12 Eyewitnesses and the Use and Application of Cognitive Theory

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LEARNING OUTCOMES

WHEN YOU HAVE COMPLETED THIS CHAPTER YOU SHOULD BE ABLE TO:

1. Explain how good we are at describing unfamiliar people, objects, and events.
2. Describe differences between familiar and unfamiliar face recognition, and how these differences relate to eyewitness memory.
3. Explain how useful are facial composites and how they can be made more effective.
4. Outline why eyewitness evidence can be unreliable, and what is done to protect innocent suspects.
5. List the main techniques used in the enhanced cognitive interview.

KEY TERMS

Caricatured Composite • Cognitive Interview • Context • Conversational Management • Cued Recall • Description–Identification Relationship • EFIT-V, EvoFIT, and ID • Encode • Enhanced Cognitive Interview • External Facial Features • Eyewitness • Facial Composite • Facial Configuration • False Memory • Familiar Faces • Facial Composite Systems • Feature Composite System • Free Recall • Group Identification • Hair • Holistic Interview Mnemonics • Holistic Composite System • Identification Parade • Individual Facial Features • Internal Facial Features • Line-up • Memory • Miscarriages of Justice • Mock Witness Paradigm • Morphed Composite • PEACE Interview • Person Descriptions • Photofit • PRO-fit • PROMAT • Picture Matching • Prototype • Rapport Building • Recall • Recognition • Reinstating the Context • Repeated recall • Report everything • Retention interval • Retrograde Amnesia • Sequential Line-up • Simultaneous Line-up • Sketch Artist • Standard Interview • Structural Code • Suspect • Unfamiliar Face Recognition • Victims • Video Identification • Video Identification Parade Electronic Recording • Weapon Focus • Witness

CHAPTER OUTLINE

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ROUTE MAP OF THE CHAPTER

Witnesses and victims may hold the only record of a crime and so their evidence can be invaluable to a criminal investigation. This chapter reviews the different types of evidence provided by eyewitnesses. The initial focus is on their ability to describe the details of a crime and those involved, plus interviewing techniques that attempt to maximise this information recall. Next, procedures used to identify offenders are examined. In the final part, face-construction systems are outlined along with techniques that have improved their effectiveness.

Eyewitnesses carry out a range of tasks to help the police bring a criminal to justice. They describe what happened during the crime and the people involved. Later, there may be reasonable grounds for the police to believe they know who is responsible for the offence and this person then becomes a **suspect**. The police may put the suspect into a **line-up** or **identification parade** and ask eyewitnesses to see if they recognise the person they saw. If the suspect is picked out, this outcome is taken as evidence that the police have arrested the correct person. The police may then spend time building a case to convict the suspect, or dismiss him or her as either there is a lack of evidence to convict or another person is responsible for the crime. Eyewitnesses also provide testimony in a court of law.

Suspect a person believed by police to have been responsible for a crime. The police will investigate, to provide evidence to suggest whether or not this person could have caused the crime.

line-up a term for an Identification parade.

identification parade a method of identification whereby a suspect is placed in a line with other people.

The police may use the description of an offender given by an eyewitness to try to locate this person using computer searches of previously convicted people. If a suspect cannot otherwise be identified, such as by using CCTV, DNA, fingerprints or other forensic evidence, eyewitnesses may construct a picture of the offender's face, an image called a **facial composite**. The police will usually circulate this image internally to police staff; if this does not identify the culprit, the image is often published on police websites, in newspapers, and on TV news and crime programmes in the hope that a member of the public will recognise the image and come forward with a name. Sometimes, the police try to establish identity by circulating a wanted poster; see Figure 12.1 for an example.

facial composite a picture of a face created by a composite system usually from eyewitness memory.

The focus of this chapter is on the various types of evidence from eyewitnesses. There have been many cases of wrongful conviction, as illustrated later by the conviction of Laszlo Virag, and these woeful outcomes must be minimised. The chapter is guided by the wealth of psychological research that has attempted to understand and improve the performance of human memory. It will be seen that eyewitness evidence, in conjunction with other evidence, is crucial for the identification and reliable conviction of offenders.

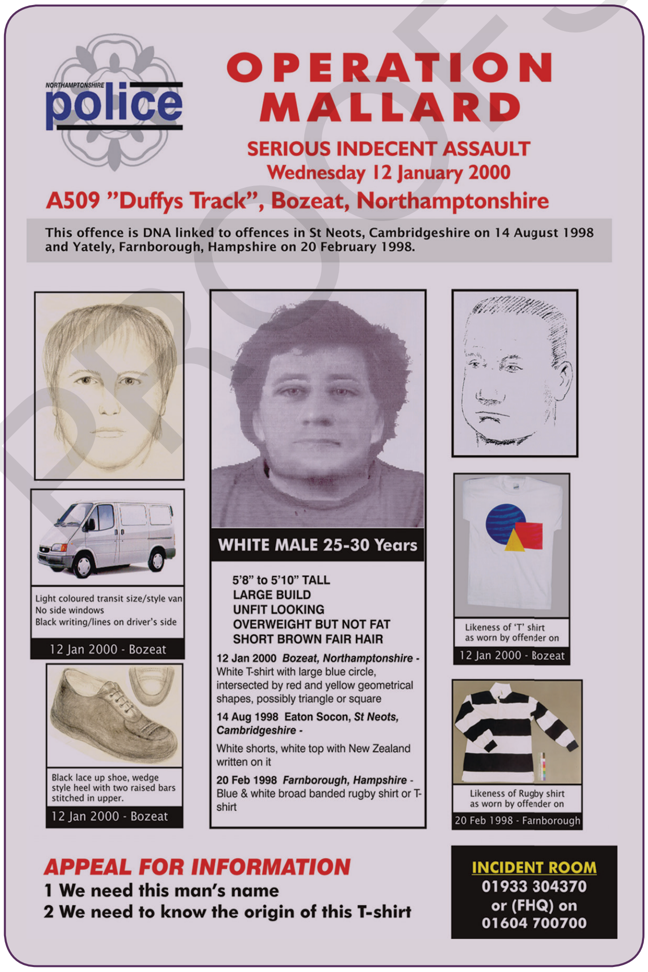

FIGURE 12.1 *Wanted poster.*

A Wanted Poster released by Northamptonshire Police as part of Operation Mallard. The criminal investigation involved a series of sexual assaults in southern England.

Source: Northants Police, with permission.

To summarise:

1. Eyewitnesses help the police bring an offender to justice.

2. Eyewitnesses give a description of crimes, take part in identification procedures, construct facial composites, and give testimony in a court of law.
3. The police may make a public appeal for information.
4. When there is good reason to believe that a person has committed an offence, he or she becomes a suspect in a criminal investigation.

12.1 INFORMATION RECALL

recall information produced by a person (often a witnesses or victim) from memory.

recognition the process of comparing a face with one stored in memory.

Eyewitnesses store a huge amount of information while observing a crime. The focus of this section is on **recall** of this information. The sections that follow this one explore eyewitnesses' **recognition** and *face-construction* abilities.

12.1.1 The Accuracy of Recall

Yuille and Cutshall (1986) were first to evaluate formally eyewitnesses' recall of a real-life event. The crime involved a thief who stole guns and money from a gun shop. In the street outside the shop, shots were fired between the shop owner and the thief, resulting in the death of the thief. Twenty-one eyewitnesses were interviewed within two days of the event. Each person provided a free account of what they saw and was subsequently questioned to expand on their recall. Thirteen of these observers also took part in a second research interview between four to five months later.

The descriptions given were detailed and contained information about actions, people, and objects. Overall accuracy was about 80% correct in each of these areas for both types of interview. Errors produced were fairly infrequent and concerned (a) actions of the thief, shop owner, and other people present; (b) descriptions of people's height, weight, age, hair, and colour of clothing; and (c) descriptions of objects.

Cutshall and Yuille (1989) investigated further shootings and armed robberies. Although the quantity of **eyewitness** recall varied among crimes and observers, accuracy levels remained high for police and (later) research interviews, suggesting that information in such situations is retained rather than being forgotten over long periods of time. Their result runs counter to normal research findings, which suggest that information recall reduces over time (Baddeley, Eysenck, & Anderson, 2020), but is perhaps retained better in **memory** owing to the serious nature of the crimes and also as observers may think about details of an incident (tending to rehearse information) before being interviewed (Read *et al.*, 1989). Again, inaccuracies involved descriptions of people, especially colour of clothing and hair, and estimates of height, weight, and age. Note that these descriptions are often used forensically—they appear on wanted posters, for example—but not all are errors of memory: height, weight, and age are arguably more to do with estimating physical quantities.

eyewitness an observer to a crime (a witness or victim).

memory part of the storage system in a brain.

