chapter

PSYCHOLOGY

# 15 Behavioural learning

## inherited behaviours and classical conditioning

### KEY KNOWLEDGE

After studying this chapter you should demonstrate knowledge of:

- behaviour not dependent on learning (reflex actions, fixed action patterns and maturation of behaviour)
- classical conditioning (Pavlov's original experiments, conditioned stimulus, unconditioned stimulus, conditioned response, unconditioned response, processes of acquisition, extinction, stimulus generalisation, stimulus discrimination and spontaneous recovery)
- one-trial learning with reference to taste aversion
- ethical issues in conditioning behaviour including J B Watson's 'little Albert' experiment.

### KEY SKILLS

After studying this chapter you should demonstrate the ability to:

- explain the differences between reflex actions, fixed action patterns and maturation
- distinguish one-trial learning from classical conditioning.

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**FIGURE 15.1**
Training animals for entertainment and advertising used to be common in Western cultures.

Animals have been trained in circuses for hundreds of years. The acts they perform are the result of learning and are not related to the behaviours found in other members of their species in the wild. Humans are born very poorly equipped for independent survival and must spend most of the first ten to fifteen years of their lives learning to survive in the company of caretakers. Naturalistic observations have revealed that animals also learn much from older members of their groups as they mature. This chapter examines some of these processes of learning.

The word **learning** refers to relatively permanent changes in behaviour and cognition. Learning results from the influences of the environment on an organism. Changes in behaviour that result from growth and maturation—for example, learning to walk—are not included in the definition of learning. Nor are changes that are only temporary, like tiredness, illness or the effects of a hangover.

Learning is a **hypothetical construct**, so it cannot be directly observed. We infer that learning has taken place by noting the modifications in the behaviour of an organism that occur in response to changes in the environment—for example, a child learning to write his name.

Two main approaches have been taken by psychologists in the study of learning. The **behaviourist** approach has emphasised only observable events, or the changes in behaviour—for example, you kick your legs and stroke your arms in the water when you have learned to swim. The **cognitive** approach has emphasised the acquisition of knowledge, or the changes that must take place in the mind of the learner—for example, you can describe how to swim as well as making gestures. Chapters 15 and 16 look at learning from the behaviourist approach, while chapter 17 considers the approach of cognitive psychology.

**GLOSSARY**

**learning**
a relatively permanent change in the nervous system of an organism resulting in different behaviours

**hypothetical construct**
idea that is abstract and cannot be represented with a concrete image

**behaviourist theory**
theory that emphasises only observable events, like the connections between the stimulus and the response in an organism

**cognitive theory**
theory that emphasises internal mental processes and the role of the learner in acquiring knowledge and remembering outcomes

**behaviours not dependent on learning**
behaviours that are inherited and are not influenced by environmental factors

## Behaviour that is not dependent on learning

A human baby is born with only a few behaviours that help it survive in the environment. These are **behaviours not dependent on learning**. If a bright light is shone in the baby's eyes, her pupils grow smaller as the irises contract. If her foot is pricked (for a blood test), she will withdraw the foot and cry. If her cheek is brushed, she will turn her head to that side. These are some of the inherited behaviours, called reflexes, that occur in all normal neonates. They are not learned.


**FIGURE 15.2**
The schedule of reflexes in a baby.

**GLOSSARY**

**reflexes**
simple behaviours that are involuntary and due to inheritance

**fixed action patterns**
movements that require little or no specific individual experience for normal execution

As the child grows she will begin to walk at between nine and eighteen months of age. This complex behaviour occurs as a result of maturation. She has to develop muscle strength, coordination and depth perception. If parents try to teach her to walk, they will succeed some time in that maturational period. If they don't try, she will begin to walk anyway.

Some animals perform particular sets of behaviour, called fixed action patterns, at particular times of their lives. One example is Chinook salmon, which return from the Atlantic Ocean to spawn in the upper reaches of North American rivers in which they themselves were fingerlings.

## Reflex actions

Adult humans have a variety of **reflexes** such as the patella reflex (your foot involuntarily kicks forward when you are tapped on the knee) and the tendency to salivate if something is put into the mouth. These involuntary responses to stimulation help us to survive.

The earliest experiments on reflexes were conducted by Sherrington (1906). In a typical experiment, he strapped a dog into a harness above the ground. When Sherrington pinched one of the dog's feet, after a short delay the dog raised the leg with the pinched paw and extended the other three legs. This flexion (or raising) and extension were reflexive movements. Sherrington cut the spinal cord so that neural messages to the brain of the dog were interrupted, but the reflex persisted. If you stand on a pin, a similar reflex occurs in your legs. The damaged foot will be raised (flexion) and muscles of the other leg will keep it extended so that you don't fall down.

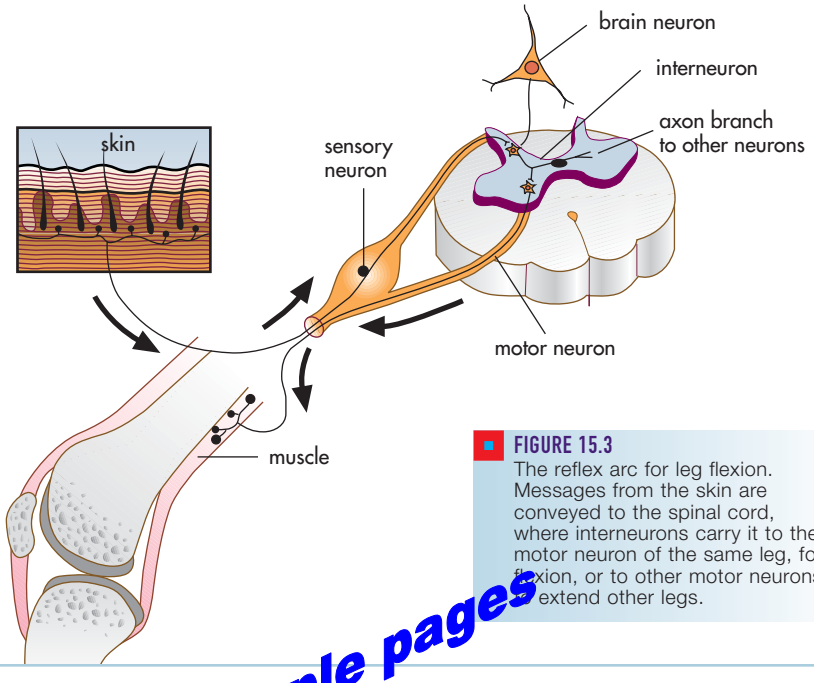



**FIGURE 15.3**
The reflex arc for leg flexion. Messages from the skin are conveyed to the spinal cord, where interneurons carry it to the motor neuron of the same leg, for flexion, or to other motor neurons to extend other legs.

## Fixed action patterns

**Fixed action patterns** are a series of behaviours that occur in a particular sequence and appear to need little or no learning before they are performed. Whereas reflexes are simple reactions, fixed action patterns are complex and often confined to a species or to related species.

Fentress (1973) investigated grooming movements of the head and face in mice. He amputated one or both of the forelimbs of newborn mice. These mice later adopted the grooming posture and executed licking and 'arm' movements even though they only had stumps to work with. When the movement would have caused a complete limb to brush the eyes, these mice closed their eyes although the stumps of their forelimbs came nowhere near their eye. It was

classic study

## Stickleback rivalry

Tinbergen (1951) studied the behaviour of stickleback fish. Male sticklebacks have red underbellies and will attack other male fish. He initially observed that the males in his aquaria would swim to the window side of their tanks and aggressively attack at a certain time of day. He watched carefully and found that at this time the bright red mail van drove past the window.

Tinbergen began to make various models of fish. He found that the males would attack a variety of models only remotely resembling a fish, provided that the models had a red underside. The red underside was the 'sign stimulus' that caused a motor program of attack behaviour—a fixed action pattern.

### Questions

1 Tinbergen found a relationship between attack behaviour in male fish and the sight of a red mail van. What is this relationship called?
2 Suggest a hypothesis for the experiment that Tinbergen conducted with his models.
3 What was the dependent variable in his experiment?
4 What is the meaning of 'sign stimulus'?

