★ REVIEWS ★

The Bird Is the Word

Bolhuis, Johan J. & Martin Everaert, eds. 2013. *Birdsong, Speech, and Language: Exploring the Evolution of Mind and Brain*. Cambridge, MA: MIT Press.

by Pedro Tiago Martins

The idea that birds might have something related to language that humans also seem to have has gone full circle: After the developments of linguistics and psychology during the 20th century put the 'uniquely human' in the center stage, with the help of failed or misled language experiments with animals, it now seems that perhaps birds have something to tell us after all. Even though the study of our closest cousins still very much dominates the understanding of our own biological and behavioral traits and tendencies, current, cutting-edge theories of language evolution now give a great deal of importance to the study of birds and their vocal abilities. It is not the case of course that scientists nowadays think that birds have 'human language' (they don't, as the reader will also have concluded, if he has ever been around birds and tried to have a conversation). Instead, what has happened is that recent developments in various fields have made the study of birds a perfectly fine component of any serious approach to the unveiling of the nature of language.

Indeed, the study of birdsong is now an emerging trend in the biolinguistic sciences. In recent years, many papers, talks, and some books have been devoted to the subject. Not surprisingly, most of the work on birdsong in the context of language studies has come from non-linguists, who are more in touch with the methodology and literature on animal studies and biology in general. The degree to which birdsong has at least fascinated linguists, however, is arguable at best. Phonology is the obvious core area of language study that should pay attention to it, but the subject is a rare sight in the phonology literature (with some exceptions by, for example, some of the contributors to the volume under review). Moreover, I suspect that the idea of even approaching it will seem ludicrous to most working phonologists today. Morris Halle's endorsement on the back cover of the book under review is somewhat revealing regarding this point, as he says that "[b]oth humans and birds produce and react to acoustic signals, but they do so in ways that have some similarities and many obvious differences" (emphasis mine). It is true that there are many obvious differences, but it is also true that for the most part we haven't been able to uncover and appreciate the similarities, partially because of a lack of interest. Of course, it is not the case that phonologists should personally be interested in a subject that apparently does not have

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much to do with what they were trained to analyze and explain, that is, I do not claim that the lack of discussion on birdsong represents a blatant omission in the phonological literature.[1]

Instead, I claim that this would be a good time and opportunity for phonologists and other linguists to reassess their claims about innateness and biology (UG) in light of a broader, evolutionary picture, of which birds and birdsong are also (a very important) part, on the one hand, and apply their knowledge of structural analysis to this domain, on the other. Perhaps phonologists even have it better than other linguists regarding the latter point; after all, other core areas of the study of language cannot rely on cues as concrete as speech or sign. As put by Philip J. Monahan and colleagues:

> [That less attention has been paid to the biolinguistics foundations of phonological systems than to those of syntactic ones] is surprising because we believe that there are a number of reasons that biolinguistic inquiry into this domain [phonology] should be more tractable. First fewer levels of abstraction separate the fundamental representations of phonology from the basic sensory input representations. This means that knowledge about how basic auditory information is represented and processed in both humans and animals is more likely to provide important insights into how phonological information could be represented and processed. […] Second there already exists an extensive literature to build on from cognitive psychology that has investigation the extent to which "speech is special" (Liberman 1996). […] Third, on most linguistic theories, phonological representations are the basic unit that connects sensory input and motor output. Therefore, by investigating the biological basis of phonological knowledge, we can benefit from existing evidence from other cognitive domains on the biological basis for sensory-motor translation, such as is needed for visually guided reaching.
>
> (Monahan *et al*. 2013: 233–234)

One would expect that the tools and methods developed in phonology could be used to describe and analyze the vocalizations of animals (namely, birds), but that has only very rarely happened. While the basic assumptions of phonology,

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[1] The lack of discussion on human biology tout court, which—one expects—is more fundamental than discussions on birds, is what we should see as a blatant omission. Surely, many linguists claim that generative grammar studies the biology of language, but in practice the field stays far apart from it. Witness, for example, the following quote by Martin Everaert and Riny Huybregts, in the first chapter of the volume under review: "Generative linguistics is biolinguistics and deals, for example, with properties of the genetic endowment of a human biological system for language (UG)" (p. 13). Quotes of this sort are a staple in the generative tradition; after all, the intention of Noam Chomsky in 1950s and 1960s was precisely to study the biological foundations of language, and be done with the mechanistic description of particular languages. However, the results of the generative program obviously didn't do justice to that intention. It is customary in the literature to repeatedly state the biological aspirations of generativism, and surely some major, paradigm-defining conceptual arguments have been put forward by generativists, but in reality the fingers of one hand might be enough to count the works in the generative tradition that actually and objectively have dealt with "properties of the genetic endowment of a human biological system for language." Thus, the general claim that "generative linguistics is biolinguistics" cannot be supported. Perhaps some of the work in generative linguistics more accurately falls within what Boeckx & Grohmann (2007) call "biolinguistics in the weak sense", that is, a concern for biolinguistic issues, but no real commitment to them, in the sense that real, biological explanations for biolinguistic phenomena are not sought.

