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What we talk about when we talk about biolinguistics

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Abstract: The study of the biological foundations of language is sometimes called *biolinguistics*. This particular term finds its historical origins in the 1950s, and for various reasons it has also gained considerable traction in recent years. While its increasing use apparently signals an equally increasing interest in biology, apart from a few exceptions not much is added to and beyond standard linguistic theorizing by those linguists who use it, resulting in a complex and confusing literature. This state of affairs has led, on the one hand, to the perpetuation of proposals that are hard to relate to the biological literature and, on the other, to ill-placed criticism on the progress and even the very legitimacy of a biologically-informed study of language. By reviewing different ways in which research under the biolinguistics label has been carried out, as well as some common criticisms, we hope to dispel some misconceptions about what constitutes a biolinguistic approach, as well as point out what we contend is real progress in the study of the biological bases and evolution of the human language faculty, to which the term is better and rightly applied.

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1 Introduction

The study of the biological foundations of language is sometimes called “biolinguistics”, a term that has gained considerable traction in recent years. Those who agree that something like a language faculty exists are inclined to use it as a means of emphasizing that their object of inquiry is ultimately a biological one. There are, however, two different factions that prominently adopted the term:

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- i) those who use it as a rebranding of theoretical linguistics of the generativist persuasion
- ii) those who use it as a departure from the common practices of theoretical linguistics, firmly oriented towards biology

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For those in i), this divide might not exist,. Its members will believe that there is no difference between generative linguistics and studying the biological nature of language, and perhaps rely on the Chomskyan origin of the term when holding that position. For those in ii), the divide is clear, and they believe that even though points of commonality can be found, they are scarce when compared to the points of departure. From an outsider’s point of view, who may or may not be terribly interested in the discussion, this divide might also not exist, and all uses of the term “biolinguistics” are lumped together under the first kind. Similarly, more often than not those who call themselves “biolinguists” are thought to have roughly similar conceptions concerning (i) what the faculty of language is, (ii) what degree of biological uniqueness it has, (ii) what the primitives that constitute it look like, (iii) the extent to which real engagement with other fields, especially biology, is needed, and even (iv) what work they are supposed to oppose or not care for. This impression, which we will show is not

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totally correct, can perhaps be attributed to the strong relation between the histories of biolinguistics and of generative linguistics, which many – opponents and advocates alike – indeed see as indissociable.¹

Biolinguistics, also called the “biolinguistic enterprise” or “biolinguistic approach”, has its origins in the work of Noam Chomsky and Eric Lenneberg, among a few others, beginning in the 1950s, as a reaction to the behaviorist paradigm that at the time dominated psychology and linguistics. Chomsky’s *Syntactic Structures* (1957) and his review of B. F. Skinner’s *Verbal Behavior* (1959) arguably put an end to behaviorism, emphasizing the importance and necessity of internal mechanisms – what one could call cognition – in the acquisition and use of human language. Chomsky further developed important concepts in his *Aspects of the Theory of Syntax* (1965), at the same time that Lenneberg was drawing evidence from a host of domains and fields for a biological basis for human language, which he put together in his *Biological Foundations of Language* (1967). These works are stepping stones in the shaping of biolinguistic thought, in what was in effect a change of paradigm in the study of language, though in embryonic form. Interdisciplinary meetings were later organized with the intention of further exploring and developing what seemed like an emergent discipline, and eventually the term “biolinguistics” was coined in 1974, by Massimo Piattelli-Palmarini. However, after these meetings both the term and the interest in interdisciplinary dialogue quickly faded away, giving way to sophisticated theories of linguistic structure, and remaining in obscurity for decades. Around the turn of the century, for several reasons the interest in the biological foundations resurfaced. These reasons have to do mostly with advancements in the biological sciences and a push for simpler machinery in linguistics and cognitive science (for details, see Boeckx 2013).

As can be witnessed by the volume of publications and meetings bearing the name, biolinguistics seems to have attained unprecedented support, apparently signaling increasing interest in biology as a crucial gateway for the unveiling of the nature of language. We argue that this is in fact not the case, and that most uses of the term “biolinguistics” and most research under the biolinguistics label – including in

¹ It would not be fair to say that all linguists who have adopted the term at some point are generativist (e. g. Givón 2002, though this author only uses the term as the title of a book, and does not discuss or even mention it in the work itself). It would also not be fair to say that all generative linguists are sympathetic to biolinguistics as a term or as what they feel it represents. Generative linguist Gillian Ramchand says the following in her statement for a recently held round table on the future of generative syntax:

There are parts of ‘generative’ grammar that I do not feel a particularly strong part of. For example, I am not sympathetic to recent trends in Biolinguistics, which to my mind is guilty of extreme Overreach in attempting to connect linguistics to Biology. I think it gives the whole field a bad name. The granularity gap and the terminology gap (to put it in Poeppel’s terms) are still too great to sustain the specific kinds of proposals that are being taken seriously in this sub-group.

