A Caricature of Behaviorism

Description	Number of respondents endorsing item
1. Behaviorism sacrifices mind, purpose, thought, and human experience at the altar of stimuli and responses. It rejects everything that is mentalistic, thus everything that psychology is supposed to be about.	13
2. Behaviorism's stimulus-response approach is atomistic. By its very nature, behaviorism cannot deal with complete individuals or total situations.	15
3. Behavioristic explanations are reductionistic: human behavior is either materialistic biology or abstract mathematical equations.	16
4. The laws that behaviorism seeks are mechanistic laws of passive adaptation. There is no place for human beings conceived as self-directed coping, causal agents.	16
5. The behavioristic approach is nomophetic. It deals with averages and promotes the concept of "standard man." It neglects the variance in behavior and fails to recognize that every human being is a unique individual.	10
6. Behaviorism is "scientistic" not scientific. It presumes to measure human attributes that are not quantitative. Its laboratory methods are artificial. They dissect behavior from its natural context and yield results that have no useful application.	5
7. Behaviorism is simplistic. It lacks the complexity required to capture the subtle nuances and the richness of its subject matter.	15
8. Behaviorism's contributions to the understanding of the human condition are trivial. They are a catalog of small effects produced by insignificant causes.	2
9. Behaviorism turns human beings into lower animals. It is insensitive to the scope of human potential and blind to the essential human quality in all of us.	11
10. Behaviorism is without human values, without a conscience, without morality or ethics.	12

Frequency Distribution of Items Endorsed

Frequency	9	5	6	1	3	3	5	1	2	0	1
Items endorsed	0	1	2	3	4	5	6	7	8	9	10

It has taken me most of the last decade to conclude that these principles are basic and that my summary statements are the best way to present them. Toward the end of that period, I had occasion (Kimble 1990a) to review James's *Principles of Psychology.* In the process, I discovered that the book contained all my orienting evolutionary assumptions and axioms of action. In this book, I present those ideas in contexts that are diverse enough to suggest that if James had foreseen things to come, he might have elected them to be his principles of psychology.

Much has happened to psychology in the century since James; to me, the new developments, even the parallel distributed processing (PDP) models of cognition, seem to fit the scheme I have described. In their summary description of such models, David Rumelhart and his colleagues (1986) present conceptions that appear to be close kin to my five principles: (1) States of activation and net input play, respectively, the roles of potential and of instigation. (2) Associative learning and regularity discovery (of "interesting" patterns in the environment) are like mechanisms that underlie adaptation and coping. The PDP models include the concepts of (3) threshold and (4) excitation and inhibition quite explicitly. (5) Connectivity matrices are forms of hierarchical organization.

In the burgeoning field of psychopathology, (1) vulnerability and risk are potentials; disordered personalities are instigated expressions of those potentials. (2) Obsessions and compulsions are maladaptive forms of adaptation and coping. (3) The diasthesis-stress interpretation of psychopathology is a threshold model. (4) Neurotic conflict—aggression and sexuality versus anxiety and conformity—is between varieties of excitation and inhibition; when inhibition wins the battle, the conflict is repressed. (5) The structure of personality is a hierarchical organization.

If I were beginning my own *Principles of General Psychology* (1956) today, it might become two volumes, spelling out the implications of these generalities for the entire subject matter of our field. Instead, I have provided a broad outline and filled in enough of the details to encourage the science of psychology to complete the picture of my hope for the future of psychology, not only as a science but also as a means of promoting human welfare.

Acknowledgments

Although the shortcomings of this book are my responsibility, there are fewer of them than there might have been because of the help I received from many colleagues. Elise Axelrod, Herbert Crovitz, Robert Erickson, Lynn Hasher, Gregory Lockhead, Nestor Schmajuk, John Staddon, Lise Wallach, and Michael Wallach, here at Duke, and Fred McManus of Hyde Park, New York, read some or all of early drafts of the manuscript and offered criticism that made me rethink many of my arguments and improve my ways of expressing them. I thank Ernest R. Hilgard, Nicholas Wade, and one reviewer who remained anonymous, who read a nearly final version of the manuscript and made constructive comments.

