Chapter 1

The Legacy of Positivism in Social Research

Social scientists at the present time work in social environments reflecting vibrant perspectives about the nature of knowledge and diverse opinions about what constitutes good research, but this generative landscape is quite a recent phenomenon in history. The positivist paradigm—once considered the "gold standard" of research—dominated social inquiry until at least the second half of the 20th century, when "the definition of research was clear, the standards well specified, and the methods agreed upon" (Paul, 2005, p. 1). In the years that followed, those standards gave way to the development of diverse paradigms and approaches that characterize research terrain today. Although positivism no longer holds a prominent position in the philosophy of science, its influence lives on in the general public's understanding of research, science, and knowledge and in some of the language, assumptions, and practices of contemporary social inquiry.

This chapter considers a few questions: What is positivism? How did it come to prominence? What led to its fall from its dominant position as a philosophy of science? Which aspects of its legacy remain? We wrote this chapter to address these questions—to identify the basic beliefs and implications of positivism as a once-dominant philosophical paradigm, to discuss its legacy in social inquiry, and to put it into conversation with postpositivist and nonpositivist paradigms emerging from or in opposition to positivism. In fact, all paradigms within the foundations of research emerging after positivism stretch, critique, or counter the tenets of this once-dominant scientific worldview. This chapter will provide much of the historical and philosophical context necessary to understand positivism, a set of ideas that will also guide readers of this book through its remaining chapters and serve as an important basis for "interpreting some of the ongoing controversies about the nature of legitimate research" (Paul, 2005, p. 2).

Key Terms

analytic and synthetic propositions, empiricism, logical positivism, natural law, nonsensical, paradigm, posited, rationalism, verification, Vienna Circle

Origins and Development of Positivism

Positivism is a philosophical paradigm that arose in early-19th-century Europe as a melding of ideas from the Enlightenment movement, the continent's scientific revolution, and Christian religious traditions that were deeply rooted in culture and practice. The paradigm drew upon the Judeo-Christian view that a meaningful, orderly world is out there *posited* (perhaps predesigned) for us and independent of our understanding. Positivism takes sensory experience of this *given* world—that is, of its mind-independent objects and their properties—as its starting point for the discovery of laws, patterns, and principles given or (pre)existent in the world. Mills (1843), for instance, stated that laws of color, motion, heat, and the weight of air preexist in the world. Laws are inherently patterned, immutable, and given. Thus, we should understand the root word *positive* in relation to something that is *posited* or *given* (rather than *reasoned to*), as used in *positive* law (which assumes a law*giver*) and *positive* religion (which takes divine revelation as its *given* starting point). These approaches, in turn, are contrasted with *natural* law and religion, both of which are based on ideas speculators form through processes of reasoning and speculation about the *nature* of things (Crotty, 1998). In a world where most cultures adopt some form of naturalistic view, perceiving the world as inextricably intertwined with human lives, whether through spirits, gods, souls, qi, or other forces, the perception that the world as posited—as absolutely and objectively separate from human beings, in which we stand only as observers—is a unique and remarkable achievement of Western civilization that marked the beginning of modern science.

The term *positivism* is most notably associated with Auguste Comte (1798–1857), whose *Course of Positive Philosophy* (1830) captured a vast intellectual movement influential in many Western countries as well as Latin America and India in the late 19th and early 20th centuries (Bourdeau, 2023). His ideas attracted wide interest at the time. Comte drew philosophical and methodological resources from English empiricists' and Enlightenment philosophers' contributions, among them Francis Bacon's (1561–1626) belief in the importance of sensory experience as a source of knowledge and his valuing of accumulating knowledge, Thomas Hobbes's (1588–1679) tracing of interaction between objects in the world and sensory perception, and David Hume's (1711–1776) efforts to develop a social science alongside natural science. Situated within an era of immense optimism marked by the Industrial Revolution, Comte separated his vision of positivist study from theology and metaphysics and proposed positive science as the sole valid source of knowledge. To Comte, facts, or the empirical aspects of the world that we can observe—rather than spiritual forces, intuition, or ineffable theories of being—were the only conceivable building blocks of knowledge. To study such facts and produce knowledge requires "reasoning and observation, duly combined" (Comte, 1830/2000, p. 28). He proposed that the positive method should focus only on the "laws" of the phenomena, "that is, their invariable relations of succession and resemblance," the "connection between single phenomena and some general facts" (Comte, 1830/2000, p. 28). He believed that immutable laws governed the world, including human beings, and that they were discernible through observation to serve humans as well as natural science.

As one of the founders of the discipline of sociology, Comte was centrally concerned with the social, or human, sciences. The *Course of Positive Philosophy* outlined different forms of law important to positivist science. In his book, Comte identified the law of three stages in

the development of human thought. Although he valued all stages, he did not consider the stages of theological and metaphysical thought as avenues to knowledge. Rather, he believed the positive method of science that Bacon had developed over a century prior—using sensory experience, observation, and reason to reach a logical conclusion—was the superior stage of human thought. For Comte, scientific thought was *the* means of arriving at knowledge. Further, he outlined the law of the classification of sciences that posited integral relationships among varied forms of science, the order in which they developed, and their movement from general to more complicated foci (Bourdeau, 2023). Although others such as Hume contributed ideas to developing social science, Comte uniquely viewed social science as the eminent, encompassing, and potentially universal scientific form that could and should organize all other sciences (Bourdeau, 2023). This view of sociology differs markedly from its current role.

Comte envisioned human sciences as playing a unifying role for all the sciences and providing a flexible scientific method for natural and human sciences using observation, experiments, and comparison to discover the "laws" that govern the physical and social worlds. Notably, Comte's vision had political implications beyond the philosophy of science; he envisioned science as having potential to reorganize society (Bourdeau, 2023). His quest for certain, generalizable social knowledge and the positivist philosophy to which he contributed through his early writings would grow to dominate social inquiry in the 20th century (Phillips & Burbules, 2000).

The Vienna Circle's (1920s–1930s) 20th-century conception of *logical positivism* is the philosophy most closely associated with the positivist paradigm and the development of empirical research. Their beliefs were in fact radical for the time in envisioning science as instrumental to progress. The Vienna Circle consisted of a group of philosophers (many of whom had been professional scientists or mathematicians) who originally met at Austria's University of Vienna to discuss the philosophy of science. The Circle developed in various stages, had diverse members, and at times included women (Edmonds, 2020). Philosophers included Moritz Schlick (1882–1936) and Rudolf Carnap (1891–1970), sociologist Otto Neurath (1882–1945), physicist Philipp Frank (1884–1966), and mathematician Hans Hahn (1879–1934), who gathered people together as early as 1907 (Edmonds, 2020) in coffeehouse discussions about philosophy. In 1928, the group became formally recognized, and in 1929, several members published statements about the Vienna Circle's mission (McKenna & Pratt, 2015) that created some tensions in the Circle. They insisted on the separation of facts from values and sought to "introduce the methods and exactitude of mathematics to the study of philosophy" (Crotty, 1998, p. 24). They, like Comte, but with different guiding priorities, were interested in a unified science salient to all disciplines. Logical positivists believed that speculation about any entity or phenomenon researchers could not observe, measure, or otherwise collect empirical sensory evidence on (e.g., the human soul; emotions; moral questions) "was nonscientific as well as *nonsensical*" (Phillips & Burbules, 2000, p. 9). In other words, such concepts made no sense, literally, as a scientific enterprise or legitimate basis of knowledge:

> They devised a criterion of meaning whereby it was literally *meaningless* to make statements about things that could not be verified in terms of possible sense experience—a criterion that renders all theological issues, for example, and Freud's theories, as strictly meaningless. They labeled such meaningless discourse "metaphysics," much to the chagrin of many other philosophers! (Phillips & Burbules, 2000, p. 9)

Positivism had roots in religious traditions and values, which allowed scientists to see the world as separate from humans with preexisting meanings. Yet the Vienna Circle of logical positivists further excluded metaphysics, ethics, aesthetics, and theology from the purview of legitimate inquiry. Blumberg and Feigl (1931), the two scholars who first used the term *logical positivism* for American readers to characterize this European movement, summarized this exclusion as follows: "For the new positivism, metaphysical propositions are, strictly speaking, meaningless, since a proposition has meaning only when we know under what conditions it is true or false" (p. 293). The logical positivists embraced a radically antimetaphysical stance that Karl Popper later critiqued (see Chapter 2) and oriented their work toward outlining criteria and practices that constituted appropriate scientific inquiry. If observing and measuring the entities of the world—boulders, cells, protons, weight loss—are for logical positivists the only legitimate bases of knowledge, all metaphysical or speculative matters lie outside the realm of science. Such abstract concepts are simply not "knowable" or observable through sense experience and therefore irrelevant to, in fact impossible, in scientific study.

Consider the significance of the logical positivists' claims for research. What objectivist positivists considered knowable underscores the clear relationship between paradigms and methodology. Our very theories of the phenomena we can use science to study—and what is utterly *nonsensical* to study—dictate the parameters of what we can and must study and the protocols and measurement techniques we must use to do so. To positivists, empirical observations and logic are within the purview of true science; intuition, values, and spirituality belong only within the arts and ethics.

The Vienna Circle was by no means a homogenous group of thinkers, even though they shared convictions on the importance of logic in philosophy, the necessity of clear and precise language, the empirical grounding of science, and philosophy's power to support science. Their disagreements illustrate the diversity of thought that can exist even within a coherent paradigm. Some were socialists, or politically active, and embraced a pragmatic stance toward science and its social value, such as Otto Neurath, while others, such as Moritz Schlick, supported the separation of philosophy and politics (Edmonds, 2020). Neurath, a robust voice in the Vienna Circle, and Rudolf Carnap (1891–1970), another key figure, experienced both personality and philosophical tensions. However, they both shared concerns about the dangers of weaponizing metaphysical ideas for political purposes. A methodical thinker interested in the logical structures constituting objectivist statements, Carnap recognized that metaphysics, however meaningless to science, could wield great power for those susceptible to influence (Edmonds, 2020). The utterly irrational and extremist ideologies of Nazism evolving in the Austrian context during the Vienna Circle's increasing popularity, for example, represented one such danger. The Circle attracted critics due to its Jewish members and its Enlightenment ideals of progress and rationality diverging from "Aryan logic" (Edmonds, 2020, p. 138).

The Vienna Circle developed a central tenet of logical positivism from Ludwig Wittgenstein's work with propositions, even though he often disagreed with them and deplored their lack of humility. His influential text, *Tractatus Logico-Philosophicus* (1921), provided a logical analysis of *propositions*—logical thoughts and pictures of the *facts* of the world—that concerned him at the time. For Wittgenstein, facts made up the world. He referred to them as truths, conceiving of facts

as the nature of the world, what he called the state of affairs that made up the objects of the world. The book consists of seven central propositions about the facts of the world that, logically, excluded attention to metaphysical, ethical, and aesthetic issues. Circle members found his work riveting (Edmonds, 2020). Like others within positivism, Wittgenstein believed the world existed before any human being's interaction with it. He classified philosophy as an activity limited to description and ideas rather than an empirical enterprise that could provide meaningful information about the real world. According to Wittgenstein, philosophy describes and elucidates propositions but cannot make them, because they reveal the "logical form of reality" only on the basis of empirical observations (or sensory evidence) of the real world. Logical positivists drew from Wittgenstein's work to develop the "verification principle," which posits that statements have meaning only if scientists can verify them through a logically and empirically rigorous process (Crotty, 1998, p. 25). Statements emerging from abstract conceptions such as the human soul, morals, and the nature of being are impossible to verify. Wittgenstein came to think of everyday statements as hypotheses in the sense that they could be confirmed or disconfirmed by a considerable variety of sensory evidence. The statements that expressed this sensory evidence became the only true propositions. They alone were capable of complete verification (cited in Hymers, 2005, p. 206).

