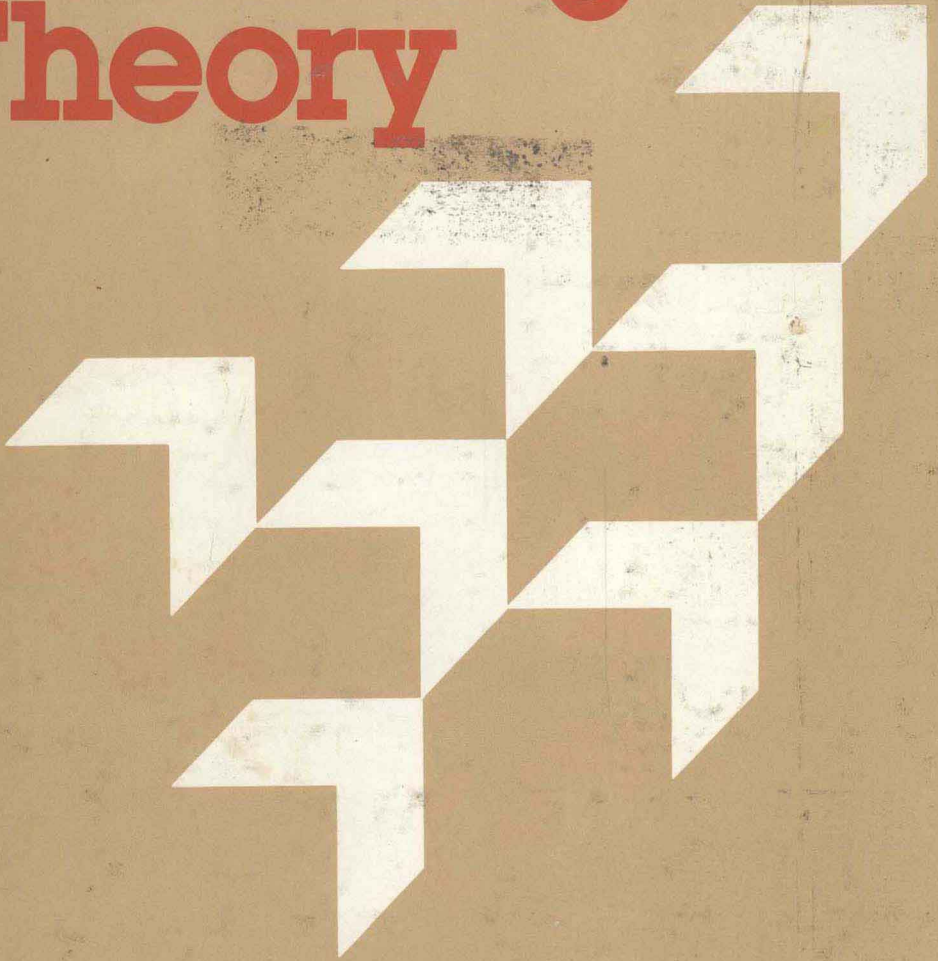


THOMAS J. TIGHE

Modern Learning Theory



Foundations &
Fundamental
Issues

Modern Learning Theory: Foundations and Fundamental Issues

Thomas J. Tighe

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Modern Learning Theory: Foundations and Fundamental Issues

*To the memory of my parents,
Thomas and Anna Vaughan Tighe*

And for Lisa and Mark

Preface

This book provides an introduction to learning theory as it has developed through the study of animal learning. The premise of the book is that developments in learning theory must be treated in historical context if they are to be properly understood and evaluated. Theoretical controversies and “new developments” abound in the field of learning, and a historical perspective is the best way to bring into focus the enduring issues and the major continuities and contrasts in explanations of the learning process. Such a perspective, too, best conveys a sense of the main achievements of the field.

The history of learning theory shows two broad types of theoretical activity. The period extending roughly from 1925 to 1955 was characterized by the construction of global theories of learning, that is, theories intended to account for the learning of all forms of behavior in all species. The period from 1955 to the present has been characterized by the cultivation of more restricted theories intended to account for particular phenomena or subareas of learning. The separation of these two types of theoretical effort is approximate. Some important limited theories coexisted with global theory, and the past decade has seen a renewal of interest in the broad theoretical questions of learning. Nevertheless, global theory clearly has historical, and therefore, conceptual primacy.

