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On Chomskian Biolinguistics: Recurrent Dichotomies and a New Hybridized Conception of Language

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1. Introduction

In recent years, Chomsky has put forward an even more radicalized internalist conception of the language faculty (henceforth FL). In particular, he has been extensively suggesting that language ought to be considered as a mainly internal biological object which is argued to be optimally designed to provide the adequate bases for humans unbounded and creative thought (Chomsky 2016; Berwick & Chomsky 2016). According to this proposal, therefore, externalization processes and language's communicative functions are merely treated as secondary and ancillary aspects. Nevertheless, Chomsky's current understanding of language appears to face a few methodological and conceptual problems. On the one hand, it rests on sharp dichotomical assumptions of the kind internal vs. external, or thought composing vs. communicative purposes of language, which, as it will be argued at length in this paper, are no longer tenable from a biological and developmental perspective of language. On the other hand, it implies a teleological and functionalist conception of this human faculty, according to which language has the proper and main function of a thought-composing device. However, as it will be observed, teleological stances of this sort fallaciously attribute a unique purpose to biological objects. As a result, they eventually come to grant an existentially autonomous character to said purpose, thus opening the dubious possibility that the apparently same recurrent function may be instantiated and realized in many diverse species or organic structures. For this reason, a recent and promising proposal, emerging from a series of engaging contributions by Balari & Lorenzo, will be analyzed and proposed as a plausible and valid alternative. According to such proposal, language, a pure biological object, is argued to comprise both endogenous and exogenous factors in an ultimately indissociable way, yielding, therefore, a clear instance of a hybrid system for language. This new proposal allows us to overcome Chomsky's recurrent dichotomies (e.g. external vs. internal factors of language; or thought first vs. communication first), and, at the same time, to avoid teleological approaches to the FL.

To do so, the current paper will be structured as follows. Section 2 will review Chomsky's current conception of the FL. Section 3 will be devoted to analyzing Chomsky's generative approach, with a special attention to the recurrent dichotomies that pervade and arguably jeopardize the author's program. Here, the most prominent criticism regarding Chomsky's dichotomies will also be considered, with the intention of demonstrating how polar distinctions of this kind should be avoided. Section 4 will deal with the communicative approach to language, which, as it will be seen, is rejected by Chomsky due to its functionalist character and to the fact that, under the author's current assumptions, communication is only a secondary aspect of language, as it will be pointed out in section 5. Subsequently, section 6 will attempt to show how, despite the author's repeated claims against teleological conceptions of language, Chomsky's current understanding of this special faculty appears

to suffer from the same functionalist disease. For this reason, section 7 will suggest a possible alternative proposal, which, without rejecting the biological character of language, allows us to conceive language as a hybrid phenomenon, in which both exogenous and endogenous factors play a crucial role. Finally, section 8 will close the paper with some concluding remarks.

2. On Chomsky's Basic Property and his current conception of the faculty of language

What Kind of Creatures are we? and *Why only us*, Chomsky's most recent extensive contributions, offer a comprehensive perspective on a variety of different topics that are not always directly and strictly related to language. The former book, in particular, deals with a variety of themes that range from closely language-related issues - such as its origin and nature - to more far-reaching and generic topics, such as the limits of humans' cognitive capacities, the defects of western education systems, and the common good humans should strive for. Despite their comprehensive and all-embracing character, both contributions present as their primary concern and main focus of interest, a rather radical view on the nature, origins and evolution of language, which is the uttermost fruit of Chomsky's voluminous and prolific production. In particular, from both contributions emerges that language, according to the author, is to be in fact understood as a complex biological organ that shares a considerable number of its crucial components, coexists and interacts with other (not always human-specific or language-specific) biological systems, such as the respiratory system or the digestive tract. As it is emphasized in Hinzen (2012), Chomsky's particular aim, following the Minimalist agenda he promulgated since the beginning of the last decade of the last century, is to offer "an account of language that makes sense of it as a natural object, as opposed to a purely formal object of the sort studied in logic, or else a wholly social or conventional one" (p. 95).

For this reason and due to the extremely complex, heterogeneous and multidimensional nature of this interesting phenomenon, Chomsky's main contention is that, in order to feasibly study this special (perhaps unique) human capacity from an adequate biological and evolutionary perspective, language should be reduced to what the author calls its Basic Property. Concretely, such Basic Property is argued to consist in the fact that each and every human language is able to provide an unbounded array of hierarchically structured expressions that, in turn, receive interpretations at two interfaces: sensorimotor for externalization and conceptual-intentional for semantic interpretation and mental processes (Chomsky 2016: pp. 4-5; Berwick & Chomsky 2016: pp. 89-90). Furthermore, following Chomsky's renowned *divide and conquer* strategy, the Basic Property of the faculty of language should be further and conveniently split into three crucial subcomponents. In particular, in both publications, it

is maintained that the three components that incontrovertibly characterize and compose the faculty of language are:

- (i) A computational system that is able to execute its recursive computational operations, allowing the production of an unbounded array of hierarchically organized expressions.
- (ii) An interface with the conceptual-intentional system, which provides interpretation to the generated or perceived linguistic expressions.
- (iii) An interface with the sensorimotor system, which is in charge of the multimodal externalized component of language.

Therefore, from this tripartite characterization it is derived and it naturally follows that, at the very least, the faculty of language necessarily incorporates a computational procedure, which is able to satisfy the Basic Property, and that, since the dawn of the Minimalist Program, has come to be known as the operation of *Merge*. Simplifying, according to Chomsky (2016), Merge, under the simplest account of the Basic Property, is a plain computational operation that takes two already constructed objects X and Y and creates a new object Z, in which X and Y appear unordered: $\text{Merge}(x, y) = \{X; Y\}$. Yet, to be meticulous, the author points out that there exist two distinct types of Merge that operate within natural languages: Internal Merge and External Merge. The latter, as it has been said, is a process that takes two syntactic objects $X = \textit{eat}$ and $Y = \textit{that apple}$, and creates a new one $Z = \textit{eat that apple}$. However, it could also be the case that one of the objects that is to be merged is, in turn, part of the other, as in $Y = \textit{which apple}$ and $X = \textit{Mary ate which apple}$. In order to form $Z = \textit{which apple Mary ate which apple}$ - that, in turn, surfaces as “which apple did Mary eat” by subsequent operations - Internal Merge is indeed required. In particular, in fact, the result of Internal Merge of X and Y is, as above, $\{X; Y\}$ but, in this case, such outcome is argued to contain two copies of Y (= *which apple*): the original one that remains within X and the displaced copy that is merged with X. That operation, Chomsky assures, is a clear example of a pervasive and ubiquitous phenomenon that permeates natural languages: the property of displacement. There are scenarios, as a matter of fact, in which phrases, when externalized, are heard (or produced) in only one place but are interpreted both there and in the original place, so that a sentence such as the previous one is understood as “for which apple x, Mary ate the apple x”. As it will be observed in the following sections, this recurrent property of displacement, which was traditionally considered a mere imperfection and a deficient feature of the architecture of language, is, on the contrary, currently taken by Chomsky as an unconfutable instance of the adequacy and optimality of such language design in fulfilling its purported primary function as a tool for thought and internal processes.

3. On Chomsky's generative approach

Leaving aside for a moment the nature of displacement operations and the concrete functions of the faculty of language - to which this paper will nonetheless extensively return in the subsequent pages - it is now time to focus our interest on Chomsky's actual characterization of natural languages. As it can be easily perceived, thus, following the aforementioned view - according to which, again, language's Basic Property primarily consists of a computational apparatus constantly capable of producing an infinite array of hierarchically structured linguistic expressions that receive interpretation at the interfaces with the conceptual-intentional and sensorimotor systems, respectively - a comprehensive and principled theory of the faculty of language necessarily "is by definition a generative grammar" (Chomsky 2016: p. 4). Consequently, according to the author, it can be straightforwardly perceived how each and every natural language is to be effectively understood as an I-language. This significant characterization of natural languages is, in effect, a traditional and permanently recurrent claim in the totality of Chomsky's extensive production. In particular, as it is explained in Chomsky (2016), such I-languages are to be considered as biological properties of humans, subcomponents of the brain, and actual organs of the so-called mind/brain. As in all previous Chomskian contributions, therefore, such concept of I-language sharply contrasts and is contraposed to E-languages, that is, mainly external and socially shared sets of expressions.

3.1 On the actual nature of E-languages

As it has been previously illustrated, in all his extensive production, Chomsky repeatedly claims that there exists a sharp distinction between I-languages and E-languages (see, for instance, Chomsky 1986, where the author firstly introduced this dichotomy). As a matter of fact, notwithstanding the different perspectives regarding the bipartite conception of the faculty of language, it seems undeniable that it is convenient to make a qualitative distinction, such as the one defended by Chomsky's contributions, between external and internal components of this human faculty. As for the former, indeed, following a generative approach such as the one that emerges from Chomskian works, it seems paramount to presuppose an organic component – with which all human beings are equally endowed - that allows the unbounded generation of hierarchically organized linguistic expressions. As for the actual nature and character of the latter, on the other hand, diversified opinions can be found in the linguistic literature. Despite noticeable discrepancies regarding the actual nature and conception of E-languages among

partisans of the different linguistic theories, however, most scholars nonetheless assume – and coincide, perhaps unconsciously - that E-languages ought to be identified with a sort of corpus of sentences, a social entity or some infinite set that is nevertheless weakly generated¹ (Chomsky 2016). Alternatively, it has also been proposed in the literature, especially in the work by Bloomfield, that an E-language is, in effect, an array of habits used to respond to situations with conventional speech sounds and, in turn, to respond to these sounds with actions. E- languages, in other words, appear to be commonly considered as conventionally established external collections of possible sentences and expressions that a speaker eventually comes to acquire and maintain as a consequence of the continuous interaction with other speakers of the same linguistic community.

