Chapter 6: Memory Traces and Memory Schemas

Overview

The study of memory processes is an incredibly important area in cognition and is worth spending a great deal of time on. The concept of a **schema**, introduced in previous chapters, is relevant to many aspects of memory performance.

Chapter 6 begins with a discussion of a type of memory that seems most clear and distinctive: **flashbulb memories**. It comes as a surprise that high confidence for flashbulb memories does not necessarily indicate high accuracy. Students tend to be quietly disbelieving when it is suggested that their flashbulb memories might be inaccurate. It is interesting to point out that it's not the case that people have high-confidence memories for all aspects of a flashbulb event. Flashbulb memories are very likely to include information about where the person was, what they were doing, who gave them the news, and so on. These are the types of things that would typically be included in the story if you were telling someone else about your experience. Those post-event discussions, then, are very relevant to the flashbulb memory: they help to preserve it *and* they may introduce inaccuracies.

Another way that inaccuracies can be introduced to memory is demonstrated by Bartlett's "The War of the Ghosts" experiment. Schemas brought by participants to any task (story comprehension, in this case) affects how memory is constructed.

Students find the topics of eyewitness memory and false memory fascinating. They tend to be very interested in real-world examples. One way to tie together issues of eyewitness testimony, false memory, accuracy, and confidence (among other things) is to discuss the work of Gary Wells at Iowa State University. Let's say a crime occurs and there is an eyewitness. The police will attempt to track down the guilty party. In consultation with the eyewitness and based on other things they know, the police may find someone who seems to be a likely suspect. The eyewitness may be shown a photo line-up. One of the photos is of the suspect and the rest are people who aren't suspected. Of course, if the eyewitness chooses the picture of the suspect, that selection is treated as evidence that the suspect is guilty. Keep in mind, though, that eyewitnesses are fallible; they may be able to provide a good description of the person and they *might* even be able to identify him, but their memory is not concrete, and they can make mistakes. It is entirely possible for the police to make comments that sway the eyewitness' confidence. For example, the eyewitness may pick up a picture of someone other than the suspect and say something like "Hmm, this looks kind of like him. . ." The police may say "Well, be sure you look at all the pictures." The eyewitness might instead pick up a picture of the suspect and say "This could maybe be the one, I don't know. . ." The police may show great interest and say something like "Tell me more about that picture." The eyewitness, initially unsure about their choice, may become much more confident based on the reaction of the police. Their confidence may be high even though their accuracy is questionable. The police probably aren't intentionally influencing the eyewitness's confidence, but their reaction can greatly affect it. Think about the implications for courtroom testimony. Who is more convincing, an eyewitness who, with certainty, points to the suspect as the perpetrator, or one who appears unsure? A confi-

dent eyewitness, though, is not necessarily an accurate eyewitness. Malleability in memory can have life-or-death consequences for the suspect.

Because so much of memory research takes place in a laboratory, often with single words as stimuli, it is important to stress the connection to "real-world" memory processing. The impact of **encoding specificity** is something that makes a great deal of intuitive sense; it is not hard to think of examples in everyday life. You might see an old friend and find that lots of memories related to her immediately come to mind. Such memories don't often spontaneously come to mind when you are in class or when you are making dinner; they come to you when you see that person. The old friend's appearance acts as a cue for recall in the same way that the word "bird" may call to mind "feathers" if those words were encoded together.

A topic that can be added on to **mood-dependent recall** is state-dependent recall: memory performance is better if your physical state at encoding matches your physical state at retrieval. Numerous studies have been done looking at the influence of different types of substances (alcohol, caffeine, nicotine, marijuana). In each case, memory performance is better when state at retrieval matches state at encoding.

In studying **autobiographical memory**, a researcher doesn't have any control over random events from a person's history and it is difficult, if not impossible, to know for sure what happened in the life of that person. Therefore, a discussion of autobiographical memory can bring up numerous challenges in testing. One way to test this type of memory is to ask people who know the participant and to look at records that have been kept. If, for example, a participant recalls a memory of being in the hospital when he was six years old, it is possible to assess the accuracy of that by asking parents and checking medical records. Diaries can also be used to keep records of daily activities that can be checked later on. Autobiographical memories show a different pattern of forgetting than other types of memory. Forgetting tends to be slower and more gradual. The accuracy of peoples' autobiographical memory for events that happened a long time ago is generally quite good (for the events that they do remember), but peoples' autobiographical memories are very selective—we don't tend to remember anything at all for most ordinary, mundane events.

