

3.3 Schema theory

Learning outcomes

- Evaluate schema theory with reference to research studies.

Schema theory is also extensively discussed in section 3.4 (pages 73–77) where the reliability of memory is addressed. It is further discussed in Chapter 5, where stereotype formation and the effects of stereotypes on behaviour are covered (pages 113–118).

Knowledge stored in our memory is to a very great extent organized. There are many theories of knowledge organization – **schema theory** is just one of them. The main idea underlying this theory is that new encounters with the world are rarely, if ever, completely new. Rather, the way we process information at any particular moment, or the way we act in specific settings, is determined to a very significant extent by relevant previous knowledge stored in our memory and organized in the form of schemas.

A schema is a cognitive structure that provides a framework for organizing information about the world, events, people and actions. This is consistent with the views of Bartlett (1932). In his pioneering work on the effects of schemas on memory, some of which is discussed below, he viewed schemas as organizations of past experience.

Different terms are often used to refer to schemas relevant to different aspects of our world.

- **Scripts** are schemas which provide information about the sequence of events that occur in a more-or-less unchanging order in particular contexts such as going to a restaurant, visiting the dentist, or attending a class.
- **Self-schemas** organize information we have about ourselves; for example, information stored in our memory about our strengths and weaknesses and how we feel about them.
- **Social schemas** (e.g. stereotypes) represent information about groups of people; for example, Americans, Egyptians, women, accountants, etc.

Over the years, theorists in many areas of psychology have used the schema notion to explain a huge variety of phenomena. Most of the discussion in this chapter relates to the effects schemas have on memory. The discussion owes a lot to the work of Bartlett (1932) on the effects of previous knowledge on the comprehension and remembering of texts.

An outline of schema theory

The term *schema theory* is used to refer to a number of interrelated ideas, proposed over the years by several theorists to account for the influence of stored knowledge on current information-processing and behaviour. Schema theory has benefited particularly from the work of Bartlett (1932), Rumelhart (1975) and Schank and Abelson (1977). According to these theorists, schemas perform many interrelated functions:

- they organize information in memory
- they can be activated to increase information-processing efficiency
- they enable the generation of expectations about objects, events and people
- they regulate behaviour
- they are relatively stable and usually very resistant to change thus ensuring continuity in the ways we process information and the ways we act.

Schemas can also lead to distortions and mistakes when:

- settings are unfamiliar (and thus require novel approaches)
- the wrong schemas become activated.

Miner's hint
Applications of schema theory in abnormal psychology see pp. 160–161.

was carrying out research on memory, a cognitive process, during the behaviouristic era in psychology. He published his research in

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Experimental studies of the effects of schemas on memory

EMPIRICAL RESEARCH

The effect of schemas on memory (Bartlett, 1932)

Bartlett asked his English participants to read *The War of the Ghosts*, a Native American folk tale. The first part of this story is reproduced below.

One night two young men from Egulac went down to the river to hunt seals and while they were there it became foggy and calm. They heard war cries, and they thought, 'maybe this is a war party.' They escaped to the shore and hid behind a log. Now, canoes came up, and they heard the noises of paddles and saw one canoe coming up to them. There were five men in the canoe, and they said, 'What do you think? We wish to take you along. We are going up the river to make war on the people.'

One of the young men said, 'I have no arrows.'

'Arrows are in the canoe,' they said.



◀ Native American hunters in traditional canoes.

The participants' memory for this story was tested by Bartlett by using two techniques, **serial reproduction** and **repeated reproduction**. In serial reproduction, the first participant reads the original story and then reproduces it on paper. The first participant's reproduction is read by the second participant who also reproduces it for a third participant. This procedure continues until six or seven reproductions are completed by an equal number of participants. In repeated reproduction, the same participant contributes all six or seven reproductions. This takes place in a number of attempts separated by intervals of from 15 minutes to as long as several years, from reading the original story. In Bartlett's studies these two methods led to very similar findings.

Unsurprisingly, with successive reproductions the story became increasingly shorter. However, the most important findings related to the distortions the participants introduced in their recall of the story. Several of these distortions were in the direction of making the story more understandable from within the participants' experiences and cultural background. Thus, activities which were culturally unfamiliar (e.g. hunting seals) were changed into more familiar ones (e.g. fishing). On several occasions, 'canoes' became 'boats'. The combined effect of these changes was to transform what started as a very strange tale into a conventional English story.

