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Why Only Us. Language and Evolution

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Why Only Us is an engaging, debate-stirring book written in a clear, accessible style that brings together some of the most hotly discussed issues from decades of research into the evolution of language. From the nature of Merge through population genetics to Neanderthals, the book touches on a very wide range of topics that are right at the centre of today's controversies. Here we will comment on the most important aspects of the authors' view of how language —and particularly its computational core— might have evolved, while at the same time exploiting the productive space their proposal opens for disagreement. We believe the value of this book resides not only in the well-informed and up-to-date view of language evolution it puts forward, but also in the exceptional way in which ideas are intertwined with questions throughout the text, allowing readers the creativity to extract their own conclusions. We explore all of this right below.

The book is divided into four beautifully interrelated chapters, all of which cover a variety of common issues and recurrent questions, each from a specialised perspective. The first and longest chapter, "Why now?", introduces the reader to the aims and starting points of the book, and goes on to discuss the notion of Darwinian continuity and some of the latest developments in population genetics, in an effort to explain how the evolutionary novelties that gave rise to language might have initially spread through a small-sized population. Chapter two, "Biolinguistics evolving", focuses on the structuring of the language faculty into three components —a computational system responsible for syntax (ideally reducible to Merge), a conceptual-intentional system for thought¹, and a sensorimotor system for externalization, plus interfaces— and justifies the authors' 'divide-and-conquer' approach, anticipated early in the book (p. 2), that leads to a focus on the computational component in the following chapter. "Language architecture and its import for evolution" then introduces an abstract analysis of the computational properties of human language syntax (a question retaken in Chapter 4), emphasising its human-specific nature and its centrality in what makes the language faculty so special and distinct from animal systems like birdsong. Finally, Chapter 4, "Triangles in the brain", re-addresses many of the questions posed earlier in the book, and presents a proposal of how the fundamental elements of the computational system and its interface to the conceptual-intentional system may be implemented in the human brain. The chapter also touches on the Neanderthal issue, and provides a tentative answer to the 'where' and 'when' questions of human language evolution.

¹ Thought here understood as "inference, interpretation, planning and the organization of action" (p. 11) among other tasks involving internal representations.

Overall, the book works as a continuous, cohesive whole, with questions constantly being re-examined from different, new perspectives. In what follows we will discuss each of these issues, while highlighting the importance of the authors' basic assumptions about language, which lie at the core of their proposal and are crucial for its articulation.

To understand the scope and limitations of the authors' view of how language has evolved, it is necessary to start by looking at what the book tries to accomplish. Three aims seem to us to be accorded a central place in the discussion: (i) the refinement of the language phenotype, as a way to better understand *what* exactly has evolved (p. 2); (ii) addressing common misconceptions about how newly evolved traits spread through populations, positing the need to incorporate stochastic effects into the picture (p. 23), and (iii) resolving the tension between Darwinist continuity and evolutionary change (p. 3), by showing that a view based on infinitesimal evolutionary modifications may not be able to correctly account for the emergence of traits like language. Let's look at these separately.

As to (i), it is quite indisputable that *some* characterisation of language as a cognitive trait is necessary for any account of its evolution. It is also true that any cognitive characterisation, such as the tripartite model of language presented in the book we are discussing, with its three-component structure, will invite the search for certain things and not others at the deeper biological levels (i.e. our neural reality, our genome, etc.). However, it is easy to imagine how a mistaken definition of the language phenotype would lead us to search for things that are simply not there in the genotype. This is to say that, as we go deeper into our biology, we may not always find what we expected from our cognitive model of language. In this sense, the top-down perspective advocated in *Why Only Us* might have its shortcomings. On the other hand, adopting the opposite, bottom-up perspective might seem like the way to advance on safe ground, in the sense that one cannot possibly find what is not there if one starts by looking at the biology of things. However, the search in this direction might be blind and ultimately fruitless without a cognitive model to which findings can be related. What this illustrates is that the so-called 'granularity problem' —the problem of 'matching' units at the different levels of analysis or biological depth— is at the moment a core difficulty for investigating language from a biolinguistic perspective, and it seems that only a combination of bottom-up and top-down approaches might work, at least for the uniquely human components² (i.e. the computational and conceptual-intentional systems and their interfaces).