**FIGURE 15.4** Model used by Tinbergen to observe the behaviour of male sticklebacks.

clear that no experience or sensory feedback was necessary to maintain this sequence of behaviour. It was a fixed action pattern.

Darwin (1872) noted that infants smile without practice or prompting. Even babies who are blind from birth begin smiling at the same age as normal infants. Smiling is a seemingly useless behaviour in the process of seeking out nourishment, and yet it plays a large role in attachment and in the formation of social contacts that will help the infant to survive. Smiling involves a sequence of facial muscle movements, particularly around the mouth and eyes. The smiling response in humans begins as a fixed action pattern, although later it comes under more voluntary control, and signals that are appropriate to the response of smiling, such as seeing someone else smile, can be learned.



## Maturation of behaviour

A number of behaviours are dependent on physiological **maturation** or readiness before they can appear. One phenomenon that is difficult to explain in terms of learning is the tendency for some birds to follow their mother almost as soon as they hatch. Lorenz (1966) found that if he exposed ducklings to a moving object in the first few hours after hatching, they would follow it around. In one case the moving object was Lorenz himself. The type of object was not important, but there was a **critical period** in which this learning occurred. If no moving object was presented during this period, hatchlings did not learn to follow anything.

The concept of critical periods has been applied to human development by some researchers. In its 'strong' form, it implies that certain behaviours can be learned only at a particular time during the process of development and, if learning does not take

GLOSSARY

**maturation** developmental processes under the influence of heredity that lead to a functioning adult organism

**critical period** period of development crucial to acquiring a learned skill, after which the skill will be very difficult, if not impossible, to acquire

**FIGURE 15.5**
Konrad Lorenz showed the importance of a critical learning period in ducklings.

**GLOSSARY**

**sensitive period**
period of development in which a learned skill is acquired more easily than at other times

place, a person may be seriously disadvantaged. A 'weaker' form of this idea is called the **sensitive period**—during this time, relevant behaviour is more easily learned than it is if learning is attempted earlier or later.

In humans, we can tell that the neural circuits controlling walking are present at birth because of a peculiar reflex of stepping movements produced by a neonate. This occurs when he is held vertically by the shoulders and his feet are placed in contact with a solid surface. However, this reflex disappears and walking movements only begin again when the muscles of the legs show sufficient strength to hold his weight.

A study by Zelarzo, Zelarzo and Kolb (1972) let newborn infants practise their 'walking reflex' several times a day during the first two months of life. These infants began to walk five to seven weeks earlier than a similar group of infants who had not had practice. It may be that this practice caused early changes in the synapses of the pre-motor and motor areas of the brain. So, although maturation is necessary for behaviour to occur, it can improve in efficiency or occur earlier than expected with appropriate learning during a 'sensitive period'.

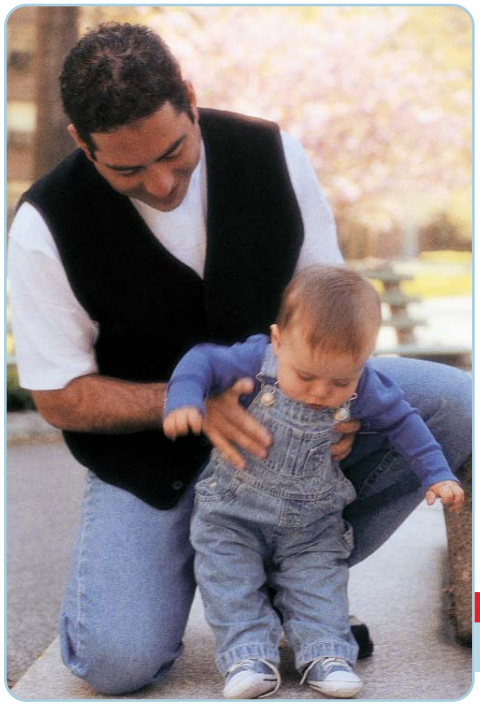


**FIGURE 15.6**
Practice may cause earlier or more efficient learning in behaviours dependent on maturation.

## KEY QUESTIONS

1 Give an example of a reflex behaviour in humans.
2 How does a fixed action pattern differ from a reflex?
3 In humans, give an example of a behaviour that develops with maturity.

## Classical or respondent conditioning

Ivan Pavlov was a Russian scientist who won the Nobel Prize for work on the physiology of digestion in dogs. Today he is better remembered for his work on **classical conditioning**.

Pavlov knew that dogs would salivate if food was placed in their mouths, but he noticed that they would also salivate before they were actually given food. He called this 'psychic salivation'. At the time he believed that digestion involved a series of reflexes, so he set out to discover what stimulus caused this response of salivation even before the dogs received food.

Pavlov surgically moved the salivary gland of a dog into its cheek, and put a tube into the gland and attached a test tube (see Figure 15.8). When the dog had recovered, it was placed in a harness to prevent any sudden attempts to escape during the test period. Various stimuli were presented to the dog, and the effects on its rates of salivation were measured. The term **respondent conditioning** reflects the passive role of the subjects in the experiments performed by Pavlov.

GLOSSARY

**classical or respondent conditioning**
learned behaviour elicited by a stimulus paired with a reflex response

**orienting reflex**
automatic turning of the body or part of the body towards a sensory stimulus

**neutral stimulus (NS)**
stimulus that does not initially cause the reflex response under study

**habituation**
adjustment of attention to ignore a continuously repeated stimulus

**unconditioned response (UCR)**
reflex or involuntary response to an unconditioned stimulus

**unconditioned stimulus (UCS)**
stimulus that causes an automatic, involuntary response, such as a reflex

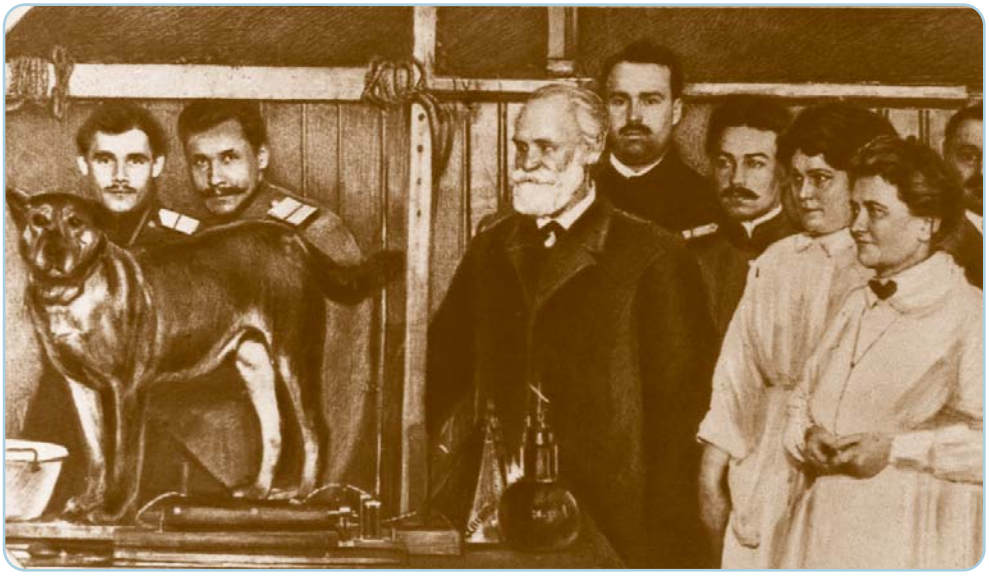


**FIGURE 15.7**
Pavlov in his laboratory. Pavlov made his major discoveries at the Military Medical Academy of St Petersburg, where he first received his doctorate and later became a professor.

Pavlov noted that when he made a noise or rang a bell, the dogs would prick up their ears and look in the direction of the sound. This is called the **orienting reflex**. However, the sound of a bell did not cause the dogs to salivate when there was no food present. Because the sound of the bell did not cause salivation he called it a **neutral stimulus** (**NS**) (Pavlov, 1927). After a few presentations of the bell, the dog did not display an orienting response—it displayed **habituation**, meaning that it had learned to ignore the sound of the bell.

