

## BOOK REVIEW

**Lewens, T.** 2004: *Organisms and Artifacts: Design in Nature and Elsewhere*. MIT Press, Cambridge, MA. 183 pp., Paperback: US\$32 or £20.95. ISBN 0-262-12261-8.

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Over the past century, the study of animal behavior has gone through a number of paradigm shifts that began with the formalized studies of Skinnerian operant conditioning and proceeded to studies of behavior within the context of ecology and evolution. Where Skinnerians dismissed any discussion of animal intelligence, emotion, and consciousness, contemporary researchers have begun to examine such cognitive aspects of animal behavior in much greater depth. Although Tim Lewens does not spend a great deal of time discussing studies of animal behavior, his book, *Organisms and Artifacts*, develops an argument for a shift in how we can view and study evolution.

Lewens' fundamental argument involves a change in approach to evolutionary problems from form-function thinking to artifact thinking. The 'artifact model of evolution... (takes) an approach to the organic world that treats it as though it were designed; when speaking of environmental problems, organismic solutions, the purposes of traits, and the design of adaptations' (p. 39). As in reverse engineering, artifact thinking reverses the direction of inferences about adaptive problems by examining the environment and inferring problems and constraints on possible solutions. Essentially, such an approach views organisms and traits as artifacts as one would do with a piece of technology. Lewens claims that such an approach to thinking is common in biology, but not in other sciences, because in selective systems 'there is a psychological motivation to think of the outcomes of selection processes as purposive' (p. 120). However, he argues that artifact thinking is beneficial in that it can take into account a larger sense of the context of 'environment,' which includes not only the physical and ecological contexts, but also the developmental context and the environments created by internal parts (e.g. structures) for other internal parts. 'Although selective forces can explain adaptation, they do not do so alone... (adaptation needs) the right kind of developmental organization' (p. 37). Although simplistic approaches to artifact thinking are problematic, such 'complexification of artifact thinking' (p. 71) can provide a powerful approach to investigate evolutionary problems by considering variables beyond those of selective pressures.

In terms of animal behavior, Lewens suggests that the concept of function is frequently avoided in biology, but is implicitly discussed within the context of the 'adaptive value' (p. 14) or advantage of a particular trait or behavior. In other words, particular traits or behaviors are selected through 'a series of gradual modifications in the direction of improved function' (p. 115). He also suggests that such a view includes the notion that a specific trait may be 'used for some intended effect, without having been designed for that effect' (p. 115). In such cases, reverse engineering can be used to ask 'not only what the function of some trait is now, but whether it was designed for that function, or for something else' (p. 116). From this perspective, he distinguishes between 'adaptations' as traits designed for specific purposes and 'exaptations' as traits that have taken on unintended functions. For example, the porcupine puffer in my lab, spits water at us if we do not put food into the water fast enough. Such behavior involves structural adaptations for taking in and expelling water quickly as a defensive behavior. At the same time, this structural adaptation is also used as predatory behavior for knocking into the water organisms that are above the water. Which of the three behaviors are intended effects of the structural adaptation? Certainly, the 'reminders for humans' is not, but is the predatory behavior an 'intended' effect of the adaptation? Although such questions suggest a 'grand plan' or theistic controller, the notion of design in artifact thinking can help to distinguish functions or behaviors in terms of those directly arising from selection and those used for purposes that are context dependent.

In general, Lewens' book may provide a useful and somewhat novel framework and a variety of analytical tools for examining evolutionary problems. However, surprisingly I found this book to be poorly written and confusing. From my experience, MIT Press books are of the highest quality, but this book contains many typographical errors and undecipherable sentences. In addition to such

technical flaws, the author's arguments are all too frequently muddled and unclear. At one point, Lewens critiques the way in which many authors use language and their lack of specificity in the meanings of particular terms, and then proceeds to dismiss the need to pin down the meanings of the terms he uses.

In addition, there appear to be some obvious gaps in his use of the extant literature. For example, although he mentions the notion of complexification, he largely ignores the major writings and authors in the areas of complexity theories. This literature seems to be of great significance to the notions of design, artifacts, and evolutionary problems. He refers only to Stuart Kaufman and never mentions the work of Bateson (1979); Prigogine & Stengers (1984); Volk (1995, 1998); Capra (1996); Margulis (1998); Maturana & Varela (1998), among many others. The work of Bateson and Volk with the notion of metapatterns (as fundamental patterns of patterns), in particular, could have added much more substance to the notion of artifacts, in that certain spatial (forms), temporal (behaviors and functions), and relational and formal (embryological, developmental, and behavioral) patterns commonly emerge across all evolutionary lineages. At the end of the book, Lewens delves into issues of cultural and technological "evolution." Although potentially interesting, he seems to deviate from the central issues of importance in artifact thinking with the biological context. Furthermore, I am not convinced that using the term 'evolution' as a descriptor of cultural and technological change and development is at all appropriate.

### Literature Cited

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