It is interesting to consider possible explanations for **childhood amnesia**. Very young children have quite impressive memory abilities. Why don't those early memories survive to adulthood? Freud argued that childhood is filled with many painful experiences and that, as a defence mechanism, we repress those memories. There is not a great deal of support for the existence of repression as Freud described it, let alone repression on the scale of childhood amnesia (the effective deletion of years of memories). Changing language abilities may be involved. As adults, we tend to frame our memories in terms of language (almost like verbal stories), but before the age of three or so, children don't have strong language abilities so it may be that memories from before we had language don't translate to a form that can be accessed in adulthood. It is also the case that young children don't have a very well-developed sense of self. Autobiographical memories are events that happened to "me"; how can things happen to "me" if there is not yet a sense of who "me" is? Almost certainly, childhood amnesia has much to do with a lack of brain development. A three-year-old brain isn't fully developed and some of the brain areas that are important for memory (the hippocampus, for example) are among the last to fully develop. As adults, then, we are working with a different brain than when we were very young so memories might not be transferred for that reason. All of this, by the way, relates to encoding specificity (recall is better when the conditions at retrieval match the conditions at encoding); when you were encoding things at two years old, not only were your surroundings and the situations in which you found yourself completely different from now, but your cognitive functioning was radically different.

The impact of various **levels of processing** is a seminal finding in memory research and makes a great deal of intuitive sense: the more meaning you assign the objects, the more memorable they

are. It is useful, though, to address the circularity in this argument: deeper processing leads to better memory; better memory results from deeper processing. It is important to explore the definition of "deep processing." Deep processing is more distinctive. For example, if a word is processed in the context of the question "Does the word contain the letter 'T'?" there is very little distinctiveness (many words contain "Ts" and many do not). If a word is processed in the context of the deeper question "Does the word mean the same as humble?" there is reason to think about the word's meaning. The word's meaning is quite distinct from most other words. Deeper processing better emphasizes **distinctiveness**. Additionally, deep processing is more **elaborate**. When items are processed deeply, there are more ideas and concepts attached to them. For example, asking about a certain letter does not elaborate on the target word; if the question involves word meaning, then elaboration is necessary.

Learning Objectives

In this chapter students will:

- Distinguish between memory traces and memory schemas.
- Outline the concept of flashbulb memories.
- Examine schema theory and review experimental evidence supporting it.
- Understand the concept of encoding specificity.
- Review research into eyewitness testimony and false memories.
- Identify the strengths and weaknesses of the "levels of processing" framework.

Key Concepts with Illustrative Examples

autobiographical memories (see page 183)

Autobiographical memories are a somewhat special form of episodic memory; they are memories about yourself from a particular time in your life. Try Galton's technique of using objects in the immediate environment to cue autobiographical memories: random objects like a kite or a maple leaf or a Labrador retriever might lead to rich, detailed memories of your past.

childhood amnesia (see page 183)

Childhood amnesia refers to the fact that individuals typically do not remember events that took place before the age of five or so. Prior to that age, the frequency of reported memories is close to zero. Nothing can induce you to remember anything from your own birth or even from your second birthday party.

flashbulb memory (see page 166)

Flashbulb memories (for major events) tend to be extremely vivid. They tend to inspire high confidence. "Extremely vivid" and "high confidence" are likely to describe your memory for 11 September 2001. Interestingly, though, vividness and confidence are not always highly correlated with accuracy.

forgetting curve (see page 190)

First plotted by Ebbinghaus, the forgetting curve depicts information retained over time. A great deal of information is lost soon after original learning, followed by a plateau of very little loss. This curve has been replicated many times over.

memory bump (see page 184)