Pavlov referred to salivating in the presence of food as an 'unconditional response' because it was involuntary. A dog makes this response every time food is placed in the mouth. Unfortunately, a translator incorrectly altered this to **unconditioned response** (**UCR**), and this term has persisted in the literature. The stimulus that causes the unconditioned response is called the **unconditioned stimulus** (**UCS**). Thus the unconditioned stimulus of food in the mouth causes the unconditioned response of salivation.

Pavlov then rang a bell just before he presented food, in the form of meat powder, to the dogs. After each trial he measured the amount of saliva collected. Then he rang the bell and did not present the meat powder. The dogs produced about the same quantity of saliva as they had done when the bell and the meat powder were presented together.

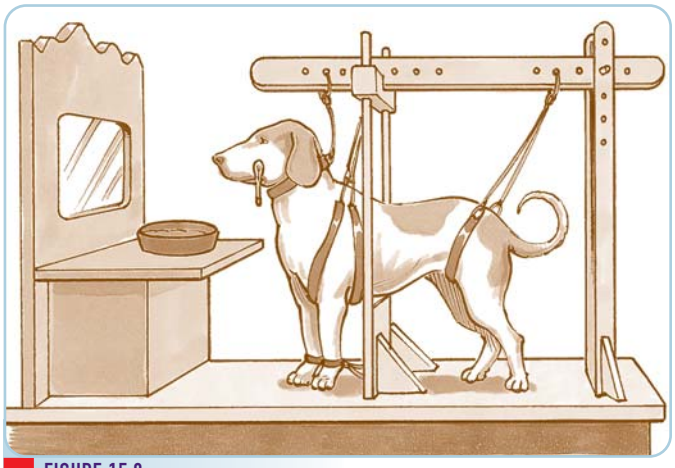
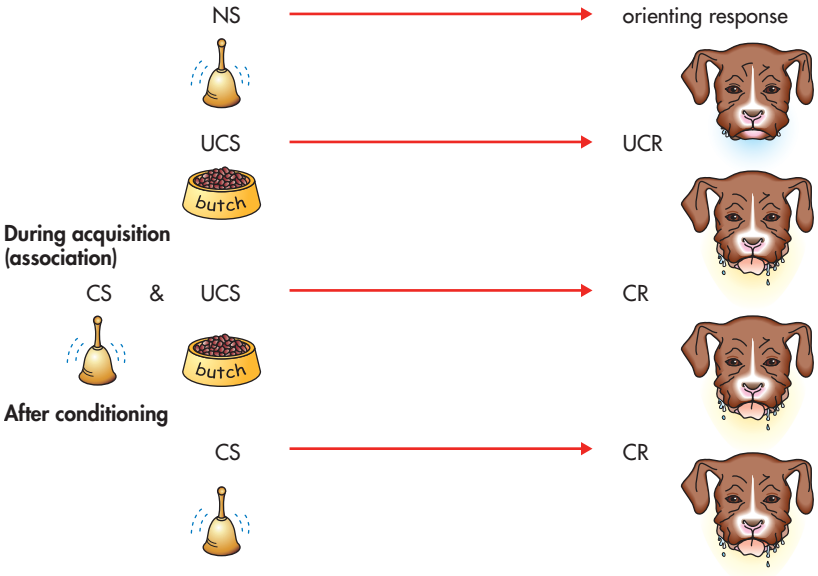


**FIGURE 15.8**
Apparatus used by Pavlov to show the effect of conditioning on salivation in dogs.

The bell had become the **conditioned stimulus (CS)** or signal for the food. The **conditioned response (CR)** was the saliva produced without the presentation of the unconditioned stimulus (that is, without the food). Thus the dogs had learned to associate two stimuli: the conditioned stimulus (the bell) and the unconditioned stimulus (the food). There was a learned **association** between the bell and the meat powder, which is summarised in Figure 15.9.

**FIGURE 15.9**
The relationships between the stimuli before and during acquisition, and after the establishment of respondent conditioning.




**GLOSSARY**

**conditioned stimulus (CS)**
any stimulus that is paired with an unconditioned stimulus, so that it eventually produces a conditioned response when presented alone through its association with the UCS

**conditioned response (CR)**
the response identical in kind (but not always in quantity) to the UCR, but produced by the CS in the absence of the UCS

**association**
connection between the UCS and CS in the central nervous system of an organism; the learning that ensures that a CR occurs

## ACTIVITY Class discussion

Divide into groups to discuss these case studies. Compare your answers as a class.

1. Alex chews gum during recess, at 10.30 a.m. every day. His psychology teacher keeps him after class to explain the errors in his test. He finds himself distracted by copious salivation after the bell rings. Explain these observations in terms of classical conditioning.
2. During a long dry summer, Harina notices that every time she opens the door of the car she receives a shock, and she pulls her hand back reflexively. Then it rains. After the rain, Harina touches the door of the car and immediately withdraws her hand, but does not feel a shock. Explain these observations in terms of classical conditioning.

## KEY QUESTIONS

4. When the bell is sounded for the first time near a naïve dog (who has not been given conditioning before), what behaviours are observed?
5. What reflex did Pavlov use to demonstrate respondent conditioning?
6. Describe Pavlov's observations when, after the CS had been paired with the UCS several times, the CS was presented alone.
7. What term is used to describe the response of salivation to the sound of the bell?

# Other elements in classical conditioning

## Extinction

When Pavlov continued trials in which only the conditioned stimulus (the bell) was presented, he found that the amount of salivation gradually declined to the low levels observed before it was paired with the meat powder (Figure 15.10). It had ceased to be a signal for food. He called this behaviour **extinction** of the conditioned response. The dog had learned that the bell was no longer a signal for food.

After a few hours or days, if the dog was tested with only the bell, it caused salivation to occur (although rarely at the maximum levels found during conditioning). Pavlov, working with the idea of conditioned reflexes, called this **spontaneous recovery**. From the dog's point of view the first signal learned, 'bell means food', was better remembered than the second signal, 'bell means no food'. If trials of the unpaired CS were continued, then extinction took place as shown in Figure 15.10.

GLOSSARY

**extinction**
when the stimulus is removed, the response gradually decreases in frequency and ceases altogether; in classical conditioning the removal of the UCS causes extinction, and in operant conditioning the removal of the reinforcer causes extinction

**spontaneous recovery**
reappearance of an extinguished conditioned response following a rest period

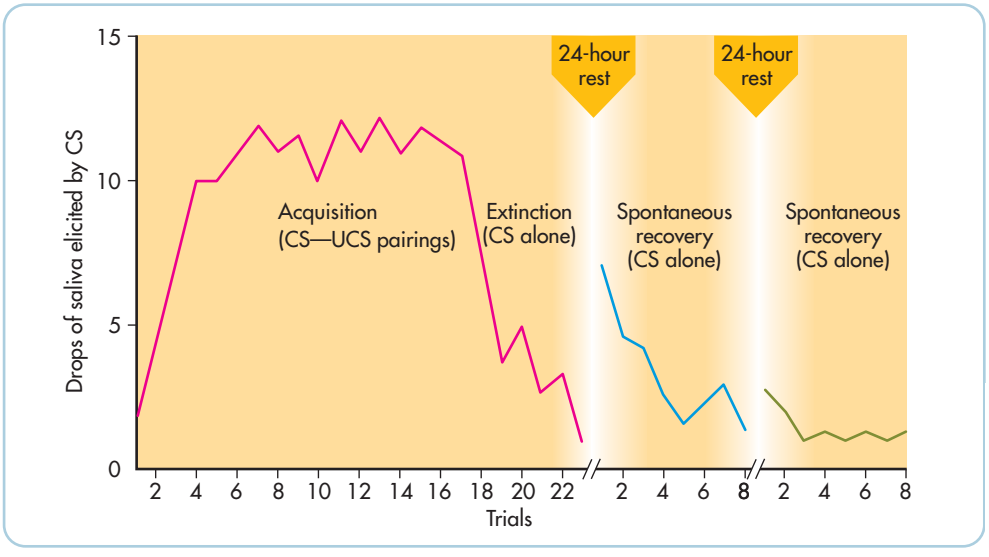



**FIGURE 15.10**
The acquisition and extinction phases of a conditioning experiment. Spontaneous recovery, occurring after several hours of rest, is also shown.

