EPISTEMOLOGY and METAPHYSICS for QUALITATIVE RESEARCH

Tomas Pernecky

SAGE

Los Angeles | London | New Delhi
Singapore | Washington DC | Melbourne

Los Angeles | London | New Delhi
Singapore | Washington DC | Melbourne

SAGE Publications Ltd
1 Oliver's Yard
55 City Road
London EC1Y 1SP

SAGE Publications Inc.
2455 Teller Road
Thousand Oaks, California 91320

SAGE Publications India Pvt Ltd
B 1/I 1 Mohan Cooperative Industrial Area
Mathura Road
New Delhi 110 044

SAGE Publications Asia-Pacific Pte Ltd
3 Church Street
#10-04 Samsung Hub
Singapore 049483

Editor: Jai Seaman
Editorial assistant: Alysha Owen
Production editor: Tom Bedford
Copyeditor: Audrey Scriven
Indexer: Cathy Heath
Marketing manager: Sally Ransom
Cover design: Shaun Mercier
Typeset by: C&M Digitals (P) Ltd, Chennai, India
Printed in India at Replika Press Pvt Ltd

First published 2016

Library of Congress Control Number: 2015960280

British Library Cataloguing in Publication data

A catalogue record for this book is available from the British Library

ISBN 978-1-4462-8238-0
ISBN 978-1-4462-8239-7 (pbk)

Two

In Search of Truths: Empiricism Versus Rationalism

The defining question of epistemology – *How is knowledge possible?* – is an invitation to thinking about how anybody is to know anything about anything (Cassam, 2009: 3). This problem of vast epistemological scope cannot be addressed by a single book, let alone in one chapter. It is possible, however, to explore some of the developments in thought about knowledge, and with this aim in mind, focus on the two rival doctrines that became the building blocks for scientific knowledge: rationalism and empiricism. This chapter commences by noting the importance of mathematical truths in establishing rationalism as the accepted worldview for nearly 2,000 years. It explains the difference between the rationalist and empiricist approaches to knowledge by situating these within broader historical debates, and outlines the main arguments advanced by their adherents on each side. The second part of the chapter examines the more contemporary manifestations of empiricism and rationalism through the epistemologies of positivism and post-positivism. It will be shown that the core values of empiricism evolved into logical empiricism, and that the principles of rationalism have been revived in Karl Popper's postpositivist critique of positivism. In addition to delineating the key tenets, the chapter will also survey the ramifications for social science research. A summary and implications for qualitative research will be offered at the end.

On the importance of mathematics

The quest for knowledge is one of the most admirable attributes of human beings. Although modern humans have survived in nature for nearly 200,000 years, as a species, we only started to form a coherent understanding of the external world in the last 3,000 years. For much of our existence, observable occurrences in nature and unexplained events were ascribed to the work of spirits and given mystical explanations. Our existence was ruled by belief. With the formation of societies and organized religion, such phenomena continued to be comprehended and explained by invoking the supernatural. Solar eclipses, for example, were seen by most ancient civilizations as a bad omen, and were linked with death, wars, famine, and disease (Steel, 2001). The use of myths was part of most cultures, including African, Mesopotamian, Indonesian, Greek, Roman, Zuni, Aztec, and Celtic societies. These were religious narratives about various aspects of reality that transcended the possibilities of common experience (Leeming, 2005). This understanding of the world influenced human behaviour, culture, and traditions in all parts of the world. Nature, then only poorly understood, was seen as chaotic and dangerous.

It was the Greek conception of the universe that set in motion the intellectual growth of humanity, and importantly, the search for scientific explanations. The Greek influence, particularly on the western civilizations, is undeniable, as it introduced many of these societies to theatre, drama, and architecture, as well as democracy, philosophy, and mathematics. Today, it is perhaps not with great enthusiasm that qualitative researchers view mathematics, mostly due to its affiliation with quantitative approaches. Yet, mathematics and geometry did play a fundamental role in the development of western philosophical thought, and, as we will see later in the book, continue to enjoy this privileged position in the field of quantum mechanics. The search for things-in-themselves at the quantum level, which is both a scientific and a philosophical endeavour, is mainly possible because of mathematics. Hence, not only did mathematics change our view of nature, its application seems inevitable for unlocking the remaining mysteries of the universe:

> From the days of Pythagoras and Plato down to those of Kant and Herbart the mathematical sciences, and especially geometry, have played so important a part in the discussions of philosophers as models of method and patterns of certitude, that philosophy cannot but be extremely sensitive to any change or progress occurring in the views of mathematicians. (Schiller, 1896: 173)

There are many books on the history of mathematics, but its rollercoaster journey is perhaps best depicted in *Mathematics: The Loss of Certainty* by Morris Kline (1982), whose insights are valuable for the task ahead. Concerning broader philosophical debates, mathematics can be understood as initiating the quest for finding objective truths, and in its early days, it was held as reality itself. Kline tells a story of a science that, for a long time, provided the security of certainty, but eventually had to face the realization that mathematical formulas were not *truths*, and that there was not only *one* mathematics according to which the universe works, but *many* mathematics. Even more damaging were assertions that the application of mathematics was determined by experience – a claim intensified by the fact that it was mathematicians themselves proposing that mathematics is the outcome of sensory experience, and that it originates in the mind of the beholder. Therefore, the 'story' of mathematics is not only important with respect to appreciating its developments as a science, it is also fundamental in thought about mathematics on the philosophical front.

As noted, the ancient Greeks were the first to challenge belief in the supernatural forces and the divine order of things in the universe, and thus marked the distinction between supernatural and natural explanations of phenomena (Kline, 1982). Although the Babylonians and Egyptians knew mathematics and astronomy and even had some medical knowledge, it was the Greeks who advanced the rational theory of nature. Reason was firmly applied by the Greeks not only to mathematics but also to justice, education, and other aspects of social life. In fact, much of what we know today – and the ways in which many societies operate – has been erected upon the pillars of reason. The departure from religious conceptions of the universe[1] was a new attitude that embraced secular, rational, and critical thinking. The Greeks were motivated to understand the *Logos* of the world, 'the underlying law that made all things in the universe run as they do' (Lightbody, 2013: 7). This drive to discover how things *really* are by applying specific methods suggests that it is in ancient Greece that we start to see the beginnings of what in contemporary terms is called *realism* and *objectivism*. The magnitude of this shift in human thought, whereby for the first time in our existence nature was believed to be rationally ordered, is emphasized by Kline:

> All phenomena apparent to the senses, from the motions of the planets to the stirrings of the leaves on a tree, can be fitted into a precise, coherent, intelligible pattern. In short, nature is rationally designed and that design, though unaffected by human actions, can be apprehended by man's mind. (Kline, 1982: 10)

In light of this newly emerged worldview, the physical world operates independent of human beings, who, nonetheless, can understand how it works. For the Greeks, there was an order according to which the universe functioned independent of man's mind, but which was within reach through rational processes. Importantly, they believed that there was a specific means of accessing the workings of nature – and this means was none other than mathematics (Kline, 1982). The early mathematical organization of nature developed by the Pythagoreans, led by Pythagoras (c. 585–500 BCE), can be seen as the first attempt at a rational explanation of the world we see. And to appreciate just how much the Pythagoreans were serious about numbers and mathematics, we only need to consider the oath that they swore by the Tetractys, which goes as follows:

> I swear in the name of the Tetractys [the numbers 1, 2, 3, and 4, particularly valued by Pythagoreans] which has been bestowed on our soul. The source and roots of the overflowing nature are contained in it. (Kline, 1982: 14)

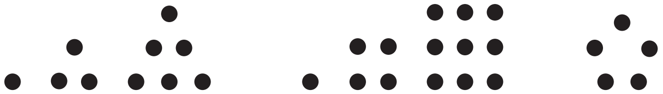

Figure 2.1 Triangular, square, and pentagonal numbers (adapted from Kline, 1982: 13)

It is worth pointing out that the early Pythagoreans believed that the external world was made up of mathematical shapes. Numbers were not mere theoretical entities or abstract ideas (as we tend to think if them today): they were points or particles which, when arranged, would form various geometric figures (triangles, squares, pentagons). Numbers were seen as inherent in things and thus nature as corresponding to geometric figures, as shown in Figure 2.1. Following the Pythagorean doctrine, therefore, all natural phenomena exhibited mathematical properties, and numbers were conceived as 'the matter and form of the universe' (Kline, 1982: 12). The extent to which this was applied to other aspects of their life, such as music, is discussed in the textbox below.

