CHAPTER SIX

MEMORY BIAS

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LEARNING OBJECTIVES

- Learn why memory is not like a video recorder
- Discover the events you are most likely to remember
- Understand how emotions may alter your memory
- Differentiate between depth of processing and transfer appropriate processing
- Gain insights into studying more efficiently for college-level courses
- Learn how to train your memory like experts

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Chapter Six
Memory Bias

Memory Bias & The Constructive Nature of Memory

Some people erroneously think of memory like a video recorder that keeps a record of memories exactly as they happened. Whereas, most researchers believe that memory is more constructive in nature. It is believed that memory is based on your current interpretation of the events which may be changed over time by experiences, knowledge, biases, and expectations. In previous chapters, we learned that the substance of a memory depends on encoding and retrieval of the memory. Each time a memory is retrieved and consequently remembered, it is in danger of being distorted and re-encoded with a different interpretation. Research in memory suggests that memories are most likely constructed but are not perfect because of interference. Recall from Chapter 4, this interference could be retroactive (new information interferes with pre-existing knowledge) or proactive (old information interferes with new information). There are many sources of interference, which we will discuss throughout this chapter. One way to study the constructive nature of memory is by studying the biases in memory and memory distortions. The constructive nature of memory can be good for problem solving and decision-making such that the ability to retrieve and manipulate memories aids in certain methods of problem solving. However, as we will see interference can lead to memory distortions, false memories, and all around memory bias.

Let’s test your memory for word lists. Word lists are commonly used to assess memory. Read the words in Figure 6.1 out loud to yourself one at a time with about a 1-second interval in between each word. After you read these words, close the textbook. Take out a

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**Figure 6.1**
Memory test from Deese (1959) and Stadler, Roediger, & McDermott (1999).
sheet of paper and write down as many words as you can remember. What type of memory test is this? Here is a hint: How many words can you recall? After writing down the words, open the book back up to check your answers. To increase the difficulty (in case you think this is an easy task) you could read a paragraph from another one of your textbooks, do a math problem, count backward from 100 by threes or take a break from studying for a while. Breaks are fine once in a great while and may facilitate memory consolidation. We will revisit this example later in the chapter.

THE WAR OF THE GHOSTS

A classic example of the constructive nature of memory can be found in the research of Bartlett’s in which he used the “War of the Ghosts” folk tale (Bartlett, 1932; Bartlett & Burt, 1933). This story is somewhat hard to follow and it does not make a lot of sense (see Figure 6.2). Bartlett used the method of repeated reproduction to assess memory for this folk tale. Repeated reproduction is a method of assessing the quality of memory retention by having participants reproduce what they remember of the stimuli multiple times at different time periods after they initially read the story. This is similar to the repeated recall method of testing flashbulb memories. (Notice the similarity in the terms. Check your memory. What is the difference between recall and reproduction?) People tend to make errors when they try to reproduce it. Errors become more frequent after longer time spans and multiple times reproducing the story. Many people have tried to explain why errors in reasoning happen. It is most widely agreed that memory is sometimes reconstructive in nature and prone to errors due to experience, emotion, and changes in attitudes. After reading the story, do you remember what the men used to cross a river? Would your answer to the question differ if you were from a different culture?

**The War of the Ghosts**

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. Then 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 noise 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.

“I will not go along. I might be killed. My relatives do not know where I have gone. But you,” he said, turning to the other, “may go with them.”

So one of the young men went, but the other returned home.

And the warriors went on up the river to a town on the other side of Kalama. The people came down to the water and they began to fight, and many were killed. But presently the young man heard one of the warriors say, “Quick, let us go home: that Indian has been hit.” Now he thought: “Oh, they are ghosts.” He did not feel sick, but they said he had been shot.

So the canoes went back to Egulac and the young man went ashore to his house and made a fire. And he told everybody and said: “Behold I accompanied the ghosts, and we went to fight. Many of our fellows were killed, and many of those who attacked us were killed. They said I was hit, and I did not feel sick.”

He told it all, and then he became quiet. When the sun rose he fell down. Something black came out of his mouth. His face became contorted. The people jumped up and cried.

He was dead.

**FIGURE 6.2**
The War of the Ghosts folktale from Bartlett’s research (1932; Bartlett & Burt, 1933).
Repeated reproduction: a method of assessing the quality of memory retention by reproducing what is remembered of a stimuli multiple times at different time periods after the first presentation of the stimuli.