Pavlov also found that even if extinction had occurred, when he attempted to re-train an animal the learning would occur more rapidly than it had occurred initially. A single pairing of the UCS with the CS can restore the CR to its previous maximum levels and the CR can only be reduced by a series of extinction trials. Pavlov concluded that the conditioned reflex is not lost during extinction but is inhibited, and that it can be reinstated by the passage of time (that is, resting the animal) or by the pairing of the conditioned stimulus with the unconditioned stimulus (Pavlov, 1927).

## Stimulus generalisation

After conditioning to a particular conditioned stimulus has taken place, other stimuli that resemble the CS can cause the conditioned response to occur although they have never been paired with the UCS. Imagine that instead of a bell, the experimenter used a touch on the dog's shoulder as the CS to be paired with the meat powder. What would happen if after being trained to salivate to the touch on the shoulder, the dog were touched on some other part of the body? Pavlov did this experiment and found that the dog did salivate when touched on another part of its body. The dog showed **stimulus generalisation**.

**stimulus generalisation**
tendency for similar stimuli to produce the same response

**gradient of stimulus generalisation**
when stimuli are systematically varied, the pattern of decrease of response as stimuli become more dissimilar to the original CS

Stimulus generalisation is the tendency for an organism to respond to stimuli that resemble, but are different from, the initial conditioned stimulus. The further away from the original location of the CS (in this case the shoulder) the smaller was the response. This is called the **gradient of stimulus generalisation**.

**GLOSSARY**

**Hertz (Hz)**
unit of frequency: 1 Hertz = one cycle per second (Middle C on a piano is 256 Hz and Concert A is 440 Hz)

**stimulus discrimination**
capability to distinguish between two or more similar stimuli; in conditioning, the ability to respond to a CS and not to respond to a similar stimulus (that is, not to generalise)

Stimulus generalisation will occur in most situations in which the stimulus is similar but not identical to the original CS. For example, a researcher may condition a dog to salivate at the sound of a tone of 900 **Hz** in pitch. The dog will respond less strongly to a sound of 1000 Hz and even less strongly to a sound of 1100 Hz. A gradient of stimulus generalisation can be established, as is illustrated in Figure 15.11.

Pavlov's researchers had a dog whose conditioning had been with a black square as the CS and meat powder as the UCS. They found that the dog had generalised, and now salivated at the sight of a grey square. They conducted a series of trials in which the dog was never given meat powder in association with the grey square (CS–) and was always given the UCS in association with the black square (CS+). The dog stopped salivating for the grey square and continued salivating for the black square when tested without the UCS. The dog had learned not to generalise. It had developed **stimulus discrimination**. The researchers continued with the discrimination training using squares of darker and darker grey until the humans had difficulty telling them apart, but the dog still demonstrated discrimination (Pavlov, 1927).

Discrimination training provides an excellent way of studying the sensitivity of animals to perceptual stimuli in difference threshold research (see chapter 5). If an animal can be trained to respond to one stimulus and not another, then it can be assumed that it discriminates between the two. Pavlov conditioned dogs to respond to sounds higher than the absolute human threshold for hearing and to discriminate between tones on a harmonic scale, in musical terms, less than one-eighth apart.

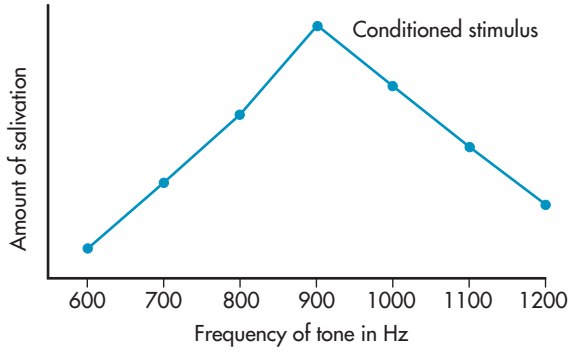



**FIGURE 15.11**
The gradient of stimulus generalisation. The amount of stimulus generalisation decreases, as the test stimuli become less similar to the original CS.

**ACTIVITY Class discussion**

Divide into groups to discuss the following case study. Then compare your answers as a class.

In year 8, Adam decides he does not like Eve sitting next to him in science. He hides a small snake in Eve's textbook. When Eve sees it she jumps up and screams. Then Adam puts the snake in her beaker, then in her folder.

Adam finds that Eve begins to get used to the snake and with subsequent presentations she does not scream, and flinches less and less. Finally she does not react at all.

In the next class however, when Adam hides the snake with her pencils, Eve jumps up quickly with a yell. Explain these observations in terms of classical conditioning.


And for the rest of his life the young reptile suffered deep emotional scars.

**KEY QUESTIONS**

8 After several conditioning trials, Pavlov presented the CS without the UCS for a number of trials. What did he observe as a response in the dog?

9 The dog was rested for twenty-four hours and then returned to the laboratory and tested with the CS alone. What was observed in the behaviour of the dog? What did Pavlov call this phenomenon?

10 When the dog was conditioned to salivate in response to a touch on the shoulder, Pavlov also found that it salivated when touched on the upper leg or along the back. Explain these observations.

11 Define 'stimulus discrimination' and give an example.

## One trial learning—taste aversion

It has been observed that people who undergo chemotherapy or radiation therapy often develop **taste aversions** to food that they ate just before the treatment. These aversions can be strong even though the sufferer knows that the effect has been artificially induced by the treatment. It is part of a phenomenon called 'anticipatory nausea' that develops when patients become physically ill after their radiation or chemotherapy treatment.

**GLOSSARY**

**taste aversion**
learned avoidance of a particular food that has become associated with a toxic or painful outcome

case study

### The béarnaise sauce syndrome

Martin Seligman has been President of the American Psychological Association and is famous for his research on resilience (being able to overcome adverse circumstances in your life).

Once, when he was out with friends, he dined on steak with a béarnaise sauce (Seligman & Hager, 1972). About six hours later he became very ill with a diagnosed case of stomach flu. Even though he knew the cause of his illness was viral and not due to bad food, he could not face eating béarnaise sauce for five years. All his learning about resilience and the cognitive aspects of learned behaviour were of no use in this case of taste aversion.

#### Questions

1 What was the cause of Seligman's nausea?

2 What did he 'learn' as a stimulus for the nausea?

3 Seligman still went to restaurants where people were eating béarnaise sauce. Why did he eventually lose the nausea reaction after five years?

**FIGURE 15.12**
Psychologist Martin Seligman developed a taste aversion to béarnaise sauce.

In classical conditioning, learning is believed to occur only if there is immediate reinforcement. The puzzle of anticipatory nausea is that it occurs even though the UCS occurs hours after the presentation of the CS. Garcia and Koelling (1966) reasoned that taste might have its own peculiar learning contingencies that differ from classical conditioning.

They allowed rats to lap at bottles of saccharin-flavoured water, and this also caused a light to flash and a clicking noise. The rats were then divided into two groups. One group received electric shocks while they were lapping. The other group received radiation (which would make them sick 30 minutes later). In both groups, lapping was again accompanied by clicks and flashes. This was the conditioning phase of the research. In the test phase, all the rats were given access to flavoured water without clicks and flashes, and to unflavoured water that was accompanied by clicks and flashes. The experimental set-up is illustrated in Figure 15.13.

