РЕЦЕНЗИИ / REVIEWS

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Among the many widely discussed monographs and edited volumes from the last decade that have addressed the evolution of human language [Bickerton 2009; 2014; Botha, Knight 2009; Fitch 2010; Burlak 2011; Tallerman, Gibson (eds.) 2012; Christiansen et al. (eds.) 2013; Dor et al. 2015, a. o.], this small book by Robert Berwick and Noam Chomsky is of particular interest. The perspective taken by the authors distances it from most work in the field, including Chomsky's previous papers on the same topic co-authored with Marc Hauser and William Tecumseh Fitch [Hauser et al. 2002; Fitch et al. 2005]. Almost all previous discussion has centered on the biological prerequisites for the origin of human language commonly understood as a combination of inward factors such as preparedness of the vocal tract, neural control of speech production, and brain size and the external conditions that might have triggered the definitive steps of its evolution. For Berwick and Chomsky (B&C), meanwhile, the main biological characteristic of human language is its computational efficiency as a system of thought and understanding. This characteristic, in their view, must have evolved in basically the same way as other cognitive systems that determine the complex behavior of animals, e.g. orientation in space or visual recognition of objects. The monograph enables its readers to better understand Chomsky's philosophy of language and the motives that have underlain the development of generative linguistics and its grammatical models since its very beginnings in the 1950s.

The main question raised in the book, as is reflected in its title, is how the ability of humans to acquire any language quickly and efficiently—the faculty of language—might have evolved and why it is species-specific, i.e. not shared by other animals to any comparable degree. As in much previous work, B&C try to connect the data obtained in different fields of knowledge and to develop a coherent scenario for the origin of language. Likewise, and equally unsurprisingly, B&C's speculations derive partly from assumptions that are based on the philosophy of language they adopt and as such can hardly be argued for (or against) via scientific methods in the strict sense. Unlike Chomsky's former co-authors on the evolution of language, all biologists, Berwick is an expert in computational linguistics, more specifically in computational models of language acquisition. In this monograph, B&C's main goal is to identify and characterize the decisive and unavoidable steps in the evolution of the computational efficiency, the steps without which there could have been no faculty of language.

Of the four chapters of the monograph, the first ("Why now?") outlines the current state of linguistics and biology, which makes it possible to hypothesize how the evolution of language might have occurred. B&C claim that generative linguists have never in fact lacked interest in the evolution of language. The main reason why it has not been widely discussed until quite recently is that linguistics was not prepared for the discussion. In the first decades of its existence, generative linguistics was forced to construct grammar models so complex that there was no imaginable

way to explain how they could ever have evolved. The complexity of human language as it was conceived on the basis of a formally oriented and rigorous approach to phonology, grammar, and semantics could not be partitioned in any convincing way into smaller elements for which plausible scenarios of evolution could be suggested.

However, generative linguistics has always aimed to elaborate and over decades has elaborated a much simpler model of grammar, which is viewed by its practitioners as the core component of human language. Systems of complex rules like phrase-structure grammars and transformations have gradually been replaced by much simpler and hence, as B&C see it, more evolutionally plausible models. In the 1980s, the generative theory attempted for the first time to reduce the seemingly infinite variation observed cross-linguistically to what was intended to be a small array of universal principles and parameters. Later, in the Minimalist Program launched by Chomsky in the 1990s, the principles and constraints proposed were reduced to those few that conformed to its author's understanding of "conceptual necessity". This shift to radical simplicity in language opened the perspective for an evolutionary explanation of its origin because the more narrowly the phenotype of a species is defined, the easier it is to understand how it might have evolved, and the narrower the evolutionary gap becomes between humans and other species that have no language. Of course, a simpler theory can be more convincing than a more complex one only if it can account satisfactorily for the same range of phenomena, rather than merely exclude a large proportion of them from consideration.

Narrowing the human language phenotype, B&C assume that what they call the Basic Property of language is that human language is a finite computational system yielding an infinity of expressions, all of which have an interpretation in the two cognitive systems adjacent to language, namely the semantic-pragmatic and sensorimotor systems. In this view, the seemingly insurmountable problem of language evolution can be divided into three plausibly solvable problems, viz. the evolution of 1) a computational system that defines a potentially infinite set of hierarchically structured expressions, with no upper bound on their possible depth; 2) a sensorimotor system for externalization that includes both production and parsing; this system establishes the linear order, whereas the computational system deals only with the structural hierarchy of embedding; 3) a component that relates hierarchically structured expressions to the conceptual system for inference, interpretation, planning, etc., informally known as "thought".