(Ramchand 2015)

We cannot determine the kind of biolinguistics Ramchand has in mind – as we intend to show in the present paper, the literature is quite confusing –, but it seems it might be that of i), since she considers biolinguistics to be a ‘sub-group’ of generative linguistics, and most likely is more familiar with ‘biolinguistic’ proposals made those who use term as just another name for the kind of linguistic theorizing that has been common practice for decades. Also, one of the points of departure of group ii) is precisely to take Poeppel’s problems (Poeppel and Embick 2005; Embick and Poeppel 2014, see) seriously and work towards plausible bridging theories, so that the gaps become less and less great. It must be someone’s task to diminish the ontological and methodological gaps that plague interdisciplinary research, and use them not as cop-outs, but instead as research directions. A good biolinguistic will attempt to contribute to that task. We do not know what Ramchand refers to when she mentions a “terminology gap”, which she attributes to Poeppel, which we could not find anywhere in his work. We think it could be a sign of the lack of interest in the problems Poeppel brings attention to and thus in the importance of interdisciplinarity. Anyone familiar with Poeppel’s reflections will quickly recognize that terminology is *not* the issue. Poeppel’s problems will not be solved by a good dictionary. It may be worth noting in the context of Ramchand’s assessment that a similar, pessimistic statement linguists often make – and it is far too common for us to pinpoint a particular case – is that we don’t know much about the brain or its relation to cognition in general. This has been said for decades now, and while it still holds true, the amount we know is far vaster than what we used to know. Again, it is up to those interested in language as a biological object of study to make the gap smaller.

venues dedicated exclusively to ‘biolinguistic’ work – ignore biology for the most part and add little to no substance to linguistic theorizing. We contend its use has done more service to the perpetuation of proposals that are hard to relate to the biological literature than to the rapprochement of linguistics to the biological sciences, in effect impeding the kind of interdisciplinarity that a biology of language demands if it is to be successful.

This is no fault of the term “biolinguistics” – it’s hard to think of a more appropriate one if the goal is to study language in light of biology – but rather of how confusingly it has been applied. Concomitantly, most criticisms of biolinguistics or even of the very legitimacy of a biologically-informed study of language are made with unfortunate, albeit more frequent, senses of biolinguistics in mind. This results in the repetition of known debates in the history of linguistics or in theory internal disputes that do not really concern or directly bear on the biological study of language, the latter being the only sense in which the term “biolinguistics” should in our view be used, and to which we will return and clarify in § 3.

The overwhelming occurrence of what we see as less fruitful uses of the term compared to what we defend as the more fecund kind of biolinguistics would lead one to conclude that ours is simply a competing usage, no better deserving than the other usages of the term. However, we believe it’s important to rescue the term for what it really means – the biological study of language –, rather than concede that widespread misuse has rendered “biolinguistics” an accepted synonym of enterprises that already bear other names. We see no point in bringing back the term if no changes in the study of language come along. The assumption that our language capacity hinges on our biology is not enough for the ‘bio-’ prefix to be used. If it were, by the same token all fields – except perhaps mathematics – should bear a ‘physico-’ prefix, since ultimately everything in the natural world falls out from physics. Thus, we see our discussion not merely as one of terminology, but as a call for bringing biological issues and perspectives to the fore, where they can be addressed and tested. In the case of those linguists who are not interested in biological issues, certainly far greater in number than those who are interested, we fail to see the point of insisting in such a biologically charged term.

2 Different senses of biolinguistics

It is symptomatic of ‘biolinguistic’ discussions that biological issues and literature are rarely dealt with. When biology is even mentioned, it is usually through metaphors or quoted passages from linguists who use biological jargon, or rephrasings thereof. It is therefore no surprise to find that most support and criticism of biolinguistics does not bear at all on issues that serious biolinguists care about or work on. Again, just the assumption that language has biological underpinnings is not enough for biolinguistics; the main goal is trying to understand what these are.

When they criticize biolinguistics, most authors are thus actually criticizing the implausibility of certain biological proposals in linguistics, using “biolinguistics” in the same way the authors of said proposals do. This is not to say that the biolinguistics we think worthy of the name is immune to criticism; like any other approach, it is obviously not.

In what follows we will give some examples of what we see as unfortunate senses of the term “biolinguistics” in the literature (summarized in Table 1). We cannot hope to provide an exhaustive list. But we think that the following offers a representative picture.²

² We will exclude the earliest uses of the term, which precede and are not related to the earliest work of Chomsky and Lenneberg. Its earlier use, as far as we have been able to determine, goes back to at least the 1920s, when it appeared in catalogs and bulletins of the University of Michigan and also in a book on the psychology of language (Pillsbury and Meader 1928). In fact, during this time a “Laboratory of Biolinguistics” was created at that university, devoted to the study of “various forms of articulation, intonation, intensity, pitch, quantity, and the other factors which contribute to the effectiveness of discourse.” (QJS 1925). It later and more notably appeared as the main topic of a handbook (Meader and Muyskens 1950), which came to be the first major publication bearing “biolinguistics” in its title. Meader and Muyskens (1950) already contains ideas in favor of the

Table 1: Different senses of “biolinguistics” in the literature.

Sense	Description	
biolinguistics as generative linguistics (§ 2.1)	biolinguistics is synonymous to generative linguistics	
biolinguistics as minimalism (§ 2.2)	biolinguistics is synonymous to minimalist accounts of language	5
biolinguistics as the genetics of language (§ 2.3)	biolinguistics assumes that (at least some) linguistic properties are encoded in the genes, which in turn it must discover	
biolinguistics as the study of the uniquely human and linguistic (§ 2.4)	biolinguistics assumes there is something biologically unique to language and humans	
biolinguistics as analogy to biology (§ 2.5)	biolinguistics is the description of linguistic processes or mechanisms through perceived similarities with or resemblance to biological ones	10
biolinguistics as a Chomskyan enterprise (§ 2.6)	biolinguistics is whatever represents Noam Chomsky’s views at any given moment	

