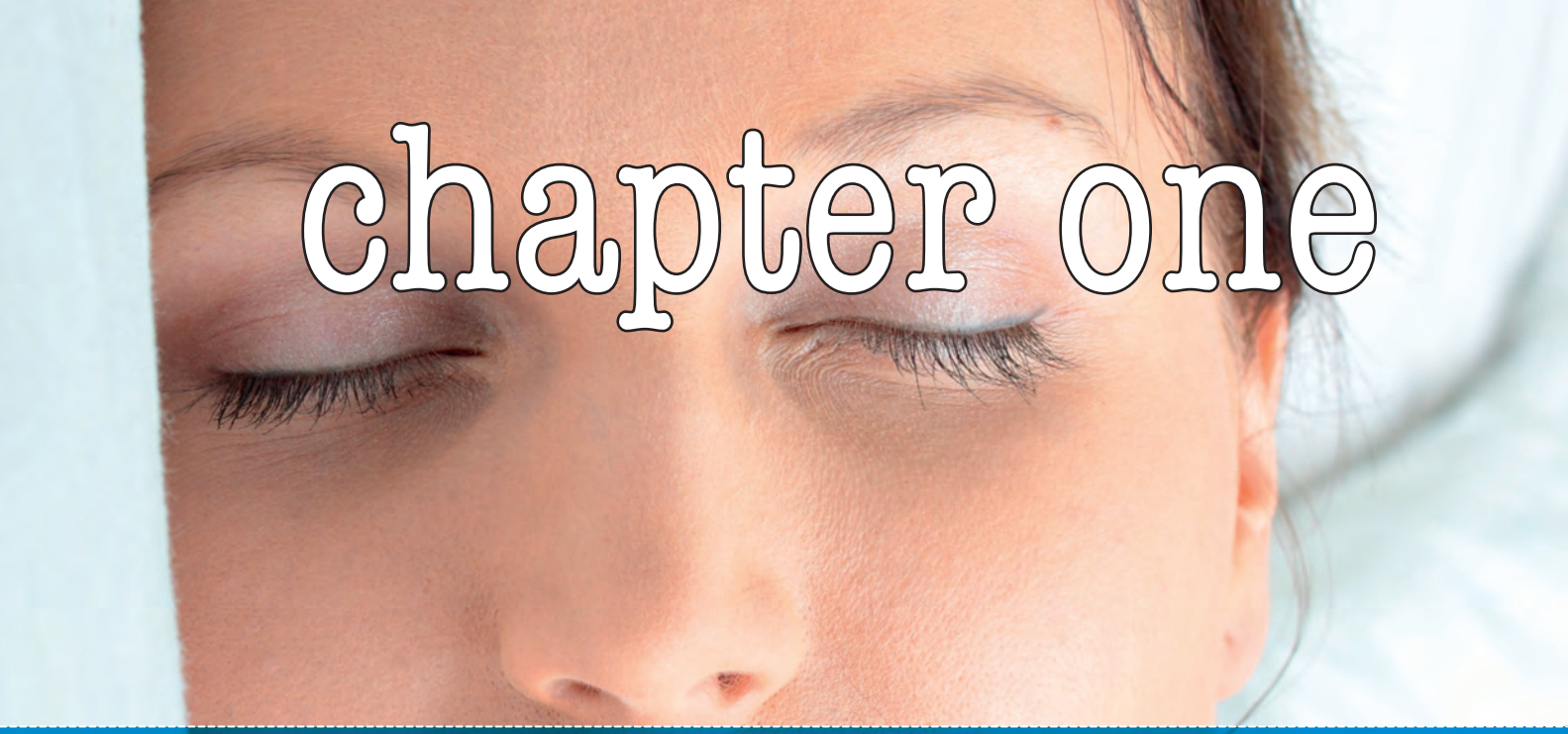
unit three

The conscious self

Area of study 1:
Mind, brain and body

Area of study 2:
Memory



chapter one

Consciousness

Key knowledge and skills

This knowledge includes:

- consciousness as a psychological construct informed by the work of René Descartes and William James
- concepts of normal waking consciousness and altered states of consciousness, including daydreaming, meditative and alcohol-induced, in terms of awareness, content limitations, controlled and automatic processes, perceptual and cognitive distortions, emotional awareness, self-control and time orientation
- sleep as an altered state of consciousness: purpose, characteristics and patterns of the stages of sleep including rapid eye movement (REM) and the non-rapid eye movement (NREM) stages of sleep
- methods used to study the level of alertness in normal waking consciousness and the stages of sleep:
  - measurement of physiological responses including electroencephalograph (EEG), electrooculargraph (EOG), heart rate, body temperature and galvanic skin response (GSR)
  - the use of sleep laboratories, video monitoring and self-reports
- the effects of total and partial sleep deprivation:
  - loss of REM and NREM sleep
  - sleep recovery patterns including amount of sleep required, REM rebound and microsleeps
  - sleep–wake cycle shifts during adolescence compared with child and adult sleep including delayed onset of sleep and need for sleep.

These skills include the ability to:

- use research literature to demonstrate how psychological concepts and theories have developed over time
- process and interpret information, and make connections between psychological concepts and theories
- apply understandings to both familiar and new contexts
- evaluate the validity and reliability of psychology related information and opinions presented in the public domain
- analyse issues relating to and implications of scientific and technological developments relevant to psychology.

CONSCIOUSNESS

What is consciousness?

- René Descartes (1596–1650)
- William James (1842–1910)

Types of altered states of consciousness

- Daydreaming
- Meditation
- Alcohol-induced state
- Sleep
  - Types (REM/NREM)
  - Purpose (restorative/adaptive)
  - Sleep deprivation (physical and psychological effects/REM rebound/microsleeps/sleep–wake cycle shifts)

Normal waking vs altered states of consciousness

- Awareness
- Content limitations
- Controlled and automatic processes
- Perceptual and cognitive distortions
- Emotional awareness
- Self-control
- Time orientation

Methods for studying consciousness

- Electroencephalograph
- Electrooculargraph
- Heart rate
- Body temperature
- Galvanic skin response
- Sleep laboratories, video monitoring and self-reports

What is consciousness?

As you read this paragraph, you are aware of the words on the page. If you stop reading and pay attention to your body, you may notice that you are hungry or that you have sore eyes. If you pay attention to the environment around you, you may notice the sound of the heater or the buzzing of the light overhead, and if you listen hard enough you may hear voices coming from another room. As you listen, you may remember that tonight you have to study for tomorrow's maths test. You might then change your focus to the air entering your lungs or to the sensation created by the feel of the watchband on your wrist. Before your attention was directed to these sensations, do you think you were *aware* of them?

The awareness of our internal and external environments is an ever-changing array of thoughts, feelings and sensations known as consciousness. Your consciousness consists of all the thoughts, feelings, sensations, perceptions and memories you are aware of at any given moment (Farthing, 1992).

You can manipulate your consciousness very easily. For example, try to remember your last birthday. What did you do? What did you eat? What day of the week was it? Now try to remember the best holiday you have been on (see Figure 1.1). Where did you go? With whom did you go? By triggering these memories and bringing them into your thoughts, you have manipulated your consciousness.

Figure 1.1 Remembering where you went and the experiences you had on your favourite holiday requires manipulation of your consciousness.

Human consciousness has been described as being personal, selective, continuous and changing (see Figure 1.2).

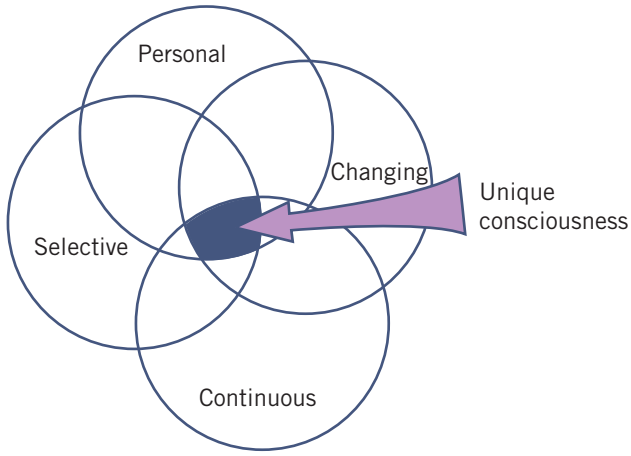


Figure 1.2 Each individual's consciousness is unique because it is personal, changing, selective and continuous.

Consciousness is *personal* because it consists of your understanding and perceptions of the world around you. It is unique for each individual.

Consciousness is *selective* because you pay attention to some things in the environment and ignore others. For example, while reading an interesting novel you are completely focused on it, so you don't notice the TV on in the background or the birds chirping outside your window.

Consciousness is *continuous* because its contents are blended into one another with no specific beginning or end. Your consciousness is never empty; that is, there is never a time when you are not thinking.

Finally, consciousness is *changing*, as your thoughts are constantly moving from topic to topic. For example, one moment you may be thinking about how hungry you are, then your consciousness is filled with thoughts of what you are planning to cook for dinner, then you suddenly start thinking about the assignment that is due tomorrow.

Sometimes our consciousness is filled with personal thoughts and feelings, while at other times it is filled with sensations from the external environment. So, as you can see, although we all experience consciousness, the actual consciousness that we experience is unique to each individual. 'Try it yourself 1.1' contains an exercise to help you explore your own consciousness.

TRY IT YOURSELF 1.1

Exploring your consciousness

If our consciousness is constantly changing, can we keep up with our own thoughts?

For five minutes, record everything that comes into your mind. Use a pen and paper, and a timer. Try to record all your thoughts, even if they occur at the same time – each time a new thought emerges, try to record

it even if you haven't 'finished' with your previous train of thought.

QUESTIONS

1. How did you go? Could you keep up?
2. Look at what you have written.
   a. What types of things are recorded?
   b. Can you identify emotions, plans, and information about the internal and external environments?
3. If you had to define what consciousness is, how would you describe it?

INVESTIGATING CONSCIOUSNESS

Something that cannot be seen and is unique to every individual is very difficult to conceptualise. However, this has not stopped people theorising about what consciousness actually is. One man who is well known for his views on consciousness is René Descartes. Descartes was born in 1596 in the town of La Haye in the south of France. He was well-known in the fields of science and mathematics for his work on geometry and algebra. However, many believe that his most important works were his philosophical writings. In the process of trying to discover what, if anything, could be said to exist with certainty, Descartes came to the conclusion that the only thing he could be sure of was that he existed – he coined the Latin phrase *cogito ergo sum*, which means 'I think, therefore I am'. Descartes therefore described himself as a 'thinking thing' (*cos regitans*). In a sense, what he was describing was his capacity for conscious thought, or what we call our self consciousness.

Descartes was the first philosopher to clearly link the mind with consciousness and to identify it as a non-physical thing separate from the brain (Descartes, 1641). The resulting school of thought, which hosts a variety of views about the relationship between mind and matter, is known as dualism. Dualism claims that mental phenomena such as consciousness are in some respects non-physical (Hart, 1995).

American psychologist William James (1842–1910) adopted the philosophy of dualism as the underpinning of psychology (Mishlove, 1975). In the late 19th century, James was the first person to offer a course in Psychology at an American university. Throughout his career, James also taught anatomy, physiology and philosophy, but he is arguably best known for his views on human consciousness. He thought that the most appropriate way of defining human consciousness was to compare it to a stream, because, similar to a stream, consciousness is constant and continuously changing (see Figure 1.3). Consciousness consists of a random flow of thoughts, feelings, memories and sensations that pass fleetingly through our mind. James suggested that this flow is endless and that there is never a gap

Figure 1.3 William James likened human consciousness to a stream that was constant and continuously changing.

between the end of one thought and the beginning of another, which again parallels the movement of a flowing stream. Consciousness helps us to survive by allowing us to learn about, adapt to and deal with the environment around us.

States of consciousness

As consciousness varies throughout the day, so does the state of consciousness we experience. Your state of consciousness refers to your level of awareness of stimuli, both internal and external. There are no distinct boundaries to indicate where one state of consciousness begins and another ends.

Many psychologists believe that the best way to describe the different states of consciousness is to place them on a continuum from complete lack of awareness (unconsciousness) to total awareness (focused attention). There are many different states of consciousness between the two extremes of the continuum. At the high end of the continuum (total awareness), your attention is focused and you

attention
: A voluntary or involuntary tendency to orient towards or focus on a particular stimulus and ignore other stimuli

consciousness
: Our awareness of internal and external environments at any given moment in time

dualism
: A variety of views regarding the relationship between mind and matter

state of consciousness
: An individual's level of awareness of internal and external stimuli at any given moment

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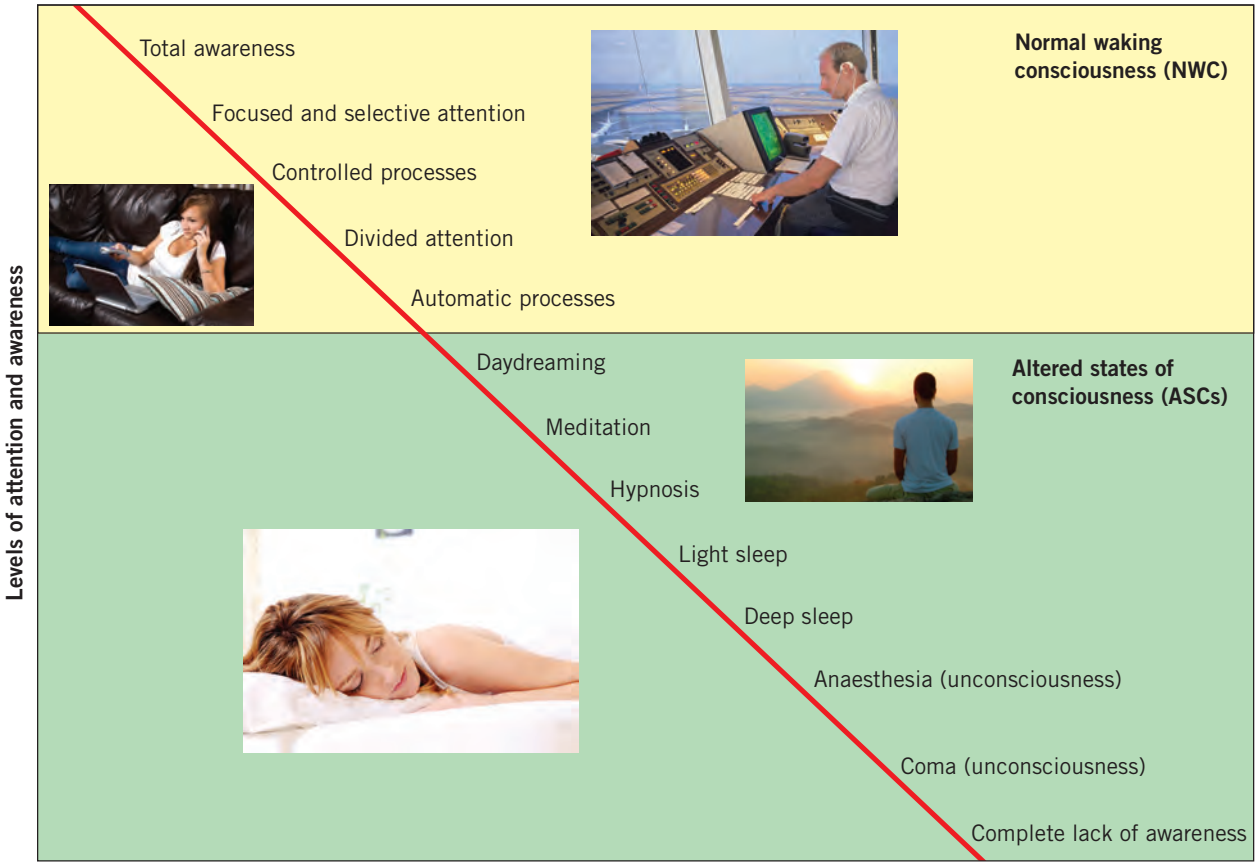


Figure 1.4 States of consciousness can be placed on a continuum from complete lack of awareness (unconsciousness) to total awareness (focused attention).

are able to concentrate on specific tasks (such as exams) and ignore other, less important information (such as birds chirping outside). This tends to occur when someone is highly attentive to a situation; for example, when learning a new concept such as mathematical problem-solving, or learning a skill such as driving a car. At the low end of the continuum (lack of awareness), you may be unaware of thoughts, feelings and sensations. This may occur when you are fatigued, meditating, under the influence of drugs or alcohol, hypnotised, sleeping or anaesthetised. Figure 1.4 shows the continuum from complete lack of awareness to total awareness.