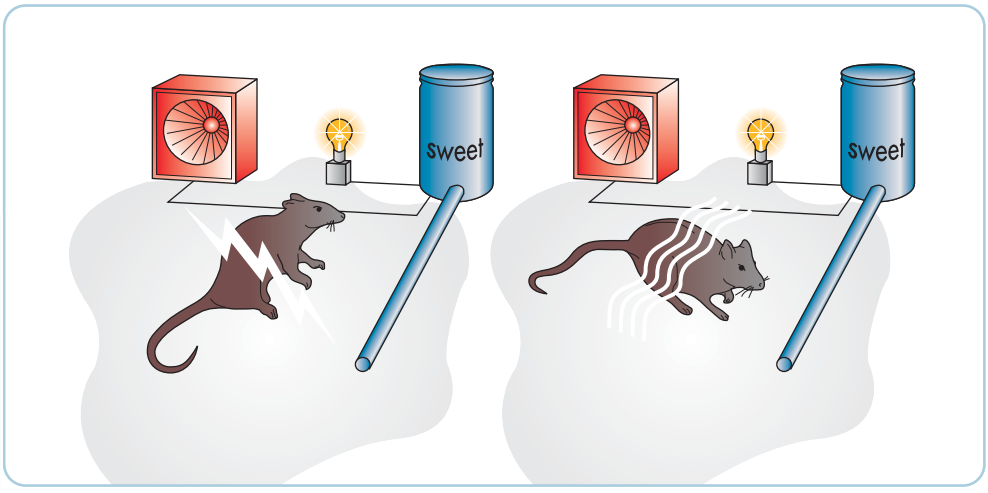



**FIGURE 15.13**
The experimental procedure of Garcia and Koelling was to shock one group of rats while they drank saccharin-flavoured water in the presence of loud clicks and flashing lights, and to irradiate a second group while they drank saccharin-flavoured water in the presence of loud clicks and flashing lights.

**GLOSSARY**

**Garcia effect**
acquired syndrome of behaviours in which an organism has learned to avoid a particular food because of a conditioned aversion to the taste or smell

**biological preparedness**
tendency to learn more quickly responses that will aid an organism's survival, usually as the result of one trial

The rats that had been shocked avoided the water that was accompanied by clicks and flashing lights. However, the rats that had been made sick were unconcerned about the clicks and flashing lights. They avoided the saccharin-flavoured water, which had been the taste they experienced before they became ill. Illness seemed to be attributed to taste, and peripheral pain (electric shock) seemed to be attributed to audio–visual signals. The rats that had been made ill associated the flavoured water with illness and had developed a conditioned taste aversion. This phenomenon is often referred to as the **Garcia effect**.

**TABLE 15.1** Garcia and Koelling's experiment showing conditioned taste aversion in rats.

| | Radiation group | Shock group |
|---|---|---|
| **Conditioning phase** | Receives flavoured water plus clicks and flashes + radiation (ill after 30 minutes) | Receives flavoured water plus clicks and flashes + electric shock |
| **Test phase** | Avoids flavoured water | Avoids clicks and flashes |

Wolves can be deterred from hunting by giving them lithium chloride tablets mixed in mutton wrapped in sheepskins. After this treatment, animals that have previously attacked sheep will at first make only half-hearted attempts and will gradually become more and more submissive, so that they run away or lie down when lambs approach them (Garcia, Rusiniak & Brett, 1977). This type of learning suggests that some environmental events are interpreted by animals as 'belonging together'. Taste 'belongs' with illness, and visual and aural stimuli (flashes and clicks) 'belong' with pain. This may be the result of adaptation and is called **biological preparedness**—the idea that the tendency to learn some responses quickly may be inherited.

## KEY QUESTIONS

12 a Draw a diagram to explain the experimental set-up used by Garcia and Koelling to demonstrate taste aversion.
b What conclusions did the researchers make about taste stimuli compared with audio or visual stimuli in classical conditioning?

13 Cancer patients treated with radiotherapy often find that they feel very sick several hours after their treatment. Children who are going to be treated are given foods (like ice-cream) to sustain their blood sugar levels, but these foods are deliberately made to taste unusual (flavoured with pickles, for example). Explain why the hospitals do not use common flavours for foods in this situation.

# Ethical principles in psychological research related to conditioning behaviour

## J B Watson and little Albert

In chapter 4 you studied the autonomic nervous system and the relationship between its two branches, the sympathetic and the parasympathetic nervous systems. Pavlov investigated reflexes and had conditioned otherwise neutral stimuli to act as signals or conditioned stimuli to produce a conditioned response. In the United States, John B Watson was investigating fear responses. Without detailed knowledge of the workings of the sympathetic nervous system, he had observed behaviours that it facilitated. In particular he had noticed that infants catch their breath, stiffen and turn away from unpleasant stimuli. Using these behaviours as the unconditioned responses, he discovered two reliable unconditioned stimuli that would induce them—a sudden loud sound or a sudden loss of support (a baby is dropped when being held).

**FIGURE 15.14**
Is it ethically acceptable to make a baby fear her teddy?

Watson and Rayner (1920) conditioned a baby boy, Albert B, who was described as 'stolid and unemotional'. At nine months of age they tested him with a variety of neutral stimuli—a white rat, a rabbit, a dog, a monkey, masks with and without hair, and even burning newspaper. He showed no fear and usually wanted to handle the stimulus presented. Then they tested him with a sound made by a hammer striking a steel bar. Albert started violently, his breathing was checked, he raised his arms in a 'characteristic manner' and eventually started to cry.

The critical experiment did not begin until Albert was 11 months old. He was allowed to play with a white laboratory rat (a neutral stimulus), and while he was paying close attention to it, the loud sound was produced (the unconditioned stimulus) close to the back of his head. He jumped violently and fell forward, and after the noise was repeated he began to whimper. He resumed playing and was not distressed.

One week later, Albert was presented with the rat again. Although he did not show fear, he would not touch it initially. Five more pairings of the rat and loud sound were made. When the rat was then presented by itself, Albert began to cry and to crawl away quickly. Thus Albert displayed a conditioned response to the white rat (CS).

Five days later, his fear was found to be generalised to a rabbit, a dog, a fur coat and to Watson himself in Santa whiskers.

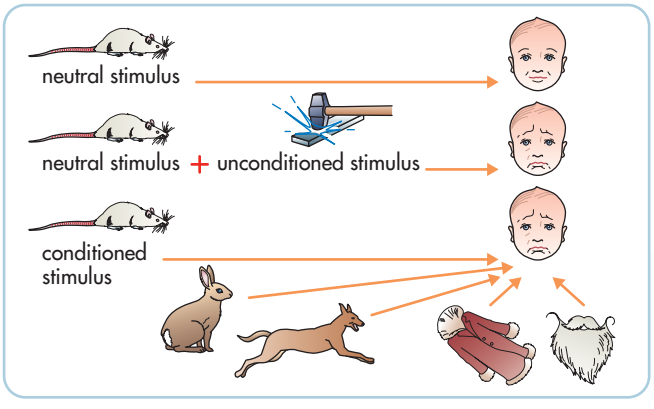



**FIGURE 15.15**
Watson and Rayner caused little Albert to fear a white rat and found that this reaction generalised to many other objects.

## Ethical issues raised by little Albert studies

The goal of Watson and Rayner's research was to study how to treat fear responses, but the experiment on little Albert was quite unethical and would not be permitted today. The activity below provides some of the **ethical issues** raised by this study.

University departments have formed committees to oversee the conduct of research and to vet research proposals to prevent unethical practice. The Australian Psychological Society has formulated a code of ethics that binds the practice of all of its members. Part of this code is reproduced in the Appendix on page 342.

Little Albert's mother did give permission for Watson to use her son in his study. However, because Watson was in a position that could influence her employment (she was a wet-nurse at the Harriet Lane Home for Invalid Children where Albert was raised), it was not known if her consent was freely given.

In another study with Cover-Jones (Jones, 1924), Watson helped to treat a two-year-old (little Peter). Peter already had a phobia of white rabbits as well as intense fears of other objects. Jones and Watson put a rabbit in a cage near Peter while he was eating his lunch. Over seventeen sessions the rabbit was brought closer until eventually Peter was able to stroke it on his lap. This was one of the first demonstrations of **systematic desensitisation**, a technique developed to gradually overcome phobias.

**GLOSSARY**

**ethical issues**
consideration of what is acceptable human conduct in terms of right or wrong in the pursuit of research or experimental aims

**systematic desensitisation**
a process of therapy where feared objects are gradually introduced to a client while relaxation exercises are being undertaken, with the aim of reducing the fear

### ACTIVITY The ethics of the little Albert demonstration

Divide the class into small groups for discussion. Allocate one question to each group and formulate a written answer. Report your responses to the rest of the class.

