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Science and Human Behavior

The history of the behavioral sciences is marked by a struggle to separate these sciences from philosophy and establish them as a distinct set of scholarly disciplines. This struggle has led to a continuing concern about their scientific status. In fact, the behavioral sciences are distinguished from philosophy precisely because they rely on scientific methods and the application of science to questions of human behavior, whereas in philosophy rational analysis is applied. Because of the success of natural scientists in understanding the natural world and solving practical problems, it seems reasonable to suggest that the same success might be achieved in the realm of human behavior. Somewhere in the communal mind-set of behavioral scientists lies the expectation that careful scientific study of human beings will yield solutions to our most perplexing human problems. Our culture as a whole seems to share this expectation, continuing to respect scientific findings and turning to the behavioral sciences for answers to life's problems.

In this chapter, we examine the nature of science to see why people in our culture have come to trust it for answers to our important human problems and whether the behavioral sciences *can,* or indeed *should,* be scientific. The assumption that human beings can and ought to be studied using natural science methods has important implications for how we understand human beings.

THE NATURE OF SCIENCE

To be confident about whether the behavioral sciences are or should be sciences, we need to answer the question: What is science? On first examination, this may seem a trivial question with an easy and straightforward answer, but on closer examination we see that the answer is not as simple as it seems. Science and scientific findings have had a pronounced impact on philosophy since the time of the early Enlightenment and through the work of early scientists such as Galileo and Newton. It is also true, however, that our understanding of science has changed as various philosophical views have become popular and replaced earlier views over the past several centuries.

It might seem strange to suggest that changes in philosophical thinking have produced changes in our understanding of science, especially as science is often contrasted with philosophy. Philosophy is seen as being speculative and fraught with uncertainty, whereas science is seen as being objective and exact. We do not have space here to trace the history of science to show how philosophy has affected it, but later in the chapter we review some of the issues that have been important in this history. For now, it is important simply to note that science itself is based on a set of ideas—assumptions about what the world is like and how it should be studied.

The word *science* comes from a Latin word meaning "knowledge." In Greek philosophy, knowledge was contrasted with mere opinion. According to this ancient view, knowledge—if it is to count as true knowledge—is knowledge of what is real or true. We cannot have knowledge about what is not real or true. That which is not real or true is mere opinion. In this way science got connected to the question of truth, and this connection remains very much a part of our beliefs about science even today. In the minds of many, science encompasses what we *know* to be true, in contrast with what we only think to be true. In our modern age, we attach some importance to the idea that we have, in science, a method of distinguishing what is true and real from what is not. This idea lies at the very heart

of our understanding of science and our confidence in it. Knowledge gained through science can be trusted.

In contemporary scholarly discourse, the term science is used to refer both to a type of knowledge that is trustworthy and to a method of arriving at that type of knowledge. Both of these meanings are important for our discussion. However, in the behavioral sciences, discussions of science are most often focused on the issue of method. As we noted above, the behavioral sciences have developed largely from the attempt to bring scientific methods to bear on the study of human beings.

It is common in our culture to refer to the *scientific method* as if it were a single thing about which all people agree. It should be pointed out, however, that there is no such thing as *the* scientific method. There are as many scientific methods as there are scientists doing research. There are, however, some commonalities among scientists in the sort of methods they use, so it is possible to study their methods and talk about what qualifies as science. And the idea of proper scientific method has changed over time.

The early Greeks are generally considered to be the first scientists. In the Western tradition we trace most of our sciences to them—as we do the Western intellectual tradition itself. As noted above, science was knowledge for these early Greeks, and knowledge was gained through careful observation and skilled exercise of rationality. Clear analytical thinking and careful discourse were very much a part of science. The Greek word meaning "discourse" (among other things) was *logos* and this word is the root of our modern suffix *-ology,* which we often use to designate a discipline as a science, as in biology, psychology, and so forth.

Many of our modern sciences owe much to Aristotle, who developed formal logic as a tool for doing science, that is, for generating knowledge that could be trusted. Science in the time of Aristotle was much closer to philosophy than we generally think of it today. Much of the work in science was aimed at classifying things of the world and placing them in categories that related to other categories of things in a rational and meaningful way. A major project in biology, for example, was the classification of living things.

In later centuries, scholars became skeptical about whether reason and logic alone could produce useful and trustworthy knowledge. It was felt that reason and logic were too likely to be influenced by traditions, habitual ways of thinking, and authority. Reason and logic were unable to correct themselves when they did go wrong. Sir Francis Bacon, a slightly older contemporary of Isaac Newton, was one of the first to make this criticism explicit in his writing about what he called *idols*. Idols, for Bacon, are worshipped and endowed with authority although they are false and do not deserve to be seen as authoritative. Among the idols Bacon wrote about are authority, habit, imprecise use of language, and other things that keep us from more useful and trustworthy truths. Bacon suggested that careful observation of the world would allow us to discern the secrets of nature. The test of whether we have, indeed, discerned the secrets is whether we can exercise power and control over nature to bring about practical ends. This dual emphasis on careful observation in the pursuit of truth and (practical) control over the natural world is at the heart of our modern notion of science.

Since the Enlightenment, science has been thought of as a method for testing ideas and opinions through observation. Observation takes place through the medium of sensory experience. This emphasis on observation of the world as a way of attaining true knowledge is the essence of *empiricism* (see Chapter 3). Scientists thus came to be empirical in their methods, meaning that they came to trust observation over what can be established by "merely" rational thought. We should note, however, that the early Enlightenment scientists such as Bacon, Galileo, and Newton did not abandon reason altogether. They still recognized that it is important for science to "make sense," and they also realized that careful rational analysis was an essential part of all scientific work. They did, however, suggest that at some point scientific ideas should be subjected to an empirical test, and that the empirical test was crucial to an idea's being accepted as true.

OUR MODERN VIEW OF SCIENCE

In our post-Enlightenment culture we continue to trust science and rely on it to produce trustworthy knowledge. The question should be asked, however, what it is about science that recommends it to us so strongly. In answering this question, we formulate the qualities and characteristics of science that give it its great credibility. We have already mentioned one of the important characteristics of science: Science emerged as a trusted source of knowledge, in part, because it *relies on observation and* not *just rationality*. For a number of reasons, we have come to trust our senses more than we trust our thoughts and ideas.

It should be pointed out, however, that just relying on sensory observation is not enough to establish science as a good source of knowledge. All people make sensory observations all the time. What sets science apart from what ordinary people routinely do is the *way* the observations are made. One of the hallmarks of scientific observation is that it is made under *objective* conditions. This is usually understood to mean that what scientists observe is not influenced by "outside" factors such as the values, expectations, and desires of the scientist, or by Bacon's idols such as traditions, authority, or habitual ways of thinking. Objective observation means that the scientist, as observer, stands on some "privileged" ground to make the observations. When made from these grounds, the observations have scientific credibility.

Another important aspect of scientific observation is that it is made under *controlled* conditions. Through the process of experimentation, scientists control the conditions under which they make their observations. Good scientific practice entails the scientist's *predicting* what he or she will observe under certain specified conditions. If the prediction is found to hold true, the theory or hypothesis that led the scientist to make the prediction is validated. Knowing what conditions to control and how to control them is often seen to be the crucial test of scientific knowledge. We therefore trust scientific knowledge because it gives us the ability to control and predict events in experimental settings. Being able to control and predict in experimental settings gives some expectation that we will be able to control and predict in real-world settings as well. This confidence in the process of control and prediction is at the heart of the desire for the behavioral sciences to truly be sciences.

This movement from the experimental setting to the real world is made possible by *technology*. When scientific knowledge is successfully applied to the solution of a real-world problem, we have technological advance. Some scientists maintain that science should, at least sometimes, be pursued for the sake of knowledge itself without any necessary hope or promise that it will "pay off" in technological advance. This position supports a sort of "pure" science, or "pure" research, in contrast to "applied" work. Even if we grant a place for scientific work for the sake of knowledge alone, it is difficult to deny that technology is one of the major reasons science is given so much credibility. The fact that the natural sciences have been so successful over the past few centuries in producing unprecedented technological advances contributes greatly to this credibility. Indeed, the ability to produce technology that solves problems has come to be an acid test for any discipline or activity that is claimed to be scientific. It is thus easy to see why researchers in the behavioral sciences have wanted their disciplines to be sciences. First, there is considerable prestige attached to the sciences because of the impressive technological success they have enjoyed. Second, behavioral scientists hold out the hope that a technology for dealing with the problems of human behavior might be developed with much the same beneficial results as in the natural sciences.

