UNIT 4 – AOS 1 PSYCHOLOGY
SUMMARY NOTES FOR THE VCAA EXAMS

WRITTEN BY A STUDENT WHO OBTAINED A NEAR PERFECT STUDY SCORE

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CHAPTER 8: NATURE OF CONSCIOUSNESS

CONSCIOUSNESS AS A PSYCHOLOGICAL CONSTRUCT

Psychological construct

A **psychological construct**, or **hypothetical construct**, is a concept that is 'constructed' to describe specific 'psychological' activity, or a pattern of activity, that is believed to occur or exist but cannot be directly observed.

In studying an individual's state of consciousness, researchers typically rely on:

- Information provided by the individual (**e.g.** self-reports), and/or
- Behaviour that is demonstrated (**e.g.** responses during experimental research), and/or
- Physiological changes that can be measured (**e.g.** recording brain activity).

Consciousness

Consciousness is the awareness of objects and events in the external world, and of our sensations, mental experiences and own existence at any given moment.

Whatever we are aware of at any given moment is commonly referred to as the **contents of consciousness**. The contents of consciousness can include anything you think, feel and physically or mentally experience; **for example**:

- Your awareness of your internal sensations, such as your breathing and the beating of your heart.
- Your awareness of your surroundings, such as your perceptions of where you are, who you are with and what you see, hear, feel or smell.
- Your awareness of yourself as the unique person having these sensory and perceptual experiences.
- The memories of personal experiences throughout your life.
- The comments you make to yourself.
- Your beliefs and attitudes.
- Your plans for activities later in the day.

Consciousness is an experience — a moment by moment experience that is essential to what it means to be human. The experience is commonly described as being personal, selective, continuous and changing.

Consciousness is personal because it is your subjective ('personalised') understanding of both your unique internal world and the external environment — it is individual to you.

Consciousness is selective because you can choose to attend to certain things and ignore others. You can voluntarily shift your attention from the words on this page to a voice in the room or the memory of what you did last Saturday night.

Consciousness is continuous because there is never a time in the course of a typical day when your consciousness is ‘empty’.

Consciousness is constantly changing, with new information continually coming into awareness, particularly while you are awake. One moment your conscious awareness may be focused on the sound of a person talking to you, and the next moment your consciousness may be filled with thoughts of an argument you had with a friend. There are times when your consciousness is dominated by the internal thoughts and feelings you experience, while at other times sensations from the external environment dominate.

States of consciousness are the levels of awareness of objects and events in the external world, and of our sensations, mental experiences and own existence at any given moment. The various states of consciousness have each been associated with distinguishable psychological and physical characteristics.

CONSCIOUSNESS VARIES ALONG A CONTINUUM OF AWARENESS

Continuum of awareness

The **continuum of awareness** is a continuum with two extremes - total awareness and complete lack of awareness. In between are other states of awareness.

In a typical day we experience many different states of consciousness and therefore many levels of awareness. Each level of awareness varies in distinctive qualities. As shown in the example of a continuum in figure 8.4, there are no clear-cut boundaries to indicate where one state of consciousness ends and another begins.

At one end of the continuum, when attention is highly focused, concentration on specific thoughts, feelings or sensations dominates our consciousness to such an extent that other incoming information may not be noticed.

For example, if you were totally absorbed in important school work during the first class of the day, you might not feel hungry despite having missed breakfast and not eating much for dinner the night before.

At the other end of the continuum, an individual may not experience any thoughts, feelings or sensations at all.

For example, someone in a deep coma or a vegetative state usually shows no evidence of awareness of them self or of their environment.

Psychologists often describe consciousness as ranging along a continuum of awareness from total awareness to a complete lack of awareness. There is, however, no precise location for each state of consciousness within the continuum.

Figure 8.4

COMA, VEGETATIVE AND MINIMALLY CONSCIOUS STATES

Coma

Coma is a state in which there is a complete or nearly complete loss of all basic functions of consciousness.

Typically, the patient lies with eyes closed, cannot verbalise or respond to commands and cannot be awakened even when intensively stimulated. There is no evidence of awareness of self or of the environment. Comatose patients can, however, often present reflexive responses to painful stimulation. Autonomous nervous system functions such as breathing and regulation of body temperature are reduced and the patients require respiratory assistance. Prolonged comas are rare but can last 2–5 weeks and then progress to a vegetative state, locked-in syndrome or brain death.

Vegetative state

The **vegetative state**, sometimes called **unresponsive wakefulness syndrome**, involves loss of consciousness, but the patient may open their eyes, either spontaneously or after stimulation.

As with coma, patients in a vegetative state cannot verbalise or make voluntary responses. Nor is there any sign of awareness of self or the environment. The patient in a vegetative state is awake but not aware, which suggests that wakefulness and awareness may be different components of consciousness.

Unlike coma, autonomic nervous system functions are preserved and breathing usually occurs without assistance. Someone in a vegetative state is also able to perform a variety of actions, such as grinding teeth, blinking and moving eyes, swallowing, chewing, yawning, crying, smiling, grunting or groaning, but these are always reflexive, unrelated to the context and often lacking in intensity.

Minimally conscious state

The **minimally conscious state** is characterised by inconsistent signs of awareness of self and the environment.

There is evidence of voluntary, intentional behaviour, such as responding to verbal commands, making understandable verbalisations and tracking a moving object, mirror or person. Emotional behaviours, such as smiles, laughter or tears may also be observed. The minimally conscious state may be temporary, long-lasting or permanent, such as the vegetative state.

Locked-in syndrome

Locked-in syndrome, also called **pseudocoma**, is a rare condition involving full consciousness and complete paralysis of the body.

Oral and gestural communications are impossible, but patients are often able to blink and move the eyes. Despite the fact that the patients cannot move, their sensations are still intact and they are fully aware of their environment and themselves. The most common way for patients with locked-in syndrome to communicate with their environment is through eye movements (such as blinking once for yes and twice for no), but they may recover control of their fingers, toes or head and use these as a means for communication too.

Brain death

Brain death is defined as:

An irreversible cessation of all function of the brain of the person.

OR,

An irreversible cessation of circulation of blood in the body of the person.

Whole brain death is also required for the legal determination of death. Assessments occur when the patient transitions from a deep comatose state. If the condition causing coma and loss of all brainstem function has affected only the brainstem and there is still blood flow to the cerebral cortex, this does not meet the legal definition. In addition, brain death cannot be determined unless there is evidence of severe brain injury sufficient to cause death.
There is no recovery from brain death. Before clinical testing for brain death can even begin, other causes of coma such as drugs, high or low blood sugar levels and abnormal electrolyte levels must be ruled out. There must also be a minimum of four hours observation and mechanical ventilation, during which the patient is completely unresponsive to any external stimuli.

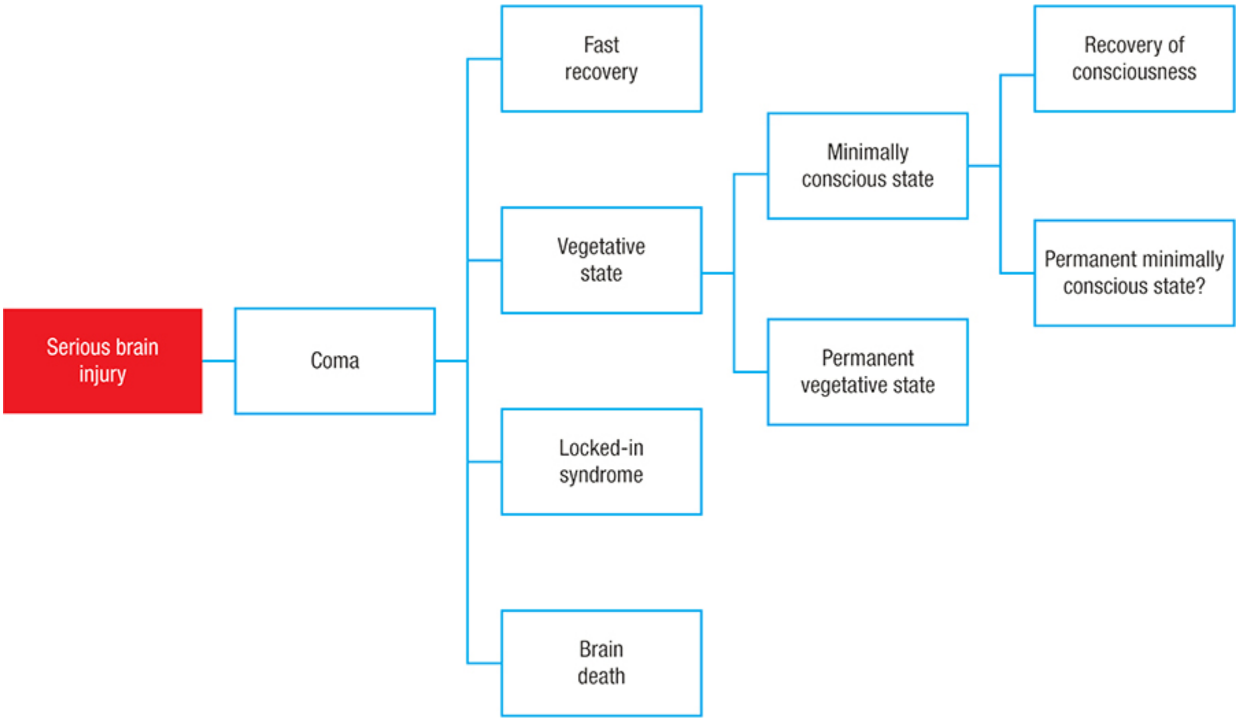


Figure 8.5

Different conditions may follow serious brain injury. Often, coma lasts for a couple of days and once the patients open their eyes, they evolve into a vegetative state. Then, they may enter a minimally conscious state after showing some signs of consciousness and eventually they recover full consciousness. In rare cases, a person may develop locked-in syndrome, a nearly complete paralysis of the body's voluntary motor responses.

NORMAL WAKING CONSCIOUSNESS AND ALTERED STATES OF CONSCIOUSNESS

Psychologists often distinguish between two broad categories of consciousness called normal waking consciousness and altered states of consciousness.

Normal waking consciousness

Normal waking consciousness refers to the states of consciousness associated with being awake and aware of objects and events in the external world, and of one's sensations, mental experiences and own existence.

Normal waking consciousness is constantly changing. However, despite this changing experience, our perceptions and thoughts continue to be organised and clear, and we remain aware of our personal identity — who we are. We also perceive the world as real and we maintain a sense of time and place.

Normal waking consciousness is not one single state, as there are varying levels or 'degrees' of awareness when we are awake. Generally, normal waking consciousness includes all states of consciousness that involve heightened awareness.

We spend about two-thirds of each day in normal waking consciousness, during which we experience variations in mental awareness.

Altered state of consciousness (ASC)

An **altered state of consciousness (ASC)** is any state of consciousness that is distinctly different from normal waking consciousness in terms of level of awareness and experience. In an altered state of consciousness, mental processing of internal and external stimuli shows distinguishable, measurable changes.

For example, self-awareness, emotional awareness and perceptions of time, place and one's surroundings may change. In addition, normal inhibitions or self-control may weaken.

Natural states of consciousness

Psychologists also distinguish between naturally occurring and induced altered states of consciousness.

Natural states of consciousness are states of consciousness that are normal parts of our lives that occur naturally in the course of our everyday activities without the need for any aid.

These include:

- Sleep
- Daydreaming
- Dreaming

For example, each day, we experience natural changes in levels of alertness and awareness as we go through cycles of wakefulness, drowsiness and sleep.

Induced states of consciousness

Induced states of consciousness are states of consciousness that are intentionally achieved by the use of some kind of aid.

These include:

- Meditation
- Hypnosis
- Alcohol ingestion
- Medications
- Illegal drugs

Some psychologists also describe altered states that are induced unintentionally due to an accident, disease or some other disorder.

For example, brain trauma from a blow to the head can produce concussion or a comatose state and a medical condition such as epilepsy produces recurring seizures that alter conscious experience.

There are many reasons why an individual may deliberately try to achieve an ASC.

For example, meditation is a useful technique to induce a state that helps people relax or manage stress. Hypnosis may be practiced as part of therapy; **for example**, in trying to help someone deal with fear of flying or to give up smoking. Alternatively, some people use medications and illegal drugs to reduce pain, for psychological pleasure or as an escape from the pressures of their life.

Naturally occurring and induced ASCs are not necessarily mutually exclusive. Some naturally occurring states may be induced.

For example, sleep is naturally occurring and can be purposely induced with medication that promotes drowsiness.

Role of attention

Researchers often use attention as a measure of awareness and as a way of distinguishing between different states of consciousness.

Attention is a concentration of mental activity that involves focusing on a specific stimulus while ignoring and therefore excluding other stimuli.

Generally, the more attention, the higher the degree of awareness and vice versa. States of consciousness within the range of normal waking consciousness at the top end of the continuum involve more awareness and therefore require more attention than altered states of consciousness at the lower end of the continuum.

In normal waking consciousness, our attention can be focused either on **internal thoughts or feelings** (**e.g.** how tired you feel) or on **external stimuli** (**e.g.** what the person sitting next to you is saying).

The focus of attention is like a spotlight that can be moved around. A shift in the focus of your attention, and therefore conscious awareness, can be intentional, such as when you concentrate on listening to arrangements for meeting friends. However, a shift in the focus of attention more often occurs without our being aware of it.

