SCIENCE, PSEUDOSCIENCE AND COMMON SENSE*

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You encounter an object mostly hidden in a dark place. Because you are a naturally curious person, you begin to wonder: "What is it? What is it made of? How did it get there? How did it get to be the way it is? Can it be put to good use?" Sometimes much can be learned with the simplest of tools, so you pick up a stick and use it to lightly poke the object. Information is transmitted through the stick into the muscles and nerves of your hand and arm, on into your nervous system where your brain gathers and sorts through the data. You begin to get a sense of the thing's size, shape, resiliency and reactions. Depending on the answers to your questions thus far, and depending on the depths of your curiosity, you may formulate a new set of questions more refined than the first, demanding more sophisticated measuring devices. If your curiosity continues to broaden and deepen, this process can go on forever.

Science is a way to *systematically* poke sticks at unknown objects in dark places. It is one of many ways to answer questions, but it stands alone in its ability to generate answers that hold up to critical analysis and that provide foundations for further inquiry. If your goal was to acquire legitimate knowledge about that hidden object, you were wise to pick up that stick rather than to seek answers by interpreting ancient myths, asking passers-by, or relying on your own untested hunches.

This chapter makes a case for the value of science in the pursuit of knowledge in general, and knowledge of such group processes in particular. As theorists and researchers of group processes, we are members of an extended family that spans all scientific disciplines. As such, we are oriented toward the goals of developing, accumulating, improving and disseminating to others the knowledge we acquire about phenomena that we feel need explaining. Those phenomena include human interactions and social structures, within which are found exertions of power, judgments of fairness, expectations for competence, negotiations for rewards, feelings of attachment, and much more. Although the people and groups that participate in these processes are visible enough, often the processes themselves are hidden in dark places and not so readily observable.

In the first section below, we approach this task by outlining the scientific orientation within which we operate and that guides our theory-building and research. In the next section we further elaborate on what science *is* by juxtaposing it with pseudosciences. These are fascinating objects to investigate as they often can *look* very scientific, but lack one or more crucial qualities that undermine their capacity to develop knowledge efficiently. After that we compare scientific approaches to an alternative with which all of us are intimately familiar: common sense. Before concluding, we briefly lay out the bare bones of a *theoretical method* and illustrate its products by re-casting a longstanding group process theory.

A SCIENTIFIC ORIENTATION

As we go about the work of assembling and organizing our best guesses about people in groups and what makes them tick, scientific theories prove to be among the most important tools of our craft. Our poking-sticks can be whittled anew for different needs, but theories persist and transcend the individual objects that contribute to their content. Intellectual communities employ theories to gain increasingly broad and precise insights about phenomena. "Increasingly" is apt because scientific theories have unique design features that distinguish them from other ways of knowing the world: When used properly, it is *inevitable* that bad scientific theories are discarded or else their errors corrected, and so over time a theory only gets better at what it sets out to accomplish. Science cannot lose when it comes to acquiring knowledge, and this is a very special quality indeed. Unfortunately, social and behavioral scientists (heretofore referred to as "social scientists") tend not to use scientific approaches to their fullest potential, and so a lot of conjectures and observations about human behavior are never developed beyond initial stages.

In the social and behavioral sciences (henceforth termed "social sciences") we often associate theories with their authors. There is an important sense in which this is misleading. Theories are not proprietary once they are published. They belong to collectivities of inquiring minds and exist, in a sense, in an imaginary place between the minds that concoct them and the empirical mysteries they are designed to unravel. It is as though we *look through* theories in order to see certain things more clearly, analogous to looking through a telescope to sharpen the images of distant objects. Telescopes offer a two-dimensional rendering of an extremely small button of sky and filter out far more light than they admit. When you look through a telescope, you explicitly and knowingly disregard practically all other aspects of the universe. That is because the instrument brings into focus only a very tiny, very particular aspect of reality for a very specific purpose.

The same is true for any good theory. Ignoring some aspects of reality is not automatically a drawback. It may *appear* to be a drawback to one who believes that a "theory of x" is incomplete until it explains *everything* about x, identifies *anything* that could possibly affect x, and applies *anywhere* and at *any time*. While some theorists may wish us to believe that their work possesses such qualities, this is not what theories do and never has there been one that could.

Theories Are Not Phenomena

This simple distinction is so fundamental—but so often ignored—that it warrants special mention here. Phenomena exist in the empirical world, which is the world of concrete objects and events and the messy interactions among them. In contrast, theories are abstract human constructions that try to explain phenomena, using the simplest possible language and the smallest possible arguments to answer the kinds of questions with which this chapter began. Part of the scientist's task is to build intellectual bridges between theories and phenomena, permitting users of the theory to apply it or to test it. These bridges are instructions for connecting elements from the imaginary world of theories to elements of the empirical world. This makes theories very different from mere representations or descriptions of the empirical world. Theories and reality are

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made of different stuff. Reality is very, very complicated. By comparison, theories are very simple, as they should be.

Theories Are Statements

Theories are made of *statements*, as are the bridges connecting them to phenomena in the natural world. In fact, statements are the only way we know to express our theoretical ideas. Statements consist of symbols that are defined so as to capture and communicate our ideas. Symbols may take the form of words or mathematical objects, but they are just empty shells until we imbue them with meaning.

To illustrate, suppose we have a set of statements that describes certain properties of actual revolutions that took place in history. These are *empirical statements* or, more familiarly, *data*. In addition, we have a theory that attempts to understand revolutions in general and expresses this understanding through a set of basic statements or *propositions*. Statement A is an example of a proposition that could be part of a theory of revolutions:

A) If group mobilization occurs, then group members identify with their social class.

In terms of its format, this is quite typical of the kinds of assertions that social scientists offer as part of their theories. Notice first that there are two complete statements contained within the larger statement: "group mobilization occurs" and "group members identify with their social class." Each of these sub-statements could stand alone as a grammatically correct sentence. Importantly, notice that **A** does not actually claim both sub-statements to be true. Rather, it expresses a single, compound *conditional statement*. The first statement being true is *a sufficient condition* for the second statement to be true. Re-stating to make this clearer: "The occurrence of group mobilization is *sufficient* for group members to identify with their social class." Note that this is not saying that mobilization is necessary for identification, implying that factors other than mobilization could as well. However, the second statement is a *necessary condition* for the first: "For group mobilization to occur it is *necessary* that group members identify with their social class." So A says that even though you can have identification without mobilization, you can't have mobilization without identification. It's a good idea to play around with these implications by substituting your own sub-statements.

Theories Are Arguments

If we are so inclined, we could develop an "explanation" of statement **A** by introducing additional statements. That is, we could ask *why* it should be that identification with the group is necessary for group mobilization to occur, and then develop a chain of reasoning that ends with statement **A**. We then could go further and ask even deeper or more detailed questions about statements within this explanation. This is one of the ways that theories can grow, and one of the reasons that scientific inquiry can go on forever. It also happens to resemble the kind of "why" questions that children are known to ask, to the eventual annoyance of their parents. As they inevitably discover, every answer to a "why" question may be questioned with another "why": Why? Because you can always seek a deeper explanation. Why? Because humans are curious animals and we like deeper explanations. Why? Because that's the way the human brain evolved…. and so on, until we run out of either answers or patience.

Back to our example. Let us pare down the original statement by substituting symbols for the sub-statements:

A) If M then Y.

where **M** is an abbreviation for "group mobilization occurs," and **Y** stands for "group members identify with their social class." Next, suppose that we assert new statements **B** and **C**, each of which uses a new sub-statement. **Z**:

B) If M then Z
C) If Z then Y

Whatever **Z** happens to assert (for example., "There are strong emotional ties among group members"), the incorporation of statements **B** and **C** provides, in a sense, a *deeper* explanation. They give us a sense of where statement **A** comes from. They *justify* statement **A** and allow us to *derive* **A**. The implicit logic that squeezes **A** out of the combination of **B** and **C** becomes transparent in the following complete argument:

(B) If M then Z
(C) If Z then Y

(A) If M then Y

Sentential logic is a system of rules for building and analyzing arguments consisting of natural-language statements. It includes a rule called the *Law of Hypothetical Syllogism*, and that is what allows us to derive **A** from the combination of **B** and **C** in the illustration above. This law tells us that if **B** and **C** are true statements, then it follows (signified by the horizontal line) that **A** must be true as well. The law capitalizes on the *form* of the statements and their connections to one another, and it cares nothing about the meanings of the statements. Even so, the *Law of Hypothetical Syllogism* turns out to be one of the most useful logical rules for building theories in both natural and symbolic languages.

Newcomers reading social science publications for the first time would get the distinct impression that logic is optional in our writing, and unfortunately they would be right. Consider what this means. Superficially, theorizing gets expressed in a kind of breezy narrative that seems easy enough to follow. On the other hand, the underlying structure of this sort of informal argumentation is often very complicated, following multiple strands, sometimes based on observation, sometimes on prior theory, sometimes on the word of authorities, and sometimes involving great leaps of faith. Editors and manuscript reviewers rarely demand that logic should be made explicit, and so it rarely is. But the down-side is that, unless the argument is capable of withstanding the high standards that would be imposed by a full logical analysis, two calamitous problems occur: First, the conclusions that the theorist wishes to draw are not actually justifiable. Second, no amount of seemingly supportive research can lend any credence at all to the theory. For a theory, it cannot really get much worse than this.

The "Physical Science Model"

We are going to consider a method of theory construction and theory analysis that sometimes is associated with main-stream sciences such as physics. Although somewhat of a misnomer, let us call this the *physical science model* (PSM) for the time being. This approach has several important features, among which is the use of *defined terms*. This simply means that the words or symbols used to communicate a theory must be assigned clear, unambiguous, agreed-upon meanings. These terms are embedded in statements, such as **A, B** or **C** above, that can go by a variety of different labels such as *propositions, postulates, axioms, premises, knowledge claims, laws, principles,* or *assumptions*. Ideally, these statements possess several properties: They are *conditional, explicit, abstract,* and *general.* Moreover, as already stipulated, the statements are expressed and organized using a system of logic. Examples of logical systems include syllogistic arguments and algebra, among many others.

Even if you haven't had a course in logic, you already know enough intuitive logic to recognize some of the ways arguments can go wrong. Perhaps without knowing exactly why, you would probably be skeptical of a theory that contained the following argument:

> All governments have multiple levels.
> Each government level has a set of procedures.
> -------------------------------------
> Therefore, nations have governments.

Here we have three statements, none of which considered alone would be much cause for debate. However, the argument *form*—the structure created by combining the statements—probably does not "feel" quite right to most readers, especially to *careful* readers! To assert that nations have governments *because* of the preceding statements should seem odd if you think about it for just a moment. The concluding "Therefore" really doesn't follow from the propositions that are supposed to be supplying its justification. So even if there's no problem with the individual statements taken one at a time, there nevertheless can be something terribly wrong with the *argument* that the statements combine to form. In fact, the above argument is *invalid* for the very reason that its conclusion does not follow from its preceding statements. Now consider this argument:

> Higher education causes higher income.
> Higher income causes greater spending on expensive merchandise.
> -------------------------------------
> Therefore, higher education causes greater spending on luxury items.