12.1.1.1 Estimates of physical quantities

Flin and Shepherd (1986) looked at our ability to make judgements of height and weight. Over 500 people interacted with one of 14 target individuals and provided a height and weight estimate. Some interesting patterns emerged. First, people were fairly accurate, with a tendency to underestimate by about 8 cm for height and 3 kg for weight. Second, there was a tendency to give *lower* estimates for heavy and tall targets, but *higher* estimates for light and short targets. The authors referred to this effect as a *regression towards the mean:* extreme estimates are avoided in preference to those that are more similar to the average or 'norm'. Third, taller participants tended not to underestimate taller targets. Therefore, participants based judgements on their own physical attributes. Estimates also varied somewhat by gender of observer (see paper for details).

Estimating another person's age is a complex task owing to the range of cues available (Ekman, 1978; see George & Hole, 2000 for a review), some of which may not be helpful. For example, in an intriguing study reported by Sporer (1996), Deusinger and Haase found that age estimates changed according to clothing that a target individual wore and the context in which he was seen. When appearing in an aggressive scene wearing a red 'windbreaker' jacket, he was perceived to be four years younger than the same person seen playing the role of an associate and wearing a fine leather jacket. Research carried out using photographs of faces suggests that we can guess a person's age correctly on average within about five years (e.g., George & Hole, 2000; Dehon & Bredart, 2001; Sorqvist & Eriksson, 2007). Our estimates of age, and also of height and weight, are therefore fairly accurate, sufficient to provide a reasonable indication for use in police investigations.

Our responses can even be influenced by the wording of a question. In a classic study, Loftus and Palmer (1974) showed participants a film of a road traffic accident. Participants were asked to describe what happened and answer a series of questions about it. The particular

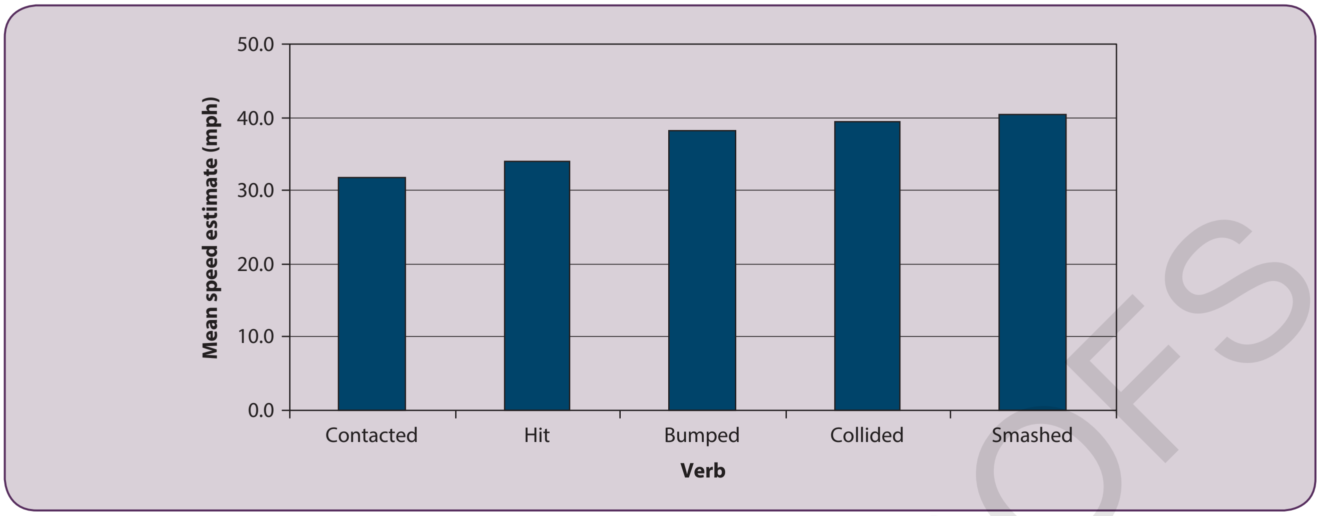

FIGURE 12.2 *Perception of speed.*

The influence of people's perception of vehicle speed following the verb used in Loftus and Palmer (1974). Average estimates of speed increased from 31.8 m.p.h. using 'contacted' to 40.5 m.p.h. using 'smashed'.

Source: Data from Loftus and Palmer (1974).

question of interest concerned the speed at which the vehicles were travelling when they *contacted* each other. Some participants were asked alternative questions using *hit, bumped, collided* or *smashed* instead of *contacted*. Average estimates of speed are shown in Figure 12.2 and increased from 31.8 for *contacted* to 40.5 m.p.h. for *smashed*. Simply changing a verb can, therefore, dramatically affect what people report.

In a second experiment, Loftus and Palmer's participants saw a similar film and, one week later, were asked whether they had noticed any broken glass. There was not, in fact, any broken glass, but more people *reported* seeing it if they (a) gave higher estimates of speed and (b) were asked whether the cars *smashed* into each other. The study emphasises the need for caution when asking questions about an event; without caution, distortion may result (e.g., leading to different estimates of speed). It is also possible to create a **false memory** (broken glass). See Loftus (1997), Sondhi and Gupta (2007), and Bernstein *et al.* (2011) for further examples.

false memory a memory that is not real or may be inaccurate due to having been affected or created by the way in which a question is asked, for example during investigative interviewing.

12.1.1.2 *Stressful events*

Studies have examined the potentially negative influence of anxiety. This is not an easy area of study due to the large number of variables involved, but the general finding is that people tend to recall less information in total, and with lower accuracy, when they have observed an event under physiological stress (Deffenbacher *et al.*, 2004), although there are exceptions (Yuille & Cutshall, 1986; Hulse & Memon, 2006). Following the normal pattern of results, Valentine and Mesout (2009) examined recall and recognition abilities of visitors to the Horror Labyrinth at the London Dungeon. This is a situation where people give their consent to be scared! Visitors who reported experiencing high levels of physiological stress (state anxiety) were found to recall fewer correct details and more incorrect details of a target individual; they also made fewer correct identifications in a line-up (identification parade).

A stressful event can affect memory retrospectively. Loftus and Burns (1982) presented participants with a violent or a non-violent film of a bank robbery and asked a series of questions about it. In the violent version, there was an unexpected and mentally shocking conclusion involving a young person being shot in the head. Fewer participants in the violent version (4.3%) correctly answered the important question—What was the number printed on a football jersey seen just before the end?—than those in the non-violent version (27.9%). Also, worse retention was found for information seen in the final two minutes, an effect of **retrograde amnesia** or loss of current knowledge. In addition, these effects were the result of upsetting but not unexpected (non-upsetting) events, further highlighting the role played by personally experienced stress.

retrograde amnesia an impact on memory such that information cannot be recalled prior to a traumatic event.

The presence of a weapon can also have an impact on recall. Participants in Loftus *et al.* (1987) saw a series of slides involving a gun or a cheque (payment for goods). Measurements of participants' eye movements revealed more fixations on the gun rather than on the cheque, and each of these fixations was for longer periods of time.

weapon focus the tendency for an eyewitnesses to be drawn to the presence of a weapon during a crime.

Participants in the condition involving the gun also answered fewer questions correctly about the perpetrator. In such situations, there is a **weapon focus**: attention tends to be drawn to the weapon and away from other objects, generally reducing information that can be recalled. Research also indicates that weapons (and/or unusual objects) tend to affect recall to a greater extent than recognition (e.g., Fawcett *et al.*, 2013; Kocab & Sporer, 2016). For example, Loftus *et al.* (1987) found only a weak effect on *recognition* when a weapon was present, as measured by a reduction in correctly selecting the target from a line-up. The weapon focus effect is generally reported in laboratory research (e.g., Steblay, 1992; Fawcett *et al.*, 2013; Erickson *et al.*, 2014), but in the real world, while there is evidence for its existence (e.g., Tollestrup *et al.*, 1994), some studies do not find one (e.g., Behrman & Davey, 2001; Valentine *et al.*, 2003). This outcome might be because weapons do not greatly influence identification, and/or procedures may be affected by other factors (e.g., selection bias, or appropriateness of setting for presence of a weapon). A weapon can also reduce recognition of facial composite images (discussed later) when there is limited time available to encode a face (Erickson *et al.*, 2022).

12.1.2 The Cognitive Interview

Until the 1980s, the police followed a question-and-answer-style interview to obtain the details of a crime from eyewitnesses: a **standard interview**. Sometimes, hypnosis was used to improve recall. Based on evidence that a standard interview did not produce the most complete and accurate testimony, and that suggestive elements of hypnosis may result in creation of false memories, Ron Fisher, Edward Geiselman, and colleagues in the United States developed an interviewing method based on sound psychological principles (Geiselman *et al.*, 1985). This is known as the **cognitive interview (CI)**.