B&C draw attention to the difference in cognitive capacities between humans and all other animals sometimes called "Wallace's Problem", cf. especially [Bickerton 2014]. Alfred Russel Wallace, who discovered the evolution by natural selection independently from Darwin, pointed out the difficulty of a gradualistic adaptationist approach to the evolution of human cognitive capacities in view of the tremendous gap in intellectual abilities between humans and animals. B&C claim that the puzzle can now be solved, given that more sophisticated recent models of evolution can countenance rapid, large-scale behavioral changes and not just the slow adaptive evolutionary changes that featured in Darwin's classical vision. As an example, they mention relatively recent adaptations in humans such as the accommodation of the Tibetan population to low oxygen levels found at high altitudes or the ability to digest lactose past childhood in dairy farming cultures. Large-scale behavioral changes can also be remarkably rapid, as seen, for instance, in the food preferences of swallowtail butterflies [Thompson 2013: 65].

B&C believe that the core property or the central mechanism of human language, the successively applied operation called Merge, i.e. the ability to assemble a hierarchical syntactic structure via a simple operation of joining two elements into one, was similarly the result of a rapid evolutionary development. The non-gradualist hypothesis is also supported by the paleoarcheological record of the *Homo* lineage, given that striking technological or cultural innovations are not simultaneous with the appearance of a new, morphologically distinct *Homo* species. As there is no evidence of gradualistic development of new tool technologies or innovations like fire, shelters, or figurative art, B&C remain skeptical as to whether anatomically modern humans had language eighty thousand years ago or earlier, although there are clear material signs of symbolic behaviour, which may or may not indicate its existence. The most serious problem is that we understand

very little about how even the simplest computational operations are carried out, or might have evolved, in the neural system.

In the second chapter ("Biolinguistics evolving"), B&C address the puzzle of why human language as a particular object in the biological world, exists at all, unique as it is to one single species, and why there are so many languages displaying so much obvious diversity. The problem of simultaneous linguistic unity and diversity is viewed on a par with the analogous problem in evolutionary biology, and the factors that underlie both are, as B&C believe, of a similar nature. Both biologists and linguists have come to understand that the diversity observed is far from being infinite and unpredictable; in biology, the factors that contribute to the basic uniformity of all organisms are common ancestry, the physiochemical constraints of the world (such as those that exclude the evolution of wheels for animal locomotion), and the predictably similar effects of natural selection.

The uniformity of language faculty across the entire human species strongly suggests that the evolution of language must have occurred fully before the exodus from Africa about sixty thousand years ago followed by humanity's spread across the entire world. Since then, the fundamental properties of human language must have remained fixed. B&C mention some of them: human languages do not use counting of elements, meaning that they lack rules employing categories of the type "third word from the beginning of a sentence"; quite unlike computer languages, they employ displacement, where elements are interpreted at one place in the grammatical structure but pronounced at another, as seen in *wh*-movement in English and typologically similar languages; all human languages draw from a fixed inventory of articulatory gestures called phonological features, and so on.

B&C claim that language is a central component of the complex they call "human capacity", which also includes creative imagination, recording and interpretation of natural phenomena, intricate social practices and the like, and they believe that this complex must have evolved among a small group of human ancestors in East Africa not long before the last exodus, distinguishing contemporary humans sharply from other animals and giving rise to their exceptional adaptive success. For Chomsky, it has always been a matter of principle that language possesses structural integrity and forms a separate module within the array of human cognitive capacities. Therefore, it has its own basic principles, different from those of other cognitive systems. B&C adopt what they believe to be the simplest assumption, viz. that the generative recursive procedure that is taken to combine two elements into one, the Merge operation, appeared suddenly as the result of a minor mutation. This was accompanied with the evolution of conceptual atoms of the lexicon and the linkage of the linguistic computational system to the conceptual systems and the mode of externalization. With this very simple understanding of the core of human language, there is no place for any simpler precursors any more, since the recursive mechanism of Merge is equally different from all non-recursive languages that allow for e.g. sentences no more than two words or seven words in length.

