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Jenkins, Lyle. *Biolinguistics: Exploring the Biology of Language.* Cambridge University Press, 2000, xiii+264 pp.

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Maynard Smith and Szathmáry (1995) conclude their brief discussion on language and life with the following remark: "... the prospect of collaboration between linguists and geneticists, after a long period of mutual distrust, is very exciting." Every reader of Jenkins' new book will readily understand that their expectation is fully warranted and is in fact already far surpassed by the development of present-day biological studies of language (biolinguistics), as crystallized by Noam Chomsky's generative enterprise.

Biolinguistics comes out of the author's continuing research in this outstanding field of modern science ever since the 1980 formation of the Harvard Medical School Biolinguistics Group, where following the lead of Chomsky and Eric Lenneberg people interested in varying areas of cognitive sciences formed an interdisciplinary forum for the study of the biology of language. His expertise on the subject has allowed Jenkins to write this book both as a valuable guide to the field for highly motivated general readers and also as an academic battleground for researchers engaged.

Throughout the book, Jenkins makes an admirable effort to elucidate the proper domain of biolinguistics and its major topics, illustrate the way they have been addressed coherently in the generative/innatist tradition, point to piles of conceptual motivations and empirical evidence for this approach, and describe the state of the art of the research domain in a most impressive manner. Jenkins is at his best when he scrutinizes alleged criticisms and opposing views (often coming from connectionism on ontogenetic issues and neo-Darwinism on phylogenetic issues), unmasking their unscientific, almost dogmatic nature due to ignorance and misrepresentation of the biolinguistic paradigm. It is the anti-generative camps that now bear the responsibility of facing the charge. Thus the book inevitably invites further heated discussions involving all interested researchers and thinkers, which is of course a welcome merit.

The book consists of six chapters, preceded by "Introduction" which briefly reviews the history of biolinguistics and summarizes its major concerns. Listed at the very beginning of the book are the central topics for biolinguists pronounced by Chomsky. They are of course (1) nature, (2) growth/acquisition, (3) use, (4) cerebral mechanisms, and (5) evolution, of knowledge of language in the well-defined sense of the term (the I-language). It will be convenient for our purpose to call (5) "Darwin's problem" in contrast to Chomsky's term "Plato's problem" for (2). The distinction between them deserves an emphasis because current minimalist program can be characterized by its shift of focus from (2) to (5); as we proceed "beyond explanatory adequacy" (Chomsky 2001b), Universal Grammar (UG) is now beginning to change its role from that of explanans (for Plato's problem) to that of explanandum to be addressed in the broad context of evolutionary biology and physical/mathematical considerations.

Quite naturally, asking Darwin's problem encourages us to go past the province of traditional linguistics and place our discussion in natural sciences as a whole, which gives rise to an even more challenging

problem — the unification problem. It inspires us to consider the possibility of conceptual integration among different domains of natural sciences by incorporating into them what we find as appropriate answers to the problems biolinguistics addresses. It makes sense, then, that Jenkins starts his academic adventure in this book by setting the scene in the first chapter under the title "The unification problem."

In this first chapter, Jenkins discusses the status of linguistics as a natural science — a controversial topic ever since the incarnation of modern biological studies of language. Doubts about the "reality" of theoretical notions like UG, parameters, I-language, modularity and autonomy have been repeatedly expressed from several corners of cognitive sciences. Taking the examples of quarks, wave functions and symmetries from modern physics, Jenkins argues convincingly that notions in linguistics are real in the very same sense that notions in physics are, i.e., their explanatory force proves their reality, nothing more or nothing less. Reality in this Weinberg-style sense, say theoretical reality, is neatly separated from objective reality, and once this point is accepted, all the fuss about psychological reality should vanish into thin air. Biolinguists hope to understand language as a biological entity just as physicists try to understand the universe, equally for the ultimate goal of unification. Chomsky's "methodological naturalism" is thus fully motivated and justified in this book over and above the so-called "methodological dualism," which misleadingly tempts us to give up all rational inquiry in studying human cognitive capacities.

From this naturalist viewpoint, Jenkins now undertakes the task of "setting the record straight," to exterminate all those misrepresentations found in the academic circle about Chomsky's thinking on the biology of language. Brought to light is the invalidity of utterly misconceived description of Chomsky as the "arch-villain," invented by people like Daniel Dennett and Steven Pinker. Dennett is accused of popularizing the wrong picture of "Chomsky contra Darwin" on the basis of his failure to see what Chomsky actually has to say about the

evolution of human language. Risky ideas like a "God-given language faculty" and "Chomsky as a Paley-type creationist" are reflections of the lack of proper understanding on the part of these ultra-Darwinian critics. Dennett (1995) worships the strong explanatory power of natural selection, speaking of Darwin's "dangerous" idea frightening the Chomsky-Gould camp, but in fact his is the literally dangerous idea threatening our scientific rationality. We can easily detect the same sort of harmful fallacy in Calvin and Bickerton's (2000) recent argumentation too, as embodied in their expression *lingua ex machina* (after *deus ex machina*). Jenkins' courageous endeavor continues in later chapters and reaches its height in the fifth chapter, where Darwin's problem undergoes an in-depth examination.