To be meticulous, however, it should be observed that a considerable number of proponents of what it has been elsewhere called “the communicative approach to language” – to which this paper will extensively return in the following section - do not only agree with the aforesaid characterization of E-languages, but they also actually identify language itself with this conventionalized collection of expressions. From this standpoint, therefore, language is merely reduced to an enormous corpus of data or a sort of infinite set of expressions that is weakly generated. As it is perspicaciously observed in Chomsky (2016), however, it “is not clear that the notion of weak generation is even definable for human language” (p. 4). At the very best, indeed, this notion is only derivative from the more fundamental notion of I-language. To put it differently, from a generativist approach to the faculty of language, it seems reasonable to believe that E-languages are, in effect, mere subordinate objects, which are the actual result of what the primary and most fundamental notion of I-language is capable to unboundedly generate.

Furthermore, as it is argued in Hinzen (2012), if language ought to be identified with an infinite set of well-formed expressions – that is, with a mathematical construct of sorts – such infinite set could not be the subject of naturalistic inquiry. As a matter of fact, such mathematical construct, the author observes, cannot, and has not been, the object of study in generative grammar. Generative grammar, on the contrary, is traditionally aimed at studying and characterizing the state of knowledge – or, in other words, the principles used by human brains to generate the expressions of a language (that is, the *generative procedure*) - underlying the use of such linguistic expressions. Nevertheless, it should be observed that the characterization and identification of language as an infinite set of well-formed linguistic expressions – that is, as an E-language – does not, and cannot, determine any such generative procedure. In fact, many diverse procedures may yield the same “extensionally” or “weakly” equivalent output. Therefore, as it has been argued above, the fact that a procedure eventually yields all (and only)

¹ To be scrupulous, however, it should be pointed out that some linguists claim that grammars actually have a strong generative capacity or, to put it differently, that they define an infinite set of linguistic types (or objects). See, for instance, Pollard & Sag (1994).

the elements of a particular designated set of expressions as its output “is as such of no particular linguistic significance”, Hinzen (2012) argues, since linguistics should be interested in only characterizing a generative procedure, or, in other words, a “strong generation”(p. 97). In turn, Hinzen (2012) claims that neither does that generative procedure as it is implemented in our brains uniquely characterize a set of linguistic expressions in the extensional sense. From a Generativist perspective, the author assures, our actual knowledge of language extends to also cover linguistic expressions that may diverge from some normative notion of what makes them “well- formed”. In other words, according to Hinzen (2012), the expressions that such generative procedure is able to produce, at the end of the derivation, may well be mispronounced, semantically deviant, syntactically deviant but assigned a coherent interpretation, pragmatically infelicitous and so on. In other words, the generative procedure underlying human languages is argued to not only create well-formed expressions, but also ungrammatical ones, which would not be included in the aforesaid infinite set of well-formed expressions. Nevertheless, in my opinion, Hinzen (2012), in this case, appears to be mixing matters of *competence* – namely, what knowing a language confers: that is, a grasp of the structural properties of all the possible sentences of a language – and matters of *performance* – i.e. actual real-time use of a language, which may diverge from the underlying internal competence for different reasons (it may be perturbed by non-linguistic factors like being distracted, or it may overstep the capacity limits of the mechanisms involved in perception or production). As a matter of fact, as Pullum (2013) aptly observes, if the faculty of language is to be characterized by a generative procedure, then, it necessarily defines a set of well-formed expressions (that is, a strong generation).

Notwithstanding, it is easy to perceive how, from a Chomskian point of view, the study of language cannot be relegated to the study of the mathematical set of well-formed linguistic expressions that is often claimed to really represent human languages, or cannot be seen as an attempt to provide the rules for generating such infinite set. Rather, it should be conceived of as the study or investigation of the principles underlying humans’ special generative procedure that is able to unboundedly generate hierarchically structured linguistic expressions. Moreover, as it is maintained in Hinzen (2012), the Minimalist enterprise, the most updated version of Chomsky’s position, not only detaches itself from the study of language as a social and conventionalized entity. Above all, it also implies “an even greater change of perspective than the generative grammar project as such” (p. 98). In particular, over and above the strong generation of language, the Minimalist project strives to find explanatory principles that are expected to make good sense in the light of a perspective on language as a natural object which, in turn, as it has been previously pointed out, is subject to biological and physical forces.

Therefore, following this perspective, as it is also argued in Chomsky (2016), language is to be conceived of as a kind of perfect system that is altogether able to offer the adequate basis for human

thought. Nonetheless, as it will be pointed out in the following sections, this view of language as a perfectly designed system of thought strikingly contrasts with the standard conception of language as a mere communicative system. Language, following this communicative-oriented approach, is mainly perceived not as a natural object as it is assumed within the Minimalist framework, but as a perfectly designed communicative tool, from a functionalist point of view. Nevertheless, it is a crucial tenet of Chomsky's production that language, thus conceived, is highly imperfect due to the fact that, if it was expressly designed for purposes of efficient communication, it would have presumably looked quite different, as it will be pointed out in this paper (e.g. it would lack ambiguities, the property of displacement, or long-distance dependencies, which are, on the contrary, extremely pervasive in natural languages). However, as this paper will also attempt to demonstrate, a debate of this sort appears to be a sterile and futile one. If language is to be conceived as a natural object, as Chomsky is eager to prove, then functionalist stances of this kind, according to which language is an optimally designed tool either for communication or for composing thoughts, are untenable. As it will be seen, indeed, a natural object is not a tool designed to perform a unique function. On the contrary, it may contemporarily serve a diversified array of functions, which are all equally important for the equilibrium of the organism in which they are realized. Consequently, a principled study of this human faculty should be exclusively based on investigating its subjacent organic form, and not on the purported primary functions that are assigned to it.

3.2 On Chomsky's *Internal vs External* and *FLN vs FLB* recurrent dichotomies

As it has been observed, it is Chomsky's recurrent contention that a sharp and dichotomical distinction between [E]*xternal* and [I]*nternal* components of language appears convenient to be made. However, said E- vs I-language polar division is not the only dichotomy proposed by Chomsky to deal with the study of the faculty of language. On the contrary, as it has been seen and as it will be pointed out throughout this paper, dichotomies of this fashion (i.e. external vs internal, competence vs performance, or computational vs communicative aspects of language) are extremely pervasive and represent crucial and foundational tenets within Chomsky's extensive production. As a relevant example of this, it should be noticed that a sharp dichotomy between different aspects of language is indeed also one of the main tenets of Hauser's et al. (2002) renowned paper on the nature, origin and evolution of the faculty of language. In this contribution, the authors introduced for the first time the polar distinction between the faculty of language in the broad sense (FLB) and the faculty of language in the narrow sense (FLN). The former, simplifying, is argued to comprise, among other systems, the mechanisms, perhaps not

necessarily language-specific or human-specific, used for externalization and communicative acts. The latter, on the other hand, defines the mere computational system - purportedly unique to humans and specific to language - underlying the unbounded capacity of generating linguistic expressions. Furthermore, according to Hauser et al. (2002), FLN - which the authors assumed to be a proper subset of FLB - ought to be almost univocally identified with the property of recursion. Following this perspective, therefore, it is the authors' main contention that it is precisely this narrow and exclusively internal component that admittedly corresponds to the actual faculty of language, while other peripheral components are only put in action when such faculty is used in certain contexts (mainly the social and communicative ones).

3.3 Some criticisms of the FLN/FLB and other Chomskian recurrent dichotomies

Due to this innovational bipartite characterization of the faculty of language and to the reiterated calls for a multidisciplinary and integrative enterprise regarding the study of language from related fields of scientific inquiry, Hauser's et al. (2002) paper - published in a period characterized by a series of pioneering scientific discoveries and innovations, of which the sequencing of the entire human genome, and the discovery of the FOXP2 as the "language gene" constitute prominent examples - has eventually come to be commonly considered a milestone for the growing interdisciplinary field that was used to be called "biolinguistics". Notwithstanding and despite the uncontroversial importance of Hauser's et al. (2002) contribution, the paper is also famous for the subsequent controversies and diatribes that it involuntarily generated. For this reason, the most prominent replies to Hauser et al. (2002) are worth mentioning.

In particular, it should be noticed how, in their two responses to Hauser's et al. (2002) article, Jackendoff and Pinker (2005) and Pinker and Jackendoff (2005), directly and consistently attacked the broad vs. narrow dichotomy as applied to the faculty of language. For example, in Fitch et al. (2005), a reply to Jackendoff and Pinker's (2005) initial skeptical remarks, it is eloquently stated that FLB does not only incorporate the two interface systems (the sensorimotor and the conceptual-intentional one), but also "all the mechanisms involved in speech and language, regardless of their overlap with other cognitive domains or with other species" (p.181). That is, FLB is argued to also include all the aspects involved in language that are not specific to this domain, or that are shared with other species (either homologous traits, inherited by a common ancestor; or analogous mechanisms, shared with other distant species as adaptations to a common function and, therefore, not inherited).

According to Jackendoff and Pinker (2005), however, this characterization is, at least in this sense, problematic. The authors, indeed, assure that, by grouping all the mechanisms shared with other animals under the ample umbrella of FLB, Fitch et al. (2005) failed to capture the diversity between homologies and analogies. The former are traits that can be found in closely related species (other non-human primates, for instance) and, therefore, have a long evolutionary trajectory that may be traced back to the last common ancestor. The latter, in contrast, are traits shared with distant relatives and may have emerged recently in the human lineage as a response to similar external selective pressures. For example, bats' and birds' wings are homologous, from a structural perspective, as forelimbs, but analogous, functionally speaking, as wings. The point is that the common ancestor of both bats and birds had no wings, so wings have evolved in both lineages independently, perhaps as a response to similar evolutionary pressures. As a consequence, Jackendoff and Pinker (2005) accurately observe that, by failing to recognize that distinction in the evolutionary process “[Fitch’s et al. (2005)] Narrow/Broad dichotomy, [...] makes space only for completely novel capacities or for capacities taken intact from nonlinguistic and nonhuman capacities, omitting capacities that may have been substantially modified in the course of human evolution”² (p. 224).