For example, when you are focused on a teacher's explanation and the person sitting next to you starts talking to you, the focus of your attention will usually shift to their comments, even if only for a second or two.

Selective attention

Selective attention involves choosing and attending to a specific stimulus to the exclusion of others.

The concept illustrates the fact that at any given moment the focus of our awareness is on only a limited range of all that we are capable of experiencing. This occurs for an internally sourced event such as the perception of a pain in the foot or an externally sourced event such as watching a car drive past.

If a stimulus is personally important to us, we are more likely to take notice of it. However, this does not mean we can only receive information from one stimulus.

For example, during the first class on Monday morning your attention may be selectively focused on hearing what happened at a weekend party. However, you may still process some of what the teacher is saying or doing with the rest of the class, which is selectively attending to what the teacher is saying. You may be aware that you need to have your book open at a particular section, or that you need to be copying down some questions from the board even if you don't know what the questions actually ask. Thus, even when your attention is focused on one thing, you are still capable of reacting to other stimuli. This suggests that we can process some information outside conscious awareness.

Divided attention

As we begin to move down the consciousness continuum, the level of attention required is generally not as focused or selective.

Divided attention refers to the ability to distribute our attention and undertake two or more activities simultaneously.

For example, in normal waking consciousness, people are often able to divide their attention among competing stimuli, such as washing a car while listening to the radio and watching their children play.

It seems that our ability to divide our attention and 'multitask' depends on how much conscious effort is required for the various tasks in which we are engaged. In turn, this depends on the similarity of the tasks, their complexity and how accomplished, or 'experienced', we are at doing them. Research findings indicate that our perceptual systems can more competently perform tasks requiring divided attention when the tasks are sufficiently similar, not complex, well known and therefore do not demand considerable mental effort. Often, especially for more complex tasks, we may think we are using divided attention but we are actually shifting attention from one task to another.

METHODS USED TO STUDY CONSCIOUSNESS

Psychologists may use a variety of techniques to study states of consciousness and identify specific responses associated with different states.

The most commonly used techniques can be organised in four different categories:

- measurement of physiological responses
- measurement of performance on cognitive tasks
- self-reports
- video monitoring

These techniques can be used independently or in combination.

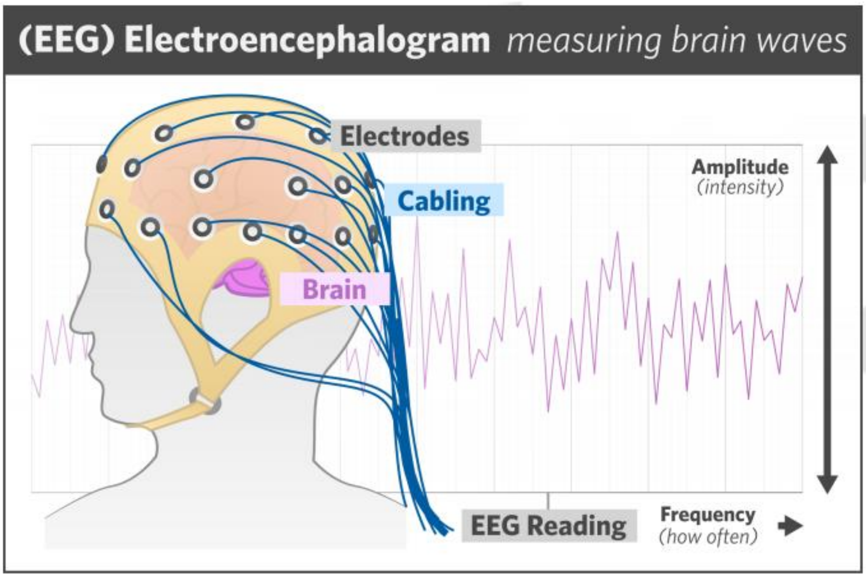
Measurement of physiological responses

Measurements of physiological responses enable researchers to obtain data on bodily changes and responses during various states of consciousness. These have provided valuable information on levels of alertness and underlying bodily changes that occur in different states.

Three commonly measured physiological responses are:

- Changes in brain wave patterns (EEG)
- Muscle activity (EMG)
- Eye movements (EOG)

Electroencephalograph (EEG)



An **electroencephalograph**, or **EEG**, is a device that detects, amplifies and records electrical activity of the brain (in the form of brain waves).

An **electroencephalograph (EEG)** records the electrical activity at different locations in a participant's brain through precisely located electrodes attached to the scalp. Each electrode detects activity at a different point on the skull and is displayed as a row of EEG data. The EEG records are called electroencephalograms.

The brain waves in the graph illustrate activity that can be matched to brain areas that correspond with the location of electrodes.

The rate, height, and length of brain waves vary depending on the brain area being studied, and every individual has a unique and characteristic overall brain-wave pattern. Age and the current state of consciousness also cause changes in wave patterns.

Brain wave patterns shown in EEG recordings vary in frequency and amplitude. Frequency refers to the number of brain waves per second. A pattern of high-frequency brain wave activity is faster and therefore has more brain waves per unit of time. A pattern of low-frequency brain wave activity is slower, and therefore has fewer brain waves per unit of time.

The amplitude or intensity of brain waves is measured in microvolts and can be visually judged by the size of the peaks and troughs of the waves from a baseline of zero activity. High-amplitude brain waves have bigger peaks and troughs, while low-amplitude brain waves have smaller peaks and troughs.

Electromyograph (EMG)

The **electromyograph**, or **EMG**, is used to detect, amplify and record the electrical activity of muscles, such as muscle movement and muscle tension.

EMG recordings generally show the strength of electrical activity occurring in the muscles, which indicates changes in muscle activity (movement) and muscle tone (tension). This data is obtained by attaching electrodes to the skin above the relevant muscles. Sometimes the activity in facial muscles is recorded. At other times, leg muscles, muscles on the torso (main part of the body), or a combination of these are recorded.

The records of the EMG are displayed as line graphs, similar to those produced by the EEG. They can be produced on paper or on a computer monitor. EMG records show that there are identifiable changes in muscular activity during certain states of consciousness.

For example, when falling asleep, we usually become less and less alert as we drift into deeper stages of sleep. While this is occurring, our muscles progressively relax (decrease in muscle tone). There are also distinguishable periods when our muscles may spasm (during light sleep) or be completely relaxed (during deep sleep). Overall, though, EMG measures of people during different states of consciousness indicate that the higher the level of muscular activity and tone, the more alert we tend to be and vice versa.

Electro-oculargraph (EOG)

The **electro-oculograph**, or **EOG**, measures eye movements or eye positions by detecting, amplifying and recording electrical activity in eye muscles that control eye movements.

This is done through electrodes attached to areas of the face surrounding the eyes. The records of the EOG are displayed as line graphs, similar to those produced by the EEG and EMG. They can also be produced on paper or on a computer monitor.

The EOG is most commonly used to measure changes in eye movements over time during different types and stages of sleep and while dreaming. In particular, sleep research studies that have used EOGs have been of immense value in clarifying the distinction between the two different types of sleep called **rapid eye movement sleep (REM)** and **non-rapid eye movement sleep (NREM)**.

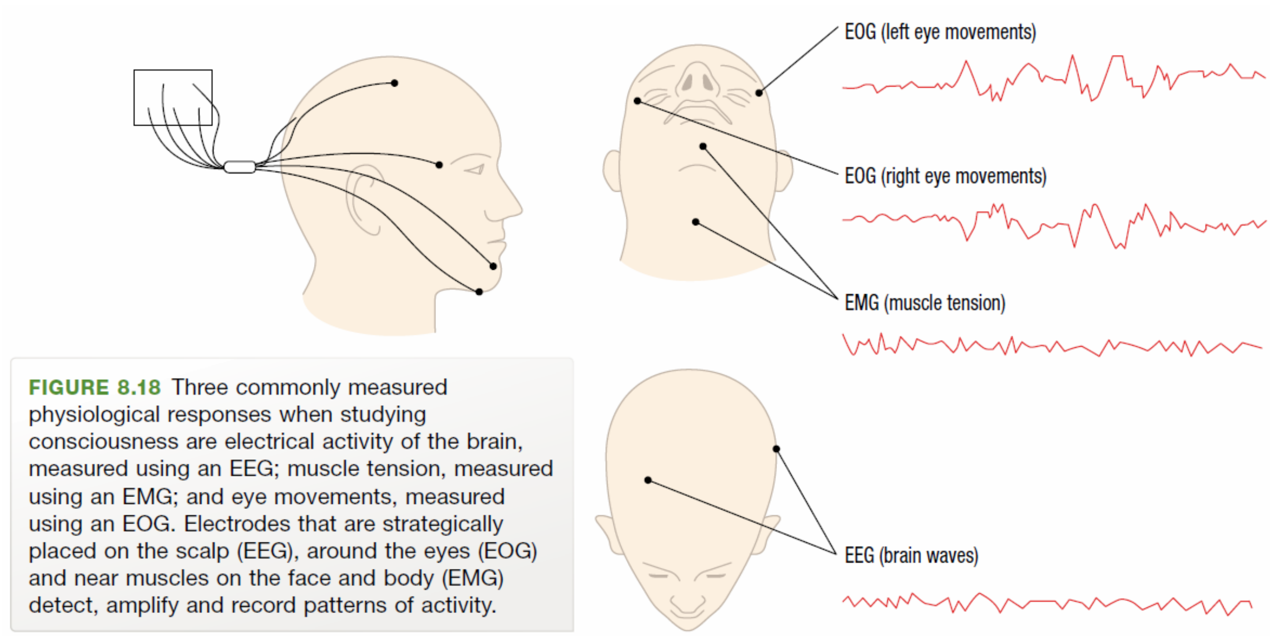


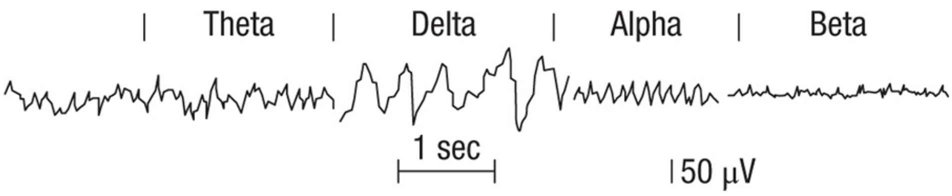
FIGURE 8.18 Three commonly measured physiological responses when studying consciousness are electrical activity of the brain, measured using an EEG; muscle tension, measured using an EMG; and eye movements, measured using an EOG. Electrodes that are strategically placed on the scalp (EEG), around the eyes (EOG) and near muscles on the face and body (EMG) detect, amplify and record patterns of activity.

EEG, EMG, EOG SUMMARY TABLE

Device/ tool used to measure	Definitions (DARE) **Detect, Amplify, Record, Electrical activity**	Measured physiological responses	How is the data obtained? (Using electrodes)
Electroencephalograph (EEG)	An **electroencephalograph**, or **EEG**, is a device that detects, amplifies and records electrical activity of the brain (in the form of brain waves).	An **electroencephalograph (EEG)** measures brain waves.	Data is obtained by attaching electrodes to the scalp of the participant.
Electromyograph (EMG)	The **electromyograph**, or **EMG**, is used to detect, amplify and record the electrical activity of muscles, such as muscle movement and muscle tension.	An **electromyograph (EMG)** measures muscle movement and tension.	Data is obtained by attaching electrodes to the skin above the relevant muscles.
Electro-oculograph (EOG)	The **electro-oculograph**, or **EOG**, measures eye movements or eye positions by detecting, amplifying and recording electrical activity in eye muscles that control eye movements.	An **electro-oculograph (EOG)** measures eye movements or eye positions.	Data is obtained through electrodes attached to areas of the face surrounding the eyes.

BETA, ALPHA, THETA AND DELTA BRAIN WAVE PATTERNS

Four commonly described brain waves are named after letters in the Greek alphabet — theta, delta, alpha and beta. These waves are shown below in an order ranging from highest to lowest frequency. Beta have the highest frequency and lowest amplitude, whereas delta have the lowest frequency but highest amplitude.



EEG recordings indicate that brain wave patterns, or 'rhythms', change as level of alertness changes within a state of consciousness. Distinguishable brain wave patterns have also been associated with altered states of consciousness. The predominance of different brain wave patterns varies with age.

For example, the EEGs of infants and children are normally characterised by a greater mixture of brain waves than is found in adults.

Beta brain wave pattern

A predominantly **beta brain wave pattern** is associated with alertness and intensive mental activity during normal waking consciousness.

For example, when we are awake, attentive to external stimuli and actively concentrating or thinking, our brain's electrical activity is at its highest. Beta waves are also present during states of tension, anxiety, threat, fear and when dreaming during a period of rapid eye movement sleep (Jovanov, 2011). The beta pattern comprises high-frequency (fast) and low-amplitude (small) brain waves. Beta are the fastest of the waves.

Beta waves
Beta waves have a high frequency (fast) and low (small) amplitude, and are irregular. They are typically associated with normal waking consciousness when alert, attentive to external stimuli and intensive mental activity e.g. someone who is awake and physically or mentally active, with eyes open and concentrating on some mentally engaging task.

Alpha brain wave pattern

When we are awake and alert but mentally and physically relaxed and internally focused, the EEG shows a predominantly **alpha brain wave pattern**.

