PSYCHOLOGY

HARLOW McGAUGH THOMPSON

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JAMES L. McGAUGH
UNIVERSITY OF CALIFORNIA, IRVINE

RICHARD F. THOMPSON
UNIVERSITY OF CALIFORNIA, IRVINE

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TO PEGGY, BECKY, AND JUDITH

PREFACE

This is a book about psychology, one of the most fascinating of all subjects. We say "about" because psychology is a vast area. The American Psychological Association, which began with about 30 members, now has about 30,000. It would perhaps be more accurate to say that the field of psychology encompasses a vast number of disciplines, each concerned with the nature and causes of behavior. We have made no attempt to produce an encyclopedia. We have focused on what we regard as some of the most intriguing and important problems. Each of us is primarily responsible for approximately one-third of the chapters. You will undoubtedly recognize different approaches to the subject matter, as well as different styles of writing. You will also, no doubt, see some of our own biases in bold relief from time to time. Since the book was written by mortals, we think that this is only fitting.

This book contains many facts. We hope you will savor them, not cherish them. After all, science is very much the exchange of new facts for old ones. The book also contains many ideas, which are sometimes called hypotheses or theories. We hope you will cherish some of these, without sanctifying them. Above all, we hope you will share our deep interest in the mystifying and marvelous machinery of the mind.

We have enjoyed writing this book. We hope you will enjoy reading it.

Our deepest thanks to Helen Lauersdorf, Karen Dodd, Nancy M.

Kyle, and Brenda Longacre for their tireless and painstaking work in typing the several drafts of each chapter and handling the countless details of preparation. Although we bear full responsibility for the final manuscript, we are grateful to our colleagues for their consultation and comments on early drafts of the chapters: Herbert P. Alpern, Louis Breger, Ronald G. Dawson, Allyn C. Deets, Wilberta Donovan, Margaret Clifford, Amerigo Farina, Philip M. Groves, Philip W. Landfield, Gary S. Lynch, Gerald McClearn, Monte G. Senko, Randy M. Stothard, Stephen J. Suomi, Norman M. Weinberger, James F. Voss, and Steven F. Zornetzer.

We also wish to thank those who permitted us to quote or reproduce material from their works. Citations appear in the text, with full publication data in the bibliography. We are, of course, deeply, if not completely, indebted to all those whose work has influenced our thinking about psychology. Many of these influences are mentioned. Unfortunately greater numbers are not.

We thank our wives and children who tolerated, consoled, and helped during the period over which we worked on this book.

HARRY F. HARLOW
JAMES L. McGAUGH
RICHARD F. THOMPSON

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PSYCHOLOGY

CHAPTER ONE

PSYCHOLOGY: THE STUDY OF BEHAVIOR

The definition of psychology has had a long and changing history. Psychology was first considered to be the study of the soul, then the study of the mind, next the study of consciousness, and lastly, the study of behavior. It has been said that psychology first lost its soul, then lost its mind, and finally lost consciousness. Psychology now is commonly defined as the study of the behavior of living organisms; depending on the methods employed and the problems attacked, it sometimes is described as the science of behavior.

All behavioral acts of human beings, normal or abnormal, appear to result from a bewildering array of intertwined and interwoven variables. There is never a single cause of any important human act. Behind every behavioral occurrence there is a series of hopelessly tangled behavioral backlashes, and no scientist or scientific technique can unravel them all.

It is a time-honored custom to use nonhuman animals as research subjects to obtain data under controlled situations as a basis for building models of behavior. As a starting point, these often are simplified models of human behavior. The first precise and accurate anatomical models

INTRODUCTION

were developed by Galen [Alexander and Selesnick, 1966], who dissected not man, but the Barbary ape, which is not an ape but a baboon. For centuries medical students had difficulty in exactly duplicating his drawings from dissection of human cadavers.

One of the first U.S. astronauts sent to secure the secrets and science of outer space was not a man, but a monkey from the Wisconsin Primate Laboratories. Through the fumbling of a lieutenant, the monkey named Able was almost able to escape from the laboratory, but he was captured by a private. The monkey entered the atmosphere safely and was ready, willing, and eager when he returned. Subsequently Able died and was buried with full military honors. His body still lies in state, but it is an unfortunate state; the Army disabled Able.

