chapter 1

The Science of Psychology

CHAPTER OUTLINE

Learning Objectives

By the end of this chapter you will appreciate:

- what psychology is, and how it differs from 'common sense';
- that psychological knowledge can be usefully applied in many different professions and walks of life;
- the emergence of psychology as a distinct discipline around 150 years ago, from its roots in physiology, physics and philosophy;
- the fundamental differences between different schools of thought in psychology;
- that psychology is the science of mental life and behaviour, and that different schools of thought within psychology place differing degrees of emphasis on understanding these separate elements of psychology;
- that most academic departments in the English-speaking world focus on the teaching of experimental psychology, in which scientific evidence about the structure and function of the mind and behaviour accumulates through the execution of empirical investigations;
- that in the history of psychology many different metaphors have been used for thinking about the workings of the human mind, and since the Second World War the most influential of these metaphors has been another complex information-processing device – the computer.

INTRODUCTION

Psychology is often defined as 'the science of behaviour'. Certainly, psychologists invest a considerable amount of time and effort in observing and measuring behaviour. But they are also interested in what people say about their experiences. Rather than studying a person's behaviour in isolation, they use the behaviour to find out about mental and biological processes, motives and personality traits. Therefore a definition of psychology as 'the science of behaviour' is inadequate.

So, what is psychology? One way to answer this question is to start with the word itself. 'Psychology' literally means 'science of the mind' (*psycho* meaning 'mind', or 'mental', and *-logy* meaning 'science'). A better definition of psychology might be 'the science of behaviour and mental processes', and indeed this is the definition offered in most introductory psychology textbooks.

But does this expanded definition cover the wide range of phenomena studied by psychologists – including topics you might not expect to find in a psychology textbook, like thirst, vision and hearing (chapters 5, 7 and 8)?

Ask yourself: 'Who am I?' You might mention many aspects of yourself when you answer this question, including your personality, your experiences, your sexual preferences, age, physical characteristics, aspirations, attitudes, social contacts and so on. All of these are of interest to psychologists (see chapters 10, 14 and 17). As if this were not enough, they would also be interested in things that you are unlikely to mention, like your physiology (especially processes in your nervous system), genetic make-up, and mental processes that are outside your conscious awareness (see chapters 3, 5 and 7).

Here is a selection of the many activities that psychologists engage in and the settings in which they do so:

- Teaching and developing training programmes (universities, colleges, hospitals, industry, government)
- Scientific research (universities, private and government research institutes, industry)
- Diagnosis and treatment of emotional and behavioural problems (hospitals, community service agencies, private practice)

- Personality testing, vocational testing and test development (personnel departments of organizations, consulting firms)
- Advising government on policies (all levels of government)
- Diagnosis and treatment of learning difficulties, emotional and behavioural problems that impair education (nurseries, schools, special education units, universities)
- Designing machines, computers, systems (e.g. assembly lines), traffic signs etc. that are optimal for human use (industry, government)
- Providing expertise to the legal system (prisons, courts, consulting firms)
- Developing advertising and marketing strategies (business)
- Helping athletes improve performance (professional sports teams, government sports institutes)

Given this diversity of activities it should be no surprise that it is impossible to identify a common set of characteristics (or even a single characteristic) that sets psychologists apart from sociologists, anthropologists, biologists and so on. What does this mean for you, as you begin your study of psychology? It means that the subject you have chosen to explore is more complex than it might appear at first sight – which makes it all the more fascinating.

Figure 1.1

Psychologists engage in a wide range of activities, including helping athletes to improve their performance.

PINNING DOWN PSYCHOLOGY

To begin with, psychology is not a single enterprise. Rather, it is a coalition of specialities, each identified by the adjective that precedes the word 'psychology'. So, for example, *developmental psychology* encompasses age-related changes across the lifespan, *clinical psychology* focuses on the causes and treatment of psychological disorders and adjustment problems, *physiological psychology* investigates the association between physiology and behaviour/mind, *cognitive psychology* looks at basic mental processes, and so on. Here is a list of the many sub-fields of psychology:

Abnormal psychology: Nature and development of abnormal behavior, thoughts, feelings associated with distress or impaired functioning that is not a culturally expected response to an event (see chapter 15)

Behaviour genetics: Impact of heredity on animal and human behaviour (see chapter 13)

Clinical psychology: Diagnosis, treatment, and prevention of mental disorders and disabilities (see chapters 14, 15 and 16)

Cognitive neuroscience: Neuronal basis of mental processes (see chapter 3)

Cognitive psychology: Study of the processes by which sensory information is transformed, reduced, elaborated, stored, retrieved and used (see chapters 8, 11 and 12)

Community psychology: Person-environment interactions and the ways society impacts upon individual and community functioning. Focuses on social issues, social institutions, and other settings that influence individuals, groups, and organizations. Emphasizes changing social systems to prevent psychological problems (see chapters 17, 18 and 19)

Comparative psychology: The study of behaviour in different species (see chapters 3, 4 and 5)

Consumer psychology: The effects of advertising, marketing, packaging, and display on the behaviour of purchasers (see chapter 17)

Counselling psychology: Traditionally associated with the field of education, counseling psychology may include vocational guidance as well as helping persons resolve problems or role issues related to work or school or family matters (see chapter 16)

Cross-cultural psychology: Impact of culture on human behaviour (see chapters 13 and 18)

Developmental psychology: Change in behavioural and mental processes over the life span (see chapters 9 and 10)

Developmental psychopathology: The origins and course of individual patterns of behavioral maladaptation whatever the age of onset, causes or transformations in behavioral manifestation (see chapter 15)

Educational psychology (also called school psychology): Diagnosis and treatment of educational, emotional, and behavioural problems in children and teenagers (see chapters 9 and 10)

Environmental psychology: Relationships between human behaviour and the physical environment (see chapters 7, 8 and 19)

Ergonomic psychology (also called human factors and engineering psychology): Design of tasks, equipment, and work places to maximize performance and well-being and to minimize fatigue, boredom and accidents (see chapter 20)

Evolutionary psychology: Applies an evolutionary perspective to understanding human behaviour and mental processes (see chapters 4 and 5)

Family psychology: Study of the family as a system, and of relationships within the system (see chapter 16)

Forensic and criminological psychology: Psychological aspects of legal processes and crimes (see chapter 21)

Health psychology: Lifestyle and physical health, the identification of psychological causes and correlates of health and illness, psychological aspects of health promotion and the prevention and treatment of illness (see chapter 19)

Mathematical/quantitative psychology: Development of mathematical models of behaviour and derivation of statistical methods for analyzing data collected by psychologists (see chapter 2)

Medical psychology (also referred to as behavioural medicine): Psychological aspects of medical practice, the doctor-patient relationship, reactions to medical advice, improving treatment compliance. Psychological issues that arise in medical treatment of children and adolescents have given rise to the field of pediatric psychology (see chapters 3 and 19)

Neuropsychology: Study of the impact of disorders of the nervous system (especially the brain) on behaviour (see chapters 3, 5 and 7)

Organizational psychology: Study of structures and functions of organizations and the activities of the people within them. Included in its remit are job satisfaction, employee attitudes and motivation, and their effects on absenteeism, labour turnover, and organizational productivity and efficiency (see chapter 20)

Personality psychology/Individual Differences: Study of characteristics that make each person unique (see chapter 14)

Social psychology: Investigation of the reciprocal influence of the individual and his or her social context (see chapters 17, 18 and 20)

Sport/exercise psychology: Reciprocal effects of psychological factors on sports/exercise

The numerous specialities make psychology a wide-reaching subject with rather fuzzy boundaries. So, you may well ask, 'What is the glue that holds psychology together as a discipline?'

If there is any one thing, it is psychology's reliance on a philosophical view known as *empiricism*. Empiricists believe that knowledge comes from observation and experience (the Greek *empeiria* literally means 'experience'). This viewpoint tells us that all hypotheses about human functioning should have an observable consequence, which can be confirmed or refuted by data collection and statistical testing (see chapter 2).

Psychologists are therefore united by their commitment to empirical research as a means of achieving their shared goal of understanding, predicting and changing human behaviour. To this end, they study not only humans but numerous other species too, including fruit flies, cockroaches, rats, cats, dogs, horses and our closest relative, the chimpanzee. Some psychologists use a laboratory, and others study creatures in their natural habitat.

Another way to address our question is to look for overlap in the content of various psychology textbooks. A psychologist called J.D. Matarazzo did this, and found a consensus on 'the core content in every generation since 1890' (1987, p. 895), despite dramatic increases in knowledge base. Four major content areas were represented over this 100-year period:

1. biological bases of behaviour,
2. cognitive and affective processes,
3. developmental processes, and
4. social bases of behaviour.

However, several studies also found that consensus on a core vocabulary is lacking (Landrum, 1993; Quereshi, 1993; Zechmeister& Zechmeister, 2000). It appears that our diversity has resulted in a number of different dialects rather than a single common language.