On a similar, though perceptibly different vein, in a series of contributions (namely Boeckx (2012), Boeckx (2013) and Boeckx (2017)), Cedric Boeckx repeatedly criticizes Hauser’s et al. (2002) dichotomous standpoint. It is Boeckx’s conjecture, in point of fact, that such a sharp and polar distinction between FLN and FLB is of little use, if not completely unproductive, for the biological and evolutionary study of human language. Indeed, according to Boeckx (2017), a dichotomy of this kind, which is “nonetheless consistent with other Chomskyan distinctions” such as core versus periphery, competence versus performance, or E-languages versus I-languages, has “over time, ossified into a scenario in which the evolution of the basic property has become a keystone added to a preexisting structure”. In fact, it should be pointed out that Hauser’s et al (2002) bipartite characterization of the faculty of language, with FLN argued to only include recursion and to be the only human component of the faculty of language was nevertheless left as an open question in the 2002 article. The authors, indeed, admitted that further empirical research was certainly needed, perhaps “restricting attention to FLN as just defined but leaving the possibility of a more inclusive definition” (p. 1571; column 1). However, as it is aptly observed in Boeckx (2017), in Chomsky’s contemporary publications and, especially in *Why Only Us?*, the possibility of a more inclusive definition of the faculty of language is no longer considered plausible. Rather, it seems that the standpoint according to which FLN represents the actual

² It is vital to notice, as it is done in Balari & Lorenzo (2017), however, that the underlying strategy used by both parties – that is, Hauser et al. (2002) and Jackendoff & Pinker (2005) – to establish analogies and homologies between organs of different species is, at least, dubious, since it relies “in a linguistic/anthropocentric stance that necessarily biases and vitiates conclusions from the outset”(p. 145). This is especially so, because said strategy rests on the adoption of one of the terms of comparisons (human language) as the basis for comparison at the same time.

and uniquely human component of the faculty of language is recently becoming an even more radical conjecture. As it has been seen, indeed, both Chomsky (2016) and Berwick & Chomsky (2016) assure that what makes human language special is language's Basic Property, which is characterized by the constant application of the operation of Merge, that, in turn, is argued to be able to provide the adequate bases for humans thought. This conception appears to parallel Hauser's et al. (2002) characterization of FLN and the property of recursion. Boeckx's alternative, on the contrary - which, as it has already been said, emerges from a series of significant contributions - is a more integrated one, in a way similar to the possibility that was taken into account at the end of Hauser's et al. (2002) article. Concretely, what the author urges us to consider in his series of articles is a mosaic view of such human faculty. Therefore, according to this alternative perspective, which Boeckx (2017) assures to be "much more in line with how evolutionary biologists understand novelties", no unique piece of the mosaic - that is, no single component of the faculty of language - is more fundamental and important than another. Moreover, despite the fact that every component and mechanism that constitutes the faculty of language might have distinct origins, Boeckx (2017) proposes that "it is only when they are assembled that a pattern emerges". In other words, then, according to this mosaic perspective, it may well be that no single component of the faculty of language is unique to this domain or unique to humans. Following this view, thus, the peculiarity of human language is to be found as the result of the particular way in which non-linguistic or non-exclusively-human mechanisms and structures are assembled. As it can be perceived, therefore, the uniqueness of language is not understood as a product of the uniqueness and specificity of any of its components, but it is rather the result of the way in which all its components (perhaps neither human-specific nor domain-specific) are integrated and interact in the faculty of language in its entirety.

Boeckx's alternative proposal, therefore, highlights a crucial methodological and conceptual problem that deeply permeates the linguistic literature. As a matter of fact, sharply dichotomical stances are not a mere peculiar characteristic of Chomsky's contributions. Rather, they represent a paradigmatic tenet of other contraposed frameworks, such as the communicative-inclined approaches to language, as well. Also in these cases, indeed, a clear-cut division between external and internal factors of language is assumed to be a crucial and necessary presupposition. Nonetheless, it is paramount to observe, as it has been done above and as it will be argued at length in the following pages, that such dichotomical positions, from a biologically informed perspective, do not represent a suitable starting point for a principled and scientific study of language. As Boeckx (2017) observes, despite the importance of qualitative and quantitative discriminations, dichotomies of the kind exclusively internal vs exclusively external, narrow vs broad or acquired vs inherited are the sort of stances that separate linguists from the rest of the research community, which, the author assures, "without rejecting *useful*

distinctions, has moved away from stark dichotomies” (emphasis mine).

4. Against the communicative approach

As it has been observed, Chomsky’s characterization of the FL implies a dichotomical distinction between communicative and thought-related aspects of language. Despite the fact that stark dichotomies appear to be no longer tenable under current biologically informed assumptions, it is necessary to point out that, according to Chomsky’s generative approach to the FL, especially from a Minimalist standpoint, the externalization process tends to be commonly considered as a mere ancillary and secondary one. In both *Why only us?* and *What kind of creatures are we?*, as a matter of fact, the authors strongly emphasize that the externalized component of natural languages is only a derivation of its primary internal aspects, to the point that it is acknowledged that “a rich tradition is correct in regarding language as essentially an instrument of thought” (Chomsky 2016: p. 16). Consequently, it is easy to observe how Chomsky’s contemporary view – which increasingly resembles Fodor’s notorious characterization of the Language of Thought (Fodor 1975) - strikingly contrasts with other externalist approaches to the faculty of language, such as the so-called communicative approach.

In particular, as it is pointed out in Hinzen (2012), the Minimalist program maintains that, even if it cannot be denied, as it has been seen, an intrinsically social component to language, the systems of cognitive competence that enter into its social uses “are not as such social themselves” (p. 96). Rather, they seem to reflect an inherent aspect of our mental organization as human beings. As it has been repeatedly stressed, indeed, from a Minimalist and generative perspective to the study of the FL, the computational system underlying language – that is, the system of rules and principles governing the generation of an unbounded set of complex linguistic expressions – has to be the primary focus of scientific inquiry. As Hinzen (2012) observes, indeed, the nature of such computational system is logically independent of its use as a communication system. Consequently, even though the computational system is undeniably used for communication, as it will be argued later, “there is no logical contradiction in imagining it to be used differently” (p. 96).

Nevertheless, it should be pointed out that, within the extensive linguistic framework, there exists a diametrically opposed view on the nature and function of language. Supporters of this particular perspective often claim that communication is an evolved organic function, similar to blood circulation or locomotion, for instance. According to this approach, therefore, language is to be considered as the communication system, among animal communication systems, specifically used by human beings. That is, a particular instance resulting from the evolution of the communicative function. Nonetheless, it seems necessary to observe that such a communicative view of language appears to face a number of

theoretical, conceptual and empirical problems and shortcomings - which will be systematically reproduced and accurately analyzed in the following pages – that, with its focus on communication, lead the speculations about the origins of language and its evolution on the wrong track.

4.1 On animal communication systems

In this sense, from a strictly theoretical point of view, to begin with, both Balari & Lorenzo (2013) and Chomsky (2016) (but also Berwick & Chomsky 2016) convincingly maintain that an approach to the study of language uniquely based on its purportedly main communicative function is to be regarded as virtually misleading (if not completely untenable). Specifically, as it is observed in Balari & Lorenzo (2013), the terms “communication” and “animal communication system” are not notions on which any principled theoretical study of language can be exclusively based, since they do not “refer to anything that may legitimately be considered a true natural kind” (p. 44). As a matter of fact, the term “communication” is traditionally understood as referring to the collection of all forms of animal behavior that imply some sort of contact between individuals through the use of externalized signals with informative content and usefulness (Balari & Lorenzo 2013). Animal communication systems, nonetheless, as Balari & Lorenzo (2013) eloquently stress, do not represent a uniform and homogeneous natural phenomenon. On the contrary, the authors argue that, among the so-called animal communication systems, there exist noticeable quantitative and qualitative diversities and discontinuities that prevent one from feasibly gathering them under a unique label. The term “animal communication system”, indeed, is traditionally used to identify a number of heterogeneous and diversified animal behaviors that range from monkeys’ alert calls, for instance, to the songs that characterize several avian species.

From a purely functionalist standpoint, however, it is necessary to observe, as it is done in Balari & Lorenzo (2013), that the former kind of animal calls has the specific function of alerting the individual’s conspecifics of the presence of some predator, while the latter is generally performed to attract the attention of females to the qualities of their conspecifics. Consequently, as it can be easily detected, both systems eventually play a crucial role in each family of species. Moreover, it should be added that the importance of such purportedly communication systems “translates positively in the reproductive rates historically attained by the most successful practitioners of such behaviors” (p.56). Nevertheless, if the calls of monkeys and the songs of some avian species already have the causal and selective function of a natural alert or of a seduction system, then, from an exclusively functionalist perspective, there is arguably no additional reason to consider them anything else than that. In other words, there does not seem to be any specific and beneficial reason - apart from humans’ (presumably

fallacious, in this case) necessity to oversimplify, anthropomorphize and categorize heterogeneous phenomena and behaviors under unique labels - to consider animal communication systems as a true natural kind on which a principled and scientific study of language should be exclusively based. As it has been maintained, in fact, such term – that is, “animal communication systems” - actually designates a highly multifaceted and qualitatively and quantitatively heterogeneous collection of behaviors, for which any sufficient and satisfactory set of common general principles that is able to justify a productive research agenda does not seem to exist.

Therefore, as it can be well observed from the aforesaid examples, the concept “animal communication system” seems to merely designate a heterogeneous group of animal behaviors that, in addition, present differences both in terms of modality and selective functions. Therefore, a communicative approach of this fashion appears to be a kind of teleological functionalism that is nonetheless based on a category – i.e. animal communication system – that is a mere product of human’s mentality and not the reflex of a proper natural kind. As a consequence, it seems reasonable to conclude that the term “animal communication system” simply refers to a group of qualitatively and quantitatively diversified phenomena that are, above all, actually independent from the diversified organic structures in which they are manifested. For this reason, such general term, following Balari & Lorenzo’s proposal (2013) does not appear to represent a feasible and productive starting point for a principled approach to the study of animals’ communicative or interactive behaviors and, in particular, for the study of language.