There are other characteristics of scientific work that contribute to its credibility. Scientific work is conducted in *public*, in the sense that the results are open to public scrutiny. The knowledge gained through scientific methods is thus available to all who can read and understand the research, or perform the scientific experiment for themselves. Scientific knowledge also increases in credibility when the results of scientific investigation are *repeatable*. We believe that if something is true it should be susceptible to being demonstrated for all to see and repeat.[1]

One other characteristic of science deserves mention. Science has always been closely associated with mathematics. To a great extent *science has mathematics* as its language. The idea that nature "speaks" the language of mathematics is a very old one, going back at least to Pythagoras (6th century B.C.). If nature speaks a mathematical language, then scientists should try to understand it. Compared to the language in which people normally communicate, the mathematical language is perceived as being more precise and less open to error and interpretation. The truths of mathematics seem sure and certain when compared to the ideas of philosophy and other forms of theoretical speculation. It seems intuitively obvious, for example, that $(2 + 3) = (3 + 2)$. We find it very difficult to argue that this is not so. Because science is often conducted in mathematical language, and because it explains many phenomena in the world mathematically, the precision and certainty of mathematics has generalized to science.

This mathematical precision is probably best represented in the machines we build. Mechanical systems of all sorts can be described accurately and precisely by mathematical operations. Indeed, mathematics has made it possible to build such machines. This relationship between mathematical precision and mechanism is part of the reason scientific explanations are often mechanistic and deterministic. Mathematics lends itself to these types of explanations. It seems reasonable for behavioral scientists

to want that same precision and power in their explanations and predictions of human behavior.

All the characteristics and qualities we have mentioned here contribute to the perceived legitimacy of science. Because of the way science is done, the knowledge produced with it is seen to be more trustworthy than knowledge attained in other ways. Scientists seem to be able to prove things true or false, establish with some authority the causes of events, and provide an understanding of phenomena that is objective and uncontaminated by traditions and subjective speculations. The question remains, however, whether the behavioral sciences should be included among the truly scientific disciplines.

ARE THE BEHAVIORAL SCIENCES SCIENTIFIC?

Whether the behavioral sciences should be regarded as scientific depends on what we take science to be. On the basis of the preceding discussion about the characteristics and qualities that lend science its credibility, we are in a position to talk about what science is in a way that might help us see how the behavioral sciences are situated in the larger scientific enterprise. There are two conceptualizations of science that are relevant in considering the status of the behavioral sciences. According to the first conceptualization, science consists of a body of knowledge that explains the nature of the world (or that aspect of the world that is the subject matter of the particular science in question, e.g., psychology, biology, family science). From this perspective, a *scientific* body of knowledge is recognizable by two main characteristics. First, scientific explanations for the most part involve rejecting supernatural explanations of phenomena in favor of naturalistic explanations. Scientific explanations are usually given in terms of matter or other naturalistic constructs. Second, scientific knowledge is generally framed in terms of laws and principles that are assumed to determine the events of the world. These laws are taken to be the real causes of the events, and because of their lawful regularity, it is possible, at least in theory, to control and predict the events.

By these characteristics of science, the majority of the behavioral sciences would probably not qualify as sciences in the minds of many. Although behavioral scientists have largely rejected supernatural explanations and tried to explain human behavior in strictly naturalistic terms, the attempt has not been wholly successful. Also, the behavioral sciences have for the most part been unable to formulate universal laws that fully account for human behavior. Behavioral scientists have assumed a deterministic posture toward human behavior, but they have not been able to demonstrate the kind of control and prediction that have been achieved in the natural sciences. This is generally assumed to be the result of there being so many variables that cannot be controlled when dealing with human beings that reliable predictions are impossible. These problematic variables make human behavior so complex that it is likely never to be as neatly controlled and predictable as other natural events. For this reason, the behavioral sciences are often referred to as *soft* sciences. If this portrayal of human life as complex and consisting of many subtle and uncontrollable variables is correct, it seems likely that the behavioral sciences will never be scientific in the same way as the natural sciences.

The second common way of speaking about the nature of science is to say that science is primarily a ***method*** of studying phenomena. This method involves careful empirical observation, control and prediction in the experimental setting, and most often, measurement and mathematization of the phenomena being studied. By this definition, any discipline in which the scientific method is used qualifies as a science. From this point of view, the behavioral sciences probably qualify as sciences because recognizably scientific methods are employed in them. Of course, the degree to which behavioral scientists are able to apply those methods is a matter of some debate. It seems difficult to measure many important aspects of human beings, because we lack the instruments to do so and because it is often not apparent what scales or units of measure are appropriate. For example, what are the proper units for measuring anger? Furthermore, human beings in many settings actively resist strict control and prediction.

As we mentioned earlier in the chapter, one of the hallmarks of science is that it produces technology. The natural sciences have an impressive record of technological advance. In this respect, the behavioral sciences are again at a disadvantage. Although the behavioral sciences have undoubtedly resulted in beneficial strategies for therapy, education, and business, the effectiveness of those "technologies," especially in comparison with technologies of the natural sciences, such as medicine and engineering, has been questioned. By comparison, the behavioral sciences seem to contribute few technological wonders in the modern age. It should be noted, however,

that the literature in nearly all the behavioral sciences contains considerable commitment to finding solutions to human problems.

In summary, then, the behavioral sciences probably do not qualify under the first of these two conceptualizations of science. However, as we will see later, the natural sciences may not qualify either. Under the second conceptualization, the behavioral sciences probably qualify as sciences, but we are left with two important questions. First, is adherence to a method adequate ground for a discipline's status as a science? From this ground, on the one hand, many students of paranormal phenomena, such as ESP, have undertaken to study these phenomena scientifically, and thus the field of parapsychology should qualify as a science. However, many scientists would be reluctant to allow parapsychologists under the umbrella of science. On the other hand, physicists working on the frontiers of quantum mechanics often do not do recognizably scientific experiments. Albert Einstein, for example, never conducted an experiment involving observation of phenomena in a laboratory. In fact, many of the things he theorized about could not be observed at the time he theorized about them. We seem quite willing, however, to refer to Einstein as a scientist.

Even if we are content to conclude that the behavioral sciences are indeed sciences because of their adherence to scientific methods, a second question remains: Are such classically scientific methods the best methods for studying human behavior? Remember that scientific methods are based on certain assumptions about the nature of truth and the world. If these assumptions are not true of the human world and of human phenomena, then the scientific methods based on these assumptions may not be appropriate for studying people. We return to this question later in the chapter, but for now, considering this question leads us to see that we need to be more explicit about the assumptions that underlie our contemporary conceptualization of science.

THE ASSUMPTIONS OF SCIENCE

It should be clear by now that it is not altogether easy to decide just what science is. It is important to note this, because science is generally accepted as the best means to settle issues and find explanations of things. It is problematic to expect science to settle issues if we cannot be entirely settled about what science is. One of the first issues that needs to be considered is whether science is, as many people in our culture have believed, a clearly defined method that always works to uncover truth. Many people believe that science is self-correcting when it goes wrong. Many also expect that science should be virtually the same in all disciplines that researchers want to call sciences. They assume that science is objective and free from the changing disciplinary influences of tradition, values, and social forces. Many recent observers of science have challenged these views. They propose that science is an activity, a way of approaching a problem, but certainly not the only way. Science is thus something human beings do, rather than a monolithic system that runs itself apart from other human activities and concerns.

In assessing the nature of science, it will be helpful to discuss two general conceptions that have been used as frameworks for talking about science: ***positivism*** and ***Weltanschauung***. Positivism should be distinguished from ***realism***. The difference between realism and positivism is closely related to the difference between empiricism and rationalism, as discussed in Chapter 3. Realism is the older view. Proponents of this position hold that the methods of science allow the scientist direct access to the reality of the world. In other words, if scientists properly apply the methods of science, they can directly observe the world as it is. Scientific explanations, in this view, describe the world as it really exists. This is a very strong position to take, because the nature of reality and our capacity as humans to discover that nature have been in question since the beginnings of the Western intellectual tradition. That people take such a strong position in relation to science is testimony to the esteem in which science is held, as compared to philosophy and other more speculative ways of studying the world.

Positivism is, in some sense, a more moderate position.[2] Its proponents do not hold that scientists study things the way they really are. Rather, the purpose of science is to help scientists formulate a coherent view, or model, of the world. From this position, scientists gain confidence about certain regularities on the basis of experiments, then they formulate laws and constructs that they use to explain those regularities. For example, we might consider scientific work dealing with gravity. Realists would suggest that gravity is a reality and that we see it at work as we observe gravitational phenomena. Positivists, on the other hand, would claim that gravity is a useful construct for explaining why things move and fall as they do. They would not necessarily claim to be observing gravity, or

even that gravity exists as described. They would claim only that the concept of gravity helps us explain the world in a coherent fashion.