1. Should an experimenter ever inflict extremely unpleasant (or physically painful) stimuli on a human participant? If so, under what conditions should this be done?
2. Should an experiment involving strong aversive (unpleasant) stimuli ever be done on young children? On animals? Should the same rules apply to animals, adults and children? Why or why not?
3. Is the question of consent important? If someone gives 'informed consent' to undergo an unpleasant experience, is this ethical? What if participation is paid for? What if it is part of a 'course credit'?
4. Is it justified to perform actions that result in unpleasant experiences for a participant if some agent or legal authority gives consent? Give reasons and examples in your answer.
5. If an unpleasant or painful treatment was found that reduced criminal or antisocial acts, would the use of such a technique be justified? (You may like to consider the novel *A Clockwork Orange* when thinking about this.)
6. If the painful treatment would stop damage to self (head-banging or self-mutilation), is the technique justified?
7. Watson believed that his work would advance the cause of science. Should one participant suffer so that conditions in other people can be investigated and relieved?


**FIGURE 15.16**
Fear of heights is called acrophobia (Greek: extremity). Can a negative experience in one situation generalise to other situations?

### KEY QUESTIONS

14 a Describe the UCS in Watson's experiment with little Albert.
b What CS did Watson choose for the experiment? How did he establish that the stimulus was initially neutral?
c Little Albert showed distress when presented with a variety of white, furry objects. Explain these observations.

15 Why would the experiment performed by Watson and Rayner have been considered unethical by psychologists today?

**WORKSHEET 1**
J B Watson and little Albert's learned fear

## Classical conditioning in practice

Do you salivate if someone says words like 'lemon tart' or 'potato crisps' to you? Humans are like dogs in that they salivate reflexively when food is placed in their mouths, but they also build up associations between food and conditioned stimuli such as words and sights. Seeing an illustration of food in a magazine or reading a menu can cause salivation in most people. This is the result of an association between the UCS (food) and the CS (picture or word), so that a **conditioned reflex** has been produced.

It is not ethical to surgically introduce a tube into a human's salivary gland to study salivation. In the past, the eye-blink reflex has been used to study classical conditioning in humans. A brief puff of air (UCS) is delivered to the eye and this causes a blinking response (UCR). Then a CS such as a light or a tone was presented just before the puff and the participant soon learned to blink (CR) to the CS alone. Eye blinks could be measured using a small electrical device attached to the eyelid.

When an unpleasant stimulus such as an electric shock is the UCS, the procedure is called **aversive conditioning**. This has been used with both animals and humans. A rat in a cage will be tested with a tone, to see that it is a neutral stimulus. After a few presentations, the rat will habituate or ignore the tone. Then the rat can be given a brief electric shock (UCS) through the bars that make up the floor. The rat will show signs of fear such as crouching and stopping still, and physiological reactions such as changes in heart rate and breathing rate (UCR). Just before the shock, the tone (CS) is presented and the rat soon learns to associate the tone with the shock so that presentation of the tone alone will cause the fear reaction (CR). The development of this **conditioned fear** can occur very quickly, even after a single pairing of the CS and the UCS, and is very resistant to extinction.

Humans can also develop conditioned fear in experimental situations. A tone (CS) presented before an electric shock (UCS) to the fingers will produce physiological reactions such as changes in galvanic skin response (GSR) and changes in heart rate, breathing rate and pupil size that are associated with reactions of the sympathetic nervous system. Very quickly, the tone alone produces these reactions. Some psychologists believe that various phobias that some people develop are conditioned fears.

GLOSSARY

**conditioned reflex**
learned response to a conditioned stimulus that normally does not evoke that response (for example, fear of dogs)

**aversive conditioning**
learning a negative reaction to a stimulus as the result of its pairing with an unpleasant experience

**conditioned fear**
feeling fear as a learned response to a previously neutral stimulus

FIGURE 15.17
An image of food is a conditioned stimulus that may make you salivate.

FIGURE 15.18
Fear of spiders may develop into a phobia.

## Phobias

**Phobias** are intense and unreasonable feelings of fear or dread towards particular objects or situations. They may be directed towards something quite specific, as in arachnophobia (fear of spiders), cynophobia (fear of dogs) or triskaidekaphobia (fear of the number 13). Such phobias are called **simple phobias**. For example, a spider may be associated with pain (from being bitten) or fear (because a parent screams at the sight of a spider on a child).

Alternatively, they can occur towards more general events or situations, as in agoraphobia (fear of public places) and social phobia (fear of situations in which the person may be watched by other people, such as restaurants or public transport). This type of phobia is called a **complex phobia**.

Behavioural psychologists argue that the various types of phobias are developed through the association of objects or situations with a strong aversive stimulus, and

GLOSSARY

**phobia**
persistent, overwhelming and unreasonable fear of a situation or object

**simple phobia**
persistent and overwhelming fear of a specific situation or object

**complex phobia**
persistent fear arising from [illegible] situations (for example, social phobia or panic attack)

then generalisation of the fear and anxiety reactions to similar situations. **Vicarious conditioning** occurs as a result of observing others. If a person is bitten savagely by a dog, someone witnessing the event will suffer similar emotional reactions to the person who was bitten. A fear of that dog breed may result, and this may be generalised to all dogs.

Similarly, fears can be taught by parents to their children. A child can recognise fear in the parent—for example, fear of being alone in a train station at night—and associates it with the situation he is currently in, so that even though there has been no personal experience of harm, he experiences dread associated with train travel.

## Higher order conditioning

extension | extension |

**In higher order conditioning**, a CS in one situation is used as a UCS in another. For instance, after a dog has been trained to salivate to a tone by pairing the tone with meat powder, it can be trained to respond to a flashing light by pairing the light (called the $CS^I$) with the tone (CS). The tone is presented before the light in the same way as the meat powder was originally presented before the tone. However, no meat powder is involved. The tone acts like an unconditioned stimulus. This is **second order conditioning**.

Pavlov (1927) found that he could produce second order and even third order conditioning. In the previous example, this would involve the presentation of the flashing light just before the new stimulus, such as a touch on the skin ($CS^I$). The light comes to act like an unconditioned stimulus. It is rare for higher order conditioning to be successful after the third order because the strength of the CR becomes smaller and smaller. In our example, the touch on the skin would only result in a few drops of saliva and would do so only on a few occasions.

In humans however, higher order conditioning can be used to explain phobias where an existing CS for irrational fear (for example, fear of rabbits) can act as the UCS for another $CS^I$ (a dog that was presented just after the rabbit). A person may end up not being able to be near any other furry objects because the $CS^I$ generalises to other similar objects. Watson and Rayner (1920) produced results that could be explained in terms of higher order conditioning.

### Questions

1 Explain how a tone can act as the UCS for a light to produce salivation.

2 Lucy fears dogs. Her aunt brings her poodle to visit Lucy. Now, when her aunt visits alone, Lucy trembles. Explain Lucy's behaviour.

GLOSSARY

**vicarious conditioning** conditioning learned by observing others, rather than by direct experience

**higher order conditioning** where a CS from one conditioning regime is used as the UCS in another regime of conditioning

**second order conditioning** the CS originally paired with a UCS becomes the signal for another conditioned stimulus ($CS^I$)

**FIGURE 15.19** Generalisation of the $CS^I$ may lead to a phobia of many furry creatures.

## Behaviour therapy

If classical conditioning can help explain how phobias are formed, can it also be used to devise a form of therapy? **Behaviour modification** (also called behaviour therapy) is an approach to treating psychological problems based on the principles of learning. One approach is called **systematic desensitisation**. The client and counsellor discuss the source of the problem and the extent of its generalisation. They draw up a schedule of objects or events ranging from the most fearful to the least fearful imaginable. The client agrees to have these introduced in order during therapy.