For example, if you complete a mentally active task and sit down to rest and calmly reflect on what you did, your brain waves will be mostly alpha, especially if you close your eyes. Typically, the alpha pattern is regular or 'rhythmic' (rather than irregular or 'jagged') in appearance, with a medium to relatively high frequency (but slower than beta waves) with low amplitude (but a slightly larger amplitude than beta waves). Alpha waves in humans mostly originate in the visual cortex area in the occipital lobe at the back of the brain. If a relaxed person with eyes closed is disturbed or opens their eyes, alpha waves abruptly stop.

Alpha waves

Alpha waves have a high frequency (but slower than beta waves) and low amplitude (but slightly larger than beta waves). A distinguishable feature is their regular configuration, which resembles the teeth of a comb. They are typically associated with a relaxed, calm, internally focused, wakeful state, with eyes closed.

Theta brain wave pattern

A predominantly **theta brain wave pattern** is most commonly produced when we are very drowsy, such as when falling asleep or just before waking.

They may also be produced when awake and engaged in creative activities, during dream-like visual imagery, when excited and when deeply meditating (Jovanov, 2011; Tatum, 2014). Relatively little theta activity is ordinarily recorded in adults during normal waking consciousness when compared with the other brain waves (but it is common in young children during normal waking consciousness). The theta wave pattern has a medium frequency and some high-amplitude (large) waves mixed with some low-amplitude (small) waves.

Theta waves

Theta waves have a medium frequency (slower than alpha and beta waves) and a mixture of high and low amplitude waves. They are typically associated with drowsiness, falling asleep, awakening from sleep, creative activities, excitement and when in a deep meditative state in which there is no awareness of external stimuli. When falling asleep there is usually a changeover from alpha to theta waves across a period of several minutes.

Delta brain wave pattern

Delta waves are most commonly associated with deep, dreamless sleep or unconsciousness. They begin to appear in stage 3 of non-rapid eye movement sleep. In stage 4, during which we experience the deepest sleep, there is a predominantly **delta brain wave pattern**. Stage 4 occurs before a period of rapid eye movement sleep that is associated with dreaming. Delta waves are usually considered normal when observed in the very young and elderly during waking states. They are predominant in waking states throughout infancy and early childhood, decreasing to less than 10% of waking time by about age 10 years (Tatum, 2014). Delta waves have a pattern of low-frequency (slow) and high (large) amplitude. They are very slow and the slowest of all the brain waves.

Delta waves

Delta waves have the lowest frequency and the highest amplitude. They are typically associated with the deepest stage of sleep which precedes periods of rapid eye movement sleep and unconsciousness.

Brain wave patterns are used in conjunction with other physiological or psychological measures to help identify and describe an individual's level of alertness and the associated state of consciousness. The distinctive brain wave patterns also make the EEG a reliable technique for determining abnormal brain activity, for monitoring changes within a state of consciousness (such as sleep stages), and to identify different states of consciousness. A living person's brain always has electrical activity. Still slower waves than delta appear during anaesthesia or when a person is in a coma. When 'brain death' occurs, the EEG becomes a flat line.

The **EEG** is **useful** in providing general, or 'overall', information about brain activity in real time **without being invasive.** The EEG is also widely used to assist with the diagnosis and study of various brain-related medical conditions, including brain damage and neurological disorders, particularly epilepsy which is characterised by uncontrollable bursts of brain activity. Different types of brain waves are seen as abnormal only in the context of variations from what would normally be expected from the location of the waves and for a person's age, their state of consciousness and level of alertness when the EEG is conducted.
In general, disease typically increases slow activity, such as theta or delta waves, but decreases fast activity, such as alpha and beta waves. Additionally, the theta waves normally found in adults during drowsiness and sleep are also normal in children when awake, and delta waves commonly occur during normal waking consciousness in infancy but not in adulthood.

A **limitation** of the **EEG** is that it poorly measures neural activity that occurs below the outer layer of the brain (**i.e.** the cortex). Nor does it provide detailed information about which particular structures of the brain are activated and what their specific functions might be, especially areas beneath the cortex. Multiple electrodes are positioned across the top of a relatively large area of the brain and it can be difficult to pinpoint exactly where in the brain the activity is coming from. Specific changes in brain wave activity do occur in response to the presentation of a particular stimulus, such as a flash of light, but the changes in brain wave activity can be hidden by the overall background activity of the brain. Furthermore, the strength of the electrical activity at its source is reduced after having travelled through the thick bone structure of the skull. Therefore, the EEG merely provides a summary of all the activity of neurons firing within different areas of the brain.

Brain waves summary

Beta waves
Beta waves have a high frequency (fast) and low (small) amplitude, and are irregular. They are typically associated with normal waking consciousness when alert, attentive to external stimuli and intensive mental activity e.g. someone who is awake and physically or mentally active, with eyes open and concentrating on some mentally engaging task.

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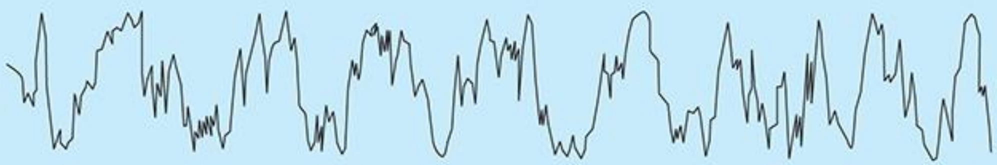
Delta waves
Delta waves have the lowest frequency and the highest amplitude. They are typically associated with the deepest stage of sleep which precedes periods of rapid eye movement sleep and unconsciousness.



BRAIN WAVE PATTERNS DUE TO DRUG-INDUCED ALTERED STATES OF CONSCIOUSNESS

A **drug** is any substance that can change a person's physical and/or mental functioning. Certain types of drugs can induce an altered state of consciousness and changes in brain wave patterns. Two broad categories of drugs that can initiate such changes are called stimulants and depressants. Drugs within each of these categories have opposite effects on central nervous system activity, as indicated by the category names — they either 'stimulate' or 'depress' activity. Like all other drugs, stimulants and depressants exert their effects by influencing specific neurotransmitters, receptors or by chemically altering neuronal function in other ways.

Their potential effects are further influenced by a range of variables such as:

- The type of stimulant or depressant that is taken
- The dose (amount) and potency (strength)
- Personal characteristics of the individual

e.g. body weight, physiology, sex, age, health and wellbeing, prior use, personality, mood, expectations

- Method of administration e.g. oral, injection, inhalation, skin patch
- When administered e.g. daytime or night time before sleep
- Whether other drugs are also taken
- Context

e.g. alone or with others, social or medical situation.

There is an interplay between these variables that influences psychological and physiological responses to a drug. Moreover, specific drug effects can vary from person to person and even for the same person in different situations. A drug's effects can also change as a person develops a tolerance to the relevant chemical. However, some effects are reasonably predictable.

Stimulants

Stimulants are drugs that increase activity in the central nervous system and the rest of the body. They therefore have an alerting, activating effect.

Some examples of stimulants include:

- Caffeine

  E.g. Coffee, tea, chocolate, cola, energy drinks and some non-prescription medications.

- Nicotine

  E.g. Cigarettes and other tobacco products, to strong, carefully regulated or illegal drugs, such as amphetamines, cocaine and ecstasy.

Some types of amphetamines are legally prescribed by doctors to treat conditions such as attention deficit hyperactivity disorder (ADHD) or the sleep disorder narcolepsy which involves excessive sleepiness. Amphetamines that can be legally prescribed are often accessed by someone without the relevant symptoms and misused to 'get high'.

Stimulants may alter attention, mood, emotional awareness, self-control, time orientation, memory, judgement, decision making and other cognitive processes.

For example, possible psychological effects of a powerful stimulant such as amphetamine include increased alertness, focus, confidence, feelings of wellbeing and motivation. People using an amphetamine will often become happier and more confident, talkative and sociable.

Amphetamines

Amphetamines also stimulate the sympathetic nervous system, producing physiological changes not unlike fight–flight reactions to a threat or stressor.

For example, blood pressure and heart rate increase, arousing the body and contributing to the overall energising effects.

The energising effects of amphetamines can reduce feelings of tiredness and have often been used by people who want to do something active, like dance for long periods of time. As amphetamines can increase energy levels, motivation and focus, they are also used as a performance enhancer.

For instance, some people use them to temporarily increase alertness, maintain wakefulness or delay sleep to work for long periods of time.

As with all drugs that are misused or abused, stimulants will have side-effects. A 'speed crash' always follows the high and may leave the person feeling nauseous, irritable, depressed and extremely exhausted for days. At very high doses and frequent heavy use, amphetamine use can result in 'amphetamine psychosis', characterised by hallucinations, paranoid delusions and out of character aggressive or violent behaviour. Psychotic symptoms are especially evident in people who abuse methamphetamine.

There are also measurable changes in brain wave patterns associated with stimulants and these tend to occur relatively quickly, especially for the more potent stimulants. Stimulants increase physiological arousal and there is a corresponding excitatory pattern of brain wave activity. Generally, when compared to the baseline brain wave of activity of normal arousal during normal waking consciousness under normal everyday conditions that would be expected for the individual's age, there is an increase in higher frequency (faster) activity and a decrease in lower frequency (slower) activity. More specifically, there is a pattern of increased beta wave activity and decreased delta, alpha and theta activity. The more potent the stimulant, the longer these changes are likely to persist, and vice versa.

Depressants

Depressants are drugs that decrease activity in the central nervous system and the rest of the body. Generally, their effects result in a state of calm, relaxation, drowsiness, sleep or anaesthesia as doses of the drug increase. They do not necessarily make a person feel 'depressed'.

Depressants range from mild, widely available drugs through to strong, carefully regulated or illegal drugs. All reduce alertness, environmental awareness, responsiveness to sensory stimulation, cognitive functioning and physical activity to some extent.

Loss of self-control is common.

In small doses they can cause a person to feel more relaxed and less inhibited. In larger doses they can cause unconsciousness and death.

Barbiturates and benzodiazepines

Barbiturates and benzodiazepines are the two major categories of depressant drugs used as medications, most commonly to aid sleep and sometimes to alleviate symptoms of anxiety or seizure activity. Often these drugs are referred to as sleeping pills and tranquillisers or sometimes just as sedatives.

Opiates

Opiates and their derivatives are another class of depressants.

These include:

- Heroin
- Morphine
- Codeine

These opiates are primarily used as analgesics to provide pain relief.

They are attractive to people seeking to induce an altered state of consciousness because they produce feelings of relaxation and euphoria. When injected, the user feels an immediate 'rush' — a strong wave of pleasurable relaxation and relief from anxiety. The user may go 'on the nod' — shifting back and forth from feeling alert to drowsy. With large doses, the user cannot be awakened. Breathing slows down and death may occur. In some cases, severe drug-induced sedation can cause a flat EEG.

Alcohol

Alcohol is classed as a depressant. Brain areas affected by alcohol include those that control inhibition, thought, perception, attention, judgement, memory, sleep and coordination.

Within the nervous system, alcohol can initially have a stimulant phase followed by a more prolonged depressant phase. Higher levels of alcohol inhibit or slow brain functioning, with the depressant effects seen behaviourally.

For example, alcohol dampens motor and sensory areas and makes perceptual judgments, co-ordination and balance more difficult.

Risky behaviour is also a common result of alcohol use because areas involved in decision-making and self-control are dampened. High enough concentrations can cause the user to eventually lose consciousness. The effects of alcohol consumption together with another drug(s) — including over-the-counter or prescribed medications — can be unpredictable, dangerous and even fatal.

Various depressants designed for medical purposes are also used recreationally. People misusing or abusing depressants generally take larger doses than would be prescribed. Typically, the desired effect is an elevated mood, with bad feelings of tension or dejection replaced by a relaxed, pleasant state accompanied by lowered inhibitions.

There are also measurable changes in brain wave patterns associated with depressants. Depressants decrease physiological arousal and there is a corresponding inhibited pattern of brain wave activity. Generally, there is an increase in lower frequency (slower) activity and a decrease in higher frequency (faster) activity. More specifically, there is a pattern of reduced beta wave activity and increased delta, alpha and theta activity. As with stimulants, the more potent the depressant, the longer-lasting these changes are likely to persist, and vice versa. Similarly, measurable changes depend on other usage related variables, as well as the specific procedures used by researchers conducting their EEG studies.

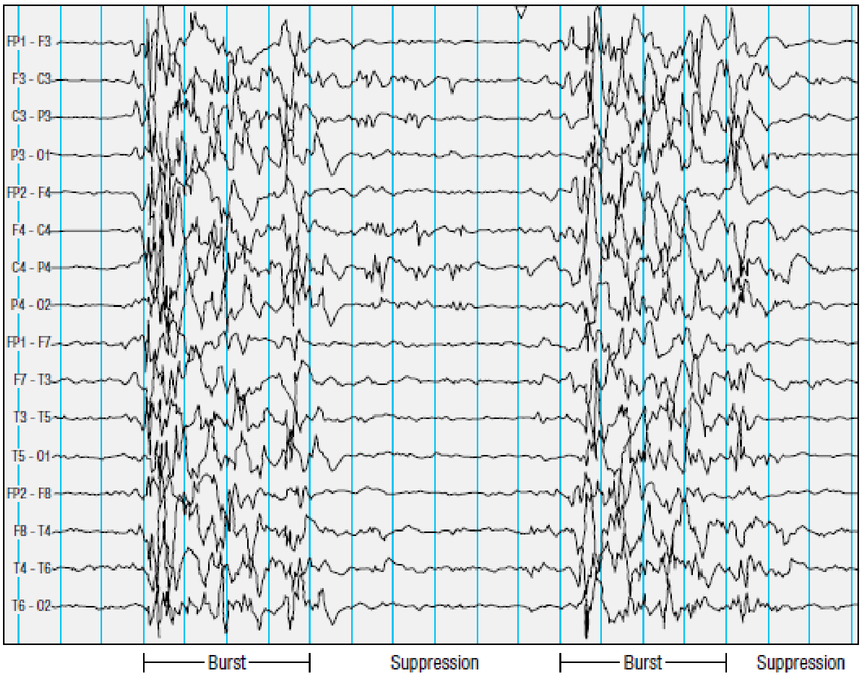


FIGURE 8.16 In high dosage or severe depressant overdose cases, the EEG may show a burst suppression pattern. This usually consists of bursts of EEG activity every 2 to 10 seconds separated by periods of suppression during which there is little or no EEG activity. This pattern can last for hours or even days depending on whether the depressant is still present.

