This student-friendly book on the history of psychology covers the key historical developments and controversies in all areas of psychology, linking history to the present by focusing on ten conceptual issues that are relevant today.

How did psychology become a science, and what kind of science did it become? How do psychologists measure and explain the fact that in some ways everyone is unique? Is psychoanalysis scientific? Why did cognitive science replace behaviorism? This book addresses all these questions and more, covering the whole range of psychology, from neuroscience and artificial intelligence to hermeneutics and qualitative research in the process. Drawing on the author’s experience of how to make the subject interesting for students, the book is structured around ten key questions that engage with all the core areas of psychology and the main schools of thought. Showing how each of the different approaches or paradigms within psychology differ not based on data but on assumptions, Michael Hyland provides an engaging introduction to debates from history and in contemporary society.

Including boxed material on hot topics, historical figures, studies/experiments, and quirky facts, this is the ideal book for undergraduate students of psychology taking CHIPS and other history of psychology modules.

**Michael Hyland** was a lecturer and later professor of health psychology at the University of Plymouth, retiring in 2018 after 44 years teaching history and theory in psychology. He is currently a part-time professor of health psychology at Plymouth Marjon University.
A History of Psychology in Ten Questions

Michael Hyland
To Orin and Theo
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Student satisfaction ratings are now an important part of university life. They were not used when I started teaching 40 years ago, but if they had my ratings would have been poor. I had no interest in history, and my own recent experience as a student had been entirely negative. The course taught by a young lecturer when I was an undergraduate went something like this:

There was Fechner, yeah, and he was early and then there was Wundt. Wundt was important. Yeah, yeah, really, really important. Then there was Watson, he was also important. He started behaviourism, like . . .

I am sure it wasn’t that bad, but that is how I remember it. My early courses were only a little better. I taught history from a respected textbook on the history of psychology, but I had no love for the subject. Over time, things changed. In the year I retired from the University of Plymouth, the average overall satisfaction for my course was 4.7 out of 5, with an interest rating of 4.6. Freetext comments from students showed that many anticipated the course to be boring because of its title only to be surprised by how interesting they found it.

Some people find history interesting. The majority of psychology students do not. They have come to study modern psychology. They have not come to study history. When presented with the term ‘conceptual issues,’ most students don’t know what it means and lack interest. However, students will find these topics interesting if they are presented in a way that is relevant to their understanding of modern psychology. To be successful in teaching historical and conceptual issues in psychology (CHIPS), the topic must be linked to existing concepts that students find interesting. This educational principle is not new!

There are two ways of teaching CHIPS. One way is to provide a historical introduction to each topic that makes up a psychology course. For example, social psychology courses start with a historical introduction to social psychology, and developmental psychology courses start with a historical introduction to development psychology. The advantage of this approach is that it avoids the negative ratings that can accompany CHIPS courses. There are two disadvantages. One is that students continue to perceive psychology as a set of disconnected topics rather than a whole that has evolved over time. A second is that this approach neglects the broader conceptual issues.

An alternative is to teach CHIPS as a separate course. If not done well, students will find it uninteresting, but if done well, this approach can cover the broader conceptual issues and provide a sense of psychology as a whole. In this
book, conceptual issues are presented in the form of questions. This technique enables students to learn with a purpose – an idea that predates the founding of academic psychology in Leipzig (Parsons, 1873). Each chapter deals with a different conceptual issue, with a historical introduction, and then shows how that issue is relevant today. Many of these conceptual issues have to do with the different assumptions of different groups of psychologists, assumptions that have changed over time.

In writing this book I have been mindful of the fact that many students have studied psychology, including the history of psychology, at school or in some introductory course. Students find repetition tedious. The content of this book is selected to avoid repetition. For example, students will have a basic understanding of behaviourism and cognitive psychology but be unaware that each answers a different type of question using a different type of theory. Students will have been introduced to some of Freud's ideas but not know why some are true, some are false, and some are unfalsifiable. Students will know about the heredity-environment controversy but not that modern epigenetics shows that it is based on a false premise, nor will they know how it is informed by the person-situation debate. Students will know about neuroscience but have little understanding of biopsychosocial interactionism. Students will know about qualitative methods but not know the different assumptions of those who use qualitative methods in different ways.

The book is also suitable for anyone wanting to gain an overall understanding of the conceptual issues in psychology, and in particular for undergraduates taking a CHIPS course on a psychology degree. There is some advantage in having some experience of psychology before reading this book, for example having studied psychology at an advanced level in school or equivalent. The discipline of psychology is like a jigsaw puzzle made out of many pieces, and it is good to have at least some understanding of the pieces in order to see the picture as a whole. Some of the conceptual ideas are more challenging than others, but there is enough in each chapter to be of interest to all students.

This book does not provide the kind of historical detail that is more suited for a specialist course on the history of psychology. I have selected some personal historical detail, but only where it is useful or interesting for students. I refer to events in William James’ life to show that even famous psychologists can have mental health problems. I refer to Watson’s sacking from his university for the less good reason that students will find the gossip interesting. I mention that Wundt was a nice guy, because I like nice guys. I refer to racism in psychology because it tends to be airbrushed out, but it is relevant to the heredity-environment controversy. I refer to personal details if it is relevant to a person’s theory or research or because it is pertinent in some other way. There is some historical detail along with the conceptual issues, but the historical details are not as thorough as will be found in proper histories of psychology, written by proper historians. I don’t mention where Wundt was born, nor reports of his performance at school – interesting as those may be.
Any book reflects the personal interests of the author. My PhD was theoretical, and as a young lecturer I was instrumental in setting up the International Society for Theoretical psychology. However, I have spent most of my working life as a health psychologist trying to solve practical problems by using new theories or new applications of old theories. I developed an interest in the history of psychology through teaching the subject. Readers may detect a sympathy with applied psychology, a fascination with theory, and an interest in the quirkier aspects of history.

This book is written for a specific purpose: to show how conceptual issues that are relevant today have developed over the history of academic psychology. My hope is that this book will help other lecturers provide interesting and inspiring lectures, and for students to enjoy a subject that can inform their understanding of the subject they have chosen to study: the discipline of psychology.
What is science and what do scientists do?
This chapter covers two topics: the philosophy of science and the psychology of science.