Hymers (2005) argued that the logical positivists' readings of *Tractatus* extracted different meanings than Wittgenstein intended. Yet they drew two different statements or propositions, which Schlick called tautologies and elementary propositions, from Wittgenstein's work to support their arguments and reconceptualized Kant's concepts of *analytic* and *synthetic judgments* in logical positivist terms and distinguished between these two types of statements. Immanuel Kant (1724–1804), the influential 18th-century philosopher, introduced the concepts of analytic and synthetic judgments as crucial to understanding the nature of knowledge. For Kant, analytic judgments are those in which the predicate is contained within the concept of the subject, but synthetic judgments are those in which the predicate adds something new to the concept of the subject. While synthetic judgments are essential in developing new knowledge, they do not have to come from sense experience. Synthetic knowledge can be a priori, which means it is not dependent on experience but rather obtained through mathematical or metaphysical reasonings, such as causation and time and space principles. For the logical positivist, tautologies and contradictions—also called *analytic propositions*—just like Kant's analytical judgments, are claims that are "true in meaning by virtue of the meaning of its terms" (Hymers, 2005, p. 215). The claims that "a kitten is a baby cat" and "two plus two equals four" are examples of tautologies. Researchers cannot verify such analytic propositions *empirically*—that is, through observation or experience. They can only verify them through logical analysis of the concept and words. Analytic propositions are either *tautologies* or *contradictions*. To logical positivists, analytical statements consist only of *senseless* content. They are *senseless* because they cannot be verified by the senses (Crotty, 1998, p. 25). Putnam (1975) summarized their general lack of empirical weight: "There they are, the analytic statements: unverifiable in any practical sense, unrefutable in any practical sense, yet we do seem to have them" (p. 396). However common, such statements are not the substance of science.

The second type of statement, *synthetic propositions*, in contrast, excludes analytic propositions, or any conditions in which the definition or statement includes the subject to which it

refers. Synthetic propositions, which have been of primary interest to logical positivists, can be verified *only* by experience—including what we experience directly or through measurement and other scientific tools that allow us to test and record what we experience empirically through our varied senses (seeing, touching, measuring, etc.). Blumberg and Feigl (1931) noted the exciting merger of empiricism and logic in what they called the "new" positivism and the implications of logical positivists' reinterpretations of Kant's propositions at the time.

> In contrast to Kant the new movement maintains as a fundamental thesis that there are no synthetic *a priori* propositions. Basing its assertions upon recent developments in factual and formal sciences, it holds that factual (empirical) propositions through synthetic [propositions] are *a posteriori*. (p. 193)

Synthetic propositions cannot contain a priori knowledge—that is, knowledge before experience—but only knowledge that comes from experience. Thus, in this view, verified synthetic propositions (and *only* verified synthetic propositions) are factual knowledge. Concepts of the good, or of justice, or of values, are not given in experience and thus cannot be rendered factual to become the basis of a synthetic proposition. Synthetic propositions that are incapable of empirical verification are deemed "nonsense" and considered to be "meaningless." These contrasting examples of tautologies (e.g., "All bachelors are unmarried men"; "My surgeon is a doctor") and synthetic propositions (e.g., "The dog is running"; "The sun will rise tomorrow") help illustrate how logical positivists conceptualized what was and what was not a legitimate scientific focus or claim. For the foundations of inquiry, these examples underscore the conceptual linkages we detail throughout the book between how fundamental characteristics of ontology (the nature of being, including the nature of the world) and epistemology (the nature of knowledge) shape beliefs about what we can and cannot study and how we must do so (methodology) within a given paradigm. The history of positivism also demonstrates the diverse voices and disagreements that can exist even within coherent paradigms.

The forms of logical positivism's rise to dominance within Anglo-American research institutions that we discuss here were perhaps most significant due to their rigid stance on what counts as legitimate knowledge or meaningful inquiry. These developments helped establish an implicit hierarchy in which positivist empirical research dominated and nonpositivist and nonempirical approaches became marginalized in terms of their perceived importance. The echoes of this hierarchy linger today. Philosophers of science and methodologists would eventually subject positivist dominance to spirited critique (e.g., Popper, 1994; Willer & Willer, 1973); however, we explore remaining aspects of this legacy below.

Positivism and Empirical Research: Embedded Assumptions and Guiding Beliefs

Positivism embodies key ontological, epistemological, and methodological assumptions that have provided support and justification for empirical research in both the natural and social sciences. As noted above, positivism rests upon a realist ontology—the belief that a real physical world exists with intrinsic governing laws and principles independent of consciousness—and

a radically objectivist epistemology, which holds that, through using our senses and reasoning capacities, humans can discover certain knowledge of reality. The idea that reality, as well as the truth or the facts of it, is posited, given, and independent of our awareness and is discoverable through empirical study is the hallmark of positivist thought.

Positivism rests upon a radical, or fundamentalist, objectivist epistemology, which suggests a clear separation between the world and the conscious subject, whether that be a researcher or another subject in the world. Appropriate to these assumptions, carrying out inquiry about this world requires using our senses, appropriate instrumentation, and reasoning capacities. Through doing so, humans can discover true knowledge of reality with certitude and precision. Even though positivists hold that the world or reality is posited independent of human consciousness, we can fully access it through appropriate tools. Humans are connected to the substance and phenomena of the world through their sense organs and instruments that amplify those tools and can discover knowledge through their senses and rational capacities. Using appropriate procedures, that knowledge can correspond to the realities of the world on which it is based.

This paradigm draws from several forms of thought, including a *foundationalist epistemology* and *rationalism*. First, a foundationalist epistemology holds that a truth claim can count as knowledge only with a *secure foundation*. Positivism is most heavily influenced by empiricists (e.g., John Locke), who hold that sense experience is the secure foundation of knowledge. That is, the basic units that work together to form our understandings of reality come directly from sense experience. Secondly, the *rationalists* (including, e.g., Descartes) also influenced positivism. They believed that rational faculties, or the systematic, logical application of human reason, are the secure foundation of knowledge and that prepared scholars can discover truth through a process of careful, systematic thought. Thus, the logical positivists' idea of synthetic propositions combined insights from both empiricism and rationalism, postulating that sense perception allows us direct access to the facts of reality and that, by following careful rational and scientific processes, we can discover certain knowledge of the world. In other words, through collecting sense data using scientific (particularly precise mathematical) methods and using inductive reasoning guided by the *principle of verification* discussed earlier, we can discover the truth about the world that is always external to us and exists even without us there to perceive it.

The positivist conceptions of scientific activity that we have described thus far indicate that there is no room for speculation, theoretical assumptions, or appeals to values, beliefs, opinions, or feelings in the process of science. Concerns with ethics or axiological assumptions, according to positivists, play no role in the process of discovering knowledge, and researchers must exclude them to ensure the purity and objectivity of both the inquiry and its product. Thus, what positivist science discovers, according to its proponents, are the facts already inherent in the world—its absolute, objective, and universal truths and its grounding and immutable laws, patterns, and elements. These demand scrutiny to increase our understanding of the world's complexity and substance.

According to positivism, a speculative claim about some aspect of reality "is *not* knowledge but is simply a hypothesis. No matter how much it appeals to the light of reason, it is an empirical/factual claim that can only be accepted as knowledge after the relevant warranting evidence has been examined . . ." (Phillips & Burbules, 2000, p. 8). Accordingly, positivist science must support claims with empirical evidence—that is, collectable, measurable sense

data. The application of systematic methods of inquiry designed to control for extraneous variables and researcher biases, positivism suggests, enable properly conducted scientific inquiries to produce objective knowledge (i.e., justified, true belief). Drawing upon the optimism of its Enlightenment roots, positivism also assumed that the gradual accumulation of generalizable scientific findings would inevitably lead to human progress, increasing our control over nature and our ability to make accurate predictions and valuable correlations about social phenomena.

Comte's work to establish the tone of positivist social sciences by charting their development from the natural sciences included his interest in methods to study the world. He conceptualized observation, experimentation, and comparison as essential to the scientific enterprise, with mathematics being a fundamental tool for the development of all science. Yet his primary interest was in tracing the laws of human thought and the order of societies to detail his vision of social science. French sociologist Émile Durkheim (1815–1917), a pivotal figure in the development of positivist social sciences, was responsible for shaping the methodologies of experimental research and survey research that presently dominate the landscape. Following Comte, Durkheim fully intended to apply the natural science methods to the study of human conditions. He proposed "a specific methodological orientation for examining and detailing 'the forces shaping society'" (Prus, 1995, p. 6).

In his 1895 publication *The Rules of Sociological Method*, Durkheim (1982) developed survey research methodology for sociology and other social science fields by delineating ways to identify "social facts" that researchers could treat as the "things" or data of the social sciences so they could use statistics to establish consistencies and stabilities. Durkheim's survey research would come to dominate social sciences in the 20th century. In 1897, Durkheim intended his *Suicide* study, which used quantitative, or rate data, analysis in a study of suicide rates among Catholic and Protestant groups, to be the first positivist psychological study. Durkheim's efforts were immediately recognized as influential in the embryonic field. Fueled in part through these developments, psychology has since evolved into a science of experimentation (Vassallo, 2017).

Durkheim believed the methodologies he developed for the social sciences were beyond epistemological dispute. "Since the law of causality has been verified in the other domains of nature, . . . one may justifiably grant that is likewise true of the social world" (Durkheim, 1895/1982, p. 159). Yet such justification through direct application remained too arbitrary at the time and undoubtedly became the point of debate, especially when the paradigm of positivism came under attack. However, the dominance of these methodologies in social sciences has not abated. Researchers now primarily use the modified versions that have developed over the decades in alignment with the postpositivism paradigm (see Chapter 2).

Other figures carried out positivist social research. Influential behaviorist B. F. Skinner (1904–1990) conducted a series of psychological studies providing exemplars of positivist social research. Skinner was deeply influenced by the ideas promulgated by the Vienna Circle and applied them, beyond the intent of the logical positivists, to the human sciences. To produce objective knowledge about our species, he believed, psychologists should ignore the purported "inner" or "psychic" causes of behavior and focus instead *only on behavior itself*. One cannot observe or measure the inner workings of the body and mind, he reasoned; "all such 'mental events,' and the 'inner person' who harbors them, are strictly inferential, and . . . [thus are]

'fictional'" (Skinner, 1953, cited in Phillips & Burbules, 2000, p. 9). Like the positivists before him, Skinner believed any conclusion arrived at through speculation about such unobservable phenomena cannot become knowledge and has no place in science. He insisted that we must "*turn from the inferred to the observed, from the miraculous to the natural, from the inaccessible to the manipulable*" (Skinner, 1972, emphasis added, cited in Phillips & Burbules, 2000, p. 10). Through a range of observations of animals and children, Skinner demonstrated that operant conditioning in which we associate rewards or punishment with certain behaviors is a learning process that can profoundly shape and modify human actions. Evident in Skinner's research is the objectivist, detached study of the empirical world separate from the observer and able to be grasped through careful, systematic, observation of actual behavior.