Source: Saletu, B., Anderer, P. & Saletu-Zyhlarz, G.M. (2006). EEG topography and tomography (LORETA) in the classification and evaluation of the pharmacodynamics of psychotropic drugs. *Clinical EEG Neuroscience*, April 37: 66–80.

Measurement of speed and accuracy on cognitive tasks (Objective performance measures)

The speed and accuracy of responding are two commonly used **objective** measures.

For example, a researcher may measure speed and accuracy of participants when perceiving and responding to road stimuli in a driving simulator after different periods of sleep deprivation, ranging from 30 minutes through to a day or more.

Similarly, speed and accuracy may be used to assess how varying amounts of a stimulant or depressant affect performance on a cognitive task involving learning, memory, spatial processing, reasoning, decision making or problem solving. In most speed and accuracy experiments, participants complete one or more **cognitive tasks** (sometimes called neurocognitive assessments) across a number of trials and mean scores are calculated.

Measurement of speed

Measurement of **speed** typically involves response or reaction time to a stimulus — how much time elapses between the presentation of some stimulus and the individual's response to the stimulus.

This is usually measured in milliseconds. These time measures are very small but nonetheless significant.

Mental events and their underlying processes when performing a cognitive task take time. Precise measurements enable researchers to pinpoint how long it takes in real time to complete them.

For example, in a driving simulator, the speed measure often involves 'perception reaction time' to unpredictable road stimuli such as traffic lights, railway level crossing signals, road signs, pedestrians and other vehicles. Many speed reactions in real world tasks involve an initial reaction time, followed by a precise movement which also contributes to the overall response time. Consequently, the researcher may take account of this aspect too.

Measurement of accuracy

Measurement of **accuracy** typically involves the number of correct responses and incorrect responses (errors) made by the individual.

Usually, the researcher calculates the proportions of correct and incorrect responses in relation to the total number of possible responses to pinpoint accuracy.

For example, in a driving simulator study, accuracy may be measured in relation to the number of road stimuli to which the participant correctly reacts.

Speed and accuracy are considered **objective** performance measures because their scores are not subject to personal opinion or interpretation by the researcher.

For example, speed can be measured using an electronic timing device which will provide exactly the same data regardless of the researcher collecting it.

In addition, the data collected can be verified (confirmed) by another researcher.

Similarly, accuracy can be measured in terms of responses with clear cut boundaries such as ‘Yes’ or ‘No’ and ‘Present’ or ‘Not present’ that are not open to interpretation and therefore vulnerable to personal opinion or bias. Such responses can also be electronically recorded to maintain objectivity.

In a typical experiment, an aspect of consciousness and a relevant cognitive task are isolated and operationalised for study. Under different conditions involving experimental and control groups (or a repeated measures design), both the speed and accuracy of performance are then measured (often scored digitally by computer), usually multiple times (in different trials) to help ensure reliability of the results.

For example, the effects of drowsiness when awakened from deep sleep on processing verbal information in short-term (working) memory could be assessed in an independent groups experiment. Participants may be presented with anagrams (scrambled words) one at a time, then required to select the correct word for each anagram from among alternatives. They would usually be instructed to respond as quickly and accurately as possible. This would clarify requirements and also help ensure participants do not focus more on accuracy than speed, or vice versa. For each experimental condition, accuracy would depend on the number of errors and speed would be calculated as the mean of response times by all participants on each trial (sometimes assessed on correct trials only).

In some experiments, it is not uncommon for a researcher to exclude response times that are extreme and vary too much from the mean (**e.g.** 2.5 standard deviations) because they could be attributable to an accidental key press. In all experiments, however, both speed and accuracy scores are considered when assessing performance under different conditions. In relation to speed, **faster = better performance** and for accuracy, **fewer errors = better performance**.

For a wide variety of real world cognitive and behavioural tasks we perform in everyday life, speed and accuracy tend to be highly related — **the faster responders tend to also be more accurate, and vice versa**, regardless of the type of movement required when responding.

For example, in a driver drowsiness study, the required response may involve a foot movement such as pressing on a brake or accelerator pedal in a simulator rather than a hand movement.

Experience on a task also tends to improve both speed and accuracy over long periods of time. For some tasks, however, we may intentionally change our performance to respond faster if necessary, but at the cost of reducing the accuracy of our response. Similarly, if high accuracy is required, then we can compromise speed and slow down our response time in order to increase our accuracy if we want to.

Subjective reporting of consciousness – sleep diaries

Subjective reporting involves the use of self-reports. A **self-report** is the participant's written or spoken responses to questions, statements or instructions presented by the researcher. Self-reports are considered to be **subjective** because the data collected from a participant is based on their personal opinion, interpretation, point of view or judgement.

Unlike data obtained through objective measures, subjective data is often biased, can vary from person to person, day to day from the same person, and is not always entirely accurate.

However, this does not mean that subjective reporting is not useful or cannot provide valuable information about consciousness. Often, asking someone to report one or more aspects of their experience during normal waking consciousness or an altered state is the most appropriate and best way of obtaining information of research interest.

Subjective reporting via self-reports is commonly used in the study of sleep. The sleep diary, sometimes called a **sleep log**, is the most commonly used method. A **sleep diary** is a self-reported record of an individual's sleep and waking time activities, usually over a period of several weeks. When the activities are to be recorded for children, a parent may maintain the required records.

Sleep diaries are most commonly **used in conjunction with physiological measures such as EEG and EMG** to support the assessment of sleep disturbances or disorders, particularly their nature, severity and possible causes. The data an individual is required to record in a sleep diary depends on what is being studied.

Records may be kept of:

- The time when trying to fall asleep
- The time when it is believed sleep onset occurred
- The number, the time and length of awakenings during sleep
- The time of waking up in the morning
- The time of getting up after waking up in the morning
- How well rested the individual feels upon awakening
- How sleepy the individual feels at different times during the day

In addition, records may be kept of events that can affect sleep, such as naps, the number of caffeinated or alcoholic drinks, use of medication, meals, exercise type, time or length, and other potentially influential activities when awake or asleep.

The sleep diary records are analysed by the researcher to identify patterns of behaviour of relevance to their topic of research interest. If the researcher is investigating a sleep onset disturbance, they will be interested in behaviours that might be interfering with sleep.

For example, participant habits such as vigorously exercising at night, watching television or using social media in bed have all been found to impair sleep onset.

Video monitoring

Video monitoring involves cameras that are used to record externally observable physiological responses.

Video monitoring is most commonly used in the study of sleep and sleep disturbances or disorders. Most sleep centres, clinics or laboratories are fitted with one or more video cameras to record externally observable physiological responses throughout a sleep episode, including behaviours when falling asleep and when waking. Video monitoring may also be conducted in a home environment.

Responses that may be observed include:

- Changes in posture or body position
- Amount of 'tossing and turning'
- Sleep related breathing problems
- What happens when awakening from a nightmare or night terror
- Behaviours associated with sleepwalking

Video cameras can simultaneously record sounds and use infrared technology so that recordings can be made in conditions of little or no light. Recordings are made in real time, but computer-assisted technologies can be used for later analysis of a scene or even a single frame.

For example, software packages can be used for frame-by-frame analysis (motion segmentation), enhancement of blurred images and 3D enhancements.

CHANGES IN PSYCHOLOGICAL STATE DUE TO LEVELS OF AWARENESS

When describing, analysing or comparing different states, psychologists do not only refer to the level of awareness. Other qualities of the 'awareness' experience to which they may refer include the contents of consciousness, use of a controlled or automatic process when engaged in one or more tasks, perceptual and cognitive distortions, changes in emotional awareness, changes in self-control and the experience of real time.

Content limitations

Generally, **the content (type of information) held in our normal waking consciousness tends to be more restricted**, **or limited**, **than the content of consciousness during an altered state**. We are able to exercise some control over what we allow into our normal waking consciousness, for instance, through selective attention. Because a significant amount of information that enters our consciousness is within our conscious control during normal waking consciousness, we can block our awareness of information that makes us feel self-conscious, embarrassed, sad, repulsed, afraid, hurt and so on. However, during altered states of consciousness we generally don't have the same control, therefore the content of our consciousness is not as limited.

The content of normal waking consciousness also tends to be more organised and logical than that in an altered state of consciousness.

For example, when we are awake and alert, we are generally able to follow logical steps in solving a problem. By comparison, when we are in an altered state of consciousness, such as when we are dreaming, the content of our consciousness (the images and content of our dreams) is often nonsensical, illogical and disorganised.

Controlled and automatic processes

Controlled process

A **controlled process** involves conscious, alert awareness and mental effort in which the individual actively focuses their attention on achieving a particular goal.

A controlled process is often required when a task is novel (unfamiliar) or difficult.

For example, studying, following a recipe, learning to drive a car.

Controlled processing of information tends to be **serial**; that is, you can usually only perform one task requiring controlled processing at a time. It is effortful, makes heavy demands on attention and requires a high level of conscious awareness to be dedicated to a task. It also tends to be relatively slow.

For example, because it is often required in unfamiliar or new situations, we don't have a reliable way to respond quickly.

Control processes can become automatic with experience. However, factors such as exposure, amount of practice and difficulty of task can influence how quickly it becomes an automatic process.

For example, driving a car, brushing your teeth and painting.

Automatic process

An **automatic process** requires little conscious awareness and mental effort, minimal attention and does not interfere with the performance of other activities.

For example, breathing.

It is used when a task is simple or familiar and tends to be rapid (**e.g.** an experienced driver can usually reverse-park more quickly than a learner driver). Unlike controlled processing, automatic processing also tends to be parallel. This means that we usually can handle two or more tasks at the same time.

Two automatic processes can be done simultaneously. An automatic process and control process can be done simultaneously. However, two control processes is extremely difficult to do simultaneously.

The more similar two processes are the more difficult it is to do simultaneously. The more different the two processes are the easier it is to do simultaneously.

When we learn a new task, it is often complex at first and we depend on controlled processing. This enables us to selectively focus our attention on each important aspect of the task. When the task becomes familiar we are often able to use automatic processing, enabling us to divide our attention between a range of other mental and/or physical activities.

Perceptual and cognitive distortions

Compared with normal waking consciousness, the way we experience sensations and perceptions in an ASC is often different. An ASC tends to have one of two effects on the senses — it either makes them more receptive to external stimuli, or dulls them to such an extent that some sensations are not experienced at all.

For example, some drug-induced ASCs make perception of sensory experiences more vivid, so that colours seem brighter, tastes and smells stronger, sounds louder or more variable, and touch more sensitive. In some instances, people may even hallucinate, experiencing perceptions of stimuli or events that are not really occurring. They may see visions or hear non-existent voices.

Alternatively, during meditation, an individual may be able to focus their concentration to such an extent that their normal pain threshold (tolerance) is so high that regardless of what is done to them, they report experiencing no pain at all.

Perceptions can be so distorted in an ASC that people may lose their sense of identity (who they are). Some people experience the feeling either that they are someone else or that they are 'outside themselves' looking in. The feeling of losing touch with reality accompanies many ASCs.

Cognitive functioning also tends to become impaired during an ASC. Thought processes are often more disorganised during a waking ASC, as well as during the ASC of dreaming when asleep. In an ASC, thinking is often illogical and lacking in sequence, and difficulties may be experienced in decision making and problem solving. In addition, people often have trouble remembering events that occur during an ASC.

For example, after experiencing an alcohol-induced ASC, people are often unable to recall in detail the events that occurred while they were intoxicated. ASCs induced through marijuana use also result in short-term memory impairment and subtle changes in thinking. In addition, when in an ASC, some individuals also have difficulty recalling information from long-term memory. However, retrieval of information from memory is usually restored when the individual returns to normal waking consciousness.

Emotional awareness

A change in our awareness and experience of emotion is also associated with many ASCs. ASCs appear to sometimes put an individual's feelings into a state of turmoil, resulting in uncharacteristic responses.

For example, in an alcohol-induced ASC, some people become more emotional and may express their emotions more openly than in normal waking consciousness. In other ASCs, people have reported feeling emotionless. They have no feelings at all for events or situations that in normal waking consciousness would produce a highly emotional reaction in them.

ASCs have also been associated with inappropriate emotional reactions, such as laughing at being told of a friend's death or crying when told a joke. Unpredictable emotional responses are also often associated with ASCs. While intoxicated, for example, an individual may burst into tears or become highly aggressive or excitable for no apparent reason.

Self-control

Changes in our ability to maintain self-control are often evident during ASCs.

For example, in an alcohol-induced ASC, individuals often have difficulty coordinating and controlling movements, sometimes being unable to walk down a hallway without stumbling into the walls. As described previously, they may also have difficulty maintaining control of their emotions; **for example**, behaving aggressively or affectionately to people with whom they would normally not behave this way in a state of normal waking consciousness.