To aid our understanding of the various levels of consciousness, psychologists use two broad categories: *normal waking consciousness* and *altered states of consciousness*. We will examine these next.

CHECK YOUR UNDERSTANDING 1.1

1 Which of the following is not a term used to describe consciousness?
- **A** Selective
- **B** Stagnant
- **C** Flowing
- **D** Personal

2 René Descartes, who was well-known for his belief that he was a 'thinking being', coined which phrase?

3 William James likened our consciousness to a stream because:
- **A** consciousness stops and starts at different times.
- **B** consciousness is always winding and turning in new directions.
- **C** consciousness is continuously changing.
- **D** consciousness is often on its way downhill.

4 Place each of the following states of consciousness in order from most aware (1) to least aware (6).
- **a** Daydreaming
- **b** Anaesthetised
- **c** Focused attention
- **d** Sleep
- **e** Meditation
- **f** Hypnosis

5 For each of the following tasks, decide whether it would involve a high level of awareness (H) or a low level of awareness (L).
- **a** Watching a movie on TV, which you have seen before
- **b** Completing an examination
- **c** Kicking a goal in the last minute of a game
- **d** Dozing on the couch
- **e** Knitting a scarf that you have been knitting for a week
- **f** Learning how to drive a car

NORMAL WAKING CONSCIOUSNESS

Each state of consciousness brings with it a different level of awareness of our internal and external environments. We spend most of our lives in normal waking consciousness (NWC), which is a state of clear, organised alertness to internal and external stimuli. We would experience NWC when reading a book, playing sport or talking with our friends (see Figure 1.5). Not surprisingly, we spend two-thirds of every day in NWC. This state of consciousness is at the high end of the continuum, where we perceive time, places and events as real, meaningful and familiar.

Figure 1.5 During normal waking consciousness we have clear, organised alertness to internal and external stimuli, which allows us to engage in a task such as having a conversation with friends.

Although everyone has an individual consciousness that is personal and unique, there are a number of common characteristics that are shown when an individual is experiencing normal waking consciousness. These include:

- moderate to high levels of awareness
- good memory and cognitive abilities
- focused attention on specific tasks
- an accurate perception of reality
- appropriate emotions
- a degree of self-control
- an accurate perception of time and sensations.

ALTERED STATES OF CONSCIOUSNESS

If we spend approximately two-thirds of our day in normal waking consciousness, then the other third is spent in an altered state of consciousness (ASC). An altered state of consciousness is any state of consciousness that is distinctly different from normal waking consciousness. An ASC may differ from NWC in a variety of ways, including the level of awareness and the quality or intensity of sensations, perceptions, thoughts and emotions.

ASCs can occur naturally, or they can be induced. For example, natural ASCs include sleep, dreaming and daydreaming states. Induced ASCs include being intoxicated by alcohol or drugs, being hypnotised, using meditation and being anaesthetised (such as during surgery – see Figure 1.6). ASCs can also occur as a result of sensory overload. These range from viewing a light-show, being at a dance party, or being in a large celebratory crowd or in a mosh pit. They may occur because of a physical condition, including high fever, hyperventilation, lack of oxygen or dehydration; or because of sleep deprivation, where you may experience hallucinations. Being in a coma is also an ASC because someone who is comatose has a very low awareness of environmental stimuli.

Figure 1.6 A patient under anaesthesia experiences an altered state of consciousness due to lack of awareness of the internal and external environment.

Characteristics of an altered state of consciousness may include:

- low levels of awareness
- memory difficulties and reduced cognitive abilities
- difficulty paying attention to specific tasks
- distorted perception of reality, such as delusions
- inappropriate or uncharacteristic emotions
- a lack of self-control
- difficulty in accurately perceiving time and sensations.

In some instances, ASCs have important cultural significance. In many cultures (such as those of different groups of Native American Indians), rituals of healing, prayer, purification or personal transformation are accompanied by altered states of consciousness (see 'A closer look: Consciousness and culture').

normal waking consciousness (NWC)
A state of consciousness characterised by clear and organised alertness to internal and external stimuli

altered state of consciousness
A state of consciousness that is characteristically different from normal waking consciousness in terms of awareness, sensation and perception

[ISBN 9780170182966]

A CLOSER LOOK

Consciousness and culture

Throughout history, people have found ways to alter consciousness. A dramatic example is the sweat lodge ceremony of the Sioux Indians (see Figure 1.7), a tribe of North American Native Indians. During the ritual, several men sit in total darkness inside a small chamber heated by coals, while cedar smoke, steam and the scent of sage fill the air. The men chant rhythmically and begin to sweat while the heat builds. When they can no longer stand the heat, the door is opened to allow in cool air. Then the cycle begins again – often to be repeated four or five times.

Figure 1.7 These Native American men stand outside a sweat lodge in Montana, USA.

The ritual 'sweats' of the Sioux are meant to cleanse the mind and body. Individuals in other cultures use pipe-smoking, prayers and ceremonies to cleanse themselves of emotions such as anger and jealousy, and can sometimes experience intense visual phenomena, or changes in their perception of time and space.

People may seek ASCs for pleasure; yet, as the Sioux illustrate, many cultures regard ASCs as a pathway to personal enlightenment. Indeed, all cultures and most religions recognise and accept some alterations of consciousness. However, the meanings given to such states vary greatly – from being seen as signs of 'madness' and 'possession' by spirits, to being considered life-enhancing breakthroughs. Thus, cultural context greatly affects which ASCs each of us recognises, seeks, considers normal and attains (Metzner, 1998; Ward, 1989).

There are many different types of altered states of consciousness and all are varied in terms of awareness and experience.

Daydreaming

Approximately halfway along the consciousness continuum is an ASC we have all experienced: daydreaming. Daydreaming is characterised by a shift in concentration from external stimuli to internal thoughts, feelings, memories and images. We are awake when we are daydreaming, but we are so focused on our internal state that we are unaware of everything going on around us. Daydreaming is a naturally-occurring ASC.

Research suggests that we are more likely to daydream when we are not moving because when stationary we are less likely than at other times to be directing our attention to external stimuli (Pope & Singer, 1978). Further, daydreaming is more likely to occur when we are alone, doing routine or boring activities, waiting to fall asleep or travelling on public transport.

We all daydream many times each day. In fact, it is believed that teenagers spend approximately one-third of their waking day daydreaming. This is a large percentage of an individual's time, so what is the purpose to daydreaming? Why do we spend so much time in this dreamlike trance instead of focusing on all of the important concerns of life?

There are a number of theories to explain why we daydream. One of the most intriguing explanations was made by psychoanalyst Sigmund Freud (1856–1939). Freud believed that daydreams reduce the tension left by our unfulfilled needs and wishes. He suggested that we daydream to allow us to create a fantasy world to which we can escape when we cannot achieve tasks in reality (see Figure 1.8). In our daydreams, we are often attractive and achieve everything we desire. Other theorists suggest that daydreams are a means by which to problem-solve and consider a possible course of action. They may help us plan a career path, decide where to travel or simply to decide what to eat for dinner. See 'A closer look: Freud and daydreams' to read more about why we daydream. 'Try it yourself 1.2' contains an activity on daydreaming.

Figure 1.8 Freud believed we daydream in order to escape to a fantasy world.

A CLOSER LOOK

Freud and daydreams

Pope and Singer (1978) conducted a study using university students to test Freud's hypotheses. In the study, all students were required to record the content of their daydreams for several days. Consistent with Freud's theory, the students' daydream diaries showed that many daydreams involved fulfilling a wish or desire. However, contrary to the theory, many daydreams also included themes of guilt, sorrow, regret and sexual tension. It was suggested that such daydreams create rather than release tension, casting doubt on Freud's theory.

Pope and Singer consequently suggested that daydreams might merely be a distortion of our current concerns and emotions. Other researchers have suggested that daydreams are a vehicle whereby we practise problem-solving and mentally try out possible courses of action (Schacter, 1976). Do you ever stare out the window during class and consider whether you would get more homework done at home or by staying at school?

TRY IT YOURSELF 1.2
Daydream diary

Keep your own daydream diary for a week. Each time you experience a daydream, record it in your diary. Also note where you were and what you were doing at the time you experienced the daydream.

QUESTIONS

1. Compare the contents of your daydreams with Freud's theory of daydreaming.
   a. What do you think about Freud's theory?
   b. When you daydream, are you dreaming about unfulfilled wishes and desires, or are you problem-solving?
2. Where were your daydreams most commonly experienced?

Meditation

Meditation involves deliberately inducing an ASC that is characterised by deep physical and mental relaxation. Due to this deep relaxation, the individual meditating has a reduced awareness of the external world as they focus on their internal environment. During deep meditation you may be unaware of noises around you and may not even know how much time is passing.

Meditation involves mental exercises that focus attention away from the typical flow of thoughts, worries and analysis to an internal place of 'calmness' (Wilson, 1986). People who meditate often report being able to 'empty' their minds. Meditation takes many forms and has different meanings in different religions and cultures. Buddhist meditation, for example, employs a variety of meditation techniques, where an individual pursues the path to 'enlightenment'. Meditation has also been used as a pain-control mechanism because it reduces people's levels of physiological arousal. It is advantageous for this and other purposes, as individuals are capable of creating a meditative state quite easily on their own, with minimal practice.

Alcohol- and drug-induced states

The effects of drugs and alcohol are widely publicised in the media. The physical effects of drinking alcohol or taking drugs include a loss of self-control, a slowing down of reaction times and an inability to accurately perceive and judge the world around you. For these reasons it is illegal in Australia to drive a vehicle under the influence of drugs or when you have a blood-alcohol concentration (BAC) above 0.05 g/100 mL (see Figure 1.9). An individual in a drug- or alcohol-induced state experiences an ASC in which awareness of internal and external stimuli is greatly reduced. Therefore, a drug- or alcohol-induced driver poses a very dangerous threat to themselves and other drivers.

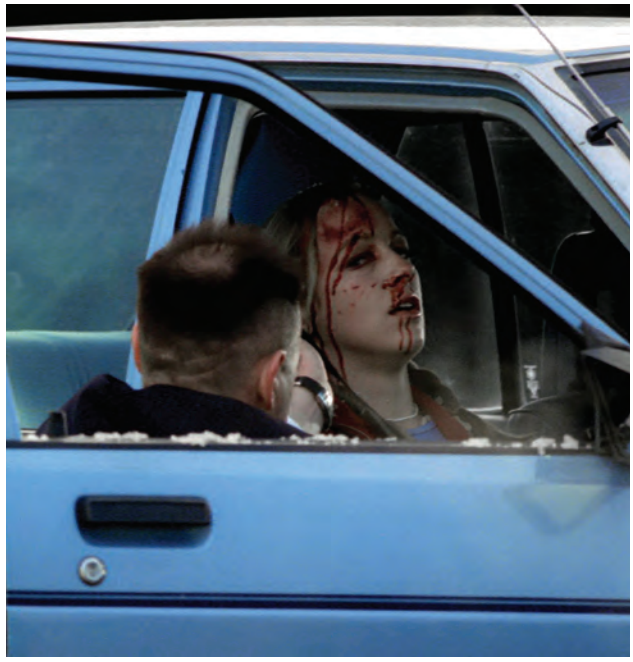


Figure 1.9 The Traffic Accident Commission's advertising campaigns highlight the dangers of drink driving.

daydreaming
An altered state of consciousness characterised by a shift in concentration from external stimuli to internal thoughts, feelings, memories and images

meditation
A purposely-induced altered state of consciousness characterised by deep physical and mental relaxation

[ISBN 9780170182966]

Being in an alcohol- or drug-induced state can also lead to an increased sense of confidence, dulled or heightened emotions and can also reduce the experience of pain. These are further indicators that an individual in this state does not have a clear and organised perception of the world and is experiencing an ASC.

Explore the issues surrounding drink driving in more detail by completing 'Try it yourself 1.3'. 'Focus on research: The effects of alcohol' explores recent research in alcohol-related road accidents.

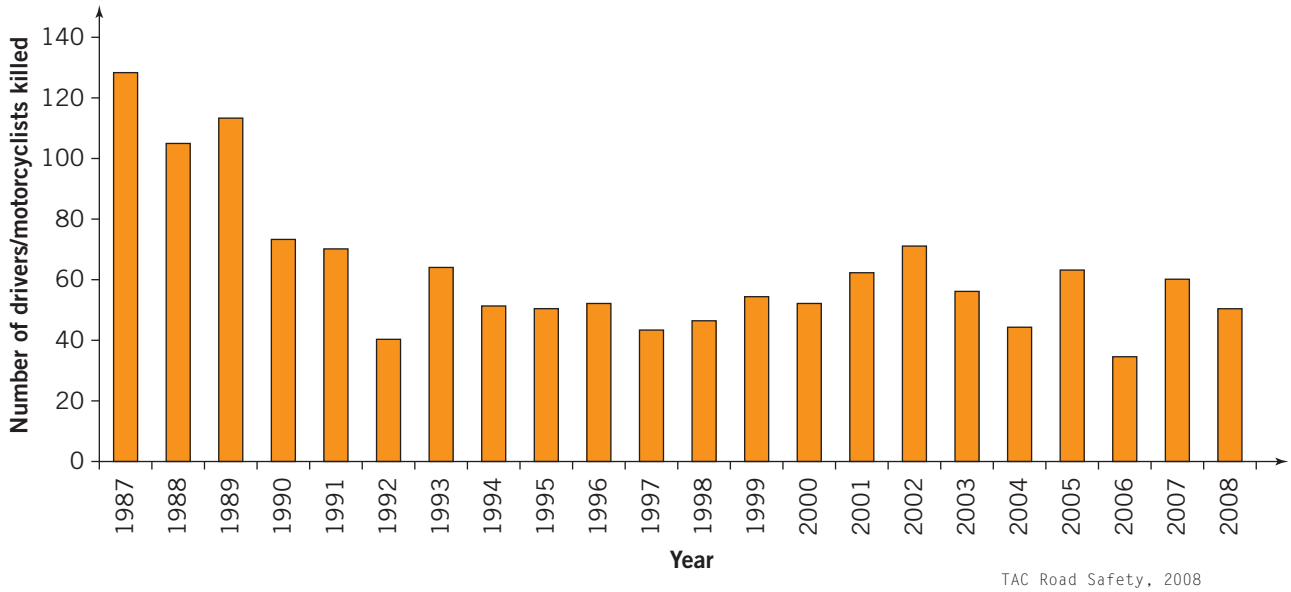
TRY IT YOURSELF 1.3
Blood-alcohol levels

Using your knowledge of some of the characteristics of altered states of consciousness, explain why it is illegal to drive when your blood-alcohol level passes a certain limit. Present the information you have found as an advertisement promoting safe driving. You may like to use a PowerPoint presentation, create a storyboard of the advertising campaign or film a short advertisement for television with some classmates.

FOCUS ON RESEARCH

The effects of alcohol

Because alcohol consumption results in an altered state of consciousness, much research has been conducted on the effects of alcohol when driving. Road trauma is the most common cause of premature death among young adults in Australia. Figure 1.10 shows a graph of the number of drivers and motorcyclists killed on Victorian roads who recorded a BAC of 0.05 g/100 mL or higher between 1987 and 2008.



TAC Road Safety, 2008

Figure 1.10 Number of drivers and motorcyclists killed in Victoria with a BAC over 0.05, 1987–2008

In 2008, a total of 50 drivers and motorcyclists with a BAC of 0.05 g/100ml or more were killed. This constituted 28 per cent of *all* drivers and motorcyclists killed on Victoria's roads in that year. Of those 50 drivers:

- 82 per cent were males
- 34 per cent were between 21 and 29 years of age, 20 per cent were aged between 30 and 39 years, 28 per cent were aged over 40, and the remaining 18 per cent were 20 years of age or younger
- 76 per cent were involved in single-vehicle crashes
- 54 per cent were involved in accidents on country roads
- 72 per cent died in crashes that occurred between the hours of 6 p.m. and 6 a.m.

The majority of killed drivers were heavily intoxicated, registering more than three times the legal alcohol limit.

Source: TAC Road Safety online (2008) *Drink driving statistics.*

QUESTIONS

1 Write a possible operational hypothesis that may investigate the effect of alcohol on driving ability.

2 **a** What types of statistics are provided in this piece of research?

b What is the purpose of using these types of statistics?

3 What possible conclusion could be made from the data shown in Figure 1.10?

Other altered states of consciousness

There are many other types of altered states of consciousness, such as hypnosis, being under the effect of anaesthetic and, of course, one that we all experience every day: sleep.

Read 'A closer look: Look into my eyes', to learn more about the fascinating world of hypnosis. Then watch the 'Fear of spiders' videolink to see radio and TV celebrity Hamish Blake (of comedy duo Hamish and Andy) receive hypnotherapy to overcome his fear of spiders.