How do you know if something is true? That question is particularly pertinent in a world where news is sometimes described as ‘fake news.’ To know whether something is true it is necessary to have criterion, a criterion that can distinguish truth from falsity. But how can you tell whether the criterion is true? The answer is that you cannot tell, because if there is a criterion for the criterion, then you don’t know whether that criterion is true. Knowing whether a criterion is true or not is called the problem of the criterion. Although philosophers have discussed the problem of the criterion for at least two thousand years, in this book two criteria for knowledge will be assumed to be true. These are the logical criterion and the empirical criterion.

The science of psychology, like any other science, is based on the empirical criterion. However, the empirical criterion has a logical basis, so this chapter starts with a brief discussion of logic.

**Logic**

Imagine you have a pack of cards face down in front of you. You take the first card from the pack, and you find that it is the ace of hearts. Let me explain, in case there is any doubt, that this is an ordinary pack of cards, and there is only one ace of hearts in the whole pack. Now, consider the two following statements

- The next card you draw will be the ace of hearts.
- The next card you draw will not be the ace of hearts.

You, the student, will know straight away that the first sentence is false and the second sentence true, and you know this without having to look. You know this without empirical evidence. The reason is that you are applying a logical rule. The logical rule is this: Something cannot be in two places at the same time.

Logic is based on the application of rules, the rules of logic. There are many different logical rules and few will be discussed here. However, students will already have come across logical rules in statistics. Null hypothesis testing is based on the assumption that a hypothesis is either true or false – but not both true and false at the same time. Statistical tests give the probability that a hypothesis is not true (e.g., two groups are not equal); statistical tests apply the rule that a hypothesis can be either true or false, but not true and false. The process of science is a logical one; it is based on following certain accepted rules of practice.
What is the logic of science?

What is the logic of scientific enquiry? Philosophers and historians of science observe what scientists do and provide an answer, but that answer has changed over time. In the 19th century the view was that science was based on the logic of induction. In the 20th century the view was that science is based on the logic of deduction. Both types of logic will be examined separately before a psychological analysis will show how both types are used in science.

Induction and inductive laws

The logic of induction is based on the assumption that general laws can be ‘induced’ from facts, or, to use the more technical term, singular occurrences. Here is an example of how it works. Suppose you are travelling around the country and you see a white swan. The observation of the white swan is a singular occurrence. You go a little further and see another white swan. You keep on travelling seeing one white swan after another until you are ready to induce a general law:

\[ \text{All swans are white.} \]

The rule of induction can be summed up as this:

\[ \text{If something has been observed to occur regularly in the past, the same will occur in the future.} \]

Inductive rules are therefore useful for predicting and controlling the world in which we live. Inductive rules make practical sense.

In the example of the swans, induction has produced the statement ‘all swans are white,’ but is this statement true? In any group of psychology students, there will be some who know that not all swans are white – swans in (or originating from) Australia are black. So, after observing some black swans, it is possible to conclude that the original law – all swans are white – is false; it is now possible to write a new statement:

\[ \text{All swans are either black or white.} \]

Again, it is possible to ask, is it possible to prove this statement true, in the sense that is known to be 100% true? The answer is no. It can never be proved with 100% certainty that all swans are either black or white as there may be some hiding away somewhere in the undergrowth that are not black or white. You may be interested to learn that the statement ‘all swans are black or white’ is in fact false. The reason is that in a far-away galaxy, on the planet Zog, there
Naughty green swan hiding from scientists on planet Zog.
are a group of swans that are pink with blue spots. You don’t believe me? You cannot be sure that there are no pink and blue swans any more than I can be sure that there are.

OK, so now it is possible to generate another rule:

\textit{Some swans are white.}

This rule can be proved true, but it cannot be proved false. The same applies to the following statement:

\textit{Some swans are green.}

It is always possible that there are some green swans hiding away somewhere – not necessarily on the planet Zog, so this statement can never be shown to be false.

From a psychological perspective, the statement that ‘some swans are white’ is a lot less interesting than the statement ‘all swans are white.’ Imagine being told this:

After careful consideration and observation, I have come to the conclusion that it sometimes rains in England.

This conclusion would be true, but it is also obvious and therefore uninteresting. Thus, the type of inductive generalisation is important. One criticism of the assumption that science is based on induction is that scientists do not collect facts randomly. They collect the facts on the basis of ‘ideas’ about what is interesting. The collected facts should be important or interesting in some way. Some swans are white is a lot less informative than all swans are white – even though the latter is false.

\section*{Prediction and explanation}

Inductive rules \textit{describe} what happens in the world in which we live. They do not \textit{explain} what happens. They describe the ‘what’ but not the ‘why.’ Because these rules describe regularities in things that happen, they can be used to predict the future. However, the prediction is limited to the rule of what has happened before. Explanations will be described in the next section and permit prediction of things that have not happened before. The early history of psychology was largely one of induction – of finding regularities but not providing explanations. The later history is one where greater emphasis is placed on explanation.
What is science and what do scientists do?

The logic of deduction and hypothesis testing

Karl Popper (and others) (Popper, 1935/1992, 1963) argued the logic of science is not based on induction. Even when scientists collect facts, they don’t do so randomly. Data collection is always based on a hypothesis or conjecture. Instead of science being based on induction, Popper suggested that the logic of science was based on deduction.

In science, deduction is the process of making a prediction on the basis of a theory. The theory explains the regularities in things that happen. Again, it is best illustrated with an example. Instead of starting with an observation, let us start with a theory, the theory of gravity. It is possible to deduce from the theory of gravity that if I let go of my keys, they will fall to earth. This prediction is of a singular occurrence or fact. The next step is used to test whether the singular occurrence, predicted by the theory, actually occurs. I hold out my hand holding my keys. I let the keys go. They fall to earth showing that the prediction of the theory is true.

Deduction is a logical rule that can be summed up as this:

On the basis of these theoretical assumptions the following events will happen.