Additionally, emotional responses may be amplified; **for example**, stronger or in excess or what would normally occur when not in the ASC.

Similarly, when in a hypnotic state, people are more susceptible to suggestion than when in their normal waking state. This can result in them behaving in a less inhibited way. An ASC induced through hypnosis has also been shown to help people gain greater self-control.

For example, therapeutic use of hypnosis has helped some people to stop smoking, gambling or overeating and has assisted others to manage chronic pain.

Time orientation

Estimation of time is frequently distorted in an ASC. **Time seems to pass at a different speed than normal**. For some individuals in some ASCs, the passing of time may appear to be quicker, while in other ASCs, time appears to pass very slowly.

For example, when you are woken from a nap you may be surprised to learn that only an hour has passed since you fell sleep. It may seem as though you have been asleep for much longer. At other times, you can feel as though you have slept for a much shorter time than you actually have.

Normal Waking Consciousness (NWC) vs Altered States of Consciousness (ASC) summary table

Psychological Indicators	Normal Waking Consciousness (NWS)	Altered States of Consciousness (ASC)
Content limitations	Content is limited in type and amount. Very few bizarre thoughts.	Content is fairly unlimited, mainly due to lack of control. **E.g.** Alcohol induced state, Dreaming
Perceptual distortions	Sensations reflect reality. Perception is clear leading to heightened awareness of surroundings.	Perceptions can be dulled. **E.g.** Anaesthetic Perceptions can be heightened **E.g.** Hallucinations in a drug induced state. Sometimes perception is so distorted that people may lose their sense of identity. **E.g.** Drug induced state.
Cognitive distortions	Cognition is usually logical and organised. Effective memory functioning. Capable of analytical and logical thinking. Strong reasoning.	Cognition is illogical and fragmented. **E.g.** Alcohol/drug induced state. Memory is impaired. **E.g.** Alcohol induced state and dreaming. Cognitive distortions may occur. **E.g.** You may think people are trying to kill you. Alcohol/drug induced state or dreaming.

Psychological Indicators	Normal Waking Consciousness (NWS)	Altered States of Consciousness (ASC)
Emotional awareness	Show normal range of appropriate emotions.	Emotional responses tend to be: Inappropriate **E.g.** Drug induced state. Heightened **E.g.** Alcohol induced state. Dulled **E.g.** Drug induced state.
Self-control	Awareness of self. Conscious ability to take control of behaviour. Some psychological and physical limitations to self-control.	Self-control is compromised. **E.g.** - Asleep - Drunk - Hypnotised
Time orientation	Perception of time is accurate. **E.g.** 1 hour feels like 1 hour. Awareness of past, present and future events.	Sense of time is distorted. **E.g.** Time could be perceived to be moving faster or slower. **E.g.** Sleep and anaesthetic.

COMPARING EFFECTS OF ONE NIGHT OF FULL SLEEP DEPRIVATION VS LEGAL BLOOD-ALCOHOL CONCENTRATIONS

In an influential study on how sleep deprivation can change conscious experience and adversely impact on human performance, Australian psychologist Drew Dawson and neurologist Kathryn Reid (1997) identified a significant relationship between fatigue due to a moderate level of sleep deprivation, legal levels of alcohol consumption and impaired performance.

They found that performance on a variety of cognitive tasks following **17 hours of full sleep deprivation** (which they called 'sustained wakefulness') had decreased to a level that was equivalent to that of a person with a **blood-alcohol concentration (BAC) of 0.05%** (which is the legal driving limit in Australia and many other countries). Performance following **24 hours of sustained wakefulness was equivalent to that of someone with a BAC of 0.10%.**

Dawson and Reid experiments

Dawson and Reid obtained their results using 40 participants in a repeated measures experiment with counterbalancing. In the first condition, the participants were kept awake for 28 hours (from 8.00 am to 12 noon the following day). In the second condition, they were asked to consume 15 grams of alcohol every 30 minutes until their BAC reached 0.10%. An Australian standard drink contains 10 grams of alcohol (12.5 ml of pure alcohol).

In both conditions, participants were assessed on 'cognitive psychomotor performance' at half-hourly intervals. This required completion of a computer-administered test of eye–hand coordination involving an unpredictable tracking task. Eye–hand coordination involves the visual processing of information to guide hand movements. As well as visual–motor integration, the eye–hand task used in the experiment requires concentration (e.g. selective attention), speed, accuracy and decision making. Performance can also be influenced by other participant variables such as mood and motivation.

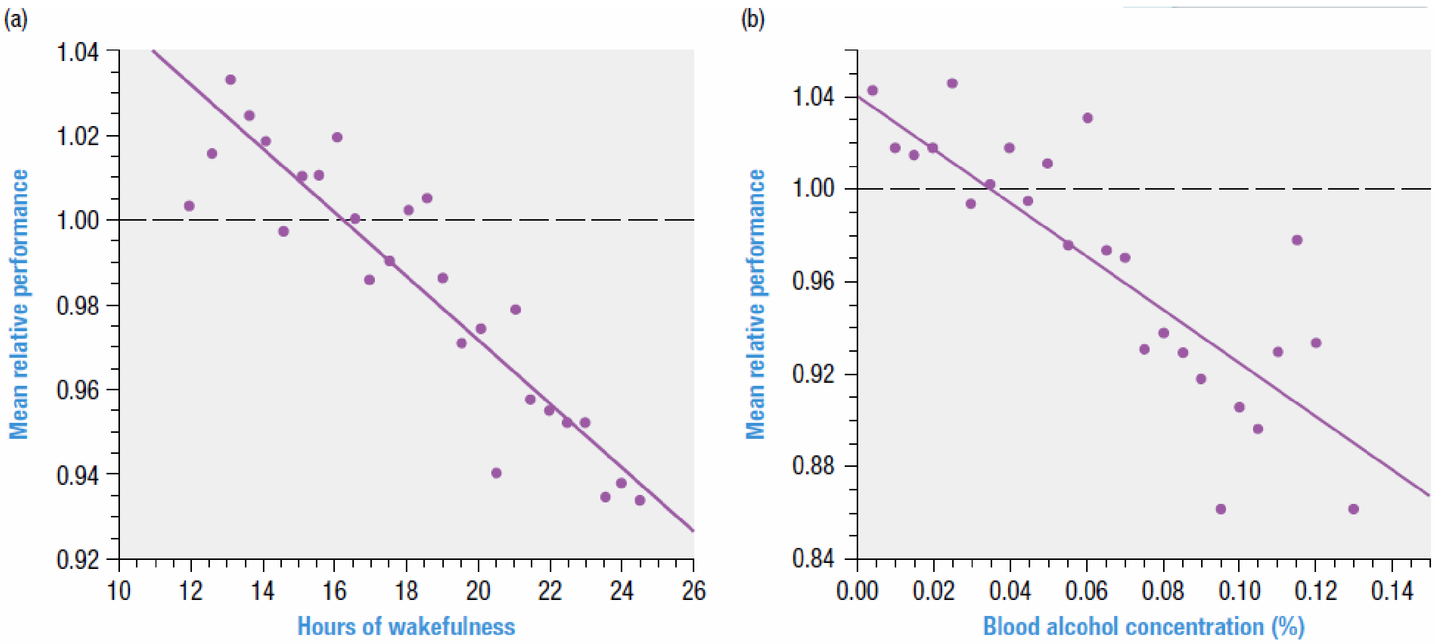


FIGURE 8.28 Scatterplots showing performance in the (a) wakefulness and (b) alcohol conditions in the Dawson and Reid (1997) experiment

Performance on the tasks decreased significantly in both experimental conditions. Statistical analysis led Dawson and Reid to conclude that the effects of moderate sleep deprivation (i.e. 24 hours) on performance are similar to moderate alcohol intoxication (i.e. 0.05%). Furthermore, the results showed that the performance impairment effects of moderate sleep deprivation are equivalent to or greater than the level of alcohol that is deemed legally unacceptable when driving, working and/or operating dangerous machinery.

In a follow-up study to test his findings, Dawson compared the effects of moderate sleep deprivation and alcohol on a range of other cognitive tasks and concentration tasks in another repeated measures experiment. Twenty-two participants aged 19–26 years were selected from a group of volunteers after screening for any type of sleep or health problem. Cigarette smokers, non-social drinkers (i.e. more than six standard alcoholic drinks per week) and anyone on medication known to interact with alcohol were also excluded. There were three experimental conditions to which participants were randomly allocated and completed in a sequence:

Condition 1: alcohol intoxication — consume an alcoholic drink at half-hourly intervals until BAC of 0.10% is reached; complete performance tests hourly.

Condition 2: placebo — rim of drinking glass pre-dipped in ethanol to give impression it contained alcohol; equal number of participants drink the placebo or alcohol to help ensure participants remain blind to the treatment condition they are participating in.

Condition 3: sustained wakefulness — deprived of sleep for one night; complete performance tests hourly.

The performance tests completed by participants in each condition were all computer administered.

These included:

- Eye–hand coordination — a tracking task using a joy stick.
- Concentration — button pressing depending on a particular light being illuminated.
- Sensory comparison — identify the correct visual stimulus from among alternatives.
- Grammatical reasoning — decide whether logical statements are true or false.

Each test session lasted for 15 minutes. Speed and accuracy was also measured and participants received no feedback on their performance to avoid knowledge of their scores affecting performance levels.

The results showed that as the level of blood-alcohol concentration or amount of sleep deprivation increased, performance on the tasks tended to decrease. The drink consumed in the placebo condition did not significantly affect performance.

Results on some of the tests are shown in figures 8.29–33 below. Overall, the effects of one full day's sleep deprivation were like the effects of the legal blood-alcohol concentration of 0.05%. Note also the effects of less than one day's sleep deprivation compared with the effects of a BAC of less than 0.05% (Lamond & Dawson, 1999).

These results were generally consistent with those of Dawson's previous research study. Although there are exceptions, similar results have since been obtained by other researchers on a variety of cognitive and concentration tasks. However, generalising the findings to real life settings from computer simulations often involving relatively simple tasks under controlled laboratory conditions requires careful consideration of a wider range of variables that also impact on human performance including the interactions between sleep deprivation and alcohol consumption combined.

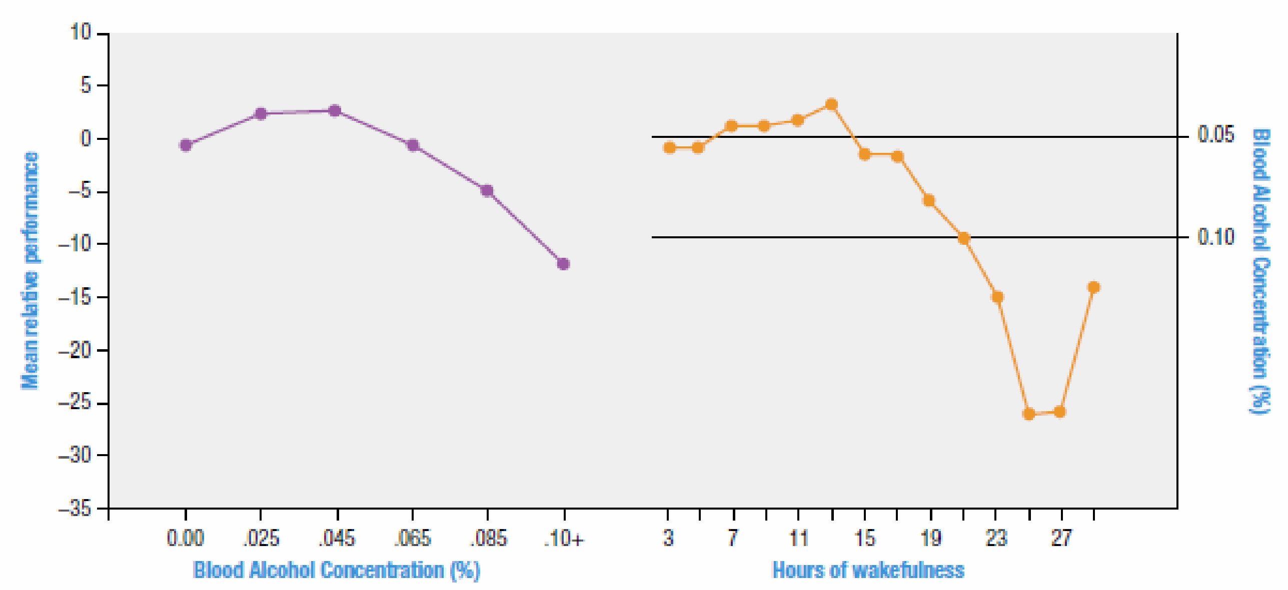


FIGURE 8.29 Mean performance levels for the speed component of the grammatical reasoning task in the alcohol intoxication and sustained wakefulness conditions of the Lamond and Dawson (1999) experiment