The present volume deals with global theories of learning, including the historical forces that gave rise to global theories, the controversial issues and major research associated with them, and their relations to contemporary developments. The field of learning is properly introduced from the perspective of global theory because the philosophy, concepts, and data of global theory constitute the foundations

of modern learning theory and because the fundamental questions which occupied the global theorists are with us today. While this book is primarily intended to acquaint the beginning student with these foundations and fundamental issues, it also seeks to foster in all who study learning a greater awareness of our common roots and concerns.

Many people should be acknowledged for their contribution to the writing of this book. I will always be grateful to Richard D. Walk who early encouraged me in the study of learning and who provided a model of balanced and dedicated scholarship. Colleagues at Dartmouth—Rogers Elliott, Carol Fowler, George Potts, James Rose, and George Wolford—were valuable resources and gave helpful advice on various aspects of the manuscript. The manuscript also benefited from the work of several reviewers, and in this regard I am grateful for the suggestions and comments of Richard Shull and Peter Holland. I am also very appreciative of the support provided by the editorial staff of the Oxford University Press.

Special thanks should be given two people. My colleague Robert Leaton was an unfailing source of encouragement and sound suggestions throughout the project. His knowledge of the field and cogent theoretical analyses were invaluable in resolving many a writing impasse, and I am most grateful for his generous assistance. Louise Tighe contributed in two vital ways. First, she served as a sounding board for organizational ideas and read much of the manuscript in draft form. Her contribution in these regards is probably best measured by what did *not* survive her judgment; the quality of the final product has been enhanced throughout because of her continual review. Second, she carried a considerably heavier share of our family responsibilities, thereby allowing me more time to write. In large measure, this book is hers as well as mine.

Finally, I thank my children, Lisa and Mark, for their understanding acceptance of the reduction in our time together occasioned by the writing of this book.

Hanover, New Hampshire
August, 1981

T. J. T.

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Modern Learning Theory: Foundations and Fundamental Issues

1

Introduction

Psychologists define learning as any permanent change in behavior resulting from experience, and the psychology, or science, of learning seeks to determine the conditions and principles which govern such changes. To put this more broadly, the psychology of learning is concerned with the ways in which we are shaped by experience. The significance of the field lies in the fact that virtually all psychological activity, whether cognitive, emotional, motivational, or motor, is shaped by experience, often definitively so. To a large extent, we are what we have learned to be.

Consider yourself, for example. A moment's reflection will produce numerous self-evident instances of learning in activities ranging from the most mundane to those vital to your well-being and happiness. You have learned to tie your shoelaces, to drive a car, to dance, to avoid certain foods, to distinguish and label an enormous number of features of your environment, to feel guilty about some actions, to inhibit emotional reactions, to cooperate with others in certain situations and to compete with others, to value success, to fear failure, and so on and on. In these and countless other such instances some enduring change in your makeup was brought about as a consequence of interaction with your environment.

Consider, too, the role of learning in your future development. Whatever your aspirations and goals, their achievement depends upon the elaboration and modification of your existing knowledge, skills, and habitual ways of behaving—the continual fashioning of yourself, so to speak, through appropriate experiences to meet particular demands imposed throughout the full range of your abilities.

Consider, finally, our hopes for the development of human society

as a whole. Efforts in this direction arise only because we believe that the psychological makeup of human beings is not fixed so as to produce a constant ratio of good and ill in society. Rather, we feel that we are capable of achieving a more harmonious and beneficial society if we but more fully understand and better control the conditions which direct our development.

The contribution of experience is thus manifest at every level of our individual and social being. Of course, the effects of experience are always conditioned by the organism's physical (genetic) makeup. But it remains true that the full potentialities of any organism are realizable only through interaction with its environment. Experience is not only the best teacher, it is the only teacher.

These reflections suggest the vast scope, complexity, and significance of the topic of learning, and they indicate as well the difficulty of coming to grips with the problem of learning. How does one attack the question of how organisms change through experience when such change can occur at so many levels of psychological activity and can be studied in such varied environmental and behavioral contexts? One answer is to begin by studying the learning process in lower organisms. The argument for such an approach is that the fundamental principles of learning might be detected more readily in simpler life forms, particularly in view of the precise control which can be exercised over the life history and environment of such subjects. Basic principles uncovered in this fashion might then be applied in analysis of more complex phenomena of learning. The study of learning in lower animals is, in fact, one of the major approaches taken by psychologists, and until quite recently it could be fairly said that our views of human learning were largely based upon information derived from the study of learning in a relatively small number of infrahuman species.