EXERCISES

- 1 Why do you think Bartlett used an unfamiliar story in his study?
- 2 Is it not strange that Bartlett published this study in 1932 during the behaviouristic era?

According to Bartlett, the way the participants recalled the story came under the influence of relevant schematic knowledge in their memory. Such knowledge consisted of schemas acquired in, and reflecting, the participants' own culture. Bartlett used the term **rationalization** to refer to the process of making the story conform to the cultural expectations of the participants.

The picture of memory emerging from Bartlett's work is that of an active reconstructive process, rather than a passive reproductive one. Bartlett's views on schemas and his portrayal of memory as a reconstructive process have exerted a very significant influence in modern psychology. His work has, however, been criticized on methodological grounds. Bartlett did not explicitly ask his participants to be as accurate as possible in their recollection of the story, nor did he use standardized instructions or care much about the exact environments in which he was carrying out his studies.

In their replication of Bartlett's study, Gauld and Stephenson (1967) did emphasize the importance of accurate recall in a better-controlled experiment. Around half of the errors expected (on the basis of Bartlett's findings) were eliminated, but many errors of the types Bartlett had detected remained. Although Bartlett's procedures were not as strict as one would expect in more recent times, confirmation for his major findings has come from several well-controlled studies (Eysenck and Keane, 2010).

Bartlett (1932) argued that schematic influences were exerted mostly during retrieval. Research by Bransford and Johnson (1972) attempted to identify more precisely the processing stage or stages at which schemas are likely to exert their influence. Bransford and Johnson's study involved participants hearing quite a long speech (partially reproduced below) under three different experimental conditions:

The procedure is actually quite simple. First, you arrange things into different groups. Of course, one pile may be sufficient depending on how much there is to do. If you have to go somewhere else due to lack of facilities, that is the next step; otherwise you are pretty well set. It is important not to overdo things ...

The three experimental conditions were:

- the 'no title' condition, in which participants heard only the paragraph
- the 'title before' condition, in which participants heard the same paragraph after being told, 'The paragraph you will hear will be about washing clothes'
- the 'title after' condition, in which participants were told that the paragraph had been about washing clothes after they had listened to it.

After hearing the paragraph, participants indicated how easy they found it to understand and tried to recall as much from it as they could.

Participants in the 'no title' and 'title after' conditions found the paragraph much more difficult to comprehend than participants in the 'title before' condition. Of the 18 ideas the paragraph contained, participants recalled an average of 2.8 ideas in the 'no title' condition, 5.8 ideas in the 'title before' condition and 2.6 ideas in the 'title after' condition.

How can this pattern of findings be explained? The what-the-paragraph-is-about information given in the 'title before' condition seems to have activated schematic knowledge about what is involved in washing clothes. This information helped disambiguate the paragraph. When hearing the sentence "The procedure is actually quite

Memory is an active reconstructive process rather than a passive reproductive one.



Bransford +
Johnson →
(1972)

Results

simple', for example, participants knew that the procedure in question was washing clothes. Words like *items* were encoded in this context as *items of clothing*. Perceiving the passage within the context defined by the relevant schemas improved understanding.

In the 'title after' condition, the information came too late to provide the necessary context. By the time participants heard the title, there was simply not much to comprehend as the relevant material had already been forgotten.

The final study in this section does not address memory in any direct way but it clearly demonstrates a basic property of schemas: that they simplify information-processing and function, to use Macrae et al.'s expression, as *energy-saving devices*.

Macrae et al. (1994) asked participants to carry out two tasks at the same time. In the first task, participants had to form impressions of a number of target persons described by their name and 10 personality characteristics. While carrying out this task, they were also participating in a comprehension test for which there were two conditions: half of the participants were told the jobs of the target persons, half were not.

It was assumed that, when forming their impressions, those who had been informed of the targets' jobs would be able to use their stereotypical knowledge of the professions to simplify the processing demands of the impression-formation task. Participants who relied on the job stereotypes did perform better at both tasks. Thus, for example, knowing that Nigel is a doctor makes the task of processing personality characteristics like caring, reliable, intelligent or hard-working, easier.