Levels of processing framework: the theory that the accuracy of memory depends on how deeply information is encoded or the level of processing involved when encoding information. According to this framework, deep processing involves attention to meaning whereas shallow processing involves little attention to meaning.

When using the repeated reproduction method there are two places that the story is coming from: from the story itself, and also from your own past experiences with similar stories from your own culture. Distortions can also be attributed to how deeply you process the information.

**LEVELS OF PROCESSING THEORY / DEPTH OF PROCESSING/ ELABORATIVE ENCODING**

How accurate and robust a memory is to distortion depends somewhat on how you encode and process the information. There are multiple levels on which information can be processed. According to the Levels of Processing Theory, memories can be processed on different levels (Craik & Lockhart, 1972). This framework suggests that deeper processing involves more cognitive processes than shallower processing. Shallow processing produces fragile memories because there is little attention to meaning and focus on physical features. Deep processing produces durables memories due to close attention to meaning of the information being processed. For example, if you are reading this textbook but only focusing on how many syllables are in each word, you are only processing the information on a shallow level. You are not likely to retain much of the information in memory and also not likely to do well on the exam. Alternatively, if you are connecting the material to your own experiences (using your autobiographical memories), then you are processing the information more deeply and more likely to remember the information when you need it later.

![Source: © TaraPatta/Shutterstock.com](image)

**VERBAL MATERIAL**

Researchers developed a series of experiments to test memory differences due to depth of processing (Craik & Tulving, 1975). A similar method was used in each study (see Figure 6.3). Participants were presented with a word and asked to respond to a question about the word. The question manipulated the induced level of processing. Later there was a surprise memory test to examine the memory of words by varying depth of processing. Experimenters manipulated depth of processing through questions such as “Is the word in capital letters?” (structural—shallow processing), “Does the word rhyme with WEIGHT?” (phonemic—less shallow processing), “Is the word a type of fish?” (deeper processing—category), and “Would that word fit the sentence”: “He met a ___ in the street?” (sentence—deepest processing; Craik & Tulving, 1975, p. 272). Correct responses to half of the questions were yes and half were no.

**Shallow processing: a** term used in the levels of processing framework to describe encoding procedures that lack attention to meaning and produce fragile memories.

**Deep processing:** a term used in the levels of processing framework to describe encoding procedures that require attention to meaning and produce durable memories.

**Depth of processing:** see Levels of Processing Framework.
Participants answering structural and phonemic questions about word lists remembered fewer words than participants answering category and sentence questions (see Figure 6.4). Superficial semantic information does not increase memory for word lists; however, deep processing of relationships and meaning of words increased recall and recognition of word lists in this research. Additionally, deeper processing requires more time than shallow processing of information. The authors conclude that memory performance depends on the degree to which you meaningfully elaborate during encoding. Elaborative encoding (as discussed in Chapter 5) is employed in techniques to increase retention and recall of memory (see the section in this chapter on Mnemonics).

![Example of a single trial](image)

**FIGURE 6.3**
Example of the procedure for Craik and Tulving’s (1975) experiment on depth of processing. Participants were given a question to answer, presented with a word, and then instructed to respond “yes” or “no” on each trial. After multiple trials participants were given a surprise memory test (either a recognition test or a recall test).

![Figure 6.4](image)

**FIGURE 6.4**
Results from one of Craik and Tulving’s (1975) experiments. Participants were able to recognize more words with deeper processing manipulation questions than with shallow processing manipulation questions.
One way to elaborately encode memory is with visual imagery. Visual imagery involves creating non-real images “in the mind’s eye.” Visual images can be associated with words and ideas to help create more robust encodings in memory. For example, Bower and Winzenz (1970) assessed depth of processing using visual imagery as one of the manipulations with recognition and recall memory tests without feedback. They used a method called paired-associate learning using word pairs. The researchers compared the ability of the participants to remember word pairs using one of four different strategies during encoding: visual imagery, sentence generation, sentence reading, or repetition of the words. In the visual imagery condition, participants were instructed to visualize the two words interacting in someway. They were instructed to make the visual image as detailed as possible. In the sentence generation condition, participants were asked to create a sentence using the pair of words. In the sentence reading condition, participants read a sentence containing the word pairs. In the repetition condition, participants repeated the word pairs aloud. Results indicated that recall and recognition were significantly greater in conditions which participants were required to elaborate on the words pairs (visual imagery and sentence generation) than when participants were reading a sentence or repeating the word pairs. This again supports the idea that elaborative encoding can increase recognition and recall memory of word pairs.