Has the simple fact of my dropping the keys proved the theory of gravity? The answer is no. Even if I keep dropping my keys and collect a sizeable pool of data supporting the theory, the theory of gravity can never be proved to be true, because there is an alternative explanation. The reason that keys keep falling to earth is nothing to do with this strange thing called gravity. There is a much simpler explanation. It is caused by a gravity monster who sits at the centre of the earth and waves its tail. Whenever the gravity monster waves its tail, it attracts objects to its tail. That is the real reason why things fall to earth. And the gravity monster is always waving its tail. Or is it?

The reality is that when data confirm a theory – i.e., when singular occurrences are consistent with the prediction of a theory – it is always possible that the same data can be explained by another theory. It is always possible that some data will be found in the future that cannot be explained by the theory. Therefore, theories can be confirmed but never proved to be true. Data do not prove theories. Scientists try to rule out competing hypotheses by setting up experiments where the competing hypotheses make different predictions. In principle, it takes only one observation that cannot be explained by the theory to show that a theory is false. Of course, as more and more data of different kinds are found to support the theory, the more the theory is corroborated by those data. So, some theories can be well confirmed, but they can never be proved to be true.

Popper suggested that science proceeds through a series of ‘conjectures and refutations’ – which is the title of one his books (Popper, 1963). Scientists have a hypothesis or conjecture. They test the hypothesis and for a while the data
confirm (but never prove) the theory. Eventually data are found that falsify the theory and so it is necessary to develop a new conjecture or hypothesis. Science proceeds by a series of conjectures and refutations; each time the conjecture becomes more ‘true’ than the conjecture before. In practice, scientific advance is not quite the elegant process suggested by Popper. Disconfirming evidence usually leads to changes rather than the rejection of a theory, or simply rejection of the disconfirming evidence.

Theories that are eventually found false

Newton developed a mathematical theory to explain the relationship between force, mass and velocity. Newton’s theory explains many things – from how cars move in collisions to the orbits of planets. Everyone was so convinced by this theory, and the way they predicted things accurately, that they became known as ‘Newton’s laws of motion.’ However, when mass becomes very large or when it is very small, Newton’s laws no longer apply. Einstein predicted that space was curved by mass, a theory first tested by observing the position of the sun during an eclipse. Other theories of classical physics have been shown to be false by quantum mechanics. Of course these classical physics theories are true in the sense that they apply under most conditions, but the fact that there are exceptions shows that they cannot be treated as the universal laws they once were.

The key difference between the earlier inductive view of science and the deductive/falsification model proposed by Popper is that the latter involves theories, and theories provide explanations as well as predictions. The theory provides an explanation of why something happens. The explanations have one key advantage over predictions based on inductive generalisations. They allow novel predictions. The ability of theories to make novel predictions is not something that is automatic. Humans are needed to make novel predictions. Science is a creative activity involving the insight of people.

Metaphysics versus science

Popper used his idea of conjectures and refutations to provide a logical criterion for science. An alternative is to use a social criterion, such as scientists are those perceived by ordinary people as scientists. Popper’s criterion was based on the application of rule – i.e., on a logical rule. Popper’s criterion of science is this:

*Scientific statements are those that can be shown to be false through observation.*
What is science and what do scientists do?

Statements that cannot be shown to be false through observation are not scientific statements but metaphysical statements.

This criterion, known as the criterion of falsifiability, distinguishes what Popper called science from metaphysics. Metaphysics, according to Popper, consists of statements that cannot be shown to be false through observation, and therefore are outside the realm of science.

There are a number of different types of statement that cannot be shown to be false by observation, and one of these has been presented already. The statement ‘some swans are green’ cannot be shown to be false through observation, whereas the statement ‘all swans are white’ can be shown to be false. The latter sentence is therefore a scientific statement – but false – whereas the former is not even scientific according to Popper’s criterion. There are many types of statement that are non-falsifiable. One particular type relates to religious beliefs.

Consider the following statement:

God exists.

What kind of evidence is there that God does not exist? It is possible to cite miracles and other kinds of evidence suggesting that God exists, but there is no type of evidence that could prove – i.e., show with 100% certainty – that God does not exist. So, the statement that ‘God exists’ is therefore unfalsifiable, and the statement is metaphysical rather than scientific. It is also, note, impossible to falsify the statement that ‘somewhere there are swans with pink spots on a green background.’ Statements that, on logical grounds, cannot be shown to be false are not scientific.

Science and religions

Religious beliefs are metaphysical beliefs and therefore outside the realm of science. Some scientists are religious, and believe in God. Some scientists are not religious and do not believe in God. Some scientists believe that religion is a dangerous illusion. Some scientists (and some psychologists) study how other people practise and believe in religion. Discussion of these different views is beyond the remit of this book but forms an interesting point of discussion as students themselves will have different views.

Falsifiability and the strength of prediction

Popper makes one additional point in relation to his criterion of falsifiability. The degree of falsifiability determines the strength of a theory. Again an example will illustrate how this works. Imagine that you are in England (where
it rains a lot) and you want to do your washing and hang it on the line to dry. Consider the following two statements:

*It will be dry on one day and only one day next week.*
*It will be dry on Wednesday and only on Wednesday next week.*

Both statements are falsifiable. If it doesn’t rain or if it rains on more than one day, then both statements are false. Both are scientific rather than metaphysical. Both show that washing is possible on one day next week. But the second sentence is a lot more useful in helping you decide when to do your washing. The second sentence is also *more* falsifiable, in the sense that it is more likely to be wrong if weather is random. The second sentence gives a more powerful prediction.

Popper distinguishes between strong theories that are highly falsifiable and weak theories that are falsifiable in principle, but difficult to show wrong. Note that the degree of falsifiability has nothing to do with whether the theory is actually false or not, which is something that is determined through observation. The strength of a theory is something that can be evaluated without observation. The degree of falsifiability or strength of the theory is an ‘internal’ property of a theory and not an ‘external’ property, which is a theory strength that can be determined independently of the observation that tests. Strong theories are easily shown to be false, but if they are not shown false then they provide more useful information than weak theories that are less likely to be shown false.