In spite of the fact that the fundamental properties of human language are uniform, the second of the two basic questions posed in this chapter ("Why are there so many languages?") addresses the linguistic diversity that we in fact observe. The answer given by B&C is that, since externalization is a difficult task, it can be solved in many different and independent ways; externalization as such may not have evolved at all because the problem could be solved by recourse to the cognitive capacities shared with other animals. Turning to the conceptual structures seemingly held in common with other primates, B&C emphasize the crucial difference that symbols of human language and thought do not pick out mind-independent objects or events in the external world. Contrary to what has been claimed in the most influential theories of reference since Frege [1892], they only correspond to mental constructs shared by the addressee and the speaker; how our ancestors developed human concepts, B&C admit, is at present "completely unknown" (p. 87).

The third chapter, "Language architecture and its import for evolution" contains B&C's view on what it is that has evolved—not the language itself but rather the capacity for language, which is modeled by generative linguistics as UG (Universal Grammar), and is quite simple

at its core; on this view, the apparent complexity and variety of languages we observe must have derived from changes in the peripheral components of the system, which may not have evolved at all. B&C claim that language is well designed for computational efficiency because the computational mechanism involves only the simplest possible operation Merge, which applies to two already available objects X and Y and constructs from them a new object Z. Merge amounts to set formation: it does not modify X or Y and leaves them unordered. It can be seen that the computational rules of language thus ignore the property of linear distance and keep to the property of structural distance. The case in which X is part of Y is called Internal Merge; therefore, displacement understood in this way must not be viewed as an imperfection of human language but merely as an automatic property of the computational process. The apparent variety of languages and the complexity of their attested structures derives from the process of externalization into one or another modality (sound, writing, or gestures). Human language is therefore well designed for computational efficiency and expression of thought but is unwieldy for use in communication. B&C note that they use the term "designed" as a metaphor, and "design" means here the simplest evolutionary process consistent with the Basic Property: a "small rewiring" of the brain.

In the concluding chapter, "Triangles in the brain" (the title reflects the graphic form given by B&C for some crucial examples in it), B&C point out that, in spite of the tremendous progress that has been made in our understanding of natural selection since the time of its discovery in the mid-19th century, "Wallace's Problem" still requires a solution: Darwinism assumes gradual continuity effected by numerous successive slight modifications, whereas language, in B&C's view, represents a yawning chasm between what is possible for humans and what is possible for all other animals. In order to address this mystery, B&C successively ask and answer six questions, and the corresponding subsections of the fourth chapter are entitled with the English *wh*-pronouns: What? Who? Where? When? How? and Why?

"What?" is the Basic Property of the human language, i. e. the ability to construct an infinite array of hierarchically structured expressions that can undergo interpretation at the two interface levels, one of realization and the other of cognition. While it has been shown that chimpanzees are able to string together and process items sequentially, there is no evidence that they can build hierarchically structured representations comparable to those that a child can manage at age three or four. To demonstrate the fundamental difference between linear order and hierarchy of embedding, B&C employ the simple English examples (1) *Birds that fly instinctively swim* and (2) *Instinctively birds that fly swim*. (1) is ambiguous: the adverb *instinctively* can be associated either with the preceding verb (1a) [*Birds* [*that fly instinctively*] *swim*] or the following one (1b) [*Birds* [*that fly*] *instinctively swim*]. However, if the adverb is extracted leftward as in (2), there is no ambiguity. In terms of linear sequencing, in (2) the adverb *instinctively* is closer to *fly* than it is to *swim*. However, (2) is unambiguous in that *instinctively* can only be associated with the more distant word *swim* and not with the closer word *fly*. The reason for this lack of ambiguity is that only structural distance, not linear order, matters in human language syntax. In (2), *fly* is embedded one level deeper than *swim*, [*Instinctively birds* [*that fly*] *swim*], and is therefore inaccessible for the adverb *instinctively*. B&C show that any language processor that is compelled to link *instinctively* and *swim*, rather than *instinctively* and *fly*, must have access to hierarchical information.

