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The human language faculty and its biological basis

Edited by Koji Fujita and Cedric Boeckx

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1 Introduction

The biolinguistic program: a new beginning

Koji Fujita and Cedric Boeckx

This collection of papers arose from the coalition of two independently working biolinguistic research groups, one Kyoto-Tokyo-based (Biolinguistics Project, Japan) and one Barcelona-based (Biolinguistics Initiative Barcelona), led by one of the coeditors, respectively. The chapters that follow represent some of the ongoing research which members of these groups have been devotedly engaged in. This brief introductory chapter offers some general background considerations with cursory reference to each contribution. For the reader's convenience, the following chapters are organized into five parts under different titles, but this does not imply that each section is detached from the others in any significant sense. On the contrary, the reader may easily find that all the chapters are so closely intertwined in their purposes and claims that this volume is in fact an inseparable and indivisible whole.

The term *biolinguistics* came into everyday use fairly recently, but biological approaches to human language are probably as old as science itself. Aristotle was among the first to compare human language with other animal communication systems, especially birdsong. He observed that humans and birds have similar vocal organs and vocalization capacities, but that only humans can use them to express and convey cognitive and propositional statements, as distinct from emotional and affective content. To use some contemporary terms, by noting both the evolutionary continuity and the discontinuity between human and bird communications, Aristotle arguably foresaw the progress of modern biolinguistics, where studies of birdsong enjoy a particularly important role as a key to understanding human language evolution.

Fortunately for today's biolinguists like us, Aristotle's comparative approach did not address one crucial gap between human language and animal communication – the presence vs. absence of a recursive computational system. The importance of this gap for understanding human language has been stressed by Chomsky's generative grammar over and over again, but it was only during the resurgence of biolinguistic concerns in the twenty-first century that the true meaning this gap carries came to be properly comprehended by linguists and biologists alike.

Today we cannot discuss language or its biological foundations without referring to the seminal joint article by Marc Hauser, Noam Chomsky and Tecumseh

Fitch, where they proposed the well-known distinction between FLN (those components of the language faculty which are unique to humans and human language) and FLB (every component of it, including FLN). They suggested recursion as the only candidate for FLN, but the problem was that they did so in a not very explicit way so that many unfruitful discussions or pointless criticisms followed as a result. We believe that we can safely equate what they meant by recursion with unbounded Merge, as proposed in the minimalist program of generative grammar. We believe this all the more not because unbounded Merge is a genuine part of FLN but because it offers a good opportunity to reexamine and seriously doubt the legitimacy of the FLN/FLB dichotomy.

Granted that a syntactic computational system is a uniquely human function, it is highly unlikely that this evolutionary novelty arose from nowhere, whether by mutation or by natural selection. Every biological trait has a precursor, often in an apparently unrelated domain with remote functions, and its current species- and/or domain-specificity is an end result of the Darwinian process of descent with modification. Merge serves as an ideal point of entry for a biologically/evolutionarily natural understanding of human syntax just because it is such a simple and elementary operation that one could easily find its analogues/homologues in other domains of both human and nonhuman cognitive behaviors, including tool making and tool using, in particular.

To pursue this exaptationist scenario and show that uniquely human syntactic computation indeed evolved from a not uniquely human, not specifically linguistic function, thereby establishing its biological nature, it is of supreme importance that studies of syntax be carried out with a keen interest both in securing the empirical coverage of the syntactic theory and in reducing the invoked syntactic machineries to even simpler operations, to the level where a direct comparison between syntax and other cognitive faculties makes good sense beyond a metaphor.