Is this a *valid* argument? The answer is that it depends whether or not "expensive merchandise" means the same things as "luxury items." If not, then there is a disconnection between the statements employing those terms, and so neither can be logically connected directly with the other. This also means that one cannot provide a *reason* to accept the other. So the argument is invalid in the sense that its reasons fail to justify its conclusion. Put another way, it would be *unreasonable* to accept that the conclusion follows inevitably from its preceding statements. When we make arguments, we always require our conclusions to be justified by our premises—unless, of course, we are illustrating bad practices.

The more numerous and complex the statements in a theoretical argument, the harder it is to detect logical flaws unless the author makes a point to lay bare the argument's structure. Still, whether the argument is simple or complex, its validity is always subject to logical rules.

The PSM: Criticisms & Responses

Many social scientists react strongly against the so-called physical science model. Some of you may even share the sense that social phenomena cannot be caged within the confines of any rigid logical system. One reason for this view is the belief that any social theory that uses a formal language such as algebra necessarily portrays people as mechanistic and thoughtless, inhuman automatons devoid of motives, feelings or free will. They are treated by the theory as though they are billiard balls, the criticism goes, bouncing around without purpose in a cold and sterile social space. If the PSM were this overtly terrible, then no thinking person would use it. In fact, the criticism is well off the mark. It is true that some theories portray people in a very abstract, pared-down fashion, but that is beside the point. Like so many misleading characterizations, refuting it takes more words than expressing it in the first place. However, it should be worth the effort.

There are at least three ways one could respond to the billiard ball criticism. First, even if it is true, the social science student who favors some other approach nevertheless is well-served by developing an understanding of the scientific approach. She will then be prepared to defend herself against scientific criticisms from within her discipline and from scientific fields outside. To "know thine enemy" is empowering.

Second, even if the characterization generally were true, it would be an anti-intellectual reflex to discredit a theory *only* because it portrays people in a particular way. Perhaps such theories *are* all wrong. On the other hand, perhaps there are important phenomena that are understood perfectly well even when emotions or some other range of known qualities are ignored. One simply cannot be sure without giving a theory fair opportunities to succeed or to fail. Certainly it would be easy to dislike a billiard ball type of theory at a "gut level"—its implications, its presentation style, its oddness. Nevertheless, although we may not *like* the way a theory looks or the things that it implies about its subject matter, whether it is true or false is an entirely distinct and far more important issue. The question of true-versus-false trumps personal taste every time. It is also worth keeping in mind that most theories which come to be accepted in science appeared heterodox, strange, maybe even *obviously* false at some earlier point in time.

Theories by their very nature *always* simplify and ignore some aspects of reality. Just as the pointed and focused telescope ignores most of the universe, a particular sociological theory may ignore human motives, emotions, racial characteristics or occupational statuses while it attempts to explain something else. A psychological theory may ignore social embeddedness or neurophysiological properties. An economic theory may ignore social interactions within organizations. The social scientist who focuses on solving a particular theoretical problem does not deny the existence of the remainder of the social universe any more than the astronomer denies the existence of the remainder of the heavens by focusing on binary star systems. An under-appreciated maxim: *A theory is to be judged not by what it ignores, but by its relative success at explaining what it claims to explain.*

More precisely, we look at how well a theory performs compared to alternative theories purporting to accomplish the same thing. You may not *like* a cold, emotionless, mechanistic theory, but if it does what it sets out to do—if it explains some aspects of human social behavior *more accurately than alternative theories*—then you cannot fault it for ignoring factors that you happen to think should be incorporated. (You can always try to do better yourself by incorporating them into your own theory!) The moment you find yourself dismissing theories for the *way* they explain, without examining whether or not they *actually* explain, you have become an ideologue and the chances that you will be able to improve your understanding of the world will have been greatly diminished.

Third, what may be the most devastating counter-argument to anti-PSM claims goes like this: To say that the PSM treats people as mechanistic, thoughtless actors devoid of motives or feelings *is false to begin with*. That a social scientist shares her method of theory construction with physics (and other sciences) does not for an instant require the *objects* of that social theory to be portrayed as overly simplistic or as sharing properties of physical objects. We are not talking about using physics to explain human behavior. We are talking about using the *theoretical methods* that physical theories use. The critic's argument is analogous to these:

> Our decimal system is used to count inventories in warehouses.
> -------------------------------------
> Therefore, our decimal system cannot be used to count human populations.
>
> The rules of grammar are employed in science fiction writing.
> -------------------------------------
> Therefore, rules of grammar cannot be used in news reporting.
>
> Systems of logic do not contain emotions.
> -------------------------------------
> Therefore, systems of logic cannot be used in theories of emotions.

It does not take a logician to recognize the invalidity (not to mention the silliness) of these arguments. Each manages to confuse a set of rules with things to which the rules may be applied. As a matter of fact, there are sociological, psychological and physiological *theories of emotions* that adopt the physical science model. Obviously these theories do not portray people as emotionless!

There are many other popular arguments against the use of this theory construction approach. This is not to say that the PSM necessarily answers all questions to everyone's satisfaction, or that its implementation throughout the history of science has always been efficient and honest. However, none of these criticisms of the PSM offers compelling reasons to eschew scientific approaches to the study of human and group behavior in favor of unscientific approaches. Several examples of these criticisms are discussed next, along with refutations.

"Social Life is Dynamic." Symbolic interactionist social psychology emphasizes that social phenomena are dynamic processes, and some take this to mean that you cannot apply the PSM. Ironically, some symbolic interactionists actually have developed dynamic theories employing the PSM. Furthermore, dynamic models and formal languages for the precise expression of dynamic processes have been around at least since Isaac Newton. They are used with regularity in both the physical and the social sciences. This makes the social science argument against them an uninformed and irresponsible critique. Unfortunately, such critiques can persist without any evidence as long as there is enough *social* support to maintain them, which apparently there is.

"Social Order Emerges." Another standard argument popular in some areas of our field is that a PSM cannot apply because social order *emerges* out of social interaction. Along with many other vague arguments against the PSM, this one would need some clarification before having any hope of being defensible. Is it saying that physical science models cannot be used to explain *anything* that emerges out of something else? That would be false. There are physical theories that focus on the explanation of what are called *emergent properties.* An example is the explanation of properties of water, such as wetness or clarity, based upon knowledge of the properties of water molecules. Another is the emergence of pattern and structure out of chaotic dynamics among constituent parts. Is the critique saying that the emergence of social phenomena out of social interaction demands a uniquely *social* explanation? Again, it would be fatuous to say that nothing is to be learned from outside one's discipline—that neither the *content* nor the *method* of non-sociological theories could provide any benefit to us. In fact, there is no *a priori* reason that various properties of the setting, the people, their minds or bodies, their institutions or anything else imaginable could not be incorporated as provisional assumptions in a PSM to generate and explain various types of emergent social orders.

If the emergence-based critique is suggesting merely that we *ought* to study how social order arises out of social interaction, then there is still a problem. This is a statement of personal opinion. There is nothing wrong with having such an opinion and allowing it to guide and motivate one's research, but that does not make it a valid argument against other approaches. Each social scientist is free to decide what questions are important to his intellectual pursuit. The flip-side is that you do not have the right to demand that others pursue those issues which you happen to believe are important. It behooves you to demonstrate the importance of your interests through the theories that you develop and through the tests that you conduct.

"Humans are Reflexive." This is the argument that you cannot apply the physical science model because, unlike atoms and molecules, people are aware of themselves and their interactions with others. That is, we *reflect upon* our own perceptions, beliefs, attitudes, intentions and behaviors, thereby behaving in ways that differ from what would be the case if we were not reflective. Again, this confuses the physical science model with actual physical theories. Of course objects in a physical theory are not reflective, and of course humans oftentimes are. But there is nothing in the PSM that prohibits taking the quality of "reflexivity" into account when explaining social behavior. What it does require is for the theorist to make explicit statements about exactly how this quality is defined, and how he or she believes it affects whatever it is that he or she is trying to explain. Merely declaring that "people are reflexive" does not explain anything until we know what the theorist means by it, and how he or she is assuming that reflexivity affects other things.

"Formality is Overly Constraining." Yet another criticism is that the languages and logics used to express theories in the physical science model are overly constraining. The main purpose of the PSM is to clarify the meanings of terms and to lay bare the relationships within and between statements. These considerations help the theorist to communicate clearly and to avoid self-contradiction and other problems. Within these constraints—which most probably would agree produce desirable consequences insofar as accurate communication and argument validity—formal methods offer tremendous flexibility and a

huge array of linguistic and semantic possibilities ranging from natural-language theories to highly specialized symbol systems. One reason for the skepticism may be that the PSM forces one to take a careful, analytic approach to the content and structure of one's own statements. Few theorists do this and so the prevailing belief is that it is not even necessary or useful to spend the time on it. For a variety of bad reasons and since the very dawn of our discipline, we have demanded little more than this from our theorists. In contrast, real theoretical analysis is hard work, and some people would rather not work so hard when there is an audience willing to accept their words without any formal analysis. Suffice it to say that even if you never choose to theorize in any mode more rigorous than common English, you should be well-versed in the languages of science. A well-informed critic is a good critic.

Limits of the Orientation

The scientific approach to building theories offers a framework for determining the logical and empirical truthfulness of statements. However, there are two very large classes of statements, discussed next, for which the approach is impotent: statements that are *singular* and statements that are *untestable*.

(1) A theory cannot include statements about singular events, and arguments designed only to explain singular events are not theoretical. A "singular event" is an empirical phenomenon that occurs at a particular time and place. For example, there can be no such thing as a scientific theory of Jack the Ripper, the fall of Rome, the birth of your cat, or your decision to get a haircut. Nevertheless, urban homicide, societal decline, biological reproduction, and decision-making all can be studied scientifically. Each entails abstractions that can be connected to unique events, but the theories are not somehow *made of* such events, nor built to explain a particular delimited set of them.

Historical analysis and scientific theorizing have different but complementary goals. Theories are applied to, and tested with, singular events. History is comprised of singular events. So all tests of theories must involve some type of historical reference. Scientific theories *apply to* historical events large and small, but they are not theories *of* those events *per se*. They are theories of *any* events that fall within their prescribed scope.

The exclusion of singular events from theories is a limitation in the sense that often it is precisely those unique, striking events for which we crave greater understanding. Of course, anyone is free to devise purely historical accounts of events. However, if an explanation refers only to singular events, it is not a scientific theory. Such a singular explanation may *stimulate* the development of a scientific theory, or it may have enormous practical value, but the singular explanation cannot be a theory in and of itself.

(2) Scientific theories must be testable in principle. There are two factors that can prevent a statement from being testable, even before getting to the point of designing empirical tests. First, the statement may be expressed in vague or ambiguous terms. Then, even evidence that may seem to contradict the statement can be taken as neutral or supportive by reinterpreting its terms. Second, the statement may be perfectly clear, but always true due to its logical structure. This is the case with *tautologies* such as "Either x, or else not x." Saying "Either it will rain today or it won't" is the same as saying that "It may rain today." Which does not really assert anything. You can never be wrong if you assert that either something will happen or else it will not, but this does not make you a genius! By making the statement untestable you also have failed to express anything that could be construed as knowledge, even if it gives you the *feeling* of always being right.

Sometimes entire disciplines are untestable at their cores due to the way their members operate. Take, for example, the claims of astrology. Astrologers claim that their field is a science, yet virtually all scientists outside of astrology disagree. They call it a *pseudoscience*—a false science. This is mainly because astrologers "test" their claims by starting with events and interpreting astrological charts in ways that make the events appear to have been inevitable. They "draw the bull's-eye around the arrow" as the saying goes. However, when astrologers are pinned down to make specific predictions in advance of events, they are never correct beyond chance rates.