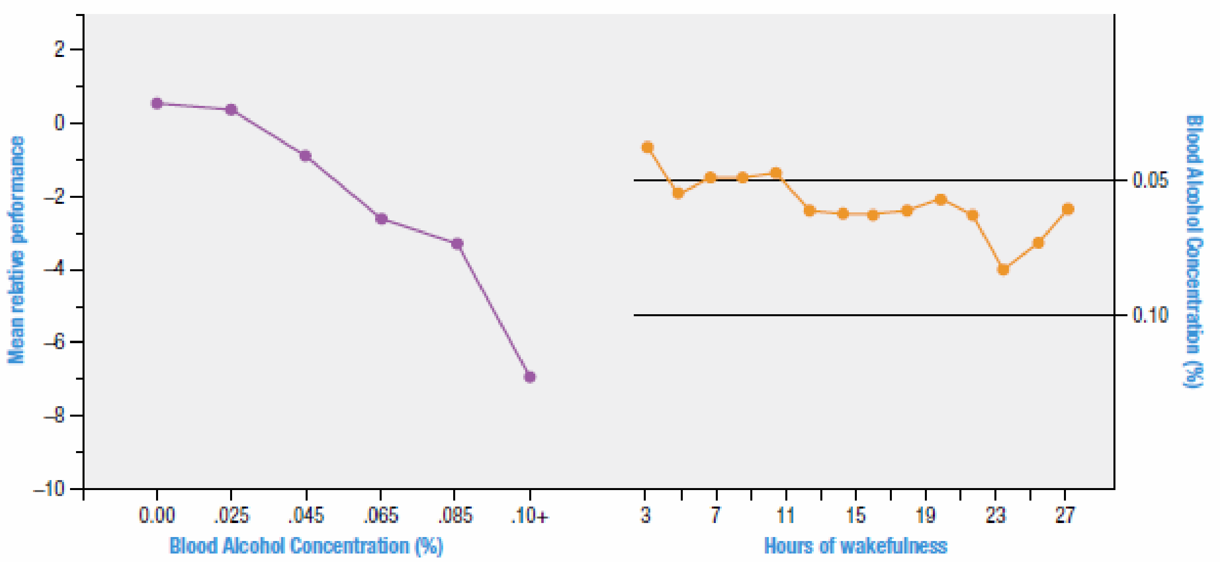


FIGURE 8.30 Mean performance levels for the accuracy component of the grammatical reasoning task in the alcohol intoxication and sustained wakefulness conditions of the Lamond and Dawson (1999) experiment

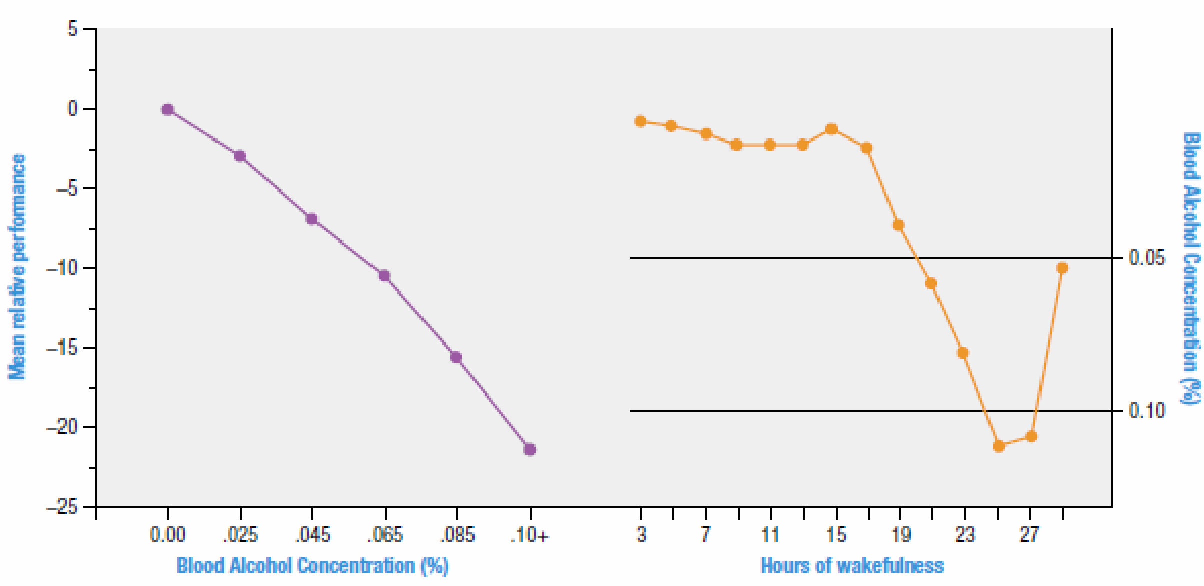


FIGURE 8.31 Mean performance levels for the speed component of the concentration task in the alcohol intoxication and sustained wakefulness conditions of the Lamond and Dawson (1999) experiment

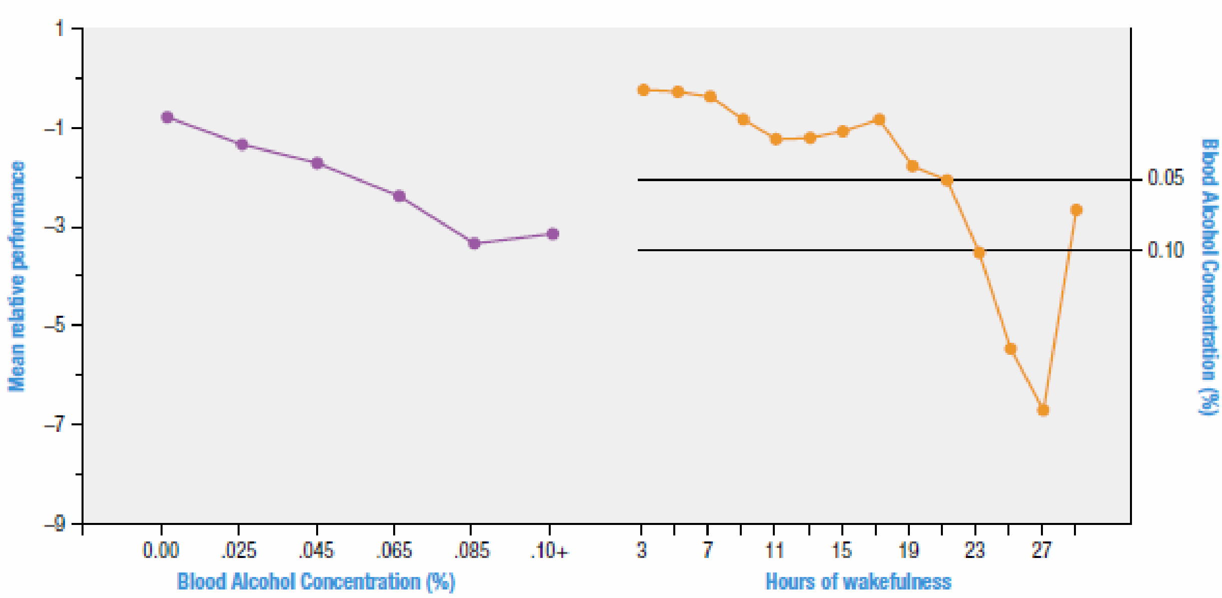


FIGURE 8.32 Mean performance levels for the accuracy component of the concentration task in the alcohol intoxication and sustained wakefulness conditions of the Lamond and Dawson (1999) experiment

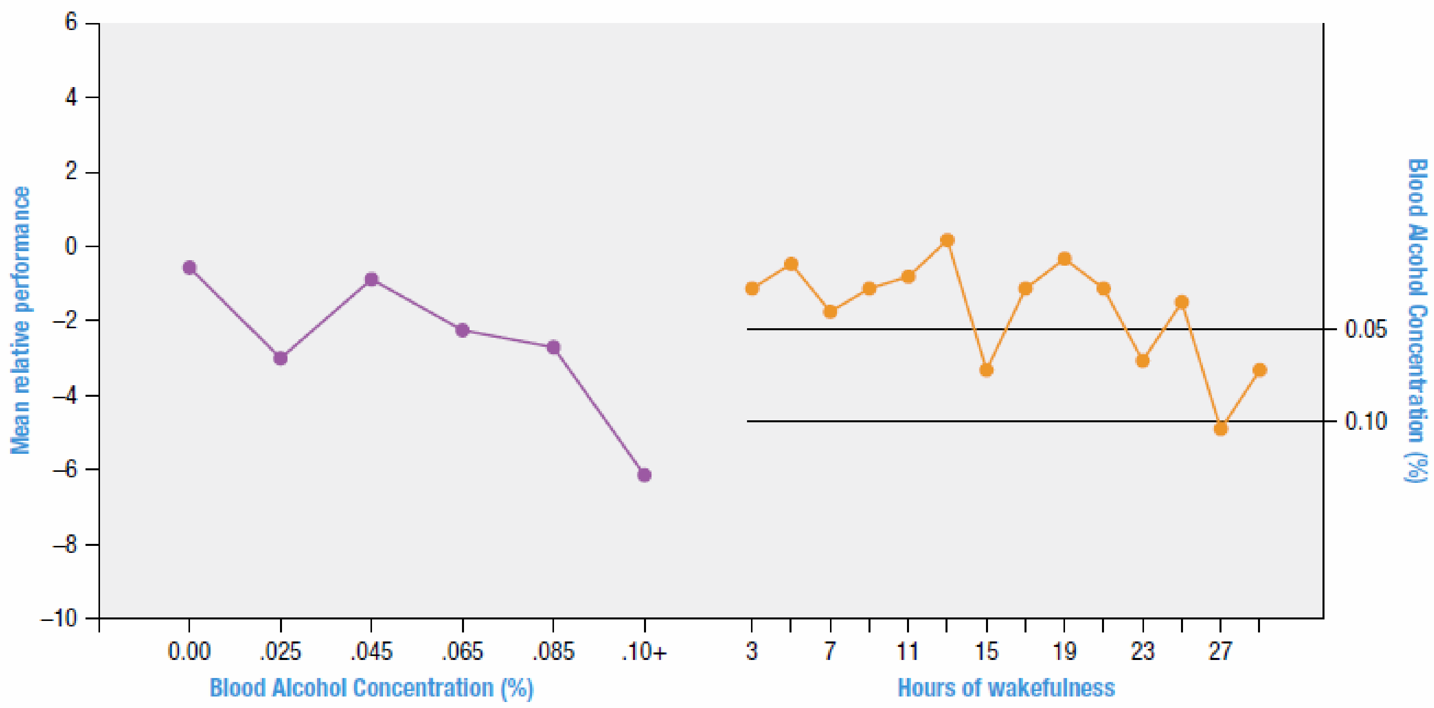


FIGURE 8.33 Mean performance levels for the sensory comparison task in the alcohol intoxication and sustained wakefulness conditions of the Lamond and Dawson (1999) experiment

There is considerable research evidence that sleep deprivation and alcohol consumption, either independently or in combination, influence and are influenced by our mood state. Generally, sleep deprivation results in a negative mood state (e.g. irritability, short-tempered), which you probably know through personal experience, and alcohol consumption results in either a positive or negative mood state, depending on such variables as the amount of sleep deprivation or alcohol, the individual and the context. In turn, our mood state influences our conscious experience and can either enhance or impair concentration and cognitive performance.

For example, inadequate sleep can make us cranky and thereby interfere with our ability to concentrate and think clearly. This can undermine performance on a variety of simple and complex cognitive tasks. In addition, our mood can influence alcohol consumption, such as whether or not to drink, what we drink and the rate and amount of consumption.

Similarly, our mood can influence sleep deprivation, **for example**, whether or not we have difficulty falling or staying asleep. **In sum, sleep deprivation, alcohol, cognition, concentration and mood are intertwined and may interact in complex ways in influencing conscious experience**.

CHAPTER 9: SLEEP

Sleep is a reversible behavioural state of perceptual disengagement from and **unresponsiveness** to the environment.

- Sleep involves a cyclical progression through different states which are associated with different levels of alertness and physiological responses. It is a naturally and regularly occurring altered state of consciousness that follows an internally regulated daily cycle of about 24 hours. Within this daily cycle are shorter cycles of distinguishable stages and activity.
- Reversibility, perceptual disengagement and unresponsiveness to the environment are key characteristics that enable sleep to be distinguished from other states of consciousness. All must be evident for an organism to be considered asleep.

Reversibility means that a sleeper can always be awoken with a strong enough stimulus and therefore 'reverse back' to the waking state quite quickly.

Perceptual disengagement means that the sleeper has no awareness of the sights, sounds, smells and other sensory stimuli in their external environment of which they are usually conscious in the waking state.

- The sleeper is therefore also *unresponsive* to environmental stimuli, although a strong enough sensory stimulus may awaken a sleeper (as per the reversibility characteristic).

Deep sleep.

SLEEP AND BIOLOGICAL RHYTHMS

A **biological rhythm** is a naturally occurring pattern of cyclic changes in a bodily function or state that repeats itself over time.

Examples include body temperature, blood pressure, blood sugar level, secretion of certain hormones, mental alertness and the sleep-wake cycle.

- Each biological rhythm is said to be maintained and controlled by an internal mechanism or neural system commonly referred to as a 'biological clock'.

Circadian rhythms

FIGURE 9.2 The human sleep–wake cycle is a naturally occurring 24-hour circadian rhythm regulated by a biological clock. This complex timekeeper is controlled by an area of the brain that primarily responds to light, which is why we are ordinarily most alert during the day, and less alert and more ready to sleep when it is dark outside.

A **circadian rhythm** is a biological rhythm involving changes in bodily functions or activities that occur as part of a cycle with a duration of about 24 hours.

The **sleep-wake cycle** is a daily, naturally occurring 24-hour circadian rhythm of sleep and wake states regulated by a biological clock.

Environmental time cues are called **zeitgebers**.

Entrain means resetting and matching a clock to an environmental cycle or changes through the influence of a zeitgeber.