Some theories are falsifiable but so weak – so difficult to show false – that they are not very useful. The strength and therefore usefulness of psychological theories is something that will be discussed later in this book. One of the criticisms against Freud’s theory is that it is almost completely unfalsifiable. Others have argued that his theory is in fact unfalsifiable, and therefore metaphysical. Both arguments cannot be true, but they certainly need consideration in relation to both psychoanalytic and other theories in psychology.

**Prediction and explanation**

Theories explain why things happen. They do this by introducing ‘explanatory concepts’ that then explain the regularities that have been detected through inductive inference. Explanatory concepts are also known as theoretical terms. In physics, examples of theoretical terms include molecules and electrons. In psychology, examples of theoretical terms include memory and cognitions. The theoretical terms explain why things happen in the way they do. However, explanatory terms can also be used to predict things that have not been observed before. So, theories enable scientists to predict – and therefore control – the world they know. Inductive rules also enable scientists to predict what happens
next so long as it has happened in the past. Theories enable prediction of things that have not happened in the past.

One way in which theories differ is whether they make quantitative predictions. Compare the following two statements

\begin{itemize}
  \item \textit{It will rain tomorrow in my village.}
  \item \textit{Two inches of rain will fall tomorrow in my village.}
\end{itemize}

The second statement makes a stronger prediction and it makes a quantitative prediction. If only one inch falls or three inches fall, then the prediction is false. Some sciences make quantitative predictions, some make (on the whole) qualitative predictions. Psychology and medicine fall into the latter category. Physics and chemistry in the former. Theories of physics are typically represented by an equation. For example, Boyle’s law predicts \textit{how much} a gas will expand when heated. Hooke’s law predicts \textit{how much} a spring expands with different weights. In medicine, theories typically predict change but not the amount of change. So, for example, antibiotics reduce infection, but there is no prediction about the rate of reduction of infection. In psychology, research shows that childhood trauma leads to behavioural problems, but the behavioural problems are not quantified.

\section*{Quantitative predictions in psychology}

Although a minority, they do exist: in psychophysics (see Chapter 2, Weber’s fraction and Fechner’s law), in behaviourism (see Chapter 4, Hull’s theory), and in mathematical psychology (see Chapter 4, Luce’s choice axiom).

Theories that make qualitative predictions – such as those in psychology and medicine – use statistics to test whether the qualitative prediction occurs or not. As an example, imagine a qualitative prediction that exam performance is enhanced by a mind-altering drug. A study is conducted where students are

\section*{Effect size}

The degree of difference is indicated by the statistic called \textit{effect size}. A small effect size between two groups is more likely to be found to be statistically significant if the sample size is large than if it is small. Hence, studies that employ very large samples will reveal effects that are statistically significant, but may have little practical significance. Guidelines for psychological journals increasingly require authors to quote effect size along with statistical significance. This information is useful as it provides quantitative information.
randomly assigned to receive the drug or a placebo and their performance compared, statistically, to see if the probability of the drug and placebo having the same effect is sufficiently low (e.g., $p < 0.05\%$) for the alternative hypothesis to be accepted. Statistics are used to test whether a difference occurs or not, not to test the degree of difference.

**Induction and deduction together: the psychology of scientific discovery**

To sum up so far: Inductive rules are created from data; the logic of deduction is used for testing theories. One view puts the primary unit of science as data, the other the primary unit of science as theory. Both views can be supported by examples from the history of science. As a general rule, inductive inference is more common in less developed or historically older sciences. Explanatory theories – from which deductions can be made – are a feature of more advanced or more recent sciences (Royce & Powell, 1983).

Popper was a philosopher rather than a psychologist. He never provided an answer to the question, where do the conjectures or hypotheses come from? Hypotheses must come from the minds of scientists. So how are hypotheses formed?

**Where do theories come from?**

The following is a quote from Popper’s *The Logic of Scientific Discovery* published in 1935 (Popper, 1935/1992):

> The question how it happens that a new idea occurs to a man – whether it is a musical theme, a dramatic conflict, or a scientific theory – may be of great interest to empirical psychology; but it is irrelevant to the logical analysis of scientific knowledge.

(p. 7)

The story of the discovery of penicillin provides one possible insight into the creative process of hypothesis formation and the relationship between theory and data.

Alexander Fleming, a Scottish researcher, was growing bacteria on a petri dish. He came back from a two week holiday in 1928 to find that one of his dishes had been contaminated with what looked like mould, and no bacteria were growing where the mould had contaminated the petri dish. One possible reaction would be to say “bother, my petri dish has been contaminated.”
Instead, Fleming made a connection with something outside his experiment. He hypothesised that the mould had killed the bacteria and the mould could therefore have therapeutic properties. This hypothesis was tested initially by Fleming and then by others. The stage of data collection took time. It wasn’t until 1942 that the first patient was successfully treated with penicillin.

In this example, there is a chance discovery that creates an observation. Fleming then formed a mental link between that observation with other knowledge that he had but was irrelevant to the initial experiment. The creative process is one of forming links between ideas, of showing how existing ideas can be combined in novel ways to form entirely new ideas. Creativity is a synthesis of the many, and in science the many can come from many different sources. These include chance discoveries, data that are recently available, past data, past theories, past lived experience. The discovery of new theories is not a mechanical process that can be easily taught. New theories come from simply thinking about things. Testing of theories is also a creative process, because testable predictions require a person to deduce a prediction. Scientific development is not a purely logical process!

Data and theory are inextricably linked in the minds of scientists to the extent that inductive and deductive inference both feature in scientific discovery. An understanding of data helps determine what questions are asked, but the questions that are asked also depends on the scientist’s prior knowledge and understanding of what is important and what is not. The modern view is that theories rather than data are the basic unit of science, but the development of those theories, and not only the testing of theories, is always linked to observation, observation that may occur over many years of a scientist’s lifetime.

Where do rules of logic come from? For curious students only

Science is based on the logical rules in induction and deduction. Are logical rules independent of observation? Consider the example used at the beginning of this chapter where it was possible to tell that the next card in a deck of cards is not an ace of hearts if it has already been drawn.