We also do not claim that any one author keeps to the same sense across his or her work. It does vary, be it because of inconsistency or development of one’s own conception. For example, in what we see as a particularly confusing case, the following passage seems to encapsulate most of these senses:

In the prevalent intellectual scenario, it is of considerable interest that the contemporary discipline of generative linguistics – also called “biolinguistics” – has raised the prospects for developing a form of inquiry achieved only in some of the basic sciences. Biolinguistics is arguably the only attempt in the history of ideas in which, according to Noam Chomsky, the study of an aspect of the human mind – language – is beginning to have the “feel of scientific inquiry.” Biolinguistics is currently suggesting that structure of language may be ‘perfect’ in design, not unlike the arrangement of petals in the sunflower and the double helix of the DNA. Yet these advances have been accomplished essentially independently of the natural sciences, especially biology. In that sense, biolinguistics has initiated a (basic) science in its own terms.

(Mukherji 2010: xv)

Our goal is to highlight that “nothing is gained by labeling the propensity for language as biological unless we can use this insight for new research directions – unless more specific correlates can be uncovered” (Lenneberg 1964).

2.1 Biolinguistics as generative linguistics

Many linguists who assume that the language faculty exists see their work as essentially biolinguistic: they see no difference whatsoever between generative linguistics and biolinguistics, and sometimes use the latter as a means of emphasizing that position.³

For a somewhat surprising instance, witness the glossary entry for “Biolinguistics” in Chomsky’s 2012 *Science of Language*, presumably attributable to the editor of the volume:

“[Biolinguistics:] The current name for the internalist and naturalistic study of language undertaken by Chomsky and others. Earlier descriptions for this methodology include “Cartesian Linguistics”, “naturalistic approach” and “methodological monism”. As these names suggest, those who adopt this methodology assume that language is a system in the head

dialogue between linguistics and biology, but the overall assumptions and focus differ quite markedly from the biolinguistics that started later, with the so-called Cognitive Revolution of the 1950s, and as such it bears no historical relation to the current uses. We do however concede that this earlier, pre-1950s use of the term might also be a source of confusion for those who stumble upon it in search of clarification.

³ The first author has conducted several, as-yet-unpublished interviews with prominent researchers on biolinguistic topics. In one such instance, a famous generative linguist confessed to seeing no difference between ‘generative linguistics’ and ‘biolinguistics’, remarking that they are “one and the same”, and questioning whether “there [were] such people who did not think they were.”

that is innate in some sense (grows/develops as other mental systems do) and is to be studied in the same ways as any other phenomenon, according to the usual desiderata for naturalistic scientific research. The assumptions appear to be reasonable ones: they and the methodology yield good theories of the language faculty”.

Surely, all of these “earlier descriptions” may share some assumptions, and they certainly do, but assumptions are not enough to distinguish between fields or approaches; they are just a starting point, and arguably the only part of any field that can be left untouched anyway. The claim that “language is a system in the head that is innate in some sense [...]” is not enough to equate all approaches that consider it to be an axiom. We all know – or at least find it extremely reasonable – that the language faculty is biological, but if we do not address its biological foundations we are not, in effect, doing anything bio-. The bar cannot be set as low as simply assuming a biological character somewhere down the line.

2.2 Biolinguistics as minimalism

Speaking on the distinction between the ‘weak’ and ‘strong’ senses of biolinguistics (after Boeckx and Grohmann 2007), Derek Bickerton says:

It is difficult to avoid the conclusion that adhering to the latest version of generative grammar [=minimalism] is indeed a prerequisite, not perhaps for simply attempting to engage in biolinguistics, but certainly for being taken seriously by serious biolinguists.

(Bickerton 2014: 73)

In order to make the point that Bickerton’s conclusion is misguided, we shall first reproduce here the original distinction:

The weak sense of the term refers to “business as usual” for linguists, so to speak, to the extent they are seriously engaged in discovering the properties of grammar, in effect carrying out the research program Chomsky initiated in Syntactic Structures.

The strong sense of the term ‘biolinguistics’ refers to attempts to provide explicit answers to questions that necessarily require the combination of linguistic insights and insights from related disciplines (evolutionary biology, genetics, neurology, psychology, etc.).

(Boeckx and Grohmann 2007: 2, our emphasis)

We believe this distinction should no longer be maintained. The reason is that for linguists to be seriously engaged in discovering the properties of grammar they must combine linguistic insights with insights from other fields, and there is no way around it. There are of course different ways of going about this task, but any route will require dealing with different disciplines. This ‘weak sense’ of biolinguistics, inclusive as it was, now almost 10 years ago, has not yielded any findings that could not have been reached by a linguistics without mention of biology. The ‘weak sense’ was perhaps useful at the onset of the biolinguistics revival (and also of the Biolinguistics journal, where it was introduced) as a way of prompting reflection by those who understandably do not want to get their hands ‘wet’, but still think biology is worth considering when coming up with theories of language. This has not happened, as far as we can tell, as linguistic theories and the entities they posit are still of the same, *sui generis* kind. In other words, the “extent [to which linguists] are seriously engaged in discovering the properties of grammar” has been null in the context of biology. The biggest motivation behind most linguistic theorizing is still to account for attested linguistic variation, and to do so in such a way that the attested range fits. This can be done completely independently from biology, and in fact it is. To actually understand how the child acquires a language, we need to understand what goes on in the child’s brain and how it got there, and not just derive an “explanation” from our preferred formalizations of language. A logical argument is not necessarily a plausible biological argument. We see this as a clear indication that ‘business as usual’ will not cut it for studying the biology of language. Linguistic description is a fine research topic, and it becomes more interesting when the theoretical tools are more sophisticated than

before, but it is now clear that there is no need to call that enterprise ‘biolinguistics in the weak sense’ if biology is left at the door and used just rhetorically.