The conquest of most human diseases attests to the advantages of studying simpler nonhuman forms; the data obtained in such studies usually generalize to man. It is possible, for example, to study the source and course of a disease much more closely in a laboratory animal whose life is constantly regimented than in a human whose life is relatively unregimentable.

In behavioral research there are four fundamental reasons for using subhuman animals in specific kinds of experiments. Behavioral

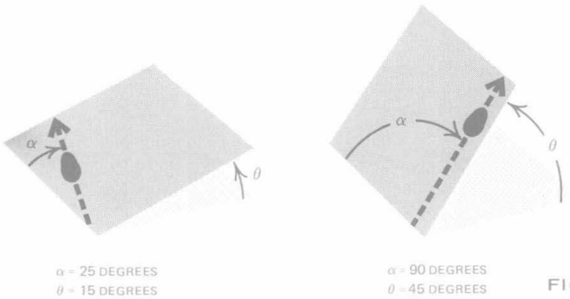

FIGURE 1-1 *Geotropism in fetal rats.*

simplicity is one. All animal behaviors are the result of a vast number of variables, but in some animals a single variable, or even a single stimulus, is so dominant that it will override all others, and this dominant variable can be manipulated at will to illustrate the fact that animals are merely complex machines, whose behavior can be demonstrated to be completely lucid and lawful.

A simple form of behavior is called a *tropism. Heliotropism*, for example, characterizes an animal that orients and moves toward light; the more intense the light, the stronger the movement. *Geotropism* is a response to gravity. Fetal rats, prematurely delivered at fourteen days, are negatively geotropic—that is, they climb upward against the pull of gravity. At fourteen fetal days the rats cannot see, cannot hear, and cannot think [Crozier and Hoagland, 1934], and therefore distractions are held to a minimum. If they are placed on a wire-covered wooden surface, they climb upward, and the steeper the angle of the surface, the steeper their angle of climbing. The relationship between surface angle θ and climbing angle α can be expressed by a mathematical equation akin to $\theta = \log \sin \alpha$ where α is the climbing angle and θ is the angle of the surface to be climbed, as shown in Fig. 1-1. Theoretically all our behaviors could be expressed by mathematical equations if there were some way to unravel the complexity of variables.

A second reason for studying the behavior of nonhuman animals lies in the degree of control that can be exercised over their daily or even lifelong schedules of living. There have been only two human studies on the effects of prolonged partial food deprivation, and these were conducted on conscientious objectors during World Wars I and II. The overall weight of the incarcerated "volunteers" was reduced by 15 percent, and during this time their learning performance was excellent and their living acceptable; however, their love life deteriorated from the symbolic to the totally indifferent. At first they pasted pinup pictures over the walls of cubicles, but as their weight declined they lost interest in buttocks and breasts [Keys et al., 1950].

The behavioral scientist can easily control diet in rats and monkeys and test the effects of any and all dietary components on all categories of behavior. He can study protein deficiencies, vitamin deficiencies, or total starvation as they affect living, loving, and learning. Beyond these three Ls there is little in life that matters. To some human beings learning does not matter; for those there are only two Ls. To a faint few human beings loving does not matter. They have only one L. Of course, when living no longer matters you are nothing but a statistic.

A third reason for using nonhuman animals as experimental subjects is that many psychological studies, like most physiological, pathological, and medical researches, are detrimental, dangerous, or even potentially lethal. The multiple incredible cruelties that society neglectfully inflicts on countless human children are unacceptable even as laboratory endeavors. No one in his right mind would plan deliberately to achieve the human "battered baby" syndrome [Helfer and Kempe, 1968].

A study of the effects of total social isolation inflicted on 20 boys and 20 girls from birth to age two would produce interesting data and extremely uninteresting children. Decades ago, a well-meaning scientist actually submitted a research proposal of this type to the National Institutes of Health, where it was, of course, summarily rejected. The disheartened scientist later became a doctor, and was very successful. He did not become a pediatrician. Since that time nonhuman experiments have told us what results this inhuman experiment would have produced [Harlow and Harlow, 1962].