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Chapter 1
Psychology as a Natural Science

When William James (1842–1910) looked at psychology a century ago, what he saw was unattractive: "A string of raw facts; a little gossip and wrangle about opinions; a little classification and generalization on the mere descriptive level; a strong prejudice that we *have* states of mind, but not a single law in the sense that physics shows us laws, not a single proposition from which any consequence causally can be deduced. We don't even know the terms between which the elementary laws would obtain if we had them. . . . This is no science, it is only the hope of a science" (James 1893, p. 468).

This book grew out of the belief that, today, that hope is brighter; that there are general principles of behavior that apply throughout the discipline, from the firings of a single neuron to the misfirings of a mind in madness.

Hallmarks of the Scientific Method

The development of the case for a unified psychology begins with a review of three "isms," the assumptions that bring the sciences together and distinguish them from other ways of interpreting natural phenomena: empiricism, elementism, and determinism. The principle of empiricism requires the knowledge of psychology to be based on observation rather than authority or intuition. The principle of elementism requires psychology to reduce phenomena to components, instead of accepting them at face value as unanalyzable wholes. The principle of determinism requires a treatment of behavior and experience as events with natural causes, instead of manifestations of God's purposes or individual free will.

James understood these criteria and although he disliked their implications, he accepted them for science. On empiricism, James said that "'scientific' conceptions must prove their worth by being 'verified'" (James 1890a, 1:v); on analysis, that "*brain and mind alike consist of simple elements*" (1:29); on determinism, that he saw no reason why "*for scientific purposes* one need give it up. [In the face of] indeterminism, science simply *stops*" (2:576).

Empiricism

Nothing forces psychology to be a science; there are other ways to understand behavior. Poets, preachers, philosophers, and people on the street also have their ways of knowing, but their criteria of truth are different. Science is empirical. For the scientist, truth is in the public facts of observation. For the poet, truth resides in personal insight and intuition. The acceptance of those subjective data as the ingredients of science mistakes private truth for public truth. In psychology, it spawns an epistemological elitist class, like Titchener's trained introspectionists, whose experiences are the only ones that are legitimate. For the preacher, truth is in the sacred texts and language of the church. The promotion of those truths replaces observation with authority, sometimes with malignant consequences, like the Scopes Monkey Trial and the Spanish Inquisition. For the philosopher, truth comes from the exercise of reason; the outside world, if it exists, is of secondary interest. For ordinary people, truth is what they have learned from personal experience—what everybody knows, what only stands to reason, and what is obviously true because the language says it is. In large measure, psychology's struggle to earn the credentials of a science has been a history of avoiding these other roads to truth.

British Empiricism The conception of psychology as an empirical science originated in the efforts of philosophers to answer fundamental questions: How do people come to know the world? What are the origins of mind? Is knowledge inborn, or is it learned? Over a period of some two hundred years, a group of British thinkers developed the argument for learning. In *An Essay Concerning Human Understanding* (1690), John Locke (1637–1704), borrowing a metaphor from Aristotle, put this position in emphatic terms: "Let us then suppose the Mind to be, as we say, white paper [*tabula rasa*], void of all character, without any ideas. How comes it to be furnished? . . . To this I answer, in one word, from EXPERIENCE." Locke's statement was a vigorous expression of one meaning of the term "empiricism": the idea that who and what a person is depends on experience.

Public Observability Generalized to science, empiricism took on a second meaning. It became an axiom of method: the proposition that knowledge of the world, including knowledge of the minds of other people, is suitable for science only when it is based on public observation. Reflection will reveal that, for psychology, the only public facts available are the things that organisms do and the situations in which they do them—responses and stimuli. The science of psychology must be a behavioristic stimulus-response psychology, fashioned out of those materials.

Surprisingly, perhaps, William James was one of those who understood this point. Although he defined psychology as "the Science of Mental Life, both of its phenomena and their conditions" (James 1890a, 1:1), he also noted that the fact that mental phenomena "lead to *acts* is of course the most familiar of truths" (1:5) and that "my thinking is first last and always for the sake of my doing" (2:333).