The beginning student of the psychology of learning is likely to be disturbed by the extent of the psychologist's reliance upon lower animals as a source of information about human behavior. The student's interest is to better understand human behavior, and he or she is likely to be disappointed when the subject must be approached from the seemingly remote point of animal behavior. But the student's reaction in this regard is no different from that of most psychologists who themselves were likely to have undertaken the study of learning in order to better understand their own behavior or that of others, and who only later accepted the study of animal behavior as an effective means toward that goal.

Strictly speaking, human beings are members of the animal world,

but the study of learning in infrahumans has become familiarly known as the field of "animal learning." Animal learning can, of course, be viewed as a subject of considerable interest in its own right, but it is clear that within psychology the study of animal learning has always been viewed as an important route to understanding human behavior. In the following chapter we shall discuss a particular combination of historical circumstances which gave impetus to the study of animal behavior toward this end and which assured it a prominent place in the psychology of learning. But at this point it may be useful to advance two considerations bearing on the question of the relevance of research with animal subjects.

First, if one accepts the basic assumption of psychology that humans are part of the natural order, then there is every reason to expect that the psychological processes of humans and those of lower organisms might exhibit some important common features. In this regard, it is interesting to note that we appear to be considerably less reluctant to accept the assumption of a continuity of neurophysiological processes between humans and lower animals than to accept the assumption of a continuity of psychological processes. Studies of neurophysiological processes in animals are generally more likely to be viewed as applicable to humans than are studies of parallel psychological processes. For example, we are not disturbed when we learn that conceptions of the nature of neural transmission in man are based largely on research on infrahuman nervous systems, yet studies of learning are likely to be viewed as specific to the species involved, even though learning appears to have its biological basis in the phenomena of neural transmission. Logically speaking, one form of extrapolation is as sound as the other. And indeed, continuity of neurophysiological processes implies a continuity of psychological processes.

The second consideration is that an approach through animal learning should be judged primarily by how well it works rather than by intuitive impressions of its appropriateness. The verisimilitude of a scientific model is irrelevant to evaluation of its usefulness. Has the study of animal learning brought into focus truly significant and general conditions of learning? Are explanatory concepts derived from animal research helpful in the analysis and understanding of complex human behavior? Are we, as a consequence of this approach, better able to predict and control our own behavior and that of others? These are the kind of questions that bear most pertinently on this issue. Students will form their own answers during the course of this book. At this point we simply urge an open mind on the issue, confident that affirmative answers will then be forthcoming.

The psychology of learning has of course proceeded along lines other than the study of animal behavior. In fact, techniques permitting objective, experimental study of rote verbal learning and memory were introduced around the turn of the century within a few years of the beginnings of experimental analysis of animal learning. During the first half of this century, these two areas, animal learning and verbal learning, formed the major concerns of learning psychologists. However, the study of verbal learning was a relatively self-contained endeavor in the sense that the data and concepts from this line of inquiry did not lend themselves to broad analysis of learning. The study of animal learning, on the other hand, has been associated from the outset with efforts to develop comprehensive theories and principles of learning applicable to all forms of behavior change. Throughout this period, then, broad theoretical and applied analyses of human learning proceeded not from the research most directly and uniquely concerned with human learning, but from research on animal learning.

The past decade has provided clear signs of a change in this conceptual state of affairs. There has been tremendous increase in research with human subjects, this increase reflecting in large part the application of techniques and principles developed in the study of animal learning. And recent developments arising within the tradition of research on verbal learning and memory are now exerting a major influence on general conceptions of the learning process. Nevertheless, the study of animal learning remains a major source of knowledge about the learning process, and familiarity with the field of animal learning and with the body of theory arising from that field is indispensable to understanding how psychology has answered the question of how we are shaped by experience.

Our coverage of theory focuses upon efforts to construct global, or all-encompassing, theories of learning. But before turning to the theories themselves we must consider the historical conditions that gave rise to global theory, since the rationale, aims, and even the content of the theories were strongly determined by those conditions.

2

Historical Background of Modern Learning Theory

Our starting point, like any starting point in the history of science, is a somewhat arbitrary one. It is the nature of science to obscure the beginnings of its major ideas and movements. Even when significant conceptual developments are widely accepted as the work of one or but a few individuals, close examination is likely to reveal the contribution, direct or indirect, of many earlier and perhaps unheralded investigators. Broad movements or programs within a field tend to develop continuously out of the successes and failures of previous approaches, rather than as the result of a single formulation. In short, science proceeds by collective and cumulative effort and thus significant advances in theory and research are apt to be fed by many sources near and remote in time. So it is with the beginnings of modern learning theory.