A CLOSER LOOK

Look into my eyes

'Your body is becoming heavy. You can barely keep your eyes open. You are so tired you can't move. Close your eyes and relax. Let go ...'

Hypnosis has long had an aura of mystery, with popular conceptions being that the hypnotist is a sort of magician or a sinister, manipulative figure. Yet hypnosis is not 'magical' at all. It is an altered state of consciousness characterised by narrowed attention and increased openness to suggestion (see Figure 1.11).

Figure 1.11 Hypnosis is an altered state of consciousness where you are open to suggestion.

The term hypnosis was popularised in the 1840s by an English surgeon named James Braid, who used it to describe the hypnotic state (the Greek word *hypnos* means 'sleep'). Today we know that hypnosis is not sleep, and that it can be explained by normal psychological principles. Hypnosis is used by many psychologists and psychiatrists as part of their therapy practice; for example, it can be used as a relaxation technique or to help people recover from addictions, such as smoking. In recent years, the validity of so-called 'recovered' memories – vivid 'memories' of past events that are brought into conscious awareness during hypnosis and other types of therapy – has been a controversial topic (APS, 2002). There is evidence that because we are so open to suggestion while under hypnosis, experiences and suggestions made during this time can be built into our memory system.

Can everyone be hypnotised? Approximately eight people out of 10 can be hypnotised, but only four out of 10 will be good hypnotic subjects. People who are imaginative and prone to fantasy are often highly responsive to hypnosis (Silva & Kirsch, 1992). Yet people who lack these traits may also be hypnotised. If you are willing to be hypnotised, the chances are high that you will be. Hypnosis depends more on the efforts and abilities of the hypnotised person than on the skills of the hypnotist (Kirsch & Lynn, 1995). But make no mistake: people who are hypnotised are not faking their responses (Perugini et al., 1998).

What does it feel like to be hypnotised? You might be surprised at some of your experiences under hypnosis. You might have mild feelings of floating, sinking or anaesthesia, or even a sense of 'separation' from your body. Personal experiences vary widely; however, hypnotised people generally remain in control of their behaviour and are aware of what is going on around them. Someone who is deeply hypnotised may relax so that normal willpower (or self-control) is reduced; however, most people will not act out hypnotic suggestions they consider immoral or repulsive (such as undressing in public or harming someone) (Kirsch & Lynn, 1995).

VIDEO
Fear of spiders

DIFFERENCES BETWEEN NORMAL WAKING CONSCIOUSNESS AND ALTERED STATES OF CONSCIOUSNESS

How do we know what state of consciousness someone is experiencing? Studying consciousness is a difficult thing to do because it cannot be directly observed. We know whether a person is male or female, has blue or green eyes or is short or tall just by looking at them. Unfortunately, however, we cannot directly measure what a person is thinking or what state of consciousness they are in just by observing them. For this reason, consciousness is referred to as a hypothetical construct.

A hypothetical construct is a concept used to describe an entity that we believe to exist, because we can measure its *effects*, but we cannot directly observe or measure the entity itself. Behaviours can be measured objectively or subjectively. Subjective measurements refer to data that are collected through personal observations of behaviour. These are often influenced by researcher or observational biases, or may be influenced by the participant's biased view of their own behaviour. In terms of consciousness, a researcher may make an assumption about a participant's level of awareness of the things going on around them, or whether they are showing

hypothetical construct
A concept used to describe something that is believed to exist, because we can measure its *effects*, but we cannot directly observe or measure *it*

[ISBN 9780170182966]

a reasonable amount of self-control. This data is subjective as it is based on opinion and observation of the individual's behaviour, but is not scientifically measured.

There are distinct differences in behaviour and experiences in normal waking consciousness compared to behaviour and experiences in an altered state of consciousness. These differences may help us to make a decision as to which state of consciousness an individual may be experiencing.

Awareness

As shown on the states of consciousness continuum (Figure 1.4), some activities require higher levels of concentration and attention than others. For example, someone reading a difficult chemistry textbook will devote a higher level of attention to their reading than someone who is reading a comic strip in a newspaper.

During an altered state of consciousness, awareness is greatly reduced. During meditation or sleep, for example, your awareness of the outside world decreases. You may be watching the football on TV while someone sleeps on the couch in the same room, yet the sound of the screaming and cheering will not disturb the person's slumber.

You can also be less aware of internal stimuli while in an ASC. This is why states such as meditation, hypnosis and, of course, going under anaesthetic, are used to reduce the experience of pain – they make you less aware of internal sensations. In an ASC it is difficult to focus your attention on a task that requires a high level of awareness.

Activities that do require a high level of awareness include anything to which a person must devote attention in order to understand them, such as solving a difficult maths problem, learning a new dance-step or learning to snorkel (see Figure 1.12). All of these tasks need to be undertaken during NWC so that they can be efficiently processed and understood.

Figure 1.12 Learning how to breathe when snorkelling requires a high level of awareness.

Activities that require an individual to be in NWC are known as controlled processes. Controlled processes are actions that require high levels of attention, awareness and concentration in order to actively achieve a particular goal. When completing controlled processes, attention is focused completely on the task, with little or no awareness directed towards other, less important activities. This is known as focused attention. See 'Videolink: Focused attention' to watch an advertisement that shows how well you can attend to a specific task at the expense of other stimuli.

VIDEO
Focused attention

We can shift our attention quickly and intentionally between stimuli, such as when choosing to listen closely to a teacher giving hints about an upcoming exam, but listening less intently when that teacher describes a concept you already know about.

Attention can also shift unintentionally. For example, if a mobile phone rings, our attention automatically shifts from what we were doing to focus on answering the phone call. Thus, it can be seen that attention is very selective in nature, making it difficult to pay full attention to more than one thing at a time. Redirecting our focus toward a particular stimulus at the expense of others is known as selective attention.

Controlled processes are experienced in all areas of life. A good example of a controlled process is when someone is learning to drive a manual car. Here, the person needs to concentrate on controlling the steering wheel; coordinating the brake, clutch and accelerator when changing gears; and using the indicator when turning (not to mention the windscreen wipers when it is raining!). To top off this extraordinary process, the car needs to be navigated through highly variable traffic, road and weather conditions at all different times of the day and night (see Figure 1.13).

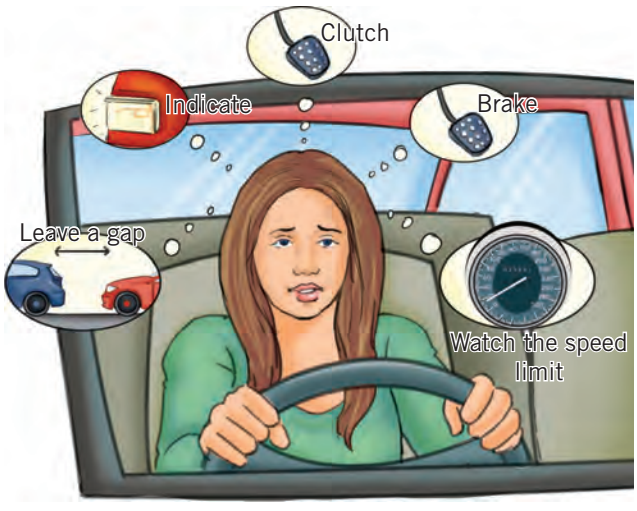


Figure 1.13 Learning to drive a car is a controlled process as it requires a high level of mental effort and attention.

After some practice, driving a car requires much less concentration and awareness than when initially learning the skill. Experienced drivers are capable of simultaneously driving, holding a conversation, changing a radio station or finding their way around an unfamiliar suburb. As with many other complex skills, driving a car can become automatic with practice. When this happens, actions shift from being controlled processes to automatic processes. An automatic process is a set of actions that require little conscious effort or awareness, and do not interfere with performance on other activities. For example, it is possible to type out an essay while listening to music.

When a behaviour is an automatic process, we are able to perform more than one activity at a time. Being able to distribute your attention in this way is known as divided attention. Divided attention is when an individual focuses on two or more stimuli simultaneously. Research into divided attention suggests that we are capable of processing some information that is outside human consciousness. To illustrate this, think about whether you have ever been asked a question by your mother while you were watching television. Initially, you may not have heard the question because you were focusing your attention on your favourite show. You may have asked your mother to repeat the question, but before she finished repeating it, you answered her. The question was not directly in your consciousness, yet you still knew what she had previously asked, and were able to respond to it.

The ability to divide attention between two tasks depends on the types of tasks being performed. For you to be able to successfully divide your attention, both tasks must be automatic processes, such as watching TV and eating a meal. Alternatively, one may be a controlled process and the other an automatic process, such as doing maths homework while listening to music (see Figure 1.14). It is difficult, however, to complete two controlled processes simultaneously, as they both require high levels of attention.

The ability to complete two tasks simultaneously is also impacted upon by the similarity of tasks. Two similar tasks are much more difficult to complete at the same time than two different ones.

Figure 1.14 Our attention can be divided between two tasks if at least one of them is an automatic process.

Table 1.1 compares the features of controlled and automatic processes. 'Try it yourself 1.4' tests your ability to divide your attention between two similar tasks.

controlled processes
Actions that require a high level of conscious awareness, attention and mental effort

focused attention
Attending to a particular stimulus while ignoring others; it requires a high level of awareness

selective attention
The ability to redirect our attention focus to a specific or limited range of stimuli while ignoring others

automatic processes
Actions that require little conscious awareness or mental effort, and do not interfere with performance on other activities

divided attention
When an individual simultaneously focuses on two or more stimuli, or simultaneously undertakes two or more tasks

Table 1.1 The differences between controlled and automatic processes

TYPE OF PROCESS	EXPLANATION	EXAMPLE	EFFECT ON COMPLETION OF OTHER TASKS
Controlled process	An action that requires a high level of conscious awareness, attention and mental effort	• Completing homework • Learning a new task	• Performance on other controlled processes is compromised • Performance on automatic processes may or may not be affected
Automatic process	An action that requires little conscious awareness or mental effort	• Knitting • Watching TV	• Performance on controlled processes may or may not be affected • Performance on other automatic processes is unaffected

TRY IT YOURSELF 1.4
Similar tasks

It is difficult to divide your attention between two similar tasks.

For this task you will need two pens and some paper. First, draw a circle with your left hand. Now draw a square with your right hand. Now complete both tasks at the same time. How do your shapes look now?

Try this task a couple of times, what begins to happen? As you get more accomplished at the task it becomes an automatic process and as a result it is easier for you to divide your attention between drawing the two shapes, even though the activities are similar.

CHECK YOUR UNDERSTANDING 1.2

1 For each of the following tasks, identify whether they are an example of a controlled process (C) or an automatic process (A).

- **a** Learning to ride a bike
- **b** Strolling in the park
- **c** Knitting a jumper you have knitted before
- **d** Stirring soup in a pot
- **e** Solving a simultaneous equation
- **f** Performing a gymnastic routine on the beam

2 Something that is believed to exist but is difficult to measure is known as:

- **A** a state of consciousness.
- **B** a hypothetical construct.
- **C** an illusion.
- **D** a hallucination.

3 Match each type of altered state of consciousness with its description.

a	Meditation	**i**	A state where we are highly open to suggestibility
b	Drug- or alcohol-induced state	**ii**	A state characterised by deep physical relaxation
c	Hypnosis	**iii**	A state where we shift our focus from external events to internal thoughts
d	Daydreaming	**iv**	A state where our sense of judgement is compromised and our emotions are heightened

4 The ability to focus on one task while ignoring others is known as _____; whereas when you are focusing on two tasks simultaneously this is known as _____.

5 Why is attention referred to as selective?

- **A** We have the ability to redirect our focus to different stimuli.
- **B** We have the ability to focus on two stimuli at the same time.
- **C** We can switch our attention off for several hours at a time.
- **D** We can attend to a limitless amount of information at the same time.

Content limitations

During NWC, our thoughts are usually controlled and limited to reality. Although our consciousness is ever-changing and flowing, the content is usually 'normal'. Wildly bizarre thoughts do not often pop into consciousness, and we are usually able to control the themes of our thinking with relative ease. For example, we are often able to block or stop thoughts that make us feel embarrassed, upset, distressed, afraid or hurt. This is very useful, as it allows us to significantly control the content of our thoughts. This is not always the case during an experience of an ASC. Hypnosis is often used to try to bring uncomfortable or distressing thoughts into conscious awareness as a means of accessing 'hidden memories'. Additionally, while dreaming we have little control over which thoughts do surface in our conscious awareness. As a result, we say that our content limitations are reduced when experiencing an ASC.

As well as being 'controlled', the content of thoughts in NWC is usually logical and organised. In NWC, we do not usually think about all our teeth falling out or about walking naked down the street; yet we may imagine these situations in a dream.

We also know that during NWC we can process a lot of information at one time; however, during an ASC the amount of information (or content) that can be processed is limited. Due to a reduced awareness of our surroundings and reduced cognitive functioning, there are limitations on how much content can be processed in an ASC.

Sensation and perception

During NWC we can accurately perceive the world around us. We feel pain when we are hurt and we see images and hear sounds that exist. However, the experience of sensation and perception in ASCs is often very different. In an ASC, sensations and perceptions can be dulled or blunted, or they can be sharpened.

Sensation and perceptions are dulled by pain medication, hypnosis, meditation or daydreaming. We discussed earlier how hypnosis can reduce the experience of pain by focusing attention away from the source of the pain. There are other states of consciousness where the experience of pain is further reduced. Being placed under anaesthetic not only dulls the experience of pain but completely blocks

any sensation to the area that is being anaesthetised. This is obviously a useful tool in treatment of physical ailments.

Hallucinatory drugs such as LSD (lysergic acid diethylamide, an illegal hallucinogenic drug) or crystal meth (methamphetamine, an illegal amphetamine) can heighten and sharpen sensations and perceptions. Individuals in a drug-induced state may see images or hear voices that do not exist or are not real. This is known as a hallucination. Hallucinations can also be experienced during extreme sleep deprivation where the onset of these symptoms clearly indicates that an individual is in an ASC.

An individual's perception of reality is also compromised during an ASC. An individual may believe they are being followed by the government or may be suspicious of people around them. These false beliefs are known as delusions and can also be characteristic of an individual experiencing a drug-induced state.

Cognitive distortions

The brain is bombarded with large amounts of sensory information from the internal and external environments. One of the brain's many roles is to decide which information is useful, necessary or relevant. The brain then actively stores and retrieves this information in the form of memories.

In NWC, an effective memory system is required in order to function. For example, you need to remember how to use the washing machine, which roads will lead you home, which channel your favourite TV show is on, or how to make an omelette. To understand this textbook as you read it, you need to remember the last few sentences you read, in order for the next few sentences to make sense.

During an ASC, memory is often disrupted, and everyday tasks can be difficult to perform. Memory tends to be less accurate, with people storing less information and experiencing more difficulty in retrieving it. For example, when you have a dream at night, you may remember it in detail for a few seconds after you wake up, but forget most of it very quickly.

Memory is just one example of a cognitive function. Others are thinking, reasoning and problem-solving. During NWC, cognition is organised and logical. In ASCs, cognition is often disorganised, illogical, fragmented and lacking sequence (see Figure 1.15). For example, have you ever tried to have a logical conversation with someone who is drunk? It is often very difficult to make sense of their arguments and reasoning. People who binge-drink alcohol (that is, who sporadically drink large amounts) often have trouble remembering what happened when they were intoxicated.

Emotions

The way people experience emotions is unique to every individual; however, we can say that during NWC the emotions are generally appropriate to the situation in terms of experience and intensity. In an ASC, emotions can be intensified, blunted or totally

Figure 1.15 A computer graphic image of a web created by a spider under the influence of drugs (in a drug-induced ASC), in an experiment by NASA. Notice that the web lacks logical order.

inappropriate to the situation. For example, people often become more emotional when they have been drinking alcohol, and usually-cheerful people may report feeling sad or depressed after consuming it (see Figure 1.16). Similarly, many people express

Figure 1.16 The altered state of consciousness brought on by alcohol consumption can heighten emotional experiences.

hallucination
: A sensory experience (e.g. seeing or hearing something) that does not actually exist

delusion
: A belief or thought that is not supported by or connected to reality

their emotions more openly after a few drinks. Some people even become more aggressive when they are drunk; many bar fights between drunken patrons over minor disagreements would have not occurred if the patrons had been sober.

On the other hand, during an ASC some people report that they are emotionless and feel empty. They have no feelings in situations that would in NWC produce intense emotional reactions. For example, it is normally upsetting to experience the death of a close friend, yet someone who has smoked a lot of marijuana might not experience these feelings in this situation.