GLOSSARY

**behaviour modification** changing a person's behaviour through a deliberate regime of conditioning

**systematic desensitisation** process of therapy where feared objects are gradually introduced to a client while relaxation exercises are being undertaken, with the aim of reducing the fear

The first part of the treatment is to learn and practise relaxation techniques. As you learned in chapter 4, slowing the breathing rate and thinking of non-stressful scenarios place the body under the control of the parasympathetic branch of the autonomic nervous system. The heart rate slows and the client should feel more in control. Then the client may be asked to merely imagine a feared object or event. The relaxation technique is practised while the feared object is imagined until it no longer induces a fear response. Clients may be presented with pictures, models or dead specimens, and finally they may be asked to actually touch the main source of their fear (a live spider, for example). All through the process, the client is coached in relaxation techniques and cognitive arguments about the real danger of each step, so that the client regains parasympathetic control of bodily responses and no longer feels such strong fear.

One interpretation of this technique is that it involves extinction. The feared object (CS) is presented many times without the original source of fear (UCS), so extinction finally occurs. More recent clinical techniques aim at treating phobias quickly in a minimum number of sessions. **Flooding** involves presentation of the feared object immediately, causing a great deal of stress and anxiety in the client, but again because the CS is presented without the original UCS, extinction is expected to occur.

**WORKSHEET 2**
Counterconditioning in systematic desensitisation

**GLOSSARY**

**flooding**
procedure in which the client is subjected to large amounts of a conditioned stimulus in order to develop an aversion (if the real consequences are unpleasant, as in smoking) or to be extinguished (if the real consequences are neutral, as in phobias)

**drug tolerance**
condition of reduced responsiveness to a drug as a result of repeated physiological exposure to it

active psychology

## Classical conditioning and drug tolerance—the ethics of injecting rooms

People need to take ever-increasing amounts of addictive drugs, such as heroin, in order to get the same effect. Classical conditioning may be involved in this development of **drug tolerance**. One reason for this is that when drugs are taken, the nervous system needs to produce a compensatory response that serves to reduce or cancel out the effects of the drug and to return the individual closer to homeostasis. The same effect comes from repeated exposure to high-risk thrilling activities like bungy-jumping. The adrenaline 'high' wears off as people repeat the actions that gave them the first thrill. It is thought that the nervous system responds to prevent the effects from being too extreme.

It is known that the stimuli associated with drug-taking (being in a particular room, preparing the needle and the arm for injection, for example) may produce certain physiological effects associated with actually taking the drug, through classical conditioning.

Each of these stimuli is a CS and comes to produce the physical effects (CR) resulting from the drug (UCS). However, these stimuli may also come to trigger compensatory mechanisms (CR) in the nervous system, before the drug (UCS) is taken. This causes people to want to take more of the drug and to be able to tolerate higher doses.

Siegel, Hinson, Frank and McCully (1982) found evidence that the actual room in which a drug is given can be important in the development of tolerance in rats. The rats were given fifteen gradually larger doses of heroin to increase their tolerance and then were suddenly given a much larger dose. Half the rats received the 'overdose' in the same room where they had received the earlier injections and the other half received it in a different room. More than twice the number of rats placed in the new room died compared with the rats which received the 'overdose' in the original room. Evidently the tolerance mechanism in the body had begun to function in response to the conditioned stimulus of the 'injecting room' in the first group of rats, so they were more physiologically prepared for the overdose. The rats in the new room were not prepared for the heroin, so they died of the overdose.

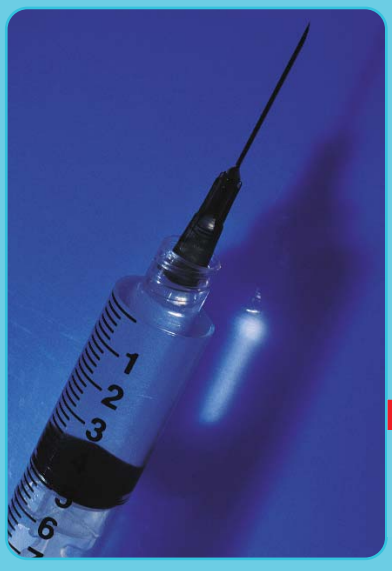


**FIGURE 15.20** Where the drug is taken may be a conditioned stimulus.

If rooms are established for humans, where those who have addiction to drugs can take their doses in clean and safe conditions, will this reduce the number of deaths from overdoses? One problem is that the drug will need to be taken in higher and higher doses just to experience any effects. Long-term addicts usually end up on high doses that produce no effect other than to prevent the distressing symptoms associated with withdrawal. Those who use the drugs to obtain an altered state of consciousness are less

likely to want to use the injecting rooms because they will seek the 'high' associated with taking the drug in unusual or unpredictable circumstances and will still be at great risk.

However, injecting rooms would be safer for those who are in the early stages of wanting to control and to eradicate their habits and particularly for addicts who do not know the quality and strength of the substances they are taking.

There is also the economic question of whether the expense of maintaining injecting rooms would be better spent on trying to control the importation of and trade in drugs.

### Questions

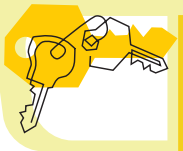
1 What was the CS and the UCS for the rats in the experiment conducted by Siegel et al. (1982)?
2 What was the independent variable in the experiment?
3 What was the dependent variable?
4 What is the generalisation to humans that came out of this research?

## Aversion therapy

If classical conditioning can be used to associate some neutral stimulus with fear and avoidance, then it must be possible to associate some undesirable neutral stimulus with an unpleasant unconditioned stimulus. This idea is adopted in the therapy of rapid smoking, which is prolonged smoking at an enforced rapid pace so that clients can become nauseous and believe they will vomit. The association of cigarettes (initially neutral) with the UCS of nausea and the UCR of vomiting is supposed to lead to the development of a CR of feeling sick in the presence of cigarettes (CS).

This therapy is only successful under supervision because most people quit too soon for the UCS to be strong enough to succeed. In aversion therapy an individual learns to associate a feared or dreaded response with an undesirable behaviour. Aversion therapy has been used to cure alcoholism, bed-wetting and self-mutilation, and to treat 'maladaptive' sexual behaviours. The principle has been highlighted in the film *A Clockwork Orange*, where a most unpleasant character was subjected to aversion therapy for his sexually perverse and aggressive behaviours.

**FIGURE 15.21**
Aversion therapy first came to public notice in the seventies in the film *A Clockwork Orange* directed by Stanley Kubrick (1971).



### KEY QUESTIONS

16 Lee was hit in the eye severely one day while playing table-tennis. Now when someone serves, she closes this eye. Explain her behaviour in terms of classical conditioning.
17 Explain how fear can be conditioned in humans.
18 How does a complex phobia differ from a simple phobia?
19 Jeremy is terrified of ghosts. He becomes very upset when stories involving ghosts are told at school or when he sees a ghost portrayed in a movie or on television. Explain how Jeremy might have acquired his phobia.
20 Describe and explain a treatment for a person with a phobia about flying in aeroplanes.
21 Explain what is meant by the term 'aversion therapy' and give an example.

**WORKSHEET 3**
Classical conditioning in practice

# chapter 15 summary

- Some behaviours are directly determined by the actions of genes and are not dependent on learning. These are reflex actions, like an eye blink; fixed action patterns, like mice grooming; and behaviours dependent on maturation, such as walking in humans.
- Pavlov studied the effects of neutral stimuli paired with stimuli that caused reflexes. He used meat as an unconditioned stimulus (UCS). The conditioned stimulus (CS), the sound of a bell, comes to elicit the conditioned responses (CR), salivation, after a number of pairings during which an association is made.
- This association can be extinguished by removal of the UCS, but will spontaneously reoccur after a rest period.
- Pavlov found that the CS generalises to other similar stimuli—bells with different tones or cards of two shades of grey—but training by pairing with the UCS causes discrimination between two similar conditioned stimuli.
- Taste stimuli connected with nausea require only one trial for conditioning. This phenomenon is called conditioned taste aversion and has been applied to controlling wolves attacking sheep.
- Watson conditioned little Albert to fear a white rat. This fear generalised to many white or furry objects. Although this demonstration was ethically unsound by today's standards, it shows how phobias can develop. Behaviour therapies use principles of conditioning to remove unreasonable fears.

# multiple choice questions

1 Male stickleback fish will attack other male stickleback fish especially if they have red underbellies. Tinbergen's explanation for this behaviour is that
- A it is a fixed action pattern.
- B normally fish with red underbellies are sick and should be kept away from the rest of the shoal of fish.
- C the males are trying to keep other males away so that they do not compete for the females.
- D the fish have learned that red means danger, and they attack red things.