Critique and Fall From Prominence

Problems with positivism invoked critiques from philosophers of science and objections from scholars whose theories of knowledge and understanding of meaningful research did not fit within the parameters of the predominant positivist paradigm. Most objections to positivism related to its metaphysical assumptions and foundationalist epistemology—the idea that any claims to knowledge must rest on a stable foundation.

> A strong argument can be made that during the second half of the twentieth century the long reign of the foundationalist epistemologies (including positivism) came to an end . . . It is important to realize, however that experience and reason have not been shown to be irrelevant to the production of human knowledge; rather, the realization has grown that there are severe problems facing anyone who would still maintain that these are the solid or indubitable *foundations* of our knowledge. (Phillips & Burbules, 2000, p. 14)

Phillips and Burbules (2000) identified several problems with positivism tied primarily to its epistemology. These critiques fueled the development of new paradigms that we discuss in later chapters: First, as Comte argued, existing theories about the world guide any empirical observations researchers carry out. Second, many theories can explain the same evidence. Third, *auxiliary assumptions* inform scientific reasoning. Fourth, induction has logical limits. Fifth, as Kuhn's work underscored (see Chapter 2), scientists began to recognize the social dimensions of scientific inquiry (p. 14). We explain these points below.

Theories Guide Researchers' Perceptions

Although positivists often perceived observation as a neutral process, a matter-of-fact translation of the real world to notations, documentation, and recordings, critics suggested that a way of seeing is also a way of *not* seeing. That is, when one collects data related to some object or phenomenon, one is inevitably attending to and consciously processing only a portion of the massive amount of possible information in the sensory world taken in by (or potentially available to) the senses. Furthermore, observers' previous experiences and theories of the world can guide the process of conceptualizing this sense data—prior learning that we apply, perhaps involuntarily,

in cognitive processing of new information. Stated another way, a researcher could potentially judge any sense information to be data. However, she only considers the information she believes to be relevant to her inquiry as data—much of the other information in the empirical world, deemed irrelevant, does not find its way into the research report.

Guba and Lincoln (1998) provide another angle of critique of the assumptions of positivist science. In their description of "*the theory-ladenness of facts*," Guba and Lincoln (1998, p. 199) suggested the inevitable role of theories in making sense of the facts of the world.

> Theories and facts are quite *interdependent*—that is, . . . facts are facts only within some theoretical framework . . . If hypotheses and observations are not independent, "facts" can be viewed only through a theoretical "window" and objectivity is undermined. (p. 199)

Thus, contrary to positivist assumptions and regardless of instruments or protocols, critics pointed out the impossibility of settling with certainty that two or more observers of the same phenomenon would record or view it in the same way.

Varied Theories Can Explain Evidence

Another issue that arose with positivism related to the limits of any data to support a particular theory or to discard another possible theory that could explain it. When researchers develop theories to explain the data that they and others have collected in relation to some phenomenon, they make inferences. Inferences involve reaching beyond direct observation to describe or explain the relations among the data and their relevance to some human interest(s). Therefore, in addition to observation, the choice of description or explanation will include ideas and frameworks that shape human thinking in that time, place, and context. These types of assumptions would be, Phillips and Burbules (2000) indicated, "just the sorts of things Skinner [and the other positivists] would advise us to ignore!" (p. 19). Thus, several equally valid theories might logically describe a given pattern of observations. They emphasized:

> Put starkly, we cannot claim that observational or other evidence unequivocally supports a particular theory or fully warrants the claim that it is true because there are many other (indeed, a potentially infinite number of other) theories that also are compatible with this same body of evidence (and can thereby claim to be warranted by it). More pithily, theory is *underdetermined* by evidence—which is a severe blow to the view that our knowledge is "founded" on sense experience. (Phillips & Burbules, 2000, p. 17)

Varied theories and concepts may be supported by the same data. Guba and Lincoln (1998) equate *the underdetermination of theory by evidence* with the *problem of induction*, which Phillips and Burbules (2000) treat separately and we describe below.

The Role of Interrelated Assumptions

The notion that each of us brings a set of assumptions to our inquiries presents a difficult challenge for positivist confidence in pure objectivity in empirical research (Lincoln & Guba, 1985). The nature of how researcher assumptions intertwine within our existing knowledge further complicates this effort. Perhaps most influential in this regard, the "Duhem-Quine thesis"

(Phillips & Burbules, 2000, p. 19) holds that we cannot test a single hypothesis in isolation because any empirical test will rely on the assumed truth of a bundle of other hypotheses—called *auxiliary assumptions*. This insight suggests the human mind does not hold individual beliefs in isolation but that each connects to multiple other beliefs, which are in turn connected to multiple other beliefs and so on, forming a network of interdependent beliefs that structure our understandings of the world. In setting out to test one belief as a hypothesis, a researcher is unlikely to be able to fully isolate that belief from others he holds. Phillips and Burbules (2000) described as inevitable that our education and experiences would inform our assumptions and the steps we take in conducting research: "[W]e may make use of measuring devices or tests or interview questions, on the assumption that they are sound; we might use various types of statistical analyses, making the same assumptions about these techniques" (p. 20). These techniques, or interrelated auxiliary assumptions, shape the work we do.

These auxiliary assumptions may seem unproblematic in action, but their existence poses issues for positivism. In the view of positivists, researchers conduct a strictly scientific process to discover the contours and facts of the world. Provided they use the proper tools, *which* skilled researchers carry out the investigation does not matter for results and knowledge. Yet if these background assumptions guide us as we move through the world, they will inevitably, if sometimes unconsciously, inform the design and conduct of any given inquiry. This critique of positivism was influential in developing postpositivism, which retained its spirit and orientation but took as a governing principle the impossibility of discovering the meaning of any phenomenon with certainty and precision.

The Limits of Induction

The fourth area of critique that contributed to undermining positivist claims was the issue of *induction*. Sir Karl Popper (1902–1994), an Austrian British philosopher of science, believed that the principle of *verification* was an unattainable standard for science and in its place argued for a standard of *falsification*. For Popper (see Chapter 2), the principle of verification was far too ambitious of a governing principle for science because it was impossible for scientists to prove anything to be absolutely true. This principle arises from the *problem of induction* (Phillips & Burbules, 2020). Induction is an analytic process of inferring from particular observations or cases larger generalities about a phenomenon. It reflects the idea that, when we make a series of observations that confirm or create some generalization, it is common (but erroneous) to assume that all future observations will follow this pattern. This intuitive expectation may appeal to researchers, but it is not a "*logically* compelling form of reasoning" (Phillips & Burbules, 2000, p. 23, emphasis added). Inductive leaps that assume having numerous cases with the same characteristics is sufficient to make empirical assertions about all such cases pose abstractions at odds with logic. Popper's (1962) principle of *falsification*—a foundational component of *postpositivism*, a paradigm that emerged from positivism (see Chapter 2)—suggested "knowledge comes from the elimination of error. Unlike the theory of verification, in which you never have all of the case[s] required to be absolutely certain that a proposition is true, a single case can be used to render a proposition false" (Paul, 2005, p. 3). Guba and Lincoln (1998) illustrate the implications of these critiques of induction and the principle of *falsification* for positivism. To do so, they used the now-common example of a black swan in conveying the point:

> Whereas a million white swans can never establish, with complete confidence, the proposition that all swans are white, one black swan can completely falsify it. The historical position of science that it can, by its methods, ultimately converge on the "real" truth is thus brought sharply into question. (p. 199)

The conceptual uncertainties of any generalization from a pattern of cases (induction) and the impossibility of verifying (verification) a proposition from that pattern, however robust and numerous the cases, rendered suspect a guiding tenet of positivism.

Scientific Inquiry Is Social

The social nature of the world fractured the certainties of positivist claims further. The traditional positivist view of science was quite individualistic and reductionist in considering complex processes reducible to fundamental natural laws, or, in social interactions, reducible to individual actions and characteristics. Also, inquiry was often pursued in isolation. In contrast, critics such as Thomas Kuhn (1962) made explicit the social nature of scientific research (see Chapter 2). Scientists conduct their research in a community with its own rules and norms in a given time period. Such norms include publishing their findings through a process of peer evaluation, guided by shared assumptions of what constitutes appropriate foci, methods, theories, criteria, and sources. The norms governing scientific practice change over time to the point where Kuhn (1962) claimed they are incommensurable with those of a previous time period. They are thus influenced by larger social and cultural forces. Even within a community sharing similar frameworks and beliefs about scientific processes, members are not equal. Status, resources, politics, and power can shape scientific inquiry.

Paul (2005) suggested that positivism's fall from its place of prominence in the second half of the 20th century left social researchers without a monolithic, authoritative vision of their craft, creating a sense of both chaos and opportunity. Sometimes, he suggested, opponents pitched fierce battles in a war for influence in the social sciences. He described the aftermath of the events he characterizes as the defeat of positivism:

> This unsettling of the epistemological foundation of science, combined with the uprooting of basic social institutions and public policies, created an unstable and turbulent intellectual environment for scholars during the latter part of the 20th century. . . Research in the social sciences and education strained, mostly unsuccessfully, to contain or, in some instances, to negate new discourses addressing issues of power, privilege, and voice, confounded with gender, race, ethnicity, and ideology. . . It was in this context that. . . [many alternative paradigms to positivism emerged]. (p. 4)

The remainder of this book details these alternative developments and their methodological implications, all of which have arisen within and against the long shadow cast by early positivists' convictions about the primacy of their scientific model. The questions critics raised about the variety of theories shaping human perception, theoretical explanations for evidence, auxiliary assumptions, induction, verification, and the social nature of science all paved the way for the development of postpositivism (Chapter 2) as well as antipositivist paradigms.

Positivist Legacy

Crotty (1998), who wrote his book on theoretical foundations at the end of the 20th century, was not convinced that positivism had fallen so far from its early position of prominence as we suggest here and detail in Chapter 2. To Crotty (1998), positivists still maintain a melioristic spirit and optimistic faith in science as the driving force of inevitable human progress. The positivist legacy remains evident in the general public's presumption of a separate world that exists independently of human thoughts, interests, and feelings as well as their belief in empirical and scientific methods to acquire certain, objective knowledge. As we noted, positivists claimed emotions, morals, aesthetics, and metaphysics were nonsense in a scientific sense: utterly bereft of empirical substance and factual meaning. Researchers informed by these tenets continue to assume theirs is an objectivist value-neutral enterprise that maintains a strict distinction between fact and value. In sum, Crotty (1998) boldly asserted,

> One thing is certain: positivism is linked to empirical science as closely as ever . . . [T]he positivist spirit at the present time continues to adhere to a philosophy of science that attributes a radical unity to all the sciences and sets few bounds to what science is capable of achieving. (p. 27)

Although trust in science can vary based on social issues, political ideology, and education level, it remains today a key site of hope for human progress (Funk & Kennedy, 2020; Funk et al., 2020). And that science continues to reflect a strong positivist legacy. Few contemporary scientists and academics, however, hold the same foundationalist epistemological commitments that early empiricists and rationalists accepted, the logical positivists' rigid understanding of which aspects of the world have scientific meaning and what counts as knowledge or B. F. Skinner's radically reductionist approach to the study of human beings in social research (1953; 1972). These extreme views are rare even in the natural sciences. We could label very few contemporary theoretical physicists or biologists, for instance, as full-fledged positivists. Consider, for instance, that physics relies on "'inferential' and not directly observable [entities], such as quarks, black holes, and cosmological 'super strings,'. . ." (Phillips & Burbules, 2000, p. 10) as well as "multiverses," particles, atoms, and so on. Similarly, though minor internal disputes arise about the scope and character of Darwin's theories, professional biologists overwhelmingly accept his theory of natural selection as the unifying theory of their field, even though his explanation is largely inferential, as it occurred over the span of millions of years of natural history and we cannot therefore subject its processes entirely to direct observation.