Most of the research on depth of processing so far has been testing memory of word or word pairs. However, what is more interesting to most students would be, “Does this work with remembering my textbook material?” (For more information on strategies for remembering see the section in this chapter on Mnemonic techniques). Research by Bransford and Johnson (1972) presented participants with pictures before listening to passages that described the images. Results indicated that participants that saw pictures before listening to the passage were more likely to remember than participants that did not receive a picture before the passage. These results would suggest that images of information help with remembering information. This may be why your instructor uses graphs or visual displays to aid in describing the more difficult concepts. Visual imagery and visual displays are two methods of assisting with elaborative encoding of information.

Some of you may wonder why in most of your classes you have exams and especially why some of your classes have cumulative final
exams. The **testing effect** helps to explain why these exams are important, not only for you to pass the class, but also to help you remember the material long after the class is done. As was mentioned in the beginning of the chapter, memory is not a perfect record of what happened. We forget and we can change our memories during re-encoding. However, the testing of our memories not only assesses what we have remembered, but can enhance the quality and retention duration. Like in most areas of memory testing, the majority of the research has been conducted on memory for words or word lists. However Roediger and Karpicke (2006) investigated memory for prose materials using free-recall tests without feedback, which is similar to taking an exam with essay questions (and not knowing how you did). The researchers compared the testing effect to relearning the material to investigate which of these conditions produces better memory for the material. Participants were tested at 5 minutes after learning, 2 days after learning, and 1 week after learning. There was a significant main effect of testing versus relearning, and a significant main effect of retention interval. However, there was a retention interval by learning condition interaction such that retesting the information may help in the short term; however, retesting is better for long lasting memory of the information. This testing effect aided memory retention even when controlling for re-exposure to the material due to testing (i.e., they had separate conditions where participants just studied the material again and they did not give feedback on the tests). This suggests that if you want to remember information from your classes in the long term (and you want to pass), you should go to your exams. Additionally, if you generate your own test questions and test your own knowledge you will do better on the exams because you will be elaborately encoding the information and in more than one way.

**Self-reference effect**

So far it seems that the more you are able to meaningfully elaborate the better the chance you will retain information and be able to retrieve that information in the future. Another way to facilitate learning and retention of new material is to use yourself and your own autobiographical memories as a reference point. This has been referred to as the **self-reference effect**. For example, you are sitting in lecture listening to your professor explain the concepts of the constructive nature of memory. Instead of writing down the lecture slides word for word and/or writing down the examples that the instructor provides, you could be actively thinking about examples from your own long-term memory. Have you ever disagreed with a friend about a shared memory? What was different between your versions of the story? Why might these differences exist? Use your own experiences to help with learning new material and research suggests this may help you remember information longer. Additionally, relate new material to information you already know. If you are enrolled in a cognitive psychology course, chances are that this is not your first course in psychology. Most likely an introductory psychology course was a pre-requisite. Did you learn anything in previous courses that would help you learn the new information
about memory? Depth of processing and elaborative encoding is all about making connections. The more associations or retrieval cues you put into memory, the more likely you will be able to access the memories when you need them.

Previous research has demonstrated that self-generated elaborations increase memory retention when the elaboration facilitates clarification of the to-be-learned information (Stein & Bransford, 1979). In other words, when a self-generated elaboration is meaningful to you and helps you to understand the new material, it will help you remember that material later when you need it. This research is consistent with the active learning. When attending lectures, it is a good idea to pay attention, but more than paying attention, it is a good idea to be active in your learning. Learning does not just happen, rather it is a matter of asking questions, elaborating on the information, creating meaningful connections between new material, and information that you already know.