Contrary to what its title suggests, this first chapter limits the range of discussion to conceptual and methodological issues and clarification of the basic tenets of biolinguistics. Detailed considerations on the unification problem are to be found later in the book. As noted, Jenkins' major concern in this chapter is to straighten the record, which he has done down to earth. His full-fledged knowledge of relevant literature, both for and against Chomsky's position, and of the history and philosophy of science, enables him to build his arguments in a flawless manner, carefully excluding every kind of prejudice and preoccupation to face only the facts (told often through direct quotations of Chomsky and other scholars).

"Knowledge and use of language" is the title of the second chapter, in which Jenkins examines and elucidates in more detail some key concepts of biolinguistics including modularity of language and mind and the language faculty. The characterization of language as a mental organ has a long history of hot contests, primarily because of the lack of shared understanding of the term *language* in the internalist sense. Jenkins provides every kind of evidence to support this view and the modularity thesis, citing many cases of aphasia where different areas of this organ are selectively damaged by genetic or epigenetic impairment.

With respect to modularity, Jenkins rightly observes that modularity at one level need not match up tightly with modularity at another level. Modularity of I-language does not presuppose or entail neuroanatomical modularity of the cortex, for example, and it is precisely for this reason that the study of UG and neuropsychological studies are claimed to be complementary to each other rather than mutually exclusive.

Jenkins takes up the issue of psychological reality once again, this time stressing the difference between UG as a theory of formal systems which abstracts away from real-time processing and psychological models which do not. He draws the readers' attention to the interesting parallelism between researches in biolinguistics and in molecular biology, pointing out that the structural analysis of proteins can be done independently of the analysis of their actual folding processes. In this connection, it is noteworthy that current derivational model of syntax pursued in the minimalist program can be seen as an integration of these two different approaches; it is argued by some that structural properties of a given phrase marker are to be better understood as consequences of its derivational process (see, for example, Epstein et al.'s 1998 discussion of "derivational c-command").

Jenkins also rejects Philip Lieberman's disfavor of the notion of an ideal speaker-listener and other linguistic idealizations, by reminding the readers that such idealizations and abstractions make modern biology possible at all, as exemplified by Mendelian population in population genetics. This chapter is to a considerable degree an advanced continuation of what the previous chapter has presented.

The third chapter, "Acquisition (growth) of language," starts with a sketch of Chomsky's principles and parameters model of UG, of how well it fares with the facts of language acquisition or, more precisely, the biological phenomenon of spontaneous language growth under poverty of the stimulus. The idea that there is a universal *Bauplan* for language, specified by principles of UG and to be fine-tuned into particular languages by parameter setting, is the most plausible hypothesis main-

tained in the biolinguistic context in order to address and solve Plato's problem. In a biologically important sense, there is only one human language just as there is only one human species. Derek Bickerton's "bioprogram" hypothesis is in conformity with this *Bauplan* idea, contrary to what Bickerton himself apparently believes.

The view of language growth in terms of parameter setting, as opposed to the classical view of language learning, is strongly supported by the immunologist Niels Jerne (Jerne 1985). The immune system is a molecular-level cognitive system in which antibody cells are formed prior to exposure to antigens and then selected from the already present repertoire by the actual antigens the system encounters. It seems likely that a similar process of internal selection (vs. external instruction) works at the core of language acquisition, in the central nervous system. Jenkins is prudent enough to caution against the absurdity of bringing the molecular mechanism directly into language acquisition and also of rejecting the whole concept of learning to the extreme position that "language is unlearnable," as it is this very absurdity that underlies many anti-generativists' pointless criticisms, including those by people like Jeffrey Elman, Elizabeth Bates and Mark Seidenberg.

Jenkins takes time to closely examine what these connectionists have to offer as an alternative to the biolinguistic approach, only to find again that these authors are preoccupied with misconceptions of such basic notions as innate knowledge, genetic endowment, poverty of the stimulus and learning. It is shown that they are only distorting and deforming Chomsky's claims in accordance with their own misunderstandings; in Jenkins' terms, they are merely "redefining" innateness and learning, rather than "rethinking" or "rediscovering" them. Seidenberg even ignores the fact that probabilistic considerations existed very early on within the generative tradition.