Why the difficulty in pinning down psychology? And why the diversity in vocabulary used to discuss the various aspects? Is the language we use simply a smoke screen to turn psychology into a science, when it is really little more than common sense?

PSYCHOLOGY AND COMMON SENSE: THE GRANDMOTHER CHALLENGE

Everyone engages, to a greater or lesser degree, in the task of understanding human behaviour. Does that mean everyone is a psychologist?

Yes, in the sense that everyone has ideas about what lies behind the behaviours he or she encounters in the world. Sometimes these ideas are easily expressed, but sometimes they are implicit and beyond conscious awareness. Implicit personality theories, for example, describe the unarticulated expectations we have about relationships between traits. If you see John as daring, you are likely to assume that he is also fearless and confident, as these traits are closely related in our implicit theories of personality (Rosenberg, Nelson & Vivekananthan, 1968; see also chapter 14).

So, can scientific psychology tell us more than our own grandmother, who has spent many years observing human behaviour? Surely scientific psychology is just common sense? The fact is that 'all sciences arise as refinement, corrections and adaptations of common sense' (Oppenheimer, 1956, p. 128), and common sense 'is the datum from which it [science] starts and to which it must recur' (Whitehead, 1949, p. 110). In this regard, psychology is no different from any other science. One of the pioneers of modern social psychology, Fritz Heider, viewed the task of psychology as the systematization of common sense. But does it offer us anything more?

Perhaps it is because psychology includes the study of obvious, everyday phenomena, that we are tempted to infer that it offers us little more than common sense. But common sense, or intuitive psychology, offers us an understanding of human behaviour that can be incoherent and is often contradictory. Consider these proverbs, which embody our collective wisdom about human behaviour: 'too many cooks spoil the broth' vs. 'many hands make light work'; 'out of sight, out of mind' vs. 'absence makes the heart grow fonder', and so on. It is not that each proverb does not offer an insight. The issue is to determine systematically the conditions under which each insight holds true.

Putting common sense to the test

Would you administer a lethal shock?

Let us put our common sense to the test. Answer the following questions simply on the basis of common sense:

1. Happily married spouses are characterized by their tendency to reciprocate positive partnering behaviours towards each other.
   (a) True
   (b) False
2. What percentage of people would administer a potentially lethal shock to another person when instructed to do so by an authority figure?
   (a) 80–90 per cent
   (b) 50–60 per cent
   (c) 20–30 per cent
   (d) 1–2 per cent
3. Animals process information in the same way that people do.
   (a) True
   (b) False
4. Schizophrenics suffer from a split personality.
   (a) True most of the time
   (b) True some of the time
   (c) True none of the time
   (d) True only when the schizophrenic is undergoing treatment
5. The principles of learning that apply to fish also apply to:
   (a) humans
   (b) birds
   (c) neither (a) nor (b)
   (d) both (a) and (b)
6. If you need help from a bystander, you are more likely to receive it if there are only one or two people nearby.
   (a) True
   (b) False
7. If you want a person to perform some action at a very high rate, you should reward the action every time it occurs.
   (a) True
   (b) False

Now check the answers on p.00.

Let us look in more detail at perhaps the most dramatic question – concerning the administration of a potentially lethal shock to another person. Psychiatrists, middle-class adults and university students alike estimated that only one or two people in a 1000 would administer a potentially lethal shock.

In one of the best known psychology studies, Milgram (1963; 1977; see also chapter 18) devised a series of experiments on obe-

Figure 1.2

Human participants were obedient to the point of murderous in Milgram's controversial experiment.

dience to authority in which pairs of participants were divided into 'teachers' and 'learners'. In reality, the learner was always a confederate – someone who works in collusion with the experimenter. The teacher – who knew nothing of the collusion – was asked to administer an electric shock to the learner whenever he or she made a mistake in the learning task. Initial mistakes resulted in low levels of shock, but as incorrect responses increased, so did the intensity of the shock.

By the time a 270 volt shock was administered, the learner was screaming, supposedly in agony, and at 300 volts was pounding on the wall in protest and refusing to answer questions. The teacher was instructed that silence should be considered an incorrect response and to administer the shock. When told to administer a potentially lethal shock (450 volts), about half the participants (in one study it was as high as 68 per cent) obeyed. In other words, there was a 250- to 500-fold difference between the common sense answer and the evidence of psychological research.

Human behaviour is complex

If you felt uneasy reading about what Milgram did to participants in his studies, you are not alone. In addition to what it tells us about obedience to authority, Milgram's research was an important stimulus for developing clearer guidelines regarding the ethical treatment of participants in psychological research. The role of ethics is discussed in chapter 2.

Although the studies demonstrate the power of social norms (in this case the norm of obedience to authority), they attracted, and rightly, severe ethical criticism (Baumrind, 1964). Milgram (1964; 1977) responded by arguing that participants were carefully and sensitively *debriefed* – in other words, after the experiment, they were told about its true nature. He reported that his 'teachers' were greatly relieved, rather than upset, and believed that the research had been worthwhile. In a follow-up several months later, 84 per cent reported feeling positive about their participation, 15 per cent reported neutral feelings, and 1 per cent described negative feelings.

Milgram's critics questioned this response, arguing that the debriefing might have eroded the participants' trust of others and that learning they were capable of committing such harm may have damaged their self-esteem (Schlenker & Forsyth, 1977).

This exercise ought to have convinced you that psychology has more to offer than your grandmother when it comes to understanding the complexities of human behaviour. Even so, at times you may find yourself unimpressed by some of the findings reported in this book. You may feel you knew all along that this was the way humans behaved. Such a response may reflect a cognitive heuristic called the *hindsight bias*. According to this bias, we sometimes falsely overestimate the probability with which we would have predicted an outcome (see also chapter 12).

In a well known study, Fischoff and Beth (1975) had people predict the likelihood of various outcomes when President Nixon visited China and the Soviet Union. After the trip, they were asked to again make the same predictions but to ignore what had actually happened. People estimated the probability of outcomes that actually occurred as higher than they did before the trip. Even when they were told about this hindsight bias and urged to avoid it, the bias remained.

The hindsight bias has implications for forensic psychology, which involves the 'examination and presentation of evidence for judicial purposes' (Blackburn, 1996; see also chapter 21). How effective is it when a judge – as judges are prone to do – tells a jury to ignore certain evidence, after they have heard it, when reaching a verdict?

Once you accept that psychology has more to offer than your grandmother when it comes to understanding human behaviour, you might legitimately ask, 'How do psychologists – as opposed to my grandmother – explain human behaviour?'

EXPLAINING HUMAN BEHAVIOUR

Imagine you are a psychologist interested in understanding a particular kind of behaviour, such as human aggression. What would you look at to advance your understanding? Brain cells and hormones? Inherited characteristics? Socialization by parents? The stimuli that precede aggressive behaviour?

Psychologists pursue all these avenues in their attempt to explain human behaviour. Some look inside the person for causes of behaviour, focusing on physical events such as physiological functioning. As a result, we now know that compulsive violence is associated with tumors and damage in a particular region of the brain – the temporal lobe (Elliot, 1988). Others look for causes of aggression in hypothetical mental activity. From this approach, we have learned that aggressive behaviour is more likely to occur when the person producing the aggressive behaviour infers that they have experienced something negative due to a volitional act of another person (Weiner, 1986).

Yet other psychologists will look to the environment for causal explanations. They may focus on events or stimuli that precede an aggressive act or on a general environmental state. From them we have learned that children acquire aggressive behaviour by observing it in models (see figure 1.3) and that high ambient temperature is associated with naturally occurring aggression. Hotter regions of the world witness more aggression than cooler regions, and hotter years, seasons and days, in comparison to cooler ones, are more likely to produce assaults, murders, rapes, riots and spouse abuse (Anderson, 1987).

It should now be apparent that there is no single explanation for aggressive behaviour. Confusion can be avoided if we accept that each explanation is useful in its own way. The variety of approaches that psychologists have taken in explaining behaviour is illustrated in the next section, which briefly outlines the evolution of psychology from philosophy to a behavioural science.

There are two reasons why you should be familiar with the history of your subject:

1. Ignorance of psychology's past leaves you unable to evaluate the significance of new developments and perhaps even to mistake old facts and viewpoints as new.
2. The vastness of psychology can be both intimidating and confusing as you try to draw connections between various concepts and approaches. Seemingly unrelated topics may

Research close-up 1

The bystander effect

The research issue

Emergencies happen every day all around the world. The most publicized emergency ever seen erupted in New York City on September 11, 2001. The Red Cross, Salvation Army, paramedics and many other humanitarian groups rushed to help the sick and injured while the 9/11 attacks were still taking place.