Light is the main environmental cue that influences the sleep-wake cycle. An area of the hypothalamus called the suprachiasmatic nucleus (SCN) is considered to be the 'master' biological clock that regulates the timing and activity of the sleep-wake cycle (as well as body temperature and other circadian rhythms). The **suprachiasmatic nucleus (SCN)** is an area of the brain's hypothalamus that regulates the timing and activity of the sleep-wake cycle (and other biological rhythms).

- The SCN receives information about the amount of incoming light from the eyes and adjusts our sleep-wake cycle accordingly. It does so by sending neuronal messages to the nearby pineal gland to secrete more or less of the hormone melatonin into the blood.
- The amount of melatonin present in the blood is associated with alertness. Higher melatonin levels are associated with a greater drowsiness and vice versa. The amount that is secreted varies with the amount of light that is detected.

Melatonin is a hormone secreted in relation to the amount of light that is detected and which influences alertness-drowsiness and timing of the sleep-wake cycle.

FIGURE 9.4 (a) Circadian rhythms are regulated by the suprachiasmatic nucleus (SCN) within the hypothalamus, which is considered to be the location of the biological clock. (b) The SCN receives information about the amount of light from the eyes and adjusts our sleep–wake cycle accordingly. It signals the nearby pineal gland to produce and secrete more or less melatonin in relation to light intensity. For clarity, the SCN is shown proportionally larger than other structures. (c) The amount of melatonin present in the blood is associated with alertness. Higher melatonin levels are associated with greater drowsiness and vice versa. The amount that is secreted varies with the amount of light that is detected. Note the melatonin feedback loop enabling the SCN to detect the level of melatonin in the blood and modify the output from the pineal gland to maintain an optimum level.

Ultradian rhythms

An **ultradian rhythm** is a biological rhythm involving changes in bodily functions or activities that occur as part of a cycle shorter than 24 hours.

NREM sleep

NREM sleep is non-rapid eye movement sleep conventionally subdivided into four stages involving increasingly deeper sleep and constituting about 75-80% of a typical night's sleep.

REM sleep

REM sleep is rapid-eye movement sleep during which the eyeballs rapidly move beneath closed eyelids and constitutes about 20-25% of a typical night's sleep and is the period in which most dreaming occurs.

	NREM Stage 1	NREM Stage 2
Description	Occurs as we drift in and out of a true sleep state. Gradually lose awareness of our surroundings.	A period of **light sleep**, some describe it as the stage in which you are truly asleep.
Physiological responses	Decrease in heart rate, respiration, body temperature and muscle tension. Muscles experience a 'jerking' sensation called 'hypnic' jerking.	Body movements and breathing becomes more regular, blood pressure and body temperature continue to fall, heart rate is slower and eye movements stop.
Other features of the stage	Can easily be awoken, meaning stage 1 has a **low arousal threshold**. Mainly alpha waves slowly replaced by theta waves.	Midway through this stage we are unlikely to respond to anything except extremely loud stimuli. Theta waves, with sleep spindles and k complexes.
Duration of the stage	Lasts for about 5 minutes, for some as little as 1 or even up to 7-8.	Lasts about 10-25 minutes and lengthens with each successive cycle.

	NREM Stage 3	NREM Stage 4
Description	The start of the deepest period of sleep, called **moderately deep sleep**.	The deepest stage of sleep, known as **very deep sleep**.
Physiological responses	Heart rate, blood pressure and body temperature continue to drop, and the breathing rate continues to be slow and steady.	Muscles are completely relaxed, with barely any movement. Heart rate, blood pressure and body temperature continue to drop, and the breathing rate continues to be slow and steady.
Other features of the stage	Extremely relaxed and becomes less responsive to external stimuli. Delta waves make up 20-50% of the waves of this stage. Also known as **slow wave sleep** because of the slow frequency delta waves.	Delta waves occur 50% of the time. Very hard to wake, 'sleeping like a log'. Has the **highest arousal threshold.** In the first sleep cycle, it lasts for 20-40 minutes, as cycles continue, time in this stage reduces. In cycles close to the morning, stages 3 and 4 may not occur. **Sleep inertia**: experiencing a post-awakening mental lag.
Duration of the stage	Lasts for sometimes only a few minutes but can be up to 10 minutes. In sleep cycles during the second half or so of a sleep episode, there may be no stage 3 sleep at all.	Lasts for 20-40 minutes in the first sleep cycle. As cycles continue, time in this stage reduces.

	REM sleep
Description	Eyeballs move rapidly beneath the closed eyelids. Similar brain activity to when we are awake (alert wakefulness) showing beta-like waves.
Physiological responses	The body's internal functioning is more active during REM sleep than NREM sleep. Heart rate is faster and more irregular. Blood pressure rises and breathing is quicker and more irregular. However, the sleeper is totally relaxed and appears paralysed.
Other features of the stage	Difficult to wake and considered deep sleep. REM sleep is sometimes referred to as **paradoxical sleep** because internally the brain and body are active while externally the body appears calm and inactive. Most dreaming occurs in REM. 80% of the time, if woken during REM, people will report having been dreaming at the time of being woken. REM sleep may help enhance brain development, facilitating the formation of synapses and consolidation of long-term memories. Infants show a higher proportion of time in REM sleep. REM plays an important role in the maturation of the nervous system. When people are allowed to sleep uninterrupted after their REM has been interrupted, they spend more time in REM sleep. This is referred to as **REM rebound**.
Duration of the stage	In the first cycle, an individual may spend 1-5 minutes in REM, in the second cycle 12-15 minutes, the third 20-25 minutes, while the later REM periods towards the end of a sleep episode may last even longer (up to 60 minutes).

IMPORTANT FACTS

- During a typical 8 hour sleep cycle, we experience **5-6** complete sleep cycles.
- A complete sleep cycle lasts for around **70-100** minutes.
- Approximately **75-80%** of our sleep cycle is spent in NREM sleep.
- Approximately **20-25%** of our sleep cycle is spent in REM sleep.
- As the night progresses, periods of **NREM sleep tend to get shorter** while periods of **REM sleep tend to get longer and closer together.**
- NREM sleep progresses from stage 1 to stage 4 in about **45-60** minutes, before gradually moving back up through stages 3 and 2.

A **hypnogram** is a 'sleep graph'.

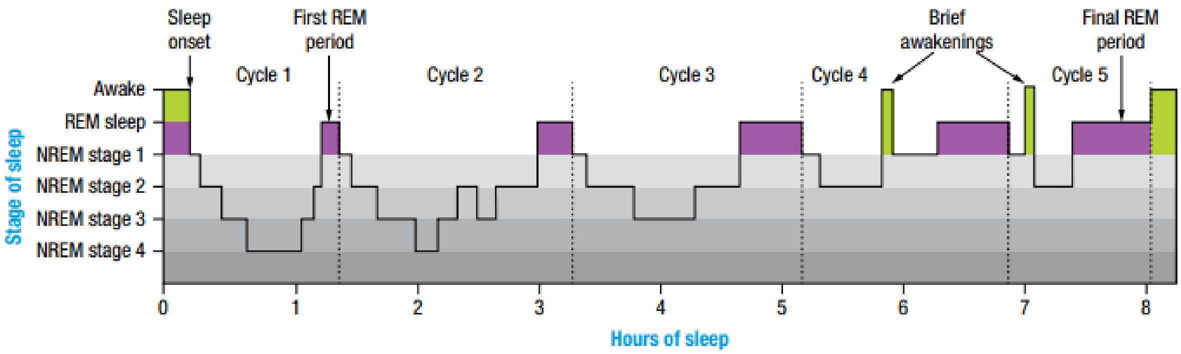


FIGURE 9.8 A typical sleep episode across a single night for a healthy young adult. The hypnogram shows alternating cycles of NREM and REM sleep and the relative amount of sleep spent in each of these. Note that as the sleep episode progresses, stages 3 and 4 (deepest sleep) may not be experienced and that REM sleep periods tend to get longer and be closer together. Stage 1 may be skipped at different times during the episode, most commonly just before the first REM period. There may also be brief awakenings during the episode.

Source: Based on Carskadon M., & Dement W.C. (2005). Normal human sleep: An overview. In M.H. Kryger, T. Roth & W.C. Dement (Eds.), *Principles and practice of sleep medicine* (4th ed., pp. 13–23). Philadelphia: Elsevier Saunders.

Terms regarding sleep

An **arousal threshold** is the level of sleep from which a sleeping person can be awakened.

Slow wave sleep is a period of sleep characterised by slower frequency delta waves that occurs during stages 3 and 4 sleep.

Light sleep refers mainly to NREM stages 1 and 2.

Deep sleep refers to stages 3 and 4 of NREM sleep.

Hypnic jerk or **hynagogic jerk** is an involuntary twitch which occurs just as a person is beginning to fall asleep, often causing them to awaken suddenly for a moment.

Sleep inertia is a sleep-to-wake transition effect characterised by grogginess, low alertness and disorientation that can interfere with behavioural and cognitive functioning.

THEORIES OF THE PURPOSE AND FUNCTION OF SLEEP

Restoration theory

Restoration theory, also called *recovery theory* and *repair theory*, is a theory on the purpose and function of sleep proposing that sleep provides 'time out' to help us recover from depleting activities during waking time that use up the body's physical and mental resources.

Restorative functions of NREM and REM sleep.

- NREM sleep is considered to be important for restoring and repairing the body. **For example**, physical growth, tissue repair and recovery from the effects of fatigue may occur during slow wave, stages 3 and 4 of NREM sleep when the brain is least active.
- A different restorative role of REM sleep is suggested by the fact that REM sleep is much more abundant in the developing foetus and infant than in childhood and subsequent lifespan stages. This indicates that REM sleep may play an important part in the peak period of brain development that occurs in the early stages of the lifespan.
- It has also been proposed that REM sleep has a restorative role throughout the lifespan by providing regular 'exercise' to groups of neurons in the brain that form neural pathways, thereby promoting the maintenance of brain circuits. Synapses can deteriorate if they go too long without being active, so the increased brain activity observed during REM sleep may help preserve important neural pathways.
- There is also evidence that REM sleep may assist in the consolidation of new memories.
- **REM rebound** involves catching up on REM sleep immediately following a period of lost REM sleep by spending more time than usual in REM sleep when next asleep.

Evolutionary (circadian) theory

Evolutionary (circadian) theory, also called *evolutionary theory*, *circadian theory*, *adaptive theory* or *survival theory*, is a theory on the purpose and function of sleep proposing that sleep evolved to enhance survival by protecting an organism through making it inactive during the part of the day when it is most risky or dangerous to move about.

- The organism's circadian sleep-wake cycle helps ensure its lifestyle and specific activities are synchronised with the day-night cycle of its environment and at the safest times.
- Thus, according to the theory, sleep serves the function of protecting the sleeper from harm or death and therefore enhances survival of the species.
- Humans sleep at night because we are highly visual animals who need light to find food and do other things necessary for survival. Consequently, we are not well adapted to searching for food in the dark or protecting ourselves from nocturnal predators.
- As a result, sleep serves an **adaptive function.**

Limitations

Restoration theory

- It has not been conclusively established in a cause-effect way precisely what, if anything, is actually restored, repaired or revitalised during sleep and at no other time.
- Nor has research in general established that restoration is the only function of sleep.

Evolutionary (circadian) theory

- It does not actually explain our need for sleep – why we must and will eventually sleep, regardless of the environmental circumstances and possibly the danger to which we may be exposed if we fall asleep.
- Nor does the theory account for the loss of awareness and alertness during sleep, since their loss may place the organism at greater risk.

DIFFERENCES IN SLEEP PATTERNS ACROSS THE LIFESPAN

Sleep patterns change considerably with age.

Newborns and infants

- More than half of the infant's sleep is REM sleep or *active sleep* that is like REM sleep.
- REM sleep plays a role in neural processes involved in early brain development.
- The young infant's circadian rhythms are not fully developed and have not yet been fully entrained to the daily day-night cycle of their external environment. At around 2 or 3 months when circadian rhythms start to exert their influence, particularly the cyclical production of melatonin, there are longer periods of wakefulness during the day and longer periods of sleep at night.
- By 3 months of age, the NREM-REM sleep cycles become more regular. Sleep onset now begins with NREM stage 1, REM sleep decreases and shifts to the later part of the sleep cycle, and the total NREM-REM sleep cycle is typically 50 to 60 minutes.
- By 6 months of age, total sleep time reduces slightly and the longest continuous sleep episode lengthens to about 5 to 8 hours at night. Sleep episodes become less fragmented and a full NREM cycle comprising all stages is likely to have emerged.
- By about 12 months old, the infant sleeps 14 to 15 hours per day with the majority of sleep occurring as a single episode in the evening.

Young children

- Total sleep time continues to decrease as the child gets older, from about 13 to 11 hours between 2 to 5 years of age.
- The proportion of REM sleep continues to decrease and the amount of NREM sleep increases, with a greater percentage of sleep time spent in stages 3 and 4. About half the NREM sleep of children is slow wave deep sleep and this decreases markedly from about age 10.
- For example, it is extremely difficult to wake a 10 year old when delta brain waves are predominant in the night's first sleep cycle.

Adolescents

- With increasing age, the total time spent sleeping decreases, as does the amount of REM sleep.
- Within NREM sleep, the amount of stages 3 and 4 sleep progressively declines and the time spent in stage 2 increases.
- By late adolescence, the amount of slow wave deep sleep has decreased by nearly 40% since early childhood.
- Research findings indicate that adolescents tend to get less sleep than they need to function at their best. One reason is a biologically driven change in their sleep-wake cycle that changes the timing of sleep, delaying its onset for one to two hours.