In the mid-1980's an unusual event took place. A group of well-reputed astrologers (well-reputed within the field of astrology, that is) agreed to submit to a set of testable claims—fairly weak claims, but nonetheless testable. The December 5th 1985 issue of *Nature*, a respected British science journal, published a report on the test. The astrologers claimed that they could match horoscopes to subjects with a greater-than-chance likelihood by examining an agreed-upon set of standard personality questionnaires filled-out in advance by those subjects. Among the many wonders claimed by astrology is the ability to predict personality characteristics based solely upon the subjects' date and time of birth. As it turned out, the astrologers performed much worse than they predicted. Their assignments of horoscopes to subjects were no better than random. After the results were published some astrologers tried to discredit the research by claiming that, since astrology is older than psychology and because its "principles" have stood for centuries, it should be seen as legitimate. Of course, the age of a field has no direct bearing on whether its claims are true or false. In fact, that a field remains unchanged for a long period of time is better evidence of stagnation than success. Many astrologers proudly claim that their "science" has remained essentially unchanged for 2,000 years, as if this were a good thing. Ironically, that fact alone demonstrates that astrology is very unlikely to be a scientific, self-correcting approach to knowledge—especially given the mythological and very non-scientific origins of the field. Another reason for failure claimed by some of the astrologers was that they could not function properly under the stress of test conditions. As for this *post hoc* excuse, astrologers were full collaborators in the design of the test and were in full agreement that it was a fair one. There was no hint *before or during the study* that the conditions may have been stressful. In fact, astrologers worked under very relaxed conditions at their own pace in their own homes. It was not until the results indicated the clear failure of astrology that the excuses began.

The Best "Way of Knowing"

Is the scientific explanation of social behavior somehow *better* than non-scientific explanations such as those of astrology? Are they superior to those given by common sense knowledge, or postmodern discourse, or by social science critiques of the physical science model? This much is certain:

> 1. We can develop more thorough and accurate knowledge of at least *some* aspects of group processes through a scientific approach than through non-scientific approaches.

> 2. No non-scientific approach is superior to a scientific approach for purposes of developing theoretical knowledge about group processes.
>
> 3. A scientific approach is useful for understanding many of the phenomena in which group processes theorists and researchers are interested.

Some criticisms of scientific method are more compelling than others. In fact, there are some issues that may never be resolved. Just as with any theory, the scientific method has at its core a set of assumptions that are assumed to be true, but are not provable by the method itself. This can be disconcerting. If the validity of the method cannot be proven logically, then why should we adopt it over any other type of method such as one that allows contradictory statements to coexist, or one that lets us assert that statements are true because they *feel* right, relieving us from the burden of actually testing them? This is a more difficult question to answer, and we cannot hope to address it fully here. However, here are a few points that may be of some comfort.

Proven Track Record. In fields much older than sociology, the method has succeeded in allowing scientists to make their theories increasingly precise and broad over time, and to develop applied research that allows them to understand, predict and manipulate events in the real world. No other method has succeeded even remotely as well for these purposes.

Strong Foundation. The method is based on a set of explicit and rational assumptions. Among their many other desirable qualities, the axioms and theorems of elementary logic prevent self-contradiction and permit new knowledge to be generated from existing knowledge. Methods without a comparable foundation in logic have less reliable means, or no means whatsoever, to eliminate contradictions or to address a host of other potential difficulties.

Attacks Problems Head-on. The norms of the scientific method impel theorists to resolve inconsistencies and problems in their own and in one another's work, rather than to sweep them under the rug or make excuses for them. This is the engine that drives a self-correcting process, and it is absent from most non-scientific and pseudoscientific approaches.

Rich in Detail, Vast in Reach. The method of science is content-free. It serves and bridges a large number of disciplines, providing the underlying structure to a growing fabric of knowledge. Developments in one field can then promote developments in another. Our own work as sociologists has benefited from some scientifically rigorous work so many fields—for example, biology, evolutionary ecology, economics, physiological psychology, cognitive psychology, structural anthropology, math, logic and sociology. Rather than being constraining as some would claim, scientific methods truly are *liberating*!

In sum, although the notion of scientific theorizing remains controversial in a variety of sociological circles, its tenets turn out to be not nearly as radical as critics sometimes claim. It promotes things like avoiding self-contradiction, being clear about what you are saying or writing, making explicit the basis for your claims, and having claims evaluated collectively by proponents and skeptics alike. It is hard to understand why it is that some people who call themselves social *scientists* are so repulsed by such ideas, and why the overwhelming majority is simply indifferent.

SCIENCE AND PSEUDOSCIENCE

Many people have spent entire careers studying the gray area between science and its pretenders. It is not as strange as it may sound, especially if you like mystery stories with palpable tension between the main characters and where the truth lies hidden in murky shadows. It also turns out to be a tremendously important question for the many thousands of us who work in disciplines that often seem to fall in that gray area.

The Demarcation Problem

Philosophers of science and others use the study of pseudosciences to help them refine criteria designed to distinguish or *demarcate* science from everything else. Over the years, debates about the "demarcation problem," as it has come to be known, have deepened and broadened. Still, the problem is not yet solved and probably never will be. Instead what philosophers of science have achieved is the realization that science is multidimensional and complex. Over the years they have generated a compendium of properties and criteria that seem to discriminate between science and pseudoscience for *most* practical purposes. Compare these definitions:

> A *pseudoscience* is a field of study whose members claim for it scientific status, but that nevertheless is viewed as non-scientific by the overwhelming majority of members of legitimate scientific fields.
>
> A *pseudoscience* is a field of study whose members claim for it scientific status, but the content of which violates one or more necessary conditions for the establishment of scientific fields.

Each definition seems plausible, and in fact there are many smart people who would stake their careers on one or the other. However, the disparity between these two statements offers a clue as to the stickiness of the demarcation problem. The first definition is based on social convention, i.e., what "legitimate" scientists declare to be their judgments, while setting aside the questions of how *they* achieved their status as legitimate, and how you could ever have a science based not on theory and evidence but on perceptions of legitimacy. The second definition presumes the existence and broad acceptance of objective demarcation criteria, while setting aside the fact that sciences are human institutions affected by group processes.

Some demarcation criteria are more widely accepted than others, but no one set has been adopted universally above all others and the problem remains unsolved. There may be two very different reasons for this. First, if there is a smooth continuum between the two extremes of science and non-science, then any line drawn between them must have an element of arbitraryness—something like trying to pinpoint the exact instant at which daytime turns to night. People will always disagree over the exact point. A second possibility is that, because there are so many dimensions that distinguish known scientific fields from known pseudoscientific fields, no demarcation criterion would account for them all, much less tell us how to weigh the relative importance of each dimension.

Karl Popper, one of the most prominent philosophers of science of the twentieth century, offered a single demarcation criterion: "Falsifiability." In fact, this is a cornerstone of Popper's philosophy of science, the key criterion for judging whether or not theories are scientific and, thus, whether or not the fields that employ the theories are sciences. Here is a definition:

> A declarative statement is *falsifiable* if, in principle, it can be disproved.

By saying "in principle" we allow for the possibility that there may be empirical limitations on testability—for instance, that a hypothesis may be untestable because a suitable measurement technology is not yet available. Even if that is the case, the hypothesis is testable in principle if one could conceive of a test that potentially could disprove it. If a statement is falsifiable then it is in fact either true or false, even if we do not yet happen to know which.

Contrast the following declarative statements:

> There is not a cloud in the sky.
> Either there is someone on the sidewalk or else there is not.
> Introverts tend to avoid crowds.

The first statement seems easily decidable: If there is no cloud to be found, the statement is true. If there is even a single cloud, the statement is false. As long as we agree on what counts as a "cloud" and how much of the "sky" must be taken into account, the statement clearly satisfies the falsifiability criterion and there should be no problem. Importantly, the criterion of falsifiability tells us nothing about whether the statement is true or false; only that it is possible *in principle* for it to be true or false.

The second statement is also very clear and easy to understand (again, assuming that we agree on what counts as a relevant stretch of sidewalk). However, it is also easy to see that it cannot be falsified. It covers all possibilities and so it is always true, and never false. (Logicians call this type of statement a *tautology.*) This may seem confusing: Don't we want our theories to contain nothing but true statements? What better way to achieve this than to fill them with statements that are guaranteed to be true 100% of the time?

If it is not obvious already, you can see that *this* kind of true statement does not provide any leverage in helping to understand or explain something. Imagine that a renowned theorist publishes a book purporting to explain the emergence of power hierarchies in small groups. Across a span of hundreds of pages and hundreds of thousands of words, the theorist asserts that any time conditions *a, b, c, d,* and *e* are all satisfied, power structures will emerge …. or else they will not. Yes, the theorist is utterly correct, but has not really explained anything. Such an *ambivalent* statement is unlikely to serve any constructive purpose in a scientific theory.

Is it conceivable that a theorist who asserts little more than "X or not X" could achieve renown because a discipline fails to enforce a falsifiability criterion? Sadly, it happens all too commonly in the social sciences. The recipe is rather simple. Combine a few pinches of "X or not X" statements with a dollop of sophisticated-sounding multi-syllabic words, spread them liberally across multiple chapters of a book, randomly substitute other terms for X (careful not to define any of them!), *et voilá!* If you believe in your own profundity, you can achieve great satisfaction by producing an enormous volume of work without ever having to really assert anything, test anything, or even prove to others that you have any idea what you're talking about!

What about the third statement: "Introverts tend to avoid crowds"? Statements of tendencies happen to be a common format for expressing social scientific propositions and predictions. Assuming that we have a valid and reliable measure of introversion, then in principle it should be simple to test the hypothesis "Introverts avoid crowds," which is another way of asserting "*All* introverts avoid crowds." Because observing even one introvert in a crowd would falsify the claim, it is very tempting to insert that little four-letter word "tend." This changes the situation quite drastically. Now if 51% of introverts avoid crowds (and 49% do not), do we say the statement is true? If 40% of introverts avoid crowds, but only 10% of non-introverts do so, what then? It is no longer so obvious whether or not the falsifiability criterion can be satisfied. At the very least, some clarification is needed.

In practice, it is not always a simple matter to apply the falsifiability criterion. Nowadays, most philosophers and scientists believe that the criterion is too simplistic and that there are good reasons to not always apply it so strictly. (Popper himself realized this and went on to qualify the criterion later in his career.) For instance, suppose your theory predicts that intelligence will be higher for members of Group A than for members of Group B. You have everyone take an IQ test and you find that, contrary to your prediction, Group B scores higher on average. Do you throw out the theory now that it has been falsified? Probably not, and definitely not if the theory is the best one available for a variety of other purposes. It is possible that there was a flaw in the procedure you used for randomly assigning people to one group or the other, or that the test you used provided only an imperfect measure of intelligence.

This complication should not lead us too quickly to dismiss the idea of falsifiability, however. By analogy, there are useful laws on the books to help protect us from personal and economic harm. Just as with the falsifiability criterion, sometimes they are difficult to enforce in the real world. Nevertheless, we do not generally argue for throwing out a good law just because it is difficult to enforce. In reality falsifiability operates more like a continuous scale along which statements may vary depending on such factors as the degree of precision or ambiguity of the terms that compose them.