The positivist legacy continues to reflect its founders' assumption that it rests fittingly at the top of the hierarchy of human knowledge pursuits. Aspects of positivism's remaining influence in social research, for many scholars and members of the public, include accepting the importance of empirical research (particularly quantitative research)—those phenomena that we can observe, hear, measure—as a valid source of knowledge (Paul, 2005). Many continue to reject "metaphysics as having any valid explanatory status" (Paul, 2005, pp. 3-4) and recognize as problematic its use as a political tool that undermines rational social science. Although positivists recognize that scientific reports of the world necessarily require a level of abstraction

because language is the vehicle for conceptualizing and communicating information about the world, as Wittgenstein examined, they accept that study results nevertheless correspond to that world. Furthermore, varied behavioral theories contain positivist grounding. Paul (2005) described approaches common in psychology and sociology, for instance, such as social learning theory, positive behavior support, and cognitive behaviorism (pp. 3–4). In the chapters to come, consider how positivism remains a site of common reference across paradigms about the possibilities and limitations of social inquiry—even as a key site to critique, counter, modify, or dismiss entirely in the service of developing rationales for other paradigms. We will explore these ideas further in the following chapters.

Review Questions and Prompts

1. What are the basic ontological beliefs of positivism?
2. What are the basic epistemological beliefs of positivism?
3. How was positivism considered radical, even visionary and liberating, at the time?
4. Consider key ideas scholars have contributed to the development of positivism. In the context of positivism, what does *posited* mean? Logical *positivism*? The *verification principle*? *Empiricism*? *Analytic* versus *synthetic propositions*? What is nonsensical to positivists? How do these concepts help you understand the paradigm?
5. How do analytic and synthetic propositions differ? How is that distinction important for envisioning the proper object of a positivist science? What does the distinction reveal about positivism's grounding epistemology and ontology?
6. What conceptual issues arise in considering the human sciences in positivist terms?
7. What types of phenomena could researchers study in a positivist paradigm as a legitimate scientific inquiry? Which types of phenomena would be impossible to study? Why?
8. What challenges has positivism faced that reduced its dominance in the late 20th century? How does the example of a black swan pose a challenge to tenets of positivism?
9. Why are the components of the positivist paradigm so important to understand, given the diverse paradigms now available for social research? Why do you think some components of positivism remain so compelling for researchers today?

Chapter 2

Postpositivism

Postpositivism is a philosophical paradigm that arose in response to devastating critiques of the foundationalist epistemological commitments of its positivist predecessor. These critiques, many of which we outlined in the previous chapter, emerged first from scientists, philosophers, and historians of science (e.g., Karl Popper and Thomas Kuhn) whose ideas dislodged positivism from its dominant position in the research fields and contributed to the development of its philosophical descendant, postpositivism. Just as other paradigms (e.g., interpretivism, critical theory, feminism, poststructuralism) emerged as alternatives to or in contradistinction to positivism, postpositivism maintained some basic assumptions of positivism while reflecting modifications in response to the various critiques. Postpositivism as we describe it here reflects modified ontological and epistemological beliefs in particular, which have helped support and justify methodologies prevalent in social research fields today. Although some use the term *post*-positivism with temporal connotations to refer broadly to any of the paradigms that emerged *after* (i.e., "post") and counter to positivism, we use the term to refer to the now-dominant paradigm in social research that maintains key but modified tenets of positivism most associated with the "scientific method." We discuss scholars' contributions to the rise of postpositivism, their varied critiques of positivism, and the important implications of postpositivism for inquiry.

Key Terms

antipositivism, complementarity principle, critiques, epistemic values, falsifiability, Kuhn's conception of paradigm, modified objectivism, modified realism, theory of probability, radical open-mindedness, realism, regulatory ideal, relativism

The Rise of Postpositivism

Some of the earliest critiques of the assertions of positivism came from within the scientific community, particularly from scientists in the field of quantum physics. Two of the prominent physicists of the 20th century, Niels Henrik David Bohr (1885–1962) and Werner Karl

Heisenberg (1901–1976), provided significant challenges to the ways we think about the world and our relationship with it in modern times.

Quantum Theory

Science of the Newtonian era had made great strides in confirming and reinforcing the positivist assumption that nature is dependable and predicable and the belief that with the correct tools and methods, science is able to discover the one and only truth about nature—that is, that science can produce certain knowledge that reflects the nature of reality accurately. However, this viewpoint began to change when scientists began to explore structures of the world at the atomic and subatomic levels—microscopic entities a human cannot see with the naked eye. In the 20th century, new findings suggested that the subatomic world was unexpectedly chaotic and unpredictable, forcing scientists to rethink their beliefs about the nature of the physical world and our ability to know its processes. Neils Bohr, a Danish physicist who was awarded the Nobel Prize for physics in 1922 in recognition of his work on subatomic structure, quantum mechanics (a branch of mathematical physics), and radiation, was among the first physicists who worked to describe and make sense of the world at that minute level.

In 1928, Bohr announced the "complementarity principle" to explain the nature and behavior of matter and energy at the atomic level. This principle provided an important physical interpretation of Heisenberg's principle of uncertainty, posed in 1925; Heisenberg later became Bohr's assistant and colleague. According to the complementarity principle, depending on the experimental arrangement, electrons and light may express themselves in forms that are either wavelike or particle-like. Such forms thus have a "wave-particle duality." Although observing both the wavelike and particle-like aspects at the same time is impossible, integrating them through different experimental conditions may provide us a fuller understanding of the structure of the subatomic world. Essentially, the complementary principle reflects the recognition that in the subatomic world, a physical phenomenon may appear differently, even if complementarily, to observers. Its appearance will depend on how and through which devices we observe it, with no way to ascertain what that phenomenon "truly is." The very experimental conditions possible for studying one aspect of the phenomenon or another shape what we see and what (partial) sense we make of it.

Accordingly, Bohr raised questions regarding our beliefs about subatomic particles. He asked: Are particles really what we think they are? Are they really particles, waves, and fields, as we call them? Or are we imposing on them concepts we have constructed based on our current knowledge and experience through other fields of understanding (e.g., classical physics)? Bohr's questions reflect his concern about how scholars conceptualized the ontology of the quantum world and how they described and represented its characteristics (Shomar, 2008, p. 329). Perhaps, as Crotty (1998) remarked about Bohr's ideas,

> these particles need to be seen as a reality different from the reality we are used to dealing with. In thinking and talking about them, we need a new set of concepts. We cannot simply take classical [Newtonian] concepts like position and momentum and apply them with accuracy to particles. (p. 30)

Yet which new concepts should we use if they do not emerge from existing knowledge? In considering these issues, Bohr hinted at the possibility that the ontology of the subatomic world differs from that of the one we experience. Although scientists developed such concepts as waves, particles, and fields as if they exist and function as postulated, they in fact created these very concepts to help us understand their referent objects. Ontologically, the structure and properties of these entities—what they really "are"—may be beyond our knowledge.

Bohr's questions and ideas thus reflect some fracturing of key positivist tenets and scholars' acknowledgment within postpositivism that we cannot discover or know all aspects of the world around us. We discussed some of these points of critique in Chapter 1. This realization about the limits of positivism reflected a major shift in conceptualizing how we imagine the world and what we can discover about it through science. Against the positivist ontological view that the world exists and the epistemological view that humans can fully access and know that world, Bohr proposed an ontological view that the world may be "posited" and given, as positivism holds, yet the details of that world may remain intractable to us. Moreover, Bohr's ideas reveal that scientists must inevitably draw from existing concepts and frames—those produced through society and language at a given historical moment—to name, interpret, and convey the new details of the world they study.

A German physicist, Heisenberg, developed other principles with implications for positivism. Heisenberg, whose work on quantum mechanics earned him the Nobel Prize for physics in 1932, went to Copenhagen in 1926 to work as Bohr's assistant. In Copenhagen, Heisenberg engaged in deep conversation with Bohr, which resulted in the publication of his 1927 landmark paper, "On the Perceptual Content of Quantum Theoretical Kinematics and Mechanics." In this paper, Heisenberg articulated his famous "uncertainty principle," which proposed that physicists cannot determine accurately the position and momentum of a subatomic particle (an electron, photon, etc.) at the same time. The inability to determine these phenomena did not result from limitations of the instrument or the experimental methods scientists employed but the inherent uncertainty of the natural world. In other words, we cannot know this rich nature with certainty and accuracy because the material world defies such capture and comprehension. Absolute knowledge of causal determination is impossible, Heisenberg suggested, and we can only achieve probabilistic formulations about the subatomic world.

Heisenberg and Bohr thus both, although differently, referred to the condition of uncertainty as shaping the outcomes of experimental study. Bohr (1948) conceptualized objectivity to include the observer as always part of rather than independent of the system. Bohr (1948) expressed, "It must never be forgotten that we ourselves are both actors and spectators in the drama of existence" (p. 318, quoted in Shomar, 2008, p. 330). He emphasized that the conditions or frames of measurement inevitably shape what researchers measure. In 1949, Bohr noted the "impossibility of a sharp separation between the behaviour of atomic objects and the interaction with the measuring instruments which serve to define the conditions under which the phenomena appear" (p. 210, quoted in Shomar, 2008, p. 330).

The philosophical implications of these scholars' work in quantum physics transcended their field. Whether because of the ontology of the physical world, the situated conditions of measurement, or the nature of concepts and language used to describe the phenomenon,

their arguments suggest we may have to accept an inherently partial understanding of atomic structures in the physical world. Further, epistemologically, these circumstances mean that researchers do not hold a "separate" relationship to the "posited" world and may not have exact knowledge of subatomic matters or the ability to predict their future state precisely or confidently. Researchers and their sciences are *in* and *of* the world. These important developments in the physical sciences inject a sense of uncertainty into the philosophy of positivist science that logical positivists had long deployed with certainty and self-confidence. Even the "laws of physics" are probable statements that include some subjective elements. We do not and cannot have full access to the world posited in positivist terms as "given."

Bohr's and Heisenberg's works provide central tenets to what some refer to as the "Copenhagen interpretation" of quantum theory, which Albert Einstein, another towering figure of the time, never accepted. In his debate with Bohr in which he dismissed the idea that nature is uncertain and we only have "probable" truth, Einstein famously declared, "God does not play dice with the universe!" Using "god" as a metaphor for the underlying forces governing nature, Einstein was conveying that nature will take definite courses rather than unpredictable ones. Yet Bohr's and Heisenberg's contributions to quantum theory built the foundation for the rise of the second industrialization, or the "technological revolution," that enabled the invention of molecular electronic devices for use in such microscopic realms.