**LEVELS OF PROCESSING VERSUS TRANSFER APPROPRIATE PROCESSING**

So far it seems that the deeper that you process the information and the more that you elaborate on the information, the longer you will be able to retain an accurate memory. However, research conducted after Craik and Lockhart’s (1975) study of depth of processing suggests an alternative to depth of processing may be transfer appropriate processing (Morris, Bransford, & Franks, 1977). Transfer appropriate processing is related to state-dependent memory (as discussed in Chapter 5). Basically, how you remember information depends on the consistency between encoding and retrieval of the information. In psychology, you may have noticed that there are competing theories about phenomena. Memory is not immune to these competing theories. Cognitive research benefits from well-designed research as much as it benefits from researchers disagreeing with each other. Sometimes these arguments may go on for years without producing anything of value. However, sometimes disagreements are the fastest route to new knowledge. Morris, Bransford, and Franks (1977) investigated depth of processing similar to Craik and Lockhart, however they also varied the type of test they used to assess memory. Whereas the main focus of Craik and Lockhart’s research was on the encoding of the information, Morris and colleagues investigated both encoding and retrieval with levels of processing. Figure 6.5 displays the results from one of their experiments. Semantic encoding was better than rhyming encoding for memory performance, which is consistent with the levels of processing theory. Additionally, the researchers found that overall performance on the standard recognition test was better than performance on the rhyming test. However, their finding that performance on the rhyming test was better for participants in the
rhyming encoding condition than the semantic encoding condition is inconsistent with the levels of processing theory. In a second experiment, this effect held even with a delayed (rather than immediate) test. The researchers suggest that depth of processing does not accurately describe the phenomena. Additionally, when encoding the information it depends on how you expect to retrieve that information in the future. If you are studying for an essay exam, rote memorization of terms and definitions will not aid you in expressing contradictions between competing theories. Although it may help to know the definitions of levels of processing and transfer appropriate processing, understanding how the research was conducted may better help you to write that essay question. Knowing what form of the information you will need at a later time will be helpful when learning the information.

**MEMORY DISTORTIONS**

As we have discussed, memory depends on both encoding and retrieval and it is definitely not a perfect recoding of everything we have ever learned and experienced. Memories cannot only be forgotten, but they can become altered when we remember and re-encode. This is referred to as memory distortion. Some of the most famous examples of memory distortions can be found in the papers of Elizabeth Loftus. Most of the research in memory is on memory for words and word lists. However, as briefly described in Chapter 5, Loftus (1975) investigated memories for events (e.g., a film of an automobile accident) and how questioning after the event influences the response and subsequent memory for that event. She found that questioning after the event could influence later memory for that event. For example, if participants were asked “How fast was the white sports car going...
when it passed the barn while traveling down the road?” (Loftus, 1975, p. 566), they were more likely to remember a barn that they did not see in the film on a later questionnaire about their memory of the film. In another study by Loftus and Palmer (1974), participants watched a film about a car crash. The researchers demonstrated that by modifying language in a question about the car crash by replacing “hit” with “smashed,” they could get participants to increase their estimated speed of the vehicles upon collision (Loftus & Palmer, 1974). Additionally, when participants were asked at a later time about seeing broken glass in the film, individuals who received the word “smashed” were more likely to report seeing broken glass than with the word “hit.” Loftus and colleagues research supports the theory that memory is constructive in nature and can be distorted by leading questions after the event (Loftus, 1975; Loftus, Miller, & Burns, 1978; Loftus & Palmer, 1974). When you experience an event you are encoding information into memory. However, when you are asked questions about the information (even if they are not true), you add this information to your original memories. In this way, you are reconstructing your memories based on the information available to you. This can cause memory distortions. These experiments have implications for eyewitness testimony.

### Eyewitness Testimony

Hopefully, you have never had the experience of witnessing a crime. However, there are many people who have and it is important that they can report their memories accurately. In this chapter, we have discussed how memory is not perfect and that memories can be distorted. One of the main reasons research on memory bias is so important is because of the implications for eyewitness testimony. Eyewitness testimony has been depicted in film and television shows. The victim or witness to the crime sits in a room with a one-way mirror and views a lineup of possible suspects. Of the available choices, the witness is asked if anyone in the lineup is the person who committed the crime. Afterward, in court, the witness is subject to further questioning about the events that occurred and the confidence of their identification. However, as we have discussed, our memory for events is constructive and can be influenced by our biases, experiences, and emotions.

Of the 300 some people who have been exonerated with DNA evidence, about 72% of those convictions were due to misidentification of an eyewitness (http://www.innocenceproject.org/). In a 1972 Supreme Court ruling, five guidelines were suggested for courts to use to determine the reliability of an eyewitness testimony: (1) the opportunity the eyewitness had to view the suspect, (2) the ability of the eyewitness to attend to the suspect, (3) the accuracy of the eyewitness’s description of the suspect before the lineup, (4) the certainty or confidence the eyewitness displays, and (5) the time between the event and the eyewitness identification (Neil vs. Biggers, 1972). However, four of the five criteria are based on the accuracy of the witness’s memory for the event, and it is not known how well these are followed.