Bickerton himself, just before his quote above, seems suspicious of the success of this distinction:

Fears widespread among both linguists and non-linguists that ‘biolinguistics’ may turn out to be merely a more scientific-sounding term for generative minimalism are reinforced by the way the distinction is made between ‘strong’ and ‘weak’ senses of biolinguistics by Boeckx and Grohmann (2007: 2).

(Bickerton 2014, 73)

Bickerton justifies his suspicion by conflating the two senses into the ‘weak’ one, and goes on to criticize the practices of minimalists when dealing with biology and more specifically Evo-Devo, with the general idea being that they cherry-pick their biology in order to support their minimalist claims. This is very clear from the following quotes from Jackendoff (2011):

In recognition of the goal of interfacing linguistic theory with biology, practitioners of the minimalist program have begun calling the enterprise (e.g. Jenkins 2000, Larson et al. 2010, Di Sciullo & Boeckx 2011, and the online journal *Biolinguistics* (www.biolinguistics.eu)).

(Jackendoff 2011: 589)

In each case the proposed answer is also motivated on grounds internal to language, and in each case it differs from the proposals of the minimalist program and biolinguistics, which are based on criteria of ‘perfection’, optimal design, and efficient computation.

(Jackendoff 2011: 617)

But the conflation we are focusing on here should go the other way: if there is a failure to properly deal with biology on the part of minimalists, it is the strong sense that should be preserved as the biolinguistics worthy of the name, and the weak sense demoted.

2.3 Biolinguistics as the genetics of language

In generative grammar, the fact that the very specific properties of UG cannot by definition be inferred from the environment has quickly led to the assumption that they are to be found in the genes. This idea has been expressed in several ways throughout the recent history of the field, with terms like ‘linguistic genotype’ or ‘genetic endowment’ becoming staples in the UG literature, as the following quotes illustrate.

The first section [of the book] includes contributions from Howard Lasnik, Tim Hunter and Paul Pietroski. The three chapters address issues regulating the derivations of FLN [Faculty of Language in Narrow sense], as well as more general issues pertaining to the mapping of syntactic expressions onto logical forms. By doing so they raise fundamental questions on the nature of FLN and its interfaces with the semantic system, addressing the central biolinguistic questions on the properties of the genetic endowment of human language. The discussions on the properties of the form of the operations and the derivations on FLN contribute to theoretical biolinguistics.

(Di Sciullo 2012: 1)

The theoretical proposals of results from experimental studies present genuine contributions to the Biolinguistic program. They contribute to our understanding of the properties of the interfaces derived by the computations of FLN, viewed as an organ in human biology. The chapters add to the usual notion of interfaces, which is generally understood as the connection between the semantic system on the one hand and the sensorimotor system on the other. They raise novel interface questions on how these connections are possible at all. They anchor the formal properties of grammar at the interfaces between language and biology, language and experience, as well as factors reducing complexity.

(Di Sciullo 2012: 1)

[...] language emerges through an interaction between our genetic inheritance and the linguistic environment to which we happen to be exposed. English-speaking children learn from their environment that the verb *is* may be pronounced [iz] or [z], and native principles prevent the reduced form from occurring in the wrong place. Children learn from their environment that *he*, *his*, etc. are pronouns, while native principles entail where pronouns may not refer to a preceding noun. The interaction of the environmental information and the native principles accounts for how the relevant properties emerge in an English-speaking child.

(Anderson and Lightfoot 2000: 6).

Numerous practitioners in biology know that this gene-centric view is far too simplistic. There is no direct route from a linguistic entity – or a native principle [that prevents] the reduced form from occurring in the wrong place –, and a gene or genes. For this reason, we think that biolinguists should refrain from narrowing the domain of the field to genetics, and should avoid conflating nativism and geneticism.

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2.4 Biolinguistics as the study of the uniquely human and linguistic

The idea that whatever constitutes the faculty of language is uniquely linguistic and uniquely human has received a great deal of attention. This has become very obvious especially after the work of Hauser et al. (2002) who make the distinction between Faculty of Language – Broad Sense (FLB), that is, that which contributes to language but is not unique to it or humans, and therefore to be found in other domains and species, and Faculty of Language – Narrow, sense (FLN), that which is unique to language and to humans. It seems that most researchers in the field of generative linguistics went for the latter. The result has been that many expect FLN to be the main focus of inquiry of biolinguistics, and this goes for proponents of generative grammar and more specifically FLN, who do not recognize the importance or even the legitimacy of studying broader, shared mechanisms, and for critics, who mistakenly think FLN is what biolinguists must care about and therefore incredulously await for evidence of such biological uniqueness. It is then no surprise to find ‘laments’ like the following:

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But if language is a biological object, as anyone holding a biolinguistics view must assume, then language must have at least some biological, that is physical, properties. Furthermore, specifically biological linguistic properties must be at least in some aspect different from biological non-linguistic properties. Yet, the biolinguistic enterprise has not specified a single biological property that is uniquely linguistic.