Standard interview a question-and-answer-style interview to obtain details (e.g., of a crime) from eyewitnesses.

cognitive interview a modern method of interviewing designed to allow eyewitnesses to recall as much accurate information as possible about a person, a face, an event, etc.

The CI is based on the idea that the memory trace of a crime comprises different parts or ‘components’. Some of these components relate to *central,* important details, such as who did what to whom and when, while others relate to *peripheral* details, such as what people were wearing, other objects present, lighting conditions, and time of day; there may also be smells, sounds, thoughts, feelings, etc. Theoretically, best recall should occur when as many components are activated as possible. The CI contains techniques, or *mnemonics*, for improving recall. For example, eyewitnesses are asked to think about the event and attempt to recreate it in their mind. This is known as **reinstating the context**. Eyewitnesses are then asked to describe the event in an uninterrupted or **free recall** format, and **report everything**, even if seemingly irrelevant, as small details may turn out to be important. However, we tend to describe what we *expect* to have occurred. This can be partly counteracted by recalling again from a *different perspective;* for example, ‘What did the cashier see happen?’ While this procedure is controversial, as it may lead to eyewitnesses guessing about what another person saw, **repeated recall** attempts in general should take a different path through our memories and trigger previously unrecalled information. This repeated-recall technique can also be carried out in a *different temporal order,* for example, by recalling events backwards in time starting from the most recent event.

reinstating the context a technique of the cognitive interview where an observer thinks about (and / or recalls) the place in which a crime occurred.

free recall a technique of the cognitive interview for obtaining an uninterrupted account from memory.

report everything a technique of the cognitive interview whereby an observer is asked to remember all details, no matter how small.

repeated recall a technique of the cognitive interview where eyewitnesses are requested to recall information again.

Geiselman *et al.* (1985) measured the effectiveness of the CI. Participants were shown a film and interviewed using a standard interview, a CI, or a hypnosis interview. As Figure 12.3 illustrates, the CI outperformed the standard interview and was as good as hypnosis.

With the aim of improving recall further, Fisher *et al.* (1987) developed the **enhanced cognitive interview (ECI)**. The main stages are summarised in Table 12.1. As a high-anxiety state can hinder recall, especially for **victims** of a traumatic event, police interviewers start by **rapport building**. They also explain the interview process and, if possible, avoid interrupting during context reinstatement and free recall. Further, interviewers review the eyewitness’s account, providing another opportunity for recall. Laboratory tests (e.g., Fisher *et al.*, 1987) indicate that the ECI is more effective than the CI (36.9–57.7% correct details), with only a fairly small increase in incorrect recall (28%). Field trials support the benefit of these new interviewing techniques (e.g., Fisher *et al.*, 1989).

enhanced cognitive interview a revised version of the cognitive interview designed by Ronald Fisher and Edward Geiselman.

victim a person who is the subject of crime—that is, has been attacked, has had possessions stolen, etc. This person may also be a witness.

rapport building a technique of the cognitive interview where an interviewer chats informally with an eyewitness or a suspect.

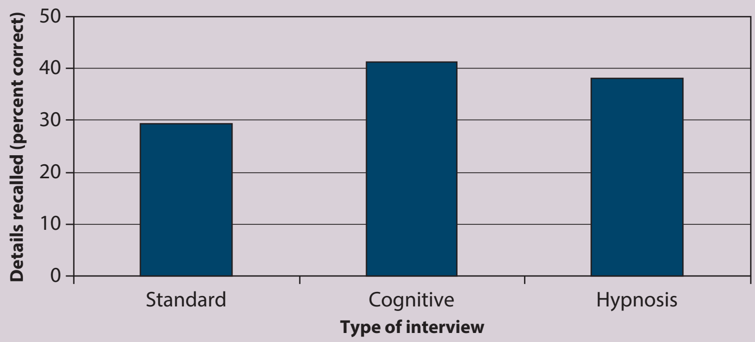

FIGURE 12.3 *The influence of interviewing on information recall.*

The figure illustrates the influence of interviewing on recall. Correct information recalled was found to be best for the cognitive interview and worst for the standard interview.

Source: Data from Geiselman et al. (1985).

TABLE 12.1 *Enhanced cognitive interview.*

The main stages of the ECI developed by Fisher *et al*. (1987)/American Psychological Association are as follows.

1. Rapport building
2. Describe the aims of the interview
3. Context reinstatement and free recall
4. Open questions (cued recall)
5. Repeated recall (free recall again, different temporal order and different perspective)
6. Summary
7. Close

12.1.3 UK Interviewing Techniques

PEACE interview an interview process designed to achieve best evidence from an eyewitness or a suspect.

conversational management a framework for interviewing designed to enhance recall of information.

witness an observer to a crime.

In the UK, the police use a **PEACE interview**, so called as it describes each stage: **P**lanning and preparation, **E**ngage and explain, **A**ccount, **C**losure, and **E**valuation (e.g., Milne & Bull, 1999). It includes components of the ECI, as described above, along with additional techniques for facilitating recall. These additions are called **conversational management** (**CM**) and are based on the principle that an interview is, in essence, a conversation between an interviewer and an eyewitness. In a conversation, people's behaviour affects one another and, in an interview context, will determine to some extent what a **witness** recalls. Important parts of CM involve listening skills, to indicate that the interviewer is interested, such as with the use of 'minimal responses', nodding and 'aha' replies. It also involves techniques to assist in recall. For instance, if a person's name is forgotten, witnesses can be asked to go through the alphabet for the first letter of the name, to help trigger the memory. Also important is transferring control of the interview at different stages, for example, before and after free recall.

Police officers learn PEACE interviewing for use with witnesses over five stages or *tiers*. Tier 1 is the basic level, which all police recruits receive, and normally takes five days. Training includes techniques of the enhanced CI, and officers gain much experience in this method of interviewing as part of operational duties. They may also attend further training courses to provide additional skills, such as those necessary for interviewing vulnerable and intimidated witnesses in Tiers 2 and 3. See Griffiths and Milne (2005) for a review.

12.1.4 Descriptions of Faces

person descriptions a description of a person's appearance that may include physical attributes (e.g., height, weight, age), clothing face, etc.

Eyewitnesses also give a description of the offender's face. As with **person descriptions**, this information can be used for public appeals and computer searches. Facial descriptions have an additional role to play for constructing line-ups and facial composites, discussed later. Before reading this section, complete Activity Box 12.1.

individual facial features parts of the face: eyes, nose, mouth, brows, hair, etc.

Human faces present an interesting challenge for our perceptual system: they all share the same basic design. All have **individual facial features**—two eyes, two brows, a nose, a mouth, and two ears—and each of these features is located in roughly the same position or *configuration* on the face: brows above eyes, nose between eyes and mouth, etc.

ACTIVITY BOX 12.1

Have a go at describing the face of a good friend from memory. First try to *visualise* the face in your mind and then describe as much as you can. Write down what you remember on a plain piece of paper. Forensic practitioners may note your recall using the following verbal description sheet. When done, compare your pattern of recall with Section 12.1.4, which describes general findings from the face recall literature.

Verbal Description Sheet

Overall observations

Face shape

Hair

Brows

Eyes

Nose

Mouth

Ears

It is the differences in this basic template for the face that give rise to individuality.

Detecting offenders is likely to be more effective if offenders' faces have aspects that are unusual or *distinctive*. Perhaps there was a small scar, tattoo or blemish, or a facial feature may be unusual in some way: small eyes, large eyebrows, or unusually shaped ears. The person's **facial configuration** can also be distinctive and provide important perceptual cues; some people, for example, have widely spaced eyes. Facial *distinctiveness,* due to unusual features or an unusual configuration, is an important aspect of face perception as it can enhance recognition accuracy (e.g., Shapiro & Penrod, 1986).

facial configuration the relative position of features on a face.

12.1.4.1 Patterns of face recall

Laughery *et al.* (1986) asked participants to describe a previously unseen and, therefore, unfamiliar face from memory. More information was reported for features in the upper than the lower half of the face, especially for hair and eyes. Most adjectives described the size and shape of features, but were not specific to faces; examples include *large* eyes, *small* nose, and *dark-brown* eyebrows. Describing a face is not an easy task, although hair was reported to be the easiest feature to recall.

Ellis *et al.*'s (1980) participants were shown one of two unfamiliar faces and recalled the face immediately, or after one hour, one day, or one week. As with Laughery *et al.*, most information recalled related to **hair** and *eyes* and then for the general structure of the face including shape, length, and size of head. Ellis *et al.* found that the *quantity* of information recalled successively reduced by facial feature as the **retention interval** increased: recall was greatest when done without delay and lowest after a week—an effect usually observed for recall of verbal information (e.g., Baddeley *et al.*, 2020).

hair an external facial feature.

retention interval the interval of time (delay) between one event and another.