To test the reconstructive nature of eyewitness testimonies, researchers showed participants a security camera video of an actual murder case...
that occurred at a Target store (Wells & Bradfield, 1998). Participants were told that they would be asked questions about the video later. They viewed the video and the murderer was in view for only about eight seconds. After they viewed the video, they saw a photo lineup of five possible suspects. Some participants were given disconfirming feedback such that participants were informed that they chose the wrong suspect and that the actual suspect was another one of the photos. Other participants were given no feedback on their identification. When participants were given feedback, they reported being more certain about their identifications, they took less time to make an identification, they were more willing to testify, and provided more details. However, none of the possible five suspects actually committed the crime. In further research, Wells and Bradfield found that a majority of the participants felt that feedback had no influence on their confidence of their testimony. This suggests that participants might not be aware of distortions to their memories or what factors may distort their memories. Similar to Loftus’s research, research on eyewitness testimony has found that memories can become distorted by providing feedback after the initial memory has been encoded. Based on this line of research the following recommendations for gathering eyewitness testimonies have been suggested (adapted from Wells et al., 2000):

1. Address the personal needs of the witness.
2. Do not prompt the witness but encourage voluntary information.
3. Avoid leading questions by asking open-ended questions.
4. Explicitly caution the witness against guessing.
5. Use sequential versus simultaneous lineup procedures to protect from “ruling-out” suspects.
6. Select a few suspects that meet the general description, but not all.
7. Counterbalance the order of suspects for multiple eyewitness accounts.
8. Explicitly tell the witness that the suspect may or may not be in the lineup. Additionally, assure the witness that it is as important as to free innocent suspects than it is to identify the actual perpetrator.
9. Avoid providing feedback to the witness about their identification. It is best that the administrator of the lineup be blind to the actual perpetrator or suspect.

MEMORY AND STRESS

Apart from the role of others in the distortion of memories, our own emotions during encoding and consolidation can affect the accuracy of our memories. This could be why there are so many errors in eyewitness testimony. Usually the circumstances under which the memories are created in witnessing a crime are emotional (and possibly stressful) in nature. To investigate
the hypothesis that stress after learning influences memory, researchers showed participants images that were either arousing or neutral (Cahill, Gorski, & Le, 2003). Participants were asked to give a one-word descriptive caption of the slide. After viewing the images, stress was induced by using the ice-water immersion technique. In order to induce stress, some participants put their left arm up to their elbow into ice water. Other participants (the control group) put their left arm in warm water. This technique has been used in research to ethically induce stress without long lasting psychological effects. Participants in the ice-water group were told to keep their arm in the water as long as possible. A few weeks later, participants were invited back for a surprise free-recall memory test (they thought they were going to view more slides). For the free recall memory test, participants were asked to recall and write down as many of the slides as they could remember. They had no time limit for the free-recall memory test. After the memory test, participants were shown each of the slides again and asked to rate how arousing they felt the images were. Results indicated that the ice-water immersion technique significantly increased stress. In addition, participants that put their arms in ice water (the stress condition) remembered significantly more details from the slides than participants in the control group. However, there was an image type by stress condition interaction such that individuals in the stress group remembered more details about the arousing images than individuals in the control group remembered the arousing images. There were no significant differences in details remembered between the two groups for neutral images (see Figure 6.6). This research is consistent from findings in animal research. In animal research, cortisol is injected directly after learning. Animal research has found that post-learning stress can enhance memory consolidation. Since the stress manipulation was administered after learning, this would suggest that the increase in recall memory was not due to attention, or encoding. Rather stress acts on the consolidation of memories. However, the influence of stress on consolidation depends on the type of information to be remembered.

![Mean number of details recalled](image.png)

**FIGURE 6.6**
Proportion of slides recalled as a function of image type and stress condition. Participants in the high stress group recalled more arousing images than the control group. There was no difference between the stress groups in their recall of neutral images.
So does this mean you should stress yourself out to increase the likelihood that you will consolidate memories? The short answer is, not necessarily. The long answer involves understanding what is referred to as the **Yerkes-Dodson Law**. This concept suggests that there is an optimal level of arousal for enhanced performance (Yerkes & Dodson, 1908). The original research was on rats. However, the reasoning can be applied to human performance. For example, think of caffeine consumption. Sometimes one cup of coffee is not enough to get you moving in the morning. If you drink another cup of coffee, you may notice that you can think more clearly and you are accomplishing your daily tasks efficiently and swiftly. However, after you have consumed your third cup of coffee, you start to feel jittery and anxious. Caffeine is one way of increasing arousal. Too little caffeine might not help performance (especially if you drink coffee everyday). Too much caffeine may cause your performance to suffer due to the jitters (see Figure 6.7). However, there may be an optimal level of caffeine. Of course, sometimes all you need is enough sleep at night.