(Behme 2015: 38)

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It is sometimes hard to distinguish between critics’ own assumptions about biology and their emulation of what they perceive the biolinguists’ assumptions to be, for the sake of their argument. Whatever the case, there is no reason to hold that just because language is due to biology, that it should have ‘specifically biological linguistic properties [that] must be at least in some aspect different from biological non-linguistic properties’. Behme’s (2015) criticism⁴ is thus addressed at those who think that some form FLN – that which is defined as biologically unique to language and humans – is the only thing worth studying, a group which not only is not representative of all biolinguists, and certainly not of those who pay attention to evolutionary biology, but is also most likely wrong, for reasons we discuss elsewhere (see Boeckx 2013), but also hint at in § 3. The lack of evidence for a biologically special linguistic structure is a failure only for defendants of the FLN/FLB distinction (and even more so for those who focus on FLN or take it to be the interesting half of the distinction).

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This kind of criticism will most likely continue to occur for as long as linguists presuppose or insist on the idea that language is a well-delineated, well-confined, *sui generis* biological ‘organ’, and definitely for as long as they proclaim that to be a (or the) central tenet and focus of biolinguistics.

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2.5 Biolinguistics as analogy to biology

Yet another sense in which biolinguistics is used is as an analogy between language and biology, that is, drawing commonalities between perceived structural and evolutionary principles of language and those of

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⁴ It is worth noticing that Behme (2015) is a continuation of an ongoing discussion with another author, which revolves around what is called ‘Chomsky’s biolinguistic ontology’ – despite the far more ambitious and generic title –, and as such qualifies for what we have identified as ‘biolinguistics as a Chomskyan enterprise’. Ultimately, the discussion does not bear on what we believe are genuine biolinguistic concerns.

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biological structures in general. Analogies and metaphors can be used to one's advantage, to convey a particular point, but there is nothing to be gained from saying that the evolution and nature of language is akin to that of organisms in general if nothing more than superficial (and not very clear) resemblance connects them. Instead, it is important to recognize that the mechanisms that subserve language evolution and development are *the same ones* that are valid for all of biology. In other words, it is not the case that there is one set of mechanisms that subserve biology *and* one set of mechanisms that subserve language exclusively (and therefore no reason to make the latter resemble the former while keeping them separate). The faculty of language – whatever one thinks it is – is part of nature, and as such it is subject to biology and ultimately physics, as one other aspect of living things. As an illustration of the sense discussed in this section, recall Mukherji's passage, which we quote on page 5, where he says that "Biolinguistics is currently suggesting that structure of language may be "perfect" in design, not unlike the arrangement of petals in the sunflower and the double helix of the DNA". The allusion to petals in the sunflower or the double helix of the DNA, though poetic, does not serve any purpose other than somehow – in the mind of the author – offering further validation of the *bio-* prefix. A demonstration of the *same principles* in action would be more interesting.

Witness, for example, the following passage, from a recent chapter entitled "Object pronouns in the evolution of Romanian: A biolinguistic Perspective":

The notion of language evolution goes beyond the classical notion of language change and grammaticalization (Roberts & Roussou 2003) by incorporating recent results from evolutionary developmental biology. This incorporation has both descriptive and explanatory advantages over classical notions of language change and grammaticalization. The descriptive advantage is that fluctuating stages are predicted to occur and can be described systematically. The explanatory advantage is that questions such as why languages change and why grammaticalization exists can be addressed on the basis of the existence of general laws governing the development and evolution of biological form.

(Di Sciullo and Somesfalean 2015: 272–273)

This instance of "evolutionary developmental biology" above, which we assume motivates the title chosen by Di Sciullo and Somesfalean (2015), constitutes the only mention of biology in the whole text. The reader is then left wondering about what "recent results from evolutionary developmental biology" the authors have in mind, and what "general laws governing the development and evolution of biological form" support their work. The authors point to what they call the 'Directional Asymmetry Principle', already in Di Sciullo (2011), according to which "language evolution is symmetry breaking", an analogy to the notions of symmetry breaking in physics in biology. But no rationale is given for the choice of analyzing the properties of Romanian in such a way, as no discussion of how one gets from the underlying, micro scale mechanisms of symmetry breaking to the faculty of language and then to variation in languages. And much less for why this would be the key factor. It seems to us that many important steps are being skipped if one can jump directly from the impressionistic appropriation of biophysical mechanisms to diachronic variation of any one language, specially while ignoring what should be the main topic of any biolinguistic inquiry: language as a cognitive faculty. It is interesting to observe that proposals inspired by other work – as opposed to proposals *built on* on other work – tend to ignore everything else around it and assume it as all-explanatory.

2.6 Biolinguistics as a Chomskyan enterprise

All of the major senses of biolinguistics we have distilled from the literature (as generative linguistics, minimalism, genetics of language, study of FLN, and analogy to biology) have one thing in common: they are all equated with Chomsky's work or work heavily inspired by it. From there, a more generic, blanket-sense becomes clear: biolinguistics as a (or the) Chomskyan enterprise. Chomsky's work is undeniably polarizing: it seems that one is supposed to be either for it or against it as a whole (of course, some variation on the details is allowed). We find it fair to say that both supporters and critics of Chomsky's take his role in the genesis and development of biolinguistic thought to mean that all of biolinguistics must rest

upon and be confined by his and his followers' work and opinions, and as a result endorse or dismiss a field that is far broader. 1

It is then not surprising to find passages such as the following:

For decades *Chomskyan biolinguistics* have [sic] failed to respond to arguments showing that their research program rests on an internally incoherent ontology. [...]I conclude that six decades after the Chomskyan revolution, the foundations of biolinguistics remain internally incoherent. 5

(Behme 2015: abstract, our emphasis)

The idea that Chomsky's work and biolinguistics are equivalent is also found in non-linguistic literature: 10

The idea that language can be approached in these terms is stressed in some recent work under the heading of Biolinguistics (see e.g. Chomsky (2005)). While we are sympathetic to many of the (mostly programmatic) suggestions in *Chomsky's work*, in practice much of the work that falls under that particular heading differs markedly in focus from the programme that we advance here.