4.2 On functionalism and teleology

Apart from the inconsistency and unproductiveness of the term “communication” regarding the study of language from a theoretical perspective, the communicative approach also incorporates other problematic aspects. As it has been said, the communicative approach contends that language is to be included under the ample umbrella denoted by the (plausibly fallacious) concept of animal communication systems, since its communicative role is purportedly considered its primary (and probably unique) function. Nevertheless, it is necessary to point out that, in general terms, biological objects, as it has been argued, are not tools that humans design and, therefore, they rarely possess an exclusive and proper purpose (Lewens 2004; Cummins 2002). As an example, Chomsky (2016) points out that the spine, a prototypical biological object, does not uniquely hold us up, or protect nerves, or store calcium or produce blood cells. On the contrary, it serves all these functions simultaneously and, in turn, it is impossible to discern its purported primary function from the others, since all of them are equally important in the human organism’s equilibrium.

Following this line of reasoning, it should be emphasized, as it is done in Hinzen (2012), that, although communication is undoubtedly one of the many functions that characterize the computational system underlying language, “an account of the function or purpose of some natural object is not in itself [...] an account of the forms or the mechanisms that enable this function”. (p. 96). Crucially, indeed, functionalist explanations are often detached from mechanistic explanations, that is, from complete characterizations of all the mechanisms underlying the phenomenon at study. As it is explained in Balari & Lorenzo (2017), it is precisely the study and description of the mechanisms that produce, underlie and maintain a certain phenomenon that will eventually offer a suitable explanation of said phenomenon, and not the mere investigation of its purported primary function (p. 154-155).

As a consequence, Hinzen (2012) asserts, language, in its totality, should be regarded as logically independent of its use as a communication system. Especially so, because, as it has been argued in the previous section, communication systems have evolved for millions of years without the necessity of a faculty of language in the human sense, since, as the author eloquently states, communication “does not in any way *require* language” (p.96). Therefore, it is easy to perceive that the purported study of communication as such will not tell us much about what is special about language because what is special about language, using Hinzen’s (2012) words, is not that it is a communication system, “but that it is a *linguistic* one” (p. 96-97, emphasis mine). This is, in effect, another crucial point. As it has been argued above, the fact that the FL is now a linguistic system does not straightforwardly imply that it is composed by any language- (or human-) specific components. On the contrary, it may well be the case, as Boeckx assures, that what makes language human- (and language-) specific is the way in which all its components are assembled and interact.

On a similar vein, also Balari & Lorenzo (2013) critically address and disregard the dominant view of language identified by the communicative approach. As it is eloquently explained by the authors, in fact, in purely functionalist frameworks such as the communicative approach itself - which contend that language should be studied in terms of communication as its primary and unique function - the purported exclusive function of a biological object not only acquires priority over its subjacent form, but it also becomes “an independent, transcendental phenomenon whose existence does not presuppose the existence of any form in particular” (p. 57). This is precisely the problem with the notion of realization: it appears to presuppose that “functions” may be realized by a diversity of underlying structures without there being any substantial structural constraint on the said realization (Balari & Lorenzo 2019).

Specifically, the authors observe, as an example, that apart from monkey’s alarm calls, several different species, with no evolutionary close connection to such monkeys, have developed similar systems that perform the role of collective alarm signals. Nevertheless, in attributing the same function

to these similar, though qualitatively and evolutionarily different behaviors, an existentially autonomous character is fallaciously granted to this recurring function, thus opening the possibility that it may be instantiated or realized in many diverse species and organic systems. As it has been previously observed, however, the impossibility of establishing a true natural kind, which is capable of eventually including all forms of animal communicative functions, is directly relatable and applicable to the function of “alarm”, in this case. This is so precisely because, as it is concisely stated in Balari & Lorenzo (2013), “no function names a true natural kind” (p.58). Therefore, a form of functionalism such as the one defended by partisans of the communicative approach is doubly fallacious. On the one hand, it exclusively rests on heterogeneous and polymorphic categories that are mere products of human mentality and, as a result, they do not designate true natural kinds on which a principled and scientific study of language should be based. On the other hand, it attributes an exclusive and predominant function to biological systems, which, as it has been seen, are rarely characterized by a proper function. On the contrary, they tend to serve an array of parallel and diversified functions that are all equally fundamental for the existence and survival of the organism in which they are found.

5. On Chomsky’s view: externalization and communication as secondary processes

As it has been repeatedly pointed out, biological objects lack a predominant and specific function. In a similar vein, conceptually, FL cannot be merely characterized by a unique purpose, which most identify, as it has been argued, with its communicative role. For this reason, Chomsky (2016) and Berwick and Chomsky (2016) contend that communication, despite profuse and prevalent opinions to the contrary, “remains a minor part of actual language use” due to a series of plausible observations (Chomsky 2016: p. 16).

First of all, from a strictly intuitive perspective, following Chomsky’s (2016) relatable personal introspection, externalization is argued to be rarely carried out completely. As a matter of fact, the author points out that most of the linguistic expressions that the computational system underlying language is able to generate do not eventually reach the external world. On the contrary, they enter a sort of internal dialogue in which what reaches consciousness is only scattered fragments. Alternatively, it may also be the case, according to Chomsky (2016), that “full-formed expressions instantly appear internally, too quickly for articulators to be involved” (p. 14). Consequently, it seems evident that the author’s convinced contention is that the faculty of language does not necessarily and systematically imply a communicative component, and that, in turn, such external component represents its primary (and perhaps unique) function. Instead, from this perspective, it appears that the use of language can essentially be reduced to its fundamentally internal functions, that is, its role as a tool for thought and

internal processes.

Secondly, as a natural consequence, if Chomsky's conjectures eventually prove to be on the right track and, therefore, language is to be fundamentally understood as an instrument of thought, then it easily follows that externalization only represents a secondary and ancillary process. In point of fact, Chomsky derives two additional arguments in favor of this stance. On the one hand, the author accurately points out that there is not a unique or exclusive externalization system within the reach of language, as witnessed by the numerous instances of attested sign languages used by deaf communities, which are nonetheless undoubtedly able to express the same kinds of complex thoughts (Chomsky 2016: pp. 13-14). On the other hand, Chomsky also claims that variation, if it exists at all, appears to only be located on the externalization side (namely morphophonology). As a consequence, from the thought-related side of language, variation seems to be almost absolutely negligible (Chomsky 2016: p. 125).

Moreover, and significantly enough, the properties of the externalized components of language appear to be a mere reflex of the restrictions and conditions imposed by the largely (or completely) independent sensorimotor system, and not a consequence of the crucial properties of the actual design of language. In particular, it should be noticed that it is a commonly agreed-upon fact that externalized linguistic expressions obey to linear order conditions, while, when created or semantically interpreted, the same linguistic expressions only respond to their hierarchical distribution. In other words, as it is argued in Berwick & Chomsky (2016), the internal hierarchical structures, created by the recursive operation of Merge, carry no information about order of words, phrases and so on. Their meaning, in fact, is reconstructed from the hierarchical organization of the syntactic structure, in which phrases are always interpreted in terms of their disposition within such structure. In particular, as it is observed in Chomsky (2016), in the author's classical examples *Instinctively, eagles that fly swim*, or *Can eagles that fly swim?* the clause-initial elements *instinctively* and *can* are both associated with a verb, but the verb is, in linear terms, the most distant one: *swim* and not *fly*. This association, as it may be easily recognized, is exclusively based on structural properties, rather than on its plain linear distribution, which would represent a far simpler computational operation. Consequently, it can be observed that language makes use of a property of minimal structural distance, "never using the much simpler operation of minimal linear distance" to the extent that "in this and numerous other cases, ease of processing is ignored in the design of language" (p. 10).

As a matter of fact, the fundamental importance and predominance of the hierarchical structure over linear distance is also empirically corroborated and supported by independent evidence coming from other related fields of research. For instance, as it is explained in Chomsky (2016), a research group in Milan conducted an experiment to study brain activity of subjects presented with two types of stimuli: invented languages satisfying the principles of Universal Grammar (UG) and, thus, based on

structural conditions, and invented languages not conforming to UG. Interestingly, in the former case - the scenario in which the stimuli followed the structural principles of UG – normal activation in the language areas of the brain was detected. In the latter case, on the other hand, despite the fact that the rules of the invented languages obeyed linear conditions - that is, far simpler computational operations than the ones involved in natural languages - no activation of the language areas in the brain was found, giving therefore additional evidence in support of the fact that natural languages mainly operate with such structural properties (Musso et al. 2003).

In parallel, there is considerable additional evidence suggesting that fundamental language design ignores order and other external arrangements also in the case of semantic interpretation. Concretely, it seems that semantic interpretation in core cases fundamentally depends on hierarchy and not on the linear order found in the externalized forms. For example, in scenarios in which Internal Merge is applied, as it has been seen, the displaced phrase is interpreted phonologically in its displaced position, and semantically in the syntactic/thematic position in which it was originally externally merged. In particular, in a prototypical *wh*- question such as *What_i did John eat t_i?* the object of the predicate *to eat* is uttered in the clause-initial position but it is semantically interpreted both in this displaced position and in the originally postverbal one. According to Chomsky (2016), Internal Merge in its simplest form “commonly yields the structure appropriate for semantic interpretation” (p. 18). Nevertheless, when these structures enter the externalization process, they represent wrong structures for the conditions and restrictions imposed by the sensorimotor system. In these cases, as a matter of fact, only the hierarchically most prominent copy is pronounced - that is, the clause-initial copy, in this case – while the lower copy is deleted. This is so, according to Chomsky (2016), because deletion of copies is the result of another uncontroversial application of Minimal Computation: “compute and articulate as little as possible” (p. 19). From this it eventually follows that the complete articulated sentences present gaps, with missing elements that the hearer has to correctly collocate and interpret. This process notoriously yields difficult complications for language processing – the so-called *filler-gap* problems - that demonstrate that, also in these cases, the design of language disregards complexity in the processing and communicative uses of language in favor of minimal computation matters.