Another syntactic paradigm adduced by B&C illustrates the well-known "precede-and-command" asymmetry (first explored in [Langacker 1969], cf. the classic analysis of the phenomenon in [Reinhart 1983]). Suppose that in the sentences (3) a. *He said that Max ordered sushi* and b. *Max said that he ordered sushi* a pronoun can be linked with a potential antecedent only if the latter precedes it as in (3b) but cannot if the latter follows it as in (3a). However, the observation based on linear order fails if other examples are involved. Contrary to this generalization, in (4) *he* can corefer with *Max*, although it precedes *Max*: (4) *While he was holding the pasta, Max ordered sushi*. The real constraint is of hierarchical nature: the subordinate clause and the main clause in (4) form a single complex sentence with the subordinator *while*, but neither of the two is a constituent of the other. On the contrary, both subordinate argument clauses in (3a, b) are constituents

of the main clause they are embedded in. The constituent containing the subject pronoun must not contain a subordinate clause with the proper name or the noun that is the pronoun's antecedent.

For B&C, it is a fact of crucial importance that human language syntax employs hierarchical rather than left-to-right sequential structures. The two types of structure are believed to have evolved separately. Linear sequencing is an externalization mechanism and as such does not belong to the Basic Property; it is shared with songbirds and other nonhuman animals.

"Who?" are anatomically modern humans, a species that must have emerged long before it acquired a language capacity in its modern form. So "Where?" and "When?" point to Africa as the most probable place and to the time period between roughly 200 000 and 60 000 years ago, prior to the last African exodus, when fully modern humans expanded into Eurasia and Australia.

The authors' answer to the "Why?" question elaborates on Chomsky's well-known idea that communication is not a basic function of human language and consequently could not have been the driver of its evolution. The evolutionary benefit of language lay in the fact that it could be used as a "cognitive glue" binding together the perceptual and information-processing cognitive systems. To support this view, B&C point to some experimental evidence that seems to show that children are not able to integrate geometric and nongeometric information before they have acquired language by the age of four or five [Hermer-Vazquez et al. 1999]. An explanation suggested by B&C for this data is that language is the mental tool that binds together different representations emanating from geometric and nongeomentric modules of thought.

I cannot but agree with B&C's decisive rejection of the idea—which has been taken for granted by too many linguists, including most authors that have contributed to the field of language origins—that the basic function of human language and the adaptive motor of its evolution is communication. Although B&C are unable to provide conclusive evidence in support of their own view that thought is the central function, one may notice that, of all the possible functions of language, communication (understood as the mere transmission of messages) is the only one which can be directly observed and whose goals are evident, unlike, for instance, language play, which is also observable but whose goals are not as evident as those of communication. The only function that is visible on the surface is not necessarily the most important of all for the evolution of language, and B&C are probably right to attempt to dismiss it from consideration.

Although it is not stated in the book, the reader may conclude that one of the main reasons for Chomsky's stepwise simplification of the model of grammar — from his revolutionary "Remarks on Nominalization" [Chomsky 1970] through to the radical simplicity of the minimalist framework he has adopted since the 1990s — might have been his intention to find an evolvable and, ideally, a single Basic Property of human language. As a result of this theoretical development, what remains at this point is solely the syntactic hierarchy formed by Merge, with the consistent binary structure throughout and with linear ordering relocated to a different and presumably non-language-specific module, i.e. externalization.

However, most accounts known to the reviewer that aim to reinterpret the phenomena of linear ordering in terms of hierarchy of embedding are not based on any compelling evidence that would show that strings (5) … X … Y … and (6) … Y … X … are different in their grammatical structure but rather amount to purely theoretical prerequisites. In effect, the reinterpretation 'linear order → structural hierarchy' has become so easily available that one cannot imagine any possible counterexample to the claim that linear order has no fundamental importance at all, and that it has nothing to do with the syntax-semantics interface, for instance. To provide (5) and (6) with different structures, it is enough to postulate for (6) a highly placed covert functional head, call it h, and the movement of Y into a position created by this head. As a result, the different hierarchical structures easily emerge in the form of (5) [… X … [Y …]] and (6) hP [Y … h … [… X … [t …]]], where t denotes the trace or the lower copy of Y that has moved upward.

