

Phonological Architecture: A Biolinguistic Perspective.

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over the last century to be particularly convenient, because I had forgotten certain items since graduate school.

Walker's message is clear: Disturbances are constantly affecting all life, everywhere, in an integrative fashion. This point of view is likely to be eye opening for many students and researchers who believe that it is possible to experimentally isolate one factor of interest, one disturbed element, in field study. Carcasses create nutrient pulses; sand dunes move across the landscape. Floods, tsunamis, treefalls, insect infestations, fires, volcanoes, and landslides are all considered and then put in a larger temporal and spatial context. Anthropogenic disturbances, including forestry, mining, agriculture, dams, urbanization, and military activities—which are novel compared with the evolutionary history of most species and ecosystems—are given a particularly thorough treatment. An estimate of the proportion of the Earth's surface affected by each disturbance type is given when data are available.

The book is not flawless, however. For example, fire intensity is measured in kilowatts (not temperature); tornadoes and thunderstorm downbursts, which probably affect areas as large as cyclones (*hurricanes* in North America), are absent; and large herbivores are not discussed in chapter 2 (“Terrestrial habitats”) but curiously appear later, in chapter 8 (“Temporal dynamics”), where they are certainly relevant but lack the necessary introduction that should have occurred earlier.

The usefulness and limitations of ecological theory are given reviews throughout the book. For example, Clements's theory on climax vegetation is put in the proper perspective with a discussion steering between the extreme viewpoints that have often been voiced elsewhere and the more indulgent approach, which allows it to mingle with the supposedly opposing individualistic theory. Discussions of ecological function, biodiversity, landscape ecology, patch dynamics

(including interface interactions, such as along shorelines), and restoration ecology appear in various chapters; these are like miniature textbooks on each of these topics and are among the highlights of the book. Chapter 8, on temporal dynamics, has a truly grand integrated discussion of the history, mechanisms, and trajectories of succession and how they are influenced by interactions with disturbance, plant-animal interactions, and environmental factors. This is the most readable discussion of the complexities of succession that I have encountered.



Some books in this genre have an anticlimactic ending that merely summarizes the earlier chapters of the book—not so here. Chapters 9 and 10 (the last two chapters) cover management concerns and future scenarios in the context of disturbance and maintain our interest until the end. These chapters highlight humans as managers of disturbance, degradation of the environment, and the possibilities and limitations of ecological restoration. Humans variously leave natural disturbance alone, try to restore it, try to mimic it, try to eliminate it, or—if none of those options fit the situation—try to adapt to it. These choices depend on views of nature that differ regionally and with the human population needs and size. Intentionally introduced disturbances can have unintended consequences, covering such a large area that ecosystems are undercut. The same applies to a number of disturbances that are unintentionally introduced, such as tree diseases like chestnut blight.

In these last chapters, Walker also intertwines his personal message regarding the balance among natural areas, exploitive uses of biodiversity such as forestry and fisheries, and urban areas in a changing climate. The vulnerability of humans to disturbance grows as population increases, putting more people in the line of fire with natural disturbances. We both enhance natural disturbance through climate change and desertification and create others ourselves, which come back to haunt us. Possibilities of using technological, cultural, and ecological knowledge to deal with these problems bring the book to a conclusion. This leaves us to ponder intangible questions such as whether a certain quality of life can be maintained in a world with rapidly changing climate and growing population, what balance of human exploitation and native species is needed to maintain that quality of life, whether we are smart enough to obtain the necessary knowledge of ecosystem functions, and if so, whether impartial science will be used, given the cultural divergences within our society.

The Biology of Disturbed Habitats shows us why disturbance is fundamentally tied to all of these questions.

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THE BIG-TENT VIEW OF BIOLINGUISTICS

Phonological Architecture: A Biolinguistic Perspective. Bridget D. Samuels. Oxford University Press, 2011. 272 pp., illus. \$55.00 (ISBN 9780199694365 paper).

Attempting to unify biology and linguistics is not a new idea. George Zipf's work in the 1930s (e.g., Zipf 1935) demonstrated that

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there is a strong correlation between the frequency of an item in language and its size or complexity. Zipf interpreted this result to reflect a biological difficulty of production in language. Eric Lenneberg's work in the 1960s (e.g., Lenneberg 1964) compared language acquisition with biologically determined (e.g., walking) and culturally determined (e.g., writing) behaviors for the purpose of highlighting the importance of understanding the biological aspects of language. In the book *Phonological Architecture: A Biolinguistic Perspective*, author Bridget D. Samuels delivers a contemporary Chomsky-like interpretation of how linguistics—specifically *phonology*, the study of sound patterns in human language—can benefit from a biologically informed point of view.