Two things are important to note as we compare these two positions. First, it seems very difficult for positivists not to take the next conceptual step and begin to believe that the constructs formulated to explain the regularities of the world (e.g., gravity) are in some sense real. There is rarely any constraining influence within science itself to prevent this. Especially when scientific advance leads to real technological advance, it is difficult to keep reminding ourselves, "This is only a construct." We are tempted instead to think, "If it works, it must be real." What this means is that positivist positions often shade into realist positions, especially among scientists who care more about their work than about philosophical questions.

The second point to be noted is that both realists and positivists put great emphasis on observation. The subject matter of science is what is observable, and what is observed is the court of final appeal for establishing the truth or validity of any conception of the world. Proponents of the two positions emphasize the observable for slightly different reasons. Realists emphasize what is observable because they are interested in dealing with what is real, and what is real ought to have some observable manifestation. For positivists, it is important to deal with the observable because all constructs used to explain the world ought to be tied directly and rather tightly to what can be observed. There is no value in claiming that a construct is important or useful in explaining the world if it cannot be shown that there is some observable phenomenon for the construct to explain. For example, why talk about gravity at all if there is not some observable phenomenon, such as things falling down, that gravity is supposed to explain? For our purposes, it is important to note that both the realist and positivist consider the subject matter of science to be what is observable. Both approaches are thus wedded ultimately to empiricism as their epistemology (see Chapter 3).

As the behavioral sciences developed as sciences in the latter part of the 19th and early 20th centuries, the dominant view of science was positivism. During this period a particular brand of positivism, ***logical positivism***, was very influential in Europe as well as the United States. Later on, the work of Carl Hempel (1965) came to be very influential. The view of science that he set down has come to be the one that for the most part, behavioral scientists still recognize as the foundation of their scientific approach. We will not go into detail about Hempel's philosophy of science; however, certain aspects of his approach should be mentioned.[3] Hempel held that the purpose of science was the formulation of general or universal *covering laws*. These are laws that explain a wide range of phenomena over a wide range of conditions. Part of the formulation of the laws was the specification of *limiting conditions* under which the laws apply. Experimentation in which control is exercised over the observational conditions is the best way to specify and refine the limiting conditions.

As this project is undertaken in the behavioral sciences, the purpose is to uncover fundamental causal laws of human behavior that apply very broadly, if not universally. As these laws are "discovered,"[4] through careful experimental study, we can specify the conditions under which they will apply, and isolate and identify the variables that affect whether the law applies. Once the laws are sufficiently known and refined that all the relevant variables and conditions can be taken into account, we are able to use the laws to our advantage. Through manipulation of the relevant variables, we can control and predict behavior in the real world as well as in the laboratory.

This positivist approach by Hempel has been challenged in recent years by a number of philosophers of science. Perhaps the best-known alternative position concerns the second general framework for discussing science, that of Thomas Kuhn (1970).[5] This framework is sometimes referred to as the *Weltanschauung* approach (e.g., Leahey, 1992), using the German word that can be translated as "worldview." This way of understanding science suggests that it is not as objective and free from cultural influences as realists and positivists have thought. The view of the world that each scientist has and shares with other scientists (and nonscientists) influences the way science is done. This worldview (in Kuhn's terms, a *paradigm*) leads scientists to think about their science in the way they do, even though they usually do not recognize their view as a worldview. The way they formulate their questions, the methods they believe to be appropriate, and the sorts of explanations they hold to be acceptable are all influenced by the worldview in which they live, as shared by a "culture" of scientists and the larger culture.

This Weltanschauung view of science is a direct challenge to positivism. If scientists cannot escape their own paradigms, culture, and history, then they cannot claim to be about the business of discovering anything universal. All scientific knowledge will emerge from, and thus apply only within, the

culturally derived paradigm that led scientists to think about the problem in that way in the first place. This argument is important, because it calls into question not only the possibility of doing what positivists suggest science ought to be doing—getting at universal laws—but also all the characteristics and qualities that have traditionally been attributed to science (objectivity, determinism, certainty, etc.). This issue might well cause behavioral scientists to carefully consider their commitment to science, at least as it has developed in the behavioral sciences.

In the behavioral sciences, however, study of the philosophy of science has not typically been emphasized as an integral part of the curricula. As a result, behavioral scientists have largely adopted science as they perceived it to be, without sustained reflection about whether what they perceived about science was true or appropriate for their subject matter. Sigmund Koch (1959), for example, observed that psychology developed during the period of history (the late 19th century) when logical positivism was the dominant force in the natural sciences, and so researchers in psychology and other behavioral sciences adopted that view. Over time, however, natural scientists became dissatisfied with logical positivism and abandoned it. The behavioral scientists, on the other hand, were not so inclined. Koch (1959) also observed that in psychology, unlike the natural sciences, researchers settled on methods before they developed their questions—that is, they did not decide psychology was a science because they were faced with questions that seemed to require a scientific method to answer. Rather, psychologists seem to have first made the decision to use scientific methods and then framed their disciplinary questions according to what could be studied using that method. It seems clear that many other behavioral sciences can be similarly characterized.

Even a cursory survey of texts and other scholarly work suggests that behavioral scientists have adopted science in a fairly eclectic form, without careful consideration of its virtues, limits, or philosophical implications. Critical discussions of these issues are rare in both text and classroom. Behavioral scientists have been mostly positivistic, but with leanings and propensities toward realism. They have acknowledged the work of Kuhn, but this has not seriously detracted from a basic commitment to the formulation of general laws of human behavior. What seems to have been constant throughout the formative years of the behavioral sciences is a commitment to *method* as the essence of science and the distinguishing feature that would make the behavioral sciences real sciences. Thus, behavioral scientists have approached their subject matter—human beings—convinced of the importance of objectivity and scientific certainty, and intent on uncovering general or universal causal laws, formulating deterministic and mechanistic explanations of behavior, and trying to develop technological solutions to human problems.

It is important to consider whether human beings are really the sort of entities best described by mechanism, determinism, and efficient causality. If they are, then the traditional methods of science may be the most appropriate methods to employ. If they are not, then the cost of traditional scientific methods may be the use of a mechanical explanation without any real grounds for or awareness of this use. It is important to emphasize that the question of whether human beings are indeed natural objects amenable to study by traditional scientific methods is not itself a question that can be solved by scientific method. Scientific method itself is based on certain assumptions about the nature of the thing it studies. We have more to say about this point later. For now we simply suggest that we ought to examine traditional science, its assumptions and implications.

EXAMINATION OF SCIENCE AND THE POSSIBILITY OF BEHAVIORAL SCIENCE

The Truth/Method Question

One of the main reasons science is so attractive is that it seems to hold the promise of truth. At least science appears to be a more trustworthy way of testing the truth of our ideas than others ways that have been developed. However, this perception of science is based on an assumption. The assumption is that truth will be found by applying some method to answer the question at hand. In other words, one of the foundations for our faith in science is the idea that truth results from the proper application of some method. The trick to finding truth, then, is to find the proper method and apply it correctly. Science is often taken to be that method.

One of the reasons this idea appeals to us is that it suggests that truth is available to anyone who follows the proper procedures. If this is so, science can serve as a defense against truth claims based on power, authority, tradition, or intellectual abilities. In this sense, science is a very egalitarian institution; anyone with training can use it. Moreover, behavioral scientists have prided themselves on their egalitarian approach to human problems, often challenging traditions and authority of all kinds.

There is, however, a conceptual problem that must be confronted before we accept the idea that truth results from the proper application of method. This problem comes from the fact that all methods for accruing knowledge in the scholarly disciplines, including science, were developed by human beings as they confronted the problems and questions in their world. We might consider the development of tools as a useful analogy. It seems reasonable to suggest—and a good deal of history supports the notion—that human beings developed tools in order to accomplish particular purposes. They designed the tools they needed to accomplish what they wanted to do, given their understanding of the world. For example, hammers are designed the way they are because of our understanding of hammering tasks. We make hammers the way we do because of what we want to do with them and because of our understanding of what we have to work with. We develop the tools we need to build the sort of house we want, rather than build only the sort of house that can be built with the tools available.

A similar point can be made in the development of science. Scientific method was developed the way it was because it seemed like a good way to go about understanding and explaining—getting at the truth of the world. Science was conceived and made the way it was because the people who developed it assumed that truth and the nature of the world were such that science, as they conceived it, would be a good way to get at truth and the world. In other words, *prior* to the formulation of any method of study, such as science, people already have an idea of what truth is (what the world is like). Method is then designed as the best way to get at that truth.

