka, J. (eds.), *Step by Step. Essays in Honor of Howard Lasnik*, Cambridge (MA), MIT Press, pp. 89-155.

— (2005), 'Three Factors in Language Design', *Linguistic Inquiry*, vol. 36, pp. 1-22.

— (2007), 'Approaching UG from below', in Sauerland, U. and Gärtner, H.M. (eds.), *Interfaces + Recursion = Language? Chomsky's Minimalism and the View from Syntax–Semantics*, Berlin and New York: Mouton de Gruyter, pp. 1-29.

— (2009), 'Opening Remarks'', in Piattelli-Palmarini, M., Uriagereka, J. and Sala-buru, P. (eds.), *Of Minds and Language. A Dialogue with Noam Chomsky in the Basque Country*, Oxford, Oxford University Press. pp. 13-43.

CHOMSKY, N. and LASNIK, H. (1991), 'Principles and Parameters Theory', in Jacobs, J., von Stechow, A.S, Sternefeld, W, and Vennemann, T, (eds.), *Syntax: An International Handbook of Contemporary Research*, Berlin, de Gruyter, pp. 506-69.

COWIE, F. (1999), *What's Within. Nativism Reconsidered*, Oxford, Oxford University Press.

CORBALLIS, M. C. (2007), 'The Uniqueness of Human Recursive Thinking', *American Scientist*, vol. 95, pp. 240-248.

CRAIN, S. (1991), 'Language Acquisition in the Absence of Experience', *Behavioral and Brain Sciences*, vol. 14, pp. 597-650.

CRAIN, S. and THORNTON, R. (1998), *Investigations in Universal Grammar. A Guide to Experiments on the Acquisition of Syntax and Semantics*, Cambridge (MA), MIT Press.

FITCH, W. T. and HAUSER, M. D. (2004), 'Computational Constraints on Syntactic Processing in a Nonhuman Primate', *Science*, vol. 303, pp. 377-380.

FITCH, W. T, HAUSER, M .D. and CHOMSKY, N. (2005), 'The Evolution of the Language Faculty: Clarifications and Implications', *Cognition*, vol. 97, pp. 179-210.

GENTNER, T. Q., FENN, K. M., MARGOLIASH, D. and NUSBAUM, H. C. (2006), 'Recursive Syntactic Pattern Learning by Songbirds', *Nature*, vol. 440, pp. 1204-1207.

GIVÓN, T. (2002), *Bio-Linguistics. The Santa Barbara Lectures*, Amsterdam, John Benjamins.

GRIFFITHS, P. E. and GRAY, R. D. (1994), 'Developmental Systems and Evolutionary Explanation', *Journal of Philosophy*, vol. 91, pp. 277-304.

GRIFFITHS, P. and KNIGHT, R.D. (1998), 'What Is the Developmentalist Challenge?', *Philosophy of Science*, vol. 65, pp. 253-258.

HAUSER, M. D., CHOMSKY, N. and FITCH, W.T. (2002), 'The Faculty of Language: What Is It, Who Has It, and How Did It Evolve?', *Science*, vol. 298, pp. 1569-1579.

HORNSTEIN, N., NUNES, J., and GROHMANN, K. K. (2005), *Understanding Minimalism*, Cambridge, Cambridge University Press.

HUANG, C.-T. J. (1982), *Logical Relations in Chinese and the Theory of Grammar*, MIT PhD Dissertation.

HYAMS, N. (1986), *Language Acquisition and the Theory of Parameters*, Dordrecht, Reidel.

JABLONKA, E., and LAMB, M. J. (2005), *Evolution in Four Dimensions. Genetic, Epigenetic, Behavioral, and Symbolic Variation in the History of Life*, Cambridge (MA), MIT Press.

JACKENDOFF, R. and PINKER, S. (2005), 'The Nature of the Language Faculty and Its Implications For Evolution of Language (Reply to Fitch, Hauser, and Chomsky)', *Cognition*, vol. 97, pp. 211-225.

JENKINS, L. (2000), *Biolinguistics. Exploring the Biology of Language*, New York: Cambridge University Press.

JOHNSTON, T. and EDWARDS, L. (2002), 'Genes, Interactions, and the Development of Behavior', *Psychological Review*, vol. 109, pp. 26-34.