As it has been seen, due to the restrictions and conditions imposed by the sensorimotor system, a simultaneous or hierarchically organized externalization of different phrases and sentences is impossible to carry out. Moreover, it has been pointed out that, in cases in which Internal Merge applies, in the externalization process, the structurally lower copies are deleted due to the application of Minimal Computations. Therefore, it is evident that the internal syntactic hierarchical structures, when reproduced, are obligatorily linearized and the lower concurrent copies are compulsorily deleted. This fact represents, according to the author, a blatant demonstration that the externalized component of

linguistic expressions pertains to a secondary process, since the restrictions and conditions that it follows are not the ones that are imposed by the design of language and the functioning of the computational system, but rather, a reflex of those imposed by the largely independent sensorimotor system.

Furthermore, it appears that in most cases, especially in scenarios in which Internal Merge applies, such as the aforementioned examples, semantic interpretation is favored, disregarding externalization. In other words, it seems that language is optimally designed to provide the adequate structures for semantic interpretation, which, in turn, nonetheless yield problems and difficulties for perception and language processing (that is, for communication). Concretely, Chomsky (2016) observes how this so-called asymmetry of the interfaces tends to be even more evident in cases in which “there is a direct conflict between computational and communicative efficiency” (p. 22). In every known case, in fact, it appears that the former is favored, while ease of communication is systematically sacrificed. In particular, it is argued that passive operations, which are often claimed to provide evidence supporting the assumption that language is optimally designed for communication, are, in fact, an additional proof to the contrary. As Chomsky (2016) explains, in sentences such as “the girls took the apples”, if one wants to foreground “the apples”, the passive operation allows her to utter “The apples were taken by the girls”. However, if one takes a sentence such as “The girls took the books from the shelves”, to foreground “the shelves”, yielding “The shelves were taken the books from by the girls” is regularly disallowed by language design, yet generating another barrier to communication in order to favor computational efficiency.

Similarly, in syntactic islands - that is, constructions in which extraction (again, Internal Merge) is prohibited – ease of communication, once more, is argued to be neglected in favor of computation. Specifically, Chomsky (2016), in order to get his point across, offers a series of examples based on the questions associated with the sentence “They asked if the mechanics fixed the cars”. From this construction, it can be asked, for instance, “How many cars”, yielding “How many cars did they ask if the mechanics fixed?” Or it can be asked “How many mechanics”, yielding “How many mechanics did they ask if fixed the cars?”, which is, technically, an ECP violation³. As it can be perceived, however, despite the fact that both interrogatives are fine thoughts, in order to correctly ask “how many mechanics” some circumlocution has to be used. This case, the author maintains, represents an additional example corroborating the fact that language design, in scenarios in which ease of communication conflicts with computational efficiency and semantic interpretation, favors the latter and neglects the former.

³ ECP (short for Empty Category Principle) is a principle that states that empty categories must be properly governed, the core case of proper government being government by a lexical head. Subject traces, such as the one in the second sentence, fail to be properly governed, so that subject extraction is often problematic cross-linguistically. No comparable problem, in contrast, arises for object traces (such as the one in the first sentence), which are properly governed by the verb. (Rizzi & Shlonsky 2007).

As it has been shown, thus, both Chomsky (2016) and Berwick & Chomsky (2016) eloquently and repeatedly argue that the structures resulting from the reiterated application of both External and Internal Merge often yield difficulties for perception and language processing. In particular, it has been seen that when ease of processing and communicative efficiency compete with computational efficiency in language design, “in every known case the former are sacrificed” (Chomsky 2016: p. 23). According to the author, indeed, all the aforementioned scenarios lend further support to the conjecture that language primary functions as an instrument of thought, “in interesting respects perfectly designed” (p.23). Therefore, within such configuration, externalization and the communicative aspects of language are reduced to ancillary, secondary and almost independent processes, which mainly obey to the conditions and restrictions imposed by the mostly autonomous sensorimotor system.

6. Language as essentially and primarily an instrument for thought

As this paper has attempted to show, Chomsky’s most actualized conception of the nature and character of language – which, in particular, mainly emerges from his two most recent extensive publications – can be perceived as an even more radicalized and strong position than the ones that were previously contended in his preceding contributions. It has been pointed out, indeed, that, in recent years, Chomsky’s works stressed the fact that language is to be essentially conceived of as a largely internal phenomenon, which, in turn, primary functions as a perfectly designed instrument for thought. As a consequence, the purported primary function that most scholars attribute to language - that is, its essential role as a communication system used by speakers of the same community to interact and exchange relevant information – as it has been argued, is relegated to a secondary process under Chomsky’s current assumptions.

It seems necessary to observe, however, that despite Chomsky’s repeated claims against the attribution of a unique and fundamental function to an actual biological object such as FL, it appears that the author’s current understanding of said faculty is, in effect, a sort of teleological approach similar to the ones profusely rejected by the author himself. In particular, Chomsky’s most actualized conception of the emergence, evolution and nature of FL contends that language emerged in humans thanks to “some slight rewiring of the [archaic humans’] brain” that eventually yielded Merge (Chomsky 2016: p. 25). As it has been seen, Merge, in its simplest form, is argued to be able to provide the unbounded generation of hierarchically structured linguistic expressions that are, in turn, the bases for modern humans’ unbounded and creative thought. Therefore, it appears that what the author is trying to prove is that FL, according to the Strong Minimalist Thesis - that is, the conjecture according to which “U[niversal] G[rammar] reduces to the simplest computational principles, which operate in accord with

conditions of computational efficiency” (Berwick & Chomsky 2016; p. 94) – is not only perfectly designed, but, above all, perfectly designed to provide the adequate bases of human thought.

It seems evident, however, that such conception parallels, despite significant differences, the teleological perspective underlying the communicative approach. On the one hand, indeed, such communicative approach, as it has been pointed out, defends the absolute priority of the communicative role of language, which, in turn, is also conceived as language’s main and perhaps unique function. On the other hand, even though the author repeatedly criticizes the functionalist and teleological stance that characterizes the communicative approach, Chomsky’s conjecture appears to (perhaps unconsciously) suffer from the same disease. In point of fact, if it is true that biological objects are not designed for and do not actually have a unique function, then, it is odd to claim that language’s design is perfectly suitable to uniquely provide the basis for humans articulated, unbounded and creative thought, while the communicative and externalized aspects of language are merely relegated to the back-burner. In other words, despite the fact that composing thoughts is undisputedly one of language’s commonest uses, Chomsky’s non-communicative approach appears nevertheless to be a functionalist and teleological one. For this reason, in the following section it will be proposed that avoiding both stances – that is, Chomsky’s surreptitiously functionalist position, as well as the alternative communicative approach – appears to be a more reasonable choice.

7. A new and hybridized conception of language

Summarizing, it has been profusely asserted that teleological conceptions of language, in which the functions of such faculty – may them be communicative or exclusively internal - prevail and take priority over its actual form, are to be regarded as misleading, if not completely untenable. As a consequence, it seems now the moment to focus the attention of the paper on a series of new and promising proposals concerning a hybridized – that is, neither exclusively external nor internal - vision of FL.

7.1 An Evo-Devo approach to the study of language

In recent years, thanks to the advancement and expansion of a new and promising biological approach to scientific inquiry – the so-called Evo-Devo program – a bottom-up perspective on comparative cognition is gaining strength and importance (Benítez-Burraco & Boeckx 2014). Such new perspective seeks to find and study how developmental dynamics take part and interact in the process of growth and

evolution of organisms (Benítez-Burraco & Boeckx 2014). In other words, it investigates how changes in development drive major transitions and innovations in organismal evolution. Relating this approach to the study of the faculty of language, thus, Evo-Devo attempts to achieve a real and plausible biological depiction of the LF in its entirety.

To be fair, however, already ten years ago, in Chomsky's (2010) *Some Simple Evo Devo Theses*, the author suggested that there exist "some analogies between 'the Evo Devo revolution' in biology and ideas that have been lurking in the background of biolinguistics since its origins" (p. 45). In particular, the author pinpointed a couple of purportedly relevant analogies between the two frameworks. The first one, which mainly refers to the Principles & Parameters (PP) model, relates to the fact that said framework considered the setting of the principles of Universal Grammar into its possible parameters as a kind of "switch box consisting of an array of switches that can be in one of two positions. [...] The fixed network is the system of principles of universal grammar; the switches are the parameters to be fixed by experience" (Chomsky 1988; p. 62-63). In parallel, Evo-Devo has demonstrated that animals from extremely different species (such as insects and vertebrates) share the same regulatory genes, and that, in turn, minor changes in regulatory mechanisms might yield strikingly different superficial results, in a way similar to linguistic parameters that, when adequately fixed by experience, yield superficially different languages. (Benítez-Burraco & Longa 2010). Consequently, both biologists and linguists, thanks to these findings, were eventually able to reverse the traditional claim according to which, in both fields, superficial variation was endless, due to the fact that both parameters and regulatory mechanisms constrained the possible infinite outcomes into a limited number.