The present view on linear order adopted by Chomsky is a development of Richard Kayne's [1994] idea of the "Antisymmetry of Syntax", which assumes that the linear order is fully determined by the hierarchy of embedding, and that if two phrases differ in linear order they must also differ in hierarchical structure. Maybe the best-known instance of order-to-structure

reinterpretation is Richard Larson's [1988] analysis of the structural asymmetries between direct and indirect objects in English, which can be seen, for example, in the behavior of pronouns that denote variables bound by quantifiers: (7) *I gave every worker$_i$ his$_i$ paycheck* vs. **I gave its$_i$ owner every paycheck$_i$*; (8) *I gave every paycheck$_i$ to its$_i$ owner* vs. **I gave his$_i$ paycheck to every worker$_i$*. To account for this sort of left-right asymmetry, Larson proposed to split the verb phrase into two, whereby in the lowest VP the first object is seen as the specifier and the second as the complement.

Contrary to the claim made by B&C, the factor of linear order in the interpretation of pronouns contained in embedded argument clauses cannot be dismissed, as can be shown by Russian (9) [*Čto Maša bol'na,*] *ona otricaet* 'That Masha$_i$ is ill, she$_i$ denies' vs. (10) *Ona otricaet,* [*čto Maša bol'na*] 'She$_i$ denies that Masha$_{j/*i}$ is ill'. The subject pronoun in the matrix clause in (9), but not in (10), can refer to the same person as the proper name in the subordinate clause. However, there is no evidence to suggest that in (9) the subordinate clause is not a constituent of the main clause, just as it is in (10).

On the contrary, there is evidence that preposed subordinate clauses like (9) are embedded. For example, argument clauses can contain indefinite pronouns of the *by to ni bylo* series if the matrix predicate is lexically negative [Paducheva 2011]: (11) *Maša otricaet, čto ona kak by to ni bylo zamešana* 'Masha denies that she is somehow involved'. The preposed argument clause behaves likewise: (12) *Čto ona kak by to ni bylo zamešana, Maša otricaet* 'That she is somehow involved, Masha denies'. The pronoun *kak by to ni bylo* 'somehow', when preposed, remains under the scope of the matrix lexical negation, which strongly suggests embedding, and therefore the difference in interpretation seen in (9)—(10) cannot be accounted for by recourse to hierarchical structure. Cf. also the evidence produced in [Bruening 2014] that linear precedence cannot be dismissed from grammar.

The other method of simplification of the model of grammar since [Chomsky 1970] has been the relocation of complex rules into a non-grammatical part of language, i.e. the lexicon or phonology. However, the lexicon of any given human language abounds with abstract and productive phenomena that do not amount to a list of items that could plausibly be acquired by a child or merely held in memory. First, most lexical items, as can be seen in the most advanced modern interpretive dictionaries [Apresjan 2004], are associated with various and rich semantic, grammatical, and distributional characteristics that still defy being subsumed into the form of abstract principles comparable to those found in Chomsky's "computational system" for syntax, cf. above on B&C's view of the complex "mental constructs" corresponding to words. Second, many grammatical constructions fail to be analyzed via a simple "computational system" that successively constructs their binary structure from atomic elements and provides a regular non-idiomatic interpretation for them. Evidence along these lines was provided by Charles Fillmore and his colleagues ([Fillmore et al. 1988] and much subsequent work) in their attempt to elaborate the competing non-atomistic approach that they call Construction Grammar. For example, the family of resultative constructions in English, as was shown in [Goldberg, Jackendoff 2004], reveals, along with some general principles of argument linking or event structure, a wealth of idiosyncratic phenomena that must be learned and stored in memory individually.

To sum up, B&C's scenario of human language evolution, convincing as it seems in itself and in many points, especially as regards the "Wallace's Problem", justifiably critical of previous approaches to the question, is wholly based on the assumption of the simplicity of human language as regards what they call its Basic Property. B&C believe that this simplicity has become evident after several decades of intensive research within the theoretical program of the generative linguistics. I believe, however, that this kind of simplicity has largely been attained by theory-internal methods and is hardly likely to meet with more empirically based and verifiable support in the near future.

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