As the science of mathematics developed, the later Pythagoreans and Platonists affirmed more and more strongly the notion of 'absolute truths'. Plato (c. 428–348 BCE), for example, distinguished between the world of objects and the world of ideas. While the material world was flawed, the *Ideal* world was perfect, and it was here that absolute and unchanging truths could be found (Kline, 1982). His ideal world of *forms* was vastly different from everyday life, susceptible as it was to change, turmoil, and inconsistency: 'For Plato, the world of everyday sensory experience was not the "real" world. The real world for Plato – reality – was a changeless ideal world that could be perceived only by the intellect' (Huerta, 2005: 20). Notably, for the Platonists, numbers and the science of mathematics were not merely the means for understanding nature: mathematics was nature itself, 'the reality about the physical world' (Kline, 1982: 29). Relating these views to our discussion on metaphysics and ontology in Chapter 1 (see Figure 1.3), we can understand Plato's idealism as a strong metaphysical claim which saw mathematics at the core of the structure of the universe. In other words, mathematics was not only a lens though which worldly phenomena could be explained, it was also one of the foundational pillars upon which the universe was erected. Thus, true reality was a 'nexus of mathematical laws' that could be verified by employing sensuous experience (Lodge, 2001: 117). Importantly, it was only through rational analysis that this *Ideal* world could be accessed.

A rationalist view of music in Ancient Greece

The Ancient Greeks believed that music, like all else in the physical world, was subject to mathematical laws. Musical theory, Gozza explains, was a mathematical discipline, whose characters were 'not sounds but numbers, and the ratios between numbers defined the relationships between sounds' (2000: 1). To produce pleasant or harmonious tunes was a matter of choosing the 'right' numbers. Pythagoras experimented with strings, water-filled glasses, vases, pipes, and finally a single string stretched over a sounding board, thereby discovering the following consonances: 'by dividing the string in two parts, one of which double ($^{2}/_{1}$), then one and a half ($^{3}/_{2}$) and finally one and a third ($^{4}/_{3}$) times longer than the other, and plucking them, two notes of different pitch can be heard at a distance, respectively, of an octave (C-C), fifth (C-G) and fourth (C-F)' (Gozza, 2000: 4). In other words, harmonious sounds are generated by dividing the string into equal parts.

Aristotle (384–322 BCE), another key figure of ancient Greek philosophy, did not share the Platonian outlook. Unlike Plato, he saw material objects, not numbers, as the source of reality, and was interested in actual observation and classification of the natural world. As Kline (1982) explains, to Aristotle, mathematical concepts were only abstractions of the real world. He emphasized universals and general qualities that can be abstracted from real things. To obtain these, he proposed that inquiry must '"start with things which are knowable and observable to us and proceed toward those things which are clearer and more knowable by nature". He took the obvious sensuous qualities of objects, hypostatized them, and elevated them to independent, mental concepts' (1982: 17). This contrast between Plato and Aristotle is not insignificant, as each paved the way to distinct philosophical stances. If Aristotle is to be seen as the forerunner of scientific inquiry, and perhaps as one of the first naturalists and empiricists, Plato can be depicted as the opposite, mainly for his abstract metaphysics. Plato's world of Ideas later became attractive to Christian thought, giving rise to Christian Platonism (Huerta, 2005). Although Plato has been the target of criticism – for example, Mayr (1982: 304) calls him the 'great antihero of evolutionism' with a 'deleterious impact on biology through the ensuing two thousand years' – we shall not descend into trivial accusations, but rather keep our minds open in order to appreciate the varied strands of philosophical thought. What we can take away from this brief analysis is that for Plato, *truth* resided in the abstract and was accessible by rational thought, and could not be obtained by observation and the methods of empiricism – thus opposing the view of Aristotle.

Deductive reasoning and the rollercoaster ride of mathematics

The popularity of geometry and mathematics, and the reason why they were so prominent, can be attributed to a specific method of reasoning devised by the Greeks: that of deductive proof. This method came to be accepted as the only way to obtain truths about the universe. Geometry became a *deductive* science due to the work of Euclid of Alexandria (fl. 300 BCE), who organized rules for computing lengths, areas, and volumes into a body of knowledge so effectively that geometry became the most bullet-proof branch of science for the centuries to come (Ryan, 2009). He established an axiomatic system which consisted of definitions, postulates, axioms, and theorems. Put simply, Euclid defined the terms he used (e.g., points, angles, lines, planes – 'a line is a breadthless length'); wrote 12 axioms or statements of self-evident truth (e.g., if equals be added to equals, the wholes are equal); he delineated five postulates – the basic suppositions of geometry (e.g., all right angles equal one another); and formulated nearly 500 theorems or geometrical statements (e.g., straight lines parallel to the same straight line are also parallel to one another) (Norton, 2013). The significance of his method is that the theorems were deduced *logically* from the definitions, axioms, and postulates. Euclid's deductive, axiomatic method therefore did not rely on empirical evidence; it was purely logical. And although the truth of the theorems was not necessarily self-evident, 'it was guaranteed by the fact that all the theorems had been derived strictly according to the accepted laws of logic from the original (self-evident) assertions' (Ryan, 2009: 1). Euclid's intellectual achievement was so crowning that Euclidean geometry was to become the foundation for a predominant view of the world for the next 2,000 years.

Mathematical investigation of nature continued well into the eighteenth century with many other scientists, including Isaac Newton (1642–1727), who insisted on mathematical descriptions of the world. It is worth emphasizing that until then, Euclidean geometry was the *only* possible geometry. Kline explains that Euclidean geometry was held in such high esteem because it was the first to be deductively established, and also because its theorems had been found to be 'in perfect accord with the physical facts' (Kline, 1982: 78). Euclidean geometry encapsulated the conviction that there was only one truth about space. With the discoveries of new, non-Euclidean geometries and algebras in the eighteenth and nineteenth centuries, such as double elliptic and hyperbolic geometries, which offered equally valid explanations of space, a crisis in mathematics was sparked. The consequences of these discoveries were of immense importance: there now seemed to be multiple truths about space and thus the external world at large. In addition, arithmetic and algebra suffered a similar blow with the appearance of quaternions, matrices, and other new, unusual algebras: 'The very fact that new algebras appeared on the scene made men doubt the truth of the familiar arithmetic and algebra' (Kline, 1982: 92).

It would be a major omission not to bring into the picture of this crucial period two other influential philosophers who challenged the privileged position of mathematics. These are Immanuel Kant (1724–1804) and David Hume (1711–1776), and we will examine both in more detail in Chapter 3. Kant questioned both the inherence of mathematical/geometrical laws in the universe and the notion of universal design by God. Even more scandalous were Hume's ideas, as he rejected both, proposing that all knowing is facilitated by the human senses. Kant and Hume's contesting views contributed to the slow demise of mathematics as the central organizing principle of the external world, and the eventual dismissal of the previously held universal truths. In other words, they undermined the primacy of rationalism and the notion that truths about the world are only obtainable by rational thought. On these events, Kline remarks that 'by destroying the doctrine of an external world following fixed mathematical laws, Hume had destroyed the value of a logical deductive structure which represents reality' (1982: 75).

Among those who challenged the ultimate status of mathematics was Hermann von Helmholtz (1821–1894), who delivered one of the strongest critiques yet. He proclaimed that arithmetic cannot be determined *a priori* – that is, before experience – because only experience can tell us in which situations it does apply and in which it does not (Kline, 1982). Consider that, when we speak of physical phenomena, it is not at all clear *a priori* that 1+1=2 is always applicable. For instance, we may add one yellow tomato to one red tomato and agree to have two tomatoes, however, if we merge one bowl of tomato soup with another bowl of tomato soup, we would not end up with two bowls of tomato soup. Likewise, adding yellow colour to red colour does not produce two yellows or two reds, rather, it may produce a different shade (orange), suggesting again that 1+1=2 does not hold in all scenarios. Hence, the laws of arithmetic do not always apply nor accurately describe phenomena in nature.