Moreover, Chomsky's (2010) second analogy between the Minimalist Program and Evo-Devo has to do with what Chomsky himself calls "third factor" conditions, which are principles not specific to the faculty of language, such as principles of efficient computation, or principles of structural architecture. As a matter of fact, the Minimalist Program notoriously changed the focus of inquiry and the weight of explanation from the first factor (genetic endowment) to the third factor (principles not specific to language) (Chomsky 2005; Chomsky 2006). According to Chomsky (2010), indeed, some of these third factors principles "have the flavor of the constraints that enter into all facets of growth and evolution, and that are now being explored intensively in the evo-devo revolution" (p. 51). Therefore, it is easy to observe, following Chomsky (2010), how recent Eco-Devo discoveries point to "architectural constraints that limit the adaptive scope and channel evolutionary patterns" (p. 51). Nevertheless, it is crucial to notice, as Benítez-Burraco & Longa (2010), in a reply to Chomsky (2010), argue, that none of the analogies proposed by Chomsky (2010) can actually aptly characterize the Minimalist enterprise. In particular, the authors state that "the Evo-Devo approach referred to by Chomsky is a strictly gene-centered theory" and that, as it has been pointed out above, "gene-centrism is explicitly rejected by

M[inimalist] P[rogram]”. (p. 310).

In this sense, a possible alternative, which appears to be much more in line with current Evo-Devo inclined approaches and, therefore, which does not presuppose a crucial and deterministic role of the genotype, is offered in Benítez-Burraco & Boeckx (2014). In this article, the authors assure that it is the complex and changing interaction between the organism and its environment that shapes and defines the final cognitive architecture of the brain. Following this Evo-Devo approach, therefore, the focus of scientific inquiry should be the study of how “[d]ifferent factors, both internal and external, affect language development, to the extent that different cognitive phenotypes can emerge from the same genotype” (Benítez-Burraco & Boeckx 2014; p. 125). Hence, in order to fully comprehend developmental outcomes, using Karmiloff-Smith’s words, “it is vital to identify full developmental trajectories, [...] and how parts of the developing system may interact with other parts differently at different times across ontogenesis” (Karmiloff-Smith 2009; p. 58).

As it can be easily perceived, hence, following an Evo-Devo oriented agenda, there seems to be no point in polarizing the study of language into the two diametrically opposed positions best represented by the communicative approach and Chomsky’s internalist view. In other words, from an Evo-Devo and biologically informed standpoint, the study of language cannot be merely relegated to the study of its exclusively internal cognitive aspects, (e.g. its biologically proper underpinnings), while relegating the socio-cultural dimension of language to the back-burner. At the same time, Evo-Devo also assures that a plain communicative conception of language, according to which natural languages are just external, socially shared codes of sorts belonging to cultural development - “a layer of human development different from and dependent on ontogeny proper” (Balari & Lorenzo 2018) - is a too simplistic position, as well. Rather, due to the fact that, as Benítez-Burraco & Boeckx (2014) correctly maintain, “in all situations language development turns out to be sensitive to environmental changes”, it seems to be precisely the constant interaction of both internal and external factors that eventually molds the developmental path of the organism.

Following this alternative line of investigation, it seems convenient to draw the attention of the reader to a recent interesting proposal that emerges from a series of contributions by Balari and Lorenzo, namely Balari & Lorenzo (2013); Balari & Lorenzo (2015a); Balari & Lorenzo (2018); and Balari et al. (2020), among others. As it will be seen, throughout this series of engaging papers, the authors, taking into account the development and nature of language, attempt to demonstrate how a more unified and integrated approach to the study of language, in which both the endogenous and exogenous components of this human faculty constantly interact and influence each other, is more fruitful from a developmental and biological perspective. In particular, the authors propose a new conceptualization of language as a “developmental hybrid” (Balari & Lorenzo 2018, abstract), that entails that the development of language

equally comprises environmental and organism-internal components in an ultimately non dissociable way.

With this aim, Balari & Lorenzo (2018) begin their article by reviewing the two main currents of linguistic thought in order to attempt to demonstrate how both positions cannot be eventually considered as valid alternatives to the proper study of language. Firstly, on the one hand, the authors address the so-called Vygotskyan/Piagetian tradition – which, in this paper, has been roughly referred to as the communicative approach – emphasizing how current approaches of this fashion perceive language “as an object external to the human organism” (p. 2) with which the latter maintains a symbolic relation. As a consequence, following this approach, humans’ biological predispositions for language are not of a linguistic sort, since the nature of language is mostly understood as a function of how cultural transmission works. Within this scenario, thus, language, as it has been argued above, is not conceived of as a proper biological object, but rather, as the result of the application of human natural resources, “without however being one such resource in itself” (p. 3). Consequently, speakers of natural languages are not assumed to be, in any way, genetically endowed with a linguistic predisposition of any sort. Rather, they are merely perceived as efficient transmitters of culturally shared linguistic conventions, yet without being capable of exerting influence on the exact nature of such conventions, apart from the requirements that the brain imposes as an “all-purposes receptacle”.

As for what it has been labelled here as the Chomskian tradition, on the other hand, Balari & Lorenzo (2018) argue that said current of thought is the result of the shift that took place in the mid-20th Century from externalist conceptions of language to an internalist standpoint. As it has been repeatedly asserted in this paper, said enterprise has advanced in the last years to an even more radically internalist position, to the point that language, under Chomsky’s current assumptions, is almost perceived as the main tool for humans’ thought, that is, a thought-composing device, to which externalization mechanisms serve a mere secondary and ancillary purpose. Within this tradition, moreover, language is conceived of as a proper organ of the mind/brain with which all humans are equally endowed. As a consequence, a crucial tenet of this framework, as opposed to the Vygotskyan/Piagetian tradition, is that the environmental stimuli to which the language organ is reactive and sensitive is not an actual object itself, since its properties and requirements are, at most, a derivation from those of the mind/brain.

To be precise, however, Balari & Lorenzo (2018) also promptly point out that, in recent years, the overall picture of the authentic nature of language has become much more complicated. In point of fact, the authors stress that, nowadays, many middle-ground positions between the strongly externalist and internalist stances - best captured by the Vygotskyan/Piagetian and Chomskian traditions respectively - can be profusely found in the linguistic literature. Nevertheless, such pluralist and intermediate positions,

according to Balari & Lorenzo (2018), eventually run the risk of giving breath to a strong divide between the cultural/psychological dimension of language and its actual biological underpinnings. An instance of this pluralist stance, according to the authors, is perfectly represented by the account offered by Boeckx & Benítez-Burraco (2014). In this paper, indeed, the authors, despite emphasizing the importance of environmental factors, nonetheless maintain a clear-cut division between languages – that is, external systems of conventionally established grammatical conventions – and their proper biological basis. By doing so, Balari & Lorenzo (2018) assure that, in Boeckx & Benítez-Burraco (2014) terms, the faculty of language boils down to a propensity to acquire and use E-languages, which is a state of the human brain that “does not entail an organ proper beyond the brain itself” (p. 4).

7.2 An Eco-Evo-Devo approach to language

A plausible alternative, which does not conceive language as an exclusively endogenous or exogenous phenomenon, or sharply separates the internal and external components of language, is therefore offered in Balari & Lorenzo (2018). This new possibility - which, nevertheless requires further empirical corroborations, as Balari & Lorenzo (2018) themselves promptly acknowledge - derives from recent Eco-Evo-Devo (short for ecological evolutionary developmental biology) oriented analyses, which postulate that the organism proper, together with the environment in which it develops, engages in substantial developmental units of action. The innovational and advantageous character of said proposal lies in the fact that it appears to offer “a very suitable model for the integration of the external and internal also in the case of human language” (p. 5).

As Balari & Lorenzo (2018) explain, the interplay between external and internal factors “is business as usual in whatever biological corner you chose”, even if, when it comes to the field of cognition, such a statement is often welcomed with skepticism (p. 9). As a consequence, in order to fully get their point across and to translate the interplay between external and internal factors also to the realm of cognition in general, and language in particular – that is, to promulgate a hybrid concept of language (and of organism) - the authors offer a series of examples based on current ideas on how environmental cue-organismal response mechanisms and dynamics may be also applied to the cognitive dimension.

In particular, Balari & Lorenzo (2018) begin their exposition by analyzing the role of agreement morphology and, especially, agreement affixes in natural languages. These kinds of items pose a controversial issue within the Minimalist Program, since they appear to clearly challenge Chomsky’s thesis that language is optimally designed to express thought. Yet, as the authors indicate, agreement affixes, which are extremely pervasive and conspicuous in natural languages, do not contribute in any

way to the thoughts that are compositionally expressed by phrases and sentences. Rather, they appear to just mimic, perhaps in a redundant manner, the feature composition of other units. For instance, the plural form of a verb such as the Italian *mangiano* or the Spanish *comen* “they eat” (-no; -n, “3rd person, plural) does not refer to more than one eating event, but to more than one eaters, an information that is nonetheless independently expressed in the subject. Therefore, it is easy to comprehend how agreement affixes only appear to redundantly express the information that is already present in other elements of the same expression.

In an attempt to give a plausible explanation to such controversial issue, Balari & Lorenzo (2015a) advanced an interesting proposal based on the conjecture that agreement components are so pervasive in languages because they help to strengthen and enhance the computational system underlying the processing of internal linguistic expressions. As a matter of fact, agreement material is often available in contexts in which complex connective patterns emerge, and indeterminately distant connections take place – e.g. a **girl**¹ who **no one**² except Sarah knows² arrives¹. In order to be able to process such complex patterns, a computational system necessarily requires a powerful working space component in which partially composed expressions can be kept in memory until all the connective links are solved. As a result, the authors argue that agreement morphology may have the developmental role of “eliciting, exciting and guiding the exercise of the working space of the human computational system, until it attains its proper storage capacity” (p. 11). This means that agreement affixes do not only guide learners to capture the correct connective patterns, but, above all, they straightforwardly help and shape the organic growth of the same system that serves to learn, and then compute, said patterns.

To thoroughly corroborate their strong claim, Balari & Lorenzo (2015a) offer an illustrative case study based on child German, which is further developed in Balari & Lorenzo (2018). In child German, indeed, the subject agreement morphology system appears to be highly idiosyncratic in relation to its adult counterpart. In particular, German learning children appear to use, in some cases, different endings for the same features, while adults do not. Furthermore, children also combine different features in a unique ending, whereas adults use distinct contrasts. However, despite the fact that the child’s morphological system seems to be decidedly redundant and almost degenerate, and its use apparently highly idiosyncratic, children, in fact, do not behave randomly in this area. On the contrary, they follow their children-specific regularities. Crucially, indeed, Balari & Lorenzo (2018) argue that the degeneracy and redundancy of German children agreement system are prototypical properties of developmental systems in general. Therefore, such degenerate and redundant agreement system may well subserve precisely such developmental role. This hypothesis, as a matter of fact, fits extremely well with some additional developmental evidence.