The hermeneutic philosopher Hans Georg Gadamer (1982) argues a similar point. Prior to the application, or even the development of any method, there is always an operative understanding of truth. It is this (pre)understanding of truth that makes it possible to frame any method at all. Without this understanding we could not formulate any method because we would not know what the method should be like—or that we even need a method. This means that understandings of truth produce methods, rather than methods producing truth. If this is the case, then we cannot be confident that properly and carefully applying scientific methods to the study of human behavior will get us to the truth. Rather, scientific method can only give us a picture of human behavior that reflects the assumptions about human behavior that we held in earlier centuries as we developed scientific methods.

One obvious conclusion to be drawn from this is that many important questions about human behavior can only be solved by careful theoretical work, not by the application of method. Methods, including the scientific method, are only devices we use to convince ourselves and others that our ideas are in some sense sound. They do not establish the truth of the matter. They only help us establish whether our observations are consistent with what we already take to be the truth of the matter.

A related conclusion is that all methods, including scientific methods, can only find the sorts of things they are "tuned" for. To illustrate, consider that a piece of scientific equipment (such as a thermometer) can only measure what it was made to measure (temperature); it is not capable of sensing other qualities (such as air pressure). Likewise scientific methods in the behavioral sciences are only good for certain functions. If what is being looked for is not what is most true and important about a subject matter, then the results deriving from the methods will not reflect what is most true and important. In the behavioral sciences, if our methods are not "tuned" for human beings, then the method can miss what is true and important about human beings. In this way, methods can act as blinders as much as they can reveal something important to us.

The Persuasive Power of Scientific Studies

In evaluating the commitment of the behavioral sciences to traditional scientific methods, it is important to understand how science has come to command such respect. The obvious answer is that science is persuasive. We are persuaded through scientific experiments that their results are trustworthy and accurate. The next question, of course, is why it is that scientific experiments are persuasive. When we look at the issue carefully, it seems clear that scientific experiments are persuasive because they follow the form and structure of a logical argument. The persuasive power of science, in this sense, is simply the persuasive power of logic.

The relation between science and logic can be traced to Aristotle, who invented formal logic as a way of doing science. It seemed to him (and does to most 20th-century thinkers as well) that following logical procedures is our best guarantee against unwarranted conclusions and errors in thinking. The form of logical argument that Aristotle developed was the *syllogism.* A syllogism consists of three statements that together make up an argument. The first statement is the ***major premise.*** This statement is a very general (categorical) statement that must be accepted as primary and true if the rest of the argument is going to be valid. An example of a major premise is the statement, "All men are mortal." The second statement of a syllogism is the ***minor premise,*** which is a more particular statement (also categorical) about some element contained in the major premise. A minor premise related to our major premise is, "Socrates is a man." The third statement in the argument is the ***conclusion.*** The conclusion is the logical consequence of the relation between the major and minor premises (and the category relations they express). In this case, our conclusion is, "Therefore, Socrates is mortal."

Putting the argument together we have:

Major Premise: All men are mortal.
Minor Premise: Socrates is a man.
Conclusion: Therefore, Socrates is mortal.

The question arises, however: Why are we persuaded by these statements to arrive at the conclusion that Socrates is mortal? An immediate response is that we are persuaded that the conclusion is true because it is *logical.* That answer leaves us with another question: Why are we persuaded by *logic?* To point out that a conclusion is logical is simply to beg the question. At this point, some behavioral scientists might be inclined to suggest that logic is some sort of universal category or structure to which the things of the mind and the world must conform. They might add that the human mind is capable of "seeing" logic and thus conforming to it in knowledge and understanding. This is an important part of many rationalist positions, as articulated in Chapter 3.

However, there is another explanation for the persuasiveness of logical arguments. This explanation holds that logical arguments are based on rules of language that people who use the language understand and agree to abide by. This agreement is rarely something we, as language users, are explicitly aware of. The rules of language are most often understood without explicit awareness. They are just part of knowing how to use language to make sense of things. For example, in the syllogism above, we are compelled to conclude that Socrates is mortal because we all know and accept the meaning of the words in the major and minor premises. We agree on what the word *all* means, and what the word *is* means, and how nouns like *men* and *mortal* and *Socrates* function in the language to specify categories of things. In other words, we agree that *if* all men are mortal, and *if* Socrates is a man, *then* Socrates is mortal, because that's what the sentences of the major and minor premises mean to all people who speak the language in which the syllogism is expressed. Most reasonable people have implicitly agreed to abide by these rules of language (and thus the rules of logic).

The point is that logic is persuasive because of the language rules, not because of the universal logical structure of things to which all our knowledge must conform.[6] There is some support for the language position in the fact that formal logic has not developed in all cultures in the way that it has in Western cultures. Certainly, people in other cultures do not have the same confidence in logic that we have. Also, they do not seem to think the way we do in the way they formulate questions and answers.

This point about the persuasive power of logic is important for our discussion of science, because a scientific experiment is essentially a logical argument. An experiment is set up much like a logical argument of the form "If _____, then _____." Essentially, the researcher says, "*If* I measure these certain variables in this way, and *if* I control for those other variables in that way, and *if* I make observations under these specified conditions, *then* I will observe that particular result." Further, the scientific community—all those who read the research and understand it—evaluates experimentation according to a similar logical form. There is an implicit agreement between the community and the researcher that says in essence, "*If* you measure those variables in those acceptable ways, and *if* you control for those other variables, and *if* you make your observations under those specified conditions, *then* we will accept your results as valid and true." All the conditions of measurement, control, and observation specified in the "if" parts of the argument (the antecedent) are those conditions that a "good" experiment ought to include. This logical form, then, is the reason that an experiment is persuasive to the community. It follows the logical argument very carefully, and it contains within it all the elements of the argument that people familiar with the subject might sensibly think are influential to the outcome.

For our analysis of science here, the important thing to note is that a scientific experiment is not persuasive because it possesses some hidden power to reach the truth despite all obstacles. Instead, it is persuasive because it constitutes a logical argument that rational people intuitively recognize and generally find persuasive. Remember that the persuasive power of logic is based simply on agreements about how language is and should be used. We can also see that science is not really an alternative to reason, or rational analysis, as some have suggested. It is a type of rational analysis. What scientists do in the laboratory and what theorists do is essentially the same thing—logical analysis. That empirical scientists deal in observations may seem like an advantage, and indeed, observation is often persuasive. Still, its persuasive power ultimately rests on the rational, logical analysis that frames our expectancies and our understanding of what we observe. Without a rational organization or analysis, observations completely lose their authority and cogency.

The final point to keep in mind, then, is that science is essentially a "language game" (Wittgenstein, 1953). By this we do not mean to imply that it is a game in the trivial sense of the term. Language games, in the sense we (and Wittgenstein) intend, are very serious. They are the means whereby we make sense of the world, decide what is real and good, and understand ourselves. Our point here is that science may not deserve the status of the *only* method for understanding and explaining the world. This may be especially true in the behavioral sciences, in which there are no unchallengeable technological accomplishments. Unlike natural scientists, behavioral scientists cannot appeal to this technology as evidence that scientific method deserves the status of the only method.

The Possibility of Verification

Many people assume that by using empirical methods scientists prove their theories or hypotheses to be true. As we have just shown, the power of scientists to persuade is based on their using the logical form, "If _____, then _____." We now look more closely at whether it might be possible to prove something using this logical form. We can convert the syllogism we used above into the if-then form:

If Socrates is a man, then he is mortal.

Note that we still have to assume that the major premise (that all men are mortal) is true or the argument cannot proceed. The part of the statement following "if" is referred to as the *antecedent,* and the part following "then" is the *consequent.* To proceed with the argument and reach the logical conclusion, the next step is to *affirm,* or demonstrate in some way, that the antecedent is true. In other words, we need to demonstrate that, indeed:

Socrates is a man.

If this is demonstrated and accepted, then we can conclude that the consequent follows, and in fact:

He is mortal.

One of the classic logical fallacies that is exposed in all introductory logic courses is called *affirming the consequent.* This happens when instead of affirming that the antecedent of the argument is true and concluding that the consequent follows, we affirm that the consequent is true and conclude that the antecedent must therefore be true as well. For example:

If Socrates is a man, then he is mortal.
Socrates is mortal. (Affirming the consequent)
Therefore he is a man. (Concluding the antecedent is true)

This is obviously not a good argument, because showing that Socrates is mortal does not necessarily show he is a man. He could be a dog or a bush or any other mortal thing.

