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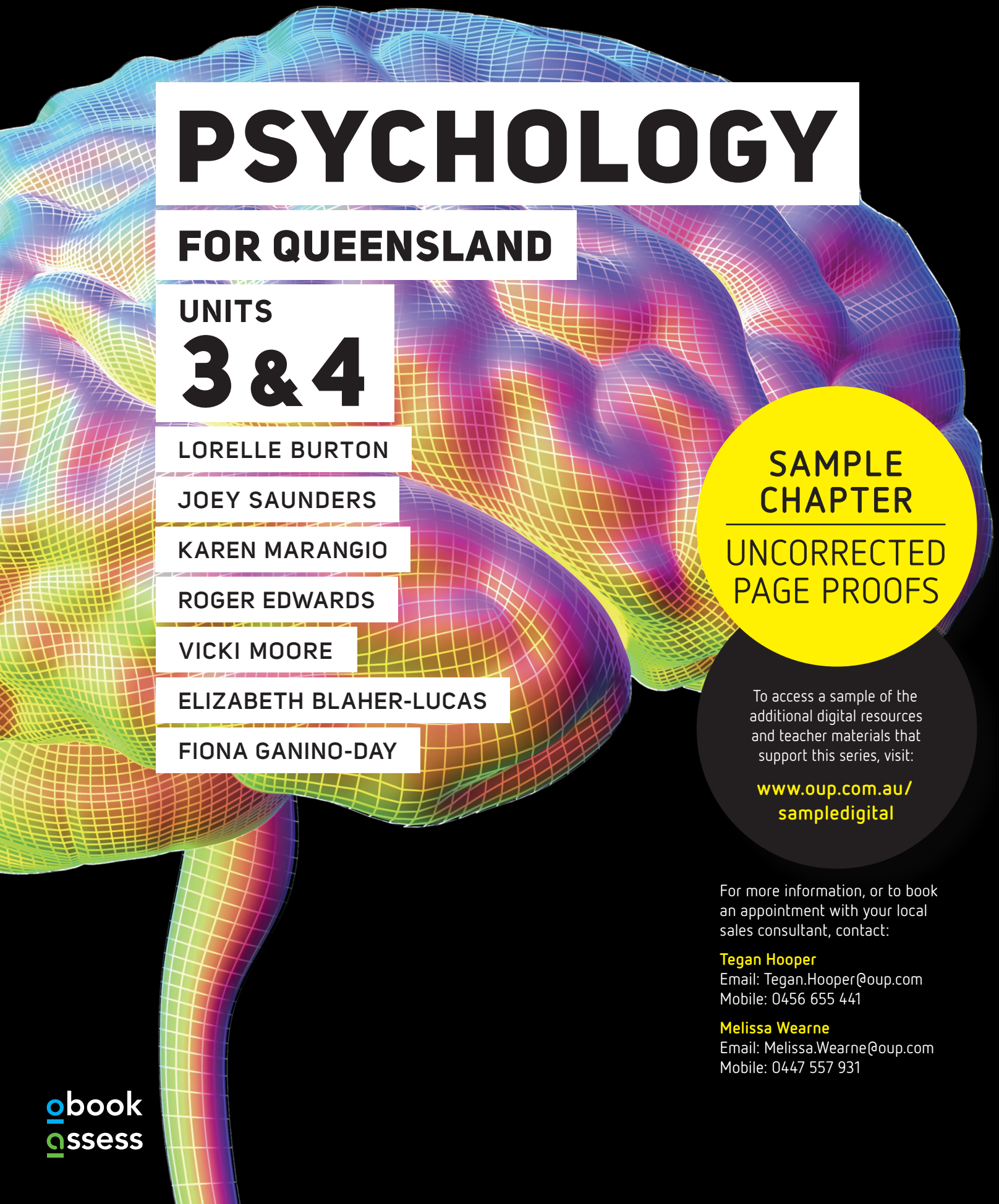

PSYCHOLOGY

FOR QUEENSLAND

UNITS 3 & 4

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CHAPTER 5

Influences on visual perception

The brain applies various procedures and rules, both learnt and innate, to enable us to make sense of what we see. Our eyes are often referred to as a camera. However, this metaphor is too simplistic for how our visual system actually works. Rather than simply taking pictures of images or objects in our environment, our visual system, along with an intricate and complex set of neural activities, also incorporates how we feel, our experiences, our memories and our responses to visual stimuli. Our brain puts all of this information together as a picture, which guides our behaviour.

Our physical make-up and normal biological processes also influence how we see. Imagine trying to read through your grandparents reading glasses with a 'younger' set of eyes. People with normal eyesight will likely find this difficult.

Additionally, we need to consider how our cultural experiences affect our visual perceptions. How might a Yirrganydji child reared on traditional Aboriginal land in the coastal culture of Tropical North Queensland perceive the urban jungle of New York?

This chapter will discuss how our visual perception is influenced by biological, psychological and sociocultural factors.

OBJECTIVES

→ Determine biological influences on visual perception, including physiological make-up, ageing and genetics
→ Explain psychological influences on visual perception, including:
- perceptual set (past experience, context, motivation and emotional state)
- visual perception principles (Gestalt, depth cues, and visual constancies)

→ Evaluate the impact of social influences on visual perception, with reference to cultural skills (Hudson 1960; Deregowski, Muldrow & Muldrow 1972)

Source: *Psychology 2019 v1.3 General Senior Syllabus © Queensland Curriculum & Assessment Authority*

SUGGESTED PRACTICALS AND RESEARCH

SUGGESTED PRACTICAL	**5.2** Conduct an experiment to investigate the effect of expectation on perceptual set (e.g. the role of frequency in developing perceptual sets in Bugelski & Alampay 1961)
SUGGESTED RESEARCH	**5.3** The impact of culture on visual perception (e.g. cross-cultural pictorial depth perception in Hudson 1960)

Source: *Psychology 2019 v1.3 General Senior Syllabus © Queensland Curriculum & Assessment Authority*

FIGURE 1 People can judge the distance and depth of this image because of perceptual cues, such as linear perspective, which is a pictorial depth cue.

5.1 Biological influences on visual perception

KEY IDEAS

In this section, you will learn about:

- the effects of our physiological make-up on visual perception
- the effects of ageing on visual perception
- the effects of genetics on visual perception.

The way we perceive visual information is influenced by a variety of factors. This section discusses the different types of biological influences on visual perception, including physiological make-up, ageing and genetics.

Physiological make-up

Our visual sensory and perception system is highly complex. Chapter 4 discussed the components of the system, including the eye and neural pathways in our brain. How and what we see is highly dependent on how these structures and neural pathways function in relation to sensory input as well as each other. If any of these structures is damaged, deteriorates or is negatively impacted during prenatal development in the womb, our ability to visually perceive the world is compromised (Moschos, 2014).

Various physiological disorders are directly related to damage or impairment of structures in the visual system. For example, colour blindness/deficiency (where a person is unable to distinguish between certain colours) develops due to structural issues of the retina, in particular the cones.

achromotopsia
a lack of cone vision that causes people to see only black, white and grey

This particular disorder is directly related to the physiological structure of the eye. If our cones are impaired or missing, we are unable to perceive light waves, which compromises our ability to perceive colour.

