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Cognitive Ecology II

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design, as a photo of two British antiaircraft guns so clearly reveals. In an image taken from the perspective of an overflying plane, two guns are present—one with traditional military green-and-brown blotched camo, the other painted with countershading patterns as directed by the naturalist Hugh Cott. The standard 1940s camo gun is a clear target, whereas Cott's gun is utterly invisible in the photograph. This evidence convinced the British military to incorporate basic biological principles of concealment throughout their operations. Critical biological details, from the perception of the viewer (planes photographed targets in black and white, rendering color camouflage useless) to the context of the surrounding environment (camo netting laced with strips of color was not so effective in the desert), began to be incorporated into the military realm.

The balance of *Dazzled and Deceived* focuses on the genetics and development of mimetic patterns, as revealed mostly through work with butterflies. The problems here are huge for evolutionary biologists. How does natural selection build a complex organism with all its integrated parts through fixation of random mutations? Butterfly mimicry has been a classic arena in which to tackle this problem precisely because the gambit is so obvious: To be a good mimic of another species requires many pattern elements of bars, lines, colors, and even wing shapes to change at once. Moreover, how can this process produce females that are perfect mimics and males that look nothing of the sort within a single species? These genetic requirements are seemingly at odds with our understanding of gradual evolutionary change and genes of small effect. Forbes takes us through the emergence of E. B. Ford's school of ecological genetics and the basement-made butterfly crosses that eventually began to illuminate the problem of linked-gene complexes ("supergenes"), sex-linked inheritance, and modifier genes. The answers to the mimicry paradox, preliminary as they are still, inform modern evolutionary-developmental studies in all species and have launched the current effort to map a number of butterfly genomes. These genomic excursions promise to uncover the genetic architecture of mimetic patterns in a variety of species and in doing so uncover the fundamental basis of adaptation and speciation.

Forbes has succeeded in producing a book with a novel perspective on an oft-visited topic. There is not much in the biological thread that will be new to anyone with a current grounding in evolutionary biology, but the historical vignettes and insights into the naturalists' battles to aid the military machine provide a strong example of how practical applications come from unlikely subjects. The account of the postwar eclosion of the field of ecological genetics provides a view to the social influences that underscore all scientific interpretations. To the more general reader, *Dazzled and Deceived* will prove an engrossing narrative of evolutionary biology as exemplified through the colors of animals, a topic that captivated the founders of the field and remains at the forward edge of genetics, evolution, and development today.

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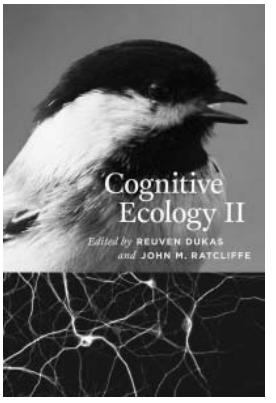
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COGNITIVE ECOLOGY COMES OF AGE

Cognitive Ecology II. Reuven Dukas and John M. Ratcliffe, eds. University of Chicago Press, 2009. 384 pp., illus. $40.00 (ISBN 9780226169361 paper).

In the 17 years since Les Real (1993) coined the term "cognitive ecology" to describe the integration of cognitive science and behavioral ecology, Reuven Dukas (1998) has published an edited collection, Victoria Healy and John Braithwaite (2000) have asked whether cognitive ecology represents a field of substance, Dukas (2004) has published the evolutionary biology of animal cognition, and in 2007 the Animal Behavior Society sponsored a symposium, "The Evolutionary Ecology of Learning, Memory, and Information Use." This volume, *Cognitive Ecology II*, is a product of that 2007 symposium.

Dukas, an associate professor of psychology, neuroscience, and behavior, and a member of the Animal Behavior Group at McMaster University, and John M. Ratcliffe, assistant professor at the Center for Sound Communication



at the Institute of Biology of the University of Southern Denmark, present a new attempt to analyze the ecology and evolution of animal cognition. The book's 23 contributors cover the mechanisms, ecology, and evolution of learning, memory, decisionmaking, and social cognition in a variety of invertebrate and vertebrate model systems. Contrary to its title, this collection is not a second edition of the 1998 version (Dukas 1998), but is a new compilation of topics. In this sense, the book follows the tradition established by Krebs and Davies (1997) in their four editions of *Behavioural Ecology: An Evolutionary Approach.*

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The book begins with a brief introduction by the editors, and is then divided into four parts: (I) learning, (II) avian cognition, (III) decisionmaking, and (IV) cognition and sociality. The editors conclude with a brief prospectus on the future of cognitive ecology. Dukas and Ratcliffe (2009) define cognition as "neuronal processes concerned with the acquisition, retention, and use of information" (p. 1). Although this definition will be comfortable for cognitive psychologists, it may seem overly broad to behavioral ecologists, who might wonder whether there are any aspects of behavior that are not "cognitive."

