

record (i.e., the rate of evolution is inversely related to generation time, because genotypic variance, which acts as a limit to natural selection in populations, varies inversely with generation time)? What is the best predictor of the rate of macroevolutionary change in different clades? How can we best account for "explosions" of new forms in adaptive radiations? When will adaptive radiations occur? How do inferred evolutionary rates for origins of taxa compare with measured rates of phyletic evolution in well-documented continuous lineages? Does macroevolution track changes in climate? Why does sex prevail? Are "living fossils" products of restricted ecological competition?

What is missing is a good quantitative analysis of gene flow, and an in-depth analysis

of the presumed flaws in Sewall Wright's evolutionary model. What are the *limits* of phyletic evolution? There is much fodder for debate here; the treatment of human evolution, for instance, is skimpy and is likely to perturb many anthropologists. But it is good to see the punctuational arguments so thoroughly treated in a single well-written resource. And it is refreshing to see well-conceived challenges to ideas that have become entrenched in the literature. This book should stimulate lively discussion, and whether or not punctuationalism prevails in its current form, it will help to advance the development of evolutionary theory.

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CULTURAL TRANSMISSION AND EVOLUTION: A QUANTITATIVE APPROACH. By L.L. Cavalli-Sforza and M.W. Feldman. Princeton, N.J.: Princeton University Press, 1981. xiv + 388 pp., figures, tables, bibliography, index. \$25.00 (cloth), \$10.50 (paper).

Since the generally-accepted modern synthesis of evolutionary theory forty years ago, biology has had a predictive model based on gene frequency change and the forces that cause it. On the other hand, cultural evolution has been an important concept in anthropology and other social sciences for at least as long, but no effective model to predict the rate of change or the forces involved has been developed despite numerous attempts. With the resurgence of interest in behavioral evolution and the development of the relatively new fields of ethology and sociobiology, many biologists have attempted to explain human behavioral and cultural evolution. For the most part this invasion of cultural anthropology has been the application of evolutionary theory as it is known in biology to human change. This results in a reductionist approach which continually asserts that man is just another animal. Cavalli-Sforza and Feldman in this book on cultural transmission certainly cannot be accused of such reductionism but instead have developed an entirely new set of models of evolutionary change that they apply to such diverse cultural phenomena as language or cognate change, the acceptance of weed-killers among Iowa farmers, and the changing attitudes toward marriage. Never-

theless, the considerable influence of genetic theory on their models is quite evident.

In the introduction the difference between Darwinian selection, which operates on individual differences in fitness or on the differential survival of individuals, is clearly distinguished from cultural selection, which is the major mechanism for the persistence of cultural traits and can have no relationship to individual survival. The authors cite the rapid acceptance of Coca-Cola and frisbies as examples of cultural diffusion that have no effect on individual survival and of parachute jumping and other dangerous sports that have increased in frequency despite their adverse effect on individual fitness. This is the setting for their definition of cultural selection that is the major determinant of cultural evolution.

Selection for cultural traits is similar to natural selection in that it involves differential transmission to the next generation. The most significant part of the authors' model is their exposition of the various ways by which cultural traits can be transmitted from one person to another. Except for an epilogue, the remaining chapters are progressive elaborations of their basic model. They begin with vertical transmission; that is, transmission from parents to offspring. For various matings of parents with and without a particular cultural trait, the probabilities of the offspring "inheriting" the trait can be specified. From these probabilities, the ultimate fate of a trait can be determined; whether there will be fixation, extinction, or a stable polymorphism. In addition, there is oblique transmission for cultural

traits, where an individual can learn and thus "inherit" a trait from an unrelated individual in the parental generation such as a teacher, and horizontal transmission, which is learning a trait from a peer in one's own generation. After the detailed presentation of the cultural transmission of a simple trait with only two states, present or absent, the authors extend their model to multiple-state traits and then to traits with a continuous distribution. Genetic evolution is also included in the model; natural selection by varying the viabilities of the phenotypes associated with the cultural trait, while assortative mating and the correlation between relatives can be calculated as they are for genetic traits.

The mathematical ramifications of the basic model are worked out in great detail, but at times the relevance of the analysis to the data of cultural change is tenuous. However, the model is applied to many sets of data, for example, the simplest two state trait model to a survey of the habits and beliefs of Stanford University students and the multiple state

model to the "inheritance" of religious preference. In addition, the book includes a great many other quantitative models that have been applied to cultural change including simple growth models, which fit a considerable amount of data, glottochronology, and even epidemiological models of the spread of infectious disease.

Whether or not their basic model of cultural transmission will be the basis of a predictive science of cultural evolution remains to be seen. I don't think so because the essential process of cultural change is not the transmission of traits among individuals or the increasing acceptance of a trait by individuals. Instead cultural change is caused more by the problems of the survival and persistence of societies, but this is the opinion of a longtime, steadfast believer in culture as a superorganism.

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THE EVOLUTION OF HUMAN SOCIAL BEHAVIOR
By J. S. Lockard. New York: Elsevier
North Holland, 1980. 336 pp., figures, tables,
references, glossary, index. \$22.95 (cloth).

The Evolution of Human Social Behavior is the product of the collaborative efforts of psychologists, anthropologists, ecologists, biologists, sociologists, and mathematicians which arose from a Spectrum course taught at the University of Washington, Seattle. The book's editor is a psychologist with stimulating ideas concerning the nature of human nature and with clever methodologies for interpreting the relationships between the biological and the sociocultural aspects of humans. The text certainly stimulated me to think about these complex relationships. However, it did not quite fulfill its ambitions: to cross-fertilize evolutionary biology and the social sciences producing hybrid vigor for these investigations (p. 210). One result of this attempt is the discussion of social behaviors in terms of both proximate causation, which often involves social variables, and ultimate causation, which involves evolutionary and genetic considerations.

The first and last chapters by Lockard consider human social signals in terms of their phyletic precursors and their ontogenetic

development. The theoretical framework in these two chapters and throughout the volume is essentially sociobiological in form and content. Social signals are interpreted as having an ultimate impact on inclusive fitness of the individual and a correlated impact on the social structure of a population. In support of sociobiological theory Lockard reviews studies of facial expression, intention movements, postural stances, solicitous behavior, and food begging among chimpanzees and in pan-handling among humans, hitch-hiking behavior, and infant carrying behavior. The second chapter by Daris Swindler is an overview of primate evolution. Swindler dwells on morphological changes and briefly touches on behavioral implications. His chapter seems anomalous in its emphasis on anatomy rather than on psychophysiological and behavioral traits that are emphasized in the other chapters. Chapter three by Gordon Orians focuses on habitat selection and the evolutionary mechanisms that may account for our species' preferences for sites with savanna vegetation rather than closed forests and open plains. He draws a number of conclusions regarding the significance of habitat selection for both the macro- and micro-evolutionary development of hominids. Chapter four by Pierre L. van den Berghe examines the human family from a sociobiolog-