Qualitative researchers may be interested to know that there were mathematicians who have argued that mathematics was an invention in the same way literature or banking was (Hersh, 1997). For this group of thinkers, mathematics had nothing to do with universal truths: it was a cultural enterprise. Indeed, for many cognitive scientists today, numbers express nothing more than ideas. According to Lakoff and Núñez, for example, the cognitive science of mathematics rules out that mathematical objects are real and 'objectively existent entities', rather they are dependent on embodied human cognition: '[s]ince human mathematics is all that we have access to, mathematical entities can only be conceptual in nature, arising from our embodied conceptual systems' (2000: 366).

The story told through the example of mathematics is a significant one. The long-held belief that mathematics was the key to understanding the secrets of the universe, and that mathematics existed in an *ideal* world outside space and time, not only inspired rationalism, it was also one of the main arguments against empiricism. Accordingly, truths about the workings of the universe were to be grasped deductively by the rational mind, without the need for experience. This conception eventually collapsed under the weight of a competing view, which insisted that mathematics, including its axioms and theorems, was determined by human experience. Mathematical truths and mathematics as a whole thus became secondary to knowledge grounded in observation. This epistemic conflict can be formulated as the battle between pure reason and empiricism.

Reason versus experience

To be able to assert that a proposition is true, it has to be justified. This important realization is credited to Plato, who defined knowledge as *true belief*. Plato held that knowledge was a form of belief – 'true belief accompanied by an account'

(Hoitenga, 1991: 1). Consider, for example, that for a long time, people were content with the belief that the Earth was flat and shaped like a disk. It wasn't until approximately 500 BCE that Pythagoras challenged this conception when he made detailed observations of the constellation Ursa Major, and inferred from these that the Earth had to be spherical (Clark & Clark, 2004). The idea of a flat Earth, however, was revived again during the Early Middle Ages, and in the fifth century CE, Father Lucius Lactantius condemned the notion of a spherical Earth as heresy (Carey, 1988). The notion of a flat Earth was 'true' because it was stated to be so in the scriptures. This episode demonstrates that the fundamental distinction between knowledge and mere belief (or dogma) rests on the recognition that beliefs can be false. In order to justify that a belief is true, it must meet certain criteria and be supported by evidence.

The question of what constitutes sufficient proof for propositions to be true was the subject of fervent discussion between two medical schools in Ancient Greece as early as 300 BCE. Frede (1990) explains that the dispute was over the supremacy of experience, advocated by the empiricist doctors (the *empeirikos*), and logic, advanced by the rationalist doctors (the *logikos*). The rationalists held that knowledge had to be an achievement of reason because experience alone could not amount to medical knowledge. On the other hand, the empiricists argued that to *know* was a matter of observation, correct remembering,[2] and application. This involved a 'specialised kind of experience' – comparable to technical knowledge – that drew mainly on use of the senses and memory (1990: 226). Furthermore, Frede tells us that the empiricist regarded *reason* as unreliable and untrustworthy, and as far as knowledge was concerned, doctors prescribed medicine not because of some kind of theoretical reasoning but because it was proven to be effective in experience. If a remedy proved successful in experiments (i.e., when tested in practice) that was all that was required as a criterion for knowledge. Hence the debates about the nature of knowledge and how it is justified (i.e., debates over inductive versus deductive thinking) date all the way back to antiquity.

With the achievements of Euclid of Alexandria, reason and mathematics eventually came to dominate the intellectual scene and laid the foundations for a worldview that prevailed for nearly two millennia. The spread of the Catholic doctrine meant that scientific advancements, including mathematics, as we have seen earlier, came to be seen as revelations of God's creative process, including that He 'designed the world in accordance with mathematical principles' (Kline, 1982: 58). Empiricism, both as a philosophy of science and as a method, was dormant for most of the Middle Ages. In this historical period, all philosophical, scholastic, and cultural activities were controlled by the Church. To contradict the teachings of the Church was to commit heresy. Galileo (1564–1642), for example, had to appear before the Inquisition in Rome for embracing the work of Copernicus (1473–1543) and for suggesting that the Earth and planets revolved around the Sun. During the Renaissance, universities were ecclesiastical organizations either supervized by or strongly connected to the Church (Rüegg, 2004), and all profound thinkers from that period were likely to be theologians by profession (Moody, 1975).[3] From Descartes, PascaI and Kepler, to Copernicus, Galileo and Newton, mathematical knowledge as absolute truth was a reflection of God's magnificence. Scientific discoveries, therefore, were not taken as the triumph of human beings and their ability to unravel the ways in which nature operates so much as testimonies to the greatness of God.

Not surprisingly, the Middle Ages and much of the Renaissance period were marked by speculation, and the interpretation of many natural phenomena involved a belief in the supernatural. This can be seen most strikingly in the area of medicine, where a paucity of medical knowledge and a poor understanding of the causes of diseases meant that conclusions were drawn based not on empirical evidence but rather on superstitious beliefs. Like universities, hospitals were religious establishments and the doctors and nurses assisting patients were members of religious orders (Rogers, 2011). Medical 'knowledge' and education in medieval universities were based on the translated writings of Roman physician Aelius Galenus (130–200 CE), whose work dominated western medicine for nearly 1,300 years (Rogers, 2011). In other words, not much progress was made in medicine during the first millennium. In the following centuries there were only pockets of experimental methods, such as at the Medical School of the Bologna University (founded around 1063), known to have lectures on Latin, Greek, Arabic, and Hebrew medical literature (Moroni, 2000). Notable among its faculty was Mondino Dei Liuzzi (1270–1326), who conducted first-hand examinations of the human body (Carlino, 1999). A more widespread return to empiricism only began in the sixteenth century, with new advances being made by means of experimentation and observation – such as the groundbreaking discoveries based on dissections, exemplified in the work of Andreas Vesalius (1514–1564), a Flemish professor of anatomy. Rogers highlights the magnitude of these developments using the example of William Harvey (1578–1657):

> Harvey's discovery of the circulation of the blood was a landmark of medical progress. The new experimental method by which the results were secured was as noteworthy as the work itself. Following the method described by the philosopher Francis Bacon, he drew the truth from experience and not from authority. (Rogers, 2011: 37)

Given that opposing the Church could lead to punishment by death, only determined intellectuals like Harvey dared proffer that religious knowledge was less important than knowledge of nature (Cook, 2010). Nonetheless, a growing number of thinkers, scientists, and practitioners began to see how limiting it was to stick with views of nature that were heavily underpinned by the doctrines of the Church. With growing acceptance of the Copernican theory and the writings of Galileo Galilei, Pierre Gassendi (1592–1655), and Marin Mersenne (1588–1648) came a gradual shift towards scientific thinking, and eventually a fundamentally different view of the natural world (Wilson & Reill, 2004). This exhilarating period was to be known by two names: the Scientific Revolution (1500–1700) and the Age of Enlightenment (1650–1800).

The Cartesian method and *a priori* knowledge

As part of our general overview of the rationalist–empiricist debate, we cannot pass over one of the pivotal figures in the philosophy of science – seventeenth-century philosopher and mathematician René Descartes (1596–1650). In contrast to those who supported the idea of scientific knowledge as mainly stemming from observation and experience, Descartes held that *true* knowledge was the product of reason and logic. He was interested in *a priori* truths and believed that 'by its own power the intellect may arrive at a perfect knowledge of all things' (Kline, 1982: 45). The Cartesian method describes the rules for 'employing rightly the natural capacities and operations of the mind' (Copleston, 1958: 73). Following Descartes' ideas, the only way to acquire *a priori* knowledge is through *intuition* and *deduction*. Intuition (sometimes called 'mental vision') refers to the operation of the mind 'in which a proposition is perceived all at once or in a moment, and so clearly and distinctly as to be certain or indubitable' (Loeb, 1986: 246). The illustration Descartes gives in Rule III, for example, is the ability of a human being to mentally intuit that a triangle is bounded by three lines (Sasaki, 2003). One only has to be attentive to grasp this truth – an example of Descartes' contention that entering this attentive state is all that is needed to access what he called 'first principles'.