When we look at an empirical experiment as this sort of logical argument, an important problem arises. Classically, the experiment is framed like this:

If the hypothesis is true, then X will be observed.

That the hypothesis is true is the antecedent, and the observation of X (some empirical result) is the consequent. When the study is actually conducted, the result is that:

X is observed. (Affirming the consequent)

and we might try to conclude:

Therefore, the hypothesis is true.

This procedure is a classic example of affirming the consequent of an if-then argument. What it means is that the very way empirical studies are set up can always and only demonstrate the consequent. Thus, it is impossible—by the rules of logic implicit in the experiment itself—to prove any hypothesis true.

That experimentation cannot prove anything true has been known for a long time.[7] Nevertheless, the full implications have not been completely examined in the curriculum of the behavioral sciences. One of those implications is that there are, in principle, an unlimited number of possible explanations for any experimental result. Our knowledge that Socrates is a mortal (through affirming the consequent in our previous example) allows us to interpret this mortality in unlimited ways; Socrates could be a bush, a man, a dog, and so forth. Likewise, the data of an experiment can be interpreted in many different ways, no one of which can be shown necessarily to be true by empirical scientific test. This means, of course, that in addition to data not *proving* a hypothesis, data cannot "tell" or "indicate" to the researcher which of the many interpretations is correct. The common notion that data "tell" scientists things or "give information" is misleading or true only in a very restricted sense. Many behavioral scientists recognize these problems, but the problems are seldom taught in textbooks and classes on research methods, and they seldom enter into discussions of the limitations of science as a method. Furthermore, the situation is not well understood by lay people, who continue to give much credibility to scientific study because of the popular notion that scientific data can prove things or indicate truth.

The Possibility of Falsification

Among philosophers of science the problem of affirming the consequent has been recognized for some time. This recognition, in part, led some (e.g., Popper, 1959) to suggest that although scientists cannot validate their theories or hypotheses, a very real power lies in the fact that they can *falsify* them. In other words, even if we can't prove true things to be true using science, we can prove false things false. Then, by implication, if we rule out all the false theories and hypotheses, we arrive at the truth by process of elimination. This strategy of falsifying hypotheses is valid according to the rules of logic, involving a form of argument known as ***negating*** (or ***denying***) ***the consequent***. It takes the following form:

> If the hypothesis is true, then X will be observed.
> X was not observed. (Negating the consequent)
> Therefore, the hypothesis is not true. (The antecedent is false)

Although the logic of falsification is valid, there remains a serious difficulty when it comes to actually falsifying a theory or hypothesis in practice. For example, we might frame a theoretical argument this way:

> If symbolic interactionism is true, then people's self-perceptions will be affected by others' evaluations of them.

Assume next that we were to study one particular subject and find no evidence for a change in self-perception, even after she heard evaluations by others. According to the logic of falsification, we should publish our results because they falsify the theory of symbolic interactionism. The falsifying logic would flow like this:

> This person is unaffected by others' evaluations. (Negating the consequent)
> Therefore, symbolic interactionism is not true. (The antecedent is false)

The problem, of course, is that scholars (mostly symbolic interactionists) have several explanations for our results: We just used a peculiar person, the evaluation was not proper or strong enough, we need more than one person and a larger number of evaluations, or we did the study wrong (in any number of ways). In other words, the strategy of falsification will not work unless we are sure that our test or experiment is the *crucial test* of the theory or hypothesis. No experiment will be a crucial test unless all possible variables (or limiting conditions) have been controlled or taken into account. There must be no other possible explanation for the failure of the experiment except the falsity of the hypothesis. This degree of control is, of course, impossible—practically and in principle. There are, in principle, an infinite number of things to be controlled in order to

falsify any theory or hypothesis.[8] Not all of them can be controlled, if only because there is no control over the particular point on the space-time continuum where any study is conducted—that is, each study is conducted at a particular place and time. Consequently, the effects of that ***particular*** context can never be controlled experimentally.

One conclusion to draw from this analysis is that the methods of empirical science cannot falsify theories or hypotheses. This point also has been well recognized among philosophers of science (e.g., Lakatos, 1970), but again its implications are not well developed in the literature and training of behavioral scientists. Some who do understand the impossibility of falsification suggest that although no one study suffices to falsify a theory or hypothesis, if we keep conducting studies over time, we can achieve an overall falsification. This strategy does seem to be useful for replicating our experiments, controlling for different influences each time. However, the argument against falsification is an argument ***in principle***—the problem is not that we cannot do enough experiments fast enough or well enough to falsify, it is that in principle we cannot exercise sufficient control to falsify a theory or hypothesis. Because each study adds a new and unique combination of variables, measurements, and controls to the discussion, conducting more studies increases the complexity of the context of falsification, making falsification less, rather than more, likely. Whatever scientific methods may be good for, they cannot be used to ***verify*** theories, in the sense of affirming the consequent, or ***falsify*** theories, in the sense of negating the consequent. In other words, we cannot through scientific methods discover whether theories and hypotheses are true or false.

The Problem of Establishing Causality

The impossibility of establishing a crucial test (as shown above) casts some doubt on whether scientists can be confident about establishing cause-and-effect relationships among variables (as also discussed in Chapter 4 on Hume). It is widely assumed that one of the hallmarks of science, including behavioral science, is that it uniquely uncovers causal relationships in the world. As a result, behavioral scientists commonly distinguish between ***experimental designs*** and ***correlational designs*** as research strategies. The distinction is almost always introduced by noting that correlational designs do not allow scientists to establish causal relationships, but experimental designs do. What really distinguishes correlational from experimental research strategies is the amount of control the experimenter exercises over variables that might influence the variable under study. In a correlational design, it is common to exercise very little control. The researcher simply observes how two variables seem to be related. Let us consider a simple research question as an example. Suppose we are interested in the relationship between hunger and motivation. We might get together a group of people and observe how long they had gone without eating (hunger) and how motivated they are (with some test of motivation or some measure of performance on some task).

In experimental research, one variable is designated the ***independent variable***—the one we expect to produce some observed effect. In our example this would be hunger. The other variable is designated the ***dependent variable***—the one we observe to see the effects of the independent variable. In our example this would be motivation. To be confident that what we observed in the dependent variable (how motivated our people were) was *caused by* the independent variable (how hungry they were), we would have to control absolutely everything else that might possibly have an effect on the dependent variable (their level of motivation) *except* the independent variable (how hungry they were). It seems unreasonable to suppose that we could know about, and eliminate from the lives of our subjects, everything that might possibly motivate them. As we discussed above, this degree of control is not only unreasonable, but in principle, impossible. For this reason, it is in principle impossible for an experiment to establish or verify that a cause-and-effect relationship exists between any two variables in a study, as Hume noted long ago.

A researcher might well admit that it is *conceptually* impossible to prove by means of scientific experiments that one variable causes another, but still point out that every time the independent variable is present a particular effect is observed in the dependent variable. In other words, this researcher might argue that if we can make something happen, we are getting at the cause of it.[9] However, to claim that we know what caused an experimental result based simply on the fact that it happens whenever the independent variable is present, commits the logical fallacy of affirming the consequent again:

If X is the cause of Y, then whenever X is present, Y occurs.
Whenever X is present, Y occurs.
Therefore, X is the cause of Y.

Again, just because the independent variable and dependent variable always seem to occur together (i.e., are correlated) does not mean that some other, as yet unidentified, variable could not always be present as the real cause.

The Problem of Operationalization

A hallmark of traditional scientific method is observation. To perform a scientific test, we must be able to observe the phenomenon we are trying to study. This is not always an easy or straightforward thing to do, even in the natural sciences. For example, a clearly scientific construct like gravity is never observed directly. We can observe what we take to be the effects of gravity, but not gravity itself.[10] When the construct under scientific scrutiny is one that cannot be observed directly (e.g., gravity), the scientist must observe something else that he or she can assume represents the construct or results from the construct (e.g., the fact that an object falls). This process of letting something we can observe represent something we cannot observe is called ***operationalizing***. When we let the falling of an object represent gravity, our observation of the object's falling is called an ***operational definition***. An operational definition is a translation of some theoretical construct into observable or measurable terms.[11]

Many things behavioral scientists study cannot be observed directly. In fact, most of what is important and human about us is unobservable. In the previous section, we used the example of a simple study looking at the relationship between hunger and motivation. Neither hunger nor motivation can be directly observed. We suggested that we might be able to get some measurement (observation) of how long it had been since our subjects had eaten. Thus "hours of food deprivation" was our operational definition of hunger. For motivation, we suggested we might be able to observe or measure how well our subjects performed some task, or we might ask them to fill out a questionnaire about their level of motivation. These would both be operational definitions of motivation. However, we have no direct access either to motivation or to hunger.