as in linguistics, pertain to humans (usually, the rules, constraints and units of language are ascribed to human biology), there is nothing about the tools themselves that makes them only applicable to human phonology. Sure, some tweaking is in order, but as soon as intuition tells us that birdsong has structure, regardless of what accounts for it, we should be tempted to use the tools we have amassed and developed over the course of a century and apply them to this new world of sound. One could even hope to refine the theories and tools used in human phonology by applying them elsewhere, as it would be a good test for what is intrinsically human in phonology (accidentally or not) and what pertains to more general constraints of the animal or, even more interestingly, the physical world.

Choosing this path would most likely blur the line between phonology and phonetics, but this should not deter anyone. In fact, in recent years that line has been moved quite a distance. For example, Blevins (2004) has very convincingly shown that many phenomena usually considered phonological could in fact have a phonetic explanation, relying on natural rules of sound change and the way the production and perceptual systems work. In the same vein, although from a different angle, phonologists such as Samuels (2011) have put forward accounts of what remains phonological after those now external factors and whittled away.

More generally, part of the mission of biolinguistics should be the blurring of conceptual, epistemological, methodological and classificatory lines. Let me explain: Any science or program should abide by very rigorous definitions of the objects of its study and the entities it cares about, but I have the impression that very often, by focusing on the division of specific factors, and the ascription of any one phenomenon to each of them individually—say, as in the case of the three factors in language design (Chomsky 2005), or the FLN/FLB distinction (Hauser *et al.* 2002), often appealed to as if they were not closely related and intertwined in many ways—, scientists ignore the important interactions from which phenomena and ultimately explanations might arise. The same could perhaps be said about biological dichotomies such as continuity/discontinuity, adaptation/exaptation, or nature/ nurture, which so often take charge of discussions of evolution. This is not to say that deriving dynamic evolutionary explanations is easy, specially if the "trait" in question is language. Martin Everaert and Riny Huybregts appeal to Chomsky's pessimistic stance on language evolution in the first chapter:

> Chomsky addresses the question of why one would want to work on language evolution, and comes to a negative conclusion on the basis of considerations like the following. There are many simpler questions that are scarcely investigated, such as the evolution of communication in the hundreds of species of bees, because they are regarded as much too hard. (p. 19)

It might be true that studying language evolution is an extremely challenging task, but I think that this quote can be countered by using one of Chomsky's own mantras: that we should allow ourselves to be puzzled by the world. Chomsky has lived up to it: He as co-authored papers on language evolution (Hauser *et al.* 2002, Berwick *et al.* 2013), and birdsong has not been left out. With this state of mind in place, I will move on to the contents of the book itself.

This volume is divided in six parts: 'Introduction', 'Acquisition of Birdsong and Speech', 'Phonology and Syntax', 'Neurobiology of Song and Speech', 'Genes, Song, Speech, and Language', and 'Evolution of Song, Speech, and Language'. While these titles seem well delineated, the structure of the books feels somewhat looser: One must bear in mind that this is a collection of contributions to a meeting ("Birdsong, Speech and Language: Converging Mechanisms" in Utrecht, 2007), and some decisions as to where each belongs had to be made. For this reason, different foundational and basic notions of both the study of language and birdsong come up more than once in different parts of the book. Since there are so many contributors to this volume, I could not possibly analyze each of them in detail, so I will instead go over each chapter briefly.

Part I is devoted to the introduction of some of the pillars of the current biolinguistic study of language. Everaert and Huybregts start off the main matter of the book by offering an outline of the generative enterprise, along with a discussion on some of the ways that classical linguistic notions have been used in the study of birdsong. Apart from some brief remarks—such as the ones I already called attention to above—, not much is objectable, and the text will seem fairly straightforward, the goal clearly being the familiarization of the non-linguist reader with the kind of things that the linguist usually does and cares about.