Furthermore, there was a difference between the cognitive operations of *intuitive* and *deductive* reasoning. For Descartes, the concept of *intuition* was 'knowledge at rest', while *deduction* referred to a 'mental movement toward knowledge' (Groarke, 2009: 310). Groarke clarifies that *intuition* was to be understood as 'an instantaneous, all-at-once illumination', and *deduction* as a kind of 'movement or succession' (2009: 310) – in other words, a mental activity performed by the inquirer. Deduction or logical inference, then, implies movement or a step-by-step process; intuition does not require movement at all. Intuitions or first principles are a 'product of looking' (2009: 311).

According to Schouls, Descartes considered himself to be doing the work of 'proper' philosophy, which involved 'seek[ing] out the first causes and the true principles from which reasons may be deduced for all that we are capable of knowing' (1989: 28). By comparison, the empiricists, who became the pioneers of the Enlightenment, were reluctant to share Descartes' conviction. The astronomer, mathematician, and physicist Galileo Galilei, for example, argued that in physics, 'first principles must come from experience and experimentation' (Kline, 1982: 48). It was through observation of nature that the mind could create concepts and make sense of external phenomena. Galileo also criticized Descartes' method for its lack of ability to predict. Galileo was not so much interested in the cause of why something happens as he was in establishing descriptive formulas – describing phenomena mathematically (Kline, 1982). Descartes, in turn, perceived Galileo's reliance on observation and the senses as a methodological weakness. It should be noted that Descartes was not against experimentation per se: he simply did not agree that it was the essence of science, 'did not think of science as a cumulative activity' (Ree, 1974: 43).

The distinction between the truths of the mind (e.g., Descartes) and truths based on experimentation (e.g., Aristotle, Galileo, Francis Bacon) is captured by the terms '*a priori* knowledge' and '*a posteriori* knowledge'. *A priori* justifications rely on rational intuitions or insights; they are based on reason alone and include mostly abstract concepts and mathematical calculations (Russell, 2007). Take for example the statement 'a bachelor is an unmarried man'. We do not need to carry out an empirical study to confirm that all bachelors are unmarried men; it is a self-evident statement because the notion of 'unmarried man' comes with the term 'bachelor'. Likewise, in the view of rationalists, mathematical truths, such as $1 + 1 = 2$, are self-evident and do not require observation. *A posteriori* knowledge, on the other hand, is knowledge derived from sense data. In their support of this notion, empiricist philosophers denied the claim of *a priori* mathematical knowledge, arguing instead that mathematical truths are analytic (expressing relations between ideas) or based on experience (Ladyman, 2002).

In summary, the proponents of rationalism, including Plato, Descartes, Malebranche, Spinoza, Leibniz, Hegel, and others, are often associated with *a priori* knowledge. Many rationalists perceived a mind–body dualism, holding that the mind is different from the body, and therefore, sense perception and mental experiences are of secondary importance. They insisted on the distinction between reality (only accessible through reason) and appearances (Nelson, 2013b: xiv). On the other hand, empiricists such Aristotle, Berkeley, Locke, Hume, and the positivistically inclined thinkers argued that knowledge derives from sensory experience and observation. As a rule, knowledge that is not *a priori* and founded on reason alone must be *a posteriori*. The following section will further explore the shift towards an *a posteriori* view of science and trace the rise and fall of logical positivism.

Positivism and logical empiricism/positivism

The revitalization of empiricism can be situated within two overlapping epochs in the history of the west noted earlier: the Scientific Revolution and the Age of Enlightenment (or simply 'the Enlightenment'). The Scientific Revolution has been described by historians in many ways, but it generally represents radical changes in humans' conception of nature, the shift from the Medieval period, and the emergence of modern science (Applebaum, 2000). Here the word 'revolution' is not being used in the traditional sense as there was no specific event in time and space. Rather, as Shapin clarifies (1996: 1), it was coined by the French historian Andre Koyré in 1943 to mark a historical period in time when 'the world was made modern'. The Enlightenment is intertwined with, and was influenced by, the Scientific Revolution, but as a term refers more specifically to the social, political, and economic changes in European societies in the eighteenth century. The Enlightenment is perhaps most fittingly described as a 'set of attitudes' underpinned by criticism and 'a growing questioning of traditional institutions, customs, and morals' (Love, 2008: xiii).

The key events associated with the setting in of the Scientific Revolution are Copernicus's heliocentric model of the solar system (approximately 1543 CE), Newton's idea of a mechanical universe (1687 CE), and the appearance of new methods and approaches to the study of natural phenomena (Rogers, 2011). With the prevailing views of the world changing, it was inevitable that scientific and philosophical conceptions would also be subjected to modification. Unlike the rationalists, the empiricists were unified in the conviction that the only way to discover facts about the universe was to search for them in nature. They 'held firmly to the principle that knowledge *about the outer world* must come from the outer world, and so can be acquired only by observation and experiment' (Jeans, 2012: 37). In Britain, empiricism gained full momentum in 1660s with the Royal Society's embracing of a novel outlook, described by Wolfe and Gal as 'an open, collaborative experimental practice, mediated by specially-designed instruments, supported by civil, critical discourse, stressing accuracy and replicability' (2010: 1). This was a move towards scientific knowledge predicated on observation of the material world and experiments. The most well-known empiricist was Francis Bacon (1561–1626), dubbed the father of empiricism, and the British trio of John Locke (1632–1704), George Berkeley (1685–1753), and David Hume (1711–1776), who became influential in the eighteenth century, and whose influential ideas we shall focus on in Chapter 3. For the time being, we continue to examine the chronological developments of empiricism, which take us to *positivism* and, later, the *logical positivism* of the twentieth century.

Positivism has its roots in empiricism, drawing ideas from Ludwig Wittgenstein (in particular his work *Tractatus Logico-Philosophicus*), Gottlob Frege, Betrand Russell, and the early British empiricists. Locke and Hume in particular were labelled 'fundamental craftsmen of modern empiricism' (Levine, 2006: 171). The term 'positivism' was coined by French philosopher Auguste Comte (1798–1857). Among his many achievements, such as building the foundations of the discipline of sociology, Comte is known for his Law of Three Stages (Comte, 1858), which puts forward the idea that every branch of science passes through three stages: the theological stage, the metaphysical stage, and the positive stage. Hung (2014), distilling Comte's ideas, explains that during the theological stage, science grapples with natural phenomena by employing supernatural agents such as spirits, devils, gods, and ghosts; the second, metaphysical stage marks an advancement inasmuch as the 'supernatural' becomes more abstract, and the language changes to refer to inanimate agents (e.g., mass in Newton's mechanics); at the third, mature or positive stage, science becomes the practice of positivism. Comte's notion of positivism, within the context of the Law of Three Stages, suggests an ascription to humans of a level of maturity in their search for knowledge. Bourdeau (2013) further comments that, in Comte's view, the first stage is necessary, the second transitory, and the last a positive state whereby the mind no longer looks for causes of phenomena, but instead seeks to understand the laws governing them.

Bourdeau (2013) emphasizes that, contrary to popular belief, Comte's positivism was not a philosophy of science, but a political philosophy whose goal was to reorganize society. This vision is most evident in Comte's *First System of Positive Polity* (Comte, 1875). With respect to the development of scientific knowledge, Comte did not believe that there was an overarching purpose to nature and saw no room for any metaphysical or theological explanations in science. Instead, he argued that 'the only legitimate practice in science is the observation and generalization of constant conjunctions of natural phenomena or events' (Hung, 2014: 314). The value of science, Comte believed, lay in the use of the positive method, be it observation in astronomy, experimentation in physics, or comparison in biology (Bourdeau, 2013).