A second group of participants matched the facial descriptions to a photograph of the targets. Delay had a progressively detrimental effect: descriptions were matched less accurately when produced after longer intervals. Therefore, the *quality* of information remembered about an unfamiliar face reduces over time. Eyewitnesses are often asked to recall an offender's face several days, or even longer, after a crime and so are likely to have forgotten information that may be useful for identification. Even using CI techniques, unfortunately, the majority of witnesses provide only a sketchy description of the face. Fodarella *et al.* (2021) illustrate the importance of these techniques for reinstating the context: asking an eyewitness to describe the place where a target face had been seen, *in detail*, leads to better recall of the face and a more effective facial composite (see 12.3). Early recall of information also helps witnesses create an accurate facial composite (e.g., Brown *et al.*, in prep).

12.1.4.2 Face encoding

encode refers to the process of storing information in our cognitive system.

The method we use to **encode** a face affects our ability to describe it. Many eyewitnesses believe that they may be asked questions about an offender's face and so focus on individual features, making 'mental notes' about sizes, shapes, and colours. This is *feature* or *intentional* encoding. Research indicates that the quality of descriptions is better (e.g., Wells & Turtle, 1988), as is the effectiveness of facial composites (Wells & Hryciw, 1984; Frowd *et al.,* 2007b), compared to when a face has been perceived more naturally, as part of communication or by making *personality* judgements about it (Wells & Turtle, 1988). Observers who use the latter, *incidental* or *holistic* encoding are better at whole-face-type tasks such as identifying a face from alternatives (Wells & Hryciw, 1984). The effect of encoding provides insight into how our cognitive system carries out different tasks: face recall involves individual features, while face recognition involves overall processing of the face. It also suggests that eyewitnesses will produce a more accurate and more complete description under intentional encoding; note that, under normal circumstances, the majority of us do not do this due to a natural tendency to encode faces holistically (Olsson & Juslin, 1999).

To summarise this section:

1. Information gained from an eyewitness is one source of evidence.
2. Evaluations of real-life crimes reveal that witnesses recall information with a high degree of accuracy, maintaining this information for long periods.
3. Errors tend to be made about the colour of clothing and hair.
4. Eyewitnesses are fairly accurate at judging estimates of height, weight, and age.
5. The way in which a question is phrased can affect recall and even result in creation of a false memory.
6. Physiological stress when observing an event can result in retrograde amnesia.
7. Attention can be drawn to the presence of a weapon, reducing recall.
8. The CI is a set of techniques (mnemonics) designed to maximise the quality and quantity of information recall.
9. An enhanced version of the CI is more effective than the standard version.
10. The UK police conduct interviews based on the enhanced CI and additional memory-enhancing techniques.
11. Human faces contain facial features and a facial configuration.
12. Descriptions of faces can be valuable to a police investigation.
13. Facial distinctiveness is an important factor for face recall and recognition.
14. How a face appears is forgotten over time.
15. Face recall is better when an observer focuses on individual facial features.

12.2 PERSON RECOGNITION

There are many cues we use to recognise someone—such as body shape and build, voice and accent, gait, face, behaviour, and clothing. But which is most important for recognition? Burton *et al.* (1999) used video footage of staff from a surveillance camera at Glasgow University. Participants were shown original footage or footage where editing obscured body, gait, or face; see Figure 12.4 for examples. People familiar with the staff were over 80% correct for each presentation format, except the one with the face concealed (less than 40%). From these cues, the study demonstrates that the *face* is the most valuable cue for recognising a familiar person.

familiar faces faces that have been encountered on numerous occasions.

We recognise **familiar faces** with almost perfect accuracy, even from different viewpoints, under different lighting conditions and in various environments (contexts) (Bruce & Young, 1998). Recognition is highly accurate, even under less-than-optimal conditions such as a grainy wedding photograph or low-quality CCTV (e.g., Lander *et al.*, 2001). For this reason, television crime and news programmes show CCTV images: so long as there is an unobscured image of the offender's face, someone who is familiar with the face person should be able to recognise him or her.

12.2.1 Unfamiliar Face Recognition

unfamiliar face recognition a type of face recognition usually where a person has previously only been seen once.

Early research seemed to suggest that we are also accurate at **unfamiliar face recognition** (e.g., Goldstein & Chance, 1971). These studies used a *recognition memory* task (RMT): participants were presented with a series of faces during a *study* phase and were asked to recognise these same items when mixed in

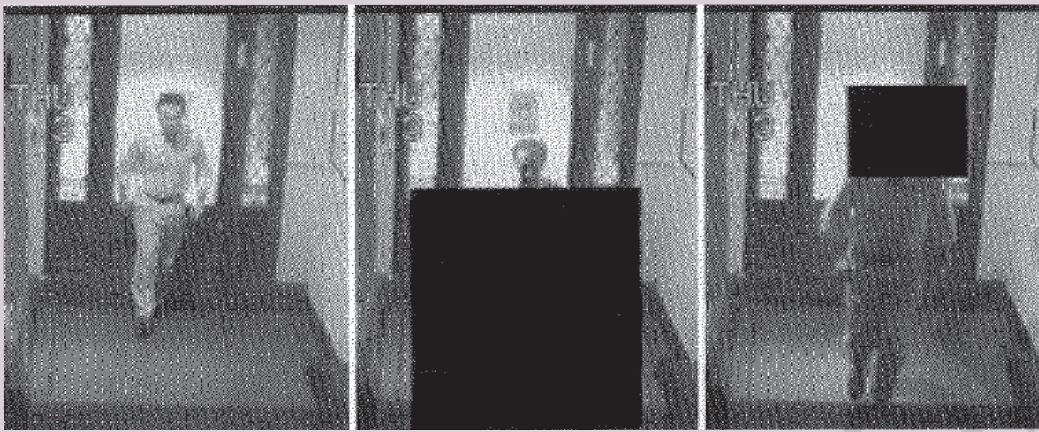

FIGURE 12.4 *Example stimuli.*

Example stimuli from Burton *et al*. (1999). Participants were presented with (left to right) unedited CCTV footage, or footage with body or head obscured. Also included was a condition where gait was disrupted. The greatest disturbance to face recognition occurred with the face obscured (far-right image), indicating the importance for recognition of this part of a person's appearance.

Source: Burton et al. (1999). Reproduced with permission of Sage Publications.

with other faces during a *test* phase. All the faces were previously unfamiliar to participants. The problem is that we can do this exercise using properties of the picture: how a person looked into the camera, the specific lighting, his or her expression, the background scene, and so on—a strategy known as **picture matching**. Showing a different photograph between study and test measures our ability to process facial structure (identity), a cognitive mechanism that compares an abstract, view-invariant representation of the face with internally stored **structural codes** (Bruce & Young, 1986). Bruce (1982) found that participants were about 90% correct using identical photographs, but lower when test faces changed by head pose *or* expression, and lowest when changes occurred to both pose *and* expression. ~~Her~~ results are illustrated in Figure 12.5. Further research

picture matching a type of recognition carried out by matching information (e.g., between facial photographs) based on properties of a picture (e.g., lighting, background scene, head pose and facial expression). This method is in contrast to structural encoding (see **structural code** below).

structural code a type of recognition carried out by matching information about a person's face. It is not based on lighting, pose, etc. (see **Picture matching** above), but is usually achieved when recognising a face seen at different times (e.g., when different photographs of a person's face are used in a recognition test).

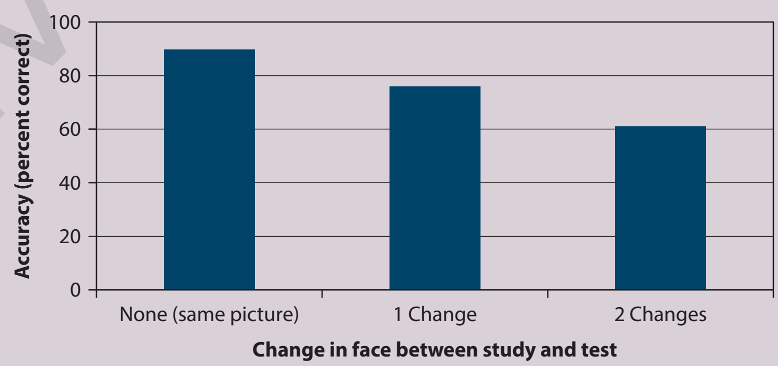

FIGURE 12.5 *Changes in the appearance of an unfamiliar face between study and test.*

The graph demonstrates that changes made to a face between study and test affect our ability to recognise it. Participants in Bruce (1982), Experiment 1, saw the same picture at study and test (far-left bar), a change in *either* pose or expression (centre bar) or a change in *both* pose and expression (far-right bar).