Conversely, to familiarize the non-biologist, Tecumseh Fitch and Daniel Mietchen treats us to a subject very much at the heart of comparative biology: homology. As the authors define it:

> Unadorned, the term homology today denotes a character shared by two taxa by virtue of inheritance from a common ancestor, regardless of current form or function. Homologies are typically used by systematicists to construct taxonomies, and in phylogenetic analysis to reconstruct ancestral traits. (p. 45)

This definition is sufficient for capturing the gist of what it means to say structures X and Y are homologues, but as the authors point out, there is more to it than that. Homology may refer to different things, both historically and in current use. For example, Richard Owen, who coined the term, saw homologues as structures within and across species that were similar in form, while for Darwin they were structures that descended from a common ancestor (something Owen would call special homology). The authors discuss various types of homology, with a focus on the very interesting notion of deep homology: "[T]raits in two widely separated species [...] generated by one or more genes or genetic networks that are homologous." (p. 48). Fitch and Mietchen put forward that the famous FoxP2 gene might be a case of deep homology in the behaviour of birds and humans: This gene plays a very important role in vocal abilities in both groups.

Gary F. Marcus' contribution on the nature of trees as a way of mentally representing structural relations is no doubt an interesting read, but its eminent relevance for the volume is not obvious, and actually no references to birds are made throughout the text. It surely is interesting to question long-held assumptions about the way humans organize information in general and sentences in particular, but indeed the engagement with the main topic leaves something to be desired.

Neurobiologist Erich Jarvis lays out a very good summary of the topic he has become known for: brain pathways for vocal learning. He goes through the brain pathways that seem to be involved in vocal learning in both birds and mammals (although with restrictions on the mammalian side, due to the ethical concerns that prevent large-brained mammals to be the subjects of certain experimental procedures), and puts forward a motor theory of vocal learning, according to which there might be deeper constants that shape the development of vocal learning systems in distant species, which goes back to the topic of Fitch and Mietchen's chapter, deep homology.

Part II deals with the acquisition models of birdsong and language. Sanne Moorman and Johan J. Bolhuis lay out a very brief and to the point chapter on the similarities and differences between birdsong and human speech, by outlining some important characteristics of birdsong and later comparing them to the analogous human behavior. We learn that songbirds, like humans, imitate and learn their songs from their parents, and that some more nuanced behavior also occurs in birds, such as a tendency to imitate their conspecific song when more inputs are available. There also seems to be a 'sensitive period' for song acquisition in birds, which gives support to a more general notion of the critical period for language acquisition in linguistics and may help explain it. Other similarities are existence of different learning phases and the importance of auditory feedback, both humans and songbirds start by taking in the characteristics of their parents' song/speech very early on, and only later start imitating them, eventually perfecting their production also with the help of their own audition. Another similarity birdsong and human speech, comes from the structure behind them: Like human language, birdsong reveals syntactic structure, even though, as the authors conclude, the connections are not so clear in this case, as birds lack a lexicon and presumably also semantics.

Neil Smith and Ann Law choose to look at parametric variation as applied to birds. This choice strikes me as odd, since parametric variation as a biologically plausible or useful notion has been convincingly disputed (reference). The authors go on to briefly summarize Principles & Parameters theory (Chomsky 1981 *et seq*.) and to identify a number of criteria for determining whether parametric variation is true for a given system, namely birdsong. The conclusion is not entirely clear, to me and the relevance for the study of the relation between birdsong and human language does not seem clear, either. This contribution is closer to a formal exercise than an investigation into the nature of variation.

Olga Fehér and Ofer Tchernichovski try to answer the following question once put by Partha P. Mitra:

> Is it experimentally feasible to have a songbird colony established by an isolate founder ad then test if and how the improvised song produced by such isolate (ISO) birds would evolve toward wild-type (WT) song over generations without any external influence? (p. 144)

They set up an experiment by establishing "an 'island' bird colony with an isolate founder, and, in addition, performed a series of experiments where exposure to songs was controlled across 'generations' of song tutoring: ISO songs were imitated by unrelated juvenile birds who, when adults, trained another generation of

birds." The authors concluded that juveniles are born with biases toward WT song, yet they must be exposed to songs to imitate before these biases take them there.

Frank Wijnen suggests in his chapter that there might be a general learning mechanism for the acquisition of linguistic categories. By pointing to some of the brain structures that underlie this mechanisms, his work opens way for cross-species experiments, although no considerations regarding this point are made.