FIGURE 1 How someone with achromotopsia would see the Brisbane city skyline

Similarly, congenital **achromotopsia** is characterised by a lack of cone vision (see Chapter 4). People with achromotopsia perceive only black, white and grey, as demonstrated in Figure 1. Cerebral achromotopsia can result from damage or trauma to the cerebral cortex, for example, when a person suffers a stroke.

Therefore, achromatopsia is not always caused by cone abnormalities (Cowey & Heywood, 1997; Zhou, He, & Li, 2018); it can also result from damage to the neural pathways between the eye and the brain as well as damage to specific areas in the brain that help us perceive colour.

Ageing

Age influences both our physical and psychological abilities. Not only do our physical and muscular appearances change with age, but so does our ability to perceive and interpret stimuli from our environment. Reading or driving can become increasingly difficult as you age. The maturing of our sensory perceptions, particularly our vision and hearing, can affect our everyday life experiences and interactions. For example, imagine how frustrating it would be if you could no longer hear or follow a conversation – or if you could no longer read. Biological ageing can affect our visual perception system, including the development of **presbyopia**, **floaters**, **cataracts**, **glaucoma** and **age-related macular degeneration**.

Presbyopia

Presbyopia occurs when the eye's lens starts to lose flexibility and begins to stretch over time. This makes it difficult to focus on objects that are close, such as printed text or text on a computer screen. This generally begins at age 50 and is irreversible. Symptoms include requiring bright light to see clearly, difficulty seeing in the dark, headaches and eye discomfort (e.g. eye strain and fatigue).

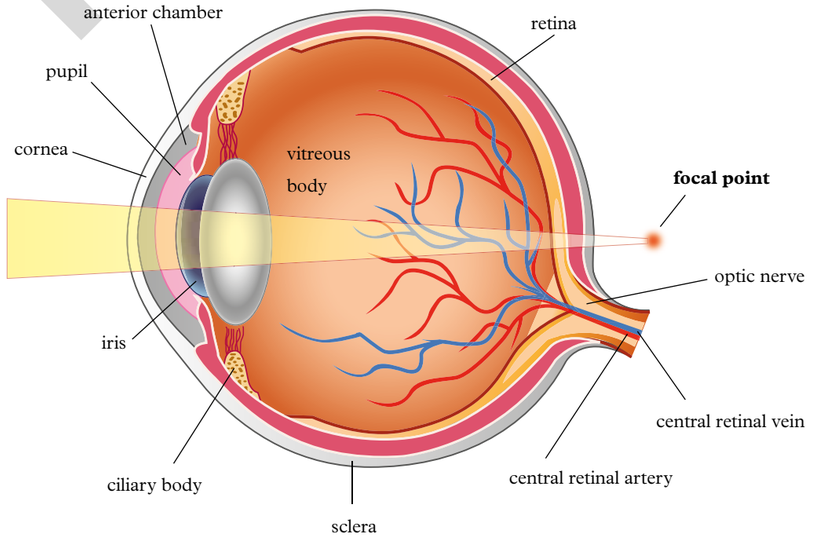


FIGURE 2 For people with presbyopia, the focal point is out of the normal range because the lens has lost its elasticity.

presbyopia
a condition that develops as the lens loses elasticity and causes difficulties in focusing on objects that are close

floaters
clumps of matter that appear as small specks or spots in central vision

cataracts
cloudy spots in the lens that cause vision to become blurred when proteins in the lens break down

glaucoma
a disease affecting the optic nerve that interferes with the transmission of peripheral visual information to the brain

age-related macular degeneration
a build-up of grainy deposits in the centre of the retina causing deterioration of central vision

Presbyopia develops because the lens begins to lose elasticity and, progressively loses the ability to bend and focus light rays onto the retina (see Chapter 4). The condition cannot be reversed, but it can be treated by wearing eyeglasses or contact lenses (see Vision Web, 2010; Heine, 2017).

Floaters

Floaters, or spots, are tiny gel-like clumps of matter that float in the vitreous fluid that surrounds our eyes. Appearing as little specks in our vision, they usually occur as part of the natural ageing process during our mid-40s. Floaters are caused when the vitreous fluid around our eyes deteriorates and forms little crystals. Floaters are harmless in nature, but they can

FIGURE 3 A healthy eye has a much clearer lens

be annoying. Imagine seeing tiny specks or squiggly lines that moved quickly out of sight whenever you tried to focus on them. They become very noticeable when we look at a bright object, such as a lamp (National Eye Institute, 2009; Vision Eye Institute, 2017; Vision Web, 2010).

Cataracts

Cataracts occur when the eye's lens starts to become cloudy due to the breakdown of proteins. This is thought to happen naturally as we age. The lens and cornea are responsible for focusing light on the retina, which then converts and transmits light stimuli to the brain. Cataracts interrupt this process, resulting in blurred vision as well as difficulty seeing at night or in bright light (Yosar, 2016a). Although ageing can contribute to the development of cataracts, lifestyle factors – such as smoking and poor diet, together with chronic diseases like diabetes and high blood pressure – also play a role. Treatment may involve controlling blood sugar levels, eating well and abstaining from smoking. Wearing stronger eyeglasses and undergoing surgery can also be effective treatment options as the disease progresses.

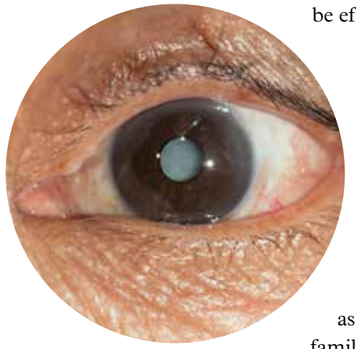


FIGURE 4 Cataracts can be seen when the lens of the eye begins to become cloudy.

Age-related macular degeneration

Age-related macular degeneration (AMD) is a disease caused by the build-up of grainy deposits in the macula – located in the centre of the retina – which results in inflammation and degeneration of the macula's photoreceptor cells. This causes a blurry 'spot' in the centre of vision and makes it difficult to see finer details. For example, someone with AMD may only be able to see someone's hair or ears when looking at a face. AMD is one of the leading causes of vision loss in the world and has no known cure. It often begins around the age of 50 and gradually deteriorates as sharp, central ('straight ahead') vision declines. Other risk factors for AMD include family history, smoking and nutritional deficits (Fritsche *et al.*, 2014; Heine, 2017; Vision Web, 2010).

Glaucoma

Glaucoma is a disease that affects the optic nerve and results in the loss of peripheral vision, which can lead to blindness if left untreated (Yosar, 2016b). Damage to the optic nerve causes disruption to the transmission of visual information from the eye to the brain. This is often associated with increased intra-ocular pressure (pressure in the eyeball) from the watery substance produced in the eye (the aqueous humour).

Glaucoma is one of the most common eye problems in the world, notably affecting people over 70 years of age (Goldberg, Graham, & Healey, 2002). In Australia, more than 150,000 elderly people are believed to experience glaucoma. Disturbingly, many people are unfamiliar with this disease and do not seek treatment, increasing the chances of eventual blindness. Although there is no cure, if it is detected early, treatment, such as medicine and laser surgery, can delay the progression of this disease (National Eye Institute, 2015).