One might reasonably suppose that the nature of humans is to help others when they are in trouble. Unfortunately, this is not always the case. 'Bystander apathy' occurs when people witness an emergency and take no action.

In the Kitty Genovese murder in the United States in 1964, 38 neighbours apparently watched and listened but did not act to help or call police. Although shocking, these neighbours' reactions were not unusual. Why do people who are willing to help in non-emergency situations not do so in an emergency?

First, there are few potentially positive rewards in an emergency situation. Life is threatened for the victims and the helpers. Second, emergencies usually come without warning and place the potential helper under a great deal of stress. People's reactions are typically untrained and unrehearsed.

Experiment 1
Design and procedure

Latané and Darley (1969) had participants fill out questionnaires in a room to which smoke was added. In condition 1 the participant was alone. In condition 2, three naive participants were in the room. In condition 3, confederates purposely noticed, but then ignored, the smoke.

Results and implications

In condition 1, 75 per cent of participants calmly noticed the smoke and left the room to report it. But in condition 2 only 10 per cent reported the smoke. In condition 3, 38 per cent reported the smoke.

Most participants had similar reactions. Those who did not report the smoke all concluded that it was not dangerous or was part of the experiment. No one attributed their inactivity to the presence of others in the room.

Other related research studies have shown that togetherness reduces perception of fear even when the actual danger is not reduced. It may be that people in groups are less afraid and less likely to act. On the other hand, they may be simply inhibited from showing fear in a group situation.

From post-experimental interviews, it became clear that participants did not act because they concluded the situation was not threatening.

Experiment 2
Design and procedure

This experiment tested what people would do if they witnessed an emergency knowing that others are present but not being able to see or hear them, and *vice versa*.

The researchers placed a naïve student participant in a room and told them that they were to talk to others via an intercom about normal personal problems. Participants were told that there were other student participants who were similarly located in isolated rooms (to preserve anonymity). One of the other students (a confederate of the experimenter) becomes a 'victim' who suffers a seizure and calls out audibly for help. The key question was whether the participant would leave his or her cubicle to assist the victim.

The researchers varied the perceived number of people, with participants talking in groups of two, three or six people. They also varied the two-person discussion group by changing the characteristics of the other bystander (female, male, or a medical student with emergency training).

Finally, two more conditions were set up: one with the participant and a real friend as bystanders, and one where the six participants had had prior contact and a brief 'encounter' with the perceived victim.

Results and implications

Ninety-five per cent of all participants responded within the first 3 minutes, 85 per cent of participants who perceived themselves to be alone left their cubicle before the victim finished calling for help, but only 31 per cent who thought there were four other bystanders acted so quickly.

Overall, 100 per cent of participants in the two-real-person condition acted to deal with the emergency, but only 62 per cent of participants in the six-person condition took action.

Even those who did not respond to the emergency showed signs of genuine concern. They were often nervous and trembling, and seemed to be in a state of indecision about responding.

Taken together, these experiments show there are strong situational factors that can inhibit people from acting in emergencies. These findings have important implications for predicting, understanding and perhaps even controlling how people behave in social situations.

Latané, B. & Darley, J. 1969, 'Bystander "Apathy"', *American Scientist*, 57, 244–68.

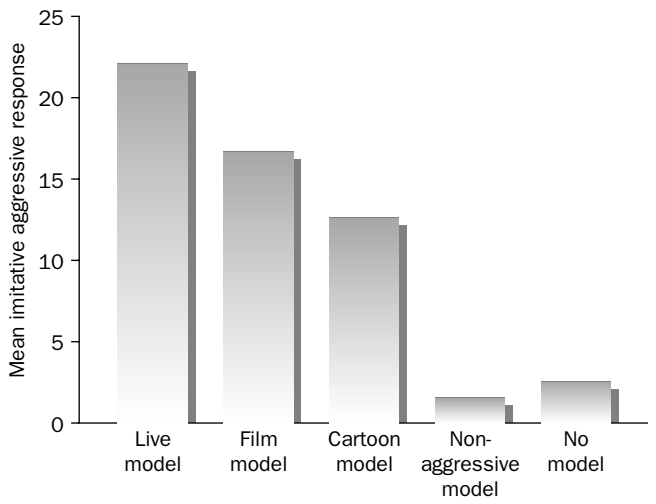

Figure 1.3

Mean imitative aggressive responses by children who were exposed to aggressive models, non-aggressive models or no models.

be intricately bound together through their historical development, so an appreciation of psychology's past can help you to integrate the many different areas and sub-specialities that make up modern psychology.

THE BEGINNINGS OF MODERN PSYCHOLOGY

Where does the history of psychology begin? Humans have long been intrigued by their own behaviour, and attempts to understand human functioning can be traced to early Greek philosophers. But until the last quarter of the nineteenth century, this endeavour was pursued through speculation, intuition and generalizations made on the basis of an individual's experience.

A major breakthrough occurred when the tools of science (carefully controlled observation and experimentation) were applied to the study of humans, and psychology began to emerge as a distinct entity.

Philosophical influences

The notion that the methods of science could be applied to mental phenomena emerged from sixteenth and seventeenth century European philosophy.

The relationship between body and mind

The work of French philosopher and mathematician René Descartes (1596–1650) led to many of the later trends in psychology. Reflecting the spirit of his times, Descartes subscribed to the idea of mechanism – an image of the universe as a machine and physical entities as mechanical devices. Descartes applied this view to animals, including humans, setting humans apart from animals only by their possession of a 'mind'.

Since Plato, most philosophers had viewed the body and the mind (or soul or spirit) as fundamentally different in nature. Descartes accepted this *dualism*. But prior to Descartes, the mind was believed to influence the body, rather than the other way around. Descartes developed what became known as *cartesian dualism*, which asserts a relationship of mutual interaction. Also, by limiting the mind to one function – thought – Descartes ascribed to the body attributes that had previously been associated with the mind (e.g. reproduction). He was the first to offer a strictly physical–psychological dualism. The way was paved for a change from metaphysical analysis of the soul to observation of the mind and its operations.

As it became increasingly clear that sensations travel to the brain and that bodily movements originate in the brain, Descartes looked for a point of interaction between mind and body in the brain. He settled on the pineal gland, or conarium, at the top of the brain stem and described the interaction in mechanical terms. For example, the mind makes an impression on the conarium (in a manner never specified), which, by tilting in the right direction, causes animal spirits to flow to the appropriate muscles, producing movement. Descartes ultimately concluded that the interaction between the physical and non-material worlds (body and mind) was miraculous.

One of Descartes' conclusions was that: 'The existence of God is demonstrated, a posteriori, from this alone, that his idea is in us' (1977, p. 234). This points to another important legacy of his philosophy, namely that some ideas (e.g. ideas of God) are innate. This notion influenced later psychological theories, especially in Gestalt psychology.

The mind as a collection of experiences

After Descartes, another French philosopher, Auguste Comte, developed a new philosophical idea that had a profound impact on psychology. Comte coined the term *positivism* to describe a way of thinking that recognized only positive facts and observable phenomena. He believed that social life is governed by laws and principles that we can discover through the methods used in the physical sciences. It was only a matter of time before the methods of science were applied to the study of mental phenomena conceived of in mechanistic terms.

A third important philosophical tradition, this time rooted in England, facilitated this application. Empiricism, as we noted earlier, sees sensory experience as the source of all knowledge and provided psychology with both method and theory. The method was observation and, to a lesser extent, experimentation. The theory concerned the growth of the mind, which was seen to occur through the accumulation of sensory experience.

John Locke (1632–1704), whose *Essay on Human Understanding* (1690) marked the formal beginning of British empiricism, rejected the notion of innate ideas, arguing that a new-born child

has no knowledge whatsoever. He admitted that some ideas might appear to be innate (such as the idea of God) but argued that this was only because they are so constantly taught that no student could remember a time when he or she was not aware of it. Instead, Locke argued, each infant is born with a mind like a blank slate, a *tabula rasa*, upon which experience is written. For Locke, all knowledge is empirically derived, with complex ideas consisting of numerous interlinked simple ideas.

Scottish philosopher David Hume (1711–76) developed this notion of the association of ideas, and made it more explicit. He outlined three laws of association, which he saw as the mental counterpart of the laws governing the physical universe:

1. resemblance or similarity
2. contiguity in time or place
3. causality (linking effects to causes)

So *materialism* (the view that all things, including mental phenomena, can be described in physical terms), positivism and especially empiricism were the three philosophical pillars on which modern psychology was built. But psychology has equally important roots in physiology. In fact it was four German physiologists who were primarily responsible for the emergence of the new science of psychology.

Physiological influences

Physiology shaped the form of early psychology and imbued it with the experimental method.