2 In Pavlov's experiments the bell becomes the _____ because it is able to elicit salivation from the dogs.
- A unconditioned stimulus
- B unconditioned response
- C conditioned stimulus
- D conditioned response

3 After conditioning, Pavlov could test for learning by
- A presenting the bell followed by the meat powder.
- B presenting the meat powder followed by the bell.
- C presenting the bell alone.
- D presenting the meat powder alone.

4 During acquisition the correct order of events is
- A CS–CR–UCR.
- B CS–UCS–UCR.
- C UCS–CS–CR.
- D CS–UCR–CR.

5 Pavlov found that if you continually present the bell with no food powder, the amount of salivation declined. However, if the dog was given a few hours' rest, the bell would again elicit salivation. This is called
- A spontaneous recovery.
- B extinction.
- C relearning.
- D reconditioning.

6 Watson paired a loud noise with the presentation of a white rat. The subject 'little Albert' developed a fear of the white rat. Watson was using conditioning to demonstrate
- A how most young children learn to fear men with beards.
- B how most people learn to fear rats.
- C how phobias could develop.
- D stimulus discrimination in humans.

7 Which of the following is a criticism of the research by Watson and Rayner?
- A The fear of rats generalised to other furry objects, rabbits, white fur coats, Watson's hair and a Santa mask.
- B Albert acquired the conditioned fear only after several trials.
- C Albert's mother was employed in their research facility and could not freely give consent.
- D Albert disappeared before they finished their observations.

8 One-trial learning is characterised by
- A a very short time period between the UCS and the CS.
- B many possible objects that can act as the CS.
- C being usually connected with external stimuli rather than those in the body.
- D long periods between the CS (external) and the UCS (internal).

9 Bruce is bitten by a dog while in his push-chair. Bruce cries and waves his arms in front of him whenever he sees other dogs, cats, and even small children. Bruce has _____ his fear to other objects.
- A generalised
- B spread
- C outsourced
- D modified

10 Alisha is very afraid of snakes. Her brother finds a lizard and surprises her with it. Alisha does not scream and cry the way she does even when she has to handle a toy snake. Alisha has learned to _____ lizards from snakes.
- A distinguish
- B model
- C generalise
- D discriminate

# short answer questions

1 Explain the term 'fixed action pattern' and how it occurs, including an example. Use a human example to describe the effects of maturation on behaviour.

2 Describe the phenomenon of spontaneous recovery in extinction. What evidence suggests that true extinction may never be achieved?

3 What is 'anticipatory nausea'? Explain how it occurs in terms of higher order conditioning. Describe the experiment by Garcia and Koelling that established the connection between taste and illness.

4 Watson did not finish his investigations with little Albert. Describe the procedure that Watson could have used to 'cure' the phobia that he had induced in little Albert. Give three reasons why the investigations by Watson and Rayner were not ethical.

5 Explain how a person may acquire a simple phobia and describe the steps in a therapy that may cure the phobia.

**WORKSHEET 4**
Crossword

# essay

## Ethical issues in conditioning human behaviour

*Introduction*

Introduce importance of ethical considerations in human research. Explain that these have been violated in past research, and briefly explain why it is important to adhere to ethical principles.

*Body*

Summarise the little Albert experiment. Explain the following terms, and discuss how these principles were violated in this experiment, and the possible detrimental implications

- informed consent
- voluntary participation
- debriefing.

Summarise the benefits and drawbacks of this research.

*Conclusion*

In light of the information you have presented, discuss your position on whether this research was justified, and how it may have been improved.

Note: This essay could be an extension of the little Albert demonstration in this chapter.

## EMPIRICAL RESEARCH ACTIVITY Conditioning the autonomic nervous system

### Abstract

This is a summary of the whole report. It is written last, but appears immediately under the title.

### Introduction

The aim of this experiment is to condition a person to respond to a conditioned stimulus with an increase in heart rate. You need to explain the effects of exercise on heart rate through the action of the autonomic nervous system. Define classical conditioning and briefly outline the work of Pavlov and the terms he used. Don't forget to acknowledge your sources and to correctly reference them. In this experiment you are going to pair exercise with a small signal like a clicker or a whistle.

Suggest a hypothesis for the experiment.

### Method

#### *Design*

Read the procedure and suggest a design for this experiment.

Explain clearly how participants were selected for this experiment and how ethical requirements were addressed.

#### *Materials*

- clickers or whistles or objects for making small noises
- clocks or stopwatches to measure heart rate

#### *Procedure*

You need to establish a base-line measure of heart rate for sitting quietly and hearing a signal (clicker or whistle) in the first phase of the research. At this stage, what is the term used for the clicker? In the second phase, when the clicker sounds the participant will jump up and down twenty times on one foot. This procedure should be repeated at intervals of about once every 3 minutes for five trials.

After a period of about 30 minutes rest (while you do some other activities) sound the clicker and immediately take the pulse of the participant, without them jumping on the spot.

### Results

Collate data for the class. Insert your data into table similar to Table 15.2.

Calculate the change in heart rate for each participant and the average change.

### Discussion

1. Describe the clicker signal, jumping on the spot and measure of heart rate in the classical conditioning terms you defined in the introduction.
2. Was your hypothesis supported? Did your participants demonstrate that they were classically conditioned to the sound of the clicker?
3. Why was there a period of 30 minutes' rest before the conditioned stimulus was tested for the conditioned response? Explain with reference to the autonomic nervous system.
4. If there is time for more testing of the conditioned stimulus, try again after about 10 minutes. In the next class you might like to see if spontaneous recovery occurs.
5. What are the limitations of this method? For example, explain whether you can use counterbalancing in the design. Is there a likelihood of participant variables occurring?
6. How were the participants selected for this research? Can you generalise to the population?
7. Write a conclusion about the value of your findings.

### References

These should be listed in the format set out in chapter 1, in alphabetical order.

**TABLE 15.2** Heart rate before and after conditioning by hopping on the spot.

| Participant number | Heart rate resting with signal (beats/minute) | Heart rate with signal after conditioning (beats/minute) | Change in heart rate (beats/minute) |
|---|---|---|---|
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| Average | | | |

**FIGURE 15.22**
Jumping on the spot raises heart rate. Can you condition someone's autonomic nervous system to raise their heart rate simply in response to hearing a clicker?

## EVALUATION OF A RESEARCH DESIGN Conditioning and occupational cramps

An early application of aversion therapy involved treating a condition known as writers' cramp. This condition has symptoms of spasms and tremors in the hand, and is found in keyboard operators and musicians as well as writers.

Sylvester and Liversedge (1960) devised three tasks that paired the muscular behaviour that led to writers' cramp with electric shock. In the first task, a pen had to be held in a small hole and any tremor brought it into contact with the sides of the hole, closing a circuit and delivering a shock.

In the second task, an irregular path had to be traced with the pen and any deviation from it caused a shock. For the third task, the patients had to hold a pen that gave a shock if too much thumb pressure was applied.

Several sessions on each task were given to each patient. Of thirty-nine cases treated, twenty-four people showed definite improvement and returned to normal employment.

Adapted from Sylvester & Liversedge (1960).

### Questions

1. What kind of research was conducted by Sylvester and Liversedge (1960)?
2. Describe the participants in this research.
3. Devise a hypothesis for the research.
4. Eysenck (1952) has remarked that people often go into spontaneous remission (they get better without help). How could the researchers have overcome this criticism?
5. What was the independent variable in this research?
6. What was the dependent variable and how was it operationalised?
7. a How would you find the percentage recovery of cases?
   b Is this lower or higher than the 70 per cent spontaneous remission quoted by Eysenck?
8. The participants were fully informed before this research was undertaken. What extraneous variables may have influenced the outcome?
9. What measures or observations would have strengthened the assertion by the researchers that they had found a therapy for 'occupational cramps'?
10. If you were designing this research, what ethical principles would you have to address?

**FIGURE 15.22**
Can writers' cramp be treated by conditioning?