Part III is devoted to the comparison between the phonological and the syntactic components of human language and birdsong. Moira Yip's contribution is a clear use of phonological notions developed in linguistics within the domain of birdsong. The author tries to find in birdsong parallels for all of the major sound units linguists are used to (from the syllable to the intonational phrase). Upon close inspection, one finds structure in birdsong that could reach up to six hierarchical levels, but it seems much more constrained in what can happen within that template than what it is the case in human language. Still, as the author points out, there is no doubt that the application of phonological tools to the domain of birdsong can only help understand both domains.

Eric Reuland offers a chapter on recursivity in language, a topic much discussed ever since Hauser *et al*. (2002). After a fairly straightforward overview of the subject, in which Reuland discusses the different types of reactions that the Hauser *et al*. (2002) have triggered—"(i) there is much more in language that is unique; (ii) recursivity is not just the basis of syntax, but recursivity is also—or even primarily—a property of the other components of the language system, notably the conceptual system; and (iii) manifestations of recursivity are also found in other species (p. 219)—, he sets out to assess the validity of (iii), which is clearly the most interesting in the context of this book. On the basis of work carried out by Gentner *et al.* (2006) on starlings, Reuland concludes that birds probably can't tell us much about recursivity, since it appears that they can only differentiate between patterns by making use of a good memory system, but no not internally represent those patterns in a recursive fashion.

Kazuo Okanoya looks at the syntax of birdsong. The term 'syntax' is used here to mean structure and hierarchy of sound: "Each birdsong note has specific acoustical properties; these song notes are ordered according to rules that are typically referred to as 'syntax'." Okanoya concludes that despite the lack of meaning and compositionally in birdsong, its syntax is a perfectly fine model of human language, since they have so much else in common (such as different stages of acquisition or similar brain mechanisms at play).

Carel ten Cate, Robert Lachlan, and Willem Zuidema present in their chapter the perfect follow up to previous two, by going over the phonological and syntactic structure of human speech and birdsong and coming to conclusions similar to the previous authors.

Irene M. Pepperberg, goes over some data from her experiments with Alex, a grey parrot, and showed that birds might have a sense oh phonology, or at least of some rudimentary phonotactics. Recent developments in the study of mechanisms underlying phonological awareness now give Pepperberg new grounds for supporting some of the results she has obtained over decades of experimentation. These results, even though highly publicized, may not have

received the attention they deserve, always at odds with the idea that language and its most important parts are uniquely human.

Part IV is the devoted to the neurobiology of song and speech. Sophie K. Scott, Carolyn McGettigan, and Frank Eisner show speech perception and production, while very obviously related, also show a fair degree of dissociation, namely at the brain level, with the dorsolateral temporal lobes being associated with perception and the bilateral motor and premotor cortex, the left anterior insula and the left posterior-medial auditory cortex with production. These areas might be activated in various patterns by different behaviours, and not always the most intuitively obvious (for example, the movement of the articulatory apparatus as if to produce a word, even if this word is not vocalized, can activate the motor cortex). Once again, no connections are made with birdsong, but understanding the brain mechanisms behind simple characteristics of speech may open the way to cross-species investigations.

A good companion to the previous chapter, Sharon M. H. Gobes, Jonathan B. Fritz, and Johan J. Bolhuis' contribution, and review the literature on the neural mechanisms underlying vocal learning in songbirds in mammals, and find actually the neurological models based on birdsong are the ones that most help us understand the human case, since both at the genetic and neurological level birds come closer to humans than non-human primates when vocal learning abilities are considered.

Christopher Pallier offers a review of neurological data in support of the critical period hypothesis, ultimately concluding that this is till a very prolific area of research. Once again, basing the investigation not on linguistic data but on neurological discoveries allows for investigation in other domains and species, such as birds and their song.

Hermann Ackerman and Wolfram Ziegler discuss the components of human language that most consensually can be looked at (and for) in birds: the phonological components, leaving aside other, so-called syntactic components. The authors note that, despite the apparent lack of meaning (in the human, semantic sense) of bird vocalization, its development bears some similarities with human speech, an idea already discussed in the volume by, for example, Kazuo Okanoya. That is, while in the end there might be some human component(s) that, with speech, constitute human language, speech alone and birdsong are strikingly similar at various levels. The authors go on to discuss various cerebral structures, mechanisms and pathways which show that, despite some obvious differences, humans and birds (and other animals) have much in common.