During ASCs some people have inappropriate emotions or emotional reactions. They may laugh at a funeral, cry when given a present, or become angry and violent when someone smiles at them.

Self-control

Self-control is characterised by a good sense of management of physical responses – such as coordination – and also as a demonstration of good judgement and physical restraint. During NWC we exhibit fine motor control and can coordinate very complex movements (see Figure 1.17). We are also able to make decisions that consider the likely outcomes and implications of a particular behaviour and as a result we are less likely to engage in risk-taking behaviours. During an ASC, however, self-control is often compromised. For example, during some stages of sleep we move around a lot, and may even sleep-talk. We are unable to control these behaviours, no matter how much we may want to. One test for sobriety is to walk along a straight line; during an alcohol-induced state our ability to coordinate movements is compromised.

Alcohol can also reduce people's inhibitions. Someone who is drunk is more likely to engage in extreme risk-taking activities – such as drink-driving, unprotected sex or drug use – because their self-control has been reduced.

Perception of time

In NWC, people's perceptions of time are generally accurate. This means that if a task takes an hour to complete, it also 'feels' as if it takes an hour. If you drop off a prescription at your local pharmacy and the pharmacist tells you to come back in 10 minutes, you are usually able to accurately guess roughly how long that is without having to look at a clock.

Figure 1.17 In normal waking consciousness we are able to coordinate complex movements.

In ASCs, perception of time is often distorted. Time feels like it is passing either more quickly or more slowly than normal. For example, when people are intoxicated with alcohol and at a party, they are often surprised by the time when they look at their watch – it may feel like 10 or 11 p.m. when it is actually 3 a.m. In other ASCs, time seems to pass more slowly than usual. Have you ever fallen asleep and woken feeling as if you have been asleep for hours, only to find you have only been asleep for a few minutes? Or have you been woken by your alarm in the morning and felt as if you have been asleep only a few hours, when really you have had a full night's sleep?

Table 1.2 shows a comparison between the characteristics experienced in an ASC compared to NWC.

Table 1.2 Differences in characteristics and behaviours between normal waking and altered states of consciousness

	NORMAL WAKING CONSCIOUSNESS	ALTERED STATES OF CONSCIOUSNESS
Awareness	High awareness of internal and external environments Able to complete controlled and automatic processes	Low level of awareness of internal and external environments Limited ability to complete controlled processes and some automatic processes are impaired
Attention	Focused attention on selected stimuli Able to divide attention between two tasks	Low level of ability to attend to stimuli
Content limitations	Able to control thoughts Able to process many different pieces of information at the same time	Unable to block unacceptable or undesirable thoughts from entering consciousness The amount of information processed is limited

	NORMAL WAKING CONSCIOUSNESS	ALTERED STATES OF CONSCIOUSNESS
Sensations and perception	Able to accurately perceive the world Experience sensations that are real	Experience distorted perceptions of the world; may experience hallucinations or delusions Reduces or heightens the experience of pain
Cognitive distortions	Able to think logically and clearly Able to memorise and recall information accurately	Experience illogical thoughts that are fragmented Unable to remember information accurately
Emotions	Experience emotions that are appropriate	Emotions may be dulled or heightened or may not be appropriately expressed
Self-control	Able to coordinate a sequence of movements and include fine motor skills	Unable to coordinate actions and behaviours Loss of inhibitions
Perception of time	Able to fairly accurately perceive the amount of time that has passed	Unable to accurately perceive time; may feel as if time passes faster or slower

CHECK YOUR UNDERSTANDING 1.3

1 While in an altered state of consciousness, your content limitations are _____.

2 Which of the following is not an example of a cognitive distortion that may be experienced when in an altered state of consciousness?
- **A** Decreased memory ability
- **B** Difficulty undertaking problem-solving tasks
- **C** Illogical thought patterns
- **D** Decreased perception of pain

3 A belief that does not exist or is not real is known as a _____, whereas a sensation that is experienced that is not real is known as a _____.

4 Which of the following examples demonstrates a high level of self-control?
- **A** Engaging in risk-taking behaviour
- **B** Blurting out a secret
- **C** Being able to walk in a straight line on a beam
- **D** Sleep-talking

5 For each situation below, identify whether it is indicative of someone in an altered state of consciousness (ASC) or normal waking consciousness (NWC).
- **a** Laughing at a funeral
- **b** Estimating that an hour has passed when really four hours have passed
- **c** Reciting a monologue
- **d** Sleep-walking
- **e** Playing a game of cricket
- **f** Seeing a large green monster chasing you
- **g** Remembering what you received for your last birthday

Methods used to measure alertness

As discussed earlier in this chapter, the state of consciousness someone is in is a hypothetical construct, and each of the previously discussed characteristics provides *subjective* indications that may help determine whether somebody may be experiencing an ASC. However, it is possible to *objectively* measure physiological changes. Some physiological changes are typically associated with ASCs, so measuring these physiological changes may provide evidence to more accurately determine the state of consciousness someone is in.

Objective data are measurements of behaviour that are collected under controlled conditions. They are easy to measure scientifically and can be compared to other pieces of data. Objective measures minimise many biases encountered in research and represent a more scientific, accurate and reliable method of data collection that allows experiments to be replicated independently. For these reasons, researchers investigating consciousness generally use objective measurements, and there are a number of physiological measures that can indicate levels of alertness and therefore whether an individual is experiencing an ASC. These measurements are: heart rate, body temperature, brainwave activity and the electrical conductivity of the skin.

objective data
Measurements of behaviour collected under controlled conditions, which allow data to be directly observed or measured

MEASURING HEART RATE

The electrocardiograph (ECG) is a machine that detects, amplifies and records the electrical activity of heart muscle (that is, the heart rate). An ECG is connected to the heart through electrodes placed on the skin around the heart, and electrical activity is then recorded on a screen or on a piece of paper (see Figure 1.18). Heart rate is an important measurement in the study of consciousness because a person's heart rate will increase or decrease depending on which state of consciousness they are experiencing. For example, research suggests that when we are asleep or meditating, our heart rate reduces to below normal waking levels, whereas people who use illegal drugs enter into a drug-induced altered state of consciousness, where the heart rate increases above normal levels. Measuring heart rate can therefore provide an indication of which state of consciousness someone is experiencing. If the heart rate is in a normal range it would indicate an individual is experiencing NWC and if the heart rate is significantly faster or slower than the normal range it could indicate an ASC.

Figure 1.18 Electrocardiographs (ECGs) such as this are used to measure a person's heart rate.

MEASURING BODY TEMPERATURE

A thermometer is a device that can be used to measure body temperature. It is important to measure body temperature, because although it is less variable than heart rate, it also changes depending on the state of consciousness being experienced.

Normal body temperature, such as that experienced during NWC, is approximately 37 degrees Celsius. Researchers have found that there is a loss of consciousness when body temperature drops to 33 degrees Celsius. It has also been found that when asleep, human body temperature drops approximately 1 degree Celsius. Before going to bed, after a day of muscular activity and food intake, our body temperature is usually slightly higher than usual.

Our body temperature also rises when we are suffering from an illness such as an infection; this is known as having a fever. The purpose of fevers is to raise the body's temperature enough to kill certain bacteria that are sensitive to temperature changes. However, if body temperature rises too much (for example, to between 41 and 44 degrees Celsius), death will occur very quickly (Brochert, 2001).

A high fever can induce an ASC. Fever can lead to delirium, where an individual experiences reduced awareness of their external surroundings and disjointed thought patterns. Therefore, body temperature can be used to indicate whether an individual is experiencing NWC or an ASC.

MEASURING THE BRAIN'S ELECTRICAL ACTIVITY

The human brain is always active. As we have learnt, consciousness is likened to a stream that continually flows. The brain is aware of our thoughts, feelings and sensations at all times. Above all, our brain regulates our autonomic functions such as breathing and heart rate, voluntary movements such as walking and speaking, as well as coordinating all the body's senses, giving us the ability to process all incoming information. The electroencephalograph (EEG) is used by researchers to detect, amplify and record the brain's electrical activity, measured in the form of brainwaves. By knowing the particular electrical activity of the brain, we can determine a person's level of awareness of their environment. An EEG recording shows the frequency and amplitude of brainwave activity.

The frequency of activity refers to the number of brainwaves per second. A pattern of high frequency refers to greater brain activity, meaning more brainwaves per second. A pattern of reduced frequency refers to slow brain activity, meaning fewer brainwaves per second.

Brain activity is also measured by amplitude, or intensity. Amplitude is measured by the size of the peaks and troughs in brain activity compared to a baseline of zero activity, as displayed on the EEG machine. High amplitude brainwaves have large peaks and troughs, and low amplitude brainwaves have small peaks and troughs. Different combinations of frequency and amplitude in an EEG recording indicate different types of brainwave activity, and thus varying states of consciousness (see Figure 1.19)

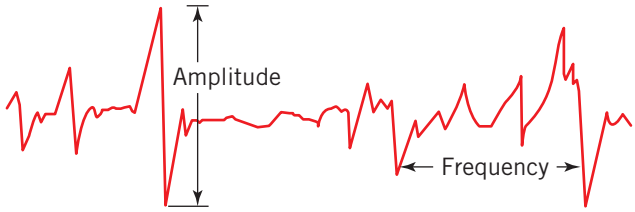


Figure 1.19 The frequency of the brainwave refers to the number of waves per second, whereas amplitude is a measure of intensity.

Table 1.3 Overview of brainwaves

BRAINWAVE	EEG RECORDING	AMPLITUDE ON EEG	FREQUENCY ON EEG	WHEN DOES IT OCCUR?
Beta		Low	High	Normal waking consciousness Beta-like waves *can* be experienced during REM sleep (discussed later), which is an altered state of consciousness
Alpha		Low–medium (higher than beta waves)	Medium–high (lower than beta waves)	Deeply relaxed state (e.g. meditation)
Theta		Medium–high (higher than alpha waves)	Low–medium (lower than alpha waves)	Early or light sleep
Delta		High (highest of all brainwave types)	Low (lowest of all brainwave types)	Deep sleep

There are four types of brainwaves, known as beta, alpha, theta and delta waves (see Table 1.3). All have different combinations of frequency and amplitude, and all are named after letters of the Greek alphabet.

MEASURING THE SKIN'S ELECTRICAL CONDUCTIVITY

The galvanic skin response (GSR) indicates changes in electrical conductivity of the skin. The GSR does this by measuring the electrical current of sweat glands in the skin on the palm of the hand. If sweat is secreted, the skin is wet, and is better able to carry an electrical current than when the skin is dry. Moisture increases electrical conductivity.

Sweat is released onto the surface of the palm during periods of heightened arousal, such as in times of high emotion (anxiety, fear, nervousness, guilt or excitement). To measure the GSR, electrodes are placed on the palm of the hand to detect sweat levels.

Research suggests that the GSR can be used to determine a person's general mood and also their immediate emotional reactions. Results from the GSR are used to distinguish between states of high arousal, when the individual is feeling tense and highly emotional, to states of low arousal, when the individual is feeling calm and may even be suffering from a complete emotional shutdown.

The GSR can be used in conjunction with one or more of the other devices mentioned so far, in order to help determine an individual's state of consciousness. For example, if a person has a low heart rate and a low GSR, they could be experiencing an ASC such as meditation. Likewise, a high heat rate and high GSR reading while sleeping may indicate the occurrence of dream sleep.

The GSR can also be used in conjunction with measurements of the brain's activity. The more aroused the brain, the more adrenalin is released into the bloodstream, increasing tension, alertness and activity of the sweat glands; this results in a heightened emotional state that could be used to distinguish between an ASC and NWC.

All of these physiological measures can indicate an individual's state of consciousness;

electrocardiograph (ECG)
: A machine used to detect, amplify and record the electrical activity of the heart

electroencephalograph (EEG)
: A machine used to detect, amplify and record the brain's electrical activity, measured in the form of brainwaves

frequency
: In terms of brainwaves, refers to the number of brainwaves per second

amplitude
: In terms of brainwaves, refers to the size of the peaks and troughs (or the intensity of the brainwave), from a baseline of zero activity

beta waves
: Brainwaves characteristic of normal waking consciousness, with a low amplitude and high frequency

alpha waves
: Brainwaves experienced during a deeply relaxed state, with a low–medium amplitude and medium–high frequency

theta waves
: Brainwaves experienced during the early stages of sleep, with a mix of medium–high amplitude and a low–medium frequency

delta waves
: Brainwaves experienced during the deepest stages of sleep, with high amplitude and low frequency

galvanic skin response (GSR)
: The measurement of the electrical conductivity of the skin's surface

[ISBN 9780170182966]

Table 1.4 Summary of the objective methods used to measure physiological changes

DEVICE	WHAT IT MEASURES	HOW MIGHT IT DEMONSTRATE STATE OF CONSCIOUSNESS?	LIMITATIONS
Electrocardiograph (ECG)	The electrical activity of the heart (heart rate)	Heart rate may increase or decrease from normal level, indicative of an altered state of consciousness	Change may be due to exercise, not state of consciousness
Thermometer	Body temperature	Body temperature may increase or decrease from normal level, indicative of an altered state of consciousness	There is only a small change in body temperature, therefore it is easily misinterpreted
Electroencephalograph (EEG)	The electrical activity of the brain (brainwaves)	Brainwaves (alpha, theta and delta waves) can indicate an altered state of consciousness. Beta waves accompanied by other physiological changes may also indicate an altered state of consciousness	Can be difficult to differentiate between stages (dream sleep and being awake and alert produce similar brainwave patterns)
Galvanic skin response (GSR)	The electrical conductivity of the skin	GSR may increase or decrease from normal level when an individual's arousal is heightened or reduced, as in an altered state of consciousness	Change may be due to exercise or heat, not state of consciousness

however, they may be misleading as well. For example, an individual may record a very high heart rate and galvanic skin response reading which *could* be indicative of an altered state of consciousness; however, the individual may have just been exercising or eating very spicy food. That is why these physiological measures should be used in conjunction with the characteristics of states of consciousness discussed earlier in the chapter, to try to determine whether an individual is experiencing NWC or an ASC. Table 1.4 summarises the methods of objectively measuring physiological changes.

CHECK YOUR UNDERSTANDING 1.4

1 Which of the following options are examples of objective data?
   - **A** A class's average score on an exam
   - **B** A patient's report of how they are feeling after surgery
   - **C** A description of why Collingwood is the greatest AFL football team
   - **D** The average speed of the cross country team when completing a 4 km course
   - **E** The number of downloads of a song from the iTunes music store

2 The normal body temperature for an individual while in normal waking consciousness is approximately _____ degrees Celsius.
   - **A** 33
   - **B** 37
   - **C** 40
   - **D** 44

3 The measurement of the electrical conductivity of the skin's surface is known as the _____ _____. When a person is in a state of arousal the electrical conductivity will _____.

4 The device that detects, amplifies and records the electrical activity of the brain is known as:
   - **A** the electroceregraph.
   - **B** the electrowavograph.
   - **C** the electrograph.
   - **D** the electroencephalograph.

5 Match each type of brainwave with its description.

a Theta	**i** High amplitude, low frequency wave
b Beta	**ii** Low–medium amplitude, medium–high frequency wave
c Alpha	**iii** Medium–high amplitude, low–medium frequency wave
d Delta	**iv** Low amplitude, high frequency wave

Sleep

There is one altered state of consciousness that we all experience every day. It can be measured using physiological measures and also by looking at behavioural characteristics. Sleep can be described as an altered state of consciousness that features the suspension of awareness of the external environment and is accompanied by a number of physiological changes to the body. The need to sleep is innate (or inborn) in humans, but because sleep is familiar, many people think they know all about it. Before reading more, test your knowledge about sleep by doing the quiz in 'Try it yourself 1.5'.

TRY IT YOURSELF 1.5
Sleep quiz

Five of the following statements regarding sleep are true (T) and five are false (F). Decide which is which, then discuss your answers as a class to see what you already know about sleep.

1. People can only have only a few hours of sleep per night and not suffer from any short-term effects of sleep loss.
2. Most people dream every night.
3. Some dreams are in black and white.
4. Resting during the day can replace lost sleep.
5. As people get older, they sleep more.
6. Hot chocolate will not help a person get to sleep.
7. If a person goes without sleep long enough, death will occur.
8. Dreams mostly occur during deep sleep.
9. A person prevented from dreaming would soon go crazy.
10. Sleep-walking occurs when a person acts out a dream.

SLEEP PATTERNS

A light-driven cycle helps to control body rhythms and sleep cycles. At night, the lack of light stimulation triggers the pineal gland to release a hormone called melatonin (see Figure 1.20). The pineal gland is located in the centre of the brain, between the two hemispheres, and helps regulate body rhythms and sleep cycles. Melatonin levels in the bloodstream respond to cycles of light and dark by rising at dusk and peaking around midnight. This increased production of melatonin makes us feel drowsy. The higher the melatonin level, the higher the level of sleepiness. Melatonin levels then fall again as morning approaches.