KATZ, J. J. (1981), *Language and Other Abstract Objects*, Totowa (NJ), Rowman and Littlefield.

KATZ, J. J. and POSTAL, P. M. (1991), 'Realism Vs. Conceptualism in Linguistics', *Linguistics and Philosophy*, vol. 14, pp. 515-554.

KOSTER, J. (2007), 'Ceaseless, Unpredictable Creativity: Language As Technology', *Biolinguistics*, vol. 3.1, pp. 61-92.

LENNEBERG, E. H. (1967), *Biological Foundations of Language*, New York, Wiley.

LONGA, V. M. and LORENZO, G. (2008), 'What About a (Really) Minimalist Theory of Language Acquisition?', *Linguistics*, vol. 46, pp. 541-570.

— (2012), 'Theoretical Linguistics Meets Development. Explaining FL From a Epigeneticist Point of View', in Boeckx, C., Horno, M. C. and Mendívil, J. L. (eds.), *Language, from a Biological Point of View*, Newcastle, Cambridge Scholars Publishing, pp. 52-84.

LORENZO, G. and LONGA, V. M. (2009), 'Beyond Generative Geneticism. Rethinking Language Acquisition From a Developmentalist Point of View', *Lingua. International Review of General Linguistics*, vol. 119, pp. 1300-1315.

MARANTZ, A., MIYASHITA, Y. and O'NEILL, W. (2000), *Image, Language, Brain. Papers from the First Mind Articulation Project Symposium*, Cambridge (MA), MIT Press.

MEHLER, J. and DUPOUX, E. (1990), *Naître Humain*, Paris, Odile Jacob.

MORO, A. (2008), *The Boundaries of Babel. The Brain and the Enigma of Impossible Languages*, Cambridge (MA), MIT Press.

OYAMA, S. (2000), *The Ontogeny of Information. Developmental Systems and Evolution*. 2nd edition, Durham (NC), Duke University Press.

OYAMA S., GRIFFITHS, P. E., and GRAY, R. D. (eds.) (2001), *Cycles of Contingencies. Developmental Systems and Evolution*, Cambridge (MA), MIT Press.

PERRUCHET, P. and REY, A. (2005), 'Does the Mastery of Center-Embedded Linguistic Structures Distinguish Humans From Non-Humans?', *Psychonomic Bulletin and Review*, vol. 12, pp. 307-313.

PINKER, S. and JACKENDOFF, R. (2005), 'The Faculty of Language: What's Special About It', *Cognition*, vol. 95, pp. 201-236.

PULLUM, G. K. and ROGERS, J. (2006), 'Animal Patterning-Learning Experiments. Some Mathematical Background', accessible on-line: *www.lel.ed.ac.uk/~gpullum/ MonkeyMath.pdf.*

PULLUM, G. K. and SCHOLZ, B. C. (2010), 'Recursion and the Infinitude Claim', in van der Hulst, H. (ed.), *Recursion in Human Language*, Berlin, Mouton de Gruyter, pp. 113-138.

RITTER, N. A. (ed.) (2002), *A Review of 'The Poverty of Stimulus Argument', The Linguistic Review*, vol. 19 (1-2) (Special Issue).

ROBERT, J. S. (2004), *Embryology, Epigenesis, and Evolution. Taking Development Seriously*, New York, Cambridge University Press.

SAMPSON, G. (2001), *Empirical Linguistics*, New York, Continuum.

SPENCER, J. P., BLUMBERG, M. S., MCMURRAY, B., ROBINSON, S. R., SAMUELSON, L. K. and TOMBLIN, J. B. (2009), 'Short Arms and Talking Eggs: Why We Should No Longer Abide the Nativist-Empiricist Debate', *Child Development Perspectives*, vol. 3, pp. 79-87.

TOMASELLO, M. (2003), *Constructing a Language. A Usage-Based Theory of Language Acquisition*, Cambridge (MA), Harvard University Press.

WEXLER, K. (1990), 'Innateness and Maturation in Linguistic Development', *Developmental Psychobiology*, vol. 23, pp. 645-660.

YANG, C.D. (2002), *Knowledge and Learning in Natural Language*, Oxford, Oxford University Press.

— (2006), *The Infinite Gift. How Children Learn and Unlearn the Languages of the World*, New York, Scribner.