



Book Reviews

The Physics of Birdsong. By G. B. MINDLIN & R. LAJE. Berlin: Springer-Verlag (2005), Pp. x+157. Price £46.00 hardback.

To my knowledge, only one other complete book has ever been devoted to the topic of how birds sing: Greenewalt's classic and widely cited *Bird Song: Acoustics and Physiology*, published in 1968. The absence of more recent books on bird phonation is surprising, given that birdsong has grown into a major research field in animal behaviour over the past half century, and has been a burgeoning field in neuroscience for a few decades. In comparison, the mechanisms underlying human vocal production are addressed in a wide array of textbooks, reflecting the importance of this topic in almost all facets of speech research, be it evolution, learning or neural mechanisms. Trying to understand the mechanisms underlying bird phonation from the literature, however, has not been a straightforward task, and until now has involved reading a hodgepodge of primary research reports and diverse book chapters, combined with reference works on general acoustics. Mindlin and Laje's new book, which is largely, but not exclusively, dedicated to acoustic phonetics in birds is thus a welcome addition to the existing literature, and helps fill a large void.

The book is written as a tutorial-like guide that can be used without any special background in physics. It starts with the fundamentals: the first chapter is on the physics of sound waves, and is followed by a chapter on acoustic sources and filters. Accounts on basic acoustics can be found elsewhere, but I found the inclusion of this material very useful, not only for the sake of completeness, but also because the explanatory examples are in the context of vocal production. Particularly useful is the clear way in which filtering is explained. This concept, which is fundamental to voice production, is sometimes used in a rather abstract way in the birdsong literature. However, the authors take the subject back from the metaphysical domain and explain what is going on under the hood. The two introductory chapters are followed by five chapters that constitute the heart of the book, as they deal specifically with the physics underlying birdsong phonation. The first of these reviews the anatomy of the avian vocal organ, the syrinx, and the others address, respectively, the physics of sound sources in birdsong, the active control of the syrinx as a dynamic system, complex voice production by nonlinear interactions between acoustic sources, and modelling birdsong by numerical and electronic synthesis.

The last two chapters are somewhat different, as they do not deal with bird phonation per se. One could even argue that they do not deal with physical phenomena at all, but

rather provide two examples in which methodology from physics can be applied to issues in birdsong research. The penultimate chapter is about modelling neural motor pathways that control the syrinx, and the final chapter is on complex rhythms in birdsong, and includes an interesting example: duetting birds modelled as a non-linear dynamical system. The latter, in particular, is a very original approach which may be more widely applicable in the study of birdsong communication.

I found the book very stimulating and a pleasure to read. The authors' enthusiasm is simply contagious. Mindlin and Laje are physicists by training and I must admit that this worried me a bit beforehand. After all, physicists primarily communicate in equations, while a book on birdsong perhaps draws most attention from biologists, not all of whom may see this as the most suitable lingua franca. However, the authors have done an admirable job in producing an accessible book with a relatively high English-to-equation ratio. Nevertheless, it must be said that some a priori skills in more advanced mathematical techniques will be of benefit to the reader. In fact, those who would like to get a complete understanding of every single word and equation in the book will have to know their way around differential equations and complex numbers. Having said that, I think that even if one's skills in such techniques are a bit rusty, much of the book can still be understood and makes for a very worthwhile read; the authors take great effort to explain many of the physical phenomena involved in plain words.

Oddly, the book has no index, perhaps in an effort to follow in the footsteps of Greenewalt's legendary book, which also lacks an index. Although I hope that this emerging tradition will not catch on, it is not a major problem in this case because the contents of the book are well structured. However, it does reinforce my opinion that this book should not be seen as a comprehensive, review-like reference work, but rather as a concise, well-written tutorial guide, to be read from cover to cover, that elegantly introduces the reader to the physics of birdsong.

Who should read this book? Its contents more or less parallel the authors' journal articles on birdsong over the last few years, but the fact that the topics are more elaborately explained and nicely introduced for the non-specialist certainly justifies its existence. The text on the back cover claims that the book is of interest to 'physicists, biologists and general readers alike', but I do not think the book will please such different groups equally. A very strong feature is that much effort is spent on explaining fundamentals, and in building up the physical story step-by-step from the beginning. Nevertheless, the idea that this book will please 'general readers' may be a little too

optimistic. The simple fact that it involves a good deal of equations will probably not appeal to many general readers, except perhaps for the exceptional die-hard enthusiast who is determined to learn how birds sing. Instead, this book seems to be targeted very well at a professional scientific audience. Physicists may skip or only skim through those parts that deal with the explanation of basic physical phenomena, but for many students and researchers in the biological sciences they are indispensable. There is no doubt that this book is a must for those involved in birdsong research, but I think that also those interested in vocalizations of other animals and those who are generally interested in nonlinear dynamics of biological systems will find this a very valuable book. I recommend it strongly.