Source: Data from Bruce (1982).

confirms that performance deficits occur following changes to background scene, hair, and lighting conditions (e.g., Davies & Milne, 1982; Memon & Bruce, 1983; Cutler *et al*., 1987; Hill & Bruce, 1996). Our performance is also worse when attempting to recognize a face from a race with which we are unfamiliar, a mechanism known as the cross-race effect (see Meissner & Brigham, 2001 for a review).

internal facial features the interior region of the face that includes eyes, brows nose and mouth.

external facial features the exterior region of the face that includes hair, face shape, ears, and neck.

Ellis *et al*. (1979) looked at how we process different facial regions. Participants were shown well-known (celebrity) photographs of **internal facial features** or **external facial features**; other participants saw complete faces. The naming of intact faces was about 80% correct, internal features about 50%, and external features about 30%. Next, an RMT was used with *unfamiliar* faces, and internal and external features were then recognised equally. The work demonstrates the relatively greater reliance on internal features for recognising a familiar face, but relatively more on external features when familiarity is low.

In police investigations, an offender is normally seen once and so this person's external facial features have greater importance to an observer than if she/he was well known. Further research indicates that **hair** is the most important external feature for unfamiliar face perception (Ellis, 1986; Burton *et al*., 1999; Frowd & Hepton, 2009). This suggests that offenders can reduce the chance of being recognised simply by changing colour, style, and/or length of their hair—although this effect can be countermanded (~~Frowd *et al*., 2019~~).

Recognition accuracy is also strongly affected by facial similarity. In Davies *et al*. (1977), participants sorted 100 faces into piles of similar appearance. 'Line-ups' were created containing faces that had been sorted together frequently or infrequently, and these were presented to further participants for identification. Overall accuracy was about 75% correct, but errors tended to occur for arrays constructed from *frequently* sorted items. The work demonstrates that faces judged similar to each other are also likely to be confused, indicating that eyewitnesses may make errors when facial similarity is high. Unfortunately, confusions also occur when similarity is lower; see Focus Point 12.1. See also Shepherd *et al*. (1978).

12.2.2 Identification Procedures

In the UK, there are two types of identification procedure (PACE Code D Revised, 2017). First, the police may escort eyewitnesses to public places to see if they can spot the offender. This is known as **group identification**.

group identification a method for identifying a suspect in a public place.

The second procedure is used when police have a suspect: the suspect is placed in a line with at least eight other individuals ('foils') and the eyewitness is asked to pick out the offender, if present. This is known as an **identification parade** or **line-up**. In fact, the suspect is filmed and presented in sequence amongst foils that have been filmed in the same way. Two systems exist for creating these video procedures: **Video Identification Parade Electronic Recording** (**VIPER**) and **PROMAT** (Brace *et al*., 2009; ibid).

Video Identification Parade Electronic Recording (VIPER) a commercial computer system for identification using video presentation.

PROMAT a commercial computer system for identification using video presentation.

VIPER and PROMAT implement a **sequential line-up**. This type of line-up is, however, not the most common format worldwide. More often, all line-up members are presented together—a **simultaneous line-up**. There has been considerable debate about which presentation format is best (e.g., Meissner *et al*., 2005), and recent evidence suggests that simultaneous is slightly better (McQuiston-Surrett *et al*., 2006).

sequential line-up a type identification procedure where members of a line-up are shown in sequence (i.e., one after another). This method contrasts with a simultaneous line-up.

Simultaneous line-up a type identification procedure where members of a line-up are shown at the same time. This method contrasts with a sequential line-up.

Considerable effort has been spent trying to understand the factors involved with line-ups, the aim of which is to maximise the chance of an eyewitness identifying a *guilty* suspect (the person who actually committed the offence) while minimising identification of *innocent* suspects (there are other reasons, however, some based on legal systems different to that in the UK; see Wells, 1985). For example, one factor relates to a witness's description of a face and his or her accuracy in a line-up. The **description–identification relationship** is fairly complicated, but a *weak* effect does appear to exist (for a review, see Meissner *et al*., 2008).

description–identification relationship the finding that a weak relationship exists between the content of a person's facial description and his or her accuracy in identifying this face.

It is crucial that line-ups are fair. If suspects stand out, the chances of them being selected increase. When an *innocent* suspect is selected, police time is wasted and the chance of wrongful conviction increases. One way to improve effectiveness is to increase line-up size. All else being equal, this reduces the probability that an innocent suspect is selected by chance; for example, chance is 1 in 10 (a probability of 0.1) for a 10-person line-up but half this rate for a 20-person line-up (0.05). Research suggests that increasing line-up size does not reduce identification rates of *guilty* suspects, even for very large line-ups (Levi, 2002, 2007, 2017; Wooten *et al*., 2020).

A well-intentioned but nevertheless flawed procedure is to select members of a line-up who look similar to a *photograph* of the suspect. The problem is that, if shown a set of faces, we tend to form an *average* of the set in our mind. The average is known as a **prototype** and becomes a memory to which we may respond (Cabeza *et al.*, 1999). So, if a line-up is constructed from a suspect's photograph, the ~~suspect~~ becomes a *prototype* and witnesses will tend to select it! A better procedure is to select line-up members based on a *description* of the *offender* given by an eyewitness (e.g., Brigham *et al.*, 1990), and is one reason for asking an eyewitness~~es~~ to recall the offender's face in the first place.

prototype a representation formed in memory of the average of a number of items (e.g., human faces).

One way to test the fairness of a line-up is to administer a **mock witness paradigm** (Doob & Kirshenbaum, 1973). To do this important check, a group of volunteers (people who are not familiar with the line-ups' faces) are given an eyewitness's description, shown the associated line-up and asked to select who they think is the suspect. Any line-up member who is picked out more often than chance provides evidence that the line-up is biased; if biased, the line-up should be reconstructed. Using this procedure, **video identification** has been found to be less biased (Valentine & Heaton, 1999) and more ergonomic (Kemp *et al.*, 2001; Brace *et al.*, 2009) than live line-ups.

mock witness paradigm a procedure used to check that an identity parade has been constructed fairly (i.e., without bias).

video identification an identification procedure where members of a line-up are shown in sequence in a video presentation.

To summarise this section:

1. There are a range of cues we use to recognise a person, but information from the face is arguably the most important.
2. We are excellent at recognising faces with which we are familiar.
3. Familiar faces are recognised more by their internal than their external features.
4. Offenders are normally only seen once and therefore eyewitnesses use unfamiliar face perception to describe and recognise the face.
5. Unfamiliar face recognition is sensitive to a range of effects including lighting, head pose, expression, and environmental context.
6. External features exert a greater influence for unfamiliar than familiar faces.
7. Line-ups involve real people, photographs or videos and are administered sequentially or simultaneously.
8. UK police use group identification and sequential video-recorded line-up procedures with eyewitnesses.
9. Line-ups should be constructed on the basis of an eyewitness's description of the offender.
10. Larger line-ups are more effective as they protect an innocent suspect.
11. Line-up fairness can be tested using a mock witness paradigm.

12.3 FACE CONSTRUCTION

Witnesses may participate in an identification procedure months into an investigation. In the absence of a suspect, however, they may help sooner by constructing a *visual* likeness of the offender's face, a picture known as a **facial composite**. These pictures are produced using a number of **facial composite systems** after a CI and are shown to police staff and/or members of the public for identification. The use of composites therefore involves two types of perceptual process: unfamiliar face perception to construct the face (by eyewitnesses) and familiar face perception to recognise it (by police staff and the public). Given the importance of these images for the identification of offenders, facial composite systems have been the focus of considerable research and development.

facial composite systems different methods for creating a face of a person usually from the memory of an eyewitness.

12.3.1 Composite Systems: Past and Present

The earliest method for constructing a face involved a **sketch artist**, a person skilled in portraiture who would draw the face by hand using pencils or crayons. The first UK system designed for police operatives with less artistic skill was **Photofit**. This **feature composite system** used individual reference features printed onto rigid card; eyewitnesses would select the best matching hair, eyes, nose, and so on, with each part being slotted together as if assembling a jigsaw. Photofit has been extensively evaluated and led to software systems that

Sketch artist a system for creating a facial composite involving a person skilled in portraiture who draws the face by hand using pencils or crayons.

photofit an archaic composite system designed around 50 years ago that allowed a face to be created from separate parts.

feature composite system a method to create a face that involves the selection of individual facial features (eyes, hair, nose, etc.).