Elementism: Analysis and Synthesis

The second trademark of the scientific method is analysis, of which the most elegant versions are quantitative. Natural events are so complicated that even talking about them requires that observations be reduced to categories, and measurement facilitates communication.

The Psychologist's Fallacy This criterion is not universally popular. William James, among others, disliked it. He was offended by "the array of younger experimental psychologists, bent on studying the *elements* of mental life, dissecting them out from the results in which they are embedded, and as far as possible reducing them to quantitative scales" (James 1890a, 1:192). But James, writing in another mood, also noted that the insistence that psychological interpretations mimic common sense is the psychologist's fallacy: "the confusion of a phenomenon of interest with the psychologist's own standpoint" (1:196). And he understood the necessity for analysis: "The less we analyze a thing, and the fewer of its relations we perceive, the less we know about it and the more our familiarity with it is of the acquaintance-type" (1:221).

The Aristotelian Elements The earliest of British empiricism held that the elements of mind are primitive sensations, produced by sensory stimulation. Sensations, in their turn, give rise to elementary images or ideas. Later, scholars in the same tradition added elementary emotions, such as pleasure, pain, and anger, and elements of "conation" (striving), such as habit and volition. These categories correspond to the human faculties identified by Aristotle (384–322 BC) as knowing ("mind"), feeling ("appetite"), and doing ("motion").

Knowing and feeling are what contemporary psychology calls, respectively, *cognition* and *affect*. Cognition is the art and practice of understanding; it encompasses such mental processes as thinking, reasoning, and problem solving. Affect is the experience associated with motivation and emotion; it includes such states as arousal, tension, energy, and excitement. The third constituent has no generally accepted name—"conation," which some of the British empiricists suggested, has too much affect in it—but *reaction tendency* has the needed connotations. It refers to such inclinations as habit, mental set, response biases, and skill. The discussions in this book will find these categories useful in a variety of contexts.

The Pyramid of Sciences Every science has its elements, but those of one science may be the wholes of another. The experiences and actions that psychology treats as units are constructed out of simpler perceptions, urges, and responses. These psychological primitives are the wholes of neuroscience, which seeks to understand them in terms of its own physiological and biochemical elements. Moving in the other direction, the behavior of individuals, the wholes of psychology, are the elements of political science and sociology. The key question is not so much about the integrity of wholes as it is about the processes of synthesis that organize the elements of a science to create these wholes.

Synthesis The analysis of psychic phenomena into elements leads to a question: What is the rule of synthesis that brings the elements together to create experience as we know it? The answer of the empiricistic philosophers was that the process is *association.* The mind organizes its ideas by forming "mental strings" that tie the elements together.

Determinism

The human view of things has always been self-centered. People think of the earth as the center of the universe. They see themselves as the best of God's inventions: divine creations endowed with talents not possessed by other animals—a true language, the ability to reason, an understanding of their own mortality, and free will. Three successive revolutions in the history of ideas demolished these presumptions.

The Copernican Revolution The first conceit to capitulate to science was the conception of the earth as the center of the universe. By the end of the second century A.D., Ptolemy, the great Greek-Egyptian geographer and astronomer, had developed the earth-centered view in ways that handled what was known about the solar system very well. And for more than a millennium, the human ego remained safely situated in a pivotal position in the cosmic scheme of things. Early in the fifteenth century, however, Nicholas Copernicus (1473–1573) proved that the sun rather than the earth is at the center of the solar system. This insight meant that what had been the hub of everything was nothing but a fly speck floating in the heavens.

The Darwinian Revolution The second blow to human superiority was delivered by Sir Charles Darwin (1809–1882), whose theory maintained that homo sapiens evolved from lower forms of life and has no claim to being a unique creation. Darwin offered data to suggest that lower creatures have human-like emotions and the elements of intel-

lect. Might they not, then, also have the beginnings of a language, some appreciation of their own mortality, and the rudiments of free will?