Despite the distinction drawn between the rationalists and the empiricists, and although the positivists and empiricists shared common ground, it would be erroneous to presume that *all* empiricists and positivists agreed about *a priori* and *a posteriori* knowledge. For some, empiricism did not necessarily mean a complete departure from reason. As pointed out by Jeans (2012), Locke and Hume, and later on Whitehead and Russell, did not object to the idea that mathematical truths could be obtained by intuition, that is, *a priori*. In this regard, one can distinguish between a *mild* version of empiricism – the willingness to accommodate logic under certain circumstances – and a *strong* version that dismissed the idea of *a priori* knowledge altogether. John Stuart Mill (1806–1873) was a prime example of nineteenth-century *strong* empiricism. As Jeans elucidates, Mill rejected the notion of any knowledge as *a priori* and refused to accept intuitive knowledge as a whole, including mathematical truths. He maintained that 'the laws of arithmetic embodied generalizations derived from observations of actual objects, while geometry dealt merely with idealizations of objects of experience' (Jeans, 2012: 36). In other words, the notion of mathematical objects could not be imagined without their representation in the natural world (e.g., a line), and so mathematics and logic, Mill argued, had to be founded on experience. Reluctant to entertain the idea of axiomatic principles (embraced by Euclidean followers such as Descartes), this is what he had to say about axiomatic truths:

> It is not necessary to show that the truths which we call axioms are originally *suggested* by observation, and that we should never have known that two straight lines cannot inclose a space if we had never seen a straight line [...] Without denying, therefore, the possibility of satisfying ourselves that two straight lines cannot

> inclose a space, by merely thinking of straight lines without actually looking at them; I contend, that we do not believe this truth on the ground of the imaginary intuition simply, but because we know that the imaginary lines exactly resemble real ones, and that we may conclude from them to real ones with quite as much certainty as we could conclude from one real line to another. The conclusion, therefore, is still an induction from observation. (Mill, 1858: 153–5)

Mill's views paint a clear picture of the different epistemic outlooks represented by the rationalists on the one hand and the empiricists on the other. His empiricism is often labelled 'extreme' because he regarded mathematical truths as empirical generalizations and all knowledge as being derived inductively (Rollinger, 1999). Logical positivism, which we define next, differed from empiricism and the work of Mill only in degree and in that, only an inquiry which could be verified by experimentation or logic was scientifically meaningful. All else was held by the logical positivist as scientifically meaningless.

Key tenets of logical positivism

In the early twentieth century, groups of intellectuals started to meet on a regular basis in Vienna and Berlin. These gatherings, which stretched through the 1920s and 1930s, came to be known as the Vienna Circle and the Berlin Circle. The Vienna Circle was led by Moritz Schlick and the Berlin Circle by Hans Reichenbach. Among the original members of the Vienna Circle were Otto Neurath, Friedrich Waismann, Hans Hahn, Olga Hahn, Victor Kraft, Philipp Frank, Kurt Reidemeister, and Herbert Feigl; later, it was joined by other prominent thinkers such as Gustav Bergmann, Béla Juhos, Karl Menger, Richard von Mises, Edgar Zilsel, Kurt Gödel, Rudolf Carnap, and Alfred J. Ayer (Stroll, 2000). In Berlin, Hans Reichenbach led the Society of Scientific Philosophy. Reichenbach preferred the term 'logical empiricism' as opposed to 'logical positivism' to distinguish his programme from the one in Vienna (McGrew et al., 2009). The members of the Berlin Circle included Carl Hempel, David Hilbert, Kurt Grelling, and Richard von Mises.[4] Apart from the German and Austrian gatherings, there were intellectuals in other parts of Europe known to support the positivist views, such as in Prague and Warsaw. During the wars, some of the scholars migrated to Britain and the United States (e.g., Carnap became a professor at the University of Chicago and Reinbach at the University of California). The extent to which the logical positivists exerted influence over scholarly communities and dominated much of philosophical thought is captured by Sarkar (1996: ix) in his assertion that they established a 'temporary hegemony over academic philosophy'.

It is useful to be aware that the terms 'logical positivism' and 'logical empiricism' tend to be employed interchangeably in the literature.[5] Another label that is used for the logical developments in the philosophy of science is 'neopositivism'.

We will use the term 'logical empiricism' to capture the continuation of empiricism in the twentieth century, reflecting that all the representative thinkers were united in their vision to eliminate 'metaphysical nonsense from empirical science' (Rosenberg, 1999: 12) and align philosophy with other 'genuinely scientific disciplines' (Uebel & Richardson, 2007: 4). Uebel explains that, in general, the philosophy of science espoused by logical empiricists treats *a priori* knowledge and any form of metaphysical intuition as unintelligible (Uebel, 2013). Furthermore, logical empiricists made a distinction between the empirical sciences (such as physics, biology, and the social sciences) and the formal sciences (such as logic and mathematics). This was a key part of their strategy to renew empiricism 'by freeing it from the impossible task of grounding logical and mathematical knowledge' (2013: 90). This way the first principles (i.e., axioms and postulates) could be recognized by the positivists in mathematics, for example, but were to be rejected in science. In this respect, logical empiricism made no allowances for anything but logic and empirical science: 'Any claim that was neither logic nor able to be adjudicated by empirical means was rejected by the logical empiricists as "meaningless" or "cognitively insignificant," whatever its noncognitive (for instance, emotional) appeal' (Sarkar, 1996: ix). There are three core principles that underpin the tenets of logical positivism. These can be formulated as (1) the distinction between analytic and synthetic statements, (2) the principle of verification, and (3) a reductive thesis. Drawing on the analysis of Stroll (2000: 65–70), we can expand upon these as follows.

The distinction between analytic and synthetic statements

There is a sharp distinction between *analytic* and *synthetic* statements. For example, 'All bachelors are single' is a tautologous and self-evident statement. The meaning of the world 'bachelor' directly implies that we are speaking about a single male. However, it is a different statement altogether to utter that 'All bachelors are mortal'. This statement cannot be viewed as self-evident because its truth can only be established through observation and experimentation – what logical positivists call *sense experience*. To determine whether or not it is true that bachelors are mortal we have to investigate the world (i.e., experience has shown us that human beings can die). In the philosophy of science, such a proposition – one that entails empirical investigation in order to confirm its truth – is called a *synthetic statement*. These are often synonymous with the terms 'factual', 'empirical', 'contingent', and '*a posteriori*'. On the other hand, the truth of a statement that is self-evident (like 'All bachelors are single') emerges from the direct meaning of its constituent words. These are called *analytic statements* and are synonymous with the words 'necessary', 'tautological', and '*a priori*' (Stroll, 2000: 65). Importantly, for the logical positivists no proposition can be both synthetic and analytic.[6] The conclusion they drew, as Stroll explains, was that 'analytic propositions do not give us any information about the world, that is, that they lack existential import' (2000: 66). Hence, only synthetic propositions are informative about reality and 'true when what they assert corresponds to the facts' (2000: 66). This meant that the rationalist tradition advanced by the philosophy of Plato, Descartes, Spinoza, Hegel, Bradley, and others, could be rejected because it drew heavily on reason.[7] Positivists held that any knowledge about the external world had to be based on sense experience and observational data because reason alone could not yield facts about natural phenomena. Stroll summarizes this:

> [I]f the positivists were right, namely, that all truths of reason were empty of factual content, the rationalist tradition was wholly misguided. In effect, this was a powerful defence of empiricism. (2000: 66)

The principle of verification

According to Stroll, the principle of verification enabled the logical positivists to dismiss not only metaphysical propositions but also humanistic disciplines in general. Why? Because they could not produce cognitive propositions. For instance, statements in poetry are not verifiable in the same way the laws of physics are. They may have a poetic meaning, but they are not scientifically significant, as Stroll (2000) explains. The positivists held that propositions had to be empirically verifiable (i.e., verifiable in principle). The principle of verification asserts that 'no sentence that refers to a "reality" transcending the limits of all possible sense-experience can have any cognitive significance' (2000: 68). Put differently, anything that is not verifiable empirically was seen as of no scientific value. Amid some disagreement, the positivists came up with several formulations of the verification principle. The basic idea was that it denoted the view that observation and empirical verification had to show that something was either *true* or *false*. The verification principle was later challenged by a new theory introduced by Karl Popper, that of *falsification*, which we will address in the next section. Another, but no less vital, feature of logical empiricism was that knowledge could never be certain – only *probable* and based on given evidence (Stroll, 2000).