The process of operationalizing always keeps the scientist one step removed from what he or she really wants to study. If we were to do our simple study on hunger and motivation, we would presumably know something about the relationship between hours of food deprivation and responses to a questionnaire, but we would not *necessarily* know anything about the relationship between hunger and motivation—which is really what we wanted to know about. The reason for this is that knowing how long it has been since a person ate is not necessarily knowing how hungry the person is. Hours of food deprivation is *not* hunger. By the same token, the way a person answers a questionnaire is *not* motivation. Just how well the operational definitions represent the constructs under study is always open to question, and it is the most basic factor affecting the quality of the knowledge that can be gained by scientific investigation.[12]

In the natural sciences, researchers are not too concerned about the problem of operationalization. If we were to challenge a physicist on this point, he or she may very well admit to not *really* getting at constructs like "gravity," "force," or "mass." However, he or she might be quick to point out that bridges stay up and airplanes fly all the same. The point is that, again, a presumably impressive technology validates natural sciences. Also, most nonscientists are not equipped with alternative explanations of why planes fly and bridges stay up. If technology is the major purpose of scientific investigation, these questions about operationalizing and the accuracy of construct representation matter little.

In the behavioral sciences, however, the situation is somewhat different. First, of course, the behavioral sciences do not have an impressive technology, at least in comparison with the natural sciences. Second, there is an extra difficulty in trying to capture human phenomena with operational definitions. We might ask, for example, what operational definition is going to adequately represent "love," "altruism," or "agency." Third, even though most of us do not have an alternative explanation for why objects fall, most of us can and do have alternative explanations for why people behave as they do. (Recall the many explanations of a friend's rude behavior at the beginning of this book.) Although few people are in a position to provide insight into the nature and workings of gravity, most are arguably in a position to give valuable insight into the nature and workings of human beings. Behavior is something with which they have a good deal of experience. Insight from the people who are actually behaving should be seriously considered.

Before closing our discussion of operationalization we might ask whether the purpose of science really is technological application. This is a particularly important question for the behavioral sciences. Technology in the natural sciences amounts to power over the entities studied as a result of manipulation. In the behavioral sciences, however, it is open to debate

whether people can in fact be manipulated by behavioral technology. There is wisdom in taking great care about how and why we would ever pursue such a project. There is also a good argument that the first and most important goal of science is not manipulation or control, but understanding. If this is true, then the problem of operationalization—the fact that we are always one step removed from what we want to study—is of great concern for the behavioral sciences.

The Problem of Objectivity

Although observation is a hallmark of scientific method, it must be the case that the observation is performed objectively. Objectivity, as we discussed above, is an essential part of scientists' claim to credibility. By objectivity we mean that scientists make observations in such a way that they do not distort or misread what they observe as a result of tradition, values, emotions, or other subjective influences. Objectivity calls for the scientist to achieve some grounds from which to observe that are independent of, or shielded from, all subjective influences. These "grounds," of course, are not spatial, a place where a particular scientist might literally stand. Rather, the grounds are conceptual, a mind-set in which the scientist can avoid subjectivity. Because subjective influences—values, emotions—are essential to the very identity of the scientist as a person, and because our history, culture, and so forth are often held implicitly rather than explicitly, it seems unlikely that we would ever achieve this kind objective grounds from which to observe anything, including experimental results. This is one of the major implications of Thomas Kuhn's (1970) work, as discussed earlier.

Someone might argue that it is possible for a scientist to achieve some sort of objectivity in the laboratory—perhaps by using a machine instead of a person to register the observations. However, once the data of the experiment are gathered by the machine, the scientist still needs to examine the data and make sense of what the machine recorded. At this point, the objectivity of the scientist again becomes an issue. More subtly, the subjective understandings, assumptions, and expectations of scientists come into play because they must decide how to make the machine make the observations, what it will be sensitive to, and how it will recognize what to record. Furthermore, scientists decide what to study, how to understand what is being studied, how to measure it, what to control for, and what not to control. The very definitions and framing of a research question are shot through with traditions, history, expectations, values, and other subjective factors. It seems unlikely that at any stage the research process is objective.

We should note, however, that it is questionable whether this kind of objectivity is necessary for the work of science to continue. Science, if we mean simply what scientists do, can be (and is being) done without this sort of objectivity. All that is required is that scientists be open to alternative explanations, be honest, and reserve judgment about what is "actually" going on. Hypotheses can still be submitted to empirical test. There is no reason to assume that technological advance will be slowed. It is only when we expect science to be capable of making truth claims that objectivity seems to be so important.

What is important for the purposes of this book is that the characteristics of science, as they are often held up for the behavioral sciences to emulate, are fully exposed for thoughtful examination. Natural science methods may not be capable of serving the validational function that many behavioral scientists desire. The best that science can offer may be *one* way of viewing human behavior, without any special warrant for claiming that it is the only or even the best way. If this is the case, then whether the behavioral sciences can or should be sciences, and just what it might mean to claim that they are sciences, remain open to question.

ALTERNATIVE VIEWS OF THE NATURE AND ROLE OF SCIENCE IN THE BEHAVIORAL SCIENCES

In this chapter, we have illustrated some of the conceptual questions regarding the nature of science and scientific knowledge. There are grounds for questioning the claim that any method, such as science, is capable of revealing truth. All the issues discussed here provide reasons for reexamining our view of the nature of science and its role in understanding and explaining human behavior.

If science cannot enable us to definitively settle theoretical questions and establish truth with certainty, the question arises, What can we accomplish with science as a method for studying human behavior? In exploring this question, an insight articulated in some postmodern theoretical positions might be helpful: Science might best be understood as a language with which or through which people try to understand the world. All languages have rules that determine what are acceptable sentences and how utterances are to be understood. Similarly, scientific rules tell us which experiments are acceptable and how one interprets the results. It is also the case, however, that like any language, the language of science is full of ambiguity. Scientists' procedures and explanations are influenced by their culture, history, and subjective factors. Just as no one would claim that English is the only, or even the best, language through which to understand the world, no such claim need be made for science.

This view suggests that every language opens the world to us[13] and helps us understand it in a particular way, from a particular perspective. The same is true of science. However, as every language opens the world to us in some ways, it closes it down in other ways. Just as everything cannot be said in a single language, everything cannot be understood and explained through a single method—science. In fact, many in the postmodern tradition have noted that the language of science, when applied to the study of human beings, is a relatively impoverished language. Using traditional scientific investigations, we force ourselves to study human beings from a distance. We measure them instead of talking to them; we ask them to fill out questionnaires from which we extract numbers as our data. Postmodern theorists remind us that the language of numbers is not the native language in which we experience or understand the world. Nowhere is this evidenced more clearly than when scientists interpret their findings to the community. Scientists quickly leave the language of numbers in order to communicate with colleagues.

Given all of this, some benefits still may accrue from applying traditional scientific methods to the study of human behavior. First, it might be possible to learn something new and unexpected by forcing ourselves and our subjects to think about the world in a strange language—one we are not as familiar with—such as the language of numbers. We may notice something we might otherwise overlook. This has certainly happened in the natural sciences—mathematics has helped guide new discoveries. Although this view does not eliminate all the problems that may come from studying people with empirical scientific methods, benefits could ensue.

Second, whatever else we may say about traditional scientific methods, we need to acknowledge that they force behavioral scientists to be public, careful, and systematic in their work. Traditional methods force us to check whether our theories and hypotheses can be shown to have any demonstrable consequences or effects in the world we live in. Even if the methods of demonstrating such an effect are flawed and not capable of verifying or falsifying, they do enable us to see whether we can relate our thoughts and theories to what we can observe among real people.

As a means of demonstrating, then, the methods of traditional empirical science may be useful. But it must be kept in mind that every demonstration is only one demonstration among many demonstrations that might be made. No one demonstration, or even a set of demonstrations, can verify, falsify, or establish the "truth of the matter" or "the way things are." Demonstrations are, moreover, seductive. If we can demonstrate something we believe, we tend to think there must be something true about the way we are thinking.[14] Someone who defends or advocates science on pragmatic grounds—based on claims that "it works"—must constantly defend against this tendency to confuse what can be demonstrated with what is true, real, or important. The fact that an experiment comes out as predicted is not evidence that it does so for any of the reasons arising from the use of any particular theory.