Victorian morality reacted negatively to Darwinism. As one Philadelphia mainline matron is reported to have said, "Evolution? Descended from apes? My dear, we will hope that it is not true. But if it is let us pray that it may not become generally known." This critical evaluation found official expression in the form of legal sanctions: laws that made it a felony to teach the theory of evolution. Eventually, of course, the evidence prevailed, and now Darwin's view has a status that is more like fact than theory. But the older prejudices are not entirely dead. In some states in the United States, there are "equal-time" regulations that require teachers of biology to cover biblical creationism if they present the theory of evolution.

The Psychological Revolution Common sense attaches great significance to a distinction between the mind and body. According to this view, the actions of the body are determined by external forces, including those imposed on it by the mind. The mind, however, is self-determined. It knows the circumstances of the body and, through its own free will, dictates the body's actions. This freedom endows the behavior of human creatures, and possibly no others, with dignity and worth.

This final citadel of faith in human preeminence came under fire from a succession of psychologists, who maintained that both consciousness and free will are illusions; the operations of the mind and human conduct are just as much determined by external forces as are the functions of the body. Freud's theory of psychoanalysis was in this tradition. Freud proposed that human behavior is determined, often by unconscious forces, and that the quality of adult adjustment is the result of infantile experience, particularly sexual experience. The shock value of the sexuality in Freud's theory brought wide attention to psychoanalysis, and its influence on Western culture has been enormous. Its importance to psychology, however, is destined to be less than that of behaviorism. Too many of Freud's ideas have failed the tests of science.

Beginning with John B. Watson (1878–1958), the behaviorists have been psychology's staunchest advocates of determinism. Its important recent champion was Burrhus Frederick Skinner (1904–1990), whose first major contribution was a series of experiments, showing how conditions of reinforcement affect bar pressing in laboratory rats and key pecking in pigeons. Later, he applied the principle of reinforcement to human behavior. His novel, *Walden Two* (1948), describes the utopia he believed could be created in a society governed by the laws of rein-

forcement. His 1957 book, *Verbal Behavior,* applies the argument to language. Skinner's most provocative opinions appear in *Beyond Freedom and Dignity* (1971), where he makes a case against free will, insisting that people become whatever brings reward and spares them punishment.

The Schools of Psychology

As psychology developed, most psychologists continued to endorse determinism, empiricism, and analysis but with different emphases that led, early in the twentieth century, to the appearance of several schools of psychology—very general theories that covered the entire discipline.

Structuralism

The earliest of these schools was structuralism, founded by Wilhelm Wundt (1832–1920), who established the first laboratory of psychology in Leipzig, Germany, in 1879, commonly taken as scientific psychology's date of birth. One of Wundt's students, Edward B. Titchener (1867–1927), brought structuralism to America. As chair of psychology at Cornell University he promoted structuralism with vigor, making it the dominant position in American psychology for many years.

Structuralism strove to understand the structure of the mind and the content of consciousness, which, following the British empiricists, it took to be composed of sensations—sights, sounds, tastes, and tickles. Some sensations, like pure red and blue, are primary; others, like orange and purple, are constructed out of combinations of these elements. The structuralists' method of investigation was introspection, in which subjects looked inward on their experience and reported on the elements they found there.

The structuralists were extravagantly analytic. They maintained that sensations can be described in terms of several "physical dimensions of consciousness" (Titchener's phrase), such as quality, intensity, duration, and extent. The color purple combines the qualities of red and blue; because of variations in intensity, different purples may be very dark, or very light, or something in between. The structuralists' dissection of the mind into elements was similar to chemists' description of the universe in terms of molecules and atoms. The obvious parallel led to the christening of structural psychology as "mental chemistry."

The structuralists believed that the makeup of consciousness is the same for everyone—that their science would reveal the mind of "standard man." This position anticipated the modern doctrine of nomothetic lawfulness—the idea that the laws of behavior apply to people

generally. The science of mental tests discovered individual differences in intelligence and personality and laid the groundwork for the alternative concept of ideographic lawfulness, according to which the laws of behavior apply only to individuals.

Gestalt Psychology

Some psychologists objected to the structuralists' atomistic stance because it violates experience. We do not see an apple as so much redness, yellowness, and roundness with a stem on top; we see it as a whole apple that resists such analysis. These psychologists demanded an approach to psychology that respects the integrity of experience. The most important version of the holistic approach was Gestalt psychology, of which Max Wertheimer (1880–1943) was the founder.