Measuring mental processes

The legacy began with Hermann von Helmholtz (1821–94), who investigated the speed of neural impulses. His work suggests that thought and movement do not occur instantaneously as previously believed, but that thought occurs first, followed by movement. This paved the way for others to investigate the psychological significance of time taken to react to a stimulus (reaction time or response latency) – an approach that remains important in modern psychology (see chapter 13). Helmholtz made significant contributions to sensory psychology, especially audition and vision (you will still find his colour theory of vision in psychology textbooks), but he saw psychology as closely related to metaphysics and never considered himself a psychologist.

Unlike Helmholtz, Ernst Weber (1795–1878) saw psychology as akin to a natural science and applied strict experimental methods. Weber found that the smallest difference between two stimuli that could be discriminated (the *just noticeable difference, or JND*) depends not on the absolute difference, but on the relative difference between the stimuli. For example, he established that the JND between two weights is a constant fraction of 1/40 (40 g is noticeably different from 41 g, 80 g is noticeably different from 82 g etc.) and that the constant varies for different senses.

Weber achieved a major breakthrough by showing how to investigate the relation between stimulus (body) and sensation (mind). But like Helmholtz, his concern was with physiological processes, and he failed to appreciate the significance of his work for psychology.

Gustav Fechner (1801–87) built on and went way beyond Weber's work in attempting to document exactly 'the functionally dependent relations . . . of the material and the mental, of the physical and psychological worlds' (1966, p. 7). Developing a programme of research on what he called *psychophysics*, Fechner devised methods that, with minor modifications, are still in use today.

For example, the idea of average error assumes that we cannot obtain a 'true' measure of sensation. So when a person is asked to adjust a variable stimulus (such as light intensity) to match it to a constant, standard stimulus, average error is the average difference between the variable stimulus and the standard stimulus over a number of trials. This technique – useful in measuring reaction time – is basic to modern psychology. In fact, Fechner, more than any other single person, prepared the way for the research on perception described in chapter 8.

The first psychology textbook

Although philosophy had paved the way for the application of scientific methods to the study of mental phenomena, it was through the work of physiologists like Helmholtz, Weber and Fechner that this potential was fully realized. Yet, despite their influence, none of these men has been credited with founding modern psychology. That honour has been bestowed on a fourth physiologist, Wilhelm Wundt (1832–1920), who published *Principles of Physiological Psychology* (1874) – widely considered the first psychology textbook.

In the preface Wundt wrote, 'The work I here present to the public is an attempt to mark a new domain of science.' Unlike his predecessors, Wundt called himself a psychologist and took a number of actions to promote this new domain of science.

PSYCHOLOGY TODAY

The birth date of psychology is most often given as 1879. It was in this year that Wilhelm Wundt is said to have established the first formal psychology research laboratory at the University of Leipzeig in Germany, and the first psychology journal followed two years later. Together they heralded the beginning of modern psychology.

Structuralism: mental chemistry

Wilhelm Wundt (along with one of his English students, Edward Titchener, who helped establish psychology in the USA) developed the first systematic position, or school of thought, in psychology – *structuralism*. According to Wundt, psychology is the science of immediate experience, unbiased by any interpretation.

Pioneer

Figure 1.4

Wilhelm Wundt is generally considered the founder of modern psychology.

Wilhelm Wundt (1832–1920) was a physiologist and psychophysicist who established the world's first psychology laboratory and wrote the first psychology textbook, *Principles of Physiological Psychology* (1874). Wundt (along with Edward Titchener, who helped establish psychology in the USA) developed the first systematic position, or school of thought, in psychology – structuralism, so called because it focuses on the structure of the mind. Wundt put students through an arduous training in the method of introspection (looking inward) to single out those who could describe the elementary sensations of experience – colours, tones, tastes and so on. But by the early twentieth century, introspection had been labelled 'superstitious' by John Watson, the founder of behaviourism.

Look at figure 1.5. Did you see a blue fish? According to Wundt, this will not do, as you are showing greater interest in the object (fish) than in the sensation of experiencing blue. In other words, this is a mediated, or interpreted, experience. Wundt put students through an arduous training in the method of *introspection* (looking inward) to single out those who could describe the elements of experience – colours, tones, tastes and so on. In our example, a good introspectionist would describe only the intensity and clarity of the sensations that occur in viewing the image, such as its blueness.

Like chemistry, psychology consists of analysis – discovering the basic elements of conscious thought – and synthesis – discovering connections between elements and the laws governing these connections. To qualify as an element, an experience has to be irreducibly simple. Titchener even dared to number the elements of consciousness and offered what one might view as a 'periodic table' of the mind (see table 1.1). Elementary sensations had to be combined because, as Wundt recognized, we experience conscious thought as a unity, not as a series of varied sensations of brightness, hue, shape etc. Wundt's doctrine of apperception describes a process of 'creative synthesis' by which elementary experiences are organized into a whole. And his law of psychic resultants posits that psychic compounds have new properties that are 'by no means the mere sum of the characteristics of the elements' (1896, p. 375).

Wundt was profoundly influential, not to mention prolific – if you read his works at the rate of 60 pages a day, it would take two and a half years to finish them. But the method of introspection did not stand the test of time and by the early twentieth century

Table 1.1 Titchener's 'periodic table' of the mind.

Elementary Sensations	
Number	
Colour	About 35,000
White to black range	600 to 700
Tones	About 11,000
Tastes	Just 4 (sweet, sour, bitter, and salty)
From the skin	Just 4 (pressure, pain, warmth, and cold)
From the internal organs	Just 4 (pressure, pain, warmth, and cold)
Smells	9 classes seem likely, but there might be thousands of elements
Total elementary sensations	46,708 plus an indeterminate variety of smells

had even been labelled 'superstitious' by an American behaviourist, John Watson. In fact, vehement reaction against the limitations of structuralism defined much of what subsequently happened in psychology for many years.

FUNCTIONALISM: MENTAL ACCOMPLISHMENT

Preoccupation with the structure of the mind was replaced by a second major system of thought in psychology, which focused on function. *Functionalism* addressed the very practical question of what the mind, or mental processes, accomplish. The precept 'thinking is for doing' is the hallmark of functionalism. Although it arose in the USA and was the first uniquely American system of psychology, it owed much to the Englishman Charles Darwin.

The notion of function is central to Darwin's theory of evolution, as the physical characteristics of a species evolve to meet its requirements for survival. The idea that behaviour might also reflect adaptation to the environment soon followed. Darwin's seminal work, *On the Origin of Species by Means of Natural Selection* (1859), also raised the possibility of continuity in behaviour and mental functioning between animals and humans, prompting the laboratory study of mental functioning in animals. Finally, Darwin's observation of variation among members of the same species focused attention on individual differences in psychology.

The most important exponent of functionalism was William James (1842–1910), who argued that: 'No one ever had a simple sensation by itself' (James, 1890, p. 224). Instead, he proposed, the most important thing about consciousness is its continual flow, and he coined the famous phrase 'stream of consciousness' to emphasize this fact. He was interested in the process of conscious activity (e.g. perceiving and learning) and viewed the attempt to divide consciousness into distinct elements as misguided. From James' perspective, the function of consciousness is to guide behaviour that will help the organism adapt to the environment. He felt that consciousness must have some biological use or else it would not have survived. Not surprisingly, James saw psychology as a biological science.

Unlike Wundt, James never set out to found anything (he started a laboratory at Harvard University in 1875 but did not carry out any laboratory research). Yet his impact on psychology was equally profound. In *Principles of Psychology*, published in 1890, James offered a vision that is closer to modern psychology than anyone else at that time. Indeed, the two volumes, with chapters on such topics as reasoning, habit, emotion, instinct, will, the self, attention and hypnotism, remain useful reading for psychologists today (see chapters 6, 12 and 16).

With the publication of this work, James felt that he had said all he knew about psychology and devoted the rest of his life to philosophy. But it was enough to pave the way for comparative psychology and the study of individual differences to become part of the mainstream of psychology.

After James, functionalism was developed more formally as a 'school' by John Dewey (1859–1952) and James Angell (1869–1949). Functionalism shifted attention away from the exclusive focus on private experience (consciousness) to include the study of objective, observable behaviour. Unlike structuralism, functionalism was not supplanted but provided a bridge for the emergence of the polar opposite of structuralism – a psychology that focused on behaviour and eschewed study of the mind.

Pioneer

William James (1842–1910) was the most important exponent of functionalism. James argued that the most important thing about consciousness is its continual flow, coining the famous phrase 'stream of consciousness'. Unlike Wundt, he viewed the attempt to divide consciousness into distinct elements as misguided. From James' perspective, the function of consciousness is to guide behaviour that will help the organism adapt to the environment. In *Principles of Psychology* (1890) James offered a vision that is closer to modern psychology than that of anyone else at that time. With the publication of this work, James felt that he had said all he knew about psychology and devoted the rest of his life to philosophy. But it was enough to pave the way for comparative psychology and the study of individual differences to become part of the mainstream of psychology.