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Reference

Greenewalt, C. H. 1968. *Bird Song: Acoustics and Physiology*. Washington, D.C.: Smithsonian Institution Press.

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In the Company of Crows and Ravens. By JOHN M. MARZLUFF & TONY ANGELL. New Haven, Connecticut: Yale University Press (2005), Pp. xix+384. Price \$30.00 paperback.

Why is a group of crows called a 'murder', with its connotation of death and extreme injustice? Why does one almost never see a single crow, but rather a group of them, individuals attending to the behaviour of one another and potentially exploiting information gained by others? Why do so many examples of human art, literature and mythology refer so frequently to crows, rather than, say, to titmice, wrens, or for that matter, squirrels?

The relationships between crows, ravens and humans are at the heart of *In the Company of Crows and Ravens*. The book addresses four basic relationships: our influence on crow/raven ecology and evolution, our influence on crow/raven 'culture', crow/raven influence on our culture and crow/raven influence on human ecology and evolution. The book is well written and often lively, with a wealth of historical and scientific information on this fascinating group of birds.

In the Company of Crows and Ravens is composed of nine chapters and two appendices, with a foreword by Paul Ehrlich. The book's major themes are raised in the initial chapters. Chapter 1, 'Cultural Connections', illustrates ways that crows and ravens have influenced human culture through history. The chapter also introduces the idea of 'culture' in nonhuman animals, i.e. how it is

typically defined and studied. Chapter 2, 'A Crow is a Crow, or is it?', describes the variation between species of crow, raven, rook and jackdaw, although, as the title indicates, the book heavily emphasizes crows and ravens. Table 1 summarizes basic morphological and natural history features of each species. This chapter also suggests that this group of birds is in many ways more similar to primates than to 'typical' songbird species. For example, crows and ravens have extremely large relative brain sizes, form long-term social bonds with others in groups, and use and make tools. Chapter 3, 'Intertwined Ecologies and Mutual Destinies', discusses how crows and ravens have influenced human ecology and vice versa. Chapter 4, 'Inspiration for Legend, Literature, Art, and Language', delves into ways in which crows and ravens have become major figures in human culture and art, which include sports teams' names, Poe's famous poem, racist Jim Crow laws and the crowbar. This chapter also sets the stage for subsequent chapters by pointing out that crows have in effect replaced ravens not just in our culture, but literally, as habitats change and become more suitable for many species of crow than for ravens.

Skipping ahead for the moment, Chapter 7, 'Reaping What We Sow', follows up on the issue by discussing how populations of ravens have typically declined while those of crows have increased in recent decades. The authors nicely break down some of the likely reasons for this shift, including agricultural practices and increased urbanization in much of North America and the greater sociality of crows (and thus the greater ability of an individual to capitalize on the behaviour of others in its group) relative to ravens. The chapter ends by noting that crow populations have increased so much as to become serious problems to some human populations, and that human attempts to alleviate these problems often fail. Chapter 8, 'Centering the Balance', conversely, cites attempts to bring back populations and/or species on the brink of extinction, such as the Alala of Hawaii and the Aga of Guam. This chapter solidly captures the importance, and difficulties, of trying to keep the overly successful species of crow, such as the American crow, in check while increasing the chances of success for declining corvid species. Chapter 9, 'Future Interactions', wraps up the book's major themes by laying out six major ways in which human culture and ecology have influenced crow/raven culture and ecology, including agricultural practices, war and backyard bird feeders.

Chapters 5 and 6 discuss the communicative behaviour and 'culture' of crows and ravens. My main criticisms of the book come from these chapters and stem from my view that the authors are not careful enough, and at times are confusing, in their discussions of 'culture' and representation in communication. The authors use a fairly standard definition of animal 'culture' ('knowledge and tradition shared by a group that is transferred among individuals by some form of social learning', page 12). This definition minimally warrants evidence of three characteristics of a species' behaviour: groups of a species differ in key behaviours, a certain behavioural variant persists in a group over a substantial period and the behavioural variant persists in the group through social