Adults

- By adulthood, we average about 8 hours of sleep a night, 20-25% of which is REM sleep.
- There is also a gradual loss of stages 3 and 4 NREM sleep. As an individual ages (between the ages of 20 to 60), slow wave deep sleep declines at a rate of about 2% per decade.
- Eventually, stages 3 and 4 disappear altogether. Females appear to maintain slow wave deep sleep later into life than men.
- Sleep also tends to become more fragmented as we age, with more night-time awakenings among older adults. One reason for more frequent awakenings is the decline in NREM stages 3 and 4 sleep with age – we are harder to awaken during slow wave sleep.
- Older people also tend to become sleepier in the early evening and wake earlier in the morning compared to younger adults. This pattern is called *advanced sleep phase syndrome.*

REM, NREM

Newborn: 16 hours, 50%, 50%

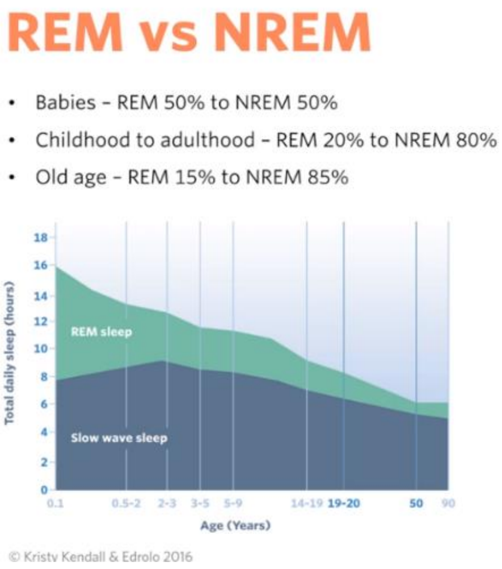
Infants: 14-15 hours, 40-50%, 50-60%

Young children: 13-11 hours, 20-25%, 75-80%

Adolescents: 8-10 hours, 20-25%, 75-80%

Adults: 7-8 hours, 20-25%, 75-80%

Elderly: 5-7 hours, 15-20%, 80-85%



CIRCADIAN RHYTHM PHASE DISORDERS

A **circadian rhythm phase disorder**, also called *circadian rhythm sleep-wake disorder*, is a sleep disorder involving sleep disruption that is primarily due to a mismatch between an individual's sleep-wake pattern and the pattern that is desired or required.

Sleep-wake cycle shift in adolescence

A **sleep-wake cycle shift** is a change in the timing of the major sleep episode, either through forward or backward movement.

Sleep debt is accumulated daily sleep loss that is owed and needs to be made up.

Shift work

Shift work is a type of work schedule designed to meet the demands of a 24/7 society.

- Day, afternoon and night shifts.
- These may be on a *fixed* schedule and require employees to work the same shift on a regular, ongoing basis, or they may be on a *rotating* schedule and require employees to change shifts every so often to work a mix of day and/or afternoon and/or night shifts.
- Our body has a sleep-wake cycle that is biologically programmed to sleep best at night and to be awake and most alert during the day and early evening. Night shift work in particular disrupts this cycle and can cause sleep-related problems.
- Sleep debt may accumulate.
- Difficulty falling asleep and/or maintaining sleep during the day after overnight shifts.
- Excessive sleepiness may impair performance because of reduced alertness. Is believed to contribute to the significant number of on-the-job accidents.
- Work rosters with rotating shift work schedules are associated with a higher frequency of sleep disturbances than rosters with fixed schedules.

Jet lag

Jet lag is a sleep disorder due to a disturbance to the circadian sleep-wake cycle caused by rapid travel across multiple time zones.

Shifting to a new time zone in this way results in a mismatch between our internal circadian biological clock and the external environment – our biological clock is out of sync with the actual time in the time zone of the new environment.

Because jet travel is quick, our sleep-wake cycle remains aligned to the environmental time cues of the home time because there has been insufficient time to adjust to the new time cues.

Jet lag may make individuals experience difficulties in initiating or maintaining sleep, excessive sleepiness, reduced daytime alertness, impaired concentration and cognitive performance, and digestive problems.

- ‘Travelling west is best’. When flying east, the day becomes ‘shortened’.

- Resetting the biological clock for the sleep-wake cycle to the destination time as quickly as possible is the key to overcoming jet lag. Travellers should start to change their eating, sleeping and other behaviour patterns to accord with the ‘destination time’ routines.

EFFECTS OF PARTIAL SLEEP DEPRIVATION

Sleep deprivation is a state caused by inadequate quantity or quality of sleep, either voluntarily or involuntarily.

Partial sleep deprivation involves having less sleep (either quantity or quality) than what is normally required.

- This may occur periodically or persistently over the short-term or long-term. Z
  For example, someone may have too little sleep for one or more days, weeks, months and so on.

Total sleep deprivation involves not having any sleep at all over a short-term or long-term period. The person stays awake for one or more days or weeks.

- Usually takes place under extreme conditions.
- Longest period of total sleep deprivation is 18.7 days.

Affective (emotional) functioning

Amplified emotional responses are emotional reactions that may be too quick and more intense or exaggerated, often out of proportion to how we would ordinarily react, often as a result of sleep deprivation.

Sleep loss seems to compromise our brain’s ability to process emotional information, make accurate emotional perceptions and then regulate how we respond emotionally.

- Harder to accurately judge other people’s emotions and reactions, making us more prone to unwarranted emotional outbursts.

Effects include:

- When we haven’t slept well, our emotional response threshold can be lowered, increasing our emotional reactivity and making us more likely to overreact to relatively neutral events.

- Detrimental effect on ability to sort out the unimportant from the important, can lead to poor judgements in relation to emotional responses.

- Overreact emotionally to trivial matters.

- May feel provoked or emotionally explode when no provocation exists.

- May find it harder to control impulses.

- Sleep loss is associated with becoming aggressive more quickly than usual and with the outward expression of aggressive impulses. We are more likely to quarrel with other people and get frustrated and overreact in traffic jams.

- Even a single night of inadequate sleep can have these effects.

REM and NREM sleep seem to play different roles in emotion regulation. **For example**, research findings suggest that emotional reactivity is more likely to occur with REM sleep deprivation.

Behavioural component

One of the immediate effects on **behavioural functioning** can be sleep inertia. **Sleep inertia** is a sleep-to-wake transition effect characterised by grogginess, low alertness and disorientation that can interfere with behavioural and cognitive functioning.

- Sometimes described as a 'state of grogginess', sleep inertia is strongest at wake time, but dissipates, or decays, rapidly thereafter.

- Usually lasts for a few minutes but can last for much longer.

- Can interfere with the ability to perform a wide range of behavioural and cognitive tasks.

- Reaction time tends to be slow

- Tend to perform below our best until we reach full alertness and recover for the inertia effects.

- Motor and cognitive functions are not at their full capacity, so performing tasks that require full alertness can compromise the safety of the individual and others.

- Awakening during the deep sleep of NREM stages 3 and 4 produces more sleep inertia than awakening in stage 1 or 2.

- Waking up during REM sleep produces sleep inertia more like awakening from deep sleep than light sleep stages.

- Tends to last longer when a person has been sleep deprived, as compared to no deprivation.

The primary behavioural effect of sleep deprivation is **excessive sleepiness** during normal waking time.

- Involves difficulty in maintaining an alert awake state.

- Fatigue is a common symptom. There is a persistent feeling of tiredness and lack of energy.

- Difficulty maintaining concentration and reduced awareness on the environment.

- Reduces our efficiency and we tend to take longer to finish tasks.

- Have slower than normal reaction times and make more mistakes.

Sometimes lack of sleep or excessive sleepiness may result in unintended, involuntary lapses into sleep called microsleeps. A **microsleep** is a very short period of involuntary sleep that occurs while a person appears to be awake. During a microsleep the person typically has a fixed gaze, a blank expression on their face and doesn't blink.

- May last between 1-10 seconds and thus, the person may have no recollection of what happened during their microsleep.

- Microsleeps can affect the way you function. **For example**, if you're listening to the teacher explaining something in class, you might miss some of the information or feel like you don't understand the point on your return to normal waking consciousness. In reality, though, you may have slept through part of the lesson and not been aware of it.

Behaviour functioning associated with partial sleep deprivation include:

- impaired regulation or control of behaviour **e.g.** behaviour problems at home; naughtiness and disruptive behaviour at school; risk-taking behaviour by adolescents

- higher teacher rated inattentiveness by students in class

- poorer teacher rated social functioning by school

- school lateness and absenteeism

- lower participation rate in extracurricular activities at school

- higher injury rates and injury prone behaviours in preschool age and school age children

- reduced motor coordination, particularly eye-hand coordination

- reduced speed and accuracy

Cognitive functioning

Sleep deprivation can affect attention. In particular, excessive sleepiness tends to reduce alertness and our ability to stay focused on a task.

- With prolonged sleep deprivation, we tend to experience lapses in selective attention and reduced ability to divide our attention on tasks that require simultaneous attention to multiple sources of information.

- The greater the sleep deprivation, the more likely it is that attention will be impaired and that errors associated with loss of attention will increase, especially if the task lacks interest or complexity.

Effects of sleep deprivation on cognitive functioning include:

- Ability to think clearly tends to reduce, especially for tasks that require more complex thought (solving maths problems).

- More likely to think in irrational ways and have difficulty making decisions and solving problems that require creative thinking.

- Tendency to need more time to analyse situations.

- Tend to lose situational awareness and it is easier to overlook important details.

- Reduced verbal creativity and the ability to think abstractly in children.

- May impair various learning and memory processes.

- Processing information in short-term working memory can be significantly impaired, making it difficult to keep details in conscious awareness for use when required.

CHAPTER 10: SLEEP DISTURBANCES

A **sleep disturbance** is any sleep-related problem that disrupts sleep, causing distress or impairment in important areas of everyday life during normal waking hours.

A **primary sleep disorder** is a sleep disorder that cannot be attributed to another condition, such as another sleep disorder, a mental disorder or medical problem, or use of a substance such as a legal or illegal drug. The sleep disorder is the main, or 'primary', cause of the sleep problem.

A **secondary sleep disorder** involves a prominent sleep problem that is a by-product of or results from another condition, or use of a substance. **For example**, someone may experience regular awakenings whenever they sleep because of their back pain, a bladder problem, a breathing irregularity, stress, an anxiety disorder or depression.

FIGURE 10.3 Narcolepsy is primarily characterised by excessive sleepiness during normal waking hours. A person may feel sleepy anywhere, at any time when awake. In some cases, they may have a sleep attack and fall directly into REM sleep regardless of what they are doing.

DYSSOMNIAS AND PARASOMNIAS

Dyssomnias

Dyssomnias are sleep disorders involving difficulty initiating, maintaining and/or timing sleep.

Narcolepsy

Narcolepsy is a sleep disorder involving excessive sleepiness during normal waking hours; may occur with other symptoms such as cataplexy, sleep paralysis and hallucinations.

Key symptoms:

- **Cataplexy** is the sudden loss of muscle tone while conscious, resulting in weakening of muscles and loss of voluntary control of affected muscles.
- **Hallucinations** (often called hypnagogic hallucinations during sleep and hypnopompic hallucinations during awakening).
- **Sleep paralysis** is the temporary inability to move and speak during sleep onset or when waking up.

Sleep-onset insomnia

Insomnia is a sleep disorder that typically involves persistent difficulty initiating or maintaining sleep.

Sleep-onset insomnia (also called initial insomnia) is used to refer specifically to the sleep disorder involving persistent difficulty falling asleep at the usual sleep time.

- Sleep-onset insomnia is distinguished from sleep maintenance insomnia which involves difficulty staying asleep (middle insomnia) and/or awakening prematurely from sleep with an inability to fall asleep again (late insomnia).

Key symptoms:

- regular failure to fall asleep within about 20-30 minutes after intending to go to sleep
- complaint of poor quality sleep that does not leave the individual feeling rested upon awakening (called nonrestorative sleep) or a consistently reduced amount of total sleep, either of which is associated with difficulty falling asleep
- the sleep difficulty occurs at least three nights a week
- the sleep difficulty is experienced for at least three months
- the sleep difficulty occurs despite adequate opportunity to sleep
- the sleep difficulty does not occur in the course of another sleep disorder and is not due to another disorder or the effects of a substance
- difficulty falling asleep causes significant impairment in behaviour or important areas of everyday functioning, such as at school or work

PARASOMNIAS

Parasomnias are sleep disorders characterised by the occurrence of inappropriate physiological and/or psychological activity during sleep or sleep-to-wake transitions.

Sleep apnoea

Sleep apnoea is an involuntary cessation of breathing that occurs during sleep.

- The duration of the stoppage is usually short (about 10 seconds) but can last for a minute or longer.

Major symptoms include loud snoring; frequent awakenings; being out of breath, with a dry mouth or a headache; unrefreshing sleep regardless of duration; and daytime sleepiness, tiredness or fatigue.

Sleep walking

Sleep walking, sometimes called somnambulism, involves getting up from bed and walking about or performing other behaviours while asleep.

- Sleep walking episodes may occur up to 3 or 4 times a week.
- They generally last only a few minutes, rarely beyond 15 minutes.
- More than one episode a night is rare.
- Sleep walking usually occurs during the deep sleep of NREM stages 3 and 4 when we have no sleep paralysis and are therefore able to move around.