BEHAVIOURISM: A TOTALLY OBJECTIVE PSYCHOLOGY

The emergence of functionalism had been evolutionary rather than revolutionary, with structuralism maintaining a strong but not exclusive hold on psychology as it entered the second decade of the twentieth century. But a student of Angell's, John Watson, changed this with the publication of a broad, cutting attack on existing systems in psychology. 'Psychology as the behaviorist views it' (1913) served as the manifesto for a revolution in psychology:

> Psychology as the behaviorist views it is a purely objective experimental branch of natural science. Its theoretical goal is the prediction and control of behavior . . . The behaviorist, in his efforts to get a unitary scheme of animal response, recognizes no dividing line between man and brute. The behavior of man, with all of its refinement and complexity, forms only a part of the behaviorist's scheme of investigation.
>
> **(p. 158)**

Like Wundt, Watson set out to promote something new – a totally objective psychology, whose subject matter was observable behaviour. Stimulus–response units were seen to be the basic building blocks of complex behaviour. So, even in rejecting structuralism, Watson shared with it an analytic and atomistic point of view. Because Watson was more interested in working with animals than humans, it is not surprising that he viewed *behaviourism* as 'a direct outgrowth of studies in animal behavior' (1929, p. 327).

By the turn of the century the study of animal behaviour had become widespread, and experimental animal psychology was

Figure 1.6

John Watson treated all functioning in terms of stimulus–response.

growing rapidly. Edward Thorndike (1874–1949) – one of the most important figures in the development of animal psychology – is credited with introducing the experimental investigation of animal behaviour. To study 'animal intelligence', he put cats in a cage, placed food outside the cage door and timed how long it took the cat to learn how to escape.

In the process of trial-and-error learning, Thorndike observed that responses were 'stamped in' or 'stamped out', depending on their consequences. He formalized this observation in his famous *law of effect*: 'Any act which in a given situation produces satisfaction becomes associated with that situation, so that when the situation recurs the act is more likely to recur also. Conversely, any act which in a given situation produces discomfort becomes dissociated from that situation, so that when the situation recurs the act is less likely than before to recur' (1905, p. 203). In building on Thorndike's work, Watson purged it of mentalistic ideas like 'satisfaction'.

Watson also profited from the work of the Russian physiologist, Ivan Pavlov (1849–1936). In his Nobel Prize-winning work on digestion, Pavlov discovered that hungry dogs would salivate at the sight of the person who brought them their food. At first, he considered this 'psychic secretion' a nuisance, but soon he realized that it revealed a very basic form of learning. He went on to show that dogs could be trained, or conditioned, to salivate at the onset of an arbitrary stimulus (e.g. the sound of a bell) if it was immediately followed by food. Without intending to do so, Pavlov had provided psychology with a basic element, the stimulus–response association – also used by Watson as the foundation of behaviourism.

Watson had argued that, with the appropriate stimuli, an organism can learn to behave (respond) in specific ways, much like Pavlov's dogs. Along with his student, Rosalie Rayner, he showed – through an experiment that raised obvious ethical concerns – how fear could be learned. Little Albert, an 11-month-old child, was shown a white rat that he was not afraid of. Each time he was shown the rat, the experimenter made a loud noise, eliciting a startle reaction (Watson & Rayner, 1920). After just seven trials, the rat alone, without the accompanying noise, produced fear (crying) (see chapter 4, *Everyday Psychology*).

In the same year, Watson's formal career as a psychologist ended prematurely and abruptly in the midst of highly publicized divorce proceedings, but his legacy lived on. Behaviourism thrived well into the 1960s, especially in the USA, where it evolved under the influence of arguably the most influential psychologist of the twentieth century, Burrhus Fredrick Skinner (1904–90) and became known as radical behaviourism.

Radical behaviourism

What is 'radical' about radical behaviourism? First, it is 'radical' because Skinner completely accepted private life as *behaviour*. Second, a mental state is treated as a sub-category of the environment – so each of us is affected by both the external environment and our own internal environment. Third, the same principles apply equally well to both environments. Fourth, radical behaviourists focus only on behaviour and the variables that control it. They look in only two places for these variables: the conditions that immediately precede the behaviour and the conditions that immediately follow it.

Imagine you are playing table tennis. As you hit the ball, you say to yourself, 'Stay focused.' You notice that the ball lands on the table more frequently when you do this. So this outcome (ball on the table) keeps you saying that phrase to yourself as you hit the ball. Consider what would happen if you said the phrase but the ball hit the net as often as it landed in play. Eventually you would stop saying the phrase to yourself.

There are two points to notice here:

1. It is the functional relationship between the outcome and the phrase that determines the likelihood that you will repeat the phrase.
2. The phrase itself has no power over the behaviour (it does not directly 'cause' the behaviour).

Radical behaviourism is sometimes viewed as simplistic, but Skinner's approach was far from simple. In *Science and Human Behavior* he notes that behaviour is very complex and difficult to study: 'Since it is a process, rather than a thing, it cannot be easily held for observation. It is changing, fluid, and evanescent, and for this reason it makes great technical demands upon the ingenuity and energy of the scientist' (1953, p. 15).

Skinner focused on establishing laws of behaviour (empirical relationships between environmental events and behaviour) based on intensive observation of a single subject under carefully controlled experimental conditions. His approach, the *experimental analysis of behaviour*, investigated 'operant' behaviours – so-called because they 'operate' on the subject's environment. Skinner viewed this approach as more representative of real-life learning. Operant behaviours are distinguished from the kind studied by Pavlov – 'respondent' behaviours, which are a response to a known stimulus (see chapter 4).

Figure 1.7

A rat in a Skinner box.

Skinner's classic work involved the study of bar pressing (or pecking) by rats (or pigeons) in a 'Skinner box' that was constructed to eliminate all extraneous stimuli (see figure 1.7). A hungry animal was placed in the box and allowed to explore it. Sooner or later the animal would accidentally press a lever that released a food pellet. The food acted as a reinforcing stimulus (or reinforcer) for the bar-pressing behaviour, increasing the probability of its future occurrence. In other words, the animal 'worked' (pressed the bar) because there was a 'payoff' (food). This is an example of *operant conditioning*.

The manner in which the payoff occurred – the *schedule of reinforcement* – influenced bar pressing. Schedules of reinforcement could vary according to time *interval* schedules (in human terms, this might be the weekly pay check), or work ratio schedules (a pay cheque based, for example, on number of items sold). Ratio schedules produce greater rates of behaviour, or faster learning. Schedules can also vary in terms of whether they are fixed or variable. Interestingly, a variable ratio schedule, in which the rate of reinforcement of the rat varies somewhat according to the number of bar presses it makes, produces the highest rate of responding (see figure 1.8).

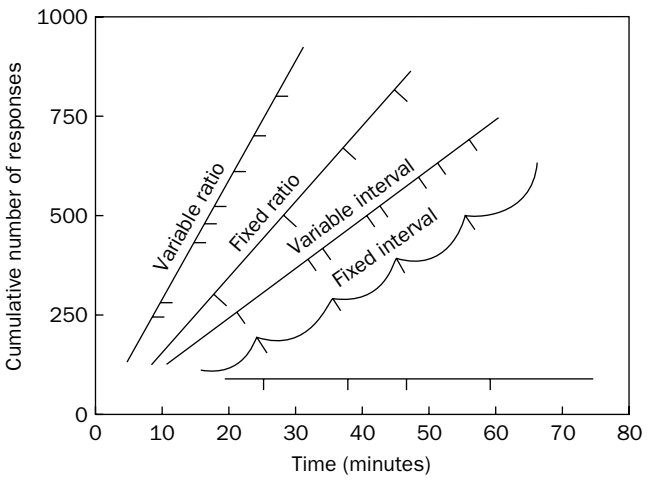

Figure 1.8

Performance curves produced by the four representative schedules of reinforcement. The steeper the slope of the curve, the faster the response. Each pause indicated by a small horizontal line signifies a period of reinforcement.

Skinner went on to show that operant conditioning can take several forms, as shown in table 1.2. One of its first applications to human behaviour occurred in 1948 when it was used to treat an institutionalized, profoundly retarded person (Fuller, 1949). Systematic research to make the experimental analysis of behaviour useful in addressing human problems soon followed, giving rise to the widespread use of teaching machines ('programmed learning'), behaviour modification in educational settings, and treatments for emotional and behavioural disorders.

The application of operant procedures to address socially important behaviours became known as applied behaviour analysis in the 1960s. Like Watson, who envisioned behavourism

Figure 1.9

Arguably the most influential psychologist of the twentieth century, Burrhus Fredrick Skinner was prominent in the birth of radical behaviourism.

Table 1.2 Four ways in which operant conditioning can occur.