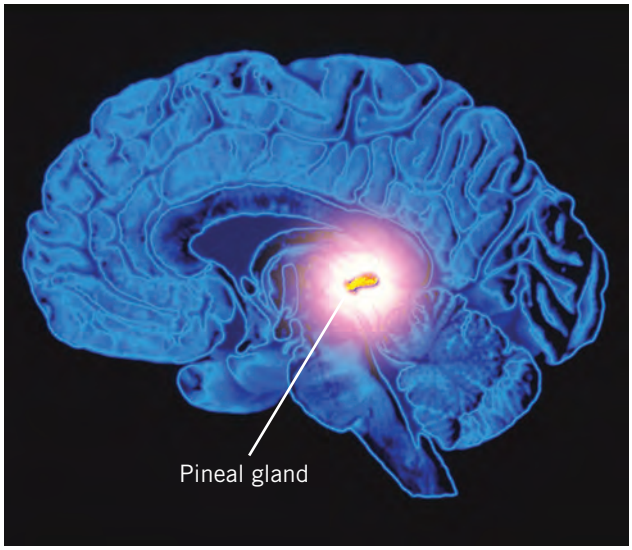
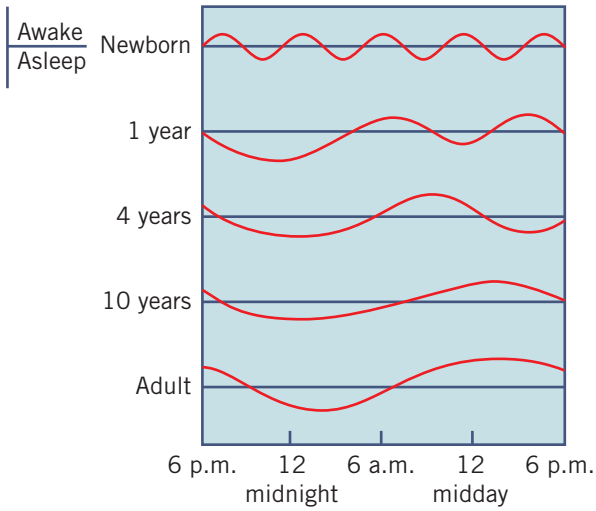


Figure 1.20 The pineal gland secretes a number of regulatory hormones, including the sleep-inducing melatonin.

Daily sleeping and waking periods create a variety of sleep patterns. Sleep patterns are rhythms of sleep and waking so steady that they continue for many days (see Figure 1.21), even when clocks and external light-and-dark cues have been removed (Palinkas, Suedfeld & Steel, 1995). It is worth noting, however, that when external cues are removed, humans eventually shift to a sleep–waking cycle that averages 25 hours, not 24. This finding suggests that external time-markers, especially those of daylight and darkness, help tie our sleep rhythms to a 24-hour day. If not for such markers, it is probable that many of us would drift into our own unusual sleep cycles. When sleep cycles are disrupted for some reason – such as in long-distance drivers and pilots, air crews, shift-workers and travellers – melatonin can be used to reset the body's 'clock' and minimise what is commonly known as jetlag.



Adapted from Williams et al., 1964

Figure 1.21 The development of sleep patterns, showing sleep cycles from infancy to adulthood

STUDYING SLEEP

Most sleep research takes place in a sleep laboratory (see Figure 1.22), which is a controlled environment that enables the electronic recording

sleep
An altered state of consciousness that features the suspension of awareness of the external environment and is accompanied by a number of physiological changes to the body

pineal gland
A gland located in the centre of the brain that helps regulate body rhythms and sleep cycles

melatonin
A hormone that is secreted to regulate the sleep–wake cycle and cause drowsiness

sleep laboratory
A controlled environment that enables electronic recording and measurement of sleep

[ISBN 9780170182966]

and measurement of sleep. A sleep laboratory allows researchers to watch people over an extended period as they sleep. Watch 'Videolink: Sleep laboratory' to see one little boy's experience of a night in a sleep laboratory.

VIDEO
Sleep laboratory

Figure 1.22 In a sleep laboratory, sleep researchers study the brainwave patterns that are produced by a person who is asleep while attached to an EEG.

Common reported sleep problems include frequent waking during the night, excessive sleepiness during the day, snoring or difficulty breathing while sleeping, night terrors and sleep-walking. The use of a laboratory allows doctors to monitor a variety of responses that may explain some of these problems. A patient may be hooked up to an EEG to record brainwave activity during sleep, or an ECG to record the activity of the heart across the night.

The patient is often filmed while sleeping, so that the video recording can be analysed for behaviours displayed while the patient is asleep. For example, the recording may show frequent waking, such as in the case of a nocturnal sleep-related eating disorder, where sufferers wake several times during the night and visit the kitchen to eat whatever they can find. In this condition the part of the brain that controls urges and decision-making is not fully functional, so sufferers can report eating anything in this state, even frozen pizza that is still frozen. See 'A closer look: Nocturnal sleep-related eating disorder' to learn more about this condition.

A CLOSER LOOK

Nocturnal sleep-related eating disorder

'When I woke up this morning, there were candy bar wrappers all over the kitchen, and I had a stomach ache. I had chocolate on my face and hands. My husband says I was up eating last night, but I have no memories of doing so. Could he be playing a joke on me?'

Maybe not. You might have nocturnal sleep-related eating disorder (NS-RED), a little-known condition that is just starting to be investigated. In spite of its name, NS-RED is not, strictly speaking, an eating disorder. It is thought to be a type of sleep disorder in which people eat while appearing to be sound asleep. They may eat in bed or roam through the house and prowl the kitchen. These people are not conscious during episodes of NS-RED, and are not aware that they are eating. They may have no memories of having done so when they wake up, or may only have fragmentary memories. When people with NS-RED wake and discover the evidence of their night-time forays, they are embarrassed, ashamed and afraid they may be losing their minds. Some, when confronted with the evidence by family members, deny that they were the perpetrators.

Food consumed during NS-RED episodes tends to be high-fat, high-sugar comfort food that people restrain themselves from eating while awake. Sometimes these people eat bizarre combinations of food (e.g. hotdogs dipped in peanut butter, raw bacon smeared with mayonnaise etc.) or non-food items such as soap that they have sliced as they would slice cheese.

Between 3 and 9 million people in the USA seem to suffer from this disorder, and 10 to 15 per cent of people with eating disorders are affected. Many of these individuals diet during the day, which may leave them hungry and vulnerable to binge eating at night when their self-control is weakened by sleep.

Can they really not remember? It seems that parts of their brains are truly asleep and, at the same time, other parts are awake. The parts that regulate waking consciousness are asleep, so the next day there are no memories of eating the night before.

Source: Adapted from Healthyplace.com (2008) *Nocturnal Sleep-Related Eating Disorder*, December, USA.

Video recordings are so useful in the diagnosis of sleep conditions that there are specialised services in Australia where you can order sleep equipment for your own home and then send off the recordings online for an assessment. However, to accurately assess and diagnose sleep problems and disorders, video recordings must be used in conjunction with self-reports. An individual may wake several times during the night, but if it does not interfere with their daily lifestyle and

they do not report feeling sleepy throughout the day, the condition is unlikely to be diagnosed. This is why self-reports are crucial in the diagnosis of sleep conditions. Self-reports allow a researcher to understand when sleep patterns are uncharacteristic, the degree to which they are affecting an individual's daily routine and all of the psychological and behavioural factors that can contribute to the formation of a sleep disorder.

One physiological measure that is particularly useful when studying sleep and related disorders is the electrooculargraph (EOG). The EOG detects, amplifies and records the electrical activity of the muscles surrounding the eyes. It records the activity through small discs or electrodes attached to the xskin around the eyes.

It is customary for EEG and EOG recordings to be made simultaneously with recordings from an electromyograph (EMG), on continuously moving chart paper (see Figure 1.23). Our muscles are tense while we are awake, but gradually relax as we go to sleep, and an EMG detects, amplifies and records the electrical activity created by active muscles. This is done using electrodes attached to the skin's surface overlying muscle – in humans, EMG electrodes are typically placed under the chin, arms and legs, since muscles in this area show changes that are associated with sleep stages. EMG measurements show a gradual decrease in muscle tension as we enter the sleep cycle, from the moderate muscle activity detected during sleep experienced early in the night to the atonia (muscle paralysis) present during our dream sleep. These measures combined can gather fairly accurate information about which stage of sleep an individual is experiencing. Figure 1.24 shows EEG and EOG and EMG recordings of a young adult.

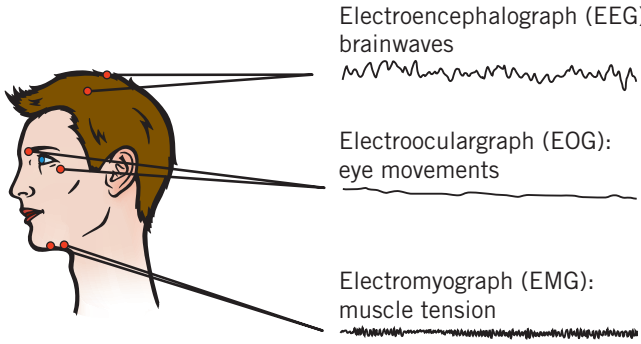


Figure 1.23 EEG, EMG and EOG recordings tend to be made simultaneously on continuously moving chart paper.

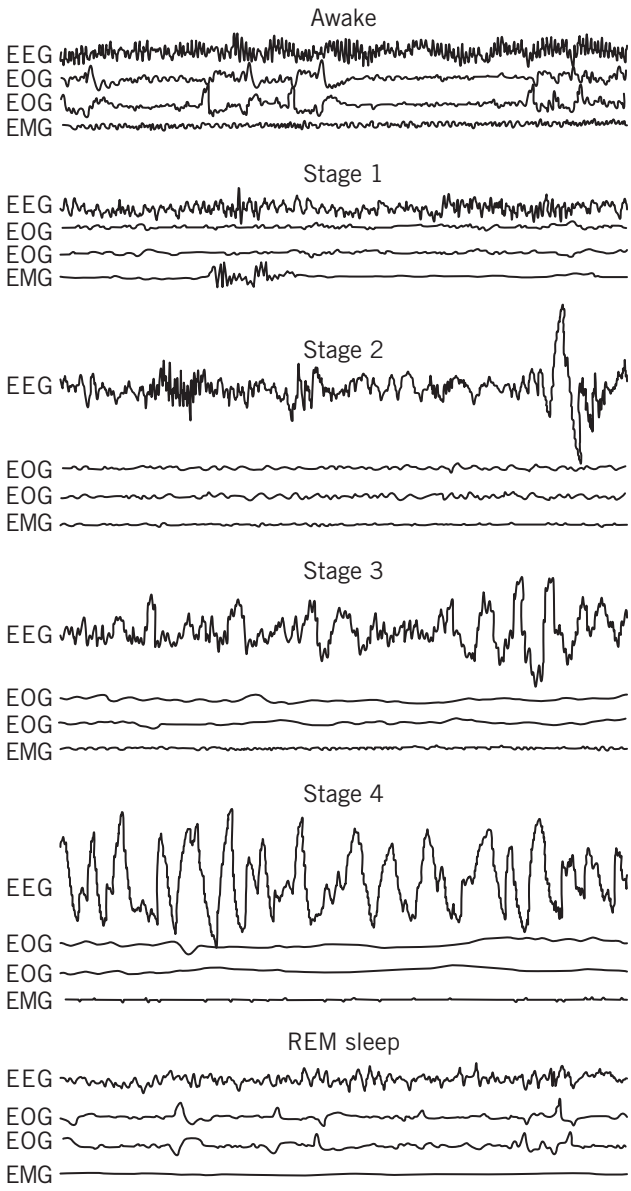


Figure 1.24 EEG, EMG and EOG recordings of a young adult

THE SLEEP CYCLE

When you are awake and alert, a pattern of beta waves indicates that the brain is active. When we start to relax, the beta waves shift to a pattern of larger and slower waves called alpha waves. These waves occur when you are about to fall asleep and you allow your thoughts to drift. This is called a hypnogogic state and it can last for several minutes. The

electrooculargraph (EOG)
A machine used to detect, amplify and record the electrical activity of the muscles surrounding the eyes

electromyograph (EMG)
A machine used to record the electrical activity created by active muscles of the body, using electrodes attached to the skin's surface

atonia
A lack of tone in the muscles, or muscle paralysis, experienced during dream sleep

hypnogogic state
A state that is experienced just before falling asleep and is characterised by slow, rolling eye movements and deep relaxation

hypnogogic state is characterised by slow, rolling eye movements as detected on an EOG. People in a hypnogogic state sometimes see vivid mental images or flashes of light and colour, which are known as hypnogogic images. These images may occur when entering sleep, and although they are somewhat dream-like, they are usually not associated with dreaming. As you fall asleep, your breathing becomes slow and regular, your pulse rate slows and your body temperature drops. Soon after, you enter the first cycle of sleep.

Sleep is broken into two distinct types: rapid eye movement (REM) and non-rapid eye movement (NREM) sleep. When first falling asleep, we experience the first stage of NREM sleep. NREM sleep is broken into four distinct stages: Stages 1, 2, 3 and 4. In each stage, the sleep experienced becomes progressively deeper.

The sleeper initially enters Stage 1, and this is the only time they will enter Stage 1 NREM sleep during that particular period of sleeping. After NREM Stage 1, the sleeper progresses through the subsequent Stages (2, 3 and 4), gradually entering deeper sleep. Once they have reached Stage 4, the sleeper then goes back through Stages 3 and 2 in reverse order. Instead of entering Stage 1 NREM sleep again, the sleeper moves from Stage 2 into their first period of REM sleep. The cycle then begins again: NREM Stage 2 > NREM Stage 3 > NREM Stage 4 > NREM Stage 3 > NREM Stage 2 > REM. Every cycle lasts approximately 90 minutes. As the night progresses, the sleep becomes less deep and the time we spend in NREM sleep becomes shorter while the time we spend in REM sleep lengthens. Close to the end of a night's sleep we can be spending up to an hour in REM sleep during one cycle (see Figure 1.25).

CHECK YOUR UNDERSTANDING 1.5

1 Indicate whether the following statements are true (T) or false (F).

- **a** Sleep is a part of normal waking consciousness.
- **b** The need for sleep is innate in humans.
- **c** A sleep cycle lasts for approximately 90 minutes.
- **d** There are three distinct types of sleep.
- **e** When external cues are removed, the sleep–wake cycle lasts for exactly 24 hours.

2 The part of the brain that is involved in arousal is known as the _____.

3 Sleep research typically takes place in a _____.

4 Match each measure for recording sleep with its techniques for measurement.

a	Electroencephalograph	**i**	A device that records the electrical activity of muscles of the body
b	Electrooculargram	**ii**	A device that records the electrical activity of the brain
c	Electromyograph	**iii**	A device that records the electrical activity of the muscles around the eyes

5 The hypnogogic state is chacterised by slow, rolling eye movements and is most typically experienced:

- **A** as we begin to fall asleep.
- **B** during deep sleep.
- **C** during REM sleep.
- **D** as we begin to wake from sleep.

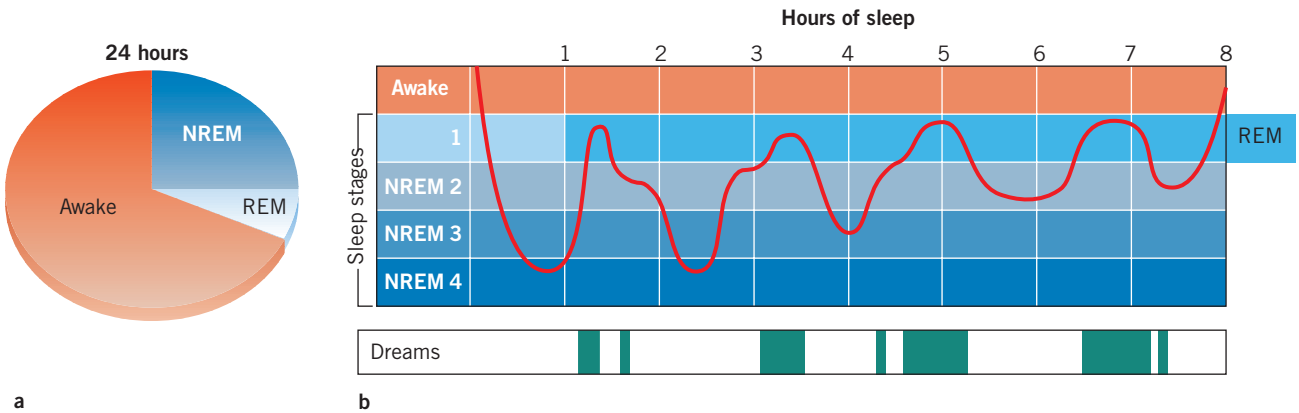


Figure 1.25 a The average proportion of time an adult spends in REM and NREM sleep during a 24-hour period; b Typical changes in sleep stages over one night, including periods of dreaming

NREM SLEEP

As outlined above, NREM sleep occurs during sleep Stages 1, 2, 3 and 4. During NREM sleep, progressively slower heart and respiratory rates are recorded. There is an increase in growth-hormone secretion, and vigorous stimulation is required to wake the sleeper, especially in Stages 3 and 4. Sweating and shivering due to temperature changes occur during NREM sleep, and stop during REM sleep.

