Part I
Philosophy of science

1 Logical positivism and Popper's falsificationism

key topics

- Logical positivism
- Verificationism
- Deduction
- Induction
- Falsificationism

Timeline

1914–18	First World War
1917	Russian Revolution
1929	Wall Street Crash
1939–1945	Second World War
1953	Discovery of structure of DNA
1955–1975	Vietnam War
1969	First Moon Landing
1989	Fall of the Berlin Wall

Karl Popper

1902	Born in Vienna
1934	First publication of the *Logic of Scientific Discovery*
1937	Moves to New Zealand
1945	First publication of *The Open Society and Its Enemies*
1946	Moves to England
1994	Dies in London

Introduction: Why the philosophy of science?

I have chosen to start this survey of the historical and philosophical foundations of psychology with an examination of some of the major theories put forward in the philosophy of science. This might, at first sight, seem to be a rather unnatural place to start, but there are good reasons for it. Firstly, given that most psychologists think of their discipline as a science and of themselves as scientists, it is important to investigate ideas about what science actually is and what, if anything, are the characteristics that differentiate it from other, non-scientific, intellectual disciplines.

But there is another reason for looking at the philosophy of science to start off with, and that is that there is a good deal of overlap between ideas in the philosophy of science and psychology. Both the philosophy of science and psychology are concerned, at least in part, with the question of how we know about the world. As we shall see, many of the themes that will arise in the course of this presentation of the philosophy of science will re-emerge later in the history of psychology. Indeed, all of the philosophers of science that will be discussed in these three chapters make use of psychological ideas about the nature of knowledge.

One particularly influential view of human knowledge goes, roughly, like this: we gain knowledge of the world through the senses; events and objects in the world impinge on our sense organs, and the basic sensory information that they thereby transmit is the basis on which our knowledge of the world stands. This view has its counterpart in the philosophy of science in the theory that scientific knowledge is built up from observations of things and events in the natural world. According to this view, observational facts form the basis on which scientific knowledge stands.

These two views go hand in hand, and they are rejected by Karl Popper, the first philosopher of science that we are going to cover. He referred, dismissively, to the view of knowledge that has just been sketched as 'the bucket theory of knowledge' because it envisages the human mind as a sort of receptacle for factual information acquired via the senses. This view is also rejected by the three other major philosophers of science to be covered in these chapters: Thomas Kuhn, Imre Lakatos, and Paul Feyerabend. Though they disagree strongly with Popper on other matters, all agree that the bucket theory of mind gives an erroneous picture not only of scientific knowledge, but of human knowledge in general.

The bucket theory is traced by Popper, with some justification, to a school of philosophy called **empiricism**. This school of thought emphasises the importance of experience, and particularly sensory or perceptual experience, in gaining knowledge about the world. It is particularly associated with philosophers such as John Locke and David Hume, whose ideas we will consider in more detail in Chapters 5 and 6. According to the empiricists, the basic perceptual information that is provided by the senses is transformed into more elaborate knowledge through association: the different isolated bits of factual information become associated with one another, they become bound together, so as to create from a disconnected array of facts a coherent network of interconnected pieces of information. This idea of learning through association was to have great influence on the behaviourists (see Chapter 16). Again, this general view of human knowledge has its counterpart in the philosophy of science. According to the empiricist view of science, scientific theories are created by joining together the isolated facts and observations that scientists collect in the course of their research.

Empiricism assumes that the basic observations and facts that are the foundation of science are *given* to the scientist. The scientist has only to observe nature to be provided with the building blocks of scientific knowledge and these observations will be all the more accurate the less the scientist's mind is filled with expectations about what will be observed. Approaching the task of observing nature with pre-existing ideas about what one is going to find is, according to the empiricist approach to science, likely to bias or distort one's observations. The scientific ideal, then, is the completely open-minded and passive recipient of incoming information. It is only subsequent to having received this information that the mind can start to take an active role in the creation of scientific knowledge, by combining, associating, abstracting, and generalising ideas on the basis of the sure information provided by the unbiased operation of the senses. The bricks are *given* by nature; the building is constructed by mind.

The idea that science starts with the neutral observation of facts given to observation goes back to one of the earliest empiricists and thinkers on scientific method, Francis Bacon (1561–1626) (see Figure 1.1). For Bacon, the most important early step in scientific investigation was to remove from one's mind all pre-existing beliefs and expectations so that one can, as a scientist, make careful and unprejudiced observations of what one really sees, observations that are pure and uncontaminated. Bacon called the traditional or accepted beliefs that the scientist had to discard 'the idols of the tribe', and he was in no doubt that these idols had to be destroyed because they blocked the advance of

Fig. 1.1 Francis Bacon

scientific knowledge. The mind of the observer becomes cleansed and approaches as closely as possible to the blank slate on which empiricists believed nature could write its message unhindered. This purging of pre-existing beliefs and expectations has been likened by Lakatos (in his 'Falsification and the methodology of scientific research programmes'; see Chapter 3) to a sort of

psychotherapy that the empiricist believes is necessary to prepare one's mind to receive the message of nature.

The four philosophers of science to be discussed in these chapters all reject the empiricist view of science. In its place they put forward an alternative view of science according to which the scientist is an *active seeker* of observations, not just a passive receiver. The scientist is not devoid of expectations or preconceptions, but, on the contrary, makes observations precisely in order to see whether these expectations are fulfilled. But the views of Popper, Kuhn, Lakatos, and Feyerabend go further than this. They assert that not only do a scientist's preconceptions guide her search for observations, but that they play an active role in actually structuring the observations themselves.