	Response – outcome contingency	*Example (developing appropriate child behaviour)*	*Effect on behaviour*
Positive reinforcement (reward)	Correct response is followed by reinforcer	Parent praises child when he shares toy	Strengthens desired response
Negative reinforcement (avoidance)	Correct response is followed by withdrawal of aversive stimulus	Parent stops nagging child when he shares toy	Strengthens desired response
Punishment (positive punishment)	Undesired behaviour is followed by aversive stimulus	Parent physically rebukes child when he snatches toy from friend	Weakens undesirable response
Omission (negative punishment)	Undesired behaviour is followed by withholding of reinforcer	Parent takes away child's candy when he snatches toy from friend	Weakens undesirable response

giving rise to 'saner living', Skinner saw his laboratory research as also providing a technology of behaviour that could improve society. In his novel *Walden Two* (1948), Skinner outlines in detail the mechanics of a society based on behavioural principles.

Most modern behaviourists no longer adhere strictly to the behaviourism espoused by Watson or Skinner. But even psychologists who reject behaviourism in all its forms are indebted to it. The objective approach to understanding behaviour has its roots in structuralism and evolved though functionalism to reach its zenith in behaviourism. This is the hallmark of modern psychology.

Gestalt psychology

While functionalism followed structuralism in the USA, and behaviourism arose in opposition to both, a different kind of opposition to structuralism emerged in Germany – Gestalt psychology.

The Gestalt attack on structuralism in Europe was independent of the opposition that had developed in the USA. It arose out of a simple observation by its founder, Max Wertheimer (1880–1943), whose paper 'Experimental studies of the perception of movement' marks the beginning of Gestalt psychology.

Wertheimer notes that we can see motion or movement even when no actual movement takes place. For example, when two lights flash in quick succession, we see what appears to be movement from one to the other and back again. Wertheimer called this the 'phi phenomenon'.

It was impossible to explain the phi phenomenon in structuralist terms by describing each elementary sensation (any more than we can explain a melody by describing each individual note). So how did Wertheimer explain it? He did not. He saw no need for explanation, for, he argued, apparent movement could not be reduced to anything simpler. From the Gestalt perspective, the perception forms a whole (in German, *Gestalt* means 'form' or 'entire figure'), or unity (the movement), that is greater than the sum of its parts (the two lights). Gestalt psychology therefore challenged the associationist views that prevailed at the time.

Gestalt psychology is based on the principles that complex mental experience exists on its own, and that perception is composed not of elements but of structured forms. Perhaps the best known Gestalt psychologist, Wolfgang Kohler (1887–1967), reminds us that 'the concept "Gestalt" may be applied far beyond the limits of sensory experience' (1947, p. 178).

Kohler studied apes and observed that they solved problems (e.g. by joining two short sticks to retrieve a banana) by 'insight', or by spontaneously seeing relationships (in this case, between two sticks). This contrasted with the work of behaviourists, whom he criticized for structuring animal problem-solving tasks in such a way that they allowed only trial and error behaviour. For example, an animal in a maze cannot see the overall design of the maze, only the alley it is in, and it is therefore limited to using trial and error.

Although it did not survive as a distinct school of psychology much beyond the 1950s, Gestalt principles were incorporated into other areas of psychology, particularly thinking and learning. It even influenced early social psychology.

Out of school: the independents

Many important developments in the emergence of psychology took place outside the context of the 'schools'. The first began within a few years of the establishment of Wundt's laboratory at Leipzeig.

Memory: Hermann Ebbinghaus

Shortly after Wundt stated that it was not possible to investigate higher mental processes experimentally, a compatriot, Hermann Ebbinghaus (1850–1909) devised ingenious experimental methods for studying memory (the process of learning and forgetting) using only himself as the subject.

One experimental technique involved learning nonsense syllables – syllables that have no meaning and therefore no connections to anything in a subject's experience. Ebbinghaus formed the syllables by using all possible combinations of consonants separated by a vowel (e.g. nim, mur), generating a pool of 2,300 syllables, from which he drew lists for his experiments. To learn the lists, Ebbinghaus went though a stack of cards, each of which

contained one syllable. He controlled the exposure to each card by using the ticking of a watch to regulate their rate of presentation. After reading the card set, he paused a fixed amount of time before reading the cards again.

Ebbinghaus reasoned that learning and forgetting could be studied using two techniques:

1. complete mastery, or counting the trials needed to memorize a list of nonsense syllables so that he could recall it at least once without error; and
2. savings, or the difference in the number of trials needed to relearn a list, compared to the number of trials required for original learning.

To be sure about the accuracy of his results, Ebbinghaus would repeat the same task several times using different lists. This allowed him to eliminate variable errors due to random fluctuations caused by things like mood and different environmental conditions. In his attempt to be systematic, he even regulated his daily habits, always learning material at the same time each day.

Using these methods, Ebbinghaus documented the influence of various conditions on learning and memory, including the passage of time on forgetting. The famous Ebbinghaus *forgetting curve* (see figure 1.10) shows that forgetting occurs rapidly in the first few hours after learning and then proceeds more slowly.

Ebbinghaus limited himself to gathering facts about memory through systematic, careful observation and did not offer any theory about how memory works. He did not found a school of psychology, had no disciples and worked alone. And yet he had a profound impact on psychology (see chapter 11). His painstaking work, reported in his brilliant book *On Memory* (1885), stood the test of time as his findings were later replicated by others and many remain valid today. According to Roediger (1999), Ebbinghaus solved three important problems faced by psychologists in their work:

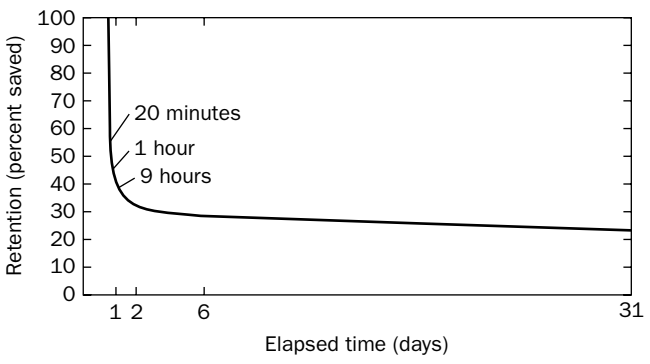

Figure 1.10

Ebbinghaus's 'forgetting curve'. This figures shows retention of nonsense syllables measured by saving in relearning (the percentage decrease in the number of trials required to relearn the list). For example, 50 per cent saving means that half the number of trials are needed to relearn the list as it took to learn it initially. Retention clearly decreases as the retention interval (the time between initial learning and the retention time) increases, but the rate of forgetting slows down.

1. converting unobservable mental processes into observable behaviour;
2. measuring the behaviour reliably; and
3. showing how relevant variables affect the behaviour.

In doing so, he started a whole new field of study that remains vital today and set the stage for later study of many aspects of cognition.

Individual differences: Francis Galton

In addition to his remarkable work on memory, Ebbinghaus was the first to publish on intelligence testing in children. He developed a test, still included in test batteries today, which anticipated *psychometrics*, the theory and measurement of psychological variables. It was not until 1905, however, that Alfred Binet (1857–1911), along with fellow French researcher Théopile Simon, produced the first successful test of general intelligence.

These efforts all rested on the earlier work of the Englishman Sir Francis Galton (1822–1910), who initiated the whole idea of 'mental tests'. He assumed that intelligence could be measured in terms of sensory abilities, reasoning that the more the senses perceive differences – for example, the ease with which weights can be discriminated – the larger the field upon which our judgement and intelligence are able to act (Galton, 1928).

Galton was also interested in the inheritance of mental abilities. Inspired by the work of his cousin, Charles Darwin, he did much to introduce the spirit of evolution to psychology.

His first influential work was *Hereditary Genius* (1869), which applies statistical ideas to the problem of heredity and documents the genealogy of 997 eminent men. Galton calculated that the chance (statistically) of members of this group having an eminent relative was less than 1 per cent. What he found was that 33 per cent had eminent relatives. His conclusion that genius is inherited would not be justified by today's research standards. These would require his findings to be compared to those for a group of

Pioneer

Francis Galton (1822–1910) was instrumental in developing psychometrics – the theory and measurement of psychological variables. He reasoned that the more the senses perceive differences (for example, the ease with which weights can be discriminated), the larger the field upon which our judgement and intelligence are able to act. Inspired by the work of his cousin, Charles Darwin, Galton introduced the spirit of evolution to psychology. His first influential work, *Hereditary Genius* (1869), applies statistical ideas to the problem of heredity, documenting the genealogy of 997 eminent men. Galton's interest in documenting human differences led him to develop statistical methods, perhaps the most famous being 'co-relation' – or correlation – between two variables.

non-eminent men, and would require closer examination of an alternative hypothesis – namely, that relatives might share similar environments and not just genes.