FOCUS POINT 12.1 MISCARRIAGE OF JUSTICE

In 1969, Laszlo Virag was convicted of the theft of money from parking meters in Liverpool and Bristol, and with the subsequent use of a firearm while attempting to escape arrest. Laszlo's conviction was based on the evidence of eight eyewitnesses who identified him from a line-up. He was sentenced to 10 years in prison. Two years later, as part of another investigation, fingerprint and other evidence implicated Georges Payen. Laszlo was exonerated and compensated for his time served in prison.

The photograph on the left is of Laszlo Virag. The one on the right is of Georges Payen who was later convicted for these offences. The images share a *passing* but not a *striking* resemblance to each other.

The case of Laszlo Virag is one of many convictions that have been overturned and innocent people set free. The case against him was based on eyewitness testimony that appeared to be accurate and convincing. The observers felt confident in their judgement, and so clearly feelings cannot always be relied on, even though they may sound convincing to a jury (Wells *et al*., 2002). One of the eyewitnesses was even reported to have spent several minutes in a hotel bar with the accused, but still mistakenly identified Virag in a line-up. A formal inquiry into such **miscarriages of justice** was carried out by Lord Devlin in the 1970s with the conclusion that eyewitness evidence is unreliable. There are many other cases involving honest but nonetheless incorrect identification; for further examples, see Rattner (1988), Davies and Griffiths (2008), and the Innocence Project (innocenceproject.org).

miscarriages of justice criminal cases where people have been wrongly convicted of crime.

Source: Devlin (1976). Reproduced from Her Majesty's Stationery Office.

the police currently use; for a review, see Ellis and Shepherd (1996) or Frowd (2021).

One problem with Photofit was that eyewitnesses selected from pages of isolated facial features. We never naturally do this: eyes, for example, are seen in a face with a nose, brows, a mouth, etc. It turns out that we are more accurate at selecting features when they are embedded in an intact face (e.g., Davies & Christie, 1982; Tanaka & Farah, 1993). This idea has been applied to modern software systems as part of a 'cognitive' approach to face construction: witnesses are presented with features that are switched in and out of an intact face, a method that creates more identifiable composites (Skelton *et al*., 2015).

A second problem was limited features: there were not enough examples to build composites of all offenders. This issue was addressed by photographing a large number of people and then classifying and storing their facial parts in a computer database; also, computer graphics technology allowed each feature to be resized and positioned freely, vastly expanding system expressivity. Unfortunately, there were now too many examples to show to witnesses! The **PRO-fit** composite system, for example, has 219 noses stored in the White Male database, but a 'manageable' set of 14 are 'long' and 'straight'. As with line-ups, a witness's description is now a prerequisite, here, to allow police practitioners to specify a subset of features within the database. A ~~CI~~ is administered to help a witness recall the face; best practice (Fodarella *et al*., 2015) includes CI mnemonics for rapport building, context reinstatement, free recall, and **cued recall**; a 'verbal description' sheet is used by practitioners to record recall (see Activity Box 12.1).

PRO-fit a software system that allows a composite to be created by the selection of individual facial features.

cued recall a method of prompting in the cognitive interview designed to enhance recall of information.

12.3.2 *The Effectiveness of Feature Composite Systems*

Frowd *et al*. (2005b) evaluated Sketch, Photofit, and its descendants, CD-FIT, E-FIT, and PRO-fit; also included was a novel system in development, EvoFIT, described in Section 12.3.4.4. Participants looked at a good-quality photograph, a face they did not recognise, waited 3–4 hours and then followed procedures used with 'real' eyewitnesses. This involved a CI, to recall a description of the face, and the use of the composite system as specified by manufacturers, the aim of which was to produce the best likeness possible (see also Fodarella *et al*., 2015). Ten target identities were constructed for each system by different people to provide a stable measure of system performance. Then, at least 10 people familiar with the relevant identities attempted to *name* the composites, a design that usually has sufficient power to be able to detect a forensically useful 'medium' effect. The target identities were celebrity faces, half of which had been previously rated as distinctive and half as more average in appearance. Examples from the study are shown in Figure 12.6.

The two UK software systems, E-FIT and PRO-fit, were named equivalently, at 18% correct overall (Figure 12.7). This level is not great, but was significantly better than the older Photofit system, at 6%. Naming was ~~somewhat lower~~ for sketch, at 9%. The study also revealed that composites of distinctive targets were named about three times higher overall than composites of average targets. This target *distinctiveness* advantage is also found when recognising *photographs* of faces (e.g., Shapiro & Penrod, 1986); here, it suggests that an offender will be identified more frequently from a composite if his or her face has an unusual appearance.

FIGURE 12.6 *Example composites.*

Example composites from Frowd *et al*. (2005b). All the pictures were constructed from different people's memories of the UK footballer, Michael Owen. From left to right, they were created from E-FIT, PRO-fit, Photofit and Sketch. The far-right image is a photograph from Wikimedia Commons that is similar to the one used in the project.

Source: Frowd et al. (2005b). Reproduced with permission of Taylor & Francis.

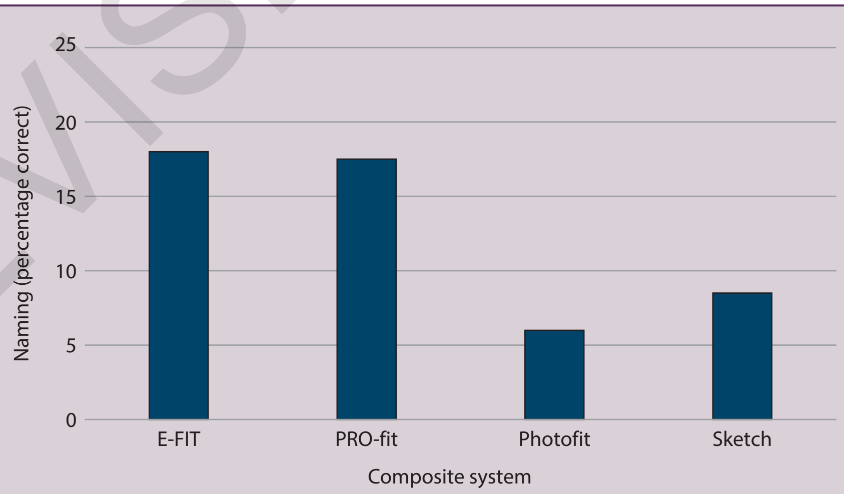

FIGURE 12.7 *The effectiveness of composites.*

The graph demonstrates how effective composites are when the delay to construction is fairly short (three to four hours). The two main UK software systems at the time, E-FIT and PRO-fit, were equivalent and better than the older Photofit.

Note: 100% on this scale means that all composites from a particular system would have been correctly named by all the participants (an outcome that was far from true).

In Frowd *et al.* (2005a), participants waited two days between seeing a target identity and constructing the face, a more usual interval for real witnesses (Frowd *et al.*, 2012b). Sketches were correctly named about the same as before, at 8%, but E-FIT and PRO-fit were less than 1% overall. This indicates that 'feature' systems fail to produce recognisable images when deployed after a realistic delay; the exception is sketch, and even then performance is not ideal. Using a similar design with a long delay, other projects have reported similarly disappointing results for software feature systems (Frowd *et al.*, 2007b, 2007d, 2010), but consistently higher correct naming for artists' sketches (Frowd *et al.*, 2015).

12.3.3 Internal and External Composite Features

Frowd *et al.* (2007a) investigated why correct naming was very low for composites constructed after a two-day delay. Similar to Ellis *et al.* (1979), Frowd *et al.* (2007a) examined two regions of the face: internal and external features; see Figure 12.8 for examples. A *naming* task could not be used as performance levels would be too low for analysis; instead, a *sorting* procedure was administered that required participants to match complete and part-face composites to target photographs. Scores were 33% correct for complete and external features composites, but only 20% for composites of internal features. The results suggested that low correct *naming* was a consequence of inaccurately constructed internal features; also, that if this inner region could be constructed more accurately, better recognition would emerge for the composite face as a whole.

FIGURE 12.8 *Example stimuli.*

Example stimuli used in Frowd *et al.* (2007a): internal and external composite features, and the corresponding complete composite. In the study, participants matched complete composites, or one of these part-composite images, to target photographs. The internal ~~feature~~ composites were not matched as well as the other types of image, indicating inaccurate construction of the central facial region.

12.3.4 Improving the Effectiveness of Composites

The following techniques have successfully improved the effectiveness of composites. Each technique is in current police use.

12.3.4.1 Combining different memories

Bruce *et al.* (2002) considered the situation where multiple witnesses had seen an offender. If each observer were to construct a composite of this face, each image would be different, but all would share characteristics. This is illustrated in Figure 12.9. Images would also contain errors. The authors hypothesised that, because each composite had been created independently, if combined, errors would be reduced and the resulting 'average' or **morphed composite** would be more accurate. Their hypothesis was confirmed in a series of experiments: a morphed composite was judged to have a better likeness than an average *individual* composite and was identified as often as the *best* individual image.

morphed composite a facial composite comprising the average of two or more individual composites.