The revolution caused by quantum theory is even more far reaching on the philosophical front in directly leading to a paradigm shift from positivism to postpositivism as the dominant paradigm for scientific inquiry. Philosophers and historians of science have attempted since then to reconsider and reconceptualize how we think about reality and our relationship with an uncertain world.

Sir Karl Popper

Karl Popper (1902–1994) was among the most influential philosophers of science in the 20th century. His work has influenced contemporary philosophy of science and scientific inquiry as well as a broad range of social and historical fields. His work was central to displacing logical positivism as the dominant foundation for scientific inquiry in favor of a postpositivist paradigm that values *falsifiability* as a standard of the scientific process. His philosophical ideas have served as a foundation for the mainstream version of postpositivism that we discuss in this chapter, which has supported and informed major methodologies in social research fields today.

Popper was born in Vienna and was associated with the Vienna Circle in his early years (see Chapter 1). World War II forced Popper, like many Jewish scholars of the time, into exile. He moved to New Zealand and eventually settled in London, England. He served as a professor at the London School of Economics from 1949 to 1969. Later in his life, he characterized himself as rigorously "unorthodox" in regard to respecting tradition, holding that "orthodoxy is the death of knowledge since the growth of knowledge depends entirely on the existence of disagreement" (Popper, 1994, p. 35). For Popper (1994), rational discussion was both a "rare" and "important ideal" in the quest for knowledge and important in resisting stasis and convention and prompting new insights (p. 44). Even theories, which he viewed as "indispensable" to making sense of the world, could too easily imprison people in a narrow framework that limited

their freedom of thought (Popper, 1994, p. 52). He was deeply invested in the rigors and beauty of science. This conviction shaped Popper's wide-ranging challenges to positivism, subjectivism, fascism, cultural relativism, and inductive reasoning as an adequate foundation for science.

In Popper's first book, *The Logic of Scientific Discovery*, published in 1935 (2002), he was concerned with the problem he called demarcation—how to distinguish legitimate scientific disciplines from nonscientific or pseudoscientific ones. Within the positivist paradigm, scientists can only regard a statement as scientifically meaningful if they can verify, or empirically confirm, that statement. Popper challenged these conventions. Popper agreed with Hume's critique of inductive reasoning, a method of drawing generalized conclusions from specific examples and situations. He dismissed inductive reasoning as an effective guide for scientific discovery because, for example, one could find endless support in the natural world for a specific claim based on observed instances, such as all daisies are white or all cats have whiskers, when only one elusive but rare example to the contrary could render that claim false. *Verification* could not ensure a valid knowledge claim. Yet, in noting the inadequacy of inductive reasoning, Popper did not share Hume's skepticism that such reasoning turns science into psychology rather than logic.

Popper posed falsification as the necessary criterion to separate serious science from myth, metaphysics, Freudian psychoanalysis, and Marxist social criticism. More logical and effective for the pursuit of science than inductive reasoning or verification, Popper argued, was using the deductive approach of falsification to actively work to refute claims. Researchers engaged in scientific inquiry should use falsification, the opposite approach to verification championed by positivism, to make every effort to disprove a hypothesis and only accept it as tentatively "true" after exhaustive, rigorous, and failed attempts to disprove it. Popper posited that knowledge is conjectural; scholars postulate reasonable theories as hypotheses that remain tentative rather than certain and lie in wait for others to falsify or replace them with better, more expansive, and more effective claims. Scientists should consider all knowledge claims as open to refutation and revision in the face of new or better evidence. Popper rejected the Baconian/Newtonian assertion (16th and 17th centuries) of "pure" observation as the beginning of scientific discovery in maintaining that all observation is already situated in a theoretical and interpretive context.

In the context of the debate over quantum mechanics, Popper developed his propensity theory of probability, which holds that probability represents a propensity or tendency inherent in physical systems or processes of the world that influences the likelihood that certain events will occur but does not determine specific outcomes. These propensities are inherent in the underlying structure of the objective world and are not dependent on subjective beliefs or interpretations. Probable theories are truth propositions about the propensities of the external, mind-independent world. They are probable not because of subjective observers' mind states or conditions of observation (the idea that science is influenced by the social world) but because of the strength of evidence and rational support for such propositions and their applicability to a range of similar phenomena. They are probable because they have predictive success. A theory that consistently makes accurate predictions strengthens confidence in the underlying propensities, whereas inconsistent predictions can lead to modifying or rejecting the theory; thus, falsifiability is critical in scientific theories. Popper argued that because some scientific theories are

successful in making accurate predictions, they cannot be mere social constructions with less correspondence to objective reality than other explanations of phenomena.

While Popper held that all knowledge claims are tentative and falsifiable and thus challenge the positivist assumption that knowledge represents fixed, certain truth about the objective world, he nevertheless emphasized that reality is, in fact, as positivists claim, real and mind-independent (objective) and scientific inquiries are attempts to describe and explain such objective reality. Popper rejected the claims Heisenberg made, the Copenhagen interpretation we described earlier, as an unjustifiable invasion of subjectivism into the field of physics. Specifically, he argued against Heisenberg's suggestion that difficulties in measuring and predicting particle location and movement reflect inherent limitations to the knowledge humans can gain about the world. He did not accept such limitations. Popper also rejected Heisenberg's idea that probable theories are merely instrumental with no correspondence to objective reality. Despite Bohr's and Heisenberg's influential arguments, Popper did not believe they offered new or devastating epistemological limitations or refutations of realism or objectivism. In this regard, he rejected Bohr's ontological assumption that some aspects of reality, by their very nature, are simply unknowable to the human observer. He considered this assumption an unwarranted epistemological restraint threatening future inquiry into any phenomena predetermined as "unknowable," thereby limiting the progress of science. Despite this diversity of opinion, collectively, these scholars' ideas were influential in creating a fracture in the certainties of positivism that led to postpositivism.

Popper made multidimensional contributions to the development of postpositivism. His theory of probability was also influential beyond the quantum world in other areas of science and everyday life. He took a leading role in displacing logical positivism as the dominant foundation for scientific research and establishing a postpositivist school of thought that preserves the rational and objective nature of scientific inquiry. Popper's critiques of both positivist and nonpositivist approaches to inquiry suggested the need for a new philosophy of science that rejected the certainty and absolutism of positivism but posed standards for separating reliable, scientific claims from the nonscientific and pseudoscientific claims that he believed suffused critical theories and cultural relativism. His contributions led to the development of postpositivist science as a response to criticisms of positivism and as a middle point between the epistemological impasse that had emerged between notions of absolute truth and relativism (Alexander, 1995).

Thomas Kuhn

Other scholars contributed to the development of postpositivism. Thomas Kuhn (1922–1996) was an American physicist, historian, and one of the most influential philosophers of science in the latter half of the last century. His major book, *The Structure of Scientific Revolutions*, published in 1962, may be one of the most cited academic books of all time. He studied physics at Harvard University and gained his master's and doctoral degrees in physics in 1946 and 1949, respectively. After graduation, Kuhn taught at Harvard and became involved in an undergraduate general education course for humanities majors focused on the history of science. In that context, he found himself trying to understand Aristotle, Newton, Einstein, and others

properly, which means on their own terms and not distorted by later interpretations. This experience was formative for him, as Crotty (1998) explained:

> Led back to Aristotle's *Physics*, [Kuhn] is struck forcefully by what he sees as an utter disparity between Aristotelian physics and the physics of Newton. Not a difference of degree but a difference of kind. Not inchoate, less-formed notions in Aristotle that are later to be developed and brought to fruition in Newton. No, these two sets of ideas appear to him so different as to be incomparable. As Kuhn sees it, Aristotle and Newton do not stand at different points on a continuum; they are not even within the same spectrum. (p. 34)

The realization that these belief systems did not simply differ but were incomparable animated the development of Kuhn's ideas. Other disparities, in Kuhn's view, included Copernicus's heliocentric model of the universe and Ptolemy's geocentric model, Lavoisier's oxygen theory of combustion and Becher's hypothesis of phlogiston, and Einstein's theory of relativity and Newtonian physics. Accounting for such striking disparities in systems of thought demanded carefully considering how scientific change occurred. The conclusion Kuhn (1977) drew from his bewildering experience of seeking to understand disparate scientific ideas over time is that the history of science does not reflect steady, rational progress, building from one idea to the next, but reflects a series of radical shifts in how scientists view reality from one period to another. This process is historical, influenced by major shifts in thinking, making particular ideas possible in one period that do not align with belief systems in previous periods.

This historical process reflects alternations between "normal" phases of science, which are periods of "consuming mopping up operation[s]" (Kuhn, 1977, p. 188) or "puzzle solving" (p. 221) efforts within the prevailing belief systems that resist change, and "revolutionary" periods, in which creative thinkers address new problems in such a radical way as to topple the status quo and replace it with a new paradigm. Scientists immersed in a prevailing paradigm (he used the term "paradigm" to refer to a matrix of interconnected beliefs much like a theoretical framework) that governs a period rely on shared assumptions and modes of thinking within their community, reinforced through education, to help them make sense of reality and inform the methodologies they employ in their inquiries. Such paradigms are so rigid, confining, and incommensurable, said Kuhn, that scholars cannot make rational progress across or between them. Paradigm shifts occur when established ideas no longer work, when frames emerge to unleash new ways of thinking, and when a revolutionary scientist—someone not dogmatically committed to the prevailing paradigm—rejects and rebels against the old paradigm. Kuhn (1970) wrote, "Led by a new paradigm scientists adopt new instruments and look in new places. Even more important during revolutions they realize new and different things when looking with familiar instruments in places they have looked before" (p. 111). For a paradigm shift to occur, forces often seen as extrinsic to scientific processes such as culture, psychology, and politics all must play a role in shaping the forms and directions of the shift. In Fischer's (1993) words, "the activity of science is a product of the very social world it seeks to explain" (p. 333).

Kuhn's line of thought had profound and even subversive implications for science and scientific knowledge. In terms of the development of postpositivism, Kuhn's ideas contrasted with those of Popper and offended scientists deeply invested in the idea that scientific knowledge accrues over time through careful testing, refinement, and accumulation. Although Kuhn shared Popper's critiques of the inductive process and positivism's approach to empiricism, he rejected Popper's ideas about falsification. Kuhn suggested that grappling with puzzles in periods of normal science does not proceed from testing and then disposing of theories as falsification requires. For Kuhn, Popper's approach relied too heavily on the revolutionary moments of theoretical dismissal that falsification demanded. It neglected the common phases of science in which researchers work daily within the governing paradigm until they cannot explain stubborn and important anomalies arising within that system of thought, forcing them to consider new frames. Kuhn believed his ideas were primarily internal to scientific communities and continued to refine his conceptions of paradigms and their incommensurability in subsequent editions of his influential manuscript.