In everyday life we observe that something cannot be in two different states at the same time. This rule can be applied to state of being alive versus being dead. An animal is either dead or alive, but not both. The rule is based on observation. However, in the world of the very small, the world of quantum mechanics, something very odd happens. The principle of quantum superposition makes it possible for something to be in two different states at the same time. The example often used to illustrate this principle is Schrödinger’s cat. A cat is placed in a sealed box where at some random point in time a cyanide capsule will be released and the cat
What is science and what do scientists do?

will die. Common sense tells us that before the box is opened, the cat must be either dead or alive. The principle of superposition says that before the box is opened the cat is both dead and alive. Neils Bohr, one of the fathers of quantum mechanics, said “If you are not shocked by quantum mechanics, you don’t understand it.” If we experienced the world like it is in the quantum world, perhaps our logical rules would be different! So logical rules are based on observations about the universe in which we live. Science is based on observation but the rules of science come, ultimately, from observation as well.

Metatheory, research programmes, and paradigms

The story so far goes like this. Scientists test their theories with data. The theories are constructed on the basis of a mix of prior theories and data, including chance observations, all informed by a lifetime of observation not necessarily related to science; it is observation and thought that enable scientists to make often intuitive guesses or ‘conjectures’ about how the world works.

The story continues like this. Although theories are tested by data, all theories are based on ‘metatheoretical assumptions’ that are never tested. These assumptions are not tested because they are (or assumed to be) so obvious that everyone thinks they must be true. Two historians of science have written about these assumptions and their work will be described below. They are Imre Lakatos (Lakatos, 1970, 1978) and Thomas Kuhn (Kuhn, 1962).

Lakatos’ concept of research programmes

Science builds on previous knowledge. Read any psychology journal article and you will find a list of papers at the end. The article you are reading builds on previous research and the discussion section, in particular, makes the link with previous research explicit. In fact, if authors fail to reference any earlier research, then they are unlikely to get their papers accepted. Furthermore, the article you have selected to read is likely to be cited by other articles that are published subsequently, and those subsequent articles will also cite articles cited in the article you have selected. Sciences builds on the past.

Lakatos suggests that, within a discipline, there are several strands of research which he calls ‘research programmes.’ The research programme is based on assumptions. Lakatos calls these assumptions ‘a positive heuristic.’ The word heuristic means a useful tool for discovery. What the assumptions or positive heuristics do is to define what research questions should be asked within the particular research programme and how to go about researching those questions. The positive heuristic defines the underlying assumptions of the strand of research that makes up a research programme.
For example, in the research programme of ‘early childhood trauma and later poor health,’ the research programme defines that the area of interest as that linking early trauma of varying kinds with later health of varying kinds. The research programme also defines the different methodologies that investigate the underlying hypothesis that early child trauma has negative consequences.

Lakatos distinguishes two types of research programme, those with a progressive problem shift, where theory precedes data, and those with a degenerating problem shift, where data precedes theory. The relationship between these two types of problem shift, and inductive versus deductive approaches to science could not be clearer. In the progressive problem shift programme, research is based on hypotheses that are tested. Research follows the conjecture and refutation approach suggested by Popper, and the creative part of theory construction comes before data collection. In the degenerating problem shift, research is based on careful data collection that then generates theory – the approach suggested by the earlier inductive approach to science. The progressive problem shift relies on the creativity of scientists, the degenerating problem shift on their methodological rigour.

Lakatos was a historian of science. He provided evidence that the progressive problem shift tends to produce better results than the degenerating problem shift (and hence his choice of terminology). In the progressive problem shift, the discovery of new data doesn’t lead to outright rejection of the theory but rather modification that is then tested with more data. The theory progresses with the data. The degenerating problem shift gets stuck in problems of methodology because the focus is on examining data without developing a new theory.

**Stages of a scientific discipline**

Joseph Royce (Royce & Powell, 1983, p. 19) suggested that sciences go through four stages of development “(a) prescientific philosophic speculation, (b) empirical exploration, (c) sophistication of methods of controlled observation and quantification, and (d) theoretical formalization and unification.” Royce felt that psychology was between (b) and (c), but psychology may have moved on since 1983.

The distinction between progressive and degenerating problem shifts is based on whether research is theory-led or data-led. This distinction is not a binary one but a continuum. In evaluating research in psychology and other disciplines, the question to be asked is to what extent the research is theory-led versus data-led?

Are there examples of progressive and degenerating problem shifts in psychology? In Chapter 4, I shall suggest that one of the reasons for the decline of behaviourism was that it became a degenerating problem shift. Behaviourism
was largely data-led. Lack of theoretical development and decline characterises other types of early psychology, such as the early German psychology of Wilhelm Wundt (see Chapter 2). By contrast, theory plays a much greater role in cognitive psychology, in neuroscience, and the more recent connectionist psychology (see Chapter 10).

Theoretical physics is a much respected part of physics where speculative theory plays a major part in empirical research. The Large Hadron Collider was built at a cost of more than six billion pounds to test theories developed by theoretical physicists. Theoretical psychologists lack that status in psychology. The Center for the Advanced Study of Theoretical Psychology was founded by Joseph Royce (1921–1989) in 1966 at the University of Alberta, Canada, and closed in 1990, shortly after his death. Royce’s vision was to create the psychological equivalent of theoretical physics. The International Society for Theoretical Psychology, founded in 1985, has conferences every two years, but much of the focus is on critiquing mainstream psychology rather than presenting new theories. Royce’s vision of a highly respected and influential theoretical psychology has not been achieved – but psychology is still a young science compared to physics. Who knows what changes will be brought about by the students of today?

Kuhn’s concept of scientific revolutions

Kuhn (1962) uses the term paradigm to describe the meta-theoretical assumptions that underpin theories. According to Kuhn, sciences go through stages. When a science first develops there are often a number of competing meta-theoretical assumptions. Kuhn calls this the pre-paradigmatic stage, because no paradigm has become universally accepted. Then one or other of these competing sets of assumptions becomes dominant, and the science has its first paradigm. The paradigm defines the kind of theories that can explain the phenomena under consideration, as well as defining the kind of phenomena that require investigation.