Genetics

Much of who we are and what we experience is determined by our genetic make-up, and our visual perception system is no exception. Some inherited visual disorders are treatable if diagnosed early. Others are not easily treated and, in certain instances, can eventually lead to blindness.

Inherited visual disorders

Inherited visual disorders are disorders passed from parents to children through their genetic make-up. Genetics play a key role in transmitting many common vision problems and eye diseases from one generation to the next. Some of these problems occur in infancy and childhood, while others appear later in adulthood (Cleveland Clinic, 2018; Mathebula, 2012). Many inherited visual disorders can be treated by conducting vision therapy, undergoing surgery or wearing prescription glasses or contact lenses.

inherited visual disorders
visual disorders passed down from parents to children due to genetic factors

Scientists continue to map the genes responsible for visual disorders. Genetic studies using twins have shown that refractive errors are particularly common among family members, which strongly suggests a genetic link in the development of these conditions (Hammond *et al.*, 2001; Hendriks *et al.*, 2017).

Common inherited vision problems that occur in childhood include cross-eyes (strabismus), lazy eye (amblyopia), refractive errors (near-sightedness or myopia, and far-sightedness or hyperopia) and astigmatism. For adults, some cases of eye disorders, such as glaucoma and age-related macular degeneration, can also be attributed to genetic factors. These conditions often lead to blindness. Inherited visual disorders, including congenital disorders, retinis pigmentos, and colour blindness are discussed in detail below.

Congenital visual disorders

Congenital visual disorders are disorders of the visual system that are present at birth (Association of British Dispensing Opticians, 2018). Although quite rare, these disorders can develop from genetic factors or from diseases and deficiencies that arise during pregnancy. Examples of congenital disorders include congenital cataracts, congenital glaucoma, congenital achromatopsia and optic nerve hypoplasia (underdevelopment of the optic nerve). Some of these disorders can be treated with surgery, medication or rehabilitation. Unfortunately, with the rarest of these disorders – such as microphthalmos, where babies are born with small eyes with anatomic malformations – sight cannot be restored.

congenital visual disorders
visual disorders present at birth

Retinis pigmentosa

Retinis pigmentosa is a genetic degenerative disease of the retina causing night blindness and gradual loss of peripheral vision (National Eye Institute, 2014). It is an inherited disease caused by harmful changes to genes that relay information on how to produce proteins required by photoreceptor cells. Genetic changes can restrict the growth of these proteins. The genetic changes can also cause the proteins to become toxic or dysfunctional. Genetics can further cause the rods, and eventually the cones in the retina, to die. Symptoms usually appear in childhood, with difficulty seeing at night being a prominent indicator. This makes sense when we remember that rods allow us to see in dim lighting. Detection is possible through electroretinogram testing, visual field testing and genetic testing. There is no known cure for the disease, however, low-vision visual aids (e.g. magnifying lenses) can help people make the most of their existing vision.

retinis pigmentosa
a genetic degenerative disease affecting the retina

Colour vision deficiency

Colour blindness, more accurately known as **colour vision deficiency**, is an inherited disorder in which people's perception of colours differs from what most people see (Burton, Westen & Kowalski, 2019). Colour is perceived through our rods and cones, as discussed in Chapter 4. Rods are sensitive and allow us to see in dim conditions, while cones are specifically sensitive to long (red), medium (green) and short (blue) wavelengths of light.

colour vision deficiency
a genetically inherited disorder affecting how people perceive colour

Colour deficiency occurs if one or more of these cones is missing or functions incorrectly.

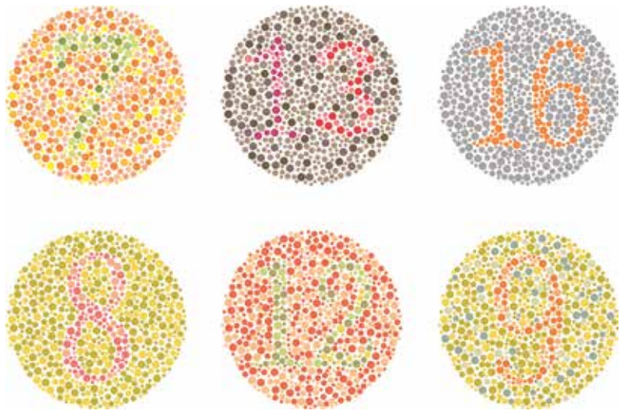


FIGURE 5 The Daltonism Ishihara test is often used to test colour blindness. Can you see what numbers are represented here?

There are three types of colour deficiency: monochromacy, dichromacy and trichromacy (National Eye Institute, 2015).

Monochromacy is the most severe form of colour deficiency, whereby people are entirely blind to colours because genetic abnormalities restrict them to one type of cone: the type that detects brightness but not colour. Dichromacy occurs when only two of the three cones are functioning. Trichromacy is the most common form of colour deficiency, occurring when any one of the three cone pigments responsible for perceiving colours is altered. This results in an impaired sense of colour, rather than total colour blindness.

Men are much more likely to suffer from colour deficiency than women. This is because the disorder is caused by a mutation of a gene located on the X chromosome, of which men only have one. Women are less likely to inherit the disorder because they have two X chromosomes, and the second X chromosome can compensate for any deficiency in the other. Colour deficiencies can present at birth or they may begin during childhood as well as adulthood. People might also be unaware that they have the condition, particularly if they have had it since birth.

CHECK YOUR LEARNING 5.1

Describe and explain

1 **Explain** the ways in which ageing can impact visual perception, and identify two disorders associated with ageing.
2 **Describe** what congenital visual disorders are.
3 **Summarise** why people with retinis pigmentosa find it difficult to see in dim light.
4 **Describe** a way in which our physiological make-up can affect our visual perception system.
5 Provide an example of a physiological disorder that is not caused by abnormalities in the structure of the eye. **Explain** why this disorder is not considered congenital.

Apply, analyse and interpret

6 **Compare** the different forms of colour blindness.
7 **Differentiate** between floaters and cataracts.
8 **Distinguish** between inherited disorders and congenital disorders.

Check your obook assess for these additional resources and more:

- **» Student book questions**
  Check your learning 5.1
- **» Video**
  Biological influences on the visual field
- **» Weblink**
  Test your eyes! Colour-blind test
- **» Weblink**
  The impacts of vision impairment

5.2 Psychological influences on visual perception

KEY IDEAS

In this section, you will learn about:

- how perceptual sets influence how we see visual stimuli
- visual perception principles – including Gestalt principles, depth cues and visual constancies.

Many factors can combine to predispose us to perceive the world in a certain way: expectations created by our previous experiences, the environment in which a stimulus is seen, our motivation and even our emotional state.

perceptual set a predisposition to attend to certain aspects of the visual scene, or to interpret stimuli in a particular way, according to certain preconceptions

Perceptual set is a predisposition to perceive stimuli in a specific way – that is, interpreting what we see according to certain preconceptions. Perceptual set comprises a predisposition to attend to only certain features or aspects of our field of view (selection).

CHALLENGE 5.2A

The farmyard

Researchers found that when they presented a picture of a farmyard to a group of subjects and then asked them to describe it from memory, the subjects were able to do so quite well. However, when shown the picture in Figure 1, the subjects were surprised by the giant octopus outside the barn – it is out of context, so they concentrated on this and failed to pay attention to the other items in the picture. Consider a scenario where this may be important.