"Gestalt" is a German word for shape or form; it carries the connotation of an integrated organization that makes wholes more than the sum of their constituent parts. The Gestalt psychologists made this point with the aid of experiments on perception, showing that what we see is coherent wholes rather than the elements of visual displays. The most convincing of these demonstrations came from Wertheimer's (1912) work on the phi phenomenon (apparent motion). When two stationary lights, separated by a certain distance, are turned on and off in alternation, an observer sees one light moving back and forth, not two individual lights. This demonstration supports a Gestaltisch interpretation because the elements (two lights flashing separately) cannot explain the whole (a single moving light). The phi phenomenon does not occur unless these elements are present, but an additional process of organization is critical to this perception.

Functionalism

Another group of psychologists objected to the structuralists' preoccupation with the content of the mind. These functionalists, greatly influenced by Darwin's theory of evolution, maintained that the purpose of the mind is to promote survival of the organism and that psychology should be studying these uses rather than the forms of consciousness.

One of the giants in the history of functionalism was William James, who found the basic functionalist idea in the writings of Herbert Spencer (1820–1903). James wrote, "On the whole, few recent formulas have done more real service of a rough sort in psychology than the Spencerian one that the essence of mental life and bodily life are one, namely 'the adjustment of inner to outer relations'" (James 1890a, 1:6). James also knew of Darwin's work, and he proposed that the actions of the nervous system "have usually the common character of being of service. They ward off the noxious stimulus and support the beneficial

one; whilst if, in itself indifferent, the stimulus be a sign of some distant circumstance of practical importance, the animal's acts are addressed to this circumstance so as to avoid its perils or secure its benefits" (1:12). James believed that, as correlates of nervous activity, mental states had purposes. He spoke of consciousness as a fighter for ends that, but for its presence, would not be ends at all (1:141).

The functionalists accepted the structuralists' introspective method, but they were clear that introspection had problems. As James noted, the method provides direct knowledge only of the mind of the introspectionist; the knowledge of other minds is inference. "[Peter] may have a *knowledge,* and a correct one too, of what Paul's last drowsy states of mind were as he sank into sleep, but it is an entirely different sort of knowledge from that which he has of his own last states. He *remembers* his own states, whilst he only *conceives* of Paul's" (James 1890a, 1:239). And then: How can a mind even know itself? Does that not require the postulation of a little man inside the head to do the knowing? Or, perhaps, "a parliament of little men together, each of whom as happens also in a real parliament, possesses but a single idea which he ceaselessly tries to make prevail" (1:29). How can introspection grasp the dynamic aspects of experience, the "flights" between the "perchings" in the stream of thought? They are past events before the mind can catch them: "The attempt at introspective analysis in these cases is in fact like seizing a spinning top to catch its motion, or trying to turn up the gas fast enough to see how the darkness looks" (1:244).

Behaviorism

Although Watson, the father of behaviorism, criticized all the other schools, he accepted the traditional themes that they endorsed. He was a vigorous advocate of empiricism but with a difference. Recognizing the importance of public observability, Watson proposed that private mental states cannot be the subject matter of a scientific discipline precisely because they are private: "The behaviorist asks: Why don't we make what we can *observe* the real field of psychology? . . . Now what can we observe? Well we can observe *behavior—what the organism does or says*" (Watson 1925, p. 6).

There was no place in such a science for the concepts of mind or consciousness or for the introspective method: "[Consciousness is] just as unprovable, just as unapproachable, as the old concept of the soul. And to the behaviorist the two terms are essentially identical, so far as concerns their metaphysical implications. . . . This thing we call consciousness can be analyzed only by *introspection*" (Watson 1925, pp. 5–6).

Watson accepted the necessity of analysis but not the structuralists' elements. Implicitly recognizing the Aristotelian categories (of knowing, feeling, and doing), he noted that "in the analyses of consciousness made by certain of the [structural] psychologists you find such elements as *sensations* and their ghosts, the *images.* With others, you find not only sensations, but so-called *affective elements;* in still others you find such elements as *will*—the so-called conative element in consciousness" (Watson 1925, p. 5). Watson's elements were reflexes, and his principle of associationism was Pavlovian conditioning.