(Embick and Poeppel 2014: note 3, our emphasis) 15

The fact that these authors refer to biolinguistics "in the third-person" also goes to show that the way in which the term has been used despite its core meaning is indeed confusing. Something has gone wrong if someone who actively studies the biological properties of language (and who frequently points out important methodological problems that redefine this endeavor, e.g., Poeppel and Embick 2005) does not identify with biolinguistics. A quick glance through Poeppel's work will reveal a much closer approximation to serious biolinguistic work – studying the biological properties of language – than what is the case in the work of those who most frequently use the term. 20

Incidentally, we think that another valuable insight can be gained from this passage. There is indeed a strong impression from outside of linguistics that Chomsky's work offers mostly programmatic proposals, suggesting that failing to go beyond it will prevent progress from actually taking place. It is the role of biolinguists to go beyond programs and towards proposals. 25

Returning to the notion of biolinguistics as Chomsky's work in the way it is used in the linguistic literature, we think that the sort of pluralism that a genuine biolinguistics demands forces us to cast a much wider net and gather insights not only from the generative tradition in linguistics, but also from approaches that are often taken as incompatible with the orthodox Chomskyan viewpoint, for instance work in cognitive linguistics, Construction Grammar, etc. 30

3 A biologically informed study of language 35

It is not reasonable to expect one researcher to be an expert in all fields that form part of the attempt to elucidate the biological foundations of language. But they must care. As there is still no degree in biolinguistics, any one who calls himself a biolinguist will have a specific background that might dictate more or less the way in which research is carried out, but they must nevertheless pay attention to the information and solutions from other fields, as a compass of sorts. This is now a central concern in biology at large, where it has become apparent that progress lies on being aware and ideally comfortable with neighboring fields, and this is something that must be fostered already at the undergraduate level or even before, in an effort to ensure that real interdisciplinarity becomes not only possible but also the norm. The modern field of Systems Biology arose out of concerns of this kind, and efforts are being put in place to ensure that the research methods of biological properties go hand in hand with their eclectic nature. The same way that it is now understood that biological properties are not controlled by single genes, but instead are the result of complex, dynamic interactions between genes, the environment, and everything in between, the fields that are necessary for the study of all these aspects are diverse, and must come together in a dynamic interaction as well (Cvijovic et al. 2016). The lesson from Systems Biology that we ought to pay 40 45 50

attention to is that compartmentalization should be fought against: it is when borders are crossed that real progress takes place.⁵

In practice, being a biolinguist means both collaborating with researchers in other disciplines and becoming well versed in their methods and literature. The findings and proposals ranging from genetics to neuroscience to cultural transmission must inform and constrain biolinguistic proposals. And a good biolinguistic proposal will have ramifications that make sense in others fields as well. This does not mean forcing hot topics into every proposal (e. g. whenever a gene is discovered to have played a crucial role in human evolution or development, this should not be taken as *carte blanche* for proposing that gene as the one for language). Instead, it means bearing in mind that for a theory to be good, it must make sense in light of what is known independently. Thus, a good theory of the language faculty must be constrained by biological theory, that is, what doesn't make sense in biology cannot make sense in a theory of language.⁶

An important step towards achieving a biologically plausible account of language is thus to rethink and, if need be, do away with notions used traditionally in linguistics. A fair reaction to this call would be to ask “why, and why not have the biologists adapt to linguistics?”. The answer is very simple: biologists are not doing linguistics or studying what are ultimately linguistic objects. Because the converse is claimed to be true, linguists have to be prepared for the primitives they posit and the theories they formulate to be scrutinized by the biologist who comes across them, and they should actually foster this kind of interaction. We find it remarkable how many linguists set themselves apart from the ‘traditional linguist’ by making clear what their assumptions are, and by actively seeking theoretical sophistication, but at the same time play down concrete biological insights and resist interdisciplinary efforts, taking cover behind the ‘linguistics is biology at a suitable level of abstraction’ mantra. This only contributes to an insular and basically unfruitful state of affairs. Linguistics must come to grips with biological information if dialogue is to take place. Developing its own ontology, though a guarantee of circumscribed success, is not the way to do it. The advantages of making dialogue and interaction possible are not only on the side of the linguists interested in language in a biological context, but also on the side of the biologists who may profit from insights coming from linguists, something which so far has not really happened either. If linguists do not worry about the evolution and brain implementation of what they posit, no one else will do that for them.