Once the paradigm is settled, there is long period of normal science when scientists investigate the theories within the paradigm. At some point in time, the original assumptions are challenged in one way or another to the extent that they are replaced by another set of meta-theoretical assumptions – i.e., new types of theory and things to be investigated. This shift from one set of assumptions or paradigms to another set of assumptions or paradigms is called a paradigm shift. Researchers then work on the new paradigm until that paradigm is replaced by yet another. Science therefore proceeds by a series of paradigms and paradigm shifts.

When scientists are working within a paradigm, they are working within what Kuhn calls normal science. Normal science consists of a series of ‘mopping up’ studies to find out the answers to things that require an answer as defined by the particular paradigm. When a paradigm changes, then this is called a
scientific revolution. So science proceeds by a series of periods of normal science followed by a short scientific revolution and then a new period of normal science.

Why do new paradigms occur? There are several possible reasons, but a common one is that there is a body of data that simply cannot be explained by any of the theories using the original paradigm. A good example of this is the paradigm shift that led to the development of quantum mechanics. Light sometimes behaves as though it were a wave. It sometimes behaves as though it were a particle. None of the explanations of classical physics could explain why light could behave in different ways at different times.

Kuhn’s paradigms and Lakatos’ research programmes are similar. Both refer to metatheoretical assumptions. The difference is that the paradigm involves a more fundamental sort of assumption than the programme, but this difference is best thought of as a continuum, rather than a dichotomy. The term paradigm is often used for units of research activity that Lakatos would describe as a research programme. The term paradigm will be used here in this more general sense. Lakatos’ distinction of theory-led versus data-led research applies to both.

The psychology of scientific revolutions
One view is that science proceeds through the falsification and therefore improvement of theories. One might imagine that scientists are therefore happy for their theory to be proved false. Nothing could be further from the truth. When a scientist develops a theory and then tests it, they will be hoping that the results come back confirming the theory. Scientists like their theories. They like to find evidence to support theory, not find evidence that shows that they are wrong. Falsification of theories in psychology is surprisingly rare.

Falsification in psychology
Students reading this book might like to ask themselves what psychological theories have been shown to be false. The issue of falsification is related to the crisis of replication described later in this chapter.

However, when it comes to research paradigms, scientists are even more protective of what they have assumed in the past to be true. No one wants to find that they have invested years of their careers carrying out research – or practice – based on assumptions that are incorrect. So when paradigm shifts are proposed, there can be strong resistance from scientists working in the older paradigm. New paradigms are met with two kinds of response: enthusiasm from those who believe that the new paradigm provides a novel solution, and hostility from those who don’t. If the latter camp is stronger, the new paradigm takes longer to become established.
The development of the paradigm of modern medicine is a good example of how people can respond to a change in paradigm. Since the time of the Greeks till the middle of the 17th century, medicine was based on assumptions that originated with Hippocrates. Illness was believed to be caused by an imbalance in four ‘humours’ that flowed round the body. The humours (in case you were wondering) were black bile, yellow bile, blood, and phlegm. An alternative paradigm became available during the middle ages, as clockwork and mechanical systems became more common. The body is a mechanical system and illness is caused by faults in that mechanical system. The mechanical paradigm was the new paradigm, and early evidence in favour of this new paradigm was published by William Harvey in 1628 who described how the heart was a pump that pumped blood round the body. Harvey wrote at the time that he expected his discovery to be met with scepticism and downright hostility and that is exactly what happened. The following (see text box) was written in 1647, shortly before Harvey’s discovery became accepted.

**Rejection of a new paradigm**

The following is a translation of the original Latin written by Emilio Parisano in 1647. Parisono was an eminent physician of Venice.

We have no problem to admit that, if the horse swallows water, we can perceive a movement and we can hear a sound. But that a pulse should arise in the breast that can be heard, when the blood is transported from the veins to the arteries, this we certainly can’t perceive and we do not believe that this will ever happen, except Harvey lends us his hearing aid. But above all, we do not admit such a transport of the blood. . . . If blood is transported from the veins of the lung . . . into the branches of the arteries, how could a pulse be felt in the breast, how a sound? I am completely innocent of such subtle speculations. Above all, Harvey has it that a pulse should arise from the movement of the blood from the heart into the aorta – no matter from which ventricle. He also claims that this movement produces a pulse, and, moreover, a sound: that sound, however, we deaf people cannot hear, and there is no one in Venice who can. If he can in London, we wish him all the best. But we are writing in Venice.

There are two points to note about Parisano’s criticism of what is now universally accepted as true – the heart does actually pump blood. The first is that the critics of the new paradigm deny that a pulse can be heard there. This point illustrates a general principle known in the philosophy of science as
theory-ladenness of observables (Hanson, 1958). The principle of the theory-ladenness of observables means that observation is always coloured by expectations about what is being observed. People perceive only what they believe to be possible. Observation is not independent of theory. The principle of ladenness of observable is represented in psychological theory (see Chapter 10) as part of the gestalt movement – perception is based on hypotheses. The idea that science is based only on induction does not stack up. Not only are data selected for observation on the basis of theory, but what is seen is also informed by theory. The physicians of Venice could not hear a pulse because they ‘knew’ that no pulse existed!

The second point to note in this criticism is in the final sentence “but we are writing in Venice.” In the 17th century, Venice was a magnificent city, looking very much as it looks today, and was a centre of learning and art. London was a hotchpotch of timber framed buildings, many of which burned down in the great fire of 1666. Parisano is, in effect, telling Harvey: “You come from an inferior place and should listen to us clever people from a superior place.”

It is not unusual for paradigm shifts to be made from people working in less prestigious institutions or who, at the time of writing, are less well known, simply because they are less immersed in the old paradigm. Freud was responsible for a paradigm shift where mental illness was treated by a ‘talking therapy’ and his work and legacy will be discussed in Chapter 5. Albert Einstein published his theory of special relativity (and other ground-breaking papers) while employed at a patent office and in the same year that he was awarded his PhD in Zurich.