Unlike REM sleep, which is characterised by dreaming, NREM sleep is dream-free approximately 90 per cent of the time (Jouvet, 1999). The amount of time spent in NREM sleep increases after physical exertion, which suggests that NREM sleep helps us recover from fatigue incurred during the day. In comparison, daytime stress tends to prompt an increase in REM sleep.

Stage 1 NREM sleep

As you start to relax, you enter Stage 1 NREM sleep. Your heart rate slows, breathing becomes irregular and your muscles relax. This may trigger a hypnic jerk, or reflex muscle-contraction, throughout the body.

Stage 1 sleep, also known as light sleep, is marked by alpha brainwaves: low–medium in amplitude and medium–high in frequency. As you progress through Stage 1, theta waves begin to appear. So, although the brainwaves are irregular, they become higher in amplitude and lower in frequency.

Stage 1 lasts for approximately 2–10 minutes. People awakened during this stage may or may not feel as if they have been sleeping.

Stage 2 NREM sleep

As sleep deepens, body temperature drops, and physiological responses such as heart and respiratory rate continue to slow down. Stage 2 sleep is a fairly solid type of sleep; however, the sleeper is still receptive to external stimuli as they can be woken by a loud noise. The EEG indicates that there is a high prevalence of theta-wave activity at this time. Theta brainwaves have a low–medium frequency, with medium–high amplitude activity. The EEG recording also begins to include sleep spindles, which are bursts of distinctive brainwave activity, indicated by a short burst of high-frequency brainwaves. Spindles seem to mark the true boundary of where sleep begins.

The EEG also shows that Stage 2 sleep is characterised by a phenomenon known as a K-complex. A K-complex is a single, large burst of high-amplitude brainwaves that is thought to be involved in memory consolidation.

Stage 2 sleep lasts for approximately 20–30 minutes. Most of the time, if a person is awakened within four minutes of spindles appearing they will report that they felt as if they were asleep.

Stage 3 NREM sleep

In Stage 3 sleep, physiological responses begin to steady. Theta waves continue to appear; however, delta brainwaves also begin to appear. This is known as the emergence of slow wave sleep (SWS). Delta waves are high in amplitude and low in frequency and their presence signals deeper sleep and a further loss of consciousness.

Stage 3 is a transitional stage and lasts for approximately 3–10 minutes. In this stage, the sleeper is in quite a deep sleep and is therefore more difficult to wake than in earlier stages.

Stage 4 NREM sleep

Deep sleep is reached after about an hour of entering the sleep cycle. In Stage 4 sleep, brainwaves become almost pure delta waves. If a sleeper is woken from Stage 4 sleep by a very loud noise, they will wake in confusion and may not recall hearing the noise. They may also take a few minutes to orientate themselves.

Stage 4 can last for approximately 20–30 minutes, but decreases in length as the night progresses. It is during Stage 4 sleep that we see the appearance of sleep problems such as sleep-walking and bed-wetting.

REM sleep
A type of sleep characterised by brainwaves with high frequency and low amplitude; the muscles of the body are in a state of paralysis and dreams may be experienced

NREM sleep
A type of sleep that is broken into four stages, where the sleeper falls into a deeper and deeper sleep as the stages progress; characterised by relaxation of the muscles, a slowing down of physiological functions and brainwaves that decrease in frequency and increase in amplitude

hypnic jerk
A reflex muscle contraction that occurs during Stage 1 NREM sleep as the body is relaxing

sleep spindles
A type of brain activity characterised by a short burst of high-frequency brainwaves, experienced during Stage 2 NREM sleep

K-complex
A short burst of high-amplitude brainwaves, experienced in Stage 2 NREM sleep

slow wave sleep (SWS)
A sleep state characterised by the emergence of delta waves; SWS is experienced during Stages 3 and 4 NREM sleep

[ISBN 9780170182966]

In this book, we have treated all four stages of NREM sleep separately. In 2007, however, the American Academy of Sleep Medicine (AASM) combined Stages 3 and 4 NREM sleep to become one stage: Stage 3. Previously considered a transitional stage, the AASM now considers Stage 3 to include all deep sleep where delta waves are present (Schulz, 2008).

REM SLEEP

If you watch a person who is asleep, you may be able to see which stage of sleep they are experiencing by noticing whether their eyes occasionally move under the eyelids. These movements, known as *rapid eye movements*, are indicative of a sleeper experiencing REM sleep.

Rapid eye movements are strongly associated with dreaming. Roughly 85 per cent of the time, people awakened during REM periods report vivid dreams. In fact, the brain is so active during REM sleep that EEG readings look as if the person is awake (Hobson, et al., 1998). Watch 'Videolink: REM sleep' to see a sleeper's eyes in action during REM sleep.

VIDEO
REM sleep

EEG recordings during REM sleep show a saw-tooth pattern of beta-like waves of low amplitude and high frequency, similar to those experienced when awake and alert. Although the brainwaves resemble alertness, REM sleep is actually considered quite a deep sleep because it is difficult to wake an individual in this stage. This is one reason that REM sleep is referred to as *paradoxical sleep*. The word 'paradoxical' means 'something that contradicts itself'. For example, during REM sleep the heart beats faster, breathing is more rapid and irregular, blood pressure varies, the genitals become aroused and the eyes dart around in their sockets. Yet with all of this internal activity going on, the body appears totally relaxed – in fact, the muscles are in a state of atonia, or paralysis.

REM sleep also seems to help us sort and consolidate memories formed during the day. Although we still have much to learn about sleep, it is clear that REM sleep and dreaming are vital for keeping the brain functioning properly (Hobson, 1999). REM sleep may increase dramatically when there is some sort of emotionally-charged event in a person's life, such as a death in the family, trouble at school or family conflict. However, on average, REM sleep totals about 90 minutes per night. The first period of REM sleep may be as brief as a few minutes, and the final period of REM sleep may last up to one hour.

Table 1.5 compares the differences between NREM and REM sleep.

Figure 1.26 shows EEG recordings of the brainwaves demonstrated during REM and each stage of NREM sleep.

Due to the distinct differences in NREM and REM sleep, measurement of physiological responses can indicate which stage of sleep an individual is experiencing. An EEG indicates beta-like (REM) or alpha–delta (NREM) brainwaves; an EOG can monitor the presence of rapid eye movement. We would also expect that if heart rate, GSR and body temperature were low, the individual would be experiencing NREM sleep, whereas elevated levels would indicate REM sleep.

Table 1.5 Some of the differences between NREM and REM sleep

	NREM SLEEP	REM SLEEP
EYE MOVEMENTS	Non-rapid eye movements	Rapid, jerky eye movements
BRAINWAVES	Alpha to delta waves	Beta-like waves
PHYSIOLOGICAL AROUSAL	Decreases	Increases
MUSCLES	Some sharp movements and a small amount of muscular activity	Atonia – the muscles are in a state of paralysis
DREAMS	Not likely to be present but when they are, they are illogical	Common
DURATION	Decreases as the night progresses	Increases as the night progresses
TYPE OF REPLENISHMENT	Replenishes the body	Replenishes the mind

CHECK YOUR UNDERSTANDING 1.6

1 Stage 1 sleep is characterised by contraction of the muscles as the body relaxes. This is known as:
   - **A** the hypnogogic stage.
   - **B** a hypnogogic jerk.
   - **C** a hypnic jerk.
   - **D** an anti-contraction.

2 During Stage 2 NREM sleep, a short burst in brain activity characterised by a high-frequency brainwave is known as a _____, whereas a sharp burst in amplitude is known as _____.

3 During which stage of sleep does sleep-walking occur?
   - **A** Stage 1 sleep
   - **B** Stage 2 sleep
   - **C** Stage 3/4 sleep
   - **D** REM sleep

4 During _____ sleep the body enters a state of paralysis. This is known as _____.

Continued

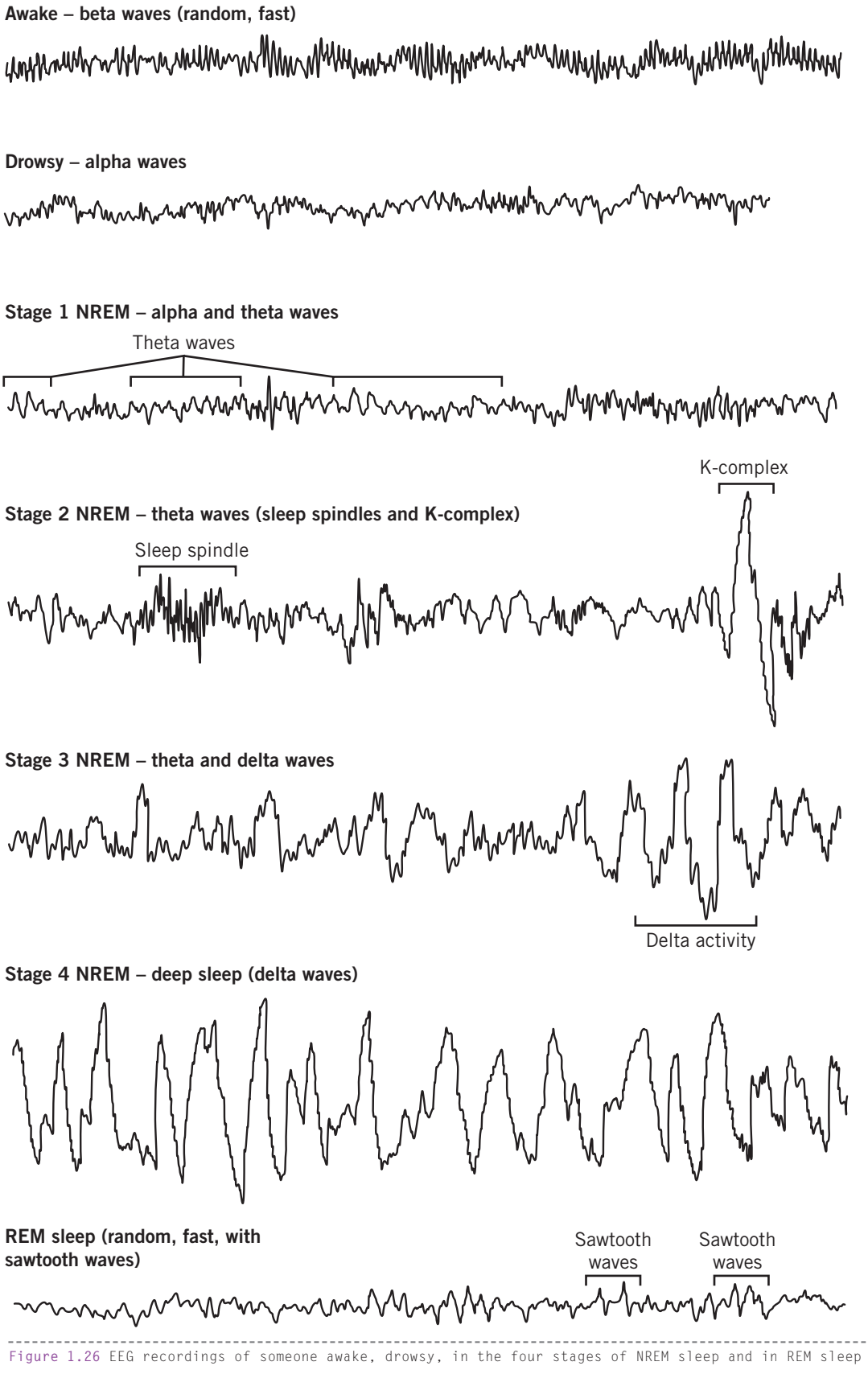


Figure 1.26 EEG recordings of someone awake, drowsy, in the four stages of NREM sleep and in REM sleep

5 Match each stage of sleep with the brainwave or combination of brainwaves experienced in each stage.

a Stage 1 sleep	**i** Delta waves
b Stage 2 sleep	**ii** Alpha and theta waves
c Stage 3 sleep	**iii** Theta waves
d Stage 4 sleep	**iv** Beta-like waves
e REM sleep	**v** Theta and delta waves

Dreaming

Dreams are a series of images, thoughts and emotions that pass through our mind during sleep. Approximately 80 per cent of dreams are experienced during REM sleep. Dreams experienced during this stage tend to be longer, clearer and more detailed than thoughts and images that occur in NREM sleep (Shafton, 1995). Studies have shown that brain areas associated with imagery and emotion become more active during REM sleep, which may explain why REM dreams tend to be more vivid than those experienced during NREM sleep (Braun, Balkin & Herscovitch, 1998).

As already mentioned, your body becomes quite still when in REM sleep, as if you are paralysed (atonic). But imagine if this were not the case – what would be the results of acting out some of your dreams? REM-sleep paralysis *can* actually fail, and when it does, some hilarious – and dangerous – night-time escapades can occur. People may thrash violently or leap out of bed and attack their bed partners. A lack of muscle paralysis during REM sleep is called REM behaviour disorder. One documented patient suffering from this disorder tied himself to his bed every night. That way, he could not jump up and crash into furniture or walls (Shafton, 1995).

The purpose of sleep

We know that we have a biological need for sleep. But why is this so? There are two main theories that seek to explain the purpose of sleep. Some theorists believe that sleep helps to restore and replenish the mind and body, while others say it helps with survival.

RESTORATIVE THEORY

The restorative theory suggests that sleep is vital for replenishing and revitalising the physiological processes that keep the mind and body functioning at optimal level. NREM sleep is essential for the restoration of the body, including repair of muscle and tissue damage and muscle fatigue. REM sleep is essential for the restoration of mental processes, allowing the brain time to regenerate and re-focus.

Evidence for this theory stems from research conducted into the amount of time that individuals who partake in strenuous physical activity (such as marathon runners) spend in NREM sleep. It has been found that after completing vast amounts of physical exercise the amount of time spent in NREM sleep increases during that night's sleep, and continues to stay above average on subsequent nights following the activity. 'Focus on research: Exercise and sleep' looks at evidence for this theory.

However, one criticism of restorative theory is that people who are bedridden (and therefore get no physical activity) still experience the same amount of NREM sleep as non-bedridden individuals who undertake average amounts of activity.

FOCUS ON RESEARCH **Exercise and sleep**

Much research has been undertaken to investigate the influence of exercise on sleep. The restorative theory suggests that during Stages 3 and 4 sleep (slow-wave sleep [SWS]), the body is replenished. If this is the case, there should be an increase in the amount of SWS experienced after completing vigorous physical activity. The aim of a study conducted by Dworak, Wiater, Alfer, Stephan, Hollmann and Strüder (2008) was to investigate the effects of moderate and high-intensity physical exercise on sleep patterns in school-aged children.

Eleven healthy children (11–13 years old) were recruited for the study. They underwent two exercise sessions on a bicycle ergometer. The sessions were performed 3 to 4 hours prior to bedtime, lasted 30 minutes, and varied in intensity. The moderate-intensity exercise was at 65–70 per cent of maximal heart rate, while the high-intensity exercise was at 85–90 per cent of maximal heart rate.

The results demonstrated that only high-intensity exercise resulted in a significantly elevated SWS proportion and less time spent in Stage 2 sleep. The results therefore suggest that exercise intensity is responsible for the effects on SWS in children.

Source: Adapted from Dworak et al. (2008) Increased slow wave sleep and reduced stage 2 sleep in children depending on exercise intensity. *Sleepmedicine, 9(3),* pp. 266–72.

QUESTIONS

1 Write a possible operational hypothesis for this study.
2 Identify which condition was the control condition and which was the experimental condition.
3 Identify the independent variable in this study.
4 Identify the dependent variable in this study.