Watson endorsed environmental as opposed to biological determinism and stated his position forcefully: "Give me a dozen healthy infants, well formed, and my own specified world to bring them up in, and I'll guarantee to take any one at random and train him to become any kind of specialist I might select—doctor, lawyer, artist, merchant-chief, and yes, even beggar-man and thief—regardless of his talents, penchants, tendencies, abilities, vocations and race of his ancestors" (Watson 1925, p. 104).

Watson was a brilliant writer. After he left the Johns Hopkins University, driven out by a scandalous affair with a female assistant, he wrote widely for the general public, chiefly on child development. A whole generation of parents accepted Watson's teachings, thus acquiring a heavy burden of guilt because of the implication that their child-rearing practices and nothing else were responsible for their offspring's misbehavior even as adults.

Psychometric Psychology

Long before the appearance of psychology's schools, a second science of psychology, based on mental tests, was already in the making; its history goes back four thousand years. From about 2200 B.C. to A.D. 1905, the Chinese government appointed candidates to various official positions on the basis of a series of rigorous examinations, culminating in a three-day session in Beijing. The Chinese tests covered the so-called six arts: music, archery, horsemanship, writing, mathematics, and the rites and ceremonies of personal and public life. These methods of assessment were so successful that, in the nineteenth century, they became a model for personnel selection in the British and German colonial services and the U.S. civil service commission (Dahlstrom 1985). The amount of time required by these tests was so great, however, that they were abandoned when more efficient methods became available.

The modern history of the testing movement dates to 1904, when the French minister of education asked Alfred Binet (1857–1911) to find a way to identify children in the schools who were below average in

ability, so that they could receive special assistance. In response to this request, Binet and his collaborator, Theophile Simon, implicitly equating the ability to do school work with intelligence, proceeded to construct a test designed to assess the talents that a child must have to succeed in school—such cognitive abilities as attention, memory, verbal and mathematical skill, and power of reasoning. Current measures of intelligence continue to emphasize this type of content.

Modern personality assessment began a few years later. In World War I, a flood of inductees into the American military created a need for methods of screening out the emotionally unfit. Responding to this need, Robert S. Woodworth (1869–1962) created a personal data sheet (1919), which produced ratings that were used to identify recruits who might not perform adequately in a military situation. Woodworth's test was the ancestor of the modern personality inventories. Just two years later, in peaceful Switzerland, the psychiatrist Hermann Rorschach (1884–1922) invented the Rorschach Inkblot Test (1921), which remains the most widely used projective method of personality assessment. It is clearer now than it was then that psychometric psychology is a different science from structuralism, behaviorism, and the rest.

Psychological Lawfulness

A science is a body of knowledge about some aspect of the world; its goal is to maximize the orderliness of that knowledge. The ingredients of order are scientific laws describing how the dependent and independent variables of a science relate to one another. *Dependent variables* are the phenomena that a science attempts to understand—in psychology, the behavior of human beings and other animals. *Independent variables* are factors that cause or predict the values of these dependent variables. The diagram,

Independent variable ——— L_1 ——— Dependent variable,

presents a general formula. L_1 refers to a Type-1 law (to distinguish it from laws of a second and a third type, to be introduced in the next chapter).

In psychology, these Type-1 laws take two different forms. The first is a set of stimulus-response (Type-S) laws, relating responses (dependent variables) to stimuli (independent variables). In this context, the term "stimulus" refers to environmental objects and events generally, not just to the atomistic elements of the structural psychologists. The term "response" refers to behavior generally, not just to the muscle twitches of the Watsonian reflexologists. Diagrammatically

Stimulus ——— Type-S law (L_1) ——— Response.

Suppose the folk saying that "practice makes perfect" is correct. It thus implies a Type-S, law which says that the quality of performance on some task increases to perfection with practice. Diagrammatically,

Practice ——— Type-S law (L_1) ——— Quality of performance,

where the L_1 law is "increases with."