Towards the end of the chapter, Jenkins takes up the topic of emergent properties of language. Contrary to the popular view, biolinguistics as a reductionist research program is fully aware that

language exemplifies emergence, with its complexities not explicable in terms of concepts and principles useful at lower, more fundamental levels of scientific inquiry. The question is how it becomes possible to integrate researches at varying levels of abstraction and reduction, from microscopic to macroscopic, and this is part of what lies at the core of the unification problem. It may be noted in this connection that Chomsky's "strong minimalist thesis" is a step forward in approaching this unification problem, in the sense that it proposes to ask to what extent language design can be directly explained in terms of natural laws working at the physical or morphogenetic level.

So what brings about the complex emergent properties of language? At this early stage of discussion, Jenkins only cursorily refers to symmetry breaking, a concept of vital importance in every area of modern natural sciences, leaving a detailed discussion of its relevance to language to chapter 5.

The fourth chapter "Mechanisms of language" might be better entitled "Genetics of language," in which the crucial role of genetic studies in biolinguistics is fully explored with illustrations of a number of case studies. UG is, it should be recalled, a genetically determined initial state of the human language faculty, so that its neurogenetic status should be everyone's concern, apart from the nonsensical "grammar gene rumor" or the "one gene - one parameter" hypothesis.

After reviewing cases of developmental dyspraxia, dysphasia and dyslexia due to genetic disorders, Jenkins neatly outlines the steps of genetic inquiries for biolinguistics. They are to (1) characterize the phenotype, (2) examine the karyotype, (3) perform linkage analysis, (4) walk the chromosome, (5) clone the gene, and (6) study the gene product. Jenkins exercises his extensive knowledge in this field to describe each step in detail. He also addresses the issues of a critical period in language acquisition and the brain asymmetry (at the four levels of functional, anatomical, architectonic and biochemical) and suggests that they too fall within the molecular genetic area of biolin-

guistics.

Cerebral asymmetries in humans and great apes are compared at the end of this chapter. It is a classical fact that chimps and macaques, like humans, have longer left Sylvian fissures, as confirmed over and again by researchers including Norman Geschwind and others. When this observation first attracted the public attention, it was mistakenly reported by the press to go against the claim of the species-specificity of language, which in fact has nothing to do with human monopolization of brain asymmetry. It is another good example of the deep-rooted misconceptions about the generative/biolinguistic view of language.

Chapter 5, "Evolution of language," is the highlight of the book, where Jenkins discusses Darwin's problem at length, taking the minimalist program as his guideline. The major concerns here are therefore the design specification of human language and its evolution. Minimalist assumptions hold that language has an optimal design as an interface between sound and meaning and that such a design, on a par with economy of nature and parsimony of the universe (organic or not), has to be explained in terms of physical or morphogenetic principles that determine and generate physically possible forms at all, rather than by natural selection alone. It is in this context that earlier works by D'Arcy Thompson and Alan Turing on morphogenesis, or such topics as the Fibonacci numbers in nature, are now often mentioned in the generative literature (Uriagereka 1998 is a representative work).

Following this stream of thought, Jenkins extends the idea that basic design features of language such as word order may be understood as instances of broken symmetry. He mentions suggestive examples in the physical and biological domains, including the familiar sunflower petals with spirals growing in Fibonacci numbers, self-assembling proteins in viruses, the evolution of genetic code, and the origin of chirality in the biological system. Jenkins argues that the limited variation of word order found in the world's languages may be thought of as another instance of broken symmetry. UG as the initial state of our language

faculty is symmetric in the sense that it potentially allows every possible combination of linear order. Fixing the value of the head parameter can be seen as a process of breaking this symmetry, giving rise to the actual order(s) in each language. That is, symmetry breaking comes in during the ontogenesis of language (language growth).

One might think otherwise here. What later came to be known as the "universal base hypothesis" (Kayne 1994) holds that UG is asymmetric in that it has a unique word order already fixed, with superficial diversity reduced to parametric variation. This would amount to saying that symmetry breaking took part in the phylogenesis of language. Similarly, one could envision analogous symmetry breaking in the derivation and interpretation of each linguistic expression, in accordance with current minimalist model. So suppose syntactic phrase markers are free from order but their morphophonological interpretation imposes linearization on them. Suppose also that the syntactic operation *Move* creates multiple occurrences of a single object in a symmetric way (so that we have *John was fired John* as a consequence of A-movement), but phonetic and semantic interpretations break this symmetry by "observing" just one occurrence (so that we now have the asymmetry of *John was fired* on the phonetic side and *was fired John* on the semantic side). This would be just to extend the whole idea to the, say, "microgenesis" of language.