It is thought that REM sleep may stimulate the developing brain early in life. Newborn babies spend eight or nine hours a day – approximately 50 per cent of their total sleep time – in REM sleep. In adulthood, REM sleep only occupies approximately 20 per cent of our sleep time. The decrease in the amount of time spent in REM sleep also supports the restorative theory, as it explains that as we age

and are not learning so much new information, the need for REM sleep also decreases. Further evidence to support this theory stems from research that shows that during periods of high mental stress and emotional problems there is an increase in the amount of REM sleep an individual experiences.

ADAPTIVE THEORY

The adaptive theory (or preservation theory) of sleep suggests that we undertake periods of inactivity, or sleep, when we do not need to engage in activities that are important to our survival.

The adaptive theory takes into consideration the amount of time an animal needs to stay awake in order to complete the activities required for their survival, such as hunting and eating. According to this theory, the remaining hours of the day are best spent asleep, because sleep does not expend much energy and also keeps the animal out of sight of predators.

For example, large, grazing animals such as elephants and cows need to consume a lot of calories in order to obtain the energy they need to live. As the type of food (vegetation) they eat contains few calories, they must consume a lot of it in order to meet their requirements. This takes a lot of time, and this is why elephants only sleep for between three and four hours a day – it is all they have time for! If elephants slept for eight hours a day, they probably wouldn't have enough wake time for all their necessary activities and requirements (Dworetzky, 1997).

Smaller animals such as bats and possums do not need to consume very much food in order to meet their calorific requirements, so they need few waking hours to eat and conduct other activities necessary for survival. They spend approximately 20 out of 24 hours asleep.

As adult humans, we need approximately 16 waking hours to sustain our lifestyle. Therefore, we spend an average of eight hours sleeping per day. Figure 1.27 compares the sleeping times of various animals.

Read 'A closer look: Animal sleep patterns' to learn more interesting facts about other species' sleep patterns.

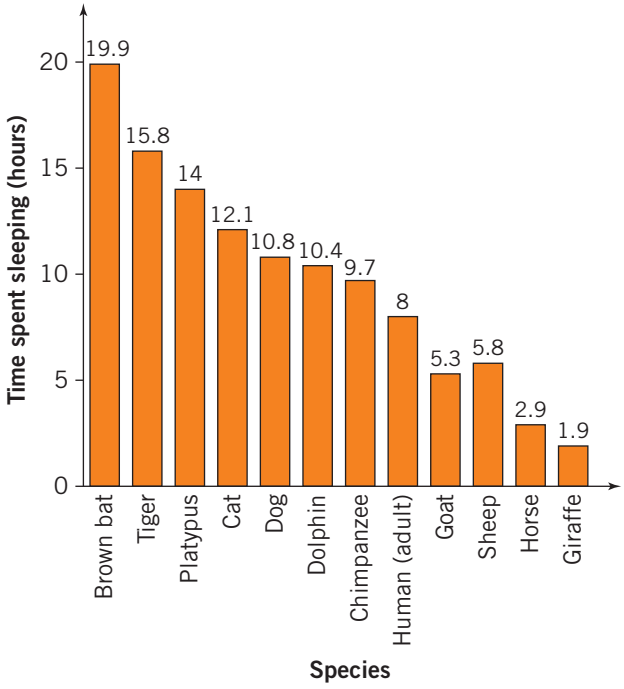


Figure 1.27 The amount of sleep required by different animals

A CLOSER LOOK

Animal sleep patterns

Some interesting facts about other species' sleep patterns:

- All mammals experience REM and NREM sleep. Birds do as well; however, their cycles are shorter.
- Small mammals sleep for 10 to 20 hours a day, whereas large mammals sleep for two to 10 hours a day.
- Brown bats are the champion sleepers, needing almost 20 hours a day, while giraffes get by on only two hours a day.
- Hippopotami sleep under the water and then wake up to go to the surface to breathe.
- Dolphins keep one half of their brain awake so they are always only half asleep and can keep on swimming while sleeping.
- Horses lock their knees into the standing position so they don't fall over while they sleep.
- Elephants and rhinoceroses cannot sleep lying on their sides for too long, as they would drown from the fluid entering their lungs. This is due to the pressure of their bulky bodies.

Source: Adapted from Zoofriends (2007) *The Ark files – Sleeping on the job.* <www.zoofriends.org.au>

Another facet to the adaptive theory is the proposal that sleeping actually protects animals from attack. When an organism is asleep, it is not moving, and is therefore less likely to attract the attention

dream
A series of images, thoughts and emotions that passes through the mind during sleep

REM behaviour disorder
A disorder whereby there is a failure of the muscle paralysis that occurs during REM sleep

restorative theory
A theory that states that sleep is vital for replenishing and revitalising the mind and body to keep them functioning at optimal levels

adaptive theory
A theory that suggests that we have periods of inactivity, or sleep, when we do not need to engage in activities important to our survival

[ISBN 9780170182966]

Table 1.6 Comparison of the two theories of sleep

THEORY	EXPLANATION	EVIDENCE FOR THEORY	CRITICISMS OF THEORY
Restorative theory	A theory that states that sleep is vital for replenishing and revitalising the mind and body to keep them functioning at optimal levels	Research shows that following vigorous activity there is an increase in NREM sleep as the body needs more replenishing. Similarly, we experience longer periods of REM after being deprived of REM sleep.	This theory has been criticised because, while dreaming, the brain is active when it is supposed to be conserving energy. People that are not active (bedridden) experience as much NREM sleep as active individuals.
Adaptive theory	A theory that suggests that we have periods of inactivity, or sleep, when we do not need to engage in activities important to our survival, and animals that are sleeping are less likely to be attacked	Animals that have few physical needs sleep for longer than animals with greater physical needs.	One of the activities necessary for survival is the simple act of staying alive. Small animals with many predators should therefore stay awake – not be asleep – for much of the day so they can be alert to attack.

of predators than when it is awake. So, in this way, sleep protects the organism from harm.

Small animals usually have the greatest number of predators and are therefore in danger much of the time. One criticism of the adaptive theory is that if small animals sleep a lot, they are left defenceless and are more vulnerable to attack. One of the activities necessary for survival is the simple act of staying alive; therefore, if an animal is small and has many predators, its best chance of survival is to be on guard and watching for potential threats – not to be asleep. Criticisms of the adaptive theory therefore state that if the theory relates to conducting activities important for survival, then small animals with many predators should spend most of their hours awake rather than asleep.

Table 1.6 compares the two theories that seek to explain the purpose of sleep.

Sleep deprivation

So far in this chapter, we have explored sleep stages and cycles. But what happens when we do not sleep? In 1959, to raise money for charity, American DJ Peter Tripp agreed to forgo sleep for 200 hours. He spent much of this time in a glass booth in Times Square, New York. All too soon, Tripp's fight to stay awake turned brutal. After 100 hours, he began to have hallucinations: he saw cobwebs in his shoes, and he watched in terror as a tweed coat became a suit of 'furry worms'. When Tripp went to a hotel to change his clothes, a dressing-table drawer seemed to burst into flames. After 170 hours, Tripp was in agony. He struggled with simple thoughts and reasoning, and had memory problems. His brainwave patterns looked like those of someone asleep, and he was no longer sure who he was. By the end of 200 hours, Tripp was unable to distinguish between his waking nightmares, hallucinations and reality (Luce, 1965).

How long might a person go without sleep? With few exceptions, four days or more without sleep becomes unbearable for anyone. Nevertheless, longer periods without sleep are possible. The world record is held by Californian Randy Gardner, who, at 17 years of age in 1964, went 268 hours (11 days) without sleep. At various times, Randy experienced irritability, memory lapses, difficulty concentrating and difficulty in naming common objects. Surprisingly, Randy needed only 14 hours of sleep to recover (Coren, 1996).

It is not necessary to completely replace lost sleep. As Gardner found, most symptoms of sleep deprivation are reversed by a single night's rest. After periods of sleep deprivation, sufferers report that any side effects of the deprivation disappear with one night of uninterrupted sleep. People who have been sleep-deprived may report sleeping for a longer period of time than normal in the few nights following deprivation, but there is generally no need to replace the total amount of sleep that has been lost.

PSYCHOLOGICAL EFFECTS OF SLEEP DEPRIVATION

Severe sleep loss can cause a temporary psychological problem known as sleep-deprivation psychosis. Sleep-deprivation psychosis is a major disruption of mental and emotional functioning brought on by lack of sleep, and has symptoms such as confusion, disorientation, delusions and hallucinations. Hallucinations may be visual, such as seeing yourself wearing a 'coat of furry worms' (as in the case described above); or tactile, such as feeling cobwebs on your face. Fortunately, it is uncommon: hallucinations and delusions rarely appear if a person has had fewer than 60 hours of wakefulness.

Figure 1.28 When an individual is sleep-deprived, it is difficult to maintain attention and concentration when undertaking the monotonous task of a long car drive.

In general, people who have not slept for two or three days show little impairment on relatively interesting or complex mental tasks (Binks, Waters & Hurry, 1999). Simple and routine tasks, however, seem to be very difficult for the sleep-deprived, and in these tasks most people experience problems with attention and concentration. This is particularly important to note for vehicle drivers, pilots or machine operators as, for these people, making a mistake when conducting simple or routine tasks may prove fatal (see Figure 1.28). If a task is monotonous (such as factory work), no amount of sleep deprivation is safe (Gillberg & Akerstedt, 1998).

It is not necessary to go completely without sleep to feel the effects of sleep loss. One-third of all adults and most teenagers do not get enough sleep each night. Such partial sleep deprivation may leave many people irritable, aggressive, anxious, lacking emotional control, exhausted, groggy, paranoid and/or unproductive by midday. The loss of just one hour of sleep a night can affect your mood; frontal lobe functioning; memory; ability to pay attention in class; and reaction-time and decision-making while driving a car, riding a bike or operating machinery (Everson, 1998).

PHYSICAL EFFECTS OF SLEEP DEPRIVATION

The most typical physical reactions to sleep deprivation are trembling hands, drooping eyelids, staring and inability to focus the eyes, increased pain sensitivity, headaches and general discomfort (Naitoh, Kelly & Englund, 1989). The pituitary gland, located at the base of the brain, releases growth hormone when you are in deep sleep, so lack of sleep, particularly NREM sleep, may cause physical growth processes to be interrupted, especially in children and teenagers. Young people spend the most amount of time in deep sleep, and as they get older they spend less time in deep sleep and so produce less growth hormone (Pekkanen, 1982).

With less sleep, less glucose is metabolised, meaning muscle strength and endurance is reduced. The ability to perform fine-motor functions such as handwriting, computer skills or operating machinery is also impaired. Your immune system is also weakened, which results in an increased chance of contracting infections. When we are sleep-deprived our appetite increases, and this can lead in the long term to weight gain and obesity (Ansch et al., 1988).

REM SLEEP DEPRIVATION

Individuals who are sleep-deprived suffer a variety of symptoms, but what is the effect of individuals being deprived of only REM sleep? A sleep researcher conducted a study where volunteers were woken each time they entered REM sleep. Soon, the volunteers' attempts to dream grew more urgent. By the fifth night, participants tried to enter REM sleep so frequently that many had to be woken 20 or 30 times to prevent them from doing so. The volunteers complained of daytime memory lapses, poor concentration and anxiety. When they were finally allowed to sleep undisturbed, the volunteers experienced more REM sleep than they usually would.

This effect is called REM rebound, whereby a person who has been deprived of REM sleep later 'compensates' by having extra amounts of it. REM rebound probably explains why many alcoholics have horrible nightmares after they give up drinking. Alcohol suppresses REM sleep and sets up a powerful rebound when it is withdrawn. For this reason, it is worth remembering that while alcohol (and other depressant drugs that have a similar effect) may help a person get to sleep, the quality of sleep is greatly reduced (Lobo & Tufik, 1997).

sleep deprivation
Going without or not getting sufficient amounts of sleep

sleep-deprivation psychosis
A disruption of mental and emotional functioning as a result of lack of sleep

REM rebound
The process whereby an individual experiences extra amounts of REM sleep after being deprived of it

Later experiments have shown that missing any sleep stage can cause a rebound for that stage. In general, however, daytime disturbances such as those described previously are related to the total amount of sleep lost, not to the type of sleep lost (Devoto et al., 1999).

SLEEP DEPRIVATION AND SURVIVAL

Following periods of sleep deprivation, sleep is a necessity, not an option. In fact, when we are sleep-deprived the body actually experiences brief periods of sleep known as microsleeps. Microsleeps are short periods where the individual appears to be awake – their eyes may even be open – however, brain activity indicates that they are asleep. Microsleeps are especially prevalent when people who are sleep-deprived complete monotonous tasks. That is why drivers who feel tired are encouraged to take a break or a 15-minute powernap.

The need for sufficient amounts of sleep is clearly evident when looking at the effects of sleep deprivation. Individuals who do not get sufficient amounts of sleep are subject to a decrease in cognitive functions such as memory and planning, a slowing of reaction times and changes to mood and behaviour. Going without sleep for between 17 and 19 hours is the equivalent of having a BAC reading of 0.05 (Williamson & Feyer, 2000). Poor sleep patterns can have an adverse effect on an individual and as such the need for sleep, especially during adolescence, is of great importance.

Sleep–wake cycle across the lifespan

As discussed earlier in this chapter, the need for sleep is innate. The amount of sleep that is needed across the lifespan, however, varies with age.

When we are infants, the world is full of new and exciting things. There are things to discover and explore and, as a result, our brain is making many new meaningful connections. On average, babies sleep for approximately 16 hours a day, and 50 per cent of their sleep time is spent in REM sleep. This is supportive evidence for the restorative theory, which would suggest that babies need a lot of REM sleep to help replenish the mental processes they exhaust when learning information during the day. Another explanation as to why babies need so much REM sleep is because it is believed that newborn babies lack the capacity for long, deep NREM sleep; a capacity that only develops with brain maturation during childhood and adolescence (Hobson, 2001).

As we continue to age, the composition of sleep continues to change. The capacity for deep sleep experienced in NREM falls around the ages of 30 to 40, which leads to an inability to sustain sleep and feel deeply rested by it (Hobson, 2001). As people enter old age, they sleep less than they did earlier in life – for approximately six hours on average. Only 20 per cent of their sleep time is spent in REM sleep.

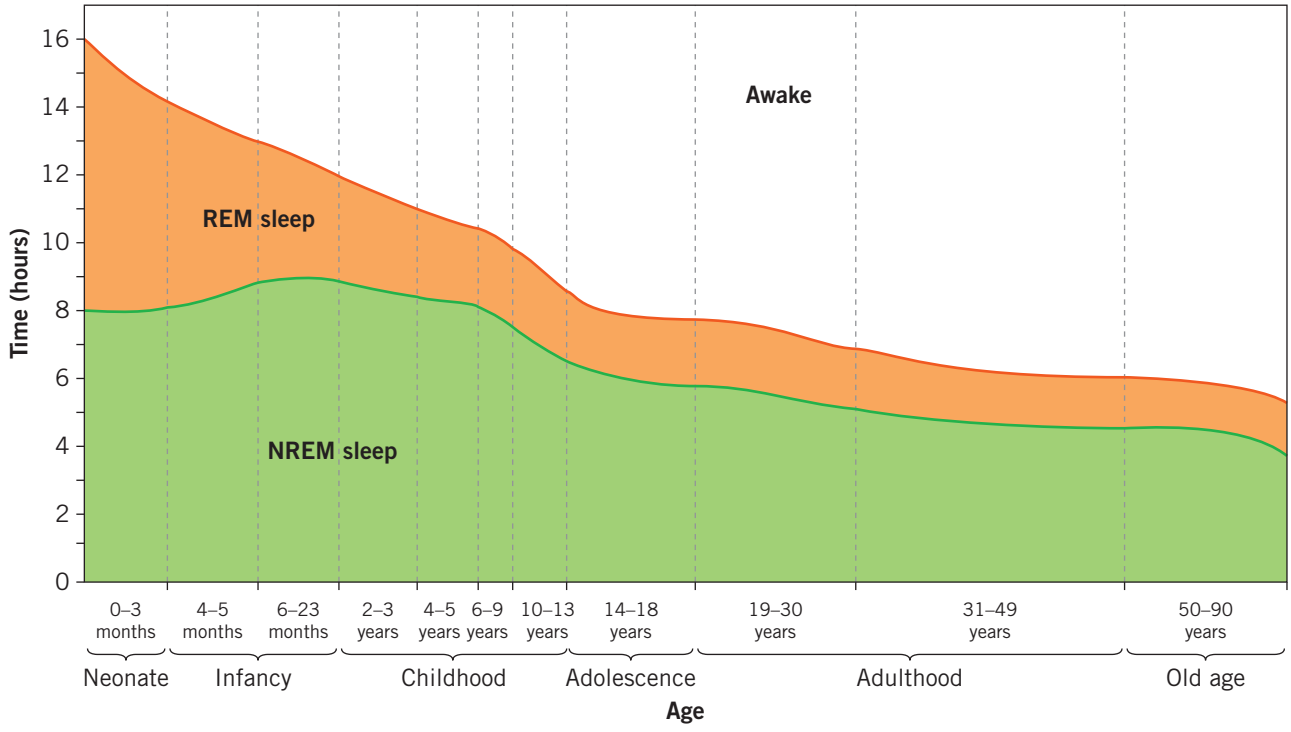


Figure 1.29 The amount of time we spend asleep decreases as we age, as does the percentage of time spent in REM sleep. (Graph not to scale)

Figure 1.30 There are many tips to help ensure sleep comes easily.