In this respect, the three chapters collected in Part I, despite their purely syntactic nature, are all important contributions to biolinguistics. ***Hiroki Narita and Naoki Fukui*** (Chapter 2) introduce the notion of feature-equilibrium to capture some interesting properties of syntactic computation, while ***Takaomi Kato, Hiroki Narita, Hironobu Kasai, Mihoko Zushi and Naoki Fukui*** (Chapter 3) propose to decompose Merge further into two more basic operations which they call 0-Search and 0-Merge. These two studies are significant attempts to show that simple and presumably not very language-specific principles and operations are often better at explaining ostensively linguistic phenomena, which further boosts our interdisciplinary inquiry into the biological nature of syntax. ***Mihoko Zushi***'s work (Chapter 4) corroborates Kato et al.'s proposal by showing that Case valuation, a representative aspect of uniquely human (morpho)syntax which was once explained in terms of highly domain-specific analytical apparatus, now directly follows from a single computational operation.

Equally important are studies of language development and language processing, each of which is discussed neatly in Part II by ***Koji Sugisaki*** (Chapter 5) and ***Hajime Ono, Kentaro Nakatani and Noriaki Yusa*** (Chapter 6),

respectively. Sugisaki addresses the issue of structure dependence, arguably the most prominent feature of human language in the biological world. Surveying English-speaking children's production of *yes/no* questions, he concludes that they are genetically predisposed to conform to structure dependence. Ono et al. argue, based on experimental data, that sentence processing is influenced by the two factors of locality effects and expectations working in a mutually exclusive way.

Processing is largely a matter of working memory, in addition to specifically linguistic knowledge, and language evolution too depends on the evolution of working memory in the brain to such an extent that we cannot discuss language evolution without considering working memory. ***Gonzalo Castillo***'s contribution (Chapter 7) is highly instructive in this respect. After presenting an explicit and detailed description of working memory, Castillo explores the connection of this generic capacity to specifically linguistic unbounded Merge. This kind of connection, between what is and what is not language-specific, provides another important key to understanding how the uniquely human language faculty may have evolved through descent with modification.

In the past generative grammar, the concept of parameters was very useful to derive the vast superficial diversity observed among the world's languages, as well as to solve the logical problem of language acquisition. Language grows in children, as it was once claimed, largely as a process of internal selection (parameter setting), not by instruction from the environment, and different parametric values lead to synchronic, diachronic and developmental variations. Unfortunately, our updated understanding of biology and genetics does not support the view that these strong analytical tools belong to Universal Grammar (UG), to the extent that it is a biologically real object.

The overwhelming question is then how we can capture linguistic diversity without recourse to parameters, particularly because minimalism requires radical minimization (maximal underspecification) of UG (basically, it's Merge-only). ***Miki Obata and Samuel Epstein*** (Chapter 8) tackle this issue and argue that parametric variations are just a reflex of language-independent physical law (known as the "third factor" of language design) working on syntactic computation. Obviously, parameter-free universal syntax is a desideratum not only for the internal consistency of generative syntactic theory but for the overall progress in biolinguistics.

Biolinguistics, just like biological sciences in general, is not only an empirical science but it also requires a high level of conceptual and methodological considerations. In Part III, both ***Koji Fujita*** (Chapter 9) and ***Pedro Tiago Martins, Evelina Leivada, Antonio Benítez-Burraco and Cedric Boeckx*** (Chapter 10) stress the importance of a pluralistic attitude towards biolinguistics, though not necessarily for the same reasons. Fujita focuses on evolutionary issues and argues that, since language is not a monolithic object but rather a modular system consisting of several independent faculties, studies of language origins and evolution should avoid the fallacy of a single origin, the false belief that language as a whole must have evolved from one preexisting capacity. Other equally

harmful fallacies in evolutionary studies of language are also discussed, and Fujita explains why the Merge-only hypothesis of the minimalist program, contrary to what one might expect, promises to remove these fallacies.

Martins et al. place their discussion in a broader context and propose to bring biolinguistics into much closer contact with modern biology. They point out that generative grammar in the past was based on some serious misconceptions about biology and evolution and show how one can remedy this situation and render biolinguistics truly biological in nature. Interestingly, both Fujita and Martins et al. argue that the FLN/FLB distinction can no longer be maintained.