Empirical science also has a part to play in understanding the human world. There are some genuinely empirical questions in the human world. Such genuinely empirical questions can profitably be investigated by the methods of empirical science. A genuinely empirical question would be one that pertains entirely to things that can be observed, measured, or counted with insignificant distortion or interpretation. For example, if we want to know the average height of adult females in a given place, the sensible thing would be to measure them. If we want to know how much a particular brain cell fires while a person is doing some sort of cognitive task, it would be a good idea to put an electrode near the neuron, get the person to perform the task, and record the firing pattern. Finally, if our interest is whether people tend to buy one brand of breakfast cereal over another, it makes sense to watch them and count how many of each they buy.

We should note, however, that the foregoing examples are, in some sense, fairly mundane questions. There is little theoretical or philosophical meaning attached to a genuinely empirical question. It is debatable whether the important questions of a human being can be satisfactorily framed

in a genuinely empirical language. We doubt that they can. To investigate such questions in the behavioral sciences we believe it is necessary to think again about the role of methods in general and the role of scientific methods in particular.

If we are to understand science, we must deal with a fundamental issue—the relation between truth and method. The tradition out of which the behavioral sciences developed includes the assumption that truth can be found through the application of method. The analysis we have made in this chapter, and much work in contemporary philosophy, suggests the reverse—that prior to any method is an assumptive understanding of what is true. Taking this latter position implies that behavioral scientists have no alternative but to be constantly and perpetually involved in the difficult analytical work of theorizing, investigating the preunderstanding from which all methods arise.[15] Science will never put "philosophical" questions to rest, because science rests on philosophical assumptions. In short, scholars in all disciplines, including the behavioral sciences, must take on the question of truth directly. On such questions, empirical science must speak through theory.

On questions of method, and the scientific status of the behavioral sciences, the theories we have analyzed throughout the book represent various positions. Eclectic and structuralist researchers have varied so much in their strategies and commitments to science that little can be said regarding the matter. Psychodynamic theorists have traditionally not been too concerned with doing scientific research, or even with the question of whether it is a good method to employ. Psychodynamic theory was built largely on individual case studies and rational and historical analysis. Among other behavioral scientists, psychodynamic theory is often criticized and marginalized for its lack of scientific rigor.

Humanistic theory has largely shared the same fate, for the same reasons. The most rigorous attempts to bring traditional scientific methods to bear on these perspectives have come from therapists and educators interested in scientifically assessing the effectiveness of strategies derived from the perspectives. Such attempts have met with mixed reviews. Of the traditional perspectives available in the behavioral sciences, behavioristic and cognitive theories have been the most actively and explicitly scientific. That behavioral scientists in general seem to share this zeal for traditional science is testimony to how influential these perspectives have been.

Alternative Views of the Role of Method in Behavioral Science

In recent years, alternative views of the role of method in the behavioral sciences have emerged. Some take issue with more traditional views of what science is and whether a *science* of human behavior is possible. We review three such perspectives. Proponents of the position exemplified in the work of Joseph Rychlak (1988, 1994) recognize most of the limitations of traditional scientific method as discussed in this chapter. Nevertheless, they recommend that behavioral scientists not abandon traditional empirical methods. Rychlak considers such methods to be essential if there is to be any behavioral science.

The importance of empirical validation is that in essence it requires the behavioral scientist to "put up or shut up." Theories should be submitted to rigorous tests. One type of test of a theory is analytical, based on reason and argument. The theory must be demonstrated to be internally consistent and coherent, and it must be able to explain or subsume an acceptably wide range of phenomena. However, in addition to this "coherence" test, a theory should be able to stand up to a test of empirical validation. Even though such tests always require operationalization, and thus never really test the theory itself, it is important for the theorist to demonstrate that the constructs of the theory can be represented in ways that relate to actual, observable behavior. Often, designing and executing this type of test demands considerable creativity on the part of the scientist.

According to this position, it is essential that theories and methods are independent of each other. This means that the methods of science can be used to test theories of all types, not only mechanistic and deterministic ones, but theories in which free will is advocated as well. It also means that all types of theories, even ones that advocate agency and thus do not look "scientific," should be considered credible so long as they can pass scientific muster according to traditional methods.

A second alternative position on the question of methods (e.g., Gergen, 1982; Giorgi, 1985; van Manen, 1990) derives mainly from postmodern thought. Proponents of this position argue that theories and methods can never be independent of each other. If we take the theoretical position that human beings are not simply natural objects, not fundamentally like mechanisms, and not determined by laws and forces the way natural objects are, then it is inappropriate to use the methods developed to study

natural objects. Use of methods developed for natural objects will result in imposing this naturalistic theoretical outlook on human beings. Some who hold this perspective argue that adequate study of human beings requires a "human science"—natural objects can be studied by the methods of natural science, but human beings require human science methods.[16] In this view, human scientists accept lived experience (or ready-to-hand engagement, discussed in Chapter 3) as the origin for understanding as well as the object to be understood. Methods of study must be faithful to and grounded in lived experiences. Methods developed for detached (or present-at-hand) study of natural objects will be inadequate.

Many human science methods are grouped under the rubric *qualitative methods*.[17] The thrust of qualitative research methods is to reject the philosophical assumptions of traditional methods. Researchers avoid measurement and quantification, allowing subjects to describe their own behaviors and experiences in the language native to their experience. The analysis of the data is likewise carried out in conversational language rather than with statistics. The qualitative researcher is essentially involved in a project of careful questioning, describing, and interpreting. Many people who subscribe to human science methods argue that qualitative methods are superior to quantitative methods and ought to be the method of choice for all the behavioral sciences.

Because most advocates of qualitative research acknowledge that theories and methods are intimately tied to each other, there is a tendency among behavioral scientists to evolve their own particular methods, faithful to the assumptions and goals of their particular theory. Thus, there seem to be almost as many qualitative methods as there are theories, making it difficult to categorize qualitative methods. One possible organization of the methods groups them into three categories: ethnography, phenomenology, and studies of artifacts.[18]

Ethnography is arguably the best known of the qualitative research traditions. Its roots are in anthropology, where it has become the predominant method of study. It has also become a significant part of research programs in nearly all the behavioral sciences. The distinguishing characteristic of ethnography is an emphasis on careful and detailed observation.[19] This observation is usually carried out by a researcher actively participating in the group or setting that is being studied. The primary objective is a detailed, participative understanding of the group or setting.

Phenomenology has as a primary interest the study of the meaning of concrete human experiences. Its roots are a bit more difficult to trace, but certainly the work of Edmund Husserl and others in the phenomenological tradition in philosophy has been important.[20] To get at the meaning of experiences, phenomenological researchers rely heavily on interviews and other verbal or written accounts of experiences. The researchers then carefully analyze these accounts in order to understand not only the individual, private meaning of the experiences, but also what is general and illuminating in understanding the meaning of human experience in a wider context of people and situations.

The third category of qualitative methods is much smaller than the other two. We have coined the term *studies of artifacts* to describe attempts to study physical objects produced by people and groups. Archeology and physical anthropology are good examples of well-established fields engaged in similar studies. Some behavioral scientists have developed methods to study cartoons, advertisements, built environments (homes, other buildings, and villages), and many other artifacts. The idea is that the artifacts—objects—that people produce and use can tell us much about their lives, what they believe, what they value, and what they understand.[21]

Qualitative research methods are becoming increasingly accepted as a legitimate alternative to traditional empirical methods. They now form an important part of the literature of many behavioral science disciplines, including education (Goetz & LeCompte, 1984), family science (Gilgun, Daly, & Handel, 1992), health care (Crabtree & Miller, 1992), psychology (van Zuuren, Wertz, & Mook, 1987), and organizational (and other kinds of) evaluation (Patton, 1990). The unique understanding these methods provide, and the fact that they are perceived to be more compatible with increasingly popular postmodern theoretical approaches, suggest that they will come to be an increasingly important tool for scholarship in the behavioral sciences.

A third position on the issue of method can be derived from a particular reading of some postmodern perspectives. Its proponents call for methodological pluralism (Faulconer & Williams, 1985, 1990; Polkinghorne, 1983).[22] They hold that the question of method is not the crucially important one for the behavioral sciences. Because all methods are languages through which we attempt to make sense of the world, we ought to make our choice of methods based on the nature of the problem we are investigating. Considerations include how we frame the problem and

the relevant strengths and weaknesses of possible methods. This position makes it all the more important that behavioral scientists are aware of their theoretical assumptions, for their assumptions influence their view of the world and their decision about what method of study seems most appropriate.[23]

All languages (and methods) open a world of understanding in some way, but leave it closed in other ways. None can open all understandings. Therefore, no method we might devise can claim preeminence. From this perspective, the issue of method is less important than how we formulate the questions to which any method may be applied. What is most important for the behavioral sciences, therefore, can only be accomplished by careful, sustained, and sophisticated theoretical work. It is to the end of fostering sophisticated theoretical work that this book has been dedicated.