**What paradigm does psychology have?**

There are three possible views. One is that psychology as a discipline is pre-paradigmatic. Another is that it does have a paradigm. And a third is that it is a special case, and different from other sciences in having several ‘complementary’ (note, not spelt ‘complimentary’) forms of paradigm.

It cannot have escaped the notice of any attentive student of psychology that their lecturers have different views about psychology, and that lecturers do not always agree about the type of explanation psychologists should employ. Some lecturers believe that explanations should involve the words and the meaning of words that people speak. Explanations should be based on a description of discourse, and interpretation of what that discourse means. Another group, associated with cognitive psychology, believe that explanations should be based on the description of information processes. Yet another group believes that explanations should be based on the description of events in the brain. This multiplicity of types of explanation can be used to conclude that psychology has not formed an accepted paradigm, and is still pre-paradigmatic.

Disciplines shift from pre-paradigmatic to paradigmatic by one or other of the original paradigms becoming universally accepted. Although there is
no universally accepted paradigm, some believe that there is a dominant para-
digm, a paradigm that is so dominant that others will eventually fade away. That dominant paradigm is cognitive neuroscience. In cognitive neuroscience, information processing is explained in terms of the physiology of the brain. It is certainly the case that at the time of writing cognitive neuroscience is the paradigm of psychology with the highest status. Papers in cognitive neuroscience are often cited by other researchers and in public newspapers, and some psychology departments have prioritised appointments in cognitive neuroscience – even though the popularity of this topic varies somewhat between students.

A third view is that psychology is special. The nature of psychology means that it is impossible to explain all phenomena using a single type of explanation and so complementary explanations are needed. That is, psychology is a science that differs from others in that it requires multi-paradigmatic explanations as a mature science, not as an immature, pre-paradigmatic science (further detail about complementarity is found in Chapter 6).

Each of these three views has its adherents. At the end of this book, the student should be able to form a view about psychology: Whether it is pre-paradigmatic, paradigmatic, or necessarily multi-paradigmatic. And of course, it is always necessary to remember that the answer to this question attracts strongly held views – and strongly held criticism – so whatever conclusion you come to will be both wrong and right according to other people!

**What do scientific psychologists do?**

Karl Popper paints a noble picture of what scientists do. Scientists come up with conjectures or hypotheses. They then test these hypotheses rigorously, trying to falsify them. Eventually the hypothesis is shown to be false and a new hypothesis is proposed. Is this really what happens? The answer is, no.

Scientists, and that includes psychologists engaged in scientific enquiry, are human. They have the same psychological characteristics as other humans. One of these characteristics is confirmation bias. Confirmation bias means that people tend to accept information confirming their existing hypothesis and ignore or discount disconfirming information. This bias is compounded by another factor. Psychologists, like other scientists, have an emotional attachment to theories they are working on. Just as football enthusiasts will support ‘their’ team, so psychologists and other scientists will support ‘their’ theory. The result is that evidence contrary to a theory may have less impact in developing new theory than might otherwise be thought. If evidence is found contrary to a theory, then a possible response is to doubt the replicability of the data – which is not necessarily a bad thing to do, as will be shown later. Another response is to find a way of modifying the theory to explain what is considered an exception. Yet another response is to simply ignore the data.
Here are two examples that illustrate this point. Both examples come from theories that inform current practice:

**Example 1.** The serotoninergic theory of depression is that depression is caused by low levels of serotonin in the brain and that drugs that increase serotonin levels (antidepressants) reduce depression. Irving Kirsch (Kirsch, 2010) and colleagues has shown that at least 80% of the effect of antidepressants in clinical practice is due to placebo. These results have been confirmed independently by other authors and, coupled with data showing that antidepressants do not always resolve depression, this finding provides evidence inconsistent with the serotoninergic theory of depression.

**Example 2.** Cognitive behaviour therapy (CBT) is based on a theory developed originally by Aaron Beck that cognitions play an important role in the cause of depression, and that changing erroneous cognitions leads to improvement. Bruce Wampold (Wampold, 2013) and colleagues reviewed several types of data to show that although CBT therapy is effective, its effectiveness cannot be explained by cognitions having the causal role as originally suggested. The findings reported by Wampold and Wampold's analysis have been confirmed by independent authors.

In both cases there is evidence that throws doubt against accepted and dominant paradigms. The serotoninergic hypothesis is the basis for a multi-million-pound drugs industry and CBT provides the accepted rationale for the funding of talking therapies. This is not the place to provide evidence for or against the various positions – which are robustly supported by both sides. Students may wish to do this independently. The argument presented here is simply that the issue of evidence and falsification of scientific theories is by no means a simple logical process. Science involves humans. Humans are messy.

**Mistakes, fraud, and scientific misconduct**

A central argument of this section is that scientists are human and have the features of other humans. What is the motivation of scientists? To a naïve observer, the motivation of scientists might be to push back the boundaries of knowledge: a pure, noble, and selfless motivation to improve knowledge and the lot of mankind. I am sure there are scientists who are motivated in this way. However, other motivations can come into play. Scientists can be motivated to demonstrate that their theory or hypothesis is correct. Scientists can be motivated by personal glory, and the status and regard achieved by scientific discovery. Some are also motivated by money, though if one were motivated by money a different career would seem a sensible alternative.

Mistakes can be made – it is human to err. Fraud is different. Fraud involves an intentional flouting of the underlying principles of scientific enquiry, namely, that of honesty. One of the best-known cases of fraud in the history of
psychology is that associated with the eminent British psychologist, Cyril Burt. Burt published data supporting the idea that there was a substantial hereditary component to intelligence. In a study of 53 monozygotic twins reared apart, Burt reported a correlation of 0.77 between the intelligence scores of twins (Burt, 1966). These results were interpreted to support the view that intelligence was largely inherited. Shortly after Burt’s death in 1971, Kamin (1974) and then others (e.g., Hearnshaw, 1979) published critiques, arguing that the data had been made up and that the research assistants Burt had cited as co-authors did not exist.

