

# The Analysis of Cultural Transmission

**Culture and the Evolutionary Process.** ROBERT BOYD and PETER J. RICHESON. University of Chicago Press, Chicago, 1985. viii, 331 pp. \$29.95.

Anthropologists have insisted for many years that human societies are different in kind from those of other animals because of the corpus of knowledge and beliefs called culture. Though the concept of culture has been a mainstay of anthropology's claim of disciplinary autonomy, there has been until recently almost no explicit dynamical theory or even formalism describing cultural transmission. It seems to have taken the challenge from biologists like E. O. Wilson and Richard Alexander to prod students of culture to generate explicit models of cultural transmission like the models describing Mendelian transmission that unified evolutionary biology in the early decades of this century.

The volume under review is an attempt to provide an analytic framework for describing some of the dynamics of cultural transmission and its interaction with genetic transmission. Many of the examples are forced and some of the exposition is awkward and opaque, but nevertheless an explicit formal notation and set of definitions are developed for modeling the joint evolution of cultural entities and of genes controlling the way in which these are transmitted among individuals. This is a major contribution to the human sciences.

The distinction between social learning and all other kinds of learning is central to the authors' perspective. Social learning by direct imitation or direct teaching by conspecifics is at the heart of cultural transmission. An organism using a social learning rule saves much time and effort compared to an organism that accomplishes the same thing by other methods such as trial and error or contemplation and insight. Widespread cultural transmission within a species can lead to a corpus of traits that follow dynamics similar to those worked out by population geneticists for Mendelian traits. There are analogues of selection, mutation, and genetic drift, but the set of mechanisms and models is richer because of new possibilities not known in genetics, like blending inheritance, transmission from children to parents or

between siblings, conflict between teachers and parents, and many others.

There are potential costs of social learning. If the environment fluctuates then the imitator may acquire a phenotype inferior to that of a conspecific who figures out the local optimum phenotype by trial and error. The social learner may also be systematically manipulated and deceived by his or her models for social learning. In response to such forces genetic evolution may favor organisms whose social learning propensities are tempered in various ways. The authors describe possible consequences of this process in chapter 4. They suppose that a (genetically transmitted) parameter sets the balance between social and individual learning and proceed to study how such a parameter would evolve in different kinds of environments and under different assumptions about the relative costs of the learning mechanisms. In this way they have defined and made explicit the central issues and problems in the study of cultural transmission.

The authors reformulate and clarify the nature-nurture debate by splitting nurture into culture and environment. A trait like first language is ordinarily acquired culturally, by cheap, simple social learning. Other traits may be environmental, in the authors' terminology, which means that an individual uses more costly learning mechanisms like trial and error and insight learning to set his or her behavior. An example might be an individual's choice of occupation formed only after examination and contemplation. The trichotomy of genes, culture, and environment leads, in chapter 5, to a valuable discussion and classification of extant global theories of human social behavior.

In the remaining chapters the authors present a diversity of models describing possible dynamics of traits determined simultaneously by genetic transmission, cultural transmission, and various learning biases. Biases are classified as direct (modify the trait to achieve some goal), indirect (do it the way generally successful conspecifics do it, for example), and frequency-dependent (do it the way most conspecifics do it, for example). There is a staggering array of possibilities of how complex systems of transmission work and how they evolve. The authors devel-

op a number of models, but they barely scratch the surface of the issues raised by their formalism.

The diversity of the empirical studies the authors discuss is impressive, from dialects on Cape Cod to the demographic transition. Some of the applications are more convincing than others, but their approach suggests for each one a number of further hypotheses subject to test. The applications can be read separately from the algebraic treatments by those who wish to avoid the mathematical development.

Language does not serve science very well as an analytic device. (This property of language is itself an interesting consequence of human evolution.) J. B. S. Haldane said that if someone could not use something in an equation then he did not really know what it meant, and Haldane's principle accounts for the universal use of mathematical notation in the sciences. The most important accomplishment of this book is the explicit algebraic representation of a rich meaningful set of unambiguous processes with which to study cultural transmission.

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## Prehistory in Peru

**Early Ceremonial Architecture in the Andes.** CHRISTOPHER B. DONNAN, Ed. Dumbarton Oaks Research Library and Collection, Washington, D.C., 1985. viii, 289 pp., illus. \$15. From a conference, Washington, D.C., Oct. 1982.

Forty years ago the Preceramic Period figured little, if at all, in the conceptual framework of Andean prehistorians. Since then, field investigations have shown that the earliest monumental architecture in the New World was built in Peru, predating the Olmec achievements in Mexico and Peru's own Chavin art style by a millennium. The first large architectural complexes were raised in the Central Andes between 2500 and 1500 B.C., drawing upon thousands of years of local cultural developments.

The purpose of the conference held at Dumbarton Oaks in 1982 and the resulting book, here under review, were to assess and explore aspects of the new synthesis on the origins of Andean civilization. The effort has been a success, notwithstanding minor editorial faults in the book and the lack of a map showing all sites discussed. No comparable treat-