To access Additional information 3.1 on an experiment by Bower et al. (1979) on scripts, please visit www.pearsonbacconline.com and follow the on-screen instructions.

3.4 Reliability of memory

Learning outcomes

- Discuss, with reference to relevant research studies, the extent to which one cognitive process is reliable.

Several of the studies discussed in this section are relevant to schema theory.

Studies of eyewitness memory

The criminal justice system relies heavily on eyewitness testimony. Judges, jurors and the police tend to often treat eyewitness testimony as very reliable. And yet, as evidence from various sources shows, eyewitness memory can be disturbingly inaccurate. An organization was founded in the USA in the 1990s (The Innocence Project), which provided assistance to wrongly convicted persons to overturn their convictions on the basis of DNA evidence. By the end of 2008, this organization helped 220 individuals prove their innocence. What is of importance in the present context is that the guilt of over 75% of these people had been established through mistaken eyewitness identification.

Much of the psychological research on eyewitness testimony has been based on Bartlett's account of memory as a reconstructive process. The idea that eyewitnesses do not reproduce what they witness but, rather, reconstruct their memories on the basis of relevant schematic information has provided the basis of much of the pioneering work on eyewitness testimony by Loftus and her colleagues (Loftus, 1979). What follows is a description of one of their more characteristic experiments.



Eyewitness testimony can be highly unreliable

EMPIRICAL RESEARCH

Schemas and eyewitness testimony (Loftus and Palmer, 1974)

Participants in this study watched seven film clips of different car accidents. After each clip, participants described what they saw and answered a number of questions about it. One of the questions, the **critical question**, asked about the speed of the cars in the accident. The experiment involved five experimental conditions which were defined by the verb used to ask the question about the cars' speed. The critical question in one of the conditions was: About how fast were the cars going when they hit each other? For the other conditions the verb *hit* was replaced with *contacted*, *collided*, *bumped* and *smashed into*. Loftus and Palmer found that the speed estimates were influenced by the wording used. The average estimates in each of the five conditions are reported below:

- contacted – 31.8 mph
- hit – 34 mph
- bumped – 38.1 mph
- collided – 39.3 mph
- smashed into – 40.8 mph.

Loftus and Palmer's findings can be explained by Bartlett's view of memory as an active reconstructive process. It can be argued that the verbs used in the various conditions activated slightly different schemas which influenced the speed estimates. Typical schemas of cars smashing into one another contain, in all likelihood, the assumption that the cars are moving faster than cars just hitting each other.

In Loftus and Palmer's study, information was received after witnessing the accident. The information took the form of a **leading question**. This is a question that contains hints about what the right answer to it may be. The accident seems to have been reconstructed in the participants' minds in ways reflecting schematic influences, a finding easily accountable by Bartlett's views on how reconstructive memory works.

Further support for this explanation comes from Loftus and Palmer's findings in a second, similar, experiment. Once more, after participants were presented with a one-minute film depicting a multiple car accident, they were asked questions about it, including a critical question about the speeds of the cars involved. Three conditions were used: two groups were asked questions about the speed by using either *smashed* or *hit*. Participants in the third group, the control group, were asked no questions about the speed of the cars. One week later, all participants were asked: Did you see any broken glass? There was no broken glass in the film. Still, 32% of those who had been asked about the cars' speed with the verb *smash* claimed they had seen broken glass compared to only 14% of the participants in the *hit* group. The schema activated by the verb *smashed* must have aroused a stronger expectation of broken glass than that activated by the verb *hit*. Of those in the control group, 12% claimed to have seen broken glass.

EXERCISES

- 3 Identify the independent and dependent variables in the two studies.
- 4 Comment on the ecological validity of these studies.

Another important aspect of Loftus's research on eye witness testimony is the demonstration of the **weapons effect**. In a study by Loftus et al. (1987), participants heard a discussion going in the room next to the one they were in. There were two conditions:

- no-weapons condition – a man with greasy hands emerged from the next room holding a pen
- weapons condition – a man came out of the next room holding a paperknife covered in blood.