It is the case that in terms of the frequencies of autobiographical memories over the entire lifespan, there are some time periods that are more highly represented than others. The memory bump refers to an increase in the number of memories for events that took place between 10 and 30 years of age. It is probably no coincidence that many major life events (graduations, first jobs, weddings, parenthood) tend to happen during that time period.

misinformation effect (see page 177)

A misleading post-event suggestion can sometimes be incorporated into memory for the original event. Another paradigm by Loftus is illustrative: participants shown a car accident that takes place at a stop sign may later be asked a question that refers to the presence of a yield sign. When tested on their memory for details of the accident, participants may be likely to mistakenly report seeing a yield sign.

principle of encoding specificity (see page 179)

Recall tends to be better if the retrieval context matches the encoding context. "Context" is a very broad term—it includes any cue that may influence processing. The "butcher-on-the-bus" is referred to in the text as part of the discussion on feeling of knowing; another aspect of this phenomenon relates to encoding specificity. You might have seen your butcher many times, but perhaps *only* in the grocery store (behind the counter, wearing a white apron, weighing meat). You will, of course, recognize him immediately in the grocery store but, if you see him on the bus, the context is so different that you might not recognize him (at least not right away).

permastore (see page 192)

Permastore refers to memories that are impossible to lose; memories that, after a certain point, are impervious to decay. Procedural memories often fit in this category (e.g., being able to ride a bike, being able to tie your shoes). Memories that have been greatly consolidated such as the names and faces of close family and friends are also part of a permastore.

scripts (see page 181)

A script is a preconceived idea for how events tend to progress. A script for going camping, for example, might include hiking to a campsite, pitching a tent, and cooking over a campfire. The existence of scripts helps people make sense of, predict, and, later, remember events better.

Discussion and Debate Ideas

1. Flashbulb memories inspire high levels of confidence but can be surprisingly inaccurate. Lead the class in a discussion about how inaccuracies might be introduced to flashbulb memories. Have students consider their own memories of 11 September 2001 (note that this example will not work very well in students born after 1996 or so). Point out that this is an experience that they are likely to have discussed with others over the years since the event. Those discussions may contribute inaccurate details and cause the memory to morph over time. Have students consider which details they remember and which they do not. The remembered details (accurate or not) tend to be the ones that are likely to be included in post-event discussions. For example, most people remember where they were when they heard the news; not many remember what they were wearing.

2. We have a tendency to think of lab-based paradigms as somehow separate from the real world, and, indeed, it is a fair criticism of the field that sometimes they are. Have the class take stock of real world examples of lab experiments. For example, where can you find misinformation effects in everyday life? Forgetting curves? Levels of processing?

3. Have the class discuss the circularity of the levels of processing approach. What is "deep" processing? If someone asked, "What kind of processing results in better recall?" the answer is "deep processing." And if someone asked, "What is deep processing?" the answer is "It is the kind that leads to better recall." Lockhart and Craik (1990) elaborated on the concept of "deep processing" with the notions of elaboration and distinctiveness. Do those concepts solve the circularity?

4. *60 Minutes* presents the story of Jennifer Thompson and Ronald Cotton. The episode is available online at http://www.cbsnews.com/video/watch/?id=5153451n. This story is a good lesson in how eyewitnesses are not all they're cracked up to be. This is also an opportunity to discuss the relationship between confidence and accuracy. Have students consider the ways that police officers can affect eyewitness confidence. What rules should be in place when eyewitnesses are interviewed?

5. Have students think about their earliest memory. How old were they when this first remembered event took place? Have them consider this question: do they actually remember the event or do they just remember hearing about it or seeing photos of it? It is very difficult to know whether you have a true memory or not.

6. Researchers have found that memory for big events from early childhood (e.g., the birth of a sibling, a move to a new house) tend to be a bit better than memory for ordinary events. Perhaps big events are inherently more memorable. But what is another explanation? Perhaps people on-

ly *think* that they remember big events. They are particularly likely to be discussed and they are particularly likely to be commemorated in photographs. Have students discuss different explanations for why we might remember big events better than ordinary events.

7. Discuss the effects of caffeine on studying and test-taking in terms of context-dependent learning and the encoding specificity principle.