Galton's interest in documenting human differences led him to develop statistical methods, perhaps the most famous of which is the correlation or 'co-relation' (Galton's term) between two variables. (See chapter 2 for a more detailed description of correlation.) Indeed, Galton's pioneering work gave rise to a number of statistical tools that psychologists still use today.

Two further, and better known, developments took place outside the mainstream of psychology – Sigmund Freud's psychoanalysis and Jean Piaget's genetic epistemology. Neither had an immediate impact on the subject, but over the course of time their influence was profound.

Psychoanalysis: Sigmund Freud

Sigmund Freud (1856–1939), a Viennese physician, formulated a revolutionary theory of human behaviour. Although familiar with the experimental psychology movement, Freud's data was not obtained from controlled experiments but by listening to patients who were not suffering from any familiar disease. He applied his own idiosyncratic interpretation of data to formulate theories. By the mid 1890s, he had become convinced that traumatic sexual experiences in childhood were responsible for many of his patients' symptoms. These painful memories were pushed out of consciousness ('repressed') and the task of Freud's 'talking cure' – *psychoanalysis* – was to bring such memories into conscious awareness.

Over the course of his career, Freud used psychoanalysis as the foundation for developing a theory of personality that included a number of mental structures – the id, ego and superego. These structures were fundamentally different from those investigated by Wundt. The Id, together with portions of the ego and superego, were considered to be unconscious and therefore could not be analysed by introspection, and, unlike Wundt, Freud was also interested in the function of these structures. His theory is described in more detail in chapter 14.

There were no points of contact between psychology and psychoanalysis. Each had a different approach, and psychologists were particularly critical of Freud's methods, including the conditions under which he collected his data, the unstated process by which he moved from data to conclusions, vagueness of terms, and the difficulty of deriving empirically testable hypotheses.

Freud, for his part, simply stated that his work was 'based on an incalculable number of observations, and only someone who has repeated those observations on himself and on others is in a position to arrive at a judgment of his own upon it' (1938, p. 144). But because no one knew how Freud reached his judgements, they could not be repeated. Eventually even his own disciples grew frustrated and split from him.

Subsequent attempts to describe the dynamics of the mind that build on psychoanalytic thinking are generally referred to as psychodynamic theories. Although psychoanalysis never became a 'school' in psychology (its home always was and remains in free-standing psychoanalytic institutes outside academia), many of his concepts came to have a profound influence on psychology, and on twentieth century civilization in general.

Figure 1.11

Sigmund Freud ignored his critics and developed his own idiosyncratic theories of human behaviour.

Genetic epistemology: Jean Piaget

How do we come to know something? This is the question addressed by the branch of philosophy concerned with the study of knowledge – epistemology. Instead of using only logical arguments to address this question, a Swiss biologist, Jean Piaget (1896–1980), studied developmental changes in knowing and the nature of knowledge (see chapters 9 and 10).

Piaget did not identify himself as a psychologist, instead labelling his work as *genetic epistemology*, the study of the origin of knowledge in child development. Drawing on his work with fresh water molluscs, his greatest insight was simply that knowledge is a relationship between the knower and the known. The knower always provides a framework for the acquisition of knowledge, which simultaneously influences (assimilates) and is influenced by (accommodates) what is known. As the knower changes, so does what is known.

Piaget argued that a child understands an object by acting on it either physically or mentally and thereby constructs knowledge. Infants develop cognitive structures or schemes, which are

Figure 1.12

Jean Piaget's integration of logic and observation offered new insights into developmental psychology.

organized patterns of actions that reflect a particular way of interacting with the environment. Cognitive structures of older children, from about seven years on, reflect abstract mental operations. These operations, or internalized actions that are organized structures, allow older children to realize that quantities remain constant (are conserved) despite changes in appearance.

Unlike behaviourists, Piaget ignored the issue of learning, which he long dismissed as 'the American question', and his theory of intelligence had little impact outside of Europe until John Flavell (1963) introduced Piaget's work to the English-speaking world. Faced with the difficulty of Piaget's writings and the scope of his work – which covered not only intelligence but also perception, language, play and such psychological processes as memory – it was all too easy for psychologists to focus only on aspects of the theory. Piaget considered this fragmentation the most common abuse of his work. And yet, even though much of his work was based on observation of his own children and has been criticized for relying too heavily on children's verbal abilities to explain their understanding, it had a profound impact on developmental psychology.

The most persistent and successful challenge to Piaget's findings came from work inspired by a new approach to understanding cognitive processes.

The cognitive revolution

It has been said that psychology 'lost its mind' with the advent of Watsonian behaviourism. It could equally be said that several factors led psychology to 'regain its mind', including the realization that:

1. the strict methodological controls that were part and parcel of behaviourism had resulted in the elimination of those concepts that related most closely to people's everyday experience (e.g., their experience of consciousness);
2. the stimulus–response approach was inadequate for explaining many psychological phenomena (e.g., how language develops); and
3. behaviourism had thereby deprived psychology of some of it most interesting problems (e.g., how people ascribe meaning to events and how this meaning influences subsequent behavior).

The 'cognitive revolution', which pushed behaviourism from its dominant position in psychology, cannot be traced to a founding figure or the publication of a particular paper. But many agree that Ulrich Neisser's book *Cognitive Psychology* (1967) and Donald Broadbent's work at the Applied Psychology Research Unit in Cambridge were important influences.

Broadbent, in his work on human skills and performance ('human factors'), noted that humans are guided by information, or 'feedback', provided by machines (e.g. instruments in an aircraft cockpit), and that often the individual will not make use of all the information in operating the machine (flying the aircraft). The problem for the person operating the machine is the allocation of attention to direct the processing of available information.

So, continuing our aircraft example, on different occasions it will be more relevant for the pilot to focus attention on the altimeter or the speed indicator, or to distribute her attention more widely across multiple sources of information. For example, both the altimeter and the speed dial may provide critical information during landing.

Integrating this work with ideas from information theory – a branch of communications sciences that provides an abstract way of analysing the processing of knowledge – Broadbent did much to develop the *human information-processing approach*, which came to inform research in virtually all areas of modern psychology.

Contemporaneous with Broadbent's work was the emergence of the computer as a research tool. Computers gripped the imagination of psychologists, soon becoming a metaphor for mental functioning. They showed that complex actions can be broken down into a series of binary, yes-or-no decisions. In principle, this meant that, with a system of feedback, a computer could duplicate the behaviour of a human, no matter how complex that behaviour. These ideas quickly led to new models of behaviour that incorporated such mentalistic concepts as plans and goals.

Research close-up 2

Conservation of liquid

The research issue

Central to Piaget's theory is the concept of mental operation. We can most easily see a mental operation at work in his famous conservation task.

Conservation gives stability to the physical world, and is achieved in relation to a number of physical properties such as number, length weight, area, and so on.

Design and procedure

A child is shown two glasses of the same physical dimensions with equal amounts of juice in them and asked, 'Which one has more?' The child correctly states, 'They both have the same.' Then, in front of the child the juice from one glass is poured into taller, narrower glass and the empty glass is taken away. The child is then asked again, 'Which glass has more?' What do you think a child before about seven years of age would say?

Results and implications

Young children will often choose the taller, narrow glass and say that it has more in it because the water level is higher. They do not recognize that the amount of juice has been 'conserved', or held constant (the child has not yet developed the concept of conservation). This is apparently because the child focuses on the 'before' and 'after' states, and ignores the process of changing from the first state to the second.

The young child at this developmental stage lacks the ability to perform such mental operations as:

Reversibility – he cannot mentally reverse the series of events to return the poured liquid to its original glass.
Compensation, or decentring – he is unable to use both height and width to determine quantity, but instead he centres his thinking on a single dimension of the container.

When a child is able to exercise mental operations in relation to concrete objects, this will be reflected in the explanation he gives for his answer to the question, 'which glass has more?'

'If you pour it back where it was, they will have the same amount' (reversibility).
'The water goes up higher but the glass is thinner' (compensation).

Ginsburg, H.P. & Opper, S. 1988, *Piaget's Theory of Intellectual Development*, 3rd edn, London: Prentice Hall.

The information-processing approach is often described as an abstract analysis. This means that it does not focus on the operation of the physical components of the processing system – whether they be brain cells or digital switches. Both the brain and the computer consist of millions of components, yet the behaviour of computers can be understood by studying the programs that run them. In the same way, a good account of human behaviour is considered possible by using terms abstract enough to transcend the operation of the brain's approximately 100 billion nerve cells.

From the human information-processing perspective, information delivered to the senses is translated into a cognitive code. In other words, specific aspects of the environment are detected and their organization begins. These are then delivered to working memory, a kind of workbench for cognitive codes where goals are established and a central processor comes into play. Two types of processing can occur: automatic processing, which is effortless and unconscious, and controlled processing, which is effortful and conscious.

More recently, the computer metaphor has been challenged by the 'brain metaphor', which gave rise to the *connectionist approach* – also known as a 'neural network' approach, meaning that it is informed by a view of how the nervous system might compute things.