Several factors can influence perceptual set:

- **Past experiences**: Previous experiences can affect visual perception, especially if the experience holds significant personal meaning. The same stimulus can be interpreted differently by different people.
- **Context**: The environment in which a perceived stimulus is observed; context sometimes has an immediate effect on our expectations.
- **Motivation**: Often we see what we want to see. On a long drive, if running low on petrol, a sign reading 'FOOD AHEAD' might be interpreted as 'FUEL AHEAD'.
- **Emotion**: We could interpret someone's facial expression as laughing or crying, depending on how we are feeling ourselves.

FIGURE 1 Quickly look at this illustration. Then close your eyes and recall what you saw.

One example that illustrates how visual stimuli can affect our perceptual set is Bugelski and Alampay's (1961) famous rat-man experiment (Figure 2). One

SUGGESTED PRACTICAL

5.2 Conduct an experiment to investigate the effect of expectation on perceptual set
Go to your obook assess »

FIGURE 2 Can you see the rat and the man?

group of participants was shown a line of face sketches and then the ambiguous rat-man stimulus – the majority identified it as an old man. The other group was shown a line of animal sketches and then the ambiguous stimulus – the majority identified it as a rat or mouse. This shows how perceptual set, created by prior experience, influences perception.

Visual perception principles

At any given moment, vast amounts of visual stimuli enter the eye – far more than we can pay attention to. The brain selects and organises visual information according to a number of visual perceptual principles.

Perceptual constancies

perceptual constancies
the tendency to maintain a stable perception of a stimulus, although the properties of the image on the retina may change

size constancy
the constant perception of an object's size, even though the size of the image on the retina alters as the object moves nearer to or further from us

shape constancy
an object is perceived to maintain its known shape despite the changing perspective from which it is observed

Perceptual constancies enable us to maintain a stable perception of a stimulus, although the image on the retina may change (e.g. size or shape). The more familiar we are with the observed object, the more likely it is that we will maintain perceptual constancy of it. Perceptual constancies are usually learnt early in childhood.

Size constancy

Size constancy refers to our ability to maintain a constant perception of an object's size, even though the size of the image on the retina alters as the object moves nearer to or farther from us. For example, when we look at a friend from a distance of 5 metres, he produces a retinal image twice the size of the one he produces when he is 10 metres away. But because we are familiar with his height, we don't change our perception of him – instead, we use the size of the image as a cue to provide information about how far away he is. See Figure 3.

Shape constancy

Shape constancy refers to the fact that an object is perceived to maintain its known shape despite the changing perspective from which it is observed. This is a learnt skill – for example, a toddler may have difficulty perceiving a familiar toy if it is viewed from an unusual angle. Objects that are familiar to us can be accurately interpreted when viewed from any direction. For example, as a door opens, the retinal image of it changes shape from a rectangle to a trapezium, but we easily maintain our perception of a rectangular door.

FIGURE 3 The young man casts a larger image on the retina as he moves closer to us, but we know he remains the same size; so we use this information to establish his distance from us.

Gestalt principles

Gestalt is a German word that means 'good form'. Gestalt psychology developed in the early twentieth century and is based on the principle that 'the whole is greater than the sum of its parts'. In terms of sight, it concerns the tendency for our visual system to perceive what we see as a meaningful whole. How can this be? This answer is described in the **Gestalt principles of visual perception**.

Gestalt principles of visual perception
used to organise and interpret perceptual stimuli; including figure–ground organisation, closure, similarity and proximity

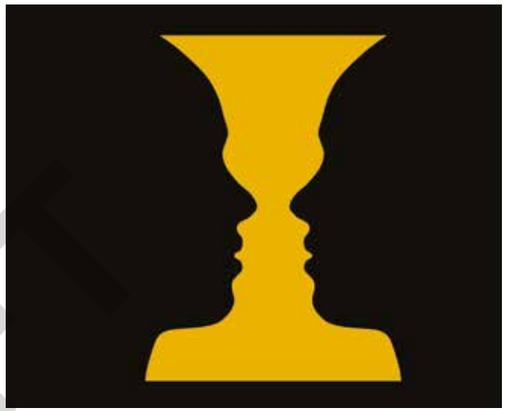


FIGURE 4 Rubin's vase is a special case of figure–ground organisation.

FIGURE 5 Can you see the soldier in camouflage? The contour is broken up and enables the figure to blend in with the background.

Figure-ground organisation

figure–ground organisation
a Gestalt principle of perceptual organisation wherein images are organised into the central object of attention (figure) and a background (ground)

camouflage
where the Gestalt principle of figure-ground is used to 'blend' the contour of the figure (which usually stands out) against the ground (background), making it more difficult to see

closure
when an object is perceived as being whole despite actually being incomplete

The first Gestalt principle of visual perception that develops in infants is **figure–ground organisation**. The figure is the part of the visual field being attended to and focused on; its surroundings are the ground. The figure and the ground are separated by an imagined contour. The contour is 'owned' by the figure. In children's drawings, we often see a black line around a figure, emphasising the separation of figure and ground. Rubin's vase (Figure 4) is an example of figure-ground organisation. Depending on whether the yellow colour or black colour is assigned as the figure or the ground, you can see a vase or two faces looking at each other.

Camouflage

Camouflage is where the Gestalt principle of figure–ground is used to break up the contour of the figure, meaning that figure and ground will blend, making the figure more difficult to see. We see camouflage in nature, for example, with leopards, tigers and giraffes – the army also uses camouflaged uniforms to help soldiers blend into their surroundings and avoid detection.

Closure

Closure occurs when we perceive an object as being whole, despite it actually being incomplete. Many company logos use such incomplete figures in their designs (see Figure 6).

similarity
the principle that elements that are similar in appearance will tend to be seen as a unit

proximity
the individual parts of a stimulus pattern are close together, allowing those parts to be perceived visually as a whole

depth perception
the ability to accurately judge three-dimensional space and distance, using cues in the environment

binocular depth cues
depth cues that use both eyes to gauge distance and space

monocular depth cues
depth cues that use one eye independently or both eyes together to gauge distance and space

retinal disparity
the binocular depth cue that arises as the brain compares and contrasts the two slightly different images obtained because of the distance between the two eyes

Similarity

Similarity is when the individual parts of a stimulus pattern are similar (for example, size, shape or colour). We tend to group them together as a meaningful 'whole' – a single unit. In Figure 7, we tend to perceive rows of 'X' and 'O' in Group A, and columns of 'X' and 'O' in Group B.

Proximity

Proximity is when the individual parts of a stimulus pattern are close to each other. We tend to group them together as a meaningful 'whole' – a single unit. We can choose how to perceive a group of shapes, such as those in Figure 8 (as rows or columns), but we tend to perceive the ones in Group A as rows and Group B as columns.

FIGURE 6 The Gestalt principles of figure–ground and closure are used when we perceive the World Wildlife Fund logo as a giant panda.

A	B
X X X X X	X O X O X
O O O O O	X O X O X
X X X X X	X O X O X
O O O O O	X O X O X

FIGURE 7 We tend to perceive rows of 'X' and 'O' in Group A, and columns of 'X' and 'O' in Group B.