Falsifiability was designed to provide an objective, one-dimensional "either-or" criterion for establishing the line of demarcation between science and non-science. In contrast, another philosopher, Mario Bunge, offered a much more complicated, multidimensional view of demarcation. In addition to considering the nature of the statements that scientists make (e.g., whether or not they are unambiguous), he also attempted to distinguish science from non-science using what we might call the "science-is-as-science-does" criterion. That is, he considers fields to be scientific when they manifest a set of properties characteristic of all scientific fields. These consider aspects of the field as an intellectual community, its relationship with a host society, the kinds of problems the field addresses and the methods it brings to bear in solving problems.

Many philosophers and non-philosophers have interpreted the lack of a clear, agreed-upon demarcation criterion to indicate that differences between sciences and non-sciences are inconsequential. That would be a big mistake, not only in practical terms but also logically. As many logicians have pointed out, the fact that there is no line of demarcation in the smooth transition from night into day, or from day into night, does not mean that the differences between night and day are illusory or inconsequential. The fact that there is no exact point on the body's surface at which the neck begins and the head ends does not allow us to conclude that there is no difference between a head and a neck. That there is a gray area between science and non-science does not mean there are not important differences between the two.

Popper's simple falsificationism represents one extreme of the spectrum of demarcation criteria that have been offered. It is an "objectivist" position which asserts that a single, objective criterion is sufficient to solve the demarcation problem. The other radical end of the spectrum would include sociologists of the "social constructionist" school of thought. They believe that the science/non-science distinction has nothing to do with the content of intellectual fields, but everything to do with the labels that people choose to apply. In other words, science is purely a socially constructed label, and criteria such as falsifiability do not really play a part in the determination because what actually takes place in the field is irrelevant to the power and status processes that "really" determine scientific legitimacy.

Markers of Pseudoscience

Let us step back from the specific issues for a moment and try to define the problem. For the sake of argument, let us assume that a field is scientific until shown to be otherwise. To do so—to demonstrate that it is a non-science—we will want to specify a set of conditions, any one of which, if violated, is grounds for declaring the field non-scientific, or at least *less* scientific. So rather than using the criteria to say what science *is*, each criterion is a different way of saying what science *is not*. Further, if it also happens to be the case that the people who are part of the field in question happen to call it a science, then violating one or more of the conditions would indicate that it is not merely a non-science, but also a pseudoscience. There is a lot of debate on the issue, but it turns out that there are some markers—some sufficient conditions—on which there is a fairly high degree of consensus and that can be applied with some measure of objectivity.

In their book *Science and Unreason,* Daisie and Michael Radner offered a set of simple markers for identifying pseudo-sciences. If a field of inquiry manifests any one of these markers, the Radners claim it can be declared a pseudoscience. Although we think their criteria are very useful, oftentimes in practice it is the case that violations of their criteria do not characterize the entire field in which they occur. Our own field of sociology is a perfect example. There are those in the field who strongly uphold the tenets of science, and those who reject them absolutely. Most sociologists are somewhere in between. They go about their work assuming that they are being scientific, but upon closer examination may find that one or more of their routine practices are questionable according to one or more demarcation criteria.

Most of what follows in the remainder of this section relies on Radner and Radner's criteria. Along the way we provide some impressions about their applicability to research and theory in the social sciences.

Anachronistic Theory. When science rejects a theory for failing to conform to the evidence, it would be wrong for a group of proponents to continue to accept the theory as valid without addressing the problems, or to revive the theory at some later point in time without making very substantial changes. Old ideas can take on new meanings due to a broader intellectual change in the field, but that is quite a different matter. For example, Pythagorean astronomy introduced the idea that the earth moves through space. However, the evidence failed to conform to the theory's predictions and a stationary earth model held sway. Later, however, Copernican astronomy revived the long ago discarded Pythagorean idea, but the *way* the earth moved in the newer scheme was very different and, as it turned out, consistent with the latest empirical evidence.

The field of astrology manifests anachronistic thinking at every turn, yet many of its proponents continue to declare it a science. It is based on a system developed some 2,500 years ago before much was known about planets and stars. Every mechanism it has offered to explain how the position of planets at the time of one's birth determine personality has been discredited. There are numerous failed tests of its basic predictions, and it has failed to keep pace with changes in relevant knowledge, e.g., that different planets have vastly different properties, that a number of planets and planetoids have been discovered in recent millennia, and that the entire zodiac has shifted over time such that people are no longer even born under the sun sign that has been assigned to them.

The social sciences have their own forms of anachronistic theorizing. In some areas, for example, it is still considered perfectly legitimate to employ very old theories as the motivation for empirical analysis. To again pick on sociology, the "classics"—Marx, Weber, Durkheim and others—still provide sources of wisdom, insight and inspiration, and serve as springboards for continued discussion and debate. Much of the discussion and debate boils down to arguments over whose interpretation is better, or closer to the "true" meanings and assertions in the minds of the original authors. In a style reminiscent of proponents of astrology, defenders of the sociological classics believe that it is the profundity of these theories that has resulted in their stability across so many decades. In science, however, such stability has always been associated with stagnation, rather than with a field's arrival at the "Ultimate Truth." Usually it means that the theory in question is formulated in such a way as to resist efforts to apply the rigorous and definitive testing required of scientific theories.

Mystery Myopia. In science, work mostly proceeds smoothly without the appearance of too many big surprises. Occasionally, however, unanticipated results or "anomalies" occur. For example, results of a survey may fail to turn out the way they were predicted according to theory. The anomaly may only be an annoyance, brought about by technical problems such as limitations or flaws in the measures used to test the theory—a "dirty test tube" problem, so to speak. If it persists in attempts to repeat (or *replicate*) the survey, however, the anomaly would become the target of scrutiny and eventually may lead to the overthrow of an established theory. Scientists will not accept a new theory only because it explains a particular anomaly, however. It also must represent an improvement over existing theories along other dimensions such as the strength of its overall empirical support, the breadth of its applicability, or the precision of its explanations. In this sense, focusing attention on mysteries can result in important contributions to scientific progress.

In contrast, some pseudosciences focus exclusively on mysteries, or what their purveyors would like us to believe are mysteries. Television and popular literatures frequently report "investigations" into the Bermuda Triangle, Bigfoot, faked moon landings, the Loch Ness monster, UFOs, or communicating with the dead. Although it is usually impossible even to establish the existence of these incredible-if-true phenomena, investigative efforts often are geared toward generating fantastic explanations rather than searching for simple and mundane causes. Invariably, they conclude with rhetorical questions and words of noncommittal mysteriousness: "Could these events be just a coincidence?" "Makes you wonder, doesn't it?" "What if it were true…?"

In the social sciences, a similar problem can arise for the researcher who studies uncommon or empirically circumscribed events—suicides among pre-adolescent females, for example—without also looking at conditions under which the phenomenon does *not* occur, or occurs within other social categories. Say you are interested in understanding the conditions under which revolutions occur. Common sense might suggest that in order to determine what causes revolutions, you should assemble a "sample" of revolutions that includes all the information you can find on the circumstances surrounding each one. Then it should be possible to identify prior circumstances that are common to *all* of the revolutions in your study, and discover those requisite conditions. There are two immediate problems with this reasoning. First, you would also need to ensure that those conditions that are common to all revolutions in your sample do not also occur commonly in the absence of revolutions. If they do, then they would lack any explanatory or predictive power. (In the same vein, drinking milk as a child does not necessarily lead to heroin addiction even though all addicts drank milk as children) Second, all social systems contain vast numbers of elements and events in complex sequences and combinations. Therefore, the fewer the revolutions in your sample and the greater the quantity and variety of data on preceding circumstances, the greater the likelihood of finding commonalities across revolutions that are purely coincidental. It would be tempting to conclude that these chance commonalities actually are the causes of revolution, but the method that has been employed cannot support such a claim.

Grab-bag Evidence. It may seem reasonable to assume that when it comes to supporting an empirical claim, large *quantities* of evidence can be used to compensate for lapses in *quality*. In actuality, the confirmation of a hypothesis potentially can exist along any of several dimensions. In addition to the number of confirming instances in support of the hypothesis, one should also consider *(i)* the variety of such instances, *(ii)* whether competing hypotheses have been disconfirmed, and *(iii)* whether the hypothesis successfully predicts a range of other phenomena. For the UFO enthusiast, it may be the case that any claimed UFO sighting is valid evidence of extraterrestrial visitations, until it is proven otherwise. Oftentimes, evidence that has been invalidated is not discarded and keeps cropping up again and again and, in contrast to legitimate science, even anecdotal evidence may be accepted uncritically.

We actually do see this mode of operation in the social sciences, and far too often. An author will make a general claim of some sort and attempt to validate it by citing a variety of cases where the claim seems to hold true. The claim is not presented with guidelines for selecting appropriate test cases; potentially disconfirming cases simply are ignored; and anecdotal evidence frequently is given tremendous weight. To be sure, it is often true that better evidence is unavailable and the writer is simply making the best of a bad evidentiary situation. Even so, it is essential that appropriate disclaimers and qualifications are expressed at least as forcefully as any conclusions the writer may wish to draw on the basis of such weak evidence.

Unfalsifiable Claims. It is always important to ask the question, "What would I consider to be evidence *against* the claim I am making?" If there is no evidence that would convince you that your claim is false, then your claim is probably not scientific. For example, one of the assertions of "creation science" is that the world must be very young—between five and ten thousand years of age. Rather than try to test this consequence of the "special creation" argument, evidence against the claim is distorted, ignored, or dismissed. There is a monumental body of evidence indicating that the world is roughly one million times older than that. To maintain their belief in a young earth, creationists have asserted that the earth was created a mere geologic blink of an eye ago, but in such a way that it has been made to *appear* to be much older to we humans—a wonderfully devious plan by the Intelligent Designer to help cull the unfaithful. Of course, using the same reasoning we could all have been created only a minute ago, complete with memories that make it appear to us as though we have lived our lives for decades. Try disproving that claim!

It is not hard to find irrefutable claims in the social sciences. They go by a variety of names: frameworks, perspectives, even "theories," but in fact they are loose collections of ideas that are buffered from falsification by their vagueness. Part of the problem is that without well developed theory, hypotheses that receive empirical support could just as well have been devised *after the data were analyzed*—the "drawing the bull's-eye around the arrow" metaphor used earlier. In the most cynical view, there is no better way to find support for your theory: Wait until you already have the "test" results, then decide how the theory could be interpreted so that it will appear to have predicted exactly what you've observed!

In this sense, the "inductive process" of creating general theoretical claims after analyzing a particular set of data can be devious, as when the claimant projects the false impression that patterns in the data were predicted *a priori* by a remarkably precise and accurate theory. In general, however, there is nothing wrong with making conjectures based on past observations. A researcher is perfectly free to collect a mass of data on multiple variables, to perform exploratory analyses of the data, to report on the statistically significant relationships and to create a story that is consistent with as much of the evidence as possible. This is a form of "grounded theory," and as good a way as any to develop theoretical ideas that are guaranteed to be consistent with at least some of the data. Viewed another way, however, because the hypotheses do not arrive on the scene until after the data have been analyzed, those hypotheses are not falsifiable. This is quite different from the way scientific theories are tested and evolve over time.