By 1925, the techniques of study which were to provide the empirical basis of modern learning theory had long been available, and in fact earlier application of these techniques had established principles of learning which were to be central to later theories. Moreover, the basic rationale of modern learning theory, its broad conception of the subject matter, and its descriptive vocabulary had all been formulated within the psychology of the early 1900's. And animal psychology itself had been an active and respected enterprise since the turn of the century. But it was not until the period extending roughly from 1925 to 1950 that these methodological and conceptual ingredients became fully fused into a new approach to the study of learning, an approach which commanded the allegiance and enthusiastic efforts of a large number of psychologists. For the first time, the science of learning became something other than the insights and research programs of

individuals or small groups working in relative independence; it became instead a broadly mounted effort to understand the learning process by application of commonly accepted analytical methods.

What was the nature of this approach which found such widespread acceptance among psychologists of the 1920's to 1950's? To answer this question requires consideration of three earlier developments in psychology which, in their later combination, define the essential features of the approach. These developments were the discovery of conditioning, the rise of behaviorism, and the emergence of animal psychology as a scientific discipline.

CONDITIONING

The term *conditioning* refers to two procedures for producing changes in behavior and in the laboratory. One procedure, designated *classical conditioning*, was introduced and studied extensively by the Russian physiologist Pavlov. The other procedure stems primarily from the work of the American psychologist Thorndike and is termed *instrumental conditioning*. Both conditioning procedures were introduced around the turn of this century.

In classical conditioning the behavior change is brought about by pairing a stimulus which reliably elicits a particular response with a stimulus which is neutral with respect to that behavior. The standard illustrative experiment is conditioning of the salivary response in dogs. The placement of meat powder in a dog's mouth unconditionally elicits salivation, but if, say, a tone is regularly paired with the placement of meat powder, then it, too, comes to elicit salivary flow. Pairing of the tone and meat powder has brought about a change in the dog's response to the tone.

In instrumental conditioning the behavior change is produced by making a particular stimulus event contingent upon occurrence of a given behavior. The standard illustrative experiment is conditioning of bar pressing in rats. A hungry rat is placed in a small, plain box containing a movable bar or lever which the rat is likely to accidentally depress in the course of moving about. If it is arranged that each depression of the bar results in delivery of a bit of food to a point inside the box where the animal is likely to find and eat it, then bar pressing soon comes to be emitted at a high rate. There has been an increase in the behavior instrumental to receipt of food.

The seeming simplicity of these procedures and of the behaviors to

which they are usually applied, coupled with their intuitive obviousness as ways of changing behavior, makes it difficult to appreciate their great value in the study of learning. In the course of the past 70 years, each of these procedures has been applied to a variety of behaviors in many species and in relation to an enormous number of variations in particular conditions of training. This work forms the core of the experimental psychology of animal learning and has had a profound influence on all of psychology. Why have these procedures merited such attention and effort? Why is it that psychologists, and particularly psychologists of the 1920's to 1950's, have tended to see conditioning as the key to understanding learning?

First and foremost, the conditioning procedures give learning psychologists a means of reliably producing in an efficient, objective, and standard way an instance of the phenomenon they seek to understand. Conditioned responses have been observed to remain virtually intact in animal subjects despite an interval of several years between conditioning and retesting. Conditioning meets the criteria defining *learning*, then, in that the behavior changes are long-term and result solely from practice or experience. These persistent changes are produced in a relatively easy and rapid fashion, and the outcomes of conditioning experiments can be verified by any investigator.

Procedural Generality of Conditioning

Procedures for producing learning in the laboratory, no matter how advantageous from the viewpoint of method, would be of little interest if they were of limited applicability, but conditioning has proved to have great generality. Classical and instrumental conditioning have been successfully applied to organisms ranging from the simple earthworm to man, and few psychologists would quarrel with the assertion that *any* organism within this phylogenetic range can be conditioned by either procedure. The variety of responses and stimuli which have been employed in conditioning experiments is so large as to make an exhaustive listing infeasible, but consideration of several samples of each type of experiment should help make clear the broad behavioral and situational generality of conditioning. Let us first consider some instances of classical conditioning taken from published experiments.

A two-second presentation of a bright light unconditionally elicits a rearing and withdrawal movement in the anterior segment of an earthworm. A six-second presentation of a vibratory stim-