Preface

This book arose from the conviction that theory is the backbone for development of any scientific discipline. There is today a need for a theory of cultural change. A number of scholars have discovered that concepts like mutation, selection, and random drift, which emerged from the quantification of the theory of biological evolution, may also be useful in elucidating evolutionary phenomena in many disciplines. Accumulated experience with the study of biological evolution has taught us that central to a satisfactory theory of evolution is the sound knowledge of the laws of biological transmission. Similarly, knowledge of cultural transmission should be important in understanding cultural change. Although cultural transmission has received little attention, it obviously differs greatly from biological transmission. Its study may provide a theoretical framework for future investigation in quantitative anthropology and social science. What emerges from the theoretical analysis is the idea that the same frame of thought can be used for generating explanations of such diverse phenomena as linguistics, epidemics, social values and customs, and the diffusion of innovations. With all of these we suffer from inadequate knowledge of the mechanisms of human behavior. A consequence of this ignorance is the confounding that occurs between imposition and independent choice, between genetic and cultural transmission, or between cultural transmission and cultural selection. The development of a quantitative theory forces us to be explicit about the distinctions between these concepts, even if they raise questions which cannot be resolved empirically.

We have chosen to develop a mathematical theory, and we are well aware of the serious disadvantages that result from this decision. The necessary over-simplification is usually so great,

especially in the applications to human behavior, that there is often a danger of distortion. Our position, however, is that a mathematical theory is always more precise than a verbal one, in that it must spell out precisely the variables and parameters involved, and the relations between them. Theories couched in nonmathematical language may confound interactions and gloss over subtle differences in meaning. They avoid the charge of oversimplification at the expense of ambiguity. Another reason for favoring a mathematical treatment is our belief that the theory of biological evolution owes much of its present strength to its mathematical background, primarily in population genetics. Quantitative predictions can provide the potential to test the validity of the quantitative theory.

A disadvantage, however, of choosing a mathematical presentation is that of potentially limiting the audience. We have tried to make the presentation as elementary as possible, for example, only elementary calculus is used, and most of the analysis involves just simple algebra. We have left a more detailed treatment of the problem to published scientific papers: here we have concentrated on simple numerical and graphical examples. It would have been our choice to use many more real examples, but there are few for which adequate data are available and from which the relevance of our transmission models might be evaluated.

The size of this manuscript grew continuously during the writing. We therefore thought the work would benefit from a partition into more than one book. The major portion of the first volume is dedicated to a mathematical treatment of cultural change, unaffected by individual differences. The first chapter contains definitions and a predominantly verbal exposition of the major concepts we have used. Chapters 2 to 5 deal with our theory of the transmission and evolution of cultural traits. Chapters 2 to 4 discuss discrete traits, and Chapter 5 examines continuous traits. A short epilogue summarizes some of the major qualitative ramifications of our theoretical treatment.

Another volume will take account of individual, inherited differences in learning ability. The introduction of individual differences, for instance in capacity to learn, requires a quantification of some classical genetic concepts, such as "norm of reaction," and allows us to make predictions about that elusive entity, genotype-environment covariance. Cultural and genetic evolution can be directly compared and their extremely complex interactions studied. Inevitably this involves reference to some controversial issues, such as the determination of IQ, and the recently expanding field of sociobiology.

When we commenced our work some ten years ago the topic of cultural transmission was clearly far from the mainstream. This is no longer the case: scholarly work on quantitative theories of cultural inheritance, transmission, and evolution are now increasingly common. There remains a need for accurate empirical observation, without which theories may prove to be frustrating exercises. But at least in the discipline of linguistics and in certain aspects of sociology and anthropology it is possible to make quantitative observations that can be used to test theory.

Our hope is that quantitative studies of modes of cultural transmission and their long-term consequences will stimulate discussion on the theoretical interpretation of cultural phenomena and present a conceptual framework for their understanding. Mathematical models may eventually be expanded and refined and in turn lead to new empirical studies of cultural phenomena.

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