**EMOTION AND MEMORY**

As discussed in Chapter 5, there is some evidence of state-dependent memory. For example, you are more likely to get a high score on an exam if you study in the room that you are to take the exam. Further research on memory and emotion suggests that emotions at the time of learning do not influence memory for word lists whether in a similar mood or opposite mood (Bower, Monteiro, & Gilligan, 1978). (The researchers used hypnosis to induce happiness and grief in participants.) There were no significant differences in memory with consistent or inconstant moods in a series of studies. However, in a third study the researchers investigated the influence of induced mood on retroactive interference. Remember, retroactive interference happens when new information interferes with the ability to remember older information. For example, reading this chapter may interfere with your ability to remember earlier chapters in the book (another

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**Yerkes-Dodson law:** this term refers to the relationship between performance and arousal. The idea is that as arousal increases, performance also increases to a point. Past this point, performance decreases as arousal increases. The law is usually depicted with an inverted quadratic function or bell-shaped curve.

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**OPTIMAL AROUSAL**

![Optimal Arousal Diagram](image-url)

**FIGURE 6.7**

A depiction of the Yerkes-Dodson Law that suggests that there is an optimum level of arousal for enhanced performance.
reason why it is important to review and re-review information that will be on the exam. With a new method, the researchers found a strong mood-dependent retention effect. One of the things that we can learn from this research is that mood states influence memory. However, another lesson is that different methodologies produce different results. The design of an experiment, the methods, and the measurement all can influence results.

In another line of research, it was found that even though emotion does not always influence your memory, people sometimes feel that their memories are more accurate, are more confident in their ability to remember, and rate their memories as more vivid. In other words, emotion typically enhances the subjective sense of remembering (even if it does not actually enhance memory). Further research on the influence of mood on memory suggests that mood is more influential on memory of internal events (mental processes such as reasoning and imagination) than memory of external events (Eich & Metcalfe, 1989). To put it another way, it is more likely that an extreme shift in mood will alter or facilitate forgetting an abstract idea, then your memory of your 6th birthday party. This research has implications for learning your coursework. If you are actively thinking during a lecture and making connections—that is good! However, it is even better to write those connections down (shift from internal event to external event) to reduce the likelihood of forgetting the connections and the to-be-learned material from class. Together, these findings of research on memory and mood suggest that mood can distort memory, even if you feel that your memories are accurate.

**SOURCE MONITORING**

Another way that memories can be distorted is by forgetting the source of the original information that we remember. For example, research on psychological phenomena may contradict your own experiences. The point of conducting psychological research studies is to look for trends in the data. When the trends go against our own experiences, it may be more difficult for you to remember the information. It is important to remember the source of information because information from different sources has different reliabilities. Information from the satirical news source The Onion is less reliable than peer-reviewed research articles with empirical data. For example, you remind your friend of how milk squirted out of their nose at lunch the day before when you told them a joke only to be met with a weird look from your friend. After realizing they have no idea what you are talking about, you might realize that you had experienced this event in your sleep rather than at lunch. This is a problem when we considered information to be reliable, but in fact we have experienced source misattributions—misremembering the source of information. Source monitoring “...refers to the set of processes involved in making attributions about the origins of memories, knowledge, and beliefs” (Johnson, Hashtroudi, & Lindsay, 1993, p. 3). Failures in source monitoring have implications for eyewitness testimony and may increase with age. Remember in the section on eyewitness testimony, research has suggested that feedback after identification of a suspect may influence later confidence of identification. This is an example of source misattribution. Although a witness may think that they were confident in
their identification, positive feedback may be unknowingly increasing confidence. The source of confidence has been misattributed. When subjects erroneously remembered the barn in Loftus’ research, they misattributed the source of that memory. When they thought they saw the barn, they were actually remembering the question and not their own experience.