Part I has two chapters on learning in insects. Dukas presents a theoretical overview of mechanistic and functional questions about learning, and then focuses on his own model system, *Drosophila*. Fahrbach and Dobrin discuss neural plasticity in the honeybee. The importance of a developmental perspective is clear as both physiology and neuroanatomy undergo dramatic changes. As a behavioral ecologist who studies birds, I found these chapters interesting and informative.

Part II comprises four chapters on avian cognition. Beecher and Burt update their 1998 chapter from *Cognitive Ecology*. Searcy and Nowicki also address song learning, with an emphasis on development and stress in a variety of species. Pravosudov discusses spatial memory and the hippocampus, with a focus on nutritional stress and brain development. Sol asks whether advantages such as behavioral flexibility compensate for the expense of producing and maintaining large brains in birds. These four chapters provide comprehensive and readable reviews of song learning, spatial memory, behavioral flexibility, and the effects of developmental stress.

Mate choice and predator-prey decisionmaking are considered in part III. Ryan, Akre, and Kirkpatrick examine signaling and decisionmaking during mate choice in several invertebrates and vertebrates from both mechanistic and functional perspectives. In contrast, Phelps and Ophir focus on the mating strategies of one species, the monogamous male prairie vole. Warkentin and Caldwell use signal detection theory to examine what they call decisionmaking by the embryo of the red-eyed tree frog, which must "decide" whether to hatch prematurely under the threat of predation. Ratcliffe considers the coevolution of moths (prey) and bats (predators) from the perspectives of both parties. These chapters do a masterful job of walking the reader through a wide variety of species, topics, approaches, and evolutionary responses, although I must admit to wondering whether a frog embryo and a moth can be reasonably considered "cognitive."

Part IV provides three considerations of sociality. Manser offers a detailed account of referential signaling in meerkats. Kendal, Coolen, and Laland discuss explanations for copying behavior in fish. Federspiel, Clayton, and Emery advocate an integrative "3 Es" (ecology, evolution, and ethology) approach to the study of social information in birds. These three chapters were informative and thought provoking. The editors then provide a brief prospectus to conclude the collection, as they did in the first edition of *Cognitive Ecology*.

Dukas and Ratcliffe have done a good job selecting a representative and interesting range of topics in cognitive ecology. Some topics are clearly follow-up considerations of material from the 1998 version, but many are not, and some subjects from the 1998 book are not covered here. Any reader might quibble about the content choices, but I can enthusiastically recommend this book for its breadth of taxa and approaches and its balance of mechanism, development, function, and evolution. I intend to assign this book in my course in animal behavior, an advanced undergraduate elective for students majoring in biology, psychology, and anthropology. As with any compilation, the chapters vary in style and level of detail, but each deals with both the theoretical and empirical, and all attempt to evaluate the current state of knowledge as well as speculate about future developments. Perhaps *Cognitive Ecology II* will help extend the bridge between cognitive science and behavioral ecology that is currently still under construction. I look forward to the publication of *Cognitive Ecology III* in another 10 years.

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ECOLOGY OF CITIES AND TOWNS

Ecology of Cities and Towns: A Comparative Approach by Mark J. McDonnell, Amy K. Hahs, and Jürgen H. Breuste, eds. Cambridge University Press, 2009. 736 pp., illus. $72.00 (ISBN 9780521678339 paper).

Somewhere around 3500 BP, humans began to build structures we now commonly refer to as cities and towns. Since then, human settlements have evolved into ever larger and more complex entities eclipsing simple architecture and emerging as quasibiological entities, complete with their own growth patterns and metabolic processes. As cities have grown to dominate the global landscape and our knowledge of ecology has evolved, both the impact of these structures on the original ecological functioning of the land surface and the internal functioning of the cities themselves as specialized ecosystems have become subjects of interest. These two perspectives unfortunately drive two

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