A	B
X X X X X	X X X X X
X X X X X	X X X X X
X X X X X	X X X X X
X X X X X	X X X X X
X X X X X	

FIGURE 8 We tend to perceive Group A as rows and Group B as columns.

Depth perception

Depth perception is the ability to accurately judge three-dimensional space and distance by using cues in the environment. Depth cues are vital, because we exist in a three-dimensional world but can only use two-dimensional images on our retinas to judge depth and distance.

Just as there are many examples of Gestalt principles, so there are of depth cues: there are many depth cues in addition to those listed here. These examples show us how depth and distance are perceived. Depth cues may be classified as **binocular depth cues** (using both eyes) or **monocular depth cues** (using one eye alone, or both eyes together).

Binocular depth cues

Retinal disparity

Retinal disparity occurs because our eyes are set about 6–7 centimetres apart (pupillary distance). When an object is within about 20 metres of a viewer (with the strongest depth cue occurring within 7 metres), each eye receives a slightly different image on the retina as a result of the different angles of view from each eye to the object being observed. The brain fuses together these two images together in stereoscopic vision: the more different the two images, the closer the object will be to the viewer.

The process of retinal disparity is artificially recreated in 'magic eye' pictures from two flat, two-dimensional patterns viewed from about 20 centimetres. Each eye observes a slightly different view of the same scene and the brain fuses the two images together in the same way it would when observing a real (three-dimensional) scene.

CHALLENGE 5.2B

Retinal disparity

Retinal disparity can be demonstrated with the following simple test. Hold a pen at arm's length and look past it at the other side of the room. Close one eye and then the other and watch how far the pen 'jumps' from side to side. Now bring the pen closer – about 40 centimetres from your eyes – and repeat the process. Summarise your findings.

convergence
a binocular cue for depth perception; the automatic turning of the eyes inwards as we watch an object approaching

accommodation
the process by which the ciliary muscles of the eye change the curvature of the lens to focus an image on the retina

Convergence

Convergence is a binocular depth cue that is best illustrated in the following example: as an object comes closer to us, our eyes turn inwards to keep the object centred on the retina. Again, this cue operates for objects within about 7 centimetres. The brain reads the amount of turning from the tension of the muscles that move the eyes and uses this to make judgments of distance. The more our eyes turn, the closer the object is to the viewer. This is demonstrated in Challenge 5.2B.

FIGURE 9 This lady is experiencing convergence as she focuses on the pencil moving towards her face.

Monocular depth cues

Two types of monocular depth cues enable us to judge depth and distance using one eye: accommodation and pictorial cues.

Accommodation

Accommodation involves the eye's lens (located behind the iris) changing shape so that it can focus light rays onto the retina. Small muscles called ciliary muscles control whether the lens bulges (for closer objects) or flattens (for more distant objects). At the same time, the tension in the ciliary muscles is received by the brain to confirm the location of the object being viewed; the greater the tension, the closer the object.

Pick up a pen and close one of your eyes. Move the pen as close to you as you can while maintaining focus. You should be able to focus on an object between 8 and 10 centimetres away (depending on your eyesight). Keep focusing on the pen until you feel the tension within your eye. That's your ciliary muscles at work keeping your brain informed.

Pictorial depth cues

Pictorial depth cues are used by artists to create a three-dimensional perception of something that exists on a two-dimensional surface.

- **Linear perspective** (first described by Leonardo da Vinci) is one of the most basic skills an artist uses to create apparent depth. Parallel lines are made to converge as they extend along the page to an imaginary point (where in theory they meet) at the horizon, as shown in Figure 10.

pictorial depth cues
a monocular depth cue used by artists to create a three-dimensional perception of something that exists on a two-dimensional surface

linear perspective
a monocular depth cue that parallel lines appear to converge as they retreat into the distance

FIGURE 10 Linear perspective shows parallel lines converging in the distance.

interposition
a monocular depth cue, in which objects further from the observer are partially obscured by those in the foreground

texture gradient
a monocular depth cue in which texture in the foreground is seen in finer detail than that further away

- **Interposition** (overlap) is based on the partial blocking or obscuring of one object by another. The obscured object appears to be further away than the object obscuring (overlapping) it. This is an effective cue for determining which objects are closer than others, but it is not as effective for actually judging distance.
- **Texture gradient** is used to make surfaces in a picture appear to recede into the distance. Artists draw less and less detail as a surface is more and more distant, the same way we see it in real life. This is illustrated by the photo of the Marcoola Boardwalk on the Sunshine Coast, Queensland, as shown in Figure 11. In the foreground, we can see every detail of the wood and the railing, but as the boardwalk gets further away it becomes much less detailed.

FIGURE 11 The Marcoola boardwalk on the Sunshine Coast – the interposition caused by the trees overlapping, the linear perspective from the boardwalk rails and the relative size of the trees allow people to judge depth.

- **Relative size** is based on our tendency to perceive the object producing the largest retinal image as being the nearest, and the object producing the smallest retinal image as being the farthest. For this cue, it is necessary to know the real size of the objects so that accurate comparisons can be made. Think about watching a game of rugby from behind your team's goal – you realise that the players at the opposite goal are far away; you don't think they are tiny!
- **Height in the visual field** shows depth by portraying objects farther away as being closer to the horizon. In a picture, objects in the sky – such as aeroplanes, clouds and birds – will be perceived as farther away as they become lower in the visual field (closer to the horizon). On the other hand, objects on the ground – such as trees, houses and people – will be perceived as farther away as they become higher in the visual field (closer to the horizon).

relative size
a monocular depth cue based on our tendency to perceive the object producing the largest retinal image as being the nearest, and the object producing the smallest retinal image as being the farthest

height in the visual field
a monocular depth cue that shows depth by portraying objects further away as being closer to the horizon

CHECK YOUR LEARNING 5.2

Describe and explain

1 **Describe** how past experience influences perception.
2 **Explain** the effects of motivation and emotion on perception.
3 **Describe** size constancy and shape constancy.
4 **Summarise** how Gestalt principles work.
5 **Explain** why we find it difficult to see animals when they are camouflaged in their environment.
6 Provide an example of similarity. **Explain** why this example is seen as a single unit.
7 **Identify** which perceptual set would be used in the following scenarios:
   a Joe is really happy because he has been sailing. Joe looks across at another boat and sees a child. Joe decides the child is laughing.
   b Rachel is walking down her childhood street. Ahead, she sees the words 'Harry's café', however, when she gets closer she realises it says 'Hair styles'.

Apply, analyse and interpret

8 **Compare** Gestalt principles and depth cues.
9 **Differentiate** between monocular and binocular depth cues.
10 **Distinguish** between convergence and retinal disparity.

Investigate, evaluate and communicate

11 **Construct** a picture using the following pictorial depth cues. Label your picture with the pictorial cues. Make sure you **explain** and **evaluate** each one's effectiveness to illustrate your understanding.
   a linear perspective
   b interposition
   c texture gradient
   d relative size
   e height in the visual field

Check your obook assess for these additional resources and more:

- **» Student book questions**
  Check your learning 5.2
- **» Suggested practical**
  5.2 The effect of expectation on perceptual set
- **» Challenge**
  Worksheet: 5.2A The farmyard
- **» Challenge**
  Worksheet: 5.2B Retinal disparity

5.3 Social influences on visual perception

KEY IDEAS

In this section, you will learn about:

+ the effects of culture and other social factors on visual perception.