Prior to Bruce *et al.*'s work, UK police guidelines did not allow more than one composite to be constructed of the same offender. Since then, these guidelines have been revised to allow the construction of multiple images, for the purpose of producing a morphed composite (ACPO, 2009). This average image would be used on a wanted poster (such as in Figure 12.1) instead of any of the individual images. The technique has been shown to benefit (a) composites created from a holistic system (Valentine *et al.*, 2010; Davis *et al.*, 2011, Davis *et al.*, 2015) and (b) forensic age progression, images used to locate missing persons (Lampinen *et al.*, 2015).

When there is only *one* witness to a crime, morphing techniques are not applicable. In this more usual situation, other methods can be used to facilitate composite naming. Some of these techniques are described below.

12.3.4.2 Facial caricature

Different observers, even after encoding a face for the same length of time, construct different-looking images (see Figure 12.9). Individual differences are also observed when people attempt to *recognise* composites: some of us are good at *naming*, while others struggle. Composites can be quite bland in appearance, and all contain 'error', together limiting recognition. Frowd *et al.* (2007c) looked at artificially manipulating distinctive information in composites. Participants observed a composite being *caricatured*, where distinctive aspects of the face were exaggerated, and then *anti-caricatured*, where these same aspects were made to look more average (potentially reducing the appearance of error). This manipulation

FIGURE 12.9 *Example composites.*

Example composites (top row) constructed by different participants in Bruce *et al*. (2002). The morphed image of these individual composites is shown bottom left; the researchers demonstrated that this image is an effective representation of the target face (in this case, the photograph, bottom right).

Source: Bruce et al. (2002). © American Psychological Association.

FIGURE 12.10 *Caricaturing a composite.*

Shown are negative and positive caricature levels: -60%, -30%, 0%, +30%, and +60% exaggerations. The image in the centre (0%) is the original composite constructed from memory. A sequence of such images (with 21 frames) is valuable for face recognition. Can you guess the identity? The answer is shown at the end of the chapter. An animated example can be seen at http://tiny.cc/animated-composite-1

caricatured composite a composite image with facial features exaggerated, for enhancing recognition.

was viewed over a 21-frame sequence, as illustrated in the **caricatured composite** of Figure 12.10.

The sequence is effective for triggering recognition of the relevant identity. The benefit extends to composites from feature, sketch, and holistic systems but is greatest for composites that themselves are infrequently identified. For these images, average naming was found to increase greatly as a result of observing the sequence, from 3% to 30%. The technique is conveniently viewed using an animated GIF on a wanted person's web page, a mobile phone or on TV. Research has also demonstrated that the positively caricatured part of the sequence is most effective for recognition, with the anti-caricatured part contributing to some extent (Frowd *et al*., 2012c). Other techniques for enhancing finished composites, such as stretching the image vertically, are discussed in Section [illegible].4.4.

12.3.4.3 Improving holistic face processing

As mentioned above, a CI is used to help an eyewitness *recall* a face, to allow practitioners to locate a subset of features in a composite system (for then presenting to the eyewitness). However, face *recognition* is engaged when selecting facial features. This is the reason why a 'cognitive' approach is used for modern systems (as described in Section 12.3.1). But this idea can be taken a stage further, by *enhancing* recognition via personality attribution. This effect was first demonstrated using *photographs* of faces. Berman and Cutler (1998) found that people were better able to recognise unfamiliar faces if they had made a series of personality judgements about them than if they had made judgements about facial features.

Frowd *et al.* (2008a) asked one group of participants to construct a face as normal, after a face-recall CI, while another group did the same but were then asked to think about personality or character of the face, and make a series of whole-face (holistic) judgements. Examples include health, honesty, and outgoing. The correct naming of the resulting composites was 9% after standard mnemonics but 41% following these **holistic interview mnemonics**. The new mnemonics take about five minutes to administer but are very effective at improving correct naming of an ensuing composite. Their advantage has been replicated for a feature composite system (Skelton *et al.*, 2019) and found to extend to a holistic system where the focus of attention for a face constructor is on internal facial features (Frowd *et al.*, 2012a, 2013, 2015) or on the important region around the eyes (Skelton *et al.*, 2019).

holistic interview mnemonics a cognitive interview that includes additional procedures based on personality attribution that are designed to improve the effectiveness of an eyewitness's composite.

12.3.4.4 Holistic composite systems

The techniques described so far run into difficulty when a witness's description is not detailed, since feature subsets cannot be located. This outcome can happen for briefly occurring or unexpected crimes (where witnesses may not try to remember the face), and following a long delay to face construction. In spite of this, some eyewitnesses report that they could recognise the face again; they could, for example, participate in a line-up if only a suspect could be located. Such witnesses appear to have a memory of the face that, while not describable, could be accessed via a *recognition* procedure. This idea is supported by research that suggests that face recognition remains stable for several weeks after an event (Shepherd, 1983), unlike face recall (Ellis *et al.*, 1980). Several research groups have been developing a so-called **holistic composite system** to help these eyewitnesses. In the UK, there are two such commercial systems, **EFIT-V** (Gibson *et al.*, 2003, currently called EFIT-6) and **EvoFIT** (Frowd *et al.*, 2008), and, in South Africa, **ID** (Tredoux *et al.*, 2006).

holistic composite system a composite method whereby eyewitnesses initially select from screens of whole faces (or whole-face regions) to evolve a likeness of a face. These systems usually involve other procedures for enhancing the likeness of the face.

EFIT-V, EvoFIT, and ID commercial holistic facial composite systems.

In collaboration with Vicki Bruce and Peter Hancock, we have been developing one of these holistic systems, EvoFIT, for about 25 years. In the original design, witnesses were presented with arrays of complete faces from which to select those that best resembled the perpetrator's face. Coefficients of the selected items were mixed together to combine characteristics and produce more faces for selection. Repeating the process a few times allowed the faces to become more similar to each other and more similar to the face in the memory of the observer. The item with the best likeness was ultimately saved as the 'composite'. Therefore, witnesses engage in face recognition, by selecting items that look *overall* similar to the intended target, to allow a composite to be 'evolved'. EvoFIT is a working example of Charles Darwin's idea of evolution by *artificial* selection. In practice, face selection is made easier: witnesses look at face arrays that change by *shape*—the shape and position of features—and then by *texture*—the greyscale shading of features (e.g., eyes, brows, and mouth) and overall skin tone (see Frowd *et al.*, 2004 for a description of the basic system). Note that this system presents faces in greyscale since, under normal circumstances, colour information is not necessary for recognition (Frowd *et al.*, 2006).

Assessment used the standard police procedure and a one- or two-day delay. This version of EvoFIT created more identifiable faces than those from a traditional 'feature' system, but correct naming was still low, at 11% (Frowd *et al.,* 2007b). Two developments improved performance. The first was to 'blur' (de-emphasise) external facial features. This helped a witness focus on the central part of the face that is important for later recognition by another person (Frowd *et al.,* 2008b). The other development allowed enhancement using a number of psychologically useful scales (Frowd *et al.,* 2006). Here, observers made changes to their evolved face by age, weight, health, masculinity, friendliness, and other holistic properties; see Figure 12.11 for an example. These two improvements allowed witnesses to construct composites two days after encoding a target face that were correctly named at 25%, compared to 5% for composites constructed under the same conditions from a modern 'feature' system (Frowd *et al.,* 2010).

Subsequent research reveals that more effective composites are created by evolving just internal features (see Figure 12.12) and selecting external features towards the

FIGURE 12.11 *Ageing and pleasantness 'holistic' scales.*

An example of ageing (top row) and pleasantness (bottom row) scales in EvoFIT. After evolving, eyewitnesses adjust their final face using these and other 'holistic' scales. The centre image is the original, while negative changes are to the left and positive changes are to the right. Can you guess the identity of this face? (Arguably, the best likeness is the top-right image.) The answer is given at the end of the chapter.