On the one hand, it should be noticed that the emergence of the aforesaid regularities in the

child's morphological system is observed to take place just before children begin to be engaged in computationally complex constructions such as relativization, a kind of construction that notoriously widens the distance between long dependent elements. On the other hand, children with "Grammatical Agreement Deficit" exhibit significant difficulties with computationally complex tasks like German verb movement from final to initial position, an additional clear instance of long-distance dependency. However, noticeable spontaneous recovery in this area is also observed after intensive training with agreement alone. Therefore, it is easy to observe how agreement morphology appears to play a crucial role in facilitating the mastering of long-dependencies.

Furthermore, it seems to be also important to emphasize a couple of observations that give further support in favor of this idea. First of all, in contrast with other properties of linguistic expressions – such as, for instance, hierarchical organization – agreement morphology is overtly manifest in externalized expressions. Secondly, learning children are able to construct and promptly internalize idiosyncratic systems of agreement which, according to the authors' proposal, they use, in a developmental way, to target the computational system underlying the composition of hierarchically organized linguistic expressions. As a consequence, it appears reasonable to assert that these kinds of items appear to have both an internal and an external character, due to the fact that, on the one hand, they mimic public and environmental models, and, on the other hand, they in turn contribute to the constitutive and developmental process of the internal machinery that is in charge of computing complex linguistic expressions.

However, and despite its apparent innovational character, the aforementioned hypothesis does not represent a *unicum* in the biological realm. In point of fact, as Balari & Lorenzo (2018) are eager to explain, there exist many cases in which environmental cues and stimuli appear to be able to trigger organismal responses. As an instance of this kind of mechanism, the authors describe a case that refers to a particular species of sea slug, the main peculiarity of which is its brilliant green color. This exceptional coloration is the result of the sea slug's diet, based on a yellow-green alga, from which the sea slug obtains chloroplasts that are in turn incorporated into the cells of its digestive tract. These chloroplasts allow the animal to photosynthesize its metabolic needs. It is important to note, as the authors do, how, also in this case, "material external to the organism is assimilated and put into use as organelles within cells, allowing those animals cells to carry out the photosynthetic function" (p. 14). As a consequence, thus, in parallel to the case of German learning children, also in the case of this peculiar sea slug, the organism incorporates its environment into its own development in an extremely profound and almost indistinguishable manner.

As it can be easily perceived, the innovational character of Balari and Lorenzo's (2018) proposal resides in the fact that such developmental perspective challenges Chomsky's most recent strongly

internalist (and functionalist, as it has been claimed) proposal in interesting ways. Under these assumptions, indeed, agreement morphology does not uniquely represent a fundamental part of the linguistic environment - that is, E-language, for lack of a better term. Rather, it also partakes and guides the development of the internal computational system (I-language), thanks to its salient regularities which are capable of exciting and strengthen computational activity. To be fair, however, from a Chomskian functionalist perspective, it should be observed that morphology, together with the rest of the externalization apparatus, is not conceived as a crucial part of the proper faculty of language, as it has been argued previously, since it does not contribute to the creation and composition of thoughts – the purported main function of language itself. Nevertheless, as Balari & Lorenzo (2018) attempt to demonstrate, the role of morphology does not exclusively belong to the externalization side, since it enters a developmental process that eventually leads to a mature system that is capable of such compositional and constructive processes.

Balari & Lorenzo's take-home message, therefore, is an innovative and plausible one, namely a "hybrid" conceptualization of language. In this sense, language appears to enter developmental relations, which are the result of the hybridization process between the organism and the environment. These developmental relations, indeed, seem to have a "facilitation" effect on the growth, maintenance, development and construction of a system, which, otherwise, would have been extremely costly and problematic without said facilitation effect. Importantly, the authors label the exogenous component of such hybridized system as a "scaffold", that is, a typically exogenous entity, which interacts with said system in order to facilitate the development of an outcome which is otherwise difficult or impossible to achieve. Following this hypothesis, thus, the system of agreement affixes has the role of feeding and enhancing the computational system, facilitating the growth and development of its working space crucial component. Nevertheless, it is paramount to notice, as Balari & Lorenzo (2018) promptly do, that the authors' position is stronger than a plain exclusively internalist or externalist conceptualization of language. In fact, their position is even stronger "than simply claiming that language is partially composed of external materials and partially composed of internal or organic machinery" (p. 18). Considering how language grows and develops in the mind of children, what the authors aim to propose is that a clear-cut division between the external and the internal appears to be of no particular convenience. On the contrary, the authors claim that children's internal computations "hook up" to properties of the environment, which, once hooked up, do not just mimic their external counterpart. Rather, they constitute a scaffold to the computational development of children. At the same time, the organic system of computation is, following the authors' view, a developmental hybrid, in which both external and internal components – that is, both Chomskian I- and E-languages - are indistinguishably dissolved into such hybrid category – a sort of H-language. The initially environmental and external

cues, indeed, when hooked up, generate a constructive influence on the internal machinery, which eventually creates a “loop of mutually transformative influence that transforms them into a single integral system” (p. 18), synthesizing the prior separate contributions of the mind and the environment. Consequently, it appears that Balari & Lorenzo’s proposal is also making another crucial point, namely that the “externalization first” vs. “thought first” debate is also sterile, since both processes – that is, externalization and the composition of thoughts – are equally important and play a crucial role in the development of language in the mind of children.

Interestingly enough, it appears that such scaffolding effects cannot be solely relegated to the case of German children’s agreement morphology. On the contrary, they appear to be extremely pervasive within language, to the point that Balari & Lorenzo (2018) are led to conclude that such scaffolding mechanism “is the main force underlying the constructive process of languages in the mind of speakers” (p. 20). Notoriously, indeed, infants, immediately after birth, begin their life with the striking capacity of telling apart languages belonging to different rhythm typologies, even if their mother tongue is not present in the sample. This inborn sensorial attunement to salient properties of the environment is used by children to start approaching the formal contrasts underlying the surrounding stimuli. As a matter of fact, at the end of their first year of life, children achieve the capacity of discriminating the most salient distinctions of their native language, while, in turn, they exclude other inter-linguistically distinctions that they were previously able to discern. Clearly, the phonological competence of the child is not a mere copy of the capacity of their caretakers since it evidently exceeds the boundaries and limitations of the latter. Nevertheless, this sublime capacity of children shows a progressive decay, emphasizing how the child system is contemporarily converging at its adult counterpart and departing from other available instantiations of possible adult systems. According to the authors, this phonological stage is an additional example of a hybrid system. In this case, indeed, the surrounding native phonological contrasts act as exogenous scaffolds that help children to model the development of their final phonological system.

Moreover, it is important to notice that the completion of such process coincides with the emergence of word-like units. For this reason, Balari & Lorenzo (2018) argue that, again, the already established phonological competence plays a crucial scaffolding function, of an endogenous fashion in this case, in the construction of an early lexicon, due to its instrumental role in identifying recurrent segmental repetitions and the calculus of phonotactic regularities. As a matter of fact, the early lexicon is not a mere copy of a public or external lexicon. In fact, children lexicon does contain constructive principles and biases or word-like units that are alien to their referent models and, at the same time, it does not include important linguistic phenomena – such as synonymy or homonymy cases - which can be profusely found in its adult counterpart. For this reason, the authors conclude that also children lexicon

represents an exemplary illustration of a cognitive hybrid due to the fact that its self-supporting developmental nature relies both on endogenous and exogenous scaffolding effects. Finally, when children reach adult-like productive word combinations at two-and-a-half years of age, the lexicon thus far stored acts, again, as an endogenous scaffold for productive syntax, while, on the other hand, environmental utterances provide prominent entities (e.g. agreement and case) that contribute as exogenous scaffolds.

This constant (exogenous and endogenous) scaffolding process during the development of children's LF is meticulously analyzed also in Balari et al. (2020), with special attention to the development of the Lexicon-Syntax interface, a component of language that, according to Chomsky, actually belongs to the core of the language capacity, that is, to the system in charge of the internal representation of thoughts, contraposed to language's externalization components. Balari's et al. (2020) conjecture is that, on the contrary, said Lexicon-Syntax interface is "a component as dependent on the (interfaces with the) environment as any other aspect of language" (p. 153, first column). In particular, the authors observe that there is enough empirical evidence corroborating that the development of such interface is dependent on both internal and external factors.

To be sure, children begin to use their first protowords at around their first year of age, while syntax does not seem to be present until three years of age. Nevertheless, it has been observed in the literature that, even if inflected verbs are learnt by rote memory, regular verbs are properly compounded (that is, computed) afterwards, as it can be easily noticed by the numerous overgeneralized forms that characterize children's productions and that children evidently do not copy from their environmental stimuli (for instance **morido* instead of *muerto* in Spanish). Moreover, it has also been corroborated that the emergence of an early computational activity coincides with the achievement of a vocabulary size of approximately 500 words and with an increasing proportion of verbs in the vocabulary. Therefore, it can be argued that these findings reveal how the emergence of computational activity is strictly related to cross-domain interactions internal to the system, that is, the impact of the growth of a vocabulary to the capacity of combining discrete items. In parallel, they also emphasize the crucial role played by the environment in providing the acquisition of lexical units. As it can be perceived, thus, it appears that the first proto-lexicon clearly provides a first scaffold for the development of syntax (i.e. the computational system underlying language).