An example of failures in source monitoring can be seen in research conducted by Jacoby and colleagues (1989). In their research, they presented lists of famous and non-famous names to participants. During the first phase of research, participants were told that they were being presented names of non-famous people. Participants were instructed to read the names aloud as they saw them. They were told that they were being tested on the speed and accuracy in pronunciation of the names (even though the researchers never actually recorded speed or pronunciation). In the second phase the non-famous and famous names were presented. Participants were asked to respond after each name by pressing a button that said either famous or non-famous. Even though participants were told that the names on the first list were non-famous, they demonstrated a failure of source monitoring. They were more likely to judge non-famous names as famous in Phase II if they read the name out loud in Phase I. These results support the theory that memory is constructive. Participants believed that they were familiar with the names because the individuals were famous, not because they read them aloud the day before in the experiment.

This has implications for advertisements. Companies spend a lot of money on the creation of amusing and memorable ads. The logic behind this is that to be able to make an informed decision about a purchase you need to remember the information about the product. In a study by Perfect and Askew (1994), the researchers used magazine ads to assess memory and attitude shifts in participants. They found that consumers were more likely to rate advertisements as favorable if they had previously seen the advertisements, even if they didn’t remember the details. This suggests that experience with products can increase favorability without memory of where the information came from (failure of source monitoring) and without memory of the details of the advertisement. This phenomenon has been referred to as the **propaganda effect**. This may be why product placement in movies and television is becoming more common—in addition to longer commercial breaks within programs.

Source monitoring also has implications for viral information on social media. The danger is that false information can reach millions of people within a day. Though we may later find out the information was false. We still may have a failure of source monitoring and a favorable attitude shift. More research is required on the influences of social media on memory, beliefs, and attitudes.

### FALSE MEMORIES

In addition to distortions in memories, researchers have demonstrated that we can believe that we remember events from our own lives that may have never even happened. A simple demonstration of false memories can be

| Propaganda effect: a term used to describe the increase in favorable attitudes toward ideas, products, or companies by repeated exposure to communications aimed toward influencing attitudes. |
| False memories: untrue or altered recollections of past events. |
found in the research of James Deese (1959). In fact, you already completed a trial in one of his experiments. Remember the word list at the beginning of the chapter that you were asked to read aloud and then use the recall method to write down as many words as you could remember? How many did you get correct? Did you put down a word that wasn’t on the list? In the late 50s, Deese found that about 40% of participants that heard the exact word list at the beginning of the chapter reported the word “soft.” Was soft on your list? It wasn’t on the original list that you were to remember. Why do so many individuals report the word soft? In fact, Desse had 36 word lists in his research. With these word lists there was a target word that never appeared on the list but had a high association with all of the other words on the list. Deese found that he could get participants to report false memories of the target words from 4%-42% of the participants depending on the list that he used. This simple demonstration is a great example of memory bias and the constructive nature of memory. We use associations to construct our memories. We can forget information as well as remember information that we never actually experienced.

Now you may think that remembering a word that you didn’t read is no big deal, but what if you falsely remembered an event from childhood that you never actually experienced? Is there an ethical way to investigate this? In a study by Loftus and Pickrell, participants were recruited for a study with the general topic “the kinds of things you may be able to remember from your childhood” (1995, p. 721). The participants were given a list of four memories from their childhood. Three of the memories actually happened with a close family member and one of the memories was a “false” memory. Family members were interviewed to obtain the true memories. The false memory typically involved getting lost in a grocery store when they were young and being found crying by an elderly person who helped the participant find their family. Family members were asked for key pieces of information that might make the false memory seem more realistic such as where would they have been likely to be shopping when the event occurred, who went on family shopping trips, and to ensure the participants had not actually gotten lost on a shopping trip. Participants were asked to write as many details as they could remember about the events and were interviewed twice about the events. Participants were also instructed to indicate if they could not remember an event occurring. After each interview about the events, participants were asked to report how clear their memory for the event was, and their confidence. Results indicated that participants remembered about 68% of the true memories. More interestingly 29% of participants initially remembered the false memory. However, participants went into greater detail with the true memories than the false memories and initially 29% of participants remembered the false memory. After the second interview, participants were debriefed and asked if they could identify the false memory. Some participants did struggle with accepting that they were not lost as a child after being debriefed. The false memory research again demonstrates the constructive nature of memory. The participants in the research were asked to describe a memory from their childhood that didn’t actually happen. Even though they might not have
been lost in a store at that age, the researchers did not confirm if they had ever been lost. It is also possible that they had experiences such that a friend described a time they were lost or remembered a news report about a child being lost. Therefore, their real memories may have become associated with the false memory over the course of the study. These results suggest that false memories can be created by mere suggestion that is added to existing knowledge structures. This research has implications for recovered childhood experiences during therapy. Just the mere suggestion of a memory can cause it to be combined with real memories aiding in the suggestion taking on the appearance of a true memory.