The exact notions that warrant serious rethinking should become apparent as interdisciplinary research proceeds. If a notion cannot be accommodated by – or, more importantly, if it is shown to be completely at odds with – current biological theory and data, that's a red flag. Such a notion will need to be reframed or even abandoned. This is a customary procedure in all sciences, and it need not be taken as radical. Anyone

⁵ In the specific case of biolinguistics, the need for change is perhaps even more urgent, given that a large portion of what makes up the study of language typically finds a home in departments of humanities, whose academic and administrative practices are far removed from those of the hard sciences. Opening up or facilitating the possibility of attending introductory courses in different subjects, even if it means going to different departments or faculties, would be a good way of encouraging interested students to adopt an interdisciplinary mindset. At the graduate level, taking in a co-advisor from a different field should be seen not as something exotic and out of the ordinary, but instead as something to be fostered. Ideally, the study of language as a capacity would not be tied to humanities departments, but instead become a topic of interest that can be studied at different departments depending on the specific problem to be studied. This is not to say that such fertile environments for the study of language do not exist at all; they do, but they are few – too few given the complexity of the problem but also the inherent interest this field attracts even in the general population. Making these proposals a reality will also depend on the perceived virtues of the interdisciplinary study of language, i. e., genuine results. It is the role of those already in a position to make a difference to highlight the benefits of interdisciplinary approaches, both as instructors and as researchers.

⁶ It goes without saying, as we hope is apparent throughout this paper, that we are not addressing linguists who explicitly do not care about the nature of language, whose work is not affected in the slightest by biological considerations (say, if biology changed overnight beyond recognition, the work of the descriptive linguist would remain unscathed; what they do is devise formal descriptions of patterns in linguistic corpora).

whose goal is to get closer to a good biological theory of language should be glad to proceed this way: 1
whittle away whatever isn't biologically plausible (or recontextualize it in a biologically plausible manner).
As an example that merits this treatment given current biological knowledge, we'll discuss the notion of
uniqueness.

No one doubts that only humans have language, and that this fact makes humans special. One way – 5
perhaps the way that prevailed until recently – to get to the bottom of this fact is to look for something
biologically unique in humans, which by process of elimination makes them, indeed, special. This is also
what led Hauser et al. (2002) to propose the FLN/FLB distinction – they recognize that the faculty of
language must have evolved, yet they still want to account for its uniqueness. The focus should, however,
be on FLB (to the point where the distinction stops making sense). We should abandon a top-down, 10
anthropocentric perspective (why humans are different from other species) in favor of a bottom-up
perspective (what humans have in common with other species). This kind of bottom-up approach is in
fact one of the traits of the minimalist program in linguistics (“approaching UG from below”; Chomsky
2007), but the important motivations for it are not always kept in mind. The goal is not to have a minimalist
theory (that's a consequence); it is rather to assign biological concerns the role they undoubtedly deserve. 15
We should then go further: We should look for basic underlying mechanisms in the animal kingdom, as
opposed to looking for “human” cognitive capacities, which anyway are only human in hindsight; evolu-
tion is not goal-oriented. The way to best interpret this message is to follow the wide-ranging bottom-up
approach in comparative psychology, which de Waal and Ferrari (2010) herald in a recent opinion article.
They ask the following question: “What if we were to replace our obsession with complex cognition with an 20
exploration of basic processes? Instead of asking which species can do X, the question would become how
does X actually work?”.

There's another, related reason for rethinking uniqueness: When one looks at it from an evolutionary
point of view, it becomes *novelty*. The bar is set very high for what constitutes a novel trait:

A morphological novelty is a structure that is neither homologous to any structure in the ancestral species nor homo-
nomous to any other structure of the same organism.

(Muller and Wagner 1991: 243)

This looks like a generalization of Hauser et al.'s (2002) FLN. But current biology, especially under the
impetus of Evo-Devo, finds it very hard to be certain about real examples of novel traits, even if we are just 30
looking at non-cognitive, morphological ones (Moczek 2008; Prud'homme et al. 2011). In other words, in
biology things are extremely unlikely to be truly unprecedented; they are built on top of previous
structures, different from the end result that we see but extremely important in its history and nature.
This is not a problem for the researcher with little interest in the real biological implications of his work or
the theories that support it. But for the serious biolinguist it forces a rethinking of what it means to deem 35
language a novel, *biologically unique* trait, on the one hand, and what it means to study it from a biological
point of view, on the other: as a problem (Martins and Boeckx 2016; Boeckx 2016), and not as a mystery
(cf. Hauser et al. 2014).

Thus, in more practical terms, a biolinguist should not be surprised with – and should in fact
welcome – the study of phenomena that apparently have nothing to do with language or with humans. 40
This goes for behavioral phenomena across domains and species, in an attempt to disentangle and
understand basic mechanisms that subserve linguistic abilities, but also for different levels of analysis of
these phenomena. By different levels of analysis we are of course not referring here to the traditional
divisions in linguistics (syntax, semantics, phonology, etc.), but instead to the different dimensions one
has to travel through to get from the phenome to, ultimately, the genome. It is essentially a “translation” 45
task. If we do our job the right way, that is, if we build “linguistic models that are explicit about the
computational primitives (structures and operations) they require, and that attempt to define linguistic
problems at a fine enough grain that one can discuss algorithmic and implementational approaches to
their solution” (Fitch 2009), we can reconcile what we know about language with what the geneticists,
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the neuroscientists, and the neurobiologists know, instead of resisting to do so and asserting and/or complaining that so little is known in these areas.

No one doubts that language is special, but maybe none of its components are, and what is remarkable is to find them all in the same organism, reshaped and put to new use. Chomsky has actually hinted at this point before:

Now a question that could be asked is whether whatever is innate about language is specific to the language faculty or whether it is just some combination of the other aspects of the mind. That is an empirical question and there is no reason to be dogmatic about it; you look and you see. What we seem to find is that it is specific.

(Chomsky 2000)

In the context of the FLN/FLB distinction, this point was also brought up:

Something about the faculty of language must be unique in order to explain the differences between humans and the other animals – if only the particular combination of mechanisms in FLB.