The reductive thesis

For the positivists, observation was at the core of the scientific method and thus had a special meaning, albeit not unanimously agreed upon. Stroll outlines their divergent views: (a) observation as direct apprehension of visual sense data (a phenomenalistic interpretation arising from the work of earlier empiricists such as Locke, Hume, and Russell, and emphasized by Carnap and Ayer); (b) observation of physical objects (a physicalistic interpretation of positivism advanced by

Neurath); and (c) observation based on either A or B (known as the 'principle of tolerance', advanced mainly by Carnap in 1937 in *The Logical Syntax of Language*). In broad terms, the main premise of the reductive thesis is that 'all factual knowledge can be reduced to observable data' (Stroll, 2000: 70).

A key aspect of logical positivism was the theory of *phenomenalism* advocated by A.J. Ayer (not to be confused with *phenomenology*, discussed in Chapter 4). Phenomenalism is the empirical thesis which states that unless statements are confirmed or verified by experience they are nonsensical. According to phenomenalism, therefore, the statements 'Plato was a great philosopher' and 'The Higgs boson is the smallest particle' are not verifiable in experience and should be excluded from scientific statements. Musgrave (1993) describes Ayer as a representative of twentieth-century idea-ism because he advocated the theory of sense data and argued that we can only know what is presented to us in consciousness.

The inductive and hypothetico-deductive methods

A typical distinction between the rationalists and the empiricists is that the first promoted the method of *deduction* and the latter the method of *induction*. The method of induction is a logical process for arriving at knowledge about observed phenomena. Despite its popularity among the members of the Vienna Circle, induction was not an innovation of the logical empiricists or logical positivists, instead dating back to their empirical predecessors. We also ought to be careful not to claim, as many texts do, that all positivists adhered to inductivism. For example, this is not true of Neurath or Carnap (Woleński, 1997). Inductive reasoning was promoted and embraced by the founder of the scientific method, Francis Bacon, for whom it played an important role in separating investigations of the scientific sort from unscientific varieties. It was later refined by Mill (1843), who took induction to be a process of 'real' inference:

> In every induction we proceed from truths which we knew, to truths which we did not know: from facts certified by observation, to facts which we have not observed, and even to facts not capable of being now observed; future facts, for example: but which we do not hesitate to believe upon the sole evidence of the induction itself. Induction, then, is a real process of Reasoning or Inference. (Mill, 1843: 225)

The aim of inductive methods is to produce universal generalizations that can be applied to yet unobserved phenomena (Smith, 1998). Inductive reasoning is 'founded on reasoning about cause and effect' (Ladyman, 2002: 38), such as observing natural phenomena and inferring that in light of past experiences, the Sun will rise tomorrow, apples fall toward the ground when ripe, birds can fly, and swans are white.[8] The scientist, immersed in the method of induction, seeks to infer general laws by moving from the particular to the general.

The gathering of observational data becomes the foundation for the building of scientific theories. It is a way of extrapolating general principles from individual observations. This process is depicted in Figure 2.2 (see 'A: Positivist/Verificationism'), as is the method of deduction, which generally follows the reverse process. Whereas induction is believed to broaden and deepen empirical knowledge, deduction tends to be explicative (Vickers, 2013).

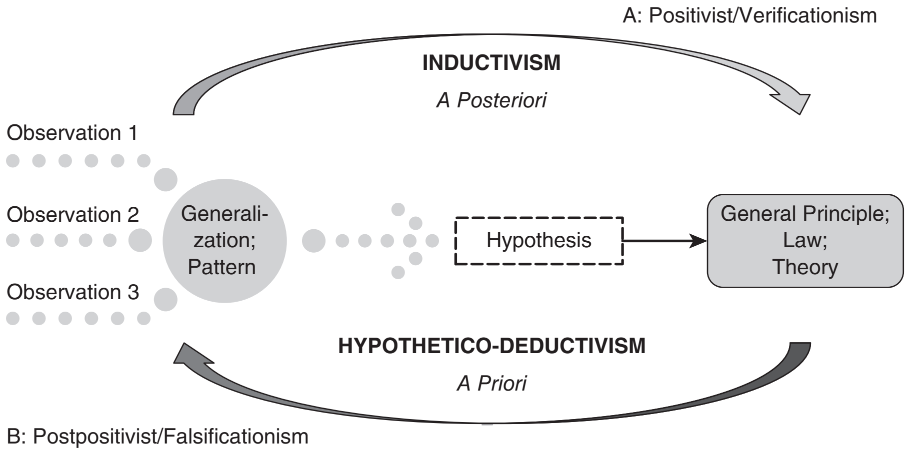

Figure 2.2 The method of induction (and deduction)

The proclamation that induction can lead to scientific knowledge was challenged by one of the greatest[9] philosophers of science of the twentieth century, Karl Popper (1902–1994). Popper, who maintained contact with the members of the Vienna Circle, was critical of the main tenets of logical positivism. He was not necessarily interested in the epistemological concerns of when a theory is *true* and under which conditions it is acceptable, rather his motivation was to distinguish science from what he called 'pseudo-science' (Popper, 1999b: 66). Later, he termed this issue a 'problem of demarcation' and argued that there were fundamental differences between the claims of various types of science. Popper's main point was that some scientific work is radically different from the rest – for example, Albert Einstein's gravitational theory – in that it could lead to knowledge that is neither based solely on observation nor merely generalized from particular instances, as is the case with induction. The role of observation was indeed important in Einstein's work: it could, and indeed did, serve to prove his hypothesis. However, in Popper's view, the very purpose of the scientific method is to use observation to either refute or confirm predictions, and predictions always involve risk (Popper, 1999b).

Popper thus saw a striking difference between the work of Einstein and the theories of other sciences. He held that Marx's theory of history, Freud's psychoanalysis, and Adler's 'individual psychology' were not scientific to the same degree because they were based exclusively on observation – which, in his opinion, was a significant limitation. Positivists used the method of *verificationism*, whereby the role of observation was to verify or confirm theories (e.g., the verification of Freud's theory by clinical observations). The difficulty with this approach, Popper explained, was that certain behaviour displayed by a person counted as yet another case to which a particular theory could be assigned. In other words, the way confirmation was obtained was by 'looking for it' in people's behaviour (Popper, 1999b). This method could only mean that each case that verified or confirmed a theory was nothing more than the case being interpreted through that theory. The biggest flaw pointed to by Popper was the impossibility of testing or refuting psychoanalytic theories. There was no human behaviour that could contradict them. Popper commented on Freud's theory:

> And as for Freud's epic of the Ego, the Super-ego, and the Id, no substantially stronger claim to scientific status can be made for it than for Homer's collected stories from Olympus. These theories describe some facts, but in the manner of myths. They contain most interesting psychological suggestions, but not in a testable form. (Popper, 1999b: 69)

Hence, for the positivists, the function performed by observation was solely confirmatory; theories that arose from observations alone by employing the method of induction were not, in Popper's view, scientific:

> 'Clinical observations', like all other observations, are interpretations in the light of theories [...] and for this reason alone they are apt to seem to support those theories in the light of which they were interpreted. But real support can be obtained only from observations undertaken as tests (by 'attempted refutations'); and for this purpose criteria of refutation have to be laid down beforehand: it must be agreed which observable situations, if actually observed, mean that the theory is refuted. (Popper, 1999b: 70)

Science, for Popper, was a hypothetico-deductive process: scientists were to formulate theories or hypotheses to be tested by experimentation and observation (as noted in Figure 2.2.). It is necessary to reiterate here that the role of observation had a fundamental role to play in Popper's methodology. The aim was not to verify or confirm theories, as in the case of the logical positivists, but instead to falsify, reject, or tentatively accept them (Vickers, 2013). In the words of Popper, 'the criterion of the scientific status of a theory is its falsifiability, or refutability, or testability' (1999b: 69). In other words, a theory could only be scientific if it were possible to test that it could be false. This possibility of proving theories wrong was imperative to his project. Another key aspect of Popper's philosophy was the separation of *truth* from the scientific process. Popper (2005) contends that the confirmation of hypotheses does not necessarily warrant that they are *true*: any theory may be refuted by future experiments, and therefore even the best and most seemingly confirmed theories available to us are, in fact, tentative.[10] As he proclaimed, 'Science is the quest for truth. But truth is not *certain* truth' (Popper, 1999a: 38).