When scientists formulate ideas based only upon examining data—the so-called "data-mining" process (or the more disdainful-sounding "data-dredging")—those ideas are only *conjectures*. They cannot be full-fledged scientific theories until they survive rigorous, independent tests and prove to generalize beyond the initial data-mining results. Theories also have certain characteristics, as we shall see, that clearly distinguish them from conjectures, hypotheses, and any other kind of statement about worldly phenomena.

Spurious Similarity. Returning to astrology, this field claims that the positions of stars at the moment of your birth determines a variety of your characteristics and dispositions, and what will happen to you in your life. Could you not then argue that since stars and planets and moons clearly exert gravitational influence on one another and on bodies of water, and since humans consist of 90% water, astrological claims are likely to have some validity? This type of argument sounds legitimate to many, but it depends on the idea that the effect of heavenly bodies on humans is in some crucial way *similar* to the effect of stars and planets on large bodies of water. In fact, the gravitational influence of, say, the moon, is related to the size of the body it is influencing. The fact that a large ocean on earth has observable tides does not mean that a human being, miniscule in mass compared to an ocean, has a tidal force of comparable magnitude operating inside her body. The gravitational force exerted upon your body by a book several feet away is actually hundreds of thousands of times greater than the gravitational effect of the moon. The earth's gravitational effect on you is your weight. The moon's effect on you amounts to approximately .0003 ounces—less than the weight of a mosquito. The tidal effect of the moon on your body is around one part in 30 trillion—thousands of times less than the tidal effect of holding a piece of paper in your hand. Further, no one has ever demonstrated that gravitational changes of any sort affect behavior or personality in any discernable way. Astrological claims have other problems as well. For instance, why should one's astrological clock start at birth? With such profound forces at play across the vastness of space, how could an abdominal wall only several centimeters thick inhibit the impact of the stars and the planets before birth, or from the moment of conception? What makes birth dates so significant from an astrological standpoint, compared to the day before or after birth? What about C-section births whose dates and times are chosen based on the availability of surgeons and operating facilities?

A lot of work passes for scientific in the social sciences merely because it employs highly rigorous quantitative analytic methods or data-gathering procedures. In fact, prestigious awards sometimes are given to scholars just for assembling potentially useful data sets! As you will learn, "quantitative" is not synonymous with "scientific" any more than "qualitative" research is automatically unscientific. If we go out today and conduct a well-designed attitude survey on a properly selected sample of American adults, asking about impressions regarding recent conflicts in the Middle East, there is nothing inherently scientific about this activity no matter how rigorous the data-gathering methods.

Scenario-as-Explanation. In his book *Worlds in Collision,* Immanuel Velikovsky offered a lengthy scenario describing how, around 1500 B.C., a comet passed close to the earth, slowed the earth's rotation, caused a rain of petroleum, several days of darkness, tidal waves, a shift in the polar regions, a change in the earth's axis of rotation, a realignment of the earth's orbit around the sun, the biblical plagues and parting of the Red Sea, and other major events. He claimed that the comet settled into stellar orbit, later to become known as the planet Venus. Unfortunately, few of the events that occurred in this scenario can actually occur, based on long-standing scientific principles that Velikovsky himself claimed to uphold. Although the scenario makes a certain kind of superficial sense of the current state of planetary affairs, the different parts of the scenario—perhaps appearing plausible to those outside of physics, astronomy, geology, etc.—are complete fabrications and violations of physical laws. Velikovsky's life's work was highly creative, but also highly unscientific.

Many social scientists attempt to explain complex social phenomena through the use of cobbled-together scenarios. Whether or not they are pseudoscientific is not quite as clear-cut as in the Velikovsky case, however, because the scenarios are less likely to conflict with inviolable principles. As far as we know, two objects really cannot occupy the same point in space at the same time, whereas a general social science claim, e.g., "all groups have norms" certainly can be violated in principle. As long as the social scenario is historically accurate, it is not pseudo-anything. On the other hand, cobbling together a detailed historical account of a complex event is not scientific in and of itself. That is not to say it can play no role in a scientific endeavor. Some of us would argue that historical accounts are most useful when treated as proving grounds for theoretically-generated predictions.

Exegetic Research. This practice consists of the analysis and interpretation of written material. With exegesis, the writing is treated as data to be *interpreted* so that its "true meanings" or essence may be comprehended. The practice is popular among religious scholars who scour sacred texts for hidden meanings. In a more contemporary vein, Michael Drosnin's book *The Bible Code* describes how a computer was programmed to sift through the Hebrew Bible, searching for and seemingly finding meaningful words and phrases. Analogously, proponents of parapsychology have attempted informal interpretations of highly formal theories, such as quantum mechanics, in attempts to provide a more scientific underpinning for their case. In the case of *The Bible Code*, however, skeptics have shown that the same method which seems to reveal prophetic lines in the Holy Bible can do the same with virtually any large text, holy or otherwise. As for the use of quantum physics for ESP, physicists vehemently deny that the theory is applicable in such "macro" contexts.

Exegetic activity is common in some theoretical areas of the social sciences. Some of our most prominent scholars immerse themselves in the writings of one or more past luminaries, thinking carefully and deeply about the "true meaning" of what has been expressed. Then they publish their own arguments about what the long-dead scholar *really* meant when he (it is nearly always "he") made a particular highly ambiguous but very portentous-sounding set of statements, and why all other interpretations to date are ill-conceived. An alternative may be to take the ideas that the deceased scholar offered, refine them, test them, revise them, test them again, and so on. Before long it is no longer the original theorist's work, but then neither can it be said that today's physics is Sir Isaac Newton's.

Resistance to Informed Critique. Pseudoscientists take pride in never having been proven wrong. Until the day he died, Velikovsky refused to revise even the most blatant errors in his theory. For instance, he claimed that certain chemical reactions in the atmosphere resulted in the creation of hydrocarbons that fell to earth and were consumed by Moses and his followers in the desert—the "manna from heaven" of Old Testament fame. The problem is that Velikovsky, who was not trained as an organic chemist, confused hydrocarbons (e.g., motor oil) with carbohydrates (e.g., pasta). Unfortunately, the chemical reactions he described indeed would have produced hydrocarbons, but he never admitted this error nor corrected it. He probably knew that doing so would have torn a hole in his thesis.

Nobody likes having their work criticized, and social scientists are no different. However, resistance to informed criticism is probably the norm rather than the exception. Some of this is warranted because much of what passes for criticism in the social sciences is not directed at issues such as falsifying evidence or logically flawed arguments. Rather, it is based on politics and personal tastes. For example, in the late 1980's Norman K. Denzin, who was then President of the Midwest Sociological Society, gave a talk before a large audience at the annual meetings of the American Sociological Association. In that talk he forcefully attacked "rational choice theory," or at least his cartoon-like characterization of that theory. He declared it to be "a monster that must be destroyed." He did *not* say that there are logical flaws in the theory, or that it has failed in tests of its predictions, or that there are more parsimonious alternatives that subsume rational choice theory and go beyond it. His reason for denigrating the theory was that it fails to address phenomena that Professor Denzin personally believed to be important such as "lived experiences." It may not be so shocking to realize that a man would use the status and authority of his position to denigrate a theory on invalid grounds while promoting his own interests. More surprising was that so many in that large audience applauded. It seems that there are significant numbers of sociologists for whom theoretical claims about social phenomena are to be accepted or rejected based on the rhetoric and idiosyncratic tastes of a pseudo-authority. (Denzin clearly did not know "rational choice theory" even well enough to understand that it is an umbrella term subsuming a variety of theories and theoretical styles.) It is entirely justified for anyone working under the rubric of rational choice theory to ignore this kind of criticism.

On the other hand, there are criticisms on the basis of which sociological (and other social science) theories should be revised, but usually are not. Most commonly a critic will identify one or more empirical instances for which a given published theory appears to generate a false prediction. Common response strategies include declaring the evidence to be irrelevant, or contending that the critic does not understand the theory, conveniently failing to recognize that *nobody* could possibly understand the theory.

In science, theories must be stated in ways that allow qualified members of the theorist's discipline to understand their meaning and perform appropriate tests if they choose to do so. This requires a great deal of clarity and explicitness. When clarity and explicitness are lacking, others will interpret the theory in ways not intended by the author, and perform tests that the author never anticipated. No one, not even the author, is then in a position to say that his or her interpretation is the only correct one. The burden is on the author to prevent misinterpretations by sincere critics, not to simply dismiss them as having misinterpreted the theory.

COMMON SENSE AND SCIENCE SENSE

As specialized repositories for systematic observation and analysis, scientific theories actually are far more mind-expanding than any personal experience. They have tremendous power to help us understand things, but they do not come cheap: They take a lot of time, resources and care to develop. The process of *doing* science includes built-in mechanisms which guarantee that, if theories are treated properly, they will only improve with time. In a sense, theories *learn* and get *smarter*. They improve in their ability to explain and predict broader classes of events in finer detail with increasing precision. Some scientists employ these "built-in mechanisms" in a very self-conscious way. Others simply follow blindly the procedures and norms they learned during their years in training. Either way, to the extent that they adhere to those procedures and norms, the theories and the predictions they spawn tend to get better and better over time.

We have looked at criteria for identifying pseudosciences as a way to discuss what science *is*. Another way to do this is to contrast scientific knowledge with common sense knowledge. It is our contention that much of what passes for theory in the social sciences differs little from common sense in its formal properties. Of course, common sense is often very astute, so this is not necessarily a bad thing. In the case of pseudosciences and popular beliefs in pseudoscience, however, we already have seen that common sense does not provide critical thinking tools for properly adjudicating between good claims and bad claims. Therefore, in much sociological theory as in common sense, an entrenched inattention to critical thinking tools may promote sloppy thinking and the acceptance of inferior theoretical products. If we are sincere about wanting to develop an ever-improving understanding of the world around us, then we are obliged to care deeply about these issues.

In what follows we first characterize "science sense" in broad strokes, followed by a look at some of the characteristics of common sense that contrast with scientific sense and that can lead to inferential failures.

Science Sense

In the world of science, theories are special. They are a unique type of explanation—one that comes with rules that allow others to *collectively evaluate* the theory via the empirical claims that it generates. Theories are the focus of claims, counter-claims, tests, replications, and revisions. No important theory lies dormant for long as good scientists see it as their duty always to be improving upon existing knowledge.

In society at-large, common sense typically regards "theories" as one of two things: (1) guesses about something that we do not understand fully, or (2) sets of prescriptions for correctly performing difficult and complex tasks. In the first case, we may hear the word used by a police detective who has a "theory" linking a shady suspect to a vicious crime, or one friend may offer you his "theory" about why another friend goes to so many parties. We have heard play-by-play announcers for baseball games propose theories of why certain players go through hot and cold spells. Substitute the word "guess" for "theory" in these examples and there are no changes in meaning.

In the second common use of the term, chronic gamblers frequently develop elaborate and worthless "theories" for beating the odds in various games of chance. These bear a closer resemblance to superstitions and delusions than to scientific theories. Another example of this commonsense type of theory occurs when a writer attempts to add the trappings of legitimacy to the title of a "how-to" book, as in *Golf: Theory and Practice.*

It goes without saying that we are not using the word "theory" in these informal ways. It is not that such uses are improper. Rather, these are common sense meanings of the word, whereas the scientific meaning is much narrower and more specific. Here is a suitable working definition for "scientific theory" (still "theory" for short):

> A theory is a set of explicit, abstract, rigorous and logically related statements that explains or predicts a general class of phenomena within a prescribed domain.