The second class of Type-1 laws are Type-P, laws relating behavior to various properties (characteristics, attributes) of organisms—such things as race, sex, age, social class, physiological condition, and the psychological traits revealed by clinical interviews and mental tests. Diagrammatically,

Property of organism ——— Type-P law (L_1) ——— Response.

Every student who is in college, partly on the basis of a high SAT or ACT score, is there in recognition of the truth of such a law. This law says that, in general, the higher a student's score on these tests of scholastic aptitude is, the better is this person's school performance, measured by such indexes as grade point averages (GPA). Diagrammatically,

SAT/ACT score ——— Type-P law (L_1) ——— GPA,

where L_1, again, is "increases with."

As in this case, many Type-P laws are response-response laws, which describe the relationship between two measures of behavior, R^1 and R^2. In this example, R^1 is a student's SAT or ACT score and R^2 is that same student's GPA. It is important to recognize, however, that in addition to responses, the P in Type-P laws may refer to other properties of organisms. For example, there is evidence that an excess of the neurotransmitter dopamine may be present in the brains of schizophrenic patients and that the probability of an individual's developing that disorder increases (L_1) as a result of this condition:

Dopamine level ———Type-P law (L_1)——— Probability of schizophrenia,

Psychology's Two Sciences

In 1957, Lee J. Cronbach made the important observation that these two types of law differentiate two scientific disciplines that are built on psychology's two main contributions to the history of ideas: the application of the experimental method to behavior and the invention of the mental test. The first of Cronbach's two sciences is *experimental*

psychology, which studies the relationships of behavior to conditions that, potentially at least, could be manipulated in the laboratory. The second is *correlational psychology,* which deals with tests and other assessments of the attributes of individuals.

Experimental psychology searches for the commonalities in behavior. It seeks to paint (the critics would say, "by the numbers") a picture of the structuralists' "standard man" that is revealed by averages and other measures of central tendency. Correlational psychology, by contrast, concentrates on the individual differences in behavior revealed by the standard deviation and other measures of dispersion. Along with William James, it sees significance in variation: "Although [experimental psychology may show that] there is very little difference between one man and another, what little there is, is very important" (James 1890b, p. 438).

The bare-bones skeletons of these two sciences, laid out in figure 1.1, reveal that they have similar ambitions: to discover the L_1 laws relating behavior to independent variables: environmental circumstances and predictors in experimental and correlational psychology, respectively. Whether a particular psychology is experimental or correlational depends on its independent variables. Sciences that go by the same name

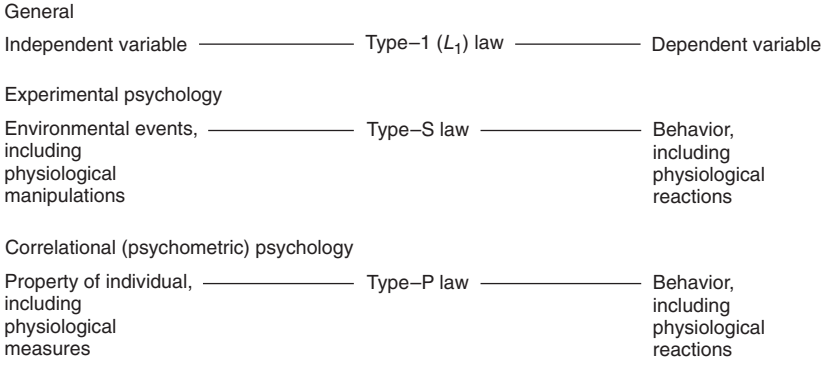

Figure 1.1
Models of Psychology's Two Sciences
The panels summarize the relationships between independent and dependent variables in psychology. The top panel presents the general case, in which Type-1 laws connect these two classes of variables. The middle panel represents the situation of experimental psychology, in which Type-S laws link responses to events in the environments and previous experiences of individuals, including physiological manipulations. The bottom panel shows the situation of correlational psychology, in which Type-P laws relate behavior to assessments of the attributes (properties) of individuals, such as the traits measured by scores on tests, and bodily conditions, such as blood pressure and brain chemistry. The independent variables of correlational psychology can be the dependent variables of experimental psychology.

may be either. Biological psychology is correlational when physiological antecedents, like brain chemistry or brain waves, are used to predict behavior; it is experimental when these reactions are the dependent variables in experiments. Psychometric psychology is correlational when it uses scores on tests to predict behavior elsewhere; it is experimental when it investigates the impact of environmental conditions on these scores.