CONCLUSION

Traditional science has long held a position of respect and prominence in intellectual circles and the broader culture. This position is based on the promise that science is a more trustworthy means of discovering the truth about the world than other methods. The justification for this position is deeply rooted in the history of ideas. Science is seen to have the attributes necessary for testing our ideas about the world in a way that affords some certainty. This is due to the fact that science is based on objective observation, its observations are repeatable and public, it approaches the world mathematically, and its hypotheses and predictions are tested under conditions of control. Also important in understanding the status of science is scientists' record of producing impressive technology, and thus achieving control over the world of nature.

The question of whether the behavioral sciences are really sciences depends on what we understand science to be. If science is taken to be a precise body of knowledge with well-established laws and perfect predictability, the behavioral sciences probably do not qualify. If, however, science is taken to be a method of study common to scientific practice, then the behavioral sciences are probably legitimately scientific.

Although many have held that science is different from and more sure than philosophy, recent work in the philosophy of science makes it clear that science itself is based on theories and assumptions. And because it is based on ideas, it cannot includes tests of its own assumptive basis. Alternative views of science have emerged that suggest that science is a social practice based on paradigms that govern the legitimacy of questions, methods, and explanations. If this is true, then it seems justified to investigate science more closely to see what can and cannot be done with it.

There are lines of argument that suggest that science cannot, as has often been assumed, verify or falsify its own theories and hypotheses. Neither can it support cause-and-effect statements with certainty. Rather, it is argued, science can be understood as a logical argument, resting on language games, and thus a form of rational analysis. Given this view, many in the postmodern tradition have suggested that as science does not uncover truth, but rather requires a preexisting view of truth to proceed, the question of truth is more important than any question of method. Although traditional methods may be important as a means of gaining confidence in ideas, ultimately the work of the behavioral sciences is done at the conceptual, theoretical level.

Notes

1. One of Hume's conditions of causality, constant conjunction, is largely responsible for the importance of repeatability (see Chapter 4). This requirement has been translated into the methods of science because two (or more) events must be observed to be constantly conjoined in order to be a candidate for causal relation.

2. We are using the term *positivism* in a very general sense. Many readers will be most familiar with logical positivism as an important movement of the late 19th and early 20th centuries. Most of what we say about positivism in the broad sense we intend also applies to logical positivism, some with more direct relevance to more recent manifestations of positivism. For purposes of the discussion in this book, we do not believe finer distinctions are necessary.

3. The interested reader is referred to other sources such as Hempel (1965), of course, and discussions in secondary sources, including Bohman (1991) and Robinson (1985, 1995a).

4. It is, of course, a matter of some debate whether the laws behavioral scientists seek are discovered or simply formulated. Putting quotation marks around the word discovered is not an adequate response to that question, but a longer discussion would take us on a detour that we judge not to be helpful at this point. It is hoped that the discussion in the remainder of the chapter sheds some light on this issue.

5. The interested reader is also referred to the writings of Lakatos (1970) and the somewhat more radical works of Feyerabend (1975, 1987).

6. Some scholars, mostly rationalists, argue that there is a difference between the content of a syllogism and the process of conceiving the syllogism or being convinced by it. The former requires language, but they argue, the latter is language independent. We think there is a strong argument that even the process of logical argument is inseparable from the language content and structure in which the process is carried out. However, this argument is beyond the scope of the present discussion.

7. In psychology, one of the first attempts to introduce this argument into the literature was made by Donald K. Adams (1937). The reader is also referred to a fuller treatment of this issue by Joseph F. Rychlak (1981).

8. This may be an overstatement. There may be, in the real world, only a relatively small number of things that have an effect on any particular phenomenon. The problem is that there is no way to know whether this is true, or what the influential things are before the experiment. So, although it may not be the case that there truly are an infinite number of things affecting a phenomenon, it makes some sense to say that a potentially infinite number of things may be influential. The decision as to how many there are, and thus which ones need to be controlled to make a crucial test, cannot be answered by empirical science. We could turn to philosophy, but then it is not a scientific question. Or we could proceed to eliminate things one at a time—but we are faced with a potentially infinite number of experiments.

9. This is essentially an appeal to *pragmatics*. If it works, it must be true. We have more to say about such a pragmatic approach to science later in the chapter, but here we are concerned with pointing out theoretical and philosophical questions about science and whether the behavioral sciences are or should be scientific in the traditional sense. Whether something like science is pragmatically useful does not necessarily have much bearing on the theoretical or philosophical evaluation of what science is or what it can and cannot do. We hope that once we are clear about the conceptual limitations and theoretical issues that are part of science we might understand better what it really means when we see an experiment "work" in the laboratory. What we want to avoid is jumping to premature and naive conclusions about causality, even when our experiments seem to "work."

10. The same is true for other properties of matter (weight, mass, etc.) as well as properties of behavioral science entities such as stimuli, responses, and so forth, as we noted in Chapters 2 and 5.

11. The term *operational definition* is meant to imply also that *operations* are important. When we are representing a construct by something that can be observed, most often it is necessary to perform some operation to make the observation possible. For example, if one were to represent gravity as the force exerted on one body by another, it would be necessary to perform some operation on the bodies so that it would be possible to measure the force. They would have to be put into a situation where the force could operate and measurement could be made.

12. What is at issue here is validity. Many behavioral scientists recognize that the validity of our measures is the most important factor affecting the quality of scientific research.

13. This expression reminds us of the experience of someone born blind or deaf, incapable of language communication. To learn language and have a means of expressing ideas and interacting with others is like an opening of the world. Language provides a frame within which things can be related and understood differently than they were before.

14. It is undoubtedly the case that there *is something* true about what we are thinking if we can make a prediction and accrue empirical support for it. The problem is that what it is that might be true, and just what it means, cannot be revealed in empirical findings.

15. Of course, any way this is done constitutes a sort of method. Scholarly investigation is thus always circular in the sense that understanding informs methods and methods help to inform understanding. This is one manifestation of what is often referred to as the *hermeneutic circle*.

16. The distinction between human sciences and natural sciences has been very influential in continental philosophy since at least the 19th century. Much is entailed in the distinction that we do not have time to develop. We refer the interested reader to Giorgi (1970) and Polkinghorne (1983).

17. The term ***qualitative methods*** is extremely broad. It refers to a number of methods that reflect a significant range of philosophical orientations as well as methodological approaches. Some of those who advocate the use of qualitative methods would not be considered postmodern or would not consider themselves to be. However, much literature in various postmodern perspectives advocates the use of qualitative methods. The reader is referred to the recent *Handbook of Qualitative Research* (Denzin & Lincoln, 1994) for a very good treatment of this diverse and growing field.

18. This is our own categorization, offered only for the purpose of giving the reader some way of organizing the field and perceiving the flavor of the important characteristics of qualitative research.

19. The type of observation that results from ethnographic methods is not intended to meet the standards of objectivity usually associated with traditional scientific methods. It is simply granted that observation is affected by theories, biases, and perspectives of the researcher. Ethnographers attempt, however, to be aware of these influences, acknowledge them, and take a critical stance toward them as part of the research method itself.

20. Some scholars, such as Amadeo Giorgi (1985) use the term *phenomenological* in a strict sense, applying it only to studies faithful to the work, insights, and methods of Husserl. Others use the term more broadly to apply to all attempts to study meaning and experience. We use the term in this broader sense.

21. Outside the fields of archeology and physical anthropology, there is much less literature on this area of qualitative research than on ethnology or phenomenology. The interested reader is referred to a small volume by Ball and Smith (1992) as a beginning source.

22. This methodological pluralism is not to be equated with theoretical eclecticism as described in Chapter 2. We contend that behavioral scientists need coherent theories, and they need constantly to be concerned about the adequacy, coherence, and even the truth of their theories. Eclecticism almost always involves a repudiation of this concern. However, behavioral scientists should employ whatever methods seem to offer the best possibility of learning something important in any given setting. An analogy might help clarify. To build, repair, or service electronic devices, one needs a single, adequate, coherent, and even true theory of electronics. However, one also ought to take advantage of tools built to perform particular relevant functions when one is actually engaged in building or repairing a device.

23. We note here that the behavioral scientists routinely use the term *methodology* to refer to the particular method used in a research study. However, the etymology of the term suggests that methodology is discourse *about* methods—the study, and evaluation of methods and what they can do. In methodology, methods are the objects of study, not the tools for study. Proponents of the third position we have articulated, methodological pluralism, suggest that methodology—in this latter sense—should be the primary concern, and choices of methods will derive from careful methodology.