8. Have students apply the readings from this chapter to their own studying. Some items for discussion would be elaboration, distinctiveness, context-dependent learning, and levels of processing.

9. Have students write down their most prevalent memories across their life. Is there an indication that they will show a reminiscence bump as they get older? Which theory of the reminiscence bump is best supported by their memories?

Further Reading, Media Suggestions, and Teaching Aids

1. **Brewer, W.F., and Treyens, J.C. 1981. Role of schemata in memory for places. *Cognitive Psychology,* 13, 207–230.**

   This paper describes an experiment in which participants were shown what they were told was a graduate student's office. When later asked to report which objects were in the office, almost all participants correctly reported seeing a desk, roughly one third recalled seeing books even though there were none, and very few reported seeing a wine bottle that *was* there. Showing the photo to the participants and testing their later memory for it is a good demonstration of how memory is guided by schemas—the schema for an office includes books and does not include wine bottles.

2. **Nature of Things. 2008. *The brain that changes itself.* Canadian Broadcasting Corporation. http://www.cbc.ca/documentaries/natureofthings/2008/brainchangesitself/**

   Based on the best-selling book, this video examines the fascinating topic of brain plasticity.

3. **The Eyewitness Test:**
   http://www.psychology.iastate.edu/~glwells/theeyewitnesstest.html

   This website (from Gary Wells at Iowa State University) includes a short video of a "crime" (a dramatization of a person putting a bomb on the roof of a building). After watching the crime video, students can view a line-up of possible perpetrators and guess which one is the culprit. In fact, the culprit is not in the line-up at all but most students are willing to take a guess. As it turns out, we are not very good at recognizing when the correct answer is not among the options; we are all too willing to guess. Of course, in real-life, when police bring in a witness to look at a line-up, they have a suspect in the line-up but the suspect isn't necessarily the culprit. Eyewitnesses tend to guess and this can have critical consequences (as illustrated by the Case Study at the beginning of the chapter).

4. **Memory for Lists of Words: Roediger & McDermott (1995).**
   http://www.gocognitive.net/demos?f[0]=field_tags%3A847&f[1]=field_tags%3A1144

   This site offers a demonstration of the Roediger & McDermott task to show students how easily a false memory can be created.

5. **Ted Talk: Elizabeth Loftus; How reliable is your memory?**
   https://www.ted.com/talks/elizabeth_loftus_the_fiction_of_memory?language=en

   Memory expert Elizabeth Loftus discusses her research in the area of false memories and the misinformation effect.

6. **Hirst, W., et al. 2015. A ten-year follow-up of a study of memory for the attack of September 11, 2001: Flashbulb memories and memories for flashbulb events. *Journal of Experimental Psychology: General*, 144(3), 604-623.**

   This study details the longest study to date on the accuracy of flashbulb memories. Detailed accounts of the memory were recorded at 1 week, 11 months, 25 months, and 119 months. Results indicate that flashbulb memories are inconsistent over time and more likely reflect information obtained from media than personal recollections.

Homework or Study Questions

1. **Outline some evidence for low levels of accuracy for flashbulb memories.**

   McCloskey, Wible, and Cohen (1988) tested memory for the Challenger explosion. Comparisons were made between immediate reports and reports nine months later. In general, reports from nine months later included fewer details and, in some cases, inconsistencies (e.g., different locations reported differently when they heard the news).

   Talarico and Rubin (2003) compared participants' memory for their experience of the events of 11 September 2001 with the memory for an ordinary event that took place around the same time. Later reports of vividness and confidence were much higher for the flashbulb event but accuracy was not.

2. **Consider the "story" schema that Bartlett's participants brought to their understanding of "The War of the Ghosts." Summarize how their memory for that story involves the four processes described on pages 174-175.**

   It is likely that participants *selected* some aspects of the story to focus on in particular. The selection may be guided by what the participant found most interesting or most relevant to them. Participants are unlikely to have read every word carefully; based on their selection, they probably put together some *abstraction* of the text, a "gist" of the story. As well, participants are not a blank slate, story-wise. They have experience-based ideas about how stories tend to go and that background information is used to *interpret* this particular story. Past experience with stories is also likely to be *integrated* to some extent into their memory for "The War of the Ghosts."