Others came to the defence of Burt, the ‘missing’ research assistants were found, and it was pointed out that data supporting similar correlations to those reported by Burt were replicated by independent researchers (Rushton, 2002). In 1980 the British Psychological Society condemned Burt as a fraud, but in 1992 revised this judgement, writing:

Council considers that it is now inappropriate for the Society as such to seek to express a fresh opinion about whether or not the allegations directed at Burt are true. Moreover, in the light of greater experience, the British Psychological Society no longer has a corporate view on the truth of allegations concerning Burt.

To his defenders, Burt was a good scientist who did not fake his data. Others take a different view.

Burt is not the only famous psychologist subsequently accused of creating fraudulent data. Hans Eysenck was a famous psychologist, best known for his work on personality – he developed the Eysenck Personality Inventory. Eysenck argued that personality was a major cause of fatal diseases such as cancer and that the link between smoking and cancer was not because smoking caused cancer, but because both correlated with a cancer-prone personality. Eysenck collaborated with another researcher, Grossarth-Maticek, and together they published cohort data showing an extraordinarily high association between the cancer-prone personality and cancer, and published experimental data showing that psychological therapy, either delivered through a therapist or through bibliotherapy, had a substantial effect of reducing cancers in those with a cancer-prone personality. That this research was funded by the tobacco industry was an early indicator that it might be flawed and at worst fraudulent. Criticisms and analysis of this case have recently been made public (Marks, 2019; Pelosi, 2019). The story has further to go.

Burt and Eysenck were senior scientists. For junior scientists, personal ambition can be a motivator for fraudulent activity (Steen, 2011). There is increasing competitiveness in science between researchers competing for scarce jobs and scarce research grants. University appointment policies and tenure are often linked to publications. In a profession where time is often scarce, there can be a temptation to short circuit the arduous business of collecting data...
and to make it up (Aulakh, 2016). There is a societal component to fraud created by a competitive research environment: Fraud is not entirely explained by characteristics of some ‘rogue’ scientists. Although fraud is not common, it occurs with sufficient regularity for it to be something to be taken seriously.

How frequent is fraud in scientific practice today? The term used nowadays is scientific misconduct which is defined as (a) any aspect of falsification of data or any other aspects of the study and (b) plagiarism – copying without citation. Gross (2016) provides a useful review of the several studies that have been conducted into scientific misconduct, which includes many based on anonymous reporting by scientists. In this review, Gross reports one study of 99 universities where 44% of students and 50% of staff were aware of scientific misconduct. In a meta-analysis of 18 studies, 2% of scientists had admitted that they themselves had falsified data and 14% had observed others doing it. The frequency of scientific misconduct varies between disciplines: It is most common in cell biology and oncology, least common in politics and sociology, with psychology falling somewhere in between (Gross, 2016).

Exposing others’ scientific misconduct carries risks. In one study of whistle blowers, 60% of whistle blowers found that their actions had negative consequences (Gross, 2016). When scientific misconduct is discovered, it has very negative effects on the careers of perpetrators as well as innocent collaborators (Hussinger & Pellens, 2019).

When journal editors become aware of scientific misconduct, they publish a retraction of the original article. However, retractions can also be published because the authors themselves note problems with the way they have reported the study, and the authors themselves initiate the retraction. In a study of 2,047 retractions published in biomedical articles, only 21.3% were due to error, whereas 67.4% were due to scientific misconduct (expected or proved), of which 43.4% were due to duplicate publication (where the author submits the same paper to two journals and both accept), and 9.8% due to plagiarism (copying from someone else’s paper), the remaining 11.3% being unknown or miscellaneous causes (Fang, Steen & Casadavell, 2012).

Even if findings are not the result of scientific misconduct or error, it does not necessarily follow that they are true. If a probability of < 0.05 is used as the criterion for significance, then 1 in 20 studies that are really non-significant will appear to be significant. Journals are more likely to accept papers with significant results compared to non-significant results, particularly if they are novel results that are interesting in some way. The publication bias towards significant findings means that there is a bias towards Type 1 error.

### Type 1 versus Type 2 error

Type 1 error means that something is assumed to be significant when it isn’t. Type 2 error means that something was thought not significant when really it is.
The possibility of Type 1 error in publications has led to something known as ‘the crisis of replication.’ Many studies are conducted – many more than are published. There have been several instances where an initially interesting finding fails to replicate. The interesting finding is often published in a high status journal, because high status journals tend to accept only the most scientifically interesting papers. The crisis of replication occurs across all sciences but particularly those that use statistical testing. This problem – the result of a combination of genuine chance events and publication bias – has become recognised in recent years, and the issue of replication is accepted as an important part of the scientific process (Zwaan, Etz, Lucas, & Donnellan, 2018).

The existence of fraud and the replication crisis could lead to the conclusion that science is fundamentally a flawed process. On the contrary, the fact that these problems are aired in print shows that problems are being attended to, problems that naturally follow from research conducted by messy humans. In some areas of science where there are commercial interests, such as clinical trials of new drugs, the regulatory requirements of conduct and reporting make any kind of fraud very difficult, and the sponsors of such studies are keenly aware of the very negative consequences should there ever be evidence of wrongdoing. Science is not perfect, but just as theories become improved over time, the process of conducting science is also improving. Many journals now require scientists to make their original data available for scrutiny. Conflict of interest statements are routinely required in medical journals.

The rest of this book

One theme runs through the remaining chapters of this book. It is that different groups of psychologists have different assumptions about psychology. These assumptions have changed over time, but differences remain in modern psychology. There are differences about psychology’s status as a science, what psychologists should be studying and the role and type of theory that is used to explain psychological phenomena. Understanding the very different underlying assumptions that have been featured in the history of psychology and remain today is a good way of understanding the discipline of psychology as a whole.

Essay questions

1. What is the logic of induction and deduction and how are they used in scientific enquiry?

2. What is a paradigm and what is a paradigm shift? Illustrate your answer with examples with particular reference to the attitudes of those involved.

3. Focussing on just one of these two individuals, did Burt or Eysenck commit scientific misconduct?
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