As discussed earlier in this chapter, many things influence how and what we see. Some of these are caused by changes in imagery and can result from changes that occur with age and genetics. It should not be a surprise that visual perception is also influenced by our social and cultural understanding.

When you see certain symbols or signs in your daily life, you are able to interpret their meanings based on the culture you have grown up in. When you meet someone, you shake their hand because that is typical behaviour in Australia; in many European countries, it is customary to kiss each other on both cheeks to say hello or goodbye; and in Japan, people often bow to each other as a sign of respect. All of these are normal in each respective society, and the way we perceive visual stimuli is no different.

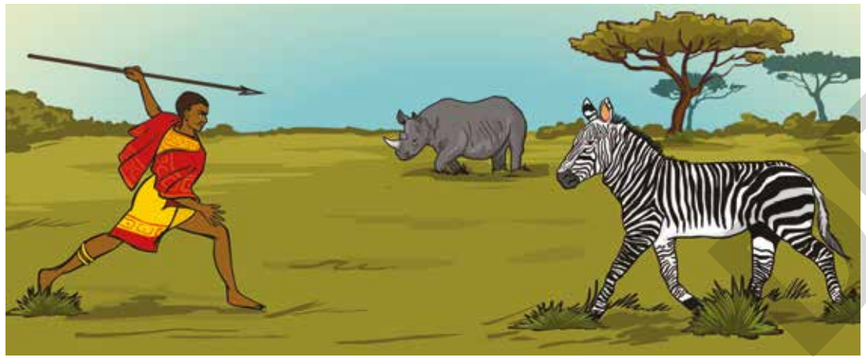


FIGURE 1 Which of these animals is being hunted by the warrior?

Studies have found that cultural norms and expectations can influence how we interpret images. An image similar to Figure 1 was used by researchers to discover that members of some African tribes do not see two of the pictorial cues (relative size and height in the visual field) to estimate depth and distance. The tribe members were surprised at what they thought was a picture of a hunter attempting to spear a very small rhinoceros.

We as Australians know that a rhinoceros is much bigger than a zebra, so we apply our knowledge to judge that the zebra is much closer to us – at about the same distance as the hunter. We apply the depth cue of 'height in the visual field' to judge that the hunter is about to spear the zebra, not the rhinoceros, which is in the distance. Cross-cultural research has allowed psychologists to understand that even though every human being with normal vision receives exactly the same visual information, our individual and cultural experiences can influence our interpretation of what we see because of what we have seen before. You will learn more about cross-cultural psychology in Unit 4.

SUGGESTED RESEARCH

5.3 The impact of culture on visual perception
Go to your obook assess »

Deregowski's (1972) research found that the way that some Africans piece together information from a picture suggested that 'some form of learning is required to recognise pictures'. This reinforced previous findings that found some African tribes were unable to recognise three-dimensional depth cues in in a photo of a profile of a human face: specifically, one participant was unable to understand where 'the other eye' had gone from the profile of the face (Deregowski, 1972). Deregowski's report built on research conducted by Hudson (1960).

Two-dimensional and three-dimensional perception

In 1957, Hudson tested 85 Bantu factory workers from different tribal backgrounds, educational levels and degrees of urbanisation. All participants were shown a series of 14 pictures that were unambiguous representations of a variety of situations where Bantu values were compared to Western values (Hudson, 1960).

Hudson found that there was a difference between two-dimensional and three-dimensional perception between African tribal members and the general population. Further, Hudson's study found that 'pictorial representation of a three-dimensional scene requires the observance and acceptance of certain artistic and graphic conventions', and that 'pictorial depth perception depends upon response to these conventional cues in the two-dimensional representation'. Using an image similar to Figure 1, Hudson found that education and cultural assumptions influenced how images were perceived. Those who had a higher education level were more likely to recognise that the 'hunter' was aiming for the 'zebra' than the rhinoceros. Furthermore, Hudson found that children who were attending school predominantly perceived images three-dimensionally, whereas children who were not attending school predominantly saw two-dimensional images.

From Hudson's and Deregowski's research, the effect of culture on visual perception is clear. Through formal education and cultural norms, people are able to learn how to interpret images that are relevant to their culture and society. The research suggests that pictorial depth cues are influenced not just by our visual systems, but by cultural and societal norms and expectations.

CHECK YOUR LEARNING 5.3

Describe and explain

1 **Explain** the role of height in the visual field and relative size in relation to Figure 1.

Apply, analyse and interpret

2 **Consider** the ethical implications involved in these studies, and the impact they have had on perceptual understanding.

Investigate, evaluate and communicate

3 **Evaluate** the impact of social and cultural expectations on visual perception, referencing the research of Hudson and Deregowski.

4 **Create** a methodology to test variations in cultural influence on visual perception.

5 **Discuss** the importance of understanding the differences in cultural influence on visual perception.

Check your obook assess for these additional resources and more:

- **» Student book questions**
  Check your learning 5.3
- **» Suggested research**
  5.3 The impact of culture on visual perception
- **» Video**
  Social influences on visual perception
- **» Weblink**
  Culture and sight

SCIENCE AS A HUMAN ENDEAVOUR

5.4 Solving a puzzle: past experiences decide what we see

KEY IDEAS

In this section, you will learn about:

- the influence of memories, feelings, past experiences and evolution on how humans perceive visual stimuli.

Until the 1980s, many psychologists and scientists believed that vision relied entirely on the eye and visual cortex. There was little thought given to the influence of interpretation and perception on vision. Research has now shown that visual perception involves various areas of the brain working together to interpret stimuli through the eyes.

During Unit 2, you learnt how people's prior experiences or fears can influence how a stimulus is interpreted. For example, someone with a phobia of spiders may misinterpret black cotton on the floor as a threat and run away. In this instance, it is unlikely that the individual's visual system has failed; rather, it is more likely that their fear, which provided prior knowledge, has influenced how they interpreted what they saw.

In a 2018 study by Gonzalez-Garcia, Flounders, Change, Baria & He, it was found that visual perception was extensively influenced by prior experiences. The study argued that for people to recognise present stimuli, they must combine their current visual pathway with previous experiences. The study used fMRI imaging to see what areas of the brain were active while processing visual stimuli, specifically while viewing a collection of Mooney images (low information, two-tone images typically of a face). See Figure 1.