Some important psychophysiological studies involve stimulation, or removal of precise areas of the brain. For obvious reasons, human mothers refuse to provide their own babies as subjects for such studies. Human adults are reluctant to offer up their brains, and many human brains would not be acceptable anyway. Hard-hearted human adolescents have never been known to volunteer. It is true that adolescents who ride high-powered motorcycles often accidentally provide neurological materials, but the brain damage is usually extensive and diffuse. (Of course there are some who may think that adolescents who ride high-powered motorcycles have little brain to lose in the first place.)

Finally, animals attain maturity relatively early, permitting a fairly rapid accumulation of data over several generations. As the population explosion roars and reverberates in the distance and we fall over each other's feet instead of into each other's arms, the problems of behavioral genetics achieve ever-increasing importance. Animal geneticists speak of improving the breed. Psychologically it would be desirable to breed the improved. There is real danger that the last thinker will be Rodin's. If so, he will have a heart of stone.

In this respect the problems of human behavioral genetics are staggering. In nonhuman animals it takes 7 to 10 generations to breed in or breed out a psychological trait, such as a specific kind of learning ability, high or low activity level, or any emotional trait including aggression or timidity [Tryon, 1940]. Human beings would make poor subjects for behavioral genetics studies of this type. Since each human generation is 30 years in length, the required 7 to 10 generations to attain a genetic alteration would span 210 to 300 years. This would be the perfect way to win the Nobel Prize—posthumously. No one has ever bred creative intelligence into any animal, nonhuman or human, with the possible exception of the Huxleys in England and the Adamses in America.

Behavioral genetics experiments require rigid control in the breeding of animals. Human beings breed in a very haphazard, lackadaisical, and uncooperative way. They object to drawing their partners out of a Latin-square design; indeed, many human beings have only a single simple design in mind. If we bred for genius, many aberrant males would confuse wavy blonde hair for intellectual elegance, or their minds would be on curves other than those of normal distribution. It is pointless to criticize the females in this mythical experiment since all of these females would be women—some of them hell-bent on proving that it does not take 30 years to produce a new generation. The problems of regimenting the behavior of a control or comparative group deliberately bred to achieve stupidity is frightening. This might well be the only phase of the experiment that would succeed.

An impressive exploratory pilot study could be achieved by erecting a 30-foot wall around a corner of the Middle East. The inhabitants would be removed and the oil wells capped, thus delaying the pollution problem. Two appropriately selected sex-balanced populations would then be introduced to the area for comparative purposes—a group of bright men and women collected in Upper Slobbovia, an area whose inhabitants are known for their superior intelligence, and a group of dull men and women, collected from Lower Slobbovia, a region generally recognized for the outstanding stupidity of its populace. Seven years later the budget would be cut and the experiment would be stopped by an act of Congress. There are advantages in using nonhuman subjects.

THE ROLE OF RESEARCH IN PSYCHOLOGY

It has been stated that citation of a single authority is plagiarism, but that citation from two or more authorities is scholarship. Actually this statement gives basic information about real research. Research is designed to produce laws that have generality within all members of a species and even among members of different species.

Laymen may regard research as some esoteric, and even evil, technique that is basically incomprehensible. However, little children often automatically engage in research even though its meaning is unknown to them; also, their research techniques are slightly crude.

If you pull one hind leg off a grasshopper and observe the animal's behavior, this is probably sadism. If you pull the right hind leg off four grasshoppers, the left hind leg from another four, leave four grasshoppers intact, and observe the behavior of all of them, this could be called re-

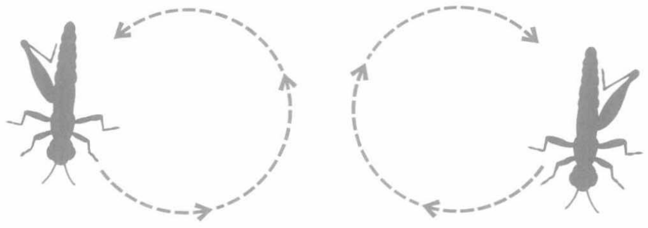

FIGURE 1–2 *Circus movements in lopped-legged grasshoppers.*

search, since a biological experiment might reveal circus, or circular, movements in the lopped-legged grasshoppers.