As to *what* has evolved, this is of course a central question that any account of language evolution must answer. As the authors point out (p. 2),

² As for the sensorimotor system, the availability of animal species with which vocal learning and production are shared has significantly cleared the way for bottom-up approaches, resulting in a much deeper knowledge of the externalisation system compared to the computational and conceptual-intentional ones. We return to this issue below.

the answer to this question is crucial to how wide or narrow the gap is between humans and other species. Here again the depth of biological perspective comes into play, this time perhaps more in the shape of a contrast between the ‘ingredients’ of language and language as a ‘whole’. What has evolved, strictly speaking—and leaving evo-devo effects out of the picture—, is the genotype, of course. In the Chomskian tradition, this—the genetic component responsible for the language capacity—is often called Universal Grammar (UG) (p. 6). As is well known, in general, changes in the genotype manifest themselves in the phenotype, and in fact minor changes in the former may be responsible for large-scale differences in the latter (p. 35), but that does not affect the basic fact that what evolves is the genotype, not the phenotype. However, we have noticed that some confusion may arise from the fact that the language phenotype (i.e. language as a cognitive entity) is (rightly) considered by the authors in purely biological terms. Throughout the book, they insist that in the context of the biolinguistic enterprise language is conceived of as an object of the biological world, as a ‘cognitive organ’ (pp. 53, 56). This is of course right, as it is the only rigorous scientific way to regard language. But at some points in the book we get the impression that because language as a phenotype is treated as a strictly biological object, it is somehow possible to say that it ‘evolves’ too, by association with the genotype. We believe this is a dangerous implication³, and should be avoided. The misunderstanding is perhaps especially obvious where the gap between humans and other animals is brought up, something that relates directly to the third relevant aim of the book (iii). Consider the following statements: “[...] since no other animal has language, it appears to be a biological leap, violating Linnaeus’s and Darwin’s principle, *natura non facit saltum* [...]” (p. 2); “[...] Darwinism demanded [...] ‘numerous, successive, slight modifications’ between our ancestors and us. Yet there is a yawning chasm between what we can do and what other animals cannot—language.” (p. 110). If what has evolved determines how wide the gap is between us and other species, then this has nothing to do with the language phenotype, but rather only with the language *genotype*. The ‘yawning chasm’ between language and no-language exists only at the phenotypic level, that is, insofar as we—and no other species—have a language that yields “a digitally infinite array of hierarchically structured expressions with determinate interpretations at the interfaces with other organic systems”⁴ (p. 110). At the genotype level, however, there is no such chasm: as Chapter 4 suggests, a tiny modification at this level could have been responsible for the formation of a ring-shaped neural circuit in the human brain that might be responsible for some of language’s fundamental human-specific features (p. 161); this circuit exists in macaques and chimps, but is just short of forming a complete ring (pp. 163-164). A small difference in the genotype, leading to a minor difference in neural phenotype, could therefore be responsible for a

³ Implying that the phenotype evolves could be seen by some as an instance of Lamarckism.

⁴ This is what Berwick and Chomsky call the Basic Property of human language.

very large cognitive phenotypic difference. Evolutionary continuity, we believe, must be assessed at the genotypic level, not by looking at the language phenotype.