(Fitch et al. 2005: 182)

The claim above actually renders the whole notion of FLN (and thus the FLN/FLB dichotomy) useless. In fact, perhaps in recognition of that very state of affairs, [Fitch 2011: 384], in a departure from the work he did with Chomsky and Hauser, seems to have abandoned the distinction altogether, and we think he is right:

[...] the distinction between general and linguistically specialized mechanisms is hard to draw, even in those cases where the mechanisms seem fairly clearly defined. Most areas of language are not, and will not soon be, so clearly defined, and the distinction itself is of little use in furthering our understanding of the mechanisms.

One thing that the biolinguist must do in order to capture the dynamic way in which complex traits come to be – they do not come out of nowhere – is to explore the role of development. This approach is embodied in Evolutionary Developmental Biology (Evo-Devo) (Figure 1). This is no easy task to undertake, and caution is needed: Evo-Devo is not a straightforward, well-delimited field, but rather an approach that seeks to reconcile evolution and development – an aspect lacking in (neo-)Darwinistic versions of biology, prevalent at the time contemplation of language in a biological context started.

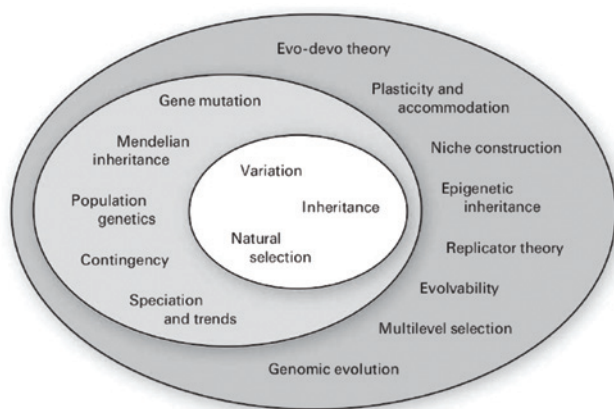


Figure 1: The current Evo-Devo landscape [Pigliucci and Muller, 2010].

As an example of how taking development into account forces the rethinking of long-held assumptions, recent genetic research indicates that one quality that the language faculty *doesn't* display is homogeneity – there are individual developmental differences at the neuronal level that are influenced

by genetic factors (Kos et al. 2012; Le Floch et al. 2012). Results such as this pave the way for contextualizing language in a broader picture. 1

There are many examples of work which in our view is on the right track, and could be taken as illustrative of the direction that seems most fruitful for the study of the biology of language. Poeppel and colleagues' work on a model of processing based on neuronal oscillations is one such clear example 5 (e. g. Giraud and Poeppel 2012; Ding et al. 2016). There is also very important work that seeks to explicitly explore and characterize the genetic underpinnings of language, which shows the inadequacy of the single-mutation story that many linguists naïvely insist on. It shows us that language, like other aspects human biology and behavior, is a product of the intricate workings of neuronal circuits, which are shaped by a complex network of genes in interaction with environment. Figuring out the molecular biology of language is 10 not a small detail that researchers of language should not care about and leave to whoever feels like picking it up: it is a necessary condition for understanding how language came about and why in humans. An easily digestible review of work of this kind is offered by Fisher and Vernes (2015), who themselves along with many colleagues have contributed immensely to it over the years. Animal models are also essential for this endeavor, particularly in the identification of further genes that affect language related disorders (such as 15 *FOXP2* or *CNTNAP2*), a crucial window into how language works (see Vernes and Fisher 2013). In this context, but also in the pursuit of neural mechanisms that may underlie human speech and language, much valuable work has been done and seems to us to be of increasing importance, namely in the case of vocal learners among birds and bats, which lend themselves to fruitful comparative research (for reviews of important work 20 by some of its main representatives, see, for example, Fitch 2010; Fitch and Jarvis 2013; Chakraborty and Jarvis 2015; Okanoya 2015; Rodenas-Cuadrado et al. 2015). There is of course much that could be mentioned, but we believe that looking into the nature and insights of the work of the kind we have alluded to here paints a realistic picture of what we see as the way forward.

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4 Conclusions

We do not own the term 'biolinguistics', and obviously people are free to use it in any way they want. But our impression is that work under the rubric of biolinguistics often tends to be dismissed by researchers from other disciplines because they associate the term with one or more of the senses we have reviewed in 30 this paper.

We cannot disagree with Eric Raimy when he writes that:

Biolinguistics is the current buzzword adopted by linguists pursuing a particular branch of generative grammar closely associated with Noam Chomsky's Minimalist Program (Chomsky 2005). This word refers to a combination of aspects of 35 biology and linguistics that varies depending on the particular researcher and the particular moment.

(Raimy 2012: 926)

Indeed, this seems to be an accurate description of those we included in group i), in our introduction (§ 1). We do not see how using the term as a more modern sounding buzzword for (generative) linguistics will do any service to the study of language from a biological point of view. If anything, the contrast between the 40 ambitious *bio*- prefix and the naïve biological notions that usually come along with it is more likely to further the gap between linguistics and the biological sciences than it is to bring them closer together.

But, like him, we think that there is a far more promising use of the term:

If we interpret biolinguistics as a research program that is dedicated to understanding the relationship between the 45 genotypes and phenotypes responsible for explaining human language, the benefits of collaborations among biologists, linguists, psychologists, cognitive scientists, and zoologists are clear. Each scientific field provides a unique perspective of the content within this expansive definition.

(Raimy 2012: 927)

We hope that integrative works along these lines will prosper.

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