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Microcognition: Philosophy, Cognitive Science, and Parallel Distributed Processing.  
Explorations in Cognitive Science by Andy Clark

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*The Quarterly Review of Biology*, Vol. 65, No. 4 (Dec., 1990), p. 526

Published by: [The University of Chicago Press](#)

Stable URL: <http://www.jstor.org/stable/2830862>

Accessed: 18/09/2012 19:11

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it ranges from Nathan Keyfitz's mathematical demography to M. Faustmann's treatment in German of the rotation age problem in forest management. The book is designed to introduce the student to all the relevant literature areas: each chapter ends with an extremely informative one-page essay introducing the important works expanding on the chapter and explaining the contents and historical significance of each item. The outlook is very modern, the reference list covering the literature to 1988.

The book is a penetrating analysis of the following problem, with all imaginable ramifications and extensions: There has been a traditional body of theory for managing renewable natural resources, developed primarily over the last 40 years. The results from application of this theory have often been drastic and unexpected. Why? The author's explanation, correct in my view, is that the decisions made by all the key political actors, from managers of fishing fleets to government bureaucrats, are in fact based on a wide variety of considerations, including not only the biological parameters of the exploited stock, but such factors as prices, costs, interest and inflation rates, and the logistics of the harvesting activity—to give only a small subset of the kinds of factors considered. The subject dealt with here is management of marine fish and mammals, although eight pages discuss forestry. The theory developed should be applicable to management of all renewable natural resources, including wildlife.

A major problem in reviewing this book is determining the intended audience. Much of the book could be understood by an undergraduate majoring in some type of resource economics or biology program. Indeed, the ideas in the book will have to be made accessible to a large audience if we are to manage resources rationally. Unfortunately, the mathematics presupposes a familiarity with at least one course in advanced calculus. This implies a two-tiered audience for the contents. Courses based on the entire book would be suitable for graduate students in biology or economics who had one prior course in both economics and ecology, and two years (six quarters or four semesters) of calculus. The bulk of the potential audience, undergraduates, could learn from the book if instructors made up a set of notes explaining the significance of the difficult parts, in language that pointed out the relation between the theory and the policy implications. Indeed, a professor could probably pull most undergraduates through a two-term sequence based on the book, by adding the necessary prerequisite mathematical, economic and ecological material as necessary. The immense gain in understanding would justify the effort on the part of professor and students.

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## NEURAL SCIENCES

MICROCOGNITION: PHILOSOPHY, COGNITIVE SCIENCE, AND PARALLEL DISTRIBUTED PROCESSING. *Explorations in Cognitive Science. A Bradford Book.*

By Andy Clark. *The MIT Press, Cambridge (Massachusetts)*. \$19.95. xiv + 226 p.; ill.; index. ISBN: 0-262-03148-5. 1989.

The development, in computer science, of parallel distributed processing has sparked a good deal of debate over the accuracy of such architectures as models for human cognition—is the brain really a parallel distributed system or a more conventional serial symbol processor? In this book, Andy Clark offers an overview of the debate combined with his own thoughts about a solution. In his view, the question of which architecture best describes our psychological/cognitive processes is largely misguided: our everyday ascriptions of psychological states (e.g., thoughts, desires, emotions) are not descriptions of neural states at all. Rather, much like Gilbert Ryle, Clark sees the ascriptions of thoughts as a means of identifying gross patterns of behavior, a skill which humans have developed as a function of its selective advantage. To have a thought is to have a set of interconnected behavioral dispositions. Hence, the question “which architecture?” should not be taken as a query about the nature of our inner cognitive events—what our thoughts are “really” like—but rather, as a question about which virtual machine(s) the brain utilizes in order to produce our complex behavioral dispositions. Clark’s “ecumenical” prediction is that the brain will have architectures of various sorts, assorted evolutionary “solutions” to diverse processing problems. While Clark’s book is enthusiastic, competent, and unusually clear, it is best viewed as an introductory textbook. Most of Clark’s philosophical and critical views are dependent upon the work of other researchers (e.g., Ryle, Dennett, Stich, Smolensky, Fodor), whose views are here merely reviewed, adopted or minimally extended. It should also be noted that many readers, particularly those from the natural sciences and women, will be befuddled or annoyed by Clark’s literary style in the initial chapters—a “knock-’em, sock-’em” insider’s take on the philosophical debate. “It ain’t the meat, it’s the motion” (pp. 21, 23) may have made for great blues lyrics but, as any PDP enthusiast would agree, context is everything.

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