Those influenced by Kuhn have, beyond his intent, applied his ideas to the social sciences and even to constructionist understandings of knowledge production. His ideas about the impact of different paradigms or disciplinary matrices on individual observers—for instance, in affecting how Einstein or Newton, situated in different disciplinary matrices, would differently observe the same phenomena—suggested that social or even personality differences shape inquiry. Similarly, his conception of a paradigm and the irrelevance of falsification to many social science disciplines provided grounding to establish newer fields as legitimate sciences. Although Kuhn situated his arguments within science, others used them to reconceptualize science itself, moving from viewing it as a disinterested, neutral, and objective endeavor proceeding over time to accumulate knowledge to perceiving it as a very human, social affair, shaped in communities, and influenced by revolutionary shifts in thought. Essentially, some scholars used Kuhn's ideas to flatten distinctions between scientific endeavors and those considered to be non- or pseudoscientific, such as psychoanalysis, through underscoring the paradigmatic and thus broad cultural, political, and psychological aspects of the enterprise. Like other ideas we have discussed in this chapter, Kuhn's work further loosened the hold positivism had taken on science.

Understandably, Kuhn encountered tremendous resistance—even hostility, as he perceived it—from philosophers of science. Popper, for one, perceived the danger of *relativism* embedded in Kuhn's line of thinking. Broadly understood, relativism is a body of philosophical thought that denies the possibility of objective truths and holds that truth, morality, and knowledge are not absolute but depend on the individual, people, or cultures holding them. Popper launched a fierce critique of Kuhn's theses and their relativist dangers and forcefully defended science in his well-known article "The Myth of the Framework: In Defense of Science and Rationality" (1994). In the article, Popper called Kuhn's description of the theoretical framework—that is, the incommensurable, mind-confining paradigm—a myth. He argued that the rational, critical, and open discussions central to scientific inquiry and the root of any scientific process are always possible among and between varied frameworks. Yet Kuhn's analysis of what scientists *do*, rather than what they *should be doing*, has had a lasting effect on how subsequent scholars think about science.

Paul Feyerabend

Another scholar who contributed to the development of postpositivism was Paul Feyerabend (1924–1994), whose philosophical beliefs changed throughout his life. Feyerabend, like Popper, was born in Vienna and influenced by the Vienna Circle in his early years. He studied science, history, singing, and theater and later turned to philosophy. He was imaginative and outspoken. In 1952, he went to England and studied under Popper at the London School of Economics. For decades, beginning in 1958, he worked at the University of California, Berkeley, with short stints lecturing elsewhere, and spent later years at a Swiss institution. When working with Kuhn at Berkeley, he found his ideas deeply influential. Before Kuhn's book *The Structure of Scientific Revolutions* was published, they discussed a draft. During Feyerabend's years in Berkeley, which became the center of the 1960s cultural upheavals and student revolutions, Feyerabend's experience kindled his interest in political questions about science. Feyerabend initially embraced the ideas of the logical positivists and later, Popper's, but over his career, he came to think entirely differently than these scholars about science as an enterprise.

Some later called him the "enemy of science" (Preston et al., 2000, p. v) for his radical claims and forceful presentation. For instance, Feyerabend titled one book *Farewell to Reason* (1987) and famously claimed in *Against Method* (1975/1993) that "science is essentially an anarchic enterprise" (p. 9). Yet he maintained that his quarry was positivism rather than science. Underneath his forceful presentation and language lay his deep concern for genuine human knowledge and scientific progress free from both irrational obstacles and the confinement of rationality. His ideas aligned with Popper's in searching for clear criteria to distinguish true science from nonscience, or, as he put it, "between the domains of the respectable thinker and the crank" (Crotty, 1998, p. 38). For Popper, this criterion was falsification based on rigorous deductive reasoning, but for Feyerabend, even reason can confine us, making us problematically privilege some beliefs over others. For instance, the fixed elevation and privilege of the principles of rationality may have encouraged the scientific pursuit of eugenics without serious ethical considerations. The influence of the student and free speech movements helped shape Feyerabend's thoughts. Although he believed movement leaders were dogmatic, he questioned whether core scientific ideas we have accepted reflect in fact the perspective of a small group of people (Feyerabend, 1978). As his ideas developed, he dismissed positivism and empiricism entirely through comparing the dogmatic features of empiricism to the features of Protestant thought. He took seriously Kuhn's critiques of the power of a given paradigm to shape developments within "normal science" and considered the benefits of theoretical pluralism with its diverse and competing ideas. In fact, he thought theories might shape language and perceptions.

In the 1970s and 1980s, he wrote influential and controversial books, *Against Method* (1975), *Science in a Free Society* (1978), and *Farewell to Reason* (1987), that reflected his growing belief that the status quo of methods and beliefs in "normal science" is a form of indoctrination and a threat to true science. He came to see the robust field of science as thoroughly shaped by political and sociohistorical values. In these decades he moved beyond his midcareer embrace of diverse theories as generative for science to argue that any common methodological approach is inherently antithetical to the complexity of the scientific enterprise. He questioned the narrow

confines of scientific thought and argued that taken-for-granted concepts such as "truth" and "objectivity" in fact constrain thought. In an argument that underscored his reputation as anti-science, he suggested that reason does not help us break free from indoctrination but helps to enforce absolutism, the certainty of scientific conclusions, and the marginalization of varied approaches to inquiry. He argued that science is not a monolithic project but rather a series of projects constituted by fragmented and disparate components, just as the world it professes to study—reality—is made up of varied components. The confines of theories and perspectives shaping the conventions of science historically limit study of the complexity of the world.

The pathway to breaking free from the inevitable confines of our perspectives and worldviews, according to Feyerabend, is through enacting a stance of *radical open-mindedness* and being willing to consider any theories and explanations—including ideas that seemed utterly unthinkable. He sought radical equity and the visibility of diverse ideas that the superior posture of science had occluded. To imagine such breakthroughs in the practice of science, Feyerabend (1975/1993) wrote,

> The first step in our criticism of customary concepts and customary reactions is to step outside the circle and either to invent a new conceptual system, for example, a new theory, that clashes with the most carefully established observational results and confounds the most plausible theoretical principles, or to import such a system from outside science, from religion, from mythology, from the ideas of incompetents, or the ramblings of madmen. (pp. 52–53)

Such radical openness, for Feyerabend, was the only way to ensure dominant frames did not limit our imagination and our potential knowledge quests. He (1993) proposed epistemological anarchism because its humanitarian grounding was "more likely to encourage progress than its law-and-order alternatives" (p. 9). Thus, to Feyerabend, scientific anarchism and radical equity in ideas are necessary for scientific and cultural progress.

The undermining of the absolute power of reason central to Feyerabend's later arguments that earned him the ire of scientists, including philosophers of science such as Popper (1994), also led to challenges in terms of how one could distinguish science from nonscience. Feyerabend argued that the work of counterinduction using "alternative assumptions" and "external standard[s] of criticism" (p. 22) to question, test, and challenge new even radical claims was a legitimate process for contributing to the body of human knowledge.

The scientists and philosophers we discuss here, Bohr, Heisenberg, Popper, Kuhn, and Feyerabend, vary in their beliefs, fields, and concerns. Yet their critiques of ideas central to positivism cumulatively contributed to its fall from prominence. Even in introducing unpopular ideas, they inspired scholarly dialogue that nuanced and decentered long-held positivist beliefs. Yet some of their critiques might have been too radical to sustain the development of the form of postpositivism we understand today as a popular contemporary paradigm guiding mainstream scientific studies. Kuhn and Feyerabend both valued the work of science, yet their arguments about the limits of scientific community values and beliefs for advancing science, their recognition of the varying influences of the sociohistorical world in human inquiries, and their openness to methodological anarchy or pluralism are likely more recognizable in

antipositivist than postpositivist paradigms (see later chapters). Scholars developing antipositivist paradigms such as critical theory, feminism, and Indigenous paradigms have used strands of Kuhn and Feyerabend's thought. The central ideas informing today's postpositivist paradigm are Popperian, as we describe below.

Postpositivism as a Paradigm

The ongoing challenges, critiques, and ideas that emerged in response to and against positivism led to developing the postpositivist school of thought. Popper's version of postpositivism has provided much of the support and justification for prevalent methodologies in social research today. In this vein, postpositivism retains positivism's general contention that an objective reality exists independent of our consciousness. It maintains its investment in conducting inquiry to accumulate knowledge about physical and social reality. It also maintains the view that objectivism, free from social and political values, can and must guide the scientific process. It has, however, significantly modified the ontological and epistemological assumptions of positivism, including objectivism and realism, in response to critiques and challenges.

Modified Realism and Modified Objectivism

Postpositivism preserved but modified some of the ontological and epistemological assumptions of positivism. If you recall, the ontological viewpoint of positivism is *realism*, the belief that there is a "posited" or given real world of physical objects, consisting of stable attributes and guided by internal laws, that exists independent of any awareness. Positivism's "pure" form of objectivism suggested that following rigorous research design could yield comprehensive knowledge/truth about the world with a level of absolute certainty. The conception of the fully knowable view of the nature of reality in realism thus had implications for positivism's epistemological position, *objectivism*.

The various examples we have noted above demonstrate the wide range of ontological views those described as "postpositivists" have held. Like positivists in all their diversity, postpositivists are not a unified group. Yet discussions in the field are focused on discerning the nature of particular aspects of reality and their accuracy rather than questioning the existence of that reality. In other words, research can constantly change our tracing of the contours and details of the *real* that exists—the exact features of a tree, the migration patterns of a butterfly, the variables of effective teaching—but that *real* endures without our research.

Within postpositivism, like positivism, reality exists, it is real, and we must direct our efforts to discovering and understanding the forms and expressions of that reality. In Popper's (2002) words, "if we conjecture that *a* is a natural law, we conjecture that *a* expresses a structural property of our world; a property which prevents the occurrence of certain logically possible singular events, or states of affairs of a certain kind" (p. 453). The ontological view from which we build our knowledge is that our inquiries seek knowledge about our world that exists in a certain way and with certain properties. Popper (2002) clarified, "The idea that there are necessary laws of nature, . . . is metaphysically or ontologically important, and of great intuitive significance in

connection with our attempts to understand the world" (pp. 459–460). Paul (2005) described postpositivism's ontological position in much the same way: "Reality is the collection of natural laws . . . and social phenomena of our universe; all of these really exist; we can observe (imperfectly) and experience (imperfectly) this reality" (p. 46).

We label this ontological view embraced by postpositivists *modified realism*. Modified realism underpins postpositivism's epistemological position of *modified objectivism*, which postulates that there may be limitations to human senses and reasoning capacities and thus we may not have full, direct access to truth (i.e., the facts of reality) even though that reflects our aim and the mission of scientific research. Neither reason nor empirical evidence represents incontrovertible "foundations" of knowledge, as positivism held. Unlike "pure" objectivism's conception of knowledge as "justified true belief," modified objectivism suggests that knowledge is not merely self-evident in the objects or phenomena under study. However closely we look, the law of gravity does not just "show" itself under our careful observation. Guba and Lincoln (1998) described postpositivism's ontological and epistemological positions as follows:

> Reality is assumed to exist but to be only imperfectly apprehendable because of basically flawed human intellectual mechanisms and the fundamentally intractable nature of phenomena . . . [Thus,] claims about reality must be subjected to the widest possible critical examination to facilitate apprehending reality as closely as possible (but never perfectly). (p. 205)

In fact, Popper suggested that knowledge consists of probable formulations representing reality that are tentative, partial, and fallible and in need of ongoing challenges with falsification. In addition, unlike the more absolutist ontological and epistemological positions of positivism, postpositivism suggests that human knowledge is conjectural. This means that we arrive at some conclusions through deduction, speculation, and guesswork. The law of gravity is clearly based on a conjecture and has been subjected to ongoing testing and examination. Similarly, although scientific evidence exists of an asteroid colliding with earth millions of years ago, scientists' deducing that the resulting environmental changes of this force likely led to the extinction of the dinosaurs is inevitably speculative and open to change with new evidence. "Our warrants for accepting these things can be withdrawn in the light of further investigation" (Phillips & Burbules, 2000, p. 25).