In one of the chapters that I found the most interesting, Michale S. Fee and Michael A. Long give us a well-crafted summary of experimental work that, according to the authors, goes on to show that different time-scales of birdsong—notes, syllables, phrases, song, etc.—are not due to different time-scales of different brain mechanisms and circuits ('oscillations'), but rather from the execution of different 'behaviour modules' in succession. According to the model the authors propose:

> Each syllable is generated by different synaptically connected chains of neurons in HVC [an essential brain area in songbirds for song production]. Each

> chain forms a 100ms behavioral module that can be activated by the thalamic nucleus Uva. (p. 369)

This is extremely interesting in that it puts into perspective a great deal of literature on the importance of brain oscillations for the determination of sound units. Moreover, it gives the thalamus a very important role, and this applies not only to speech and language, but to the generation of complex hierarchical behaviors, as the authors explain.

Jonathan F. Prather and Richard Mooney discuss mirror-neurons, a very hot topic, specially since the collaboration between Giacommo Rizzolatti and Michael Arbib that started in the 1990s. The authors show—based on experiments in their research group—that some specific neurons in the swamp sparrow brain exhibit auditory-vocal correspondence, that is, they fire both when the swamp sparrow produces or listens to the same vocal gesture, as well as to similar gestures of other species. They go on to defend that the activity of these cells while singing is important for vocal learning itself, which renders these neurons an important component of vocal learning in birds.

Gabriël J. L. Beckers provides in his chapter a comparison between peripheral mechanisms of vocalization in birds and humans. As the author explains, interest in the mechanisms of bird vocalization have long been studied, but comparisons with humans have only more recently been studied, after the realization that, even though their vocal apparatuses are different, there is ample room for comparative approaches between the two. Beckers goes through years of research in the physical principles of vocal production (common to all tetra-pods), the role of respiration (both birds and humans mostly vocalize during expiration), the voice organ (different in humans and birds, since the latter make use of their specialized syrinx, instead of the larynx, for vocalizing), the mechanisms of voice production (which tends to periodic, rich sound waves in humans, and sinusoidal, pure tone sound waves in birds), or vocal tract filtering (much more dynamic in humans than songbirds, although also important in the latter). The general conclusion is that there is much still much work to be done in bird vocalization, since there is no way of generalizing the known mechanisms to all 9,000 species, by the author's count. One can hope that renewed interest in bird-song and its relation to language will inspire researchers to carry out more work of this sort in the upcoming years. Of course, all of the aspects mentioned also display important differences in birds and humans, which Beckers is right to point out.

Part V is devoted to genetics. Simon E. Fisher offers a general overview of what is known about the FOXP2 gene. The main lesson to take from this chapter is that, as the author rightfully acknowledges, FOXP2 is not a 'language gene':

> The investigations of FOXP2's potential role in human evolution have led to something of a revival of the 'speech gene'/'language gene' tag, particularly in the media. Is it worth reiterating here that it is unlikely that any single gene is responsible for the emergence of the complex suite of skills that allows members of our species to acquire spoken language. (p. 447)

Fisher goes on to explain how FOXP2 should be interpreted in the context of language evolution:

> FOXP2 is an ancient gene and is found in similar form in nonspeaking vertebrates, where we suspect it affects plasticity of circuits involved in sensorimotor integration and motor-skill learning. Perhaps the alterations of FOXP2 in the human lineage were important in enhancing these processes, at time points when spoken language was emerging an evolving (driven in part by other genetic and nongenetic factors). Such modifications may have had wider ramifications, beyond facilitating sequence of articulatory movements, if FOXP2 also plays roles in neural plasticity during procedural learning, for example. This fits in with the idea that our speech and language skills did not appear fully formed and out of the blue, instead involving recruitment and refinement of existing anatomical, physiological, and neurological systems (Fisher & Marcus, 2006). (p. 447)

Is it definitely worthwhile to go through Fisher's chapter and understand what FOXP2 can do, what other genes it's closely related with (e.g. CNTNAP2, and what it cannot do.

A great follow-up, Constance Scharff and Christopher K. Thompson's chapter do for birdsong what Fisher does for human speech and language. After covering some of same ground, the authors highlight the development and expression of FOXP2 in birds and the effects it has both for their vocal abilities and for the study of vocal learning in general.

Franck Ramus devotes his chapter to the way language disorders can inform our understanding of the genetic basis of language, and thus our (at least partial) understanding of its evolution (for a very recent take on this topic, see Benítez-Burraco & Boeckx 2013). More specifically Ramus focuses on developmental dyslexia, a disorder of reading acquisition. He describes the disorder's cognitive and neurological phenotypes, and reviews the genetic findings related to it, establishing some links with it and SLI and Speech Sound Disorder. The rigorous study of the genes that enter into this and other language disorders might prove to be essential in the unveiling of the genetic basis of different components of the language faculty: a language genetics.