Importantly, moreover, Balari et al. (2020) also point out that, once the computational system in charge of syntax begins to fully work, "the learning of verbal meanings benefits from the location of verbs within certain syntactic frames" (p. 153, second column). In particular, it is explained how, for instance, causal meanings of verbs are more easily inferred from transitive contexts than from intransitive ones by children. By means of such "syntactic bootstrapping strategies", therefore, the size of the lexicon

quickly grows up in this area. The final result is a sort of developmental loop in which both subsystems - the syntax and lexicon - appear to play distinct, reciprocating developmental roles, by scaffolding each other's growth and equilibrium, before the computational architecture of language is eventually and solidly established. The onset of the process is an early proto-lexical ability that opens the way for the emergence of an incipient (not specifically linguistic) computational capacity. This sort of proto-syntax, in turn, endows the child with the capability of internalizing a proper lexicon that will empower said proto-syntax until the computational system attains its species-typical level of complexity.

As it can be seen, thus, Balari & Lorenzo's (2018) and Balari's et al. (2020) main conjecture is that, especially in the first years of life, when children are engaged in the process of acquiring their native language, both external and internal factors constantly cooperate to incite the functioning of the computational system and, in turn, to enhance its associated operative memory until it reaches its species-typical power (Balari & Lorenzo 2018; p. 22-23). The overall picture, therefore, is that of language understood as a hybrid system in which internal and external factors, with their scaffolding roles, constantly cooperate and interact, to the point that the prior separated contributions of the mind and the environment are eventually synthesized in a unique, integrated system.

Following this proposal, therefore, it is easy to understand how there is no point in conceiving language as an exclusively exogenous or endogenous phenomenon. At the same time, the study of its purported main function – may it be communication or thought composing – should not take absolute priority, since both factors are equally important for the development of language. As a matter of fact, this paper has attempted to promulgate a hybridized version of language, in which both the internal (thought-related) material and the external (communicative) component enter a developmental, reciprocating scaffolding loop, demonstrating how, also in the case of this special human faculty, there is “no rigid boundary dividing nature from culture” (Balari et al. 2020; p.157).

8. Concluding remarks

To conclude, as it has been observed throughout this paper, the linguistic literature has increasingly polarized into two diametrically opposed positions that mirror Chomsky's notorious E-/I-language distinction. On the one hand, indeed, a sector of the literature claims that language is to be conceived of as a purely external and social object, which properly belongs to speaking communities, and, for this reason, communication is identified as its main and purportedly unique function. On the other hand, the opposing view, which mainly emerges from Chomsky's latest contributions, maintain that language, an authentic biological object, powered by a strong computational system, is to be essentially understood

as an entirely internal apparatus that serves the function of providing the basis for humans' thought. Nevertheless, it has also been pointed out here that both approaches suffer from the same functionalist disease, since both positions claim that language's purported primary functions – may them be communication or the composition of thoughts – should be privileged and its investigation should take priority over the study of its subjacent form.

As a last thought, however, it should be remarked - and vindicated - that Chomsky is certainly right in regarding language as a proper natural object, which is characterized by an underlying computational procedure that is able to generate an unbounded array of hierarchically structured expressions. For this reason, it should also be stressed that the purposes and goals of Chomsky's bilinguistic program – that is, the intention of providing explanatory principles and an accurate depiction and account of language that makes sense of it as a purely natural object, as opposed to a formal or abstract social/conventional one – are entirely legitimate. Especially so, in the context of contemporary cognitive sciences, which, inevitably, as it has been argued in this paper, need to take biology into deeper consideration. However, as it has been also pointed out, the problems with Chomsky's program arise when one considers some of its conceptual shortcomings. This paper, in particular, has pinpointed two of them. On the one hand, the fallacious necessity of resorting to sharply dichotomous stances, which are no longer tenable under current biologically informed assumptions. On the other hand, the conjecture according to which language, despite Chomsky's profuse claims against functionalist approaches to the study of such human faculty, is optimally designed only to perform its function as a thought-composing device. For this reason, and with the aim of providing a more coherent adherence to the biolinguistics program, this paper has attempted to promulgate a hybridized version of language. According to said proposal, both endogenous (thought-related) and exogenous (communicative) factors are equally crucial in its development. For this reason the sharp E-/I-divide, which is not only put forward in Chomsky's voluminous production, but which, as it has been seen, actually jeopardize the entire linguistic literature, can now be surpassed in light of a hybridized conception of the faculty of language.

References

- Balari, S. & Lorenzo, G. (2013) *Computational phenotypes. Towards an evolutionary developmental biolinguistics*. Oxford University Press, Oxford.
- Balari, S. & Lorenzo, G. (2015a) It is an organ, it is new, but it is not a new organ. Conceptualizing language from a homological perspective. *Frontiers in Ecology and Evolution* 10.
- Balari, S. & Lorenzo G. (2015b) The end of development. *Biological Theory* 10, 60–72.

- Balari, S. & Lorenzo G. (2015c) Should it stay or should it go? A critical reflection on the critical period for language. *Biolinguistics* 9, 8–42.
- Balari, S., & Lorenzo, G. (2017) What Lenneberg Got Right: A Homological Program for the Study of Language Evolution. *Biolinguistics* 11, 139–170.
- Balari, S., & Lorenzo, G. (2018). The internal, the external and the hybrid: The state of the art and a new characterization of language as a natural object. *Glossa: A Journal of General Linguistics*, 3 (1), 22.
- Balari, S. & Lorenzo, G. (2019) Realization in Biology? *History and Philosophy of the Life Sciences* 41:5
- Balari, S., Lorenzo, G. & Sultan, S.E. (2020) Language Acquisition and EcoDevo Processes: The Case of the Lexicon-Syntax Interface. *Biological Theory* 15, 148–160.
- Berwick, R.C. & Chomsky, N. (2016) *Why only us. Language and evolution*. MIT Press, Cambridge.
- Benitez-Burraco, A. & Boeckx, C. (2014) Universal Grammar and Biological Variation: An EvoDevo Agenda for Comparative Biolinguistics. *Biological Theory* 9, 122–134.
- Benitez-Burraco, A. & Longa, V.M. (2010) Evo-Devo — Of Course, But Which One? Some Comments on Chomsky's Analogies between the Biolinguistic Approach and Evo-Devo. *Biolinguistics* 4.4, 308–323.
- Boeckx, C. (2012) The I-language mosaic. In: Boeckx C., Horno-Chéliz M.C & Mendivil-Giró J.L. (eds.), *Language, from a biological point of view*, 23–51. Cambridge Scholars Publishing, Newcastle upon Tyne.
- Boeckx, C. (2013) Biolinguistics: forays into human cognitive biology. *Journal of Anthropological Sciences* 91, 1–28.
- Boeckx, C. (2017) Not only us. *Inference: International Review of Science* 3.
- Boeckx, C. & Benítez-Burraco, A. (2014) Globularity and language-readiness: Generating new predictions by expanding the set of genes of interest. *Frontiers in Psychology* 5. 1324.
- Chomsky, N. (1986) *Knowledge of Language. Its Nature, Origin, and Use*. Praeger, New York.
- Chomsky, N. (1988) *Language and the Problems of Knowledge*. MIT Press, Cambridge.
- Chomsky, N. (2005) Three factors in language design. *Linguistic Inquiry* 36(1),1-22.
- Chomsky, N. (2006) The Biolinguistic Perspective after 50 Years, in [Lauree honoris causa per gli 80 anni dell'Università degli studi di Firenze. - (Università degli studi di Firenze 80. anniversario 1924-2004 ; 3)] Firenze : Firenze University Press.
- Chomsky, N. (2010) Some simple evo devo theses: how true might they be for language. In: Larson, R.K., Déprez, V., Yamakido, H. (eds.) *The evolution of language. Biolinguistic perspectives*. Cambridge University Press, Cambridge.

- Chomsky, N. (2016) *What kinds of creatures are we?* Columbia University Press, New York.
- Cummins, R. (2002) Neo-Teleology. In Ariew, A., Cummins, R. & Perlman, M. (eds.) *Functions. New Essays in the Philosophy of Psychology and Biology*. Oxford University Press, Oxford, 157-172
- Fitch, W. T., Hauser M.D. & Chomsky N. (2005) The evolution of the language faculty: clarifications and implications. *Cognition* 97(2), 179–210.
- Fodor, J. A. (1975) *The Language of Thought*, New York: Thomas Y. Crowell.
- Hauser, M.D., Chomsky N. & Fitch W.T. (2002) The faculty of language: What is it? Who has it? How did it evolve? *Science* 298, 1569–1579.
- Hinzen, W. (2012) Minimalism. In: Kempson, R., Fernando, T. & Asher N. (eds.) *Philosophy of Linguistics. Handbook of the Philosophy of Science* 14. North Holland, Amsterdam, 93–141.
- Jackendoff, R. & Pinker, S. (2005) The nature of the language faculty and its implications for evolution of language (Reply to Fitch, Hauser, and Chomsky). *Cognition* 97, 211–225.
- Karmiloff-Smith, A. (2009) Nativism versus neuroconstructivism: rethinking the study of developmental disorders. *Developmental Psychology Journal* 45, 56–63.
- Lewens, T. (2004) *Organisms and Artifacts. Design in Nature and Elsewhere*. MA: The MIT Press, Cambridge.
- Musso, M. et al. (2003) Broca's area and the language instinct. *Nature Neuroscience* 6(7), 774–81.
- Pinker, S. & Jackendoff, R. (2005) The faculty of language: What's special about it. *Cognition* 95, 201–236.
- Pollard, C. & Sag, I.A. (1994) *Head-Driven Phrase Structure Grammar*. University of Chicago Press, Chicago.
- Pullum, G.K. (2013) The central question in comparative syntactic metatheory. *Mind and Language* 28(4), 492–521.
- Rizzi, L., & Shlonsky, U. (2007) Strategies of subject extraction. In U. Sauerland, & H.-M. Gärtner (Eds.), *Interfaces + Recursion = Language? Chomsky's Minimalism and the View from Syntax-Semantics* (pp. 115-160). Mouton de Gruyter, Berlin, 115-160.