Postpositivism requires that for the products of inquiry to count as knowledge, researchers must provide adequate justification—warrants—for their claims. Acknowledging the inherent limitations in each research project does not discourage postpositivist researchers from engaging in a "good-faith" pursuit of objective truth in their inquiries. Objectivity, for postpositivists, remains a *regulatory ideal* of inquiry, which means that however challenging and elusive it is in practice (as Kuhn's critique reflected), researchers should hold this ideal as their highest priority in their work. In this view, scholars should limit the influence of their biases and produce findings that help to continue what they believe to be a progressive accumulation of increasingly accurate knowledge about the world (Guba & Lincoln, 1998).

To distinguish between better-and-worse or more-and-less-justified knowledge claims—or, as Popper put it, the subject of "demarcation"—postpositivists devised a set of judgment criteria.

Falsification/Falsifiability

One major criterion postpositivists commonly embrace is the principle of *falsification* or falsifiability. Popper argued that the logical positivists' principle of verification was unrealistic and fundamentally flawed. As we discussed in the previous chapter, the logical positivists claimed the scientific method relied on a process of induction to arrive at scientific laws through a series of carefully conducted observations and experiments—that is, researchers looked for confirming examples to allegedly prove or verify scientific laws. Popper rejected this view, arguing that scientists engage in a

> continual process of conjecture and falsification . . . An advance in science is not a matter of scientists making a discovery and then proving it to be right [through induction]. It is a matter of scientists making a guess [in the form of a testable hypothesis] and then finding themselves unable to prove the guess wrong, despite strenuous efforts to do so. (Phillips & Burbules, 2000, p. 31)

He proposed an alternative, postpositivist approach to inquiry that sought to replace verification with *falsification* and induction with a *hypothetico-deductive* scientific method. This three-step process involved scientists proposing theories hypothetically, deducing a set of propositions from these theories, and then testing such propositions through engaging in every effort to prove them false (Crotty, 1998). This hypothetic-deductive model reversed the process of induction as the logical way to determine scientific laws.

Popper used this criterion of falsifiability to differentiate between scientific claims and nonscientific or pseudoscientific claims—that is, we should consider as scientific a claim (e.g., an explanation or hypothesis) that is open to refutation through observation and/or experimentation by the researcher as well the scientific community; if such a claim is not testable and open to such refutation, we should consider it nonscientific or pseudoscientific (Crotty, 1998). For instance, Popper would consider the oxygen theory of combustion to be scientific because the process is observable and open to refutation. Yet he rejected Marx's dialectical view of history and Freud's claims about the benefits of psychoanalysis as pseudoscience because they established their theories more on ideas and information than on directly observable evidence. In other words, direct data from observation or experiments cannot support or refute such theories. The criticism of falsifiability as challenging in practice, irrelevant to many fields, and not reflecting "normal science," as Kuhn detailed, has rendered it a regulatory ideal rather than always carried out as a sole standard of good science.

Probability

Postpositivism holds that more-or-less-objective knowledge is possible, but its modified conception of knowledge aims at standards of falsifiability and nonfalsification rather than certainty or verification. While Popper's probability theory does suggest that the strength of evidence and rational support, as well as consistent success in prediction, would increase the probability of the knowledge claim, Reichenbach (1953) added to this list a *standard of probability* that uses induction to reach probable truth. The problem of induction has led some philosophers of science,

such as Popper, to believe it is a faulty or unimportant aspect of scientific inquiry. Yet others have determined that, however uncertain, it offers solid reasons to believe our conclusions are probably true. This argument suggests that every new observation that supports a hypothesis increases the probability that it is true; every new observation that does not support a hypothesis decreases the probability that it is true. Reichenbach explained:

> A set of observational facts will always fit more than one theory; in other words, there are several theories from which these facts can be derived. The inductive inference is used to confer upon each of these theories a degree of probability, and the most probable theory is then accepted . . . [and] tested by new observations specifically planned for this purpose. Each test, based on new material, increases or decreases the probability of the explanation; but never can the explanation constructed be regarded as absolutely certain. (p. 232; cited in Phillips & Burbules, 2000, p. 24)

Thus, researchers must test various statements against empirical evidence (i.e., data) and/or rational critique (depending on the nature of the statement) and then elevate the most warranted, most probable, unfalsified but (hypothetically) falsifiable theories, explanations, and claims over others to continue the progressive accumulation of knowledge. Their belief that knowledge can be fallible and tentative obligates postpositivist researchers to reject or revise their theories as appropriate in the face of new and better evidence and better (i.e., more warranted) arguments.

The Role of Values

Like their positivist predecessors, postpositivists aspire to objectivity and to holding a "disinterested" or value-neutral axiology. For all objectivists, ethical, political, and cultural values have no place in research and knowledge production. Scientists' opinions about nuclear power or the implications of the atomic bomb may affect their decision to engage in the project, but they are not relevant to the actual *process* of the science that can create it. Although scholars such as Feyerabend (1975, 1978, 1993) and others operating within antipositivist paradigms refute that such objectivity is possible or desirable, the basic ontological and epistemological assumptions of postpositivism have prescribed that researchers should follow the criteria of "dedication to the pursuit of truth, openness to counter evidence, receptiveness to criticism, accuracy of measurements and observations, [and] honesty and openness in reporting results" in any scientific endeavor (Phillips & Burbules, 2000, pp. 54–55).

Accordingly, researchers should exclude any influence from funding sources, social-cultural forces, or the ethical-political concerns of the entity or context under study. This view suggests that, if reality is independent of human consciousness, and if research is to produce knowledge that increasingly approximates objective reality, many human values would only limit such effort. As Popper has indicated, human beings should use knowledge to solve problems as widely as possible and judge it only on the strength of its evidence and problem-solving power. The role of the academic community, Phillips and Burbules (2000) emphasized, should ensure scholars work diligently to pursue the ideal of objectivity and prevent inquiries from becoming seduced by external values that ebb and flow across sociohistorical contexts and the whims of

people's fleeting belief systems. The description of these processes and standards in postpositivism will seem familiar to many readers given their prevalence in some fields of research today.

The Open and Critical Spirit

The process of scientific research was in no way fixed or dogmatic for Popper. Good science depended on open inquiry and critical engagement with different ideas. The pursuit of objective truth, a profound awareness of the fallibility inherent in all methods and theories, and the willingness to consider evidence that countered any given scientific statement all led to the open and critical spirit with which he believed science should be imbued. Popper (1994) emphasized that the scientific method is essentially "the method of critical discussion, which makes it possible for us to transcend not only our culturally acquired but even our inborn frameworks" (p. 58) that can so limit the way humans see the world. As he framed it, the scientific way of life entails "a burning interest" in the rich substance of objective scientific theories and the question of their truth, or their proximity to truth (Popper, 1994, p. 56). This burning interest is rooted in critical and argumentative inquiry. In his own words, "as long as science is the search for truth it will be the rational critical discussion between competing theories" (1994, p. 58).

Illustrating this position, Phillips and Burbules (2000) describe Popper's approach to evaluating knowledge claims. The process requires considering the claims as well as examining the varied sources of evidence that support the claims, whether manifesting from observations, interviews, statistical analyses, or experiments. In the spirit of interrogating our own claims as fallible, evaluation also requires examining any counterarguments, alternative explanations, or contradictory evidence we might encounter in our analysis. It may also require additional empirical research, review of scholarship, or consulting other scholars. These steps position us to support or alter our claims even "with the realization that at some later date we might come across pertinent evidence or criticism that forces us to change our mind" (p. 30).

Popper believed in rigorously pursuing and questioning empirical claims as the foundation of good science. In his observation that holds continuing relevance for a world in which beliefs can become dogmatic and entrenched—even those we believe reflect justice or the common good—Popper (1994) admitted that some scientists too often "just follow the lead of others, or give way to social pressure and accept a new theory as a new faith because the experts, the authorities, have accepted it" (p. 57). Rather than assuming his behavior to be "normal science," as Kuhn branded it, Popper (1994) asserted that authoritative dogma of any kind "will be the end of science as we know it" (p. 57). Science for Popper is the opposite of dogmatism, infinite regression, or relativist doctrines. The open and critical spirit that characterizes scientific inquiry distinguishes it from nonscientific or pseudoscientific pursuits.

Implications for Methodology

Postpositivism requires that researchers adhere to the principles outlined above and engage in rigorously designed and conducted inquiry to produce *warranted* findings (Phillips & Burbules, 2000). Researchers can have varied research topics, questions, and purposes within a

postpositivist paradigm. The questions they ask and the research purposes they pursue require different methods, theoretical frameworks, and reporting styles, yet those diverse projects all share grounding epistemological and ontological frames. Studies reflect a modified realist ontology, modified objectivist epistemology, and disinterested axiological stance. Further, postpositivist researchers are unlikely to name any of these theoretical features when sharing their findings. The current common acceptance in many fields of postpositivism as the "the gold standard" guiding science means that, as with positivism a century ago, those operating within this paradigm do not entertain the need to detail its grounding philosophical assumptions in their research reports and publications. Typically, the types of research methodologies most aligned with postpositivism reflect the following logic and criteria:

- The *purpose of research* is to discover the objective truth, facts, and laws in physical or social phenomena. For postpositivist research, knowledge is the probable representation of the existing, objective reality, either in the physical or social world (e.g., subjective perceptions, patterns, or correlations), and the purpose of research is therefore to identify and discover the probable truth of such reality and add to existing knowledge. A researcher might analyze databases with student grades, graduation rates, demographics, and college courses with the purpose of, for example, exploring correlations between first-generation student status and college graduation rates. A researcher might conduct surveys of faculty at set points across the academic year with the purpose of understanding their perceptions of well-being. Or a study might use an experimental design with a participant group and a control group to study the effects of an exercise program with agricultural workers over an eight-week period.
- The *theoretical framework* and construction of the theoretically informed hypothesis can play a significant role in postpositivist studies. Popper has argued that an integral part of the methodology is that of the deductive testing of theories. In this deductive process, the researcher constructs a tentative hypothesis and then infers conclusions from the hypothesis. A study investigating the effects of an exercise program for agricultural workers, for example, can hypothesize using self-efficacy theory that the self-efficacy of participants will improve with the eight-week program and the control group will experience no effect. This kind of hypothesis could be tested through deploying written instruments measuring the variable of self-efficacy before and after workers engage in a program of weightlifting and exercise and interviewing them before and after about their experiences and feelings tied to their sense of efficacy and ability to carry out their jobs.
- *Data collection* proceeds under the assumption that research begins with problems that necessitate researchers' attention—issues that matter in a field of scholarship based on existing knowledge or those in the lived world that affect people's lives. In this view, theory shapes "pure" observation of "bare facts." Observations and logical conjectures are made within the context of theory. The theoretical framework of the study shapes data collection, whether in the form of isolating and defining variables or gathering information from surveys, interviews, observations, or documents. Yet the criteria of

data collection typically still follow the logic of representing the universal condition (large sample size, random sampling across contexts, etc.) or must be exemplary and representative of the phenomena of the study.