Part VI is the devoted to the evolutionary models. Tecumseh Fitch presents a modern version of a Darwinian model for language evolution: musical protolanguage. This model gives pride of place to vocal control, and as such it is well place in the comparative, cross-species landscape. Under this model, music and speech, which require similar (or the same) brain mechanisms and genetic basis become, become two evolved versions of a more general phenomenon in the animal kingdom.

Kazuo Okanoya reviews several experimental results that seem to indicate that the evolutionary path of birdsong goes to various stages of complexity. Okanoya focuses on the Bengalese finch, and offers a scenario according to which complex song-note transitions became the object of sexual selection, later toned down by environmental needs and costs of several kinds, and need for a certain degree of 'simplicity' in order for a species member to be recognized. Later, domestication eliminated most selective and environmental pressures, allowing for the genetic basis of song complexity to materialize.

The final chapter, by Irene M. Pepperberg, offers and avian model for the evolution of vocal communication. Pepperberg uses the bellbird mirror neuron system, a species which appears to be at an intermediate stage of vocal learning,

as a model for what could innate and learned, and more specifically for a model of what needed to have happened non-linguistic primates to homo sapiens.

This volume is perhaps the only one available that offers a state-of-the art perspective on birdsong and its relation to language. All chapters are written by acclaimed figures of their respective fields, offering mostly what is the result of their own work or their associates, which is a guarantee for an authoritative view on the subject. For the linguist, perhaps some of the chapters will seem too technical for a book of this sort, with extensive use of abbreviations of names of brain areas, making argumentation at times hard to follow. This obstacle notwithstanding, taking the extra step to understand and learn what each author—and field—is trying to tell us is ultimately rewarding. However, as I have pointed out above, some chapters, namely some the more linguistically oriented ones, seem odd in the context of birdsong and language, offering no angle that makes them a better fit for this volume than for any standard textbook in linguistics. Still, this is a very minor fault, and surely some interesting insights can also be derived from those chapters if the reader is willing to do the work.

But perhaps even more importantly than providing a state-of-the-art, this book gives the reader information about whose and which lines of work to pay attention to: Remember that these contributions come from a conference that took place almost seven years ago, and even though some important work published after that is often cited throughout the book, each of the topics covered and most of the authors have produced fresh literature in the meantime. Also, some chapters are reworked versions of work published after the meeting took place (this is either inferable from the text or explicitly acknowledged in most cases). This being said, perhaps this volume would have made a bigger impact two or three years ago, had it taken less time to put together.

In my opinion, *Birdsong, Speech, and Language* is a clear example of biolinguistics in the strong sense (cf. Boeckx & Grohmann 2007), with real biological explanations of biolinguistic phenomena. Even though we are in our comparisons obviously dealing with human language as one side of the equation, I think it's important to forget about its specificity, which many times results in very strict methodological limitations. After all, biology does not 'know' what language is, and the biological processes that lead to language do so because it so happens; the idea that everything or most things about human language are special and unique is no longer valid, and it might even turn out that nothing about it is unique, except perhaps for the fact that all of its components are in place in humans. Some of these components are present in other species, and some of these species are not closely related to humans. Birds are a very important and the most widely studied example of this subset of species, and the convergence of neurological, genetic and behavioral discoveries of recent years that are brought together in this book will only help solidify our understanding of human biology as one possible result of the biological processes that guide all animal life.

As a whole, the different contributions are a lesson for those who think that Chomskyan linguistics and biolinguistics are one and the same thing. This reaction is common from both Chomskyans and non-Chomskyans, and it has different but related consequences: The Chomskyan linguist will not try to go bey-

ond what has become the canonical, descriptivist modus operandi of the field, while the non-Chomskyan will outright reject anything with 'Biolinguistics' in its name. Upon noticing that Noam Chomsky and Robert Berwick wrote the foreword for this book, I urge Chomskyans and anti-Chomskyans alike not to take their respective positions for granted, but rather to open the book, read the chapters and realize that perhaps things are not so black and white.

Birdsong, Speech, and Language is recommended not only to anyone who is interested in the foundations of birdsong and its relation to human language and speech, but also to anyone who wants to take a look at where biolinguistics is hopefully heading.

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