Popper's critique of logical positivism, verificationism, and inductivism has led to him being labelled one of the main figures of *postpositivism*. His view of the scientific method as a hypothetico-deductive process underpinned by falsificationism is illustrated in Figure 2.2 (see 'B: Postpositivist/Falsificationism'). In contrast to the method of induction, Popper's scientific process commences with a theory, proceeds to forming a hypothesis that is tested through observation and experimentation, and finally is either confirmed or refuted. Through a continual process of falsification, successful hypotheses are eventually accepted as *best current theories*. As noted in Figure 2.2, the method for induction and verificationism is commonly associated with logical positivism, whereas the methods for hypothetico-deduction and falsificationism are methodological features ascribed to postpositivism. Knowledge grounded in observation and derived by means of induction is *a posteriori*; knowledge claims formulated prior to sense-observation and obtained via the hypothetico-deductive methods are *a priori*. Popper was a strong proponent of the *a priori* nature of propositions. He held that all knowledge was hypothetical and asserted that '99 per cent of the knowledge of all organisms is inborn and incorporated in our biochemical constitution' (Popper, 1999a: 70). With regard to the doctrine of rationalism, Popper used the term 'critical rationalism'[11] to emphasize that any proposition ought to be subjected to his principle of falsificationism and thought through rationally before being subjected to empirical testing. He contrasted it with 'uncritical rationalism' or 'comprehensive rationalism' – more dogmatic approaches to truth (Popper, 2013 [1945]).

Empiricism and rationalism in the social sciences

A longstanding problem of the social sciences can be expressed in the question of whether or not a conceptual line should be drawn between the social and the natural sciences at all. The answer determines how one conceives of not only social phenomena but also their ontological status, epistemological strategies, methodologies, and methods. The positivists and postpositivists responded with a resounding 'no' and strove to replicate in the social sciences the success of the scientific methods in the natural sciences. According to Bernstein, social science was to become 'a genuine natural science of individuals in society' that would 'diff[er] in degree and not in kind from the rest of the natural sciences' (1983: 27). For example, Otto Neurath, a member of the Vienna Circle, sought to establish the rules for an empirical sociology, and argued there was no difference between the natural and the social sciences as far as cognitive methods were concerned. As further remarked by Kolakowski, 'according to Neurath, the social sciences do not deal with human intentions, experiences, aspirations, or "personalities," but solely with the behaviour of human organisms' (1968: 190). There were also academics such as Max Weber – a pivotal figure of *interpretive* sociology, yet somewhat open to the idea of a scientific model of the social sciences – who claimed that it is possible to 'check the validity of sociological interpretations by appealing to statistical laws based on observations of what happens' (Bernstein, 1983: 27). This claim was rejected by anti-positivist thinkers, the likes of Peter Winch, who maintained that statistics were not the court of appeal for sociological interpretations because a misleading interpretation is still a misleading interpretation. Winch instead argued that:

> What is then needed is a better interpretation, not something different in kind [...] Someone who interprets a tribe's magical rites as a form of misplaced scientific activity will not be corrected by statistics about what members of that tribe are likely to do on various kinds of occasion. (Winch, 2008 [1958]: 113)

To appreciate the epistemic tensions and the numerous dichotomies that prevail to this day, it is necessary to underscore that the nineteenth century marked the debates over whether or not the social sciences should be called sciences at all. Jones (2000: 199) explains that the main dispute was over *humanistic* (*Geisteswissenschaften*) versus *positivistic* (*Naturwissenschaften*) approaches to social science, which led to 'understanding versus explaining', 'interpreting versus explaining', 'reasons versus causes', 'subjective versus objective', 'qualitative versus quantitative', 'sympathetic versus detached', and 'insider versus outsider accounts'. In this regard, many others had much to say on the issue of knowledge production in the social sciences, from critical theorists and interpretivists to social constructionists and hermeneuticians, some of whom we will explore in Chapters 5 and 6. To conclude our exploration of the empirical approaches to the social sciences, there is one more influential scholar whose impact should not go unnoticed: Émile Durkheim.

Émile Durkheim's positivism and the social sciences

Émile Durkheim (1858–1917) was key in establishing a scientific approach to sociology. He belonged to a generation of scholars who were fervent about the creation of new scientific fields and disciplines in what we now call the *social sciences*. During his time, there were multiple and competing views about the ways in which the human world was to be studied. Collins explains that 'it was not at all clear whether these should be part of the biological sciences, or the lineup of political ideologies, or connected to law and public administration [...], or part of the general education taught in the secondary schools' (2005: 106). Moreover, it was not certain whether sociology was to be combined with, or made distinct from, anthropology, social work, and other rival social disciplines such as psychology. His quest to cement the foundation for sociology as a unique discipline led him to 'formulate the character of sociology as dealing with "social facts," the *sui generis* character of patterns of social interaction, constraining the individual from without' (2005: 106). Sociology was to be established as a general science, and its task was to build general theory by empirical comparison and synthesis (Collins, 2005).

In his epistemic quest, Durkheim's (1982) notion of social facts was as 'things' that existed independent of individuals and which were to be studied and explained in terms of the norms, values, and structures within a society. His ambition was no less than for sociology to become a scientific, objective study of social facts as external 'givens' existing independent of individuals. The success of social science lay in adopting the scientific methods of the natural sciences. This conviction is elucidated in Steven Lukes's introduction to Durkheim's *Rules of Sociological Method* (Durkheim, 1982: 3): 'The sociologist must adopt what Durkheim thought was the state of mind of physicists, chemists and physiologists when they venture into an as yet unexplored area of their scientific field'. The extent to which social facts can be claimed to be 'things' that exist independent of individuals will concern us in Chapter 6 when we examine social ontology. In this respect, Durkheim epitomizes a realist and an objectivist view of social phenomena, as expressed by him in the following statement:

> Indeed, we do not say that social facts are material things, but that they are things just as are material things, although in a different way. What indeed is a thing? The thing stands in opposition to the idea, just as what is known from the outside stands in opposition to what is known from the inside. A thing is any object of knowledge which is not naturally penetrable by the understanding. It is all that which we cannot conceptualize adequately as an idea by the simple process of intellectual analysis. It is all that which the mind cannot understand without going outside itself, proceeding progressively by way of observation and experimentation from those features which are the most external and the most immediately accessible to those which are the least visible and the most profound. (Durkheim, 1982: 35–6)

Through a philosophical lens, Durkheim's main legacy is the application of the positivist principles to sociology. The study of social phenomena in general as 'things' or external structures that exist independent of social agents is what is perhaps most characteristic of the positivist, postpositivist, and (scientific) realist approaches to social science. The influence of positivism and postpositivism has been well covered in many qualitative research texts and need not be rehearsed here (see, for example, Denzin & Lincoln, 1994, 1998, 2000, 2003, 2005, 2011b; Guba, 1990; Guba & Lincoln, 1989, 1994; Lincoln & Guba, 1998, 2000). Broadly, positivism denotes the view that the scientific methods of the natural sciences ought to be adopted as a model in the study of human experience, behaviour, and social worlds. The positivistic view, as we have seen, is underpinned by the original ideas of empiricism, which 'establishes the basis for assuming that we can know what is "out there" objectively in the world via our sensory experiences' (Slife & Williams, 1995: 214). Positivistically motivated social science is often characterized by the discovery of fundamental causal laws, careful empirical observation, and value-free research, whereby preference is given to surveys, statistics, and quantitative data – all to be thought through with prudence to secure rigorous and objective knowledge (Neuman, 2011). These postpositivist approaches differ from Popper's rationalism, where the role of observation and experiment is solely to confirm or refute hypotheses.