Correlation versus Causation

Experimental psychology is like experimental physics. Its concern is with the effects of independent variables that can be manipulated in the laboratory. Correlational psychology is like astronomy. Its independent variables cannot be manipulated. Variations in its independent variables are obtained by selecting individuals who differ in measures of these variables.

In terms of practicalities, a knowledge of the Type-S laws obtained in experimental psychology allows control as well as the prediction of behavior, whenever the scientist can manipulate the independent variables. The Type-P laws of correlational psychology permit prediction but not control because their independent variables are beyond manipulation. In some thinking, the concept of causation applies only to independent variables that are manageable. This idea appears to be the basis for the claim sometimes heard that experimental psychology is "more scientific" than correlational psychology: the laws of experimental psychology are causal laws, while those of correlational psychology are not, and, in the words of a methodological cliché, "Correlation does not prove causation."

The Concept of Causality

Statements of causality relate phenomena to something other than themselves. The cause of an event, *Y*, is another event, *X*, that has a dual relationship to *Y*. First, if *X* occurs, *Y* always happens (*X* is a sufficient cause of *Y*); second, if *X* is absent, *Y* never occurs (*X* is a necessary cause of *Y*). Stated in a single formula, this double definition of causality is: "If-and-only-if *X*, then always *Y*."

The *X* in the formula can vary. The independent variables in well-established laws provide one form of explanation. Thus, it is acceptable to say that an extra X chromosome in the twenty-first position is a cause of mental retardation in children with Down's syndrome. More tentatively (because the law is less well established), it also is legitimate to say that poverty and other environmental deprivation cause most mental retardation.

Pitfalls

Causality is a tricky concept, and it may have created more confusion than understanding for psychology. The confusions have been of two main kinds.

First, the definition of causality—"if-and-only-if *X*, then always *Y*"—implies that events have single causes. For psychological events, however, this is never true because even the simplest responses and experiences have many causes. What you see when a spot of light appears on a wall depends on the shape of the spot, several wave lengths that determine its color, the intensity of the light, the color of the wall, the stimuli that you have looked at recently, and the sensitivities of a host of mechanisms in the retina and the visual nervous system.

The medical model of psychopathology routinely fails to recognize the fact of multiple causality by making the assumption that mental disorders are single entities brought on by single causes that a patient either has or does not have. Although such diagnoses are appropriate for some medical conditions—there is only one known cause for pregnancy, and a patient is never marginally in that condition—psychological disorders are more complicated than the medical model suggests. They may be full-blown or borderline, and even "normal" people have symptoms. And, like every other important aspect of behavior, they express an array of dispositions. In terms of the Aristotelian classification, the mental disorders all involve faulty thinking, inappropriate feelings, and disordered doing. A single underlying physiological cause of such an array of symptoms seems unlikely. Moreover, the etiology of mental disorders is both environmental and biological. Even the identical twin of someone who is schizophrenic may not develop that disorder. Although the two twins have the same genotype, the environment determines its phenotypic expression.

In addition to reminding us that a science of psychology must be analytic, this complexity raises an interesting question: Do causes vary in importance? Can *X* be a "stronger" cause of *Y* than *Z*? The answer to this question, in a certain sense, is yes. Whether *X* is a more important cause than *Z* depends on what analysis reveals about the ingredients of *Y*. If *Y* is three-fourths *A* and one-fourth *B*, and if *X* causes *A* and *Z* causes *B*, then *X* is, indeed, a stronger cause of *Y* than *Z*. In the language used in answering such questions, variations in *X* account for more of the variation in *Y* than do variations in *Z*. Ironically, correlational psychology had this insight much earlier than experimental psychology.

The second confusion, a failure to take the "if-and-only-if *X*, then always *Y*" formula literally, leads psychology to look backward in its search for causes, whereas causality itself works forward. The formula