This alternative to the empiricist view of science has its roots in an alternative view of human knowledge and perception, which can be traced to the ideas of Immanuel Kant (1724–1804). According to Kant, whose ideas will be discussed in more detail in Chapter 6, the human mind does not passively record sensory impressions, but has a hand in constituting and constructing those impressions from the outset of perception itself. In particular, argued Kant, the mind has an innate structure, a built-in framework, through which we make sense of the world around us. The most obvious example of this is the physiology of the sensory apparatus itself – we can only hear a limited range of sounds or see a limited range of light frequencies. Thus, even our most basic perceptions are determined not only by what is out there in the external world, but by the form of our own minds. This fundamental Kantian insight formed the basic presupposition of psychologists such as Wundt (see Chapter 11).

The physiology of the perceptual systems is, however, not the only influence on the way that the mind structures perceptual experience. Another influence is the cultural experience of the perceiver, and it is on this factor that philosophers of science have focused. This, unlike the physiology of the perceptual systems, is not fixed, but can change as a result of learning. Popper, Kuhn, Lakatos, and Feyerabend all in their own ways argue that, just as the education and training of a literate person allows her to see lines and squiggles on a page as meaningful words, so the education and training of a scientist structures her observations in particular ways. The expert naturalist has *learned* to see specific species of birds where the non-expert sees just undifferentiated 'birds'; the trained astronomer has *learned* to see the constellations whereas the non-expert just sees 'stars'. Contrary to empiricism, it is not just the edifice of knowledge that is constructed by the mind, but also the very building blocks of which it is made.

> such a metaphysical pseudo-proposition as 'the Absolute enters into, but is itself incapable of, evolution and progress', is not even in principle verifiable. For one cannot conceive of an observation which would enable one to determine whether the Absolute did, or did not, enter into evolution and progress. (*Language, Truth and Logic*, p. 17)

We can conclude this section, then, by saying that, according to the logical positivists, for a statement to have any meaning at all it must fall into one of these two classes: it must either be true as a matter of logic or it must be an observational statement that gives us verifiable information about the way that the world is. It is because of this emphasis on the verification of empirical statements that the logical positivists' theory of meaning is sometimes referred to as **verificationism**.

The problem of induction

We have seen in the earlier sections of this chapter that, from the empiricist viewpoint, all science starts with observations. The statements or propositions that convey these observations clearly fall into the second of the logical positivists' two categories of meaningful statement: they assert the existence of some fact or facts about the world which can be verified by making appropriate observations.

But, though facts are important to science, science is not just a collection of facts. The scientist is not content with a large number of individual observations such as 'steam was produced when a kettle of water was brought to boiling at 7.30 a.m. on 26th April 2013'. She does not just want to make statements about *individual* events, but wants to make *general* statements about whole classes of events: not just what happened when water was boiled this morning in a kitchen in Manchester, but what happens when water boils in general. Something has to be done with the individual facts collected by the scientist to convert them from reports of particular events or things into general statements. Bacon believed that general patterns would somehow emerge from a large number of observations, but the logical positivists wanted to be more rigorous in identifying how this might happen. Specifying exactly how general scientific statements or laws are derived from individual observations was particularly important to the logical positivists because they believed that the meaningfulness of any scientific law depended on its being built from verifiable facts.

The process by which general conclusions are drawn from a number of individual observations is called **induction**, and it is here that, according to

of every square that one encounters and *discovering* that squares have four sides. Rather, we would say that squares have four sides *by definition*. If someone were to announce that he had found a 'three-sided square', we would not hail this as a mathematical breakthrough but as evidence that the person in question did not know the meaning of the term 'square'. These mathematical statements are examples of *logical truths*. Logical truths are true in virtue of their structure and the definitions of the terms that they contain, not because they give us accurate information about the world. For example, the statement 'It is either raining or not raining outside my window' is true – it really *is* either raining or not raining – but it gives no information as to what the weather is actually like.

The second class of meaningful statements, according to Hume, consists of those statements containing 'experimental reasoning concerning matter of fact'. In contrast to logical truths, statements of this second type *do* give us information about the way that the world actually is. They are *observational statements*. In contrast to 'It is either raining or not raining outside my window', the statement 'It is raining outside my window' is an empirical statement; it says that a certain state of affairs exists in the world. It asserts a fact.

Empirical or observational statements, unlike logical truths, can be true or false, and we can check on their truth or falsity by actually making the relevant observations to see if the world actually is the way that the statement says that it is. We can, for example, look outside the window to see if it really is raining. If we see that the facts actually correspond to what the statement says, then we have *verified* the statement. An observation statement, then, is a statement that can, even if only in principle, be verified.

Ayer made the point as follows:

> The criterion which we use to test the genuineness of apparent statements of fact is the criterion of verifiability. We say that a sentence is factually significant to any given person, if, and only if, he knows how to verify the proposition which it purports to express – that is, if he knows what observations would lead him, under certain conditions, to accept the proposition as being true, or reject it as being false. If, on the other hand, the putative proposition is of such a character that the assumption of its truth, or falsehood, is consistent with any assumption whatsoever concerning the nature of his future experience, then, as far as he is concerned, it is, if not a tautology, a mere pseudo-proposition. (*Language, Truth and Logic*, p. 16)

Ayer goes on to give a quotation from the English philosopher F. H. Bradley as an example of the sort of meaningless metaphysics that the logical positivists sought to excise from philosophical discourse:

> such a metaphysical pseudo-proposition as 'the Absolute enters into, but is itself incapable of, evolution and progress', is not even in principle verifiable. For one cannot conceive of an observation which would enable one to determine whether the Absolute did, or did not, enter into evolution and progress. (*Language, Truth and Logic*, p. 17)

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