3. **Mood-dependent recall can be thought of as the demonstration of a principle described in Chapter 6. What principle is that and how is mood-dependent recall a demonstration?**

According to the principle of encoding specificity, recall tends to be better if the retrieval context matches encoding context. Therefore, memory for material is better when *mood* at the time of encoding matches mood at the time of retrieval (mood-dependent recall).

4. **According to Craik and Lockhart (1972), what are the levels at which we might process information? What types of information do we process at each level?**

Shallow processing: physical characteristics of the word such as all capital letters or lower case letters.
Intermediate processing: the sound of the words e.g., rhyming words
Deeper processing: semantic meaning of the words

5. **How do depressed individuals differ in memory performance from non-depressed individuals?**

In many cases, depressed individuals perform more poorly on tests of recall. Perhaps because of a lack of motivation, they may be less likely to spontaneously use effective strategies for remembering and they may be less likely to focus attention on the items to be remembered.
In another way, depressed individuals are less likely to forget. Dysphoric individuals have been found to be less likely to suppress items after being told to do so. This may be because of a tendency to ruminate. It may also be due to a lack of attentional control.

6. **What are some explanations for the memory bump in the frequency of autobiographical memories between the ages of 10 and 30?**

One contributing factor may be the fact that most people make a majority of their important life choices during the bump years (getting married, choosing a career, etc.) These choices (and the events surrounding them) are likely to be reminisced about and, by extension, remembered better. A "life script" is a narrative schema that guides autobiographical memories. People are likely to more easily recall events that conform to their life script and that script tends to focus on positive events—for example, falling in love or getting a first job (things that are likely to happen in late adolescence or early adulthood). As well, events that are more distinctive tend to be more memorable and the 10 to 30 age range is one that is likely to include a lot of distinctiveness (first-time experiences, for example).

7. **What is the connection between Jost's law of forgetting, Ribot's law of retrograde amnesia, and the law of progressions and pathologies? What key concept explains these laws?**

All of these support the idea that our most recent memories are more fragile and more likely to decay than our older memories. This was found in Jost's law, as well as in persons with retrograde amnesia (who tend to recover older memories before recovering recent memories). All of these may be explained through the concept of consolidation where, over time, memories become more resistant to interference from more recently acquired information.

8. **According to Bahrick, what is the key determinant of how much course information students will remember over time? Why?**

   Bahrick found that retention of learned knowledge increased with the number of courses the student took that were related to the topic. He found this for students of Spanish, math, and geometry. Bahrick's theory is that with repeated exposure, the material was transferred to permastore.

Suggestions for Research Paper Topics

1. Find a case study of someone with incredible memory abilities. How do this person's mental processes differ from those of most people? Is it possible to train someone to have superior memory abilities?

2. What don't we know about flashbulb memories? Design an experiment on flashbulb memory that would be ready to go when the next flashbulb event occurs.

3. We know it is possible to implant a false memory (create a memory for an event that *didn't* happen). What is the support for "recovered" memories ("discovering" a memory much later on for something that *did* happen)?

4. Is there any evidence for cohort effects in timing and/or length of the autobiographical memory bump (perhaps because of societal changes)? What about gender differences? Cultural differences?

5. There can be a very strong connection between odours and autobiographical memories (the Proust effect). The smell of cookies baking, for example, may instantly bring to mind a memory of helping your grandmother in the kitchen on a snowy day. With reference to the relevant literature, explain the connection. Is there any evidence for an explanatory connection between the olfactory bulb and the hippocampus?

6. One of the cognitive deficits often seen in persons with schizophrenia is the inability to place events and actions in temporal order. This is a key skill required to properly sequence events in a script. Review the literature on this topic and offer explanations as to what might underlie this deficit.

7. Imagine you are a lawyer defending a client who may be convicted solely on the testimony of an eyewitness. Based on what you have learned about the accuracy of eyewitness memory, prepare your defense to convince the jury that your client has been wrongly charged.