Biolinguistics is the current buzzword adopted by linguists pursuing a particular branch of generative grammar closely associated with Noam Chomsky's Minimalist Program (Chomsky 2005). This word refers to a combination of aspects of biology and linguistics that varies depending on the particular researcher and the particular moment. Samuels's interpretation of the term echoes what was defined by Chomsky as pursuing linguistics through the investigation of three factors: genetic endowment, experience, and additional factors that are not specific to language. *Genetic endowment* is the innate capacity for the acquisition of human language referred to as *universal grammar*. *Experience* is the interaction between a child and the speech community that the child grows up in that determines which and how many languages the child acquires. According to Lenneberg, an adequate understanding of human language requires proper attention to both factors, in addition to knowledge of how they interact with each other. Neither nature nor nurture is sufficient on its own to explain human language.

The book's biolinguistic investigation of phonology begins with a review of the evolutionary basis of sound patterns in human language. This survey clearly demonstrates that much of phonology has precursors

in nonhumans. Samuels considers research on many different species to demonstrate that categorical perception of sounds is not unique to humans and, therefore, does not need to be explained by phonologists, nor should it be questioned.



Considering patterns of sounds that other species can learn is more of a mixed bag of results. A debate exists as to whether patterns of sounds found in different animal communication systems have *syntax*. Much of this debate is a confusion over nomenclature, however. If *syntax* is used to mean patterns among sequential elements, reasonable parties should agree that all communication systems have it. If *syntax* is used to mean patterns that demonstrate a complexity based on hierarchical generalizations, the question is more complicated and empirical in nature. Both human phonology and different animal communication systems have this type of hierarchical structure in at least a limited fashion, where smaller units of sound are grouped into larger chunks that have distinct patterns of their own. Samuels is correct in suggesting that our understanding of human phonology can benefit from a better grasp of what we know about the cognition of sound in animals and about the sound structure of animal communication systems.

Whether other animal communication systems are equivalent to human speech is another question. Samuels believes that the answer is clearly *no*, because there is a tight connection between human syntax and human phonology, wherein phonological

domains are directly derived from syntactic structure. This is where we have to recognize a third distinct meaning of the word *syntax*. Samuels and many other generative linguists reserve the use of the term for dependencies among different elements that are more than a simple hierarchical structure. The particulars of these dependencies are defined in contemporary syntactic theories, and it is at this point in *Phonological Architecture* where the book is written strictly for generative linguists.

The remainder of the book and the arguments therein are “inside baseball” for linguists only (e.g., arguing for phase-theory-deriving domains in phonology, being in favor of similar algorithms for processing syntactic and phonological structures, voicing against markedness theory in phonology)—for better or worse. Samuels is explicit enough in her arguments so that linguists can evaluate and argue with them, which always helps to push the field forward. However, when the analysis of human language becomes so narrowly technical, the connections to other fields of study or to other animal behaviors become completely opaque. If Samuels and linguists are interested in new collaborations with other researchers, especially biologists, it is incumbent on linguists to work on building these relationships and making their work more accessible.

It is difficult to accept all of Samuels's arguments off the shelf. The strong connection between syntactic (as it is narrowly defined by theoretical linguists) and human phonological structure that she proposes runs immediately into two complications. First, human phonology appears to lack syntax in the technical sense (Heinz and Idsardi 2011), which makes the interface between syntax and phonology more indirect than what Samuels proposes. Second, the structure of human phonology and those found in other animal communication systems are quite similar. If the structure of human phonology is so connected with human syntax, why

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do other animal communication systems resemble human phonology?

If we gain nothing from *Phonological Architecture* other than the motivation to work on a better understanding of the relation between human syntax and human phonology and an understanding of what is viewed as common and what is species specific across animal vocal communication systems, Samuels should be very happy. Additional technical points are made in the book that linguists should pay attention to, and specific claims are stated about possible computations in phonology and about the relationship between variation and language change. As with the rest of the book, these topics are presented in a clear and decisive manner, which allows them to be evaluated and argued by specialists in the field.

More credit will be given to Samuels's work if scientists heed her call to be more collaborative and cross-disciplinary in the study of human language. If we interpret *biolinguistics* as a research program that is dedicated to understanding the relationship between the genotypes and phenotypes responsible for explaining human language, the benefits of collaborations among biologists, linguists, psychologists, cognitive scientists, and zoologists are clear. Each scientific field provides a unique perspective of the content within this expansive definition. It is the message of *Phonological Architecture* that only with this big-tent view of biolinguistics will phonology research be a fruitful endeavor.

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