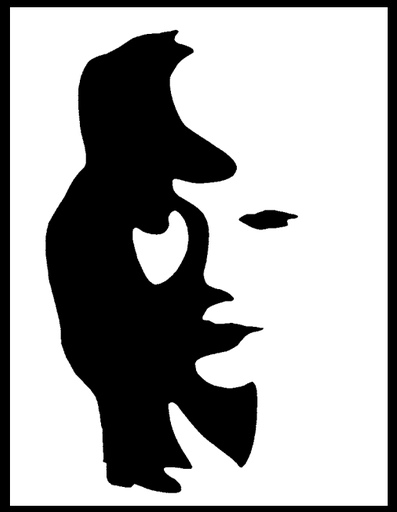
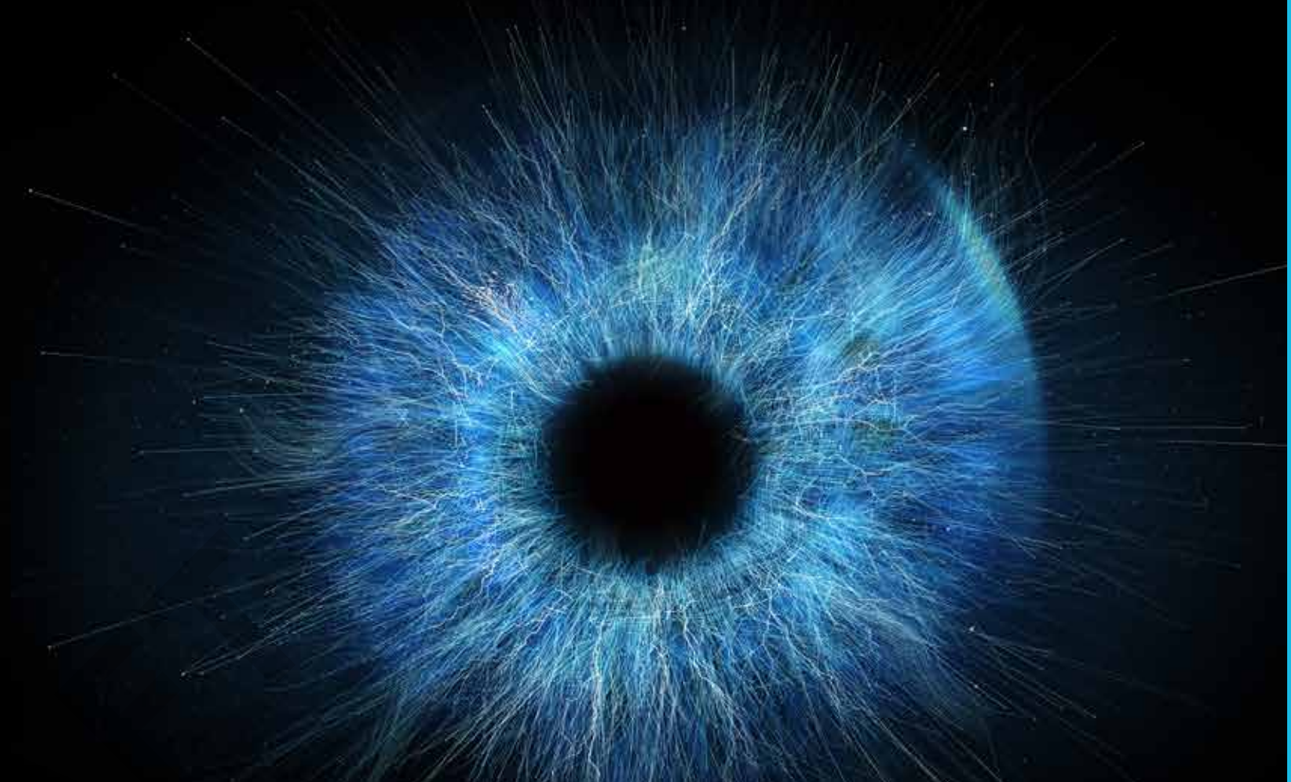


FIGURE 1 An example of a Mooney face

Each image was shown briefly and blurred. After viewing the images, participants were asked if they could identify the object that was shown. As participants identified the images, the fMRI images revealed that, when shown a clear image of the Mooney picture, participants could name the object easily. But when an image was not clear, participants had to call on past memories and experiences to identify the image, which led to both false and correct identifications.

This study showed that two brain networks are used to identify an image: the default-mode network (DMN), and the frontoparietal network (FPN). These systems had previously not been associated with visual interpretation and perception.

The study provided further evidence that human visual perception and interpretation was largely reliant on cognitive processes – not specifically the eye or biological processes, as previously thought. As mentioned earlier in this chapter, visual acuity is strongly influenced by psychological and social factors; such as cultural expectations and prior experience.



CHECK YOUR LEARNING 5.4

Describe and explain

1 **Describe** the relationship between interpretation, perception and visual acuity.

Apply, analyse and interpret

2 Trey was recently playing football in the park with his friends when he jumped at the sight of a snake. Trey's friends laughed, because it was actually a stick. Upon closer inspection, Trey realised it was a stick too and questioned why he had been so quick to believe it was a snake. When Trey was 5 years old, he lived on a property in rural Queensland populated with many snakes.

Apply your understanding of visual acuity and past experiences to Trey's scenario.

Investigate, evaluate and communicate

3 **Evaluate** the 2018 study by Gonzalez-Garcia, Flounders, Chang, Baria & He and **propose** a modification.

4 **Assess** the following claim: 'Without access to cognitive systems, humans would not be able to assign meaning to anything they see, and would therefore not be able to visually perceive sensory stimuli'.

Check your obook assess for these additional resources and more:

- **Student book questions** Check your learning 5.4
- **Video** The research investigation
- **Weblink** Cognitive influence on vision
- **Weblink** The influence of memory on what you see

CHAPTER 5

Review

Summary

5.1
- With age, people can develop presbyopia – a condition that develops as a result of the lens losing elasticity, which makes it difficult to focus on close objects.
- As people age, they may find 'floaters' appear in their vision. These are clumps of matter that form in the vitreous fluid around our eye.
- Cataracts form when proteins in the lens break down and cause the lens to become cloudy.
- Glaucoma is a condition where the optic nerve is damaged and the transmission of peripheral information to the brain is interrupted.
- Age-related macular degeneration occurs with age as grainy deposits build up in the centre of the retina and affect central vision.
- We can inherit visual disorders, such as colour blindness, which is carried on the X chromosome. We can also inherit retinis pigmentosa, which causes problems with night vision.

5.2
- Our perceptual set is a predisposition to attend to certain aspects of a visual scene or interpret information in a particular way. This is influenced by our past experiences, the context of the visual scene, our motivation and our emotions.
- Size constancy is our ability to maintain a constant perception of an object's size, despite the size of the image on our retina altering as the object moves closer to or farther from us.
- Shape constancy is our ability to maintain the shape we know an object is, despite changing perspectives.
- There are four Gestalt principles of visual perception:
  - figure–ground organisation: where we tend to focus on the central object of an image (figure) and a background (ground)
  - closure: where we perceive an object as whole, despite it actually being incomplete
  - similarity: where elements that are similar in appearance tend to be seen as a unit
  - proximity: where we perceive close parts of a visual stimulus to be a whole.
- Depth perception is the ability to judge three-dimensional space and distance based on environmental cues.
- Two of the most prominent binocular depth cues include:
  - retinal disparity, where we contrast the slightly different images because of the distance between our eyes
  - convergence, where our eyes will turn inwards to watch an object approaching.
- Monocular depth cues use one eye to judge depth and distance. The eye does this via accommodation where the eye changes the curvature of the lens to focus an image on the retina via pictorial depth cues.
- Pictorial depth cues include linear perspective, interposition, texture gradient, relative size and height in the visual field.

5.3
- Visual perception is influenced by our social and cultural understanding. Studies found that two-dimensional and three-dimensional perception can vary between cultures based on cultural norms and understanding.