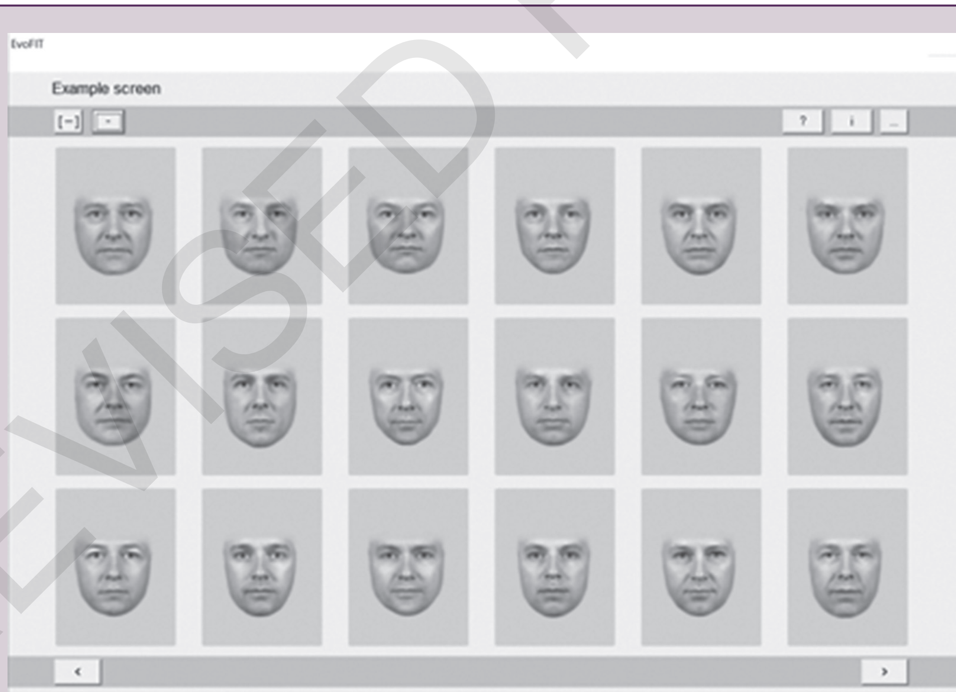

FIGURE 12.12 *EvoFIT faces.*

An example array of EvoFIT faces as would be presented to an eyewitness. The external parts of the face are not shown, to allow focus on the important, central region. At the end of evolving and enhancing internal features, hair and the other external features are added to the face.

end of the process; this development improved naming to 45% correct (Frowd *et al.*, 2012d). Research also reveals how successive developments can be effective when applied together: in Frowd *et al.* (2013), use of holistic interview mnemonics, evolving internal features first and an image-stretching technique (to enhance recognition of a finished composite), led to composites that were named at an astonishing 74% correct.

Further work has revealed that more identifiable composites are constructed from EvoFIT (and presumably from other holistic composite systems) when witnesses (a) are asked to focus on the eye region, an important area for face recognition (Fodarella *et al.*, 2017; Skelton *et al.*, 2019); (b) describe the environmental context in detail prior to face recall (Fodarella *et al.*, 2021); (c) engage in a mindfulness technique (Martin *et al.*, 2017; Giannou *et al.*, 2021); (d) evolve the face using a smaller population size (Frowd, 2021); (e) have encoded a face that is low (EvoFIT) or medium (feature system) in perceived attractiveness compared to one with higher attractiveness (Richardson *et al.*, 2020); (f) freely recall the face in the interval between face encoding and CI / construction, a 'testing' effect (Brown *et al.*, in prep); and (g) construct the face on the same day as the crime (Frowd *et al.*, 2015), a situation estimated to be feasible in around 10% of criminal investigations. There is also good utility in allowing witnesses to construct a face themselves (Martin *et al.*, 2018), an ergonomic approach for identifying offenders of minor crime. Similar to EvoFIT, there is substantial benefit for combining techniques for a feature system: use of holistic interview mnemonics, constructing the face in regions (first internal features with external features masked, then the reverse), and enhancement via image stretching (Skelton *et al.*, 2019). In addition to dynamic caricature, mentioned above, innovative techniques have enhanced recognition of finished composites created from different systems (e.g., Frowd *et al.*, 2014; McIntyre *et al.*, 2016; Lander *et al.*, 2017; Brown *et al.*, 2018).

It is important to verify performance outside of the laboratory in field studies, as was seen for the CI (e.g., Fisher *et al.*, 1989). EvoFIT has been audited in a series of field trials. In spite of difficulties in controlling for variables (e.g., target encoding, exposure time, and delay), as part of a nominal six-month trial period, EvoFIT was found to directly lead to an arrest in about 40% of cases using the latest interviewing procedures (Frowd *et al.*, 2011); the arrest rate increased to 60% (29% of which led to conviction) when witnesses evolved internal features of the face, adding external features towards the end (Frowd *et al.*, 2012b). Results are, therefore, broadly similar in the laboratory and in the hands of the intended user. See Frowd *et al.* (2019) for a more recent assessment of impact.

To summarise this section:

1. Eyewitnesses construct a picture of an offender's face when police do not have a suspect.
2. There are various traditional methods to build a composite face and these include sketch artists and 'feature' systems.
3. A modern computerised feature composite system contains a large number of individual facial features for eyewitnesses to select, size and position on the face.
4. Research suggests that feature systems are somewhat effective when the target delay is up to a few hours in duration, but usually not when it is one or two days, the norm for 'real' witnesses.
5. There are a range of techniques that have been developed to improve the effectiveness of facial composites.
6. Composites from different witnesses may be combined to produce a morphed (average) composite.
7. Eyewitnesses may be asked to think about the personality of the offender's face in an 'advanced' CI (one involving holistic interview mnemonics).
8. Identification of a composite is improved using a dynamic caricaturing procedure.
9. Holistic composites systems such as EvoFIT allow a composite to be constructed in situations where an eyewitness's recall of the face is poor.
10. A **holistic composite system** presents screens of complete faces to allow a face to be 'evolved'.
11. EvoFIT is much more effective than previous systems even when the delay to face construction is one or two days.

12.4 SUMMARY: EVIDENCE AND EYEWITNESSES

Evidence given by eyewitnesses is one of many sources available in a police investigation. Criminals may unknowingly leave their DNA at a crime scene, having touched objects, and left fingerprints; even fibres from clothing may fall and be collected for analysis. These sources of evidence may also produce false leads, since we naturally leave behind physical materials: hairs fall off, we make footprints, and CCTV cameras record our presence. As in the case of Laszlo Virag, and others, any one source of evidence (e.g., from eyewitnesses) may not be reliable enough in itself. The Crown Prosecution Service in England and Wales and the Procurator Fiscal in Scotland do not allow a case to be brought before a court if based on insufficient or unreliable evidence.

Eyewitnesses can still be valuable to a police investigation. There are many situations where they are the only observers, and so their memory of what happened is of importance. Each of our senses produces memories that are potentially valuable, even personal feelings. Eyewitnesses can provide descriptions of events and people, take part in identification procedures, and construct a likeness of the offender's face. Each area of their evidence has potential problems, but research has attempted to limit bias and maximise the value of a memory. Each piece of evidence is potentially unreliable but, when combined, can provide a reliable system for identifying and convicting criminals.

As a final summary:

1. There are many types of evidence available in a criminal investigation.
2. There have been historical cases of wrongful conviction, particularly when eyewitness evidence alone was used to convict a person.
3. A stronger case is made by combining different sources of valid evidence.
4. The criminal justice system does not allow a case to go to court unless there is sufficient, reliable evidence to support a conviction.

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SELF-TEST QUESTIONS

- Describe the various sources of evidence available in a police investigation.
- How well do eyewitnesses recall information?
- Describe the cognitive interview and say how it has been enhanced.
- The UK police use a special kind of interview. What is it called and what techniques does it contain?
- What is weapon focus?
- Do we recall different parts of a human face in different ways? If so, how?
- What cues do we use to recognise a person? Which of these is most effective?
- How is familiar and unfamiliar face recognition different to each other and how does this issue relate to eyewitnesses?
- Describe the different types of identification procedures.
- What are potential problems with constructing line-ups and how can they be overcome?
- What is a facial composite?
- How effective are traditional composite systems and are they effective as a method of identification?
- Various developments have improved the effectiveness of traditional composites. What are these?
- Is eyewitness evidence reliable? If not, why?
- How does the criminal justice system protect innocent suspects?

ESSAY QUESTIONS

(This section can also be used by teachers/instructors to lead class discussions on eyewitness research and forensic issues.)

- What are the different sources of evidence collected in a criminal investigation?
- What kinds of errors do eyewitnesses make with face recognition?
- What are the three main methods used to construct a facial composite?
- How useful are facial composites?
- How reliable is eyewitness evidence?
- What normally happens to information in our memory over time, and does this occur in real crimes?
- Why might it be possible to accurately describe details of a crime but not details of a person's face?
- Which techniques are used in the cognitive interview with eyewitnesses for obtaining a description of an offender's face? Which are not used?
- Do eyewitnesses need to have good face recall to use a **holistic composite system** such as EvoFIT?
- What are the main reasons for miscarriages of justice?

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ANSWERS

Figure 12.10 was constructed from memory of former UK Prime Minister Boris Johnson. The images in Figure 12.11 are based on an EvoFIT composite constructed from memory of media mogul Simon Cowell.