All participants were later asked to identify the man from a selection of 50 photographs. Participants in the no-weapons condition were more accurate. Loftus et al. explained this finding in terms of the different ways in which participants in the two conditions allocated their attention. The weapon drew more attention to itself than the pen, so less attention was paid to the man's face. This explanation was supported by an analysis of the participants' eye movements. Of course, weapons may also exert their influence by raising the eyewitness's anxiety level. It is to the effects of anxiety on the reliability of eyewitness testimony that we now turn.

Deffenbacher et al. (2004) conducted meta-analyses of studies investigating the role of emotion on eyewitness testimony. They found that anxiety and stress reduces the reliable recall of crime details including information about the behaviour of the main characters.

There have been studies, however, where anxiety and stress seem to improve eyewitness accuracy. Deffenbacher et al. deal with such exceptions by suggesting that increases of anxiety up to a certain level increase accuracy but further increases may produce the opposite effect.

Evaluation of research on eyewitness memory

Many of the studies discussed above were laboratory experiments. This raises questions about their ecological validity. Eysenck and Keane (2010), for example, discuss the following differences between eyewitness reports obtained in laboratory studies and those provided by eyewitnesses in real-life situations.

- The reports of real accidents or crimes, unlike those in experimental studies, are very often provided by the victims themselves.
- Watching a video of an accident or crime is far less stressful than observing one in real life.
- Cases of mistaken eyewitness identification in real life (e.g. a court case) have real and often serious consequences.
- Most of the memory distortions demonstrated seem to involve peripheral or minor details (e.g. the presence of broken glass) rather than central aspects of the scene (e.g. features of a criminal).

Although the differences between experimental demonstrations and real-life cases of eye witness testimony are real, they should not be overstated. An experiment relevant to this issue is reported below.

Ihlebaek et al. (2003) staged a robbery involving two robbers armed with handguns. There were two conditions: a live condition in which participants were involved in the staged robbery, and a video condition in which participants viewed a video of the robbery in the live condition. It was found that memory for the robbery tended to be better in the video condition. As Eysenck and Keane (2010) note, such findings suggest that the distortions in eyewitness memory obtained under laboratory conditions may underestimate the unreliability of real-life eyewitness testimony.

There is little doubt that eyewitness testimony can be unreliable. In fact, even when participants are warned about the presence of misleading information they are still vulnerable to it (Eakin et al., 2003). But there are also studies which show that eyewitness testimony can be reliable.

In an archival study of eyewitness memory of the sinking of the *Titanic*, Riniolo et al. (2003) found that, in general, survivors recalled the events accurately. Yuille and Cutshall (1986) followed up 13 witnesses to an armed robbery in Canada. These eyewitnesses were interviewed around five months after the crime. Their recollections of the crime were

W To learn more about Loftus and her work, go to www.pearsonhotlinks.com, enter the title or ISBN of this book and select weblink 3.1.

I Meta-analysis is a statistical procedure, often used in psychology, which combines the results of several studies addressing the same hypothesis. The outcome is an average measure of the effects obtained in the individual studies. Usually it is a weighted average: the better studies (e.g. those with the bigger sample sizes) are allowed to influence the outcome to a greater extent.

I Although the most confident and consistent eyewitnesses are the most persuasive, all eyewitnesses (whether right or wrong) express more or less the same level of confidence in their reports (Bothwell et al., 1987). Moreover, confidence does not predict the accuracy of eyewitness testimony (Colby and Weaver, 2006).

compared with the initial detailed reports they had given to the police. Despite the fact that the interviews intentionally included misleading questions, the recollections of the eyewitnesses very closely matched the original reports.

Conclusions: To what extent is memory reliable?

The discussion in the last two sections is based on the premise that memory is an active reconstructive process. Our memory system is not a passive container of information. To a very great extent, every time we use it, stored information is altered. We live in a world which bombards us with far more information than we can handle and, moreover, imperfect information that is full of ambiguities. We are forced to simplify it by relying on our prior knowledge which, at least according to the theoretical views expressed in this section, is organized in the form of schemas.