We now turn to the second relevant aim of the book (ii), involving population genetics. In Chapter 1, the authors try to address what they perceive as common misconceptions regarding the way in which a newly emerged trait can initially spread through a population. They believe that the relevance of stochastic or (roughly speaking) ‘chance’ effects has not been correctly assessed in the early stages of this process, and that this is crucial for the case of language evolution, where a beneficial genotypic change might have occurred in one individual and have had to spread through a small-sized population (pp. 19-22). We understand that, in the authors’ view, the gravest mistake consists in assuming that because the trait is beneficial (i.e. confers selective advantage) it will not get lost once it emerges. This is wrong, as they elegantly illustrate. Natural selection is definitely an important factor driving evolution, but is not the *only* factor, and actually does not operate from the very beginning of the process once a new trait has emerged, be it advantageous or not (pp. 19-21). On the contrary, at first, with the new trait present in a single individual, everything will depend on how many descendants the individual produces (p. 22). If the trait finally survives this initial generational barrier—in their words, a ‘stochastic gravity well’ (p. 22)—and reaches a certain minimum presence in the average population, then (and only *then*) will natural selection have something to select for (pp. 22, 39). This lesson, we believe, is of capital importance to any evolutionary theory that assumes the crucial event leading to human language as we know it was the sudden appearance of a genotypic change of some kind possibly in only one individual and in a population of reduced size.

So far we have discussed some of the most relevant issues in Chapters 1 and 2—except for a few considerations on the ‘divide-and-conquer’ strategy we would like to save for the end—, leaving us to deal with the computational properties of language (Chapters 3 and 4), and with the issues of Neanderthals and neural implementation covered in Chapter 4. So let us start by the first issue. The book presents an abstract characterisation of the computational properties of language responsible for human syntax, which, in the spirit of the Minimalist Program, the authors assume can be ideally reduced to the operation Merge, which is just set formation (p. 70). Then this Merge-based account is put in relation to formal languages, and particularly Type 2 grammars, as described in what is known as the Chomsky hierarchy (for details, cf. Chomsky, 1956 and 1959) (pp. 112-113). Type 1 grammars are not brought into the picture, possibly because natural human languages do not require full Type 1 computational power but only a small subset of it (Joshi *et al.*, 1985:4), and therefore an extension of a Type 2 such as MCFG (mildly context-sensitive formal grammars) might suffice to illustrate the authors’ point. What really interests us here is that this explicit side-by-side comparison of a Merge-based view and the different formal

grammar types is that it has a tremendous relevance for the issue of whether any ‘protolanguages’ preceded our language faculty in the *Homo* lineage. From a Chomsky hierarchy perspective, it could make sense to imagine the theoretical possibility of a protolanguage of Type 2 complexity, for instance, given that human language as we know it falls into a very restricted subset of Type 1. However, this possibility is eliminated by the authors’ understanding that the existence of the same computational operation, Merge, defined as the simplest that can yield human language, would be able to produce all the formal types considered (p. 72). In their account, there is either Merge or not-Merge, and therefore there is no middle-ground space left for protolanguages. It is possible that some readers, like us, might find this relating of Merge and the formal languages slightly obscure in some respects, but we leave it to those in the formal sciences to further reflect on the questions raised.

Turning now to Neanderthals, we agree with the authors that the symbolic record for this species seems clearly insufficient if we are to support the notion that they possessed a fully modern language like ours (p. 154). They most probably did not, as a number of authors have attempted to shown from different perspectives (cf. Longa, 2013 for a computational account). In any case, and contrary to what is suggested in the book, we believe this is not a matter than can be resolved by looking at the symbolic record: at best, symbolic ability is evidence of a minimum capacity for representation, but whether the represented entities enter into computations by interfacing with a computational system like Merge is a separate issue. Proof of representation is not, in our opinion, proof of complex computation of the kind displayed by natural human language. At best, it is a necessary prerequisite: Merge hypothetically needs to feed on some kind of elements from a ‘lexicon’ in the conceptual-intentional system (p. 149). Clearly, some kind of evolutionary change happened since the split from Neanderthals 600 to 400 thousand years ago (p. 152) and before our modern ancestors left Africa some 60 thousand years ago (p. 157). The authors pinpoint this innovation to a 130 thousand-year period in between the appearance of anatomically modern humans in southern Africa 200 thousand years ago and the exodus from the continent. This is still quite a short time in evolutionary terms, but is in agreement with the dates that are commonly posited for this evolutionary event.