The percentage of time spent in NREM and REM sleep across the lifespan is shown in Figure 1.29.

So how much sleep should we be getting? The University of South Australia's Dr Sarah Jay recommends nine hours for teenagers and seven or eight hours of sleep per night for adults (Reid, 2008). Complaints of poor-quality sleep or insufficient amounts of sleep are common among teenagers, especially those with increased study demands and who try to maintain a balanced lifestyle between school, work, sport and social commitments. The following are some tips to try to ensure sleep comes easily (see Figure 1.30).

- Make sleep a priority; don't skimp on the amount of sleep required just to fit in other activities.
- Regularise your sleep cycle; go to bed and wake up at the same time every night/morning.
- Don't go to sleep unless you are tired; this may lead to shallow or fragmented sleep.
- Manage your stress; wind down both physically and mentally.
- Have a relaxed atmosphere in the bedroom.
- Don't drink caffeine within six hours of bedtime.
- Stop smoking.
- Exercise before dinner time (Reid, 2008).

DELAYED SLEEP ONSET DURING ADOLESCENCE

Many teenagers report that they are not tired late at night when others are going to bed. Parents see this as a ploy to stay up late; however, research has shown that in late puberty, the body secretes the sleep-related hormone melatonin at a different time than it normally does for other age groups (Stanford University, 1999). Melatonin regulates the sleep–wake cycle by causing us to become drowsy. If melatonin is not released in the evening, then an adolescent may find it hard to get to sleep. For instance, you may have been told to go to bed at 10 p.m., but you lay awake until 1 a.m. waiting to fall asleep.

At about 7:30 p.m. an adolescent feels wide awake and fully alert, unlike an adult who is starting to 'wind down' and feel sleepier as the evening

microsleep
A short period of sleep, where the individual appears to be awake

circadian rhythm
Our internal body clock, which cycles approximately every 24 hours

progresses. For a teenager, 'wind-down' time takes place much later (Stanford University, 1999). If this problem is persistent, it is known as delayed sleep phase disorder. Delayed sleep phase disorder is diagnosed when an individual's internal body clock, known as a circadian rhythm, does not match the external environment. Sufferers usually fall asleep a couple of hours after midnight and, if they are allowed the full amount of sleep (approximately eight hours), they function completely normally (Swierzewski, 2000). However, this is often not the case, as school and work demands lead to early awakening, which means a sufferer has not obtained a sufficient amount of sleep. Their need for sleep is then worsened.

CHECK YOUR UNDERSTANDING 1.7

1 There are two main theories that seek to explain why we sleep: the _____ theory that suggests that sleep allows the body to replenish and the _____ theory that suggests that we remain inactive when we are conducting activities necessary for our survival.

2 For each of the following symptoms of sleep deprivation, indicate whether they are psychological (PSY) or physical (PHY) symptoms.

- **a** Microsleeps
- **b** Paranoia
- **c** Difficulty concentrating
- **d** Droopy eyelids
- **e** Irritable
- **f** Colds/flu

3 Rosie has been awake for four days straight after being involved in a psychology experiment on sleep deprivation. How many nights will she need to sleep to eliminate any side effects of her sleep deprivation?

- **A** No nights, as there are no side effects after only four days
- **B** One night
- **C** Two nights
- **D** Four nights

4 Match each stage of the lifespan with the average number of total hours spent asleep per night.

a	Newborn	**i**	eight hours
b	Child	**ii**	six hours
c	Adolescent	**iii**	11 hours
d	Adult	**vi**	nine hours
e	Old age	**v**	16 hours

5 The hormone released in the evening to cause drowsiness is known as _____.

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Chapter summary

WORDCHECK TEST YOURSELF

Consciousness:

- Human consciousness is defined as all the perceptions, sensations, memories, thoughts and feelings one is aware of at any given moment.
- René Descartes questioned whether anything existed with certainty. Knowing that he was a thinking being and had a conscious awareness led to the development of his expression, 'I think, therefore I am'.
- William James compared human consciousness to a stream, in that it is continuous and ever-changing, and because there is never a distinct beginning or end to a thought.
- Human consciousness is divided into two main levels of consciousness: normal waking consciousness (NWC) and altered states of consciousness (ASCs).

Difference between NWC and an ASC:

- Examples of ASCs include states of hypnosis, meditation, daydreaming, sleep, anaesthesia, coma and being under the influence of alcohol or drugs.
- NWC is characterised by selective attention, controlled processes, automatic processes and divided attention.
- During NWC, humans have high levels of attention and awareness; high content limitations; a reliable memory; logical, controlled and rational thoughts; reliable emotional awareness; good self-control; good awareness of sensations and a realistic sense of time.
- During ASCs, humans may have lower attention and awareness of internal and external stimuli; reduced content limitations; poor memory; illogical and bizarre thoughts; heightened, blunted or inappropriate emotional experiences; poor self-control; blunted or sharpened sensations; and an inaccurate sense of time.

Measuring consciousness:

- Human consciousness is a hypothetical construct, which means it cannot be directly observed or measured. Thus, it has to be indirectly measured.
- Consciousness is measured indirectly using a variety of physiological devices, such as the electroencephalograph (EEG) for brain activity, an electrocardiograph (ECG) for heart rate, a thermometer for body temperature and the galvanic skin response (GSR) for electrical conductivity of the skin.
- An EEG measures the brain's electrical activity and tells us which brainwaves are prominent at any given moment. The four types of brainwaves are beta, alpha, theta and delta waves. These brainwaves differ in their amplitude and frequency.

Studying sleep:

- Sleep research is typically conducted in a sleep laboratory. It is a controlled environment that uses participants' self-reports, video recordings and electronic recording devices to measure sleep.
- The electromyograph (EMG) detects, amplifies and records the electrical activity of active muscles in the body. It could be used to detect hypnic jerks experienced in Stage 1 NREM sleep and atonia experienced during REM sleep.
- The electroencephalograph (EEG) detects, amplifies and records the electrical activity of the brain, through brainwaves. It could be used to detect the presence of delta waves indicating deep sleep, or beta-like waves indicating REM sleep.
- The electrooculargraph (EOG) detects, amplifies and records the electrical activity of the muscles around the eyes. It could be used to detect whether an individual was experiencing NREM or REM sleep.

What is sleep?

- Sleep is an innate biological rhythm essential for survival.
- There are two basic sleep states: rapid eye movement (REM) sleep and non-rapid eye movement (NREM) sleep. REM sleep is strongly associated with dreaming.
- NREM sleep occurs in four stages. Stage 1 is light sleep and Stage 4 is deep sleep. This type of sleep is characterised by a slowing of physiological functions.
- REM sleep is characterised by an increase in physiological functions, as parts of the body are in a state of arousal; however, at the same time there is complete muscular paralysis (atonia).
- During a night's sleep we cycle through all stages of NREM and REM sleep. Each cycle lasts around 90 minutes, with periods of NREM decreasing as the night progresses and periods of REM increasing.

The purpose of sleep:

- The restorative theory of sleep suggests that sleep is vital for replenishing and revitalising the mind and body. NREM sleep is essential for the restoration of the body and REM sleep is essential for the restoration of the mind.
- The adaptive theory of sleep suggests that a species sleeps at times when it does not need to conduct activities necessary for its survival.

Sleep deprivation:

- Sleep deprivation occurs when we do not get a sufficient amount of sleep. There are many negative side effects of sleep deprivation but all are reversed with a single night of uninterrupted sleep.
- Psychological side effects include irritability, aggression, moodiness, confusion, disorientation, stress, anxiety, paranoia, exhaustion, grogginess, delusions, hallucinations and a lack of reasoning, and impairment of concentration, memory and emotional control.
- Moderate sleep loss mainly affects the ability to perform simple, routine tasks or boring tasks.

There is relatively little impairment on interesting or complex tasks.
- Physical side effects include trembling hands, drooping eyelids, staring and inability to focus eyes, increased pain sensitivity, headaches, decreased production of growth hormone, decreased metabolism, decreased muscle strength, decreased fine-motor function, lowered immunity to illness and increased appetite and weight.
- People derived of sleep also experience microsleeps, which are short periods of sleep where the individual appears to be awake. When deprived specifically of REM sleep people may experience REM rebound when allowed to sleep without interruption.

The sleep–wake cycle:
- Newborn babies require 16 hours of sleep per day, with about 50 per cent of this time being spent in REM sleep.
- Adolescents and adults are required to sleep between seven and nine hours per day, with around 20 per cent of this time being spent in REM sleep.
- The elderly sleep for, on average, six hours per night, with around 20 per cent of their time being spent in REM sleep.
- During adolescence, the release of melatonin occurs later in the day and, as a result, creates delayed sleep onset. This in turn leads to a reduction in the amount of sleep experienced each night.

Apply your knowledge and skills

SECTION A: MULTIPLE-CHOICE QUESTIONS

1 Which of the following is not an ASC?
- **A** Reading
- **B** Sleeping
- **C** Daydreaming
- **D** Being under the influence of marijuana

2 Beta waves are found during:
- **A** deep sleep.
- **B** light sleep.
- **C** hypnosis.
- **D** normal waking consciousness.

3 NWC is different from an ASC because:
- **A** in NWC, thoughts are logical and controlled but in an ASC thoughts are rational and illogical.
- **B** in an ASC, memory is often good but in NWC memory is often impaired.
- **C** in an ASC, hallucinations may occur, but in NWC this is unlikely.
- **D** in NWC, thoughts are logical and rational, but in an ASC thoughts may be illogical.

4 Which of the following is the best example of selective attention?
- **A** Driving a car while talking and changing the radio
- **B** Playing a difficult computer game
- **C** Watching cartoons on television
- **D** Having a shower and washing your hair

5 Meditation can decrease a person's experience of pain by:
- **A** releasing adrenalin into the bloodstream.
- **B** activating the sympathetic nervous system.
- **C** releasing sugar into the bloodstream.
- **D** reducing physiological arousal.

6 Lauren underwent hypnosis as a treatment to lose weight. Afterwards, she was surprised to learn that she had been hypnotised for 40 minutes, yet it seemed to her that only five minutes had passed. Lauren had most likely experienced:
- **A** a state of NWC.
- **B** an ASC.
- **C** stream of consciousness.
- **D** an automatic process.

7 Which of the following statements is true of daydreaming?
- **A** Daydreaming is a voluntary process of shifting attention from external thoughts and feelings to internal stimuli.
- **B** Daydreaming is an involuntary process of shifting attention from external thoughts and feelings to internal stimuli.
- **C** Daydreaming is a voluntary process of shifting attention from external stimuli to internal thoughts and feelings.
- **D** Daydreaming is an involuntary process of shifting attention from external stimuli to internal thoughts and feelings.

8 The task of learning how to drive a car can be considered a controlled process because:
- **A** it is likely to interfere with performance of other tasks.
- **B** the level of mental effort required is much less than for other skilled performance tasks.
- **C** the driver must use the controls at all times.
- **D** it allows the driver to have more control of their life.

9 The GSR can best be described as a physiological response that involves a change in the:
- **A** level of resistance of the skin to sweating.
- **B** amount of tension in the muscles of the body.
- **C** level of resistance of the skin to an electrical current.
- **D** number of nerve signals being transmitted from the skin surface to the brain.

10 Craig was having problems sleeping, and spent a night in a sleep laboratory on his doctor's suggestion, so that his brainwaves could be measured. Craig took a long time getting to sleep, but he finally fell into a deep sleep. The doctor used a device called an _____ to determine Craig's brainwave activity. When Craig was in the deep sleep, his brainwaves became _____ and were _____ waves.

A EEG; faster; delta

B EEG; slower; beta

C EEG; slower; delta

D ECG; faster; beta

11 If you suffered sleep deprivation, what type of effect would occur first?

A Hallucinations and delusions

B Loss of ability to pay attention and perform simple routines

C Both long-term and short-term memory loss

D Coma

12 Which brainwaves are characteristic of Stage 1 NREM sleep?

A Beta waves

B Sleep spindles

C Small, irregular waves with some alpha waves

D Delta waves

13 What stage of sleep typically has sleep spindles?

A Stage 1

B Stage 2

C Stage 3

D Stage 4

14 Lexi is 17 years old and has gone to a sleep clinic as she is having difficulty sleeping at night. How much sleep would the staff at the clinic recommend Lexi gets each night?

A 16 hours

B 12 hours

C 8 hours

D 4 hours

15 The belief that REM sleep replenishes the mind and NREM sleep replenishes the body is the basis of the _____ theory of sleep.

A adaptive

B survival

C revival

D restorative

SECTION B: SHORT-ANSWER QUESTIONS

1 Describe William James' theory of consciousness.

2 What are controlled processes? Provide an example to support your answer.

3 Name two devices that can be used to monitor consciousness and explain what they measure.

4 Mark has learnt how to meditate. Name and describe three physiological characteristics Mark is likely to experience while in this ASC.

5 Give one reason why REM sleep is sometimes referred to as paradoxical sleep.

6 Provide three differences between REM and NREM sleep.

7 Your sister wants to stay awake for the next three days so she can study for an upcoming exam. Using your understanding of sleep deprivation, explain two possible physiological effects she may experience.

8 Explain the differences between amplitude and frequency in relation to brainwaves.

9 Explain how an electromyograph (EMG) and an electrooculargraph (EOG) could indicate whether an individual was experiencing REM sleep.

10 Why is there believed to be a delayed sleep onset during adolescence?

SECTION C: EXTENDED-RESPONSE QUESTION

Discuss the differences between normal waking consciousness and an altered state of consciousness. Ensure that you use examples to support your answer and that you discuss the differences between the two states in terms of both physiological and psychological factors. Explain why it is difficult to ascertain whether an individual is in an altered state of consciousness.
This question is worth 10 marks.

SECTION D: ASSESSMENT TASK

Data analysis

An important component of psychology is the conducting of research to learn more about the field. To understand the research you need to analyse the data that you collect. Complete the task below and answer the questions regarding the findings of each experiment.

Task

Find a small group of participants. You could use some friends or your family. You will conduct two sessions (a meditation and a presentation) on two separate occasions with this group of participants.

Meditation session

1 Find a guided meditation recording that you could use for a meditation session. You could use a CD or download a meditation track from the Internet. The session should last for 10 minutes, so make sure your track is long enough. (If you cannot find a track, you can conduct the session in silence.)

[ISBN 9780170182966]

2. Listen to the track and write down four questions about the material your participants will hear. The questions should help you identify whether the participants were concentrating on the track during the session. (If you are conducting the meditation session in silence, write down four noises you will make during the session.)
3. Run a 10-minute meditation session with your participants, playing the track. (If you are conducting a silent session, make sure you make the planned four noises during the session.)
4. At the conclusion of the meditation session, ask participants to record how much time they feel has passed and to answer the questions you wrote about the guided meditation session. (If you conducted a silent meditation, ask them to identify the four noises you made.)

Presentation session

1. On a separate occasion, present information to your participants on a topic of your choice. It could be something you have learnt at school or the latest storyline in your favourite TV show. Your presentation should last for approximately 10 minutes.
2. At the conclusion of the presentation, ask participants to record how much time has passed and to answer questions about the lecture.

Collate your data from the questions asked after both the meditation and the presentation. Work out the average number of minutes participants thought had passed for each condition and the number of questions correct for each condition.

Questions

1. Draw a graph that illustrates the results for accuracy of time.
   a. Discuss the differences between NWC and ASC in terms of time perception.
   b. What are possible reasons for this difference?
   c. What are other contributing factors or extraneous variables that may have brought about this change?
   d. Was the data as expected? Explain your answer.
2. Draw a graph that illustrates the results for accuracy of memory.
   a. Discuss the differences between NWC and ASC in terms of time perception.
   b. What are possible reasons for this difference?
   c. What are other contributing factors or extraneous variables that may have brought about this change?
   d. Was the data as expected? Explain your answer.
3. Look at the way your data has been presented. Is this data an objective or subjective way to determine an individual's state of consciousness? Explain your answer.

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