Stressing the import of spontaneous symmetry breaking in an evolutionary theory of language (an instantiation of the minimalist/internalist perspective) does not go well with the neo-Darwinian tradition that holds natural selection as the omnipotent explanatory tool, and in fact generative grammar has been viewed as an expression of "neo-neo-Darwinism." Jenkins devotes a large portion of this chapter to the task of defending Chomsky's position against attacks from ultra-Darwinists like Pinker and Dennett. He very righteously points out that Chomsky does not argue against natural selection per se, accepting it as one major driving factor of evolution in perfect harmony with Darwin's

original thinking. Jenkins rejects criticisms by ultra-Darwinists as deriving from further misconceptions of Chomsky's position (a Darwin-hating creationist, etc.) and uncovers the dogmatic nature of ultraselectionism, condemning its methodological dualism.

The point is clear enough: natural selection can only work on already existing forms, and whatever possible form can exist is a consequence of physical constraints. Minimalist inquiries are primarily concerned with discovering the extent to which language design can be understood in terms of these constraints, without recourse to functional-teleological or adaptationist considerations. Concepts like language as a spandrel and exaptation (as opposed to adaptation), familiar to the Chomsky-Gould camp, summarize this minimalist/internalist view on the issue of language evolution (and it is unfortunate that Jenkins does not explicitly mention these notions in the book).

Jenkins then reviews recent studies on ape communication. Excluding every kind of ideological fanaticism, he emphasizes the importance of studying each biological system to determine the specificity of the mechanisms working in it. Instead of asking whether chimps have language, for example, we should ask what properties their system does and does not share with ours. The minimalism program, like its predecessors, posits discrete infinity as one major property of human language, with the operation *Merge* as its generative engine. It is suggested, then, that at some stage of our evolution this combinatorial operation became available in our brain, which led to the emergence of human language (see Berwick 1998 for relevant discussion). Darwin's problem requires us to ask how this was possible at all.

At the end of the chapter, Jenkins takes up Terrence Deacon's (1997) brain-language "co-evolution" theory which treats language as a virus that exists external to the brain and parasitizes it. Like many others, Deacon holds the erroneous belief that primate communication data challenge Chomsky's position, quite contrary to fact. His own "language-as-a-parasite" story is nothing but "complete regression in

linguistics," which is also based on blatant misunderstandings (Deacon even relates the "hopeful monster" theory of evolution to the UG hypothesis). All in all, one of Jenkins' main purposes in this chapter is again to "set the record straight," this time in connection with evolutionary issues.

Chapter 6 is the conclusion, in which Jenkins summarizes the preceding discussions and suggests some future courses biolinguistics may take. In particular, he remarks on the potential usefulness of comparing human language syntax and the chemical syntax of DNA.

Biolinguistics serves better than anyone can expect as an illuminating invitation to this exciting interdisciplinary field. Although I think Jenkins could have made the book even more readable, and instructive, by avoiding sporadic repetition of similar arguments across chapters and minimizing use of highly technical terms without clarification (which makes chapter 4 hard to follow for nonspecialists), this is a book strongly recommended to everyone interested in or engaged in the biology of language and its related areas.

Errata: p. 57, "Plato's problem" should read "Humboldt's problem" and vice versa: p. 223, "(Lasnik, 1997)" should read "(Lasnik, 1999)"

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本書はチョムスキーの生成文法理論の基本理念や近年の展開を，生物学諸分野との関わりを中心に描写した概説書である．生物言語学と呼ぶべき方法論は生成文法の独占するところでは決してないが，とりわけミニマリズムが言語設計の最適性を重要課題に据えて以来，人間言語に対する生物学的論考は今や生成文法を中心に言語科学の大きな潮流となりつつある．本書でも遺伝性言語失陥をめぐる旧来からの遺伝学との連携はもとより，形態発生学から進化論争までさまざまなレベルにおける生物学との生成文法の交流ぶりが活写されている．特に本書では言語進化の問題が大きく取り上げられており，「説明的妥当性を超える」ことを目指し始めた現在の生成理論の姿を理解する上で大いに有益であろう．言語の特性の根本的説明として近年示唆されることの多い対称性の破れや自己組織化の概念にもそつなく言及しており，生成文法が言語を含めた自然物に繰り返し現れる数学的パターンやそれを生む自然法則の研究としての側面を合わせ持つことをよく伝えている．一方で，対立陣営からのチョムスキー批判の多くが誤解と無知に基づく不当なものであると繰り返し指弾し，時に難解な専門用語も多用されるため，初学者よりはむしろ，生成文法にすでに馴染みがありさらに視野を拡げたいと思う言語学徒，他の専門領域の視点から生成文法に関心を寄せる自然科学者などに薦められる一冊であろう．

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