- *Data analysis* can involve processes appropriate to the specific methods in use and the study purpose. In observing participants in the exercise study, data gathering would occur at set moments, in specific patterns, with systematic analysis of behaviors over time. Researchers studying behavioral changes in an experimental study might use scientific, mathematical operations, rigorous decoding, peer reviewers, or appropriate software to analyze data to minimize subjective influence and bias.
- *Criteria of rigor* reflect the acceptance of objectivity as the guiding ethos and necessity in research. Researchers work to exclude external values and bias from the research process, ensure a detached stance toward the phenomenon of interest, and use appropriate techniques of validity and reliability to ensure quality. In quantitative studies, such rigor may entail using instruments that have been appropriately validated; in qualitative studies, it may involve using vetted structured interview protocols, an audit trail of documentation, interrater reliability in analysis processes, member checks with participants, and active searching in the data corpus for any discrepancies or warrants that counter empirical claims.
- *Nature of findings* reflects tentatively established facts, provisional and probable truth claims (unfalsified propositions) that are primarily generalizable (universal) and objective or, in qualitative work, instrumental or illustrative for other contexts. The studies reflect the building blocks of knowledge in rational progress to get closer to truth about a given phenomenon or entity.
- *State of adequate findings* represents the probable truth based on the available evidence and the rigor of the study design and processes, but they are always open for refutation, revision, and further study. A research community is necessary to falsify the tentative truth: When seriously challenged, a proposition will be replaced by a better proposition.

The most common methodologies scholars use in the social sciences are experimental research and survey research, which have developed in the context of positivist beliefs but have been adjusted to fit the postpositivist paradigm and its logic and criteria. Francis Bacon (1561–1626) is credited with developing the classic method of experimental research for scientific investigation, which focuses on gathering and analyzing data through experiments to reach logical conclusions considered to be nature's truths. In postpositivist social science, researchers often use experimental research to collect observation and measurement data from phenomena and derive knowledge from it. Often, experimental research begins with a hypothesis (based on a theoretical framework or prior knowledge), then experiments with or on it by manipulating a variable and analyzing the results to see if it supports the hypothesis. Scholars acknowledge their findings as tentatively established truth and are open to criticism and renewal by possible future findings.

Émile Durkheim (see Chapter 1) also formulated survey research as a positivist social science methodology, even though his formulation at the time was vague and rudimentary, with epistemological problems and contradictions. He proposed methods for identifying social facts in a complex social world that can be used as data for social research and looked for methods in the newly discovered field of statistics study to establish the consistency and stability of the social facts. While Durkheim believed this methodology could produce definite "laws" of social phenomena, survey research has been recast to align with the postpositivist paradigm and has become a much stronger, better thought out, and more justified methodology that social scientists use widely. Currently, when social researchers design survey research inquiries, they typically start with a constructed theory or hypothesis. They use the hypothesis to guide the kind of "representative data" they isolate and collect, and they conduct data analysis through rigorous statistical processes. The knowledge claim of the findings recognizes that they represent tentatively established correlations, probable truth in terms of statistical significance, and that they are subject to criticism and open to being falsified or replaced by possible future findings.

One enduring misconception of postpositivism is that it supports only quantitative or experimental methodologies. These approaches may indeed dominate as most aligned with the paradigm's principles, yet postpositivism's applicability is not limited to quantitative research or any particular methodology or set of methods. A leading scholar of qualitative research and evaluation, Michael Quinn Patton (2015), described the paradigm's compatibility with varied approaches. He wrote, "Postpositivism, which takes into account the criticisms against and weaknesses of rigid positivism, now informs much of contemporary social science research, including truth- and reality-oriented qualitative inquiry" (p. 106). As one example, the classical grounded theory approach that Glaser and Strauss (1967) and Glaser (1992) forged included objectivist tenets. It called for researcher detachment, neutrality, systematic methods, and exclusion of a literature review prior to analysis to ensure the generation of theory from the data. Other expressions of grounded theory are interpretivist and constructionist (see Chapter 3). Thus, the assumptions of the paradigm continue to guide how one conceptualizes research design, how one chooses and applies methodology and methods, and the procedures and claims that count as valid knowledge. If researchers set out to make accurate claims about reality, either physical or social reality (i.e., people's subjective beliefs about the world), and the project reflects the regulative ideals of objectivity, axiological disinterest, and neutrality, we can evaluate them as postpositivist regardless of the methods they employ.

Discussion

The postpositivist paradigm suggests that some knowledge statements may be more or less warranted than others. This possibility potentially creates tension among researchers about how to determine which knowledge statements and which criteria or values/commitments they should prioritize in the consideration. Postpositivism requires basing these decisions solely on the criterion of objectivity. Researchers should include only those values that promote objectivity and rigor (we call them epistemic values) in their consideration. Cultural and political values are irrelevant in the process. This tenet sets postpositivism apart from some other constructionist and subjectivist paradigms (see chapters to follow).

Critics of postpositivism have argued that these epistemic values are not independent from moral and political values (or cannot meaningfully be separated into different categories) and/or that postpositivism simply fails to recognize or acknowledge that its assumptions are inherently value laden, like those of all paradigms. From the general interpretivist perspective, we create meanings about the world individually and intersubjectively that are shaped by our communities, culture, and context. From critical and poststructural perspectives, the concepts of objectivity and neutrality are in fact cultural concepts and values created within a given social-cultural-historical context that researchers believe and perform as omniscient, ahistorical, and detachable from culture. In this critique, knowledge production can never be separate from the culture that created it. As Stanfield (1994) summarized, "the sciences and humanities are products of specific cultural and historical contexts that shape the character of intellectual work" (pp. 181–182). Further, some interpretivist, critical, and feminist critics hold that researchers' insights and values are products of their cultures, training, and positionalities (e.g., race, class, sexuality, gender). In pointing to the often white European minds that produced conceptions of epistemology and science, critical race theory scholars Scheurich and Young (1997) argued that many epistemologies, in fact, are racially biased. Critics of postpositivism vary across the epistemological spectrum, which we will discuss in future chapters. Yet proponents of postpositivism suggest that researchers should and can adhere strictly to the logic and criteria provided by its ontological and epistemological assumptions and reduce the influence of the hidden cultural or personal values shaping a culture or researcher.

Thus, for postpositivists, knowledge claims must be assessed based on the empirical evidence, regardless of group perspectives and regardless of the social, cultural, historical, or embodied context in which research takes place.

Examples of Postpositivist Research

Many fields reflect postpositivist research, as they follow common assumptions that research can study, grasp, and convey the realities of the natural and social world. Here are just a few examples of research conducted under this paradigm:

1. Carales, V. D., & Nora, A. (2020). Finding place: Cognitive and psychosocial factors impacting Latina/o students' sense of belonging. *Journal of Student Affairs Research and Practice, 57*(4), 355–370. https://doi.org/10.1080/19496591.2019.1662795

2. Farrell, A. M., & Frank, M. L. (2022). It's complicated: How a subordinate's gender influences supervisors' use of past performance information when appraising potential. *Journal of Management Accounting Research, 34*(2), 137–161. https://doi.org/10.2308/JMAR-2020-031

3. Farruggia, S. P., Han, C., Watson, L., Moss, T. P., & Bottoms, B. L. (2018). Noncognitive factors and college student success. *Journal of College Student Retention: Research, Theory and Practice, 20*(3), 308–327. https://doi.org/10.1177/1521025116666539

4. Fritz, M. M., Armenta, C. N., Walsh, L. C., & Lyubomirsky, S. (2019). Gratitude facilitates healthy eating behavior in adolescents and young adults. *Journal of Experimental Social Psychology, 81*, 4–14. https://doi.org/10.1016/j.jesp.2018.08.011

5. Gurin, P., Dey, E., Hurtado, S., & Gurin G. (2002). Diversity and higher education: Theory and impact on educational outcomes. *Harvard Educational Review*, *72*(3), 330–366.

6. Hall, M. M., Worsham, R. E., & Reavis, G. (2021). The effects of offering proactive student-success coaching on community college students' academic performance and persistence. *Community College Review, 49(*2), 202–237. https://doi.org/10.1177/0091552120982030

7. Krapohl, E., & Plomin, R. (2016). Genetic link between family socioeconomic status and children's educational achievement estimated from genome-wide SNPs. *Molecular Psychiatry, 21*, 437–443.

8. Lerner, J. S., & Keltner, D. (2001). Fear, anger, and risk. *Journal of Personality and Social Psychology, 81*(1), 146–159. https://doi.org/10.1037/0022-3514.81.1.146

9. Lipson, S. K., Kern, A., Eisenberg, D., & Breland-Noble, A. M. (2018). Mental health disparities among college students of color. *Journal of Adolescent Health, 63*(3), 348–356. https://doi.org/10.1016/j.jadohealth.2018.04.014

10. Lo, H. H. M., Kwok, S. Y. C. L., Yeung, J. W. K., Low, A. Y. T., & Tam, C. H. L. (2017). The moderating effects of gratitude on the association between perceived parenting styles and suicidal ideation. *Journal of Child and Family Studies, 26*(6), 1671–1680. https://doi.org/10.1007/s10826-017-0683-y

11. Ma, F., Zeng, D., Xu, F., Compton, B. J., & Heyman, G. D. (2020). Delay of gratification as reputation management. *Psychological Science, 31*(9), 1174–1182. https://doi.org/10.1177/0956797620939940

12. McGrew, S., & Chinoy, I. (2022). Fighting misinformation in college: Students learn to search and evaluate online information through flexible modules. *Information and Learning Science*,*123*(1/2), 45–64. https://doi.org/10.1108/ILS-09-2021-0081

Review Questions and Prompts

1. We offer important terms to help you understand postpositivism. What is empiricism? Relativism? Objectivity? Falsifiability? Probability? Modified realism? What other concepts manifest as important to understanding this dominant paradigm in social science?

2. What are some of the varied arguments and ideas philosophers and scientists have contributed, quite differently, to the fracturing of positivism that have allowed postpositivism to emerge?

3. What are key differences between positivism and postpositivism?
   a. What is the ontological view of postpositivism compared to that of positivism?
   b. How do the epistemological views of postpositivism differ from those of positivism? Why are they both called objectivism?
   c. What is the axiological stance of postpositivism?
   d. How is postpositivism's truth claim different from that of positivism? If, according to postpositivism, truth is tentative and subject to being falsified, why should we take it seriously as an approach to science? How does this approach to truth claims differ from any other opinion or political or religious assertion?
4. What distinguishes a scientific inquiry from a nonscientific one, according to the postpositivists?
5. How does Popper's view of science align with or differ from your understanding of science? Why was he so critical of dogma and relativism?
6. Why might or might not a postpositivist researcher use a theoretical framework? What role would a theoretical framework play in their research?
7. Imagine carrying out a postpositivist study. Choose a topic that interests you. What are the characteristics of methodology and methods that would align with postpositivist claims in carrying out research on your topic? What types of research questions would your postpositivist study support? Develop some examples. How would you carry out this study? Using what methods and approaches? How would you reduce "bias"?
8. How does a postpositivist paradigm support or justify the method of a survey?
9. Why have critics raised questions about postpositivism's claims of neutrality and objectivity?