Returning to Merge and how it feeds on the atom-like elements from the conceptual-intentional system—a mechanism that gives rise to the Basic Property of language (see footnote 4)—, Chapter 4 presents a hypothesis about how this information transfer, among other related tasks, may be implemented in the human brain. As anticipated earlier, a set of two dorsal and two ventral pathways⁵ forming a ring-like circuit is proposed as the

⁵ The first dorsal pathway would link the mid-to-posterior superior temporal cortex to premotor cortex, corresponding to an auditory-to-motor mapping task; the second would link temporal

means to circulate information from the lexicon so that it can be used by Merge (p. 161). The idea is that syntactic processing is impossible without this ring-like circuit, and is in accordance to the fact that in humans it is not functional before 2 to 3 years of age, and in macaques and chimps the circuit is too short to form a full ring (pp. 161-163). We find this proposal interesting but somewhat too daring, in the sense that there probably is some truth to it, while at the same time we find a few important shortcomings. One is that an excessive explanatory load is perhaps placed on a single circuit; another is that the proposal seems to focus solely on the cortex, while ignoring subcortical structures completely. We find that the results of the study of other language components, namely the externalisation component, clearly warn against these two things. We return to these issues below in the context of a related discussion.

Finally, we would like to close this review on some remarks on the ‘divide-and-conquer’ strategy employed by the authors. As we have anticipated, throughout the text the computational component of the language faculty is accorded a central place in the discussion, while the other two components (sensorimotor and conceptual-intentional) are mostly left to the side. We believe that such a strategy is a virtue of the present book, and that a similar way to proceed might even be necessary to some extent for any evolutionary view that seeks to offer a comprehensive account of any aspect of language. However, it is very important to note —and this is perhaps not stressed enough in the text— that the sensorimotor component for externalisation is not even close to a ‘solved issue’ at the moment, though advances in the last decades have been great (cf. Bolhuis *et al.*, 2010 for a review). Research on vocal learning and production has yielded outstanding results through the use of the comparative method and animal models such as songbirds. But despite these major steps forward, many crucial issues remain unresolved, such as whether vocal learning is a gradual trait, with species ranging along a continuum (Arriaga, Gustavo and Jarvis, Erich D., 2013: 112-113), or even how this trait actually evolved —via convergent evolution, as is commonly assumed, or via something else in the line of the Pervasive Deep Homology Hypothesis (put forward by Fitch, 2011)—. As for the conceptual-intentional component for thought, the authors are already sufficiently clear on how little we know about it (p. 88). To this we would just like to add that the truly biolinguistic questions about thought —precisely how mental entities like ‘concepts’ or the ‘atoms of computation’ relate to neural reality, for example— remain thoroughly unanswered, and the discussion often gets lost into philosophy of language debates (p. 85). This is clear confirmation of the enormous problem granularity poses for this system.

cortex to Broca’s, and be responsible for the processing of sentence syntax. The ventral pathways would link the region where the ‘lexicon’ is presumed to be located (middle temporal cortex) to the front dorsal region (p. 161).

To this we would suggest one tentative solution: to make use of what has been learned from the advances in mapping vocal learning and production to the brains (and genomes) of the various species. First, we would advise caution assigning functions to circuits or brain areas, since no comparative animal models are available, and especially when the explanatory load on particular locations seems excessive. Something of the kind might perhaps be objected to the account of the implementation of the Basic Property presented in Chapter 4, where the ring-shaped circuit is presented as playing a very, very important role in language processing. Second and most important, research on vocal learning presents perhaps one of the strongest arguments against excessive corticocentrism in the proposals of brain implementation of the different language tasks: we must extend the search beyond the cortex into the thalamus, basal ganglia and remaining subcortical structures, as several authors have argued independently (cf. Hagoort, 2014 and Lieberman, 2009). It seems unlikely to us that all there is to the Basic Property will be found in the cortex, and we strongly encourage efforts to look deeper into our neural reality.

In sum, *Why Only Us* is a thrilling book that will interest not only those already working in the field but also students wanting to have a first look into the beautiful mess that is language evolution. We believe the text is a wonderful collection of old and new problems, and suggests a wealth of ways forward, some of which are right at the borders of contemporary research.

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