Summary and implications for qualitative research

The difference between mere beliefs and knowledge is that the former are mere claims which are not supported by sufficient evidence and justified, whereas the latter is furnished by reason, observation, and experiments designed to determine whether propositions are true or false. This chapter has illustrated that the debate over what counts as knowledge and whether or not it is possible to arrive at truth merely by reason, or via observation and experience, goes back to the time of Ancient Greece. The Greeks were the first to abandon a supernatural view of the universe, substituting it with laws, order, and truths that were accessible to humans. The Platonists believed that nature followed a rational order and that it was mathematically structured. Thus any *truth* about the external world was to be deduced logically. This was the beginning of a *rationalist* outlook. It was challenged by the competing standpoint of *empiricism*, espoused by the early empiricists, such as Aristotle, who emphasized the need for knowledge to be based on the observation of real things. They argued that only those aspects of the world that were accessible to the senses and observable could be knowable. The ways in which rationalism manifests in science today reflect the thesis that reality, not merely appearances available to the senses, is revealed through rational thought and can be tested through experimentation. Empiricists, on the other hand, draw their conclusions mainly from observation.

In the social sciences, empiricism is largely exhibited through positivistic approaches to research, whereas rationalism (reformulated as a hypothetico-deductive method by Karl Popper) is most obvious in postpositivistic tactics. Qualitative inquiry underpinned by positivism and postpositivism may, but does not have to, employ computational tools, such as the UAM CorpusTool, which allows researchers to perform comparative statistics. Postpositivist studies tend to formulate theories and hypotheses that can be tested by collecting qualitative data (for example, through interviews) in order for these to be confirmed or falsified. If confirmed, they become the 'best available theories' but remain subject to revision and future refutation. As far as suitable methodologies are concerned, Spencer, Pryce, and Walsh (2014), for example, argue that grounded theory, as formulated by Glaser and Straus, is aligned with positivistic and postpositivistic research.[12] Although it requires data to begin with, these academics hold that 'the foundational assumptions on which traditional grounded theory rests are largely rooted in post-positivism' (2014: 85).

It is necessary to emphasize here that all qualitative research relies on the use of empirical data (observation, interviews, focus groups, etc.). In this regard, the qualitative researcher does not have to be a positivist or a postpositivist, and in fact the vast majority of qualitatively minded academics are philosophically and methodologically opposed to these views. At the level of techniques, the mere deployment of participant observation or interviews (or any other tools) is not sufficient in itself to distinguish between positivist, postpositivist, interpretivist, and constructionist approaches. What sets these apart are the philosophical assumptions that ultimately inform methodological and methodical decisions. As such, a positivist study can draw on interviews with the aim of formulating a theory that could be generalized to a larger population, a postpositivist study can draw on interviews to test a hypothesis, a phenomenological study can use interviews to describe the essence of a phenomenon, a hermeneutic study may seek to understand the emergence of meanings in specific contexts, and a constructionist study can use interviews as a way of expounding the plurality of meanings. It is a common mistake – and indeed false – to assume that the methods popular among qualitative researchers, such as interviews or participant observation, are *inherently* 'qualitative'.[13] It is also important to emphasize that there is a difference between the methods of data collection and the methods of data analysis, a point to which we will return in Chapter 8.

Finally, although it was necessary to highlight the differences between the doctrines of rationalism and empiricism, it is essential to resist the temptation to place all the rationalists in one box and all the empiricists in another. Markie (2015), for example, cautions against the adoption of a simple-minded general classification. To this end, the picture painted in this chapter mainly serves the purpose of revealing the landscape of the core epistemic problems. The final task lies with the researcher who must follow up and immerse herself in the works of individual philosophers whose ideas she may find resonated the most. It is indeed possible to formulate a more complex stance and be a rationalist about mathematics and physics and an empiricist about medicine and social science. It is also possible to be a realist about some things, but not others – a problem we shall pursue in later chapters.

Recommended reading

Casullo, A. (2003) *A Priori Justification*. Oxford: Oxford University Press.

Hung, E. (2014) *Philosophy of Science Complete: A Text on Traditional Problems and Schools of Thought* (2nd edn). Boston, MA: Wadsworth.

Kline, M. (1982) *Mathematics: The Loss of Certainty*. Oxford: Oxford University Press.

Monton, B. & Mohler, C. (2012) Constructive Empiricism. In E.N. Zalta (ed.), *The Stanford Encyclopedia of Philosophy* (Winter, 2012 edn). Retrieved 9 February 2014 from http://plato.stanford.edu/archives/win2012/entries/constructive-empiricism/

Nelson, A. (ed.) (2013) *A Companion to Rationalism*. Chichester: Wiley-Blackwell.
Popper, K. (1999) Falsificationisms. In R. Klee (ed.), *Scientific Inquiry: Readings in the Philosophy of Science* (pp. 65–71). New York: Oxford University Press.
Stroll, A. (2000) *Twentieth-Century Analytic Philosophy*. New York: Columbia University Press.
Uebel, T. (2013) Logical empiricism. In M. Curd & S. Psillos (eds), *The Routledge Companion to Philosophy of Science* (2nd edn; pp. 90–102). Abingdon: Taylor & Francis.

Notes

1. Religion and spirituality did continue to play a fundamental role in ancient Greece, so there was not a complete departure from religion per se. However, the laws of nature could now begin to be developed using rational processes and methods as opposed to natural phenomena being explained through mere 'beliefs'.
2. Of course it goes without saying that reason and logic are necessary for drawing inferences. What we see with the *empeirikos*, as Frede (1990) explains, is a particular conception of reason that is different from how we would employ the term today. Frede likens it to an 'associationist account of thought' whereby knowledge is accounted for solely in terms of memory and senses (1990: 226).
3. In the present day, we think of universities as secular places that strive to foster critical thinking and promote scientific methods of inquiry. However, the process of secularization of universities only began later, in the Enlightenment era.
4. For a complete list of the intellectuals associated with the Vienna and Berlin Circles, see Uebel's entry in the *Stanford Encyclopedia of Philosophy*: http://plato.stanford.edu/entries/vienna-circle/
5. Uebel, for example, notes that it is difficult to make a sharp distinction between the Viennese logical positivism and Berlin logical empiricism, and although some have suggested that Carnap's phenomenalist verificationism and Reichenbach's physicalist verificationism is precisely the difference needed, any such attempt would only mark a temporary difference and misrepresent the changing theories of the Vienna Circle (Uebel, 2013).
6. For the positivists the theorems of mathematics were *analytic* or *a priori*. This view was rejected not only by Mill, but also by White, Quine, and Tarski (for more see Stroll, 2000).
7. Stroll (2000) notes that while the positivists indeed acknowledged the importance of reason in the processes of deduction to allow for the derivation of truths from truths, they viewed reason as playing a facilitative role, not to be confused with an existential application to reality.
8. Of course not all birds fly and not all swans are white, which is why inductive knowledge can never be absolute, only probable (see also Chapter 3).

9. According to the *Stanford Encyclopedia of Philosophy* (see http://plato.stanford.edu/entries/popper/).
10. This view of theories as being potentially false is also called *fallibilism*.
11. For more information on critical rationalism, see www.iep.utm.edu/cr-ratio/
12. Spencer et al. (2014) are quick to point out that grounded theory can be adopted into, and is compatible with, a number of philosophical approaches. This is an important point, but not one that we will examine further here.
13. Some academics contrast quantitative and qualitative methods whereby the meaning of the term 'qualitative' is painted as 'anti-realist', 'anti-positivist', or 'anti-objectivist'. This generalization ought to be avoided as it is misleading. We will examine qualitative research in Chapter 8 in terms of attitudes: as *means* and as *orientation*.