In contrast, much pseudoscience, most non-science, and a good portion of social science theorizing is essentially nothing more than *elaborate* common sense. It is different from *simple* common sense in that it is usually impenetrable to non-social scientists and difficult to comprehend even for many within these fields. It is frequently characterized by its array of esoteric terms and the absence of any glossary for the uninitiated.

Common Sense

The dictionary definition of common sense typically is something like "natural good judgment." Think of it as a storehouse of knowledge about common things—objects, events, and relationships among those objects and events—that individuals and their cultures build up and utilize on a regular basis. One could question how "natural" it really is, given that "good sense" varies cross-culturally. And just how "good" the judgment really is could only be known from the results of testing common sense, and often that is not done. Still, common sense gets us through the day. Without it the world would seem incoherent and unpredictable, and we could not survive without help from others who happen to possess some of it. So in general, common sense is a very good thing to have.

Marvin Minsky characterized common sense this way in *The Society of Mind:*

> Common sense is not a simple thing. Instead, it is an immense society of hard-earned practical ideas—of multitudes of life-learned rules and exceptions, dispositions and tendencies, balances and checks.

Whereas Minsky emphasized a storage warehouse image of common sense, in *Gödel, Escher, Bach,* Douglas Hofstadter emphasized its dynamism:

> [Common sense is a] capacity that has to do with fluidity in representation of concepts, an ability to sift what is important from what is not, an ability to find unanticipated analogical similarities between totally different concepts.

So common sense helps us find patterns across different situations, patterns we are better off recognizing than overlooking. Again, both perspectives emphasize that common sense is a very good thing to have.

On the other hand, common sense has its limitations. There are many questions that are never asked of it, and many aspects of reality that it is never called upon to address. Also, many of the answers that it provides are accepted without any critical examination. For some purposes that involve acquiring knowledge about the world, common sense is just not adequate. Worse, it is most often employed unconsciously, and its foibles never recognized as such.

Some influential philosophers of science believe that it is possible or even advisable to begin the scientific theory-building process from common sense foundations. They look at science as a process of elaborating and refining common sense. This does not imply that common sense and theories are the same thing, of course. It means common sense may be a reasonable and desirable starting point. We are not so convinced. First, common sense is not a *necessary* starting point for theories. Recall that at the stage of theory development, pretty much *anything goes.* Second, starting from a common sense perspective may handicap theory development by locking us into preconceived worldviews that are functional but naive. This may be apocryphal, but it has been reported that Albert Einstein lacked many kinds of common sense. Because he labored under an absence of certain common preconceptions about reality, the story goes that he was less mentally encumbered than the rest of us and better able to see reality in a novel way that ultimately proved to be superior.

Be that as it may, this discussion inexorably leads us to two important questions: "What is the difference between scientific theory and common sense?" and "How does scientific theory improve upon common sense?" These questions are especially relevant for social scientists. When the general public reads or hears about our research findings, often they accuse us of expending valuable resources only to restate the obvious. The findings seem to have been predictable using *nothing more than common sense!* The result is a seething resentment toward social scientists for using hard-earned tax dollars to support research projects that tell us nothing beyond what we ostensibly knew already through common sense alone.

Is common sense really so powerful that it may substitute for a substantial body of social and behavioral research? Some research most certainly does conform to common sense expectations, but it would be quite a leap to then presume that common sense could replace research. Ironically enough, cognitive psychologists have conducted research that has addressed the question of how accurate common sense is when it comes to predicting research findings. Contrary to common sense, the results clearly indicate that common sense is *not* a good substitute for theory and research. Studies have shown that *after* people know a particular research finding, they presume that it was highly likely and convince themselves that they "knew it all along." This is called the *hindsight bias*. (Compare this to the way we can make horoscopes seem to "fit" events in our day-to-day lives.) In fact, when it comes to predicting the outcomes of experiments *before* their results are known, observers' powers of common sense turn out to be not much better than blind guessing.

Common sense is often defined as "that which most everyone believes to be true." So, most people think that if a sufficient number of other people believe in something, then they are justified in holding that belief. Logicians call this the *strength in numbers fallacy*. In general, it fails to provide solid grounding for arguments. Throughout history, numerous popular beliefs both major and minor have proven to be false or unverifiable, even when convictions in the belief were widespread and absolute.

For science and in general, this is a good rule:

> The more important it is for a claim to be true, the more strongly it should be supported by theory and evidence.

The fact that many people believe in something does not mean that it has strong theoretical and empirical support, just as having many disbelieve a claim does not make it false. Through nearly all of human history, everyone firmly believed that the world was flat, virtually without negative consequences for anyone. Eventually, however, it became extremely important to be right about this belief as navigation over greater distances demanded more accurate theories and methods for moving about on the earth's surface.

Some philosophers see no strict dividing line between science and common sense, but still can pinpoint several differences. For example, common sense is often accurate, even while the reasons given for its accuracy are false or unknown. This situation may be fine for common sense purposes, but much less tolerable in a scientific theory. Members of some isolated group may know that the sun will rise at 6:12 AM tomorrow morning. But they also may "know" that sunrise occurs at the same time everywhere on a flat and stationary earth. That is a good example of how common sense can be pragmatic but not explanatory. It can be very useful to know when the sun rises and sets, even if you have no clue as to how it does so. For the purpose of developing general theory, however, the existence of flawed premises will quickly undermine the effort.

There are other points of distinction. For instance, scientific theories try to organize and classify what is known on the basis of small numbers of general principles. In contrast, common sense accumulates without such constraint and tends to get messy. Furthermore, scientific theories attempt to explicate the underlying mechanisms of phenomena and how they are affected by prevailing conditions. Common sense, on the other hand, works best when prevailing conditions are constant because it cannot systematically incorporate those conditions in its descriptions and prescriptions.

For these reasons and others, a common sense approach—or any approach that falls short of scientific theory—stands an excellent chance of failing when it attempts to acquire knowledge about complicated phenomena. Scientific theories are designed to overcome precisely these limitations.

What's Wrong With Common Sense?

Following is a partial list of problems with common sense approaches. It is not meant to imply that common sense is always flawed in these ways, or that scientific theories never have such flaws. We would claim that common sense is *much more often* flawed in these ways—sufficiently more often that it is bound to cause problems for explanation. Furthermore, common sense has no built-in defenses to protect itself against these problems, whereas the scientific method includes techniques for rising above the foibles and fallacies of common sense. In fact, the scientific approach arguably is the most efficient and successful method known for accomplishing this.

Common Sense Explanations Can Be Circular. In a circular explanation, that which is to be explained appears as part of the explanation, often in a disguised form. A simple example appears in the following exchange:

> *Alice*: "Do you believe in God?"
> *Byron*: "Yes."
> *Alice*: "Why do you believe this?"
> *Byron*: "Because the Bible says He exists."
> *Alice*: "Why do you believe what the Bible says?"
> *Byron*: "Because it's the word of God, of course!"

If one asserts that the Bible is "the word of God," this presumes a belief in God's existence. However, it was that very belief which was supposed to have been justified by the argument for which "The Bible is the word of God" was offered as a justification. *The argument depends on the claim that it was supposed to validate.* Usually circular explanations are much more difficult to identify than this one. The circularity can be buried under layers of discussion, or thinly spread across hundreds of pages, or obscured by subtle changes in the words that are used. Also important is the fact that the conclusion of a circular argument can be either true or false. Circularity in the God-and-Bible argument neither justifies nor refutes belief in God. In general, circular arguments are *irrelevant* to whatever it is that one is trying to assert. They have no bearing one way or the other.

In everyday discourse, however, circular arguments tend not to be examined so carefully. They may thus *seem* very compelling to the uncritical listener or reader. Usually that is enough to convince someone, even though such arguments are invalid.

Scientific theories use several methods to help guard against circularities. These include *(i)* adopting a formal language involving logic or mathematics to organize and check their statements, *(ii)* using as few terms as possible and making them as unambiguous as possible, and *(iii)* having others critically evaluate the theory. A formal language guards against circularities by making them immediately evident and defining them as problematic. Minimizing the number of terms used to express a theory simplifies its analysis and, again, helps to make circular statements more evident. Having the theory critically evaluated by others—especially *skeptical* others—is a powerful method for locating problem areas and often leads to suggestions for remedies.

Common Sense Explanations Can Be Ad Hoc. An *ad hoc* explanation is developed to account for a specific observation. Because it is based on a small sample—usually a single case—the *ad hoc* explanation tends to ignore factors that may be relevant to the observation and others like it. For example, a sexual assault may be "explained" by a so-called "blame-the-victim" form of argument: "I'll bet she was dressed provocatively." "She probably wandered into a neighborhood where she didn't belong." This *ad hoc* reasoning ignores many factors that may not be apparent to the casual observer. The location of the assault may have been irrelevant; the attacker may have been stalking the victim for weeks; the victim may have been dressed conservatively; the attacker may have a history of violent criminal activity. The *ad hoc* explanation ignores larger patterns of which the particular event is but a part, and ignores particulars that are not consistent with the explanation. *Ad hoc* explanations are attractive as tools of common sense because they give us a feeling of security and control—the feeling that we understand life's complexities and so can choose to seek pleasant outcomes and avoid the harmful ones. Common sense says that one may avoid sexual assault simply by dressing conservatively. Common sense contains many myths.

In science, *ad hoc* explanations frequently are offered as provisional explanations for anomalous findings—that is, for unexpected observations. At the same time, they also are widely recognized as *provisional* explanations, practically useless in and of themselves. They may eventually prove fruitful by motivating the development of alternative theories and new directions for research. Until that time, however, *ad hoc* explanations take us no further than the observation for which they were concocted, and most fail to pan out.

Common Sense Explanations Can Be Particularistic. The scope of common sense is often limited to particular times, places and things. Usually this is not a problem. It is very useful to be able to anticipate a friend's responses to your words and actions, or to know how your car behaves on wet roads. Most of us also have deep interests in certain worldly events, and so we turn to journalists who, as part of their jobs, obtain as much information as they can pertaining to specific occurrences. But when the goal is to gain knowledge that can apply to times, places and things beyond the immediate, a particularistic approach is self-defeating. For instance, no amount of detailed information about the workings of the board of directors of a particular company on a particular day could by itself increase our theoretical knowledge about group decision-making. As a matter of fact, the more detailed our information about this particular group, the less likely it is to bear a resemblance to any other group.

Following the lead of Bernard P. Cohen in *Developing Sociological Knowledge,* let us more carefully distinguish two types of approaches to gaining knowledge: the particularizing strategy and the generalizing strategy. If we accept that the construction of *general* theories is a goal of science, then particularizing approaches do not provide much benefit. There is quite widespread use of the particularizing approach in the social sciences. It may take the form of an "ethnography" or "case study" of a given organization or group, or it may appear as a collection of relatively unorganized, concrete, and common sense propositions about social behavior. Again, the problem boils down to just this: The greater the depth of knowledge acquired with regard to any particular phenomenon or entity, the less the degree to which that knowledge will apply to anything else. This runs counter to the goal of developing general knowledge.

In contrast to a particularistic focus, theories are designed to be generalizable. Abstractness, and a focus on underlying mechanisms, are the qualities that allow this. Ironically, common sense tells us that abstractness is a *bad* quality because it implies detachment from reality. To be sure, a theory with no connection to reality is not going to be of any use in explaining real events. However, total concreteness—the other extreme—would prevent any generalization beyond the case at hand. So good theories are abstract, but in a way that is designed to allow them to connect to real phenomena. This is what lets a theory explain a potentially unlimited number and variety of events.