Experiments like the one by Bransford and Johnson (1972) establish schemas as great facilitators in the comprehension and memorization of information. Macrae et al. (1994) demonstrated how schemas (in this case, stereotypes) assist ongoing information processing by simplifying it and thus enabling more effortless and efficient processing. Thus, reconstruction does not necessarily, perhaps not even typically, mean distortion. Life is full of repetitive patterns and by capturing essential regularities, schemas help us predict future occurrences and fill up gaps.

Of course, schematic processing can lead to error and distortion. Mere forgetting, which of course can lead to extremely unreliable reports, is not the focus of this discussion. Rather, we concentrated on the effects on memory reliability of schematic processing mostly in the area of eyewitness testimony where it has been most systematically investigated.

Several studies point to the unreliability of eyewitness testimony, including Loftus and Palmer's (1974) laboratory experiment and Ihlebaek et al.'s (2003) study involving a more realistic setting. Yuille and Cutshall's (1986) findings, on the other hand, showed that eyewitness testimony in real-life settings can be very accurate. Research addressing specific factors or processes can no doubt help us predict the circumstances in which eyewitness testimony will be reliable or unreliable. Representative of such streams of research were the studies by Loftus et al. (1987) on how attention may underlie the weapons effect. Similarly, research on the role of stress and emotion on eyewitness testimony provides additional information about the settings in which eyewitness testimony may be expected to be unreliable.

What ethical issues are raised by the research studies on eyewitness testimony discussed in this section?



The reconstructive nature of memory does not necessarily make it unreliable.



Some concluding comments on schema theory

Schemas help us organize and process information efficiently. This, along with the fact that schemas are usually activated automatically and effortlessly, makes them energy-saving devices. Just imagine having to perceive and remember all the details of each new object, person or event we encounter, or having to plan the actions we regularly carry out from scratch. In a sense, schemas function as our theories about how the world is and how best we can act upon it. They enable us to approach the world with expectations that determine how we attend to, interpret, perceive, store and retrieve information. They also direct to a very great extent our actions. Finally, they are relatively stable and usually very resistant to change, thus ensuring continuity in the ways we process information and act.

In situations where new encounters require a genuinely novel approach, when schema-based expectations conflict with reality, or simply the wrong schemas become activated, errors and distortions in the way we perceive, remember and think can be all but inevitable.

EXERCISE

- 5 Think of examples where schemas conflict with reality, or situations where the wrong schemas become activated. How do such occurrences affect information processing?

By identifying and exploring the functions performed by schemas, and by elucidating both their positive and negative effects on information processing and behaviour, schema theory has made a most important contribution to several areas in psychology. References to schemas are made throughout this book. For example, in Chapter 4 we discuss how social schemas like stereotypes lie at the heart of our perceptions and misperceptions of entire groups of people. Moreover, schema theory is one of the major contributors to attempts to explain stereotype formation and the effects stereotypes have on behaviour. In conclusion, most of the studies discussed in this chapter, along with those in Chapter 4, provide an impressive base of empirical support for schema theory.

As Eysenck (2009) remarks, 'Schema theories have proved generally successful. Of particular importance, they have identified some of the main reasons why our memories are sometimes distorted.' However, many researchers have complained that schema-based theories tend to be vague in that they do not specify the precise nature of schemas. Schema theory is a cognitive theory relying on the notion of the schema. Schemas are not, of course, directly observable. Like any other cognitive structure they are inferred from behavioural evidence. Identifying and exploring the properties of such inferred cognitive structures, even with the tools provided by the computer metaphor and sophisticated experimental techniques, was never meant to be easy.

As discussed earlier (page 68), psychologists are trying to arrive at the best possible explanation of the findings obtained in their empirical studies. The schema notion has served them well in that it offers plausible explanations for the structuring, and often distorting, effects previous knowledge can have on the ways perception, memory, and other cognitive processes work. Whereas general theoretical claims about such effects are unlikely to be revised significantly in the coming years, more specific claims about the internal structure of schemas and the precise manner in which schemas operate are bound to show considerable development.



Research on the unreliability of eyewitness testimony poses serious questions about the possibility of reaching certainty when making knowledge claims about directly perceived events

● Examiner's hint

Do not finalize your notes on schemas before you study stereotype formation and activation in Chapter 4. This will lead to a richer understanding of schema theory and its applications.