You would find, as shown in Fig. 1-2, that the left-lopped-legged grasshoppers circled to the left, the right-lopped-legged grasshoppers circled to the right, and the intact grasshoppers jumped straight ahead. Experiments of this type were done by biologists 50 years ago.

For millions of years men lost in the woods have circled to the left if right-handed and circled to the right if left-handed. If an equally strong left-handed man and right-handed man hold hands and walk, they will probably go straight. If a left-handed man and a right-handed girl hold hands and go walking in the woods, the chance of their going straight is not very good, but they may have some exciting tales to tell when they return.

The most ingenious researchers are careful and methodological in planning research operations and thus in finding solutions to problems that are beyond the pale of speculation. Some years ago Edmund Jacobson, an American physiologist, developed a technique for muscle relaxation which he termed *progressive relaxation*. He trained his subjects to relax completely by directing them to exert maximal tension in a particular muscle, such as a flexor or extensor of the arm, and then to pay close attention to the sensations as the muscle was completely relaxing. Muscle after muscle was trained to relax—even the facial muscles [Jacobson, 1938].

Several decades later progressive relaxation became a basic component of a three-step behavior-therapy technique evolved by Wolpe [Wolpe and Lazarus, 1968] called *systematic desensitization*. This technique was based on the assumption not only that neurosis stems from emotional habits, but that this emotional behavior *is* the neurosis. Thus desensitization seeks to overcome anxiety by having the patient unlearn the emotional behavior associated with a specific fear-arousing situation.

The subjects were first trained in deep-muscle relaxation. Concurrent with this training they were questioned about their fears in order to construct an "anxiety hierarchy." For example, a person upset by large crowds of people would be asked to recall 10 situations or experiences related to this fear and to arrange them in ascending order according to the degree to which they disturbed him.

Desensitization was initiated by asking the subject to imagine the least-feared situation first. While thinking of this minimal-anxiety situation the subject was instructed to relax completely. Soon he found that he was no longer anxious, even while imagining the situation. He was then asked to imagine the remaining situations in ascending order of fear arousal, relaxing completely for each one. Anxiety was inhibited through relaxation, and eventually the subject was able to reconstruct mentally the most fear-producing situation without experiencing the accompanying anxiety. In a follow-up study of many patients treated by systematic desensitization it was reported that 2 to 15 years after treatment an overwhelming majority had no recurring symptoms and that only 4 of the 249 patients had acquired new symptoms. The data were encouraging and suggested that progressive desensitization may sometimes be an effective way to treat some neuroses—particularly minor ones.

In a somewhat related vein, a series of exciting studies conducted by Miller et al. [Miller and Banuazizi, 1968; Miller and DiCara, 1968] cast some doubt on the age-old notion of scientists (as opposed to mystics) that the behavior of visceral organs, which are controlled by the autonomic nervous system, cannot be modified by learning. By definition, such physiological responses as heart rate, blood pressure, sweating, and brain waves are involuntary, and thus animals, human or otherwise, seldom learn to control them voluntarily. Trial-and-error learning—or *instrumental learning*, as it is usually called—refers to a procedure in which an animal produces the required response prior to receiving a reward.

It had been commonly assumed that responses to instrumental learning could be exhibited only in terms of the skeletal muscles, as when a rat responds by pressing a lever with its foreleg. The first problem was to convince a skeptical scientific audience of the feasibility of distinguishing between skeletal and visceral learning. By injecting rats with curare, a drug that paralyzes the skeletal muscles but does not affect the visceral muscles, Miller was able to show that changes in heart rate could be caused by direct control of the cardiac muscle rather than by the indirect control of some skeletal muscle. Even after the problem of skeletal muscle interference was resolved the researchers faced another serious problem. Physiological functions occur so rapidly that feedback must be almost instantaneous to reward the appropriate response. Take heart rate, for instance. Even with the normal heartbeat of 70 beats per minute there are constant fluctuations—minute increases or decreases in heart rate around the average. If we are interested in a decrease in an animal's heart rate, the reward must be given almost immediately after the decrease occurs, because any undue delay would reward not the decrease in heart rate, but some other event, perhaps even an increase in heart rate.