Although largely interested in idealized nervous systems, connectionists do take pains to show that the human nervous system could process material in ways that are similar to their idealized systems. These systems conduct processing in parallel, not in the serial manner assumed in the information-processing approach. Connectionists also reject the idea of a central control unit – the notion of 'boss' neurons directing other neurons' activities is foreign to connectionism – and argue that mental processes cannot be broken down into components. Instead, the neural and cognitive systems function as a whole.

It is important to note that, while the cognitive revolution did not embrace biological explanations of behaviour, neither did it actively banish biology from psychology – unlike its behavioral predecessor. Startling new advances in the study of the nervous system have been made possible by technology, and neurobiologists (biologists who study the nervous system) can now study the brain in ways that were unimaginable just a couple of decades ago (see chapter 3). Imaging techniques allow us to see the brain

at work as it engages in various activities. It is also possible to measure brain activity in a very fine-grained manner, focusing on areas that might be as small as a few cubic millimeters.

So far, these techniques have been applied to basic psychological processes such as reading, listening, remembering and experiencing emotion, and more recently to the study of social cognition (the processes involved in perceiving, interpreting, and acting on social information, see Phelps et al., 2000). But we are still not in a position to observe the brain as it operates in naturally occurring 'real life' situations.

Final Thoughts

The combination of cognitive psychology and neuroscience – cognitive neuroscience – brings us to the present day. It is not yet clear just how far this cutting-edge endeavour will advance our understanding of human behaviour, but it is one that holds much promise, especially with regard to psychological conditions and disorders (such as dyslexia or Alzheimer's disease) in which a thorough understanding of both cognitive and neurological perspectives may provide substantial 'added value'.

Other developments involve the further use of computers and information technology in psychology. For example, as psychologists now embrace computer-generated virtual reality, it is possible that they will unlock hidden aspects of perception using such previously unavailable technological advances.

Looking further into the future, if humans are successful in colonizing other planets and solar systems, it is possible that novel psychological phenomena will need to be studied and understood. Indeed, with the continuing evolution of new research techniques and methods, and the emergence of new psychological horizons, the psychology of the future may be virtually unrecognizable to today's generation of psychologists.

summary

- We have seen in this chapter that psychology differs from 'common sense' but that we can sometimes be influenced by a psychological phenomenon known as the hindsight bias to believe that they are one and the same.
- We have also considered the emergence of psychology as a distinct discipline around 150 years ago, from its roots in physiology, physics and philosophy. These separate roots of modern day psychology can be discerned within the different schools of thought in psychology that we have considered in this chapter.
- Most centrally, psychology is the science of mental life and behaviour, but separate schools of thought place differing degrees of emphasis on understanding different facets of psychology.
- Most academic departments in the English-speaking world (such as that within which you as a student will be based) focus on the teaching of experimental psychology, in which scientific evidence about the structure and function of the mind and behaviour accumulates through the design, execution and evaluation of empirical investigations.
- In the history of psychology many different metaphors have been used for reflecting upon the workings of the human mind. Since the Second World War the most influential of these metaphors has been another complex information processing device: the computer. The value of this metaphor has been complemented in recent years through the use of experimental techniques which have enabled us to visualize activity in the human brain (i.e. the hardware within which the human mind is implemented and through which behaviour is regulated).

Revision Questions

What is psychology, and how does it differ from 'common sense'?

Provide three examples of psychological knowledge can be usefully applied in different professions/walks of life.

What were they key issues in the emergence of psychology as a distinct discipline around 150 years ago, from its roots in physiology, physics and philosophy?

Considering psychology as the science of mental life and behaviour, what are the fundamental differences between different schools of thought in psychology, and the methods that they employ?

What are the fundamental tenets of behaviourism? When thinking about your answer, reflect on how a behaviourist might account for the subjective phenomena of dreaming.

How would a) a psychoanalyst and b) your grandmother address the same question?

How would a structuralist consider the experience of eating an ice cream?

How would you design a study to determine whether there is a heritable factor underlying intelligence? How would you measure intelligence?

Is studying the brain relevant to our understanding of mental life and behaviour? How do you think a) an information processing theorist and b) a connectionist might address this question?

Can you think of any profession or walk of life in which the advice of a psychologist would *not* improve at least one aspect of that activity?

Further Reading

Evans, R.I. (1976). *The Making of Psychology*. New York: Alfred A. Knopf.

Consists of 28 engaging interviews with leading psychologists representing a variety of areas in psychology. Highly recommended for students interested in gaining insights into the person as well as their work in psychology.

Furnham, A. (1996). *All in the Mind*. London: Whurr Publications.

A good introduction to a number of controversies in psychology.

Schultz, D.P. & Schultz, S.E. (2000). *A History of Modern Psychology*. 7th edn. Fort Worth, TX: Harcourt Brace.

Excellent coverage of the emergence of psychology and its various schools of thinking.

Solso, R.L. & Masssaro, D.W. (1995). *The Science of the Mind: 2001 and Beyond*. Oxford: Oxford University Press.

Leading figures in their fields 'address an age-old question: Where have we been, where are we, and where are we going?' An engaging series of essays that provide both a retrospective on psychology as it entered the new millennium and predictions about its future.

Answers to questions on p. 00

1. False. Prior to psychological research on the topic there was a longstanding belief that happily married couples are characterized by a *quid pro quo* principle by which they exchange positive behaviour. But research shows that while dissatisfied spouses reciprocate one another's (negative) behaviour, happily married spouses tend to follow a 'bank account' model: positive behaviour is not reciprocated in the short term but adds to a balance of goodwill from which a spouse can draw in the longer term (Fincham & Beach, 1999).
2. 50–60 per cent. This amazing percentage is discussed further in this chapter.
3. True. This is the basis for several branches of psychology.
4. True none of the time. Schizophrenia (from the Greek *schizo*, meaning 'split', and *phrene*, meaning 'mind') does not refer to a split personality but simply designates the main attribute of the disorder – a disintegration of mental functioning. A key sign of schizophrenia is pervasive thought disturbance, and another pervasive feature is withdrawal from other people. Chapter 15 discusses this disorder in great detail.
5. Both humans and birds. The principles of learning that govern human behaviour were first discovered in studies of animals, as we discover later in this chapter. Greater detail about learning can be found in chapter 4.
6. True. Willingness to intervene in emergencies is higher when a bystander is alone than when they are surrounded by several others. This is the bystander effect. The sense of responsibility for helping decreases as the number of bystanders increases (Latané, 1981). Social psychologists who study helping behaviour have also found that the presence of bystanders can lead a potential helper to feel apprehension that their attempt to help might be viewed negatively rather than with approval (see chapter 18).
7. False. The highest and most persistent rate of desired behaviour is produced by rewarding the behaviour on a variable basis. See 'Radical behaviorism' in this chapter, and chapter 4 for more details.

Everyday Psychology

Saving lives

Some people find the methods used in behaviourism research unpalatable. Pigeons and rats? Cages and electric shocks? What possible good can this contribute to improving the quality of human existence? What follows is perhaps the simplest yet strongest answer – life itself.

Rumination – the voluntary regurgitation of food without nausea or retching – is common among infants. Prolonged rumination can produce death rates as high as 20 per cent due to malnutrition and decreased immune function. One particular nine-month old infant was literally starving to death after four months of rumination. Several unsuccessful attempts were made to stop the rumination by using physical restraints, antiemetic drugs, and even a course of counselling for his mother.

Two behaviourally oriented psychologists were brought in to try a treatment of last resort. Peter Lang and Barbara Melamed (1969) used electromyographic recording to isolate the entire vomiting sequence – and they managed to stop it without affecting important behaviours such as sucking and swallowing.

Their treatment consisted of a brief, intense electric shock to the child's leg at the first sign of vomiting, repeated at one-second intervals until all signs of vomiting stopped. The first treatment proved successful, and five subsequent trials were administered. Within two weeks of the first treatment the child's body weight increased 20 per cent. He appeared to be well, both physiologically and psychologically, when followed up at six months, twelve months and two years.

Although successful, it would be a mistake to conclude that electric shock is a standard treatment for ruminative vomiting. Most punishment-based treatments or aversion therapies are generally restricted to situations where no other alternatives are feasible. In this case, the child's life was in danger and an immediate intervention was needed to prevent starvation. There simply wasn't time to try other behavioral techniques.

Since then, other cases of rumination have been successfully treated by less dramatic means. One successful treatment was to squirt lemon juice into the child's mouth at the first sign of rumination (Sawaj et al., 1974) and another entailed withdrawing attention from the child when she vomited (Wright et al., 1978).

Lang, P.J., Melamed, B.G., 1969, 'Case report: Avoidance conditioning therapy of an infant with chronic ruminative vomiting', *Journal of Abnormal Psychology*, 74, 1–8.