Common Sense Explanations Succumb to the Post Hoc *Fallacy.* This may be the most serious problem with common sense explanations, but one of the easiest to overcome using standard scientific procedures. The *post hoc* fallacy is the claim that event A caused event B because B followed A. All animal species, humans included, are physiologically wired to learn by recognizing *temporal contiguities.* These are events that follow one another rather closely in time. We recognize the temporal contiguity and infer from it that the earlier event caused the later one. This inference of causality is oftentimes valid: Lightning does cause thunder, and a wound does cause pain. Sometimes, however, our programs backfire and we make false inferences. For example, most children have had the feeling that they can make a red light turn green just by concentrating on it. Even adults can be taken in by such contiguities. Many millions of Americans believe that all sorts of phenomena, from crime waves, to hospital emergency ward admissions, to losing car keys, are caused by full moons. Study after study has found no such effect, but it still seems very real to those who believe in it.

The logic of scientific theorizing and testing cannot fully prove that a causal relation exists between events A and B. However, theories can generate hypotheses that should hold up under the most rigorous testing if the events indeed are related causally. Statistical techniques are then applied to determine whether those observed relationships are unlikely to have been due to chance alone. To use the example just mentioned, many people believe that increases in crimes, natural disasters, and other phenomena are associated with the full moon. Instead of considering that there is no theoretical basis for the belief, or checking to see whether these phenomena occur more frequently during a full moon than expected by chance, believers tend to ignore the lack of any theoretical or statistical basis. Instead they may base their belief on what others have said or on a "gut feeling," or perhaps they can even recall unusual events that occurred around the time of a full moon.

Common Sense is Fooled by Surface Features. A good example of this is the formation of first impressions. We quite easily formulate hunches about the deeper aspects of acquaintances' personalities, often based on very limited information. Because we feel confident about these impressions, we rarely check their accuracy no matter how ill-informed they may be.

Another example is that, when facing something mysterious or unknown, our tendency is to attach a great deal of weight to the first explanation that we hear. People often accept any scenario that appears to account for the surface features of a complex phenomenon. A related problem is that sometimes we take the *lack* of a known conventional explanation to support an unorthodox explanation—the so-called *argument from ignorance,* another common fallacy. For example, a newspaper in upstate New York reported that citizens and scientists alike were at a loss to explain colored lights in the evening sky over a certain small city. Members of a state UFO-enthusiast network, questioned by the press, announced that this inability to identify the lights provided further evidence that the earth is under surveillance by alien life forms. The failure to account for the unidentified objects, however, does *not* increase the likelihood that they are the spacecraft of alien visitors. "Unidentified" means *unidentified*, not "alien." In this case, the "UFO" turned out to be a hoax perpetrated by a local group of small airplane enthusiasts who put lights on their planes and flew in formation at night. In general, there is no scientific shame in having insufficient data to draw conclusions. The only shame is the overly zealous promotion of speculations whose *only* merit is an ability to weave surface features of phenomena into a whimsical fabric.

Common Sense Allows Contradictions. A contradiction says that something is both true and false at the same time. This is impossible unless one distorts the meanings of "true" and "false" beyond recognition. When friends are separated, we may want to predict whether their relationship will strengthen or weaken. Two famous sayings, part of our culture's storehouse of common sense adages, suggest contradictory outcomes: "Absence makes the heart grow fonder," and "Out of sight, out of mind." Each statement seems sensible enough, but both cannot be true simultaneously without introducing reinterpretations and changes. Still, neither piece of folk wisdom is likely to be removed from our store of common sense, despite the fact that together they tell us that separated friends' relationships will grow stronger *and* weaker. In science, if we wish to know whether or not "y" will follow "x," it is altogether unsatisfying to be told that "if x occurs then y will follow and y will not follow." Also, note that if somebody conducted a study to see what happens to friends or lovers who have been separated, then whatever the result of that study, someone is sure to come along and point out that common sense predicted it all along! What this critic will fail to mention is that common sense also predicted the opposite result. With a little elementary logic, one can actually "prove" any ridiculous statement you can imagine to be true—that is, *if* we allow a contradiction into the explanation. Contradictions lead to absurdities, and that is why we have to take care to exclude them. Theories guard against contradictions by adopting logical frameworks to help locate and eliminate them.

Common Sense is Under-conditionalized. A condition is a phrase that places constraints on a statement. "Grass is green." is an unconditional statement. To it we could add "if properly irrigated and warmed in the spring" as conditions. When common sense tries to reach beyond particulars in search of generalizations, such as with "absence makes the heart grow fonder," often it does so unconditionally. That is, the conditions under which the claim applies either are not considered or are left unstated. The unintended consequence is that this virtually ensures the statement will be false.

Even before taking our first science class we learn that water freezes at 32 degrees Fahrenheit, an unconditional statement. What a rude complication it is to then learn in class (or by observation) that water in a pond can freeze *before* water in the river that feeds it, and that ocean water can be much colder than 32-degrees without forming any ice! The actual freezing point is conditional on such factors as the purity of the water, its flow rate, and the barometric pressure. Notice that just because the statement is conditional does not prevent it from being general. The statement applies any time, any place, to any vessel of water, *if* the appropriate conditions are satisfied. A "universal conditional" claim is true in a potentially infinite number of times and places.

Conditionalization adds precision to theoretical claims and prevents their application to phenomena outside of the intended purview of the theory. Another benefit of conditionalization is its capacity to resolve apparent contradictions. For example, it may be reasonable to claim that for two people who have regular face-to-face contact and positive evaluations of one another, "physical separation increases emotional attachment" *under the condition* that the relationship has progressed beyond the level of an acquaintanceship when the separation takes place. The effect of separation may be claimed to be just the opposite under the condition that the relationship has not progressed beyond this critical stage. Both statements can be true simultaneously, without fear of contradiction.

Common Sense is Poorly Tested. It is far easier and more psychologically satisfying simply to believe that we are correct about something than it is to carefully test our beliefs and risk being wrong. This is not to say that we ought to test every opinion we hold, every observation we make, or every statement we utter. Much of what we believe, observe and say is based on common sense at its practical best. Little would be gained, and much time and energy lost, by subjecting this knowledge to systematic examination. Nevertheless, we should not be surprised to find that common sense errs from time to time. If we are honestly concerned with the truthfulness of particular explanations and beliefs—especially those we hold most dear—and with the possible consequences of acting on their behalf, then testing is the best way we know to verify those beliefs, to eliminate false alternative explanations, and to resolve differences of opinions.

Systematic testing is part of a method for improving upon untested common sense. This is because we may legitimately attach more confidence to claims or beliefs that have survived direct attempts to disconfirm them than we would attach to those that have not been so tested.

Common Sense Promotes Subjective Validation. Subjective validation is a method that we all use to verify our beliefs. It is a form of non-systematic testing that involves accepting evidence that supports a belief, and ignoring neutral or unfavorable evidence. Whatever the source of a belief, and however outlandish it may be vis-à-vis the facts, subjective validation can allow it to flourish by fostering a false sense of validity.

In the example of belief in the "full moon effect," once you have in mind the possibility that moon phases affect behavior, your attention is drawn to those events that can be interpreted as supporting the belief. Quite often this involves granting a good deal of latitude in those interpretations. A rise in ER admissions a few days prior to or subsequent to the full moon may be interpreted as evidence for an effect, as might reading about a moderate earthquake in Europe, a hefty drop in the Dow Jones Industrial Average, or a riot involving ardent fans at a British soccer match. During other lunar phases, the believer simply does not realize how often these events occur or whether they also occur as regularly during other moon phases. Around a full moon, virtually any non-ordinary event may be interpreted as caused by the moon. Overlooked is the fact that in the long-run such events actually occur independent of lunar phases.

Many people can recount experiencing something in a dream that later came to pass, and so believe that dreams are capable of foretelling the future. For example, some have reported dreams in which a certain loved one dies, followed soon thereafter by his or her actual death. In fact, such dreams turn out to be fairly common, especially when the loved one is elderly or ailing. We also tend to be unaware of the fact that the contents of the vast majority of our dreams are *not* played out in reality, and that we are prone to fill in many of a dream's details long after awakening. Still, the coincidence of a dream event and a real event can have such a powerful emotional impact that the subjective validation of a dream's ability to foretell the future follows almost inevitably. In this example, the belief is usually harmless. Unfortunately, however, subjective validation is also at the root of many harmful beliefs and perceptions. The same mechanism that allows us to validate unfounded beliefs about dreams or moon phases also permits us to hold onto harmful and false beliefs such as racial and sexual stereotypes. It also leads to a misplaced faith in our own or others' abilities to make accurate judgments under complex or ambiguous circumstances.

Scientists are humans too, and often they engage in a process of subjectively validating their theories. While the theorist may find this sufficient to convince himself of the truthfulness of a theory's claims, it should never be sufficient to convince others. A theory's tests must survive the careful examination of skeptics before it can ever be generally accepted in a field,. These skeptics are duty bound to point out when a test is too weak to rule out alternative explanations. Subjective validation fails as a theory-testing method precisely because it systematically ignores information that would suggest alternative explanations for observed phenomena.

Common Sense is Unorganized and Vague. Common sense is unorganized because it lacks a system for keeping track of what is known already, the amount of evidence backing that knowledge, and how existing information can be used to garner further knowledge. The difference between the ways that common sense and theory are organized is something like the difference between a long list of independent sentences versus a book in which sentences are organized into paragraphs, sections, and chapters. Long, unstructured lists are extremely inefficient storehouses for knowledge. In constructing new theories, a great deal of attention is paid to the theories already existing, the kinds of evidence offered for them, and how they can be improved by making them simpler, more compact, and still as accurate and comprehensive as possible.

Common sense is vague in the sense that definitions for its terms are ambiguous. What do we really mean when we say that someone has a "good personality," a "strong will," or a "mean streak"? What are we actually talking about when using the ideas of "power," "status," "love," or "justice" in everyday discourse? If you and nine of your friends wrote down definitions for each of these terms, chances are you would end up with ten different meanings for each. This is a problem because explanations— scientific or common sense—can only be of use if we first agree on the meanings of their terms.

In theories, it is perfectly reasonable to assume that there is no absolute, "true" definition for a particular idea or term used in the theory. Instead, the theorist will try to ensure accurate communication by stating exactly the meaning that he or she intends to communicate. This is done by including definitions for key terms as part of the theory. Then it is possible to have the term "injustice," for example, defined in one theory as "the violation of objective allocation standards," and in another theory as "the emotional response to the perception of mistreatment," without implying that at least one of the definitions must somehow be wrong.

To sum up, scientific theories provide a means of improving upon common sense. They open new worlds of knowledge where common sense tends never to venture. They are able to do this by employing methods that are designed to eliminate circularities and contradictions; by striving toward abstraction and conditionalization; by probing below the surface characteristics of phenomena; by organizing and structuring knowledge in a way that promotes testability, depth, breadth and precision; and by using clearly defined terms whose meanings may be communicated accurately, thus facilitating the continuous refinement and expansion of the theory containing those terms.

All this may seem a tall order for something so ephemeral as a theory, especially for those theories attempting to deal with human social behavior. In fact, theories can do all this and more, but only at a price: Building theories is a slow, painstaking process, and the job is never finished. Even so, anyone who has taken part in the process knows that the benefits far outweigh the costs.