Masanobu Ueda (Chapter 11) attempts to place the biolinguistic program in the context of the philosophy and history of natural sciences and critically evaluates its current status as a biological science. In particular, contrary to what is sometimes claimed by other practitioners of generative grammar, Ueda finds some serious mismatches between Tinbergen's four questions and the goals and proposals of biolinguistics today.

Part IV provides discussions more directly associated with evolutionary questions. ***Masayuki Ike-uchi*** (Chapter 12) casts doubt on the popular belief that the Merge-based human language first appeared around 60–80 kya in H. sapiens and argues that its emergence took place around 130–150 kya. This conclusion is based on recent discoveries in archaeology, paleoanthropology and genetics. Researchers' views divide between gradual/incremental vs. rapid/saltational evolution of language, the latter of which is obviously in conformity with the minimalist view of language design. Ike-uchi's observation may help resolve the tension by suggesting that the emergence of UG or human language may not have been very recent, an important antidote to the often not very productive conflict between generativists and anti-generativists.

Michio Hosaka's contribution (Chapter 13) has a similar effect of bridging the gap between the two opposing camps. The original function of language has been a hot issue; some support the communication-first theory while others favor the thought-first theory. While Hosaka agrees with other generativists that language first evolved as an instrument of thought, he argues that the evolution of syntax was adaptive for communicative purposes, too. The distinction between external Merge and internal Merge corresponds to the difference between these two adaptive functions, with external Merge serving thought and both external and internal Merge (Move) serving communication. Hosaka supports the view that the evolution of syntax was somewhat gradual, from external to internal Merge, and that communication is as important a factor in understanding language evolution, and in this respect he adopts a pluralist position, much like Fujita and Martins et al.

Language is firmly based on our neurology, and biolinguistic studies hardly make sense if one fails to connect theoretical proposals about the mechanisms of language to their neuronal implementation in the brain, which in fact has proven very difficult to achieve. In Part V, ***Noriaki Yusa*** (Chapter 14) focuses on the role that Broca's area plays in processing the hierarchical, as opposed to sequential, structure of human language. Structure dependence is one

biologically unique property of language, and it is mandatory that neuroscience explicate the neuronal mechanism of it. Whether Broca's area is the locus for this purpose, and, if so, then which subdomain of it is, remains one prominent target of inquiry. Yusa demonstrates the involvement of this region by gathering evidence from neurological studies of second language acquisition. He also suggests that within Broca's area, BA 45 may be the locus of domain-specific, syntactic Merge, whereas BA 44 may serve domain-general Merge, thereby supporting the evolutionary scenario from action to syntax in the brain.

Constantina Theofanopoulou and Cedric Boeckx (Chapter 15), by sharply departing from the classical cortico-centrism, highlight and examine the central role played by the thalamus to connect and regulate different regions inside the globular brain unique to H. sapiens. The suggested cortico-thalamus-cortical circuits have implications not only for language but for human cognition at large. The expansion of focus from cortical to subcortical structures should drive biolinguistics in a new, and more productive, direction.

Antonio Benítez-Burraco (Chapter 16) explores the possibility of restructuring clinical linguistics by bringing it into a closer relation with biolinguistic concerns. Language disorders have played a privileged role in biological studies of language, both as a window to the neurological underpinnings of language and as a clue to the supposed protolanguage. Benítez-Burraco stresses the need of a paradigm shift in studies of language disorders, by changing the focus from adult phenotypes to the dynamic process of development, much in line with what is going on in the evo-devo approach in biology and biolinguistics. His discussion offers an opportunity for us to thoroughly rethink the role of genes in language and language disorders and to move towards a biologically more natural understanding of language evolution and language development, of how they may interact with each other.

What all of these contributors and their chapters have in common, though they are dedicated to a variety of topics, is the humble realization that we are still so far from what biolinguistics should be like. We believe that biolinguistics needs to be an integral part of biological science that goes way beyond today's theoretical linguistics. We hope this volume will provide a strong driving force to reboot the biolinguistic program for the next generation.