Key terms

- accommodation
- achromotopsia
- age-related macular degeneration
- binocular depth cues
- camouflage
- cataracts
- closure
- colour vision deficiency
- congenital visual disorders
- convergence
- depth perception
- figure–ground organisation
- floaters
- Gestalt principles of visual perception
- glaucoma
- height in the visual field
- inherited visual disorders
- interposition
- linear perspective
- monocular depth cues
- perceptual constancies
- perceptual set
- pictorial depth cues
- presbyopia
- proximity
- relative size
- retinal disparity
- retinis pigmentosa
- shape constancy
- similarity
- size constancy
- texture gradient

Revision questions

The difficulty of the short answer questions is indicated by the number of stars: ⋆ = easy, ⋆⋆ = medium, ⋆⋆⋆ = hard.

Multiple choice

1 Identify which of the following statements about size constancy is correct.
- **A** Size constancy refers to the fact that our pupils grow bigger or smaller as an object moves nearer to or farther from us.
- **B** Size constancy refers to how one object compares in size to another.
- **C** Size constancy means that even though an object moves nearer to or farther from us, our perception of its size remains constant.
- **D** Size constancy refers to how our eyes actually take in more visual stimuli than we pay attention to.

2 Define the Gestalt principle of camouflage.
- **A** an animal classification for those whose appearances match their environment
- **B** where the contour of the figure is broken so that it blends in with the ground, obscuring the figure
- **C** an army uniform
- **D** where the figure is distinct from the ground

3 Identify which of the following correctly pairs the names of two sets of visual perceptual principles with examples from those sets.
- **A** Gestalt principles – linear perspective; depth cues – convergence
- **B** perceptual set – expectancies; Gestalt principles – closure
- **C** depth cues – retinal disparity; Gestalt principles – orientation constancy
- **D** Gestalt principles – figure–ground organisation; depth cues – texture gradient

4 As I was driving along the freeway, a huge truck came hurtling up behind me. It seemed to take ages for the long body to get past as it overtook me. Afterwards, it gradually disappeared up the road in front of me. Which of the following principles would I have applied to help me realise that the truck remained the same size, although its image on my retinas changed?
- **A** shape constancy and size constancy
- **B** size constancy and orientation constancy
- **C** brightness constancy and orientation constancy
- **D** brightness constancy and size constancy

5 Distinguish between the Gestalt principles of similarity and proximity.

A They are two different names for the same concept.

B Similarity is when parts of a stimulus pattern are a similar distance from each other; proximity is when parts of a stimulus pattern are the same colour.

C Similarity is the part of a stimulus pattern that sits in rows, while proximity is the part that sits in columns.

D Similarity is when parts of a stimulus pattern are physically similar so that we perceive them as a whole; proximity is when parts of a stimulus pattern are close together so that we perceive them as a whole.

6 Identify the binocular depth cues.

A linear perspective and convergence

B retinal disparity and accommodation

C relative size and linear perspective

D convergence and retinal disparity

7 As she was driving to Perth from Melbourne, Jodi called out, 'Look, Mum, there are hundreds of rabbits!' As they gradually got closer, Jodi said, 'Oh! They're actually big kangaroos!' What caused Jodi's initial error of perception?

A previous experience with rabbits, causing a perceptual set that led to selection of specific parts of the scene being attended to

B previous experience with rabbits, causing a perceptual set that led to a particular interpretation of the scene

C the context in which the animals were seen, causing a perceptual set that led to selection of specific parts of the scene being attended to

D the context in which the animals were seen, causing a perceptual set that led to a particular interpretation of the scene

8 Select which of the following statements is true of glaucoma.

A It is degeneration of the optic nerve, affecting peripheral vision.

B It is an age-related condition that can be cured if diagnosed early.

C It is an age-related condition that affects the cornea and lens.

D It is age-related degeneration of the optic nerve, affecting central vision.

9 Identify the definition of age-related macular degeneration.

A the degeneration of the cornea, which affects peripheral vision

B a break-down of proteins in the lens, which affects central vision

C a build-up of grainy deposits in the retina, which affects central vision

D a build-up of proteins in the lens, which affects central vision

10 Culture has been shown to influence our visual system in which of the following ways?

A Formal education has no impact on our visual system but societal and cultural norms do.

B Formal education, cultural norms and expectations, and our visual systems influence depth cues.

C Prior learning is not essential to recognise pictures.

D People from all cultures interpret depth cues in similar ways.

Short answer

Describe and explain

★ 11 **Explain** the Gestalt principle of similarity, and **use** a visual example to support your answer.

★ 12 **Explain** how senses other than taste influence our perception of flavour.

★ 13 **Explain** why people from traditional hunter-gatherer societies may have difficulty interpreting three-dimensional images. **Use** an example to illustrate this.

★ 14 **Describe** retinis pigmentosa.

★★ 15 **Explain** what is meant by the term 'perceptual set'. Provide an example for the:

a sense of vision

b perception of flavour.

★★ 16 **Identify** and briefly **describe** the different types of colour blindness/deficiency.

★ 17 **Explain** what a perceptual constancy is.

★ 18 **Describe** how closure works.

Apply, analyse and interpret

★ 19 **Compare** the main distinction between congenital and inherited visual disorders.

★ 20 **Contrast** perceptual constancies and Gestalt principles.

★ 21 **Distinguish** between motivation and emotion in relation to perceptual set.

★ 22 **Consider** possible social influences on how teenagers in Australia interpret certain visual stimuli and how this may differ from teenagers in other countries.

★★ 23 Eli has noticed that his grandfather's eye has become cloudy. **Determine** what is affecting Eli's grandfather's eye and **explain** what causes it.

Investigate, evaluate and communicate

★★ 24 Jack and his cricket team were practicing fielding by catching a ball that the coach hit high in the air. After a few team members had dropped catches, the coach insisted that all players hold their hands in front of their face and watch the approaching ball through the gaps between their fingers. Jack was surprised that his success rate improved using this new technique. **Propose** why his performance improved.

★★ 25 Your Aunty Kathy is complaining about the squiggly lines that float through her vision as she focuses on the white wall she is painting. **Propose** what this condition might be and **explain** its biological cause.

★★ 26 **Explain** how our physiological make-up can impact on our visual perception system. **Justify** your answer with an example.

★★★ 27 Your grandfather is having trouble reading the drinks menu at the café. **Explain** what may cause this, and **evaluate** why this happens. **Investigate** treatment options if any are available.

28 **Predict** whether people would be more likely to see a rat or a man in the rat-man illusion (Figure 2, p. XX) after viewing either the first row or the second row of the following images.

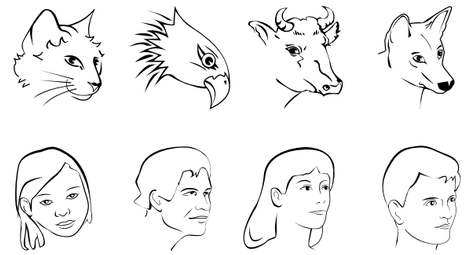


FIGURE 1 Do you think either row would affect someone's perceptual set?

Check your obook assess for these additional resources and more:

- **» Student book questions** Chapter 5 Review
- **» Revision notes** Revision notes for Chapter 5
- **» assess quiz** Test your understanding with this self-correcting multiple-choice quiz
- **» Flashcard glossary** Key terms in Chapter 5