SCIENTIFIC THEORY CONSTRUCTION

The final section of this chapter will provide a short primer on theory construction, including an illustration of a small, well-formed theory. At various points above we emphasized that theories are essentially arguments with transparent logic and well-defined terms, and so the method for theory construction promotes these qualities. When successful, these modest little devices meet all the requisites for the scientific orientation outlined in the first section. Whether or not their formal properties are then taken seriously by an intellectual community determines their status with respect to the demarcation criteria discussed in the second section. Their ability to evolve by capitalizing on the constructively critical efforts of a community of scientists is what elevates theories beyond common sense, as discussed in the third section.

The "Ideal" Theory

First, it is important to re-emphasize that it is not easy to build a good theory. There is no such thing as an "ideal theory" *per se,* however some methods are better than others when it comes to constructing a theory, and some theories are better than others insofar as their formal properties. For instance, if for no other reason than easing their readers' workloads, theorists should always try to reduce the number of terms and statements in their theories to a minimum. Also, for the sake of science, theorists should strive to maximize the depth, breadth and accuracy of the theory's applications. This is not something that is accomplished on the first pass. Rather, it demands lots of tries, lots of careful analysis, and lots of revisions. Revisions may be introduced as a result of examining how well the theory fits the evidence—the *empirical analysis* of the theory. However, even before gathering empirical evidence it is important to conduct *logical* and *terminological analyses.* We cannot do full justice to these kinds of analyses in this short space, but we will try to impart a sense of their purpose and some directions for further information.

To illustrate the method we will first lay out a pared-down interpretation of Balance Theory, an early and influential theory in social psychology. Since this is for illustrative purposes, we do not try to encapsulate the entire theory, and we most certainly do not attempt any sort of empirical analysis. Even so, all of the key elements are present and their functions are as clear as can be.

Balance Theory

Metatheory. It may be a bit misleading to discuss "metatheory" under the "Balance Theory" heading because technically metatheory is not part of the theory. Literally, metatheory means "after theory," in the sense of discussions *about* a theory that take place after the theory has been written down and disseminated. In practice, metatheory usually means any kind of discourse about a theory, whether it occurs before, after, or as part of a theory's exposition. This may include information on the theory's history, sources of inspiration, dead-ends that have been abandoned, ideological positions, empirical illustrations, methodological recommendations, and so on. In contrast, a well-formed theory contains a relatively small number of specific, interrelated parts, described below. Unfortunately, it is all too common in sociological writing to blend theoretical and metatheoretical discourse to the point where it is impossible to distinguish the two. We strongly advise against this style of theorizing, if for no other reason than the fact that we need to know what statements are part of the theory because those are the ones that are being offered as testable assertions. Metatheory is generally too vague and impressionistic to be testable, but this is not problematic as long as it is not being offered as testable theory.

A brief metatheoretical statement on Balance Theory might go something like this:

> We are comforted by the knowledge that we agree with our friends' opinions, especially when it comes to how we feel about particular other people. This is the source of the expression "My friend's friend is my friend; my friend's enemy is my enemy." At the same time, its not always the case that everyone can agree on everything. Sometimes we like a person whom we later discover is disliked by one or more of our friends. And sometimes we dislike someone that a close friend turns out to like very much. Such

> realizations create in us a certain sense of discomfort, and when possible, we do what we can to change this situation. Can one predict the conditions under which this sort of social discomfort will occur? If it does occur, can we predict how the situation may be modified to reduce the discomfort?

The remaining subsections contain all of the necessary components of Balance Theory: *Primitive terms* is the set of undefined terms on which a theory is built. If every term in a theory had to be defined, then every term in every definition also would have to be defined. Unless the terminological system was circular, this situation would lead to an "infinite regress." Instead, certain terms are artfully chosen such that it is safe to assume they will be understood by the theory's intended audience. These become available for use in other parts of the theory. *Defined terms* are given meaning by virtue of definitions that consist of primitive terms and/or previously defined terms. *Scope conditions* are statements that indicate the conditions under which the theory is deemed to be applicable. *Assumptions* are the core assertions that compose the theory's logical argument. Finally, *derivations* are conclusions that may be logically drawn from the theory using the assumptions and the rules of logic. Importantly, the terms, scope conditions, assumptions and derivations of a theory are all abstract and general. That is, they do not refer to specific, concrete, empirical entities. They are expressions of ideas constructed for theoretical purposes. Recall the "lens" metaphor: Theoretical ideas provide lenses *through which* we can look at not one, but a range of empirical phenomena, from various angles that may differ from our common sense perspectives.

This formalization of Balance Theory (right) required some interpretation of Fritz Heider's less formal original version, and others would be likely to interpret the original in different ways. The point here is that the core of a major social psychological theory has been reduced to a single page. All terms and statements have been laid bare, making them much easier to discuss, modify, test, and build upon. The only part of the theory that is not shown here is the underlying "logical calculus" that provides the rules for pulling valid derivations out of assumptions. A number of such rules can be borrowed from the logician's tool kit, but here it was sufficient to use one of the simplest—the same *Law of Hypothetical Syllogism* that we discussed near the beginning of this chapter.

Primitive terms, defined terms, scope conditions and assumptions, along with a logical calculus, are all that one really needs to construct a theory. These elements work together as parts of a system, each playing an essential role. Without terms, there can be no statements. Without definitions, we cannot share meanings of terms or statements with others. Without statements, we cannot express our ideas about how some things cause other things to happen. Without scope conditions, we would be unable to locate contexts appropriate for applications of the theory.

The astute reader may recognize some flaws in this formalization of the Balance Theory. For instance, there are some terms that appear as if out of nowhere, and the assumptions may not always form a seamless argument chain. It is also questionable whether Heider would endorse some of our interpretations of his original work. He is no longer alive, and so we can never be sure. However, anyone is free to develop their own alternative interpretation. Differences among various interpretations ought to have different implications when it comes to testing the alternative theories. The version that fares best under rigorous empirical testing would be the version that is provisionally accepted.

BALANCE THEORY

Primitive Terms

actor, object, evaluation (positive or negative), **situation**

Defined Terms

attitude: an actor's evaluation of another actor or object
sentiment relation: an actor's attitude toward another actor or object
unit relation: the association or dissociation of an actor with another actor or object
balance: the presence of zero or an even number of negative relations among two or three actors
imbalance: the existence of an odd number of negative relations among two or three actors

Scope Conditions

The theory applies in situations where, from the standpoint of an actor p, there are

1. one or more other actors in the situation
2. face-to-face interaction
3. some elements linked by sentiment or unit relations
4. all status equals
5. all positive self-evaluations

Assumptions

1. If the situation is balanced, then the situation will remain unchanged.

2. If the situation is unbalanced, then actors will experience stress, strain, or discomfort.

3. If actors experience stress, strain or discomfort, they will attempt to change relations so that the situation becomes more balanced. (If there are impediments to such change, then there will be continuing stress, strain and discomfort.)

4. If actors attempt to change the situation, they will seek to change their own relations to others, then others' relations toward themselves, then others' relations toward others.

Derivations

1. (From Assumptions 2 and 3.) If the situation is unbalanced, then actors will attempt to change the situation.

2. (From Assumptions 2 and 4.) If actors experience strain, and if they cannot change their own relations to others, then they will seek to change others' relations toward themselves.

So far we have side-stepped an important question: How can we test a theory if all of its terms are abstract and thereby disconnected from reality? The key is to build the theory in such a way as to make those connections as clear as possible to intended readers. In the case of primitive terms, it is assumed that the audience members possess *tacit knowledge* which links the terms to empirical phenomena. For example, when Balance Theory uses the primitive term "actor," social psychologists know that they can "operationalize" or "instantiate" this term as "laboratory subject" or "survey respondent" or "student in classroom," depending on their chosen research setting. For defined terms, the definitions provide guidance for identifying empirical cases—the better the guidance, the better the definition. For example, a social psychologist interested in field research on family dynamics may operationalize "unit relation" as "married couple," if such an empirical case indeed appears to meet the requirements of the abstract definition. In this way, the assumptions and derivations of the theory can all be *translated* into empirical terms. This, in turn, allows the researcher to formulate *hypotheses* that apply to actual events in the empirical world—the world of laboratories or surveys or field research. In the case of Balance Theory, the hypotheses would predict for a specific group of actual people connected via a specific configuration of relations, which if any of those relations would be expected to change in particular ways.

CONCLUSIONS

We began by delineating the principles of scientifically oriented theorizing. Scientific research is geared toward developing and evaluating explicit, testable theories. Well-constructed scientific theories illuminate the complex social world via a relatively small and simple package of ideas. They combine carefully defined terms into statements, and combine statements into logical arguments. Arguments are then tested with empirical evidence to assess their power to explain phenomena in the world. Theories are specifically designed to avoid many of the problems that plague common sense understandings and pseudoscientific reasoning.

There is a gray area between science and pseudoscience, however there are several demarcation criteria to help navigate these borderland regions. Pseudoscientific theories tend to be anachronistic, continuing to be supported even after dozens of tests provide evidence to the contrary. In addition, pseudoscientists often fail to revise their work in light of informed criticism. However, should a scientific theory fall short in explaining what it purports to explain, the norms of the scientific method compel theorists to resolve even the slightest discrepancies, ensuring that theories only get better, not worse, over their lifetime. Theories concentrating on the explanation of anomalies and spurious associations also tend to be pseudoscientific. The type and nature of the evidence provided to support a theory can also be an indicator of its (non)scientific roots. Grab-bag evidence or untestable claims are red flags that an explanation is pseudoscientific.

In many important ways, alternative approaches to understanding the world fall short when compared to scientific theorizing. While we recognize the rightful place of common sense knowledge in our daily lives, such reasoning cannot substitute for scientific theory. Arguments based on common sense run the risk of being circular, *ad hoc*, particularistic, *post hoc*, superficial, contradictory, under-conditionalized, untested, subjectively validated, unorganized, and vague. But common sense need not be abandoned. Theories provide a method for improving upon our common sense inclinations. The foundations of the scientific method prevent self-contradiction and eliminate circularities. Furthermore, the language employed in theories eliminates vagueness and ambiguity, allowing for objective validation through rigorous empirical tests.

After outlining the benefits to sociological knowledge that can be attain via scientific theorizing, we would have been remiss not to explicate the essential characteristics of sound theories. Primitive terms, defined terms, scope conditions and assumptions, along with a logical calculus, are the fundamental building blocks for a formal, scientific theory. The terminology in a theory must be well communicated in order to avoid misinterpretations and nebulousness. Well-defined terms lead to the creation of explicit assumptions, denoting causal relationships. Scope conditions then dictate the situations in which the theory does and does not apply. Putting these pieces together under a logical calculus, such as mathematics or sentential logic, protects the theory from contradiction. A clear theory can be easily translated into empirical terms, allowing for the formation of hypotheses to be tested via the laboratory, field research, surveys, or other methods.

The scientific approach to building theories offers a framework for determining the logical and empirical truthfulness of statements. However, despite our attempts to provide a "cookbook" for theory building, the process is not an easy one. Building theories is an arduous task. However, we believe that there really is no option as to whether or not to use theories. The process of creating, testing and re-testing our theories will lead to more confident assertions about the causal mechanisms at work in a wide range of group processes.

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