APPLICATIONS OF MEMORY BIASES RESEARCH

Most of this chapter has demonstrated how our memories can fail us. However, there is hope for improving and training our memories. There are some people that have an exceptional memory. Were they born this way? Most likely they had to practice and train their memory. Research on experts suggests that deliberate practice and time spent practicing leads to expertise (Ericsson, Prietula, & Cokely, 2007). Joshua Foer (2012) details a good example of expert memory in his book *Moonwalking with Einstein: The Art and Science of Remembering Everything*. Foer is a journalist by training and by no means had an exceptional memory. During his time covering the championship he realized that to really understand what was going on at these championships, he would have to participate. Over the next year he trained his brain and developed the skill of memory. There are multiple techniques to train your memory and a few of them are contained in this chapter and listed below.

1. Meaningfully elaborate on the to-be-remembered information. When you connect the information to your own experiences, you are more likely to remember the information (The self-reference effect).

2. Generate your own questions about the information and test your-self periodically (The testing effect).

3. Take breaks. It is a good idea to study, but it is also a good idea to space your studying. If you don’t break, you run the risk of retroactive interference.

4. Avoid the illusion of learning. Familiarity is not knowledge. Just because something seems familiar doesn’t mean you understand it. If you are studying for an exam and the concepts are familiar to you. Don’t be fooled. Test yourself. Ask yourself questions (could practice exam questions or questions that you generate yourself) to check your understanding.

In addition to studying, there are mnemonic techniques that you can employ to aid in remembering. Mnemonics, or memory tricks, may help you to remember lots of information in a short amount of time. Below are a few mnemonics that you might try to help you remember lists of items
or categories of information. These methods capitalize on elaboration to increase the likelihood of retrieving memories through association. One way to improve memory is by using different techniques to create robust connections that induce a depth of processing. Some of these techniques use visual images to help make connections with memory.

1. **Method of loci**: The method of loci capitalizes on elaboration and visual imagery. Say you wanted to remember the following grocery list: eggs, bread, milk, and butter. You would pick a place that was familiar to you: your childhood home, your best friend’s house, grandparent’s house, gym, and so on. For example, I’m going to use my childhood home. Imagine the front door. Our front door was red. Now imagine the eggs interacting with the door. Someone has walked up behind you and thrown eggs at the door. The eggshells are white in contrast to the red door. The runny yellow yolks are smeared and dripping goo everywhere. Open the door. Once you are inside you smell bread. Warm delicious fresh bread. The smell overpowers you and fills your nose and your lungs. You take a second to breathe it in. Next you head upstairs where your sibling (or dog or friend or whoever) usually can be found about this time of day. On the way up the stairs you notice a row of empty milk cartons with their caps still in place. To have some fun, you jump from one carton to the next. Popping the tops off and after each one hearing the satisfying pop that fills the house as you make your way up the stairs. Your sibling rushes out and tries to warn you, but too late you realize that there is a stick of butter under the last milk carton at the top and you slip (not very gracefully) all the way down the stairs. Now we have imagined all of the items on the grocery list in a place. When you walk through the grocery store, you can mentally walk through your house and remember the items. Every time you have a different list you can imagine different scenarios. And remember, the more elaborate, the less likely you are to forget.

2. **Peg-Word Technique**: This technique is useful when you have a series of steps to remember in a particular order. First you need to come up with a list of associations for steps 1, 2, 3, 4, 5, 6, and so on. A typical technique involves rhyming. One is a bun, two is a shoe, three is a tree, four is a door, five is a hive, six is sticks, and so on. Next you use visual imagery to imagine each step interacting with the number words (bun, shoe, tree, door, and so on). For example, we can use the peg-word technique to remember the steps to make a pot of coffee.

- The first step is to gather the materials that you will need. To make a pot of coffee you should have a coffee pot, coffee maker, coffee filters, water, and coffee. You can imagine a bun with all of these materials laid out on top of it. You could image them stuck inside...
of it or imagine another way in which the materials you need and the bun are interacting.

- The second step is to put the water in the coffee pot. For this step you can imagine a shoe full of water.
- The third step to making a pot of coffee is to put the coffee filter and coffee grounds in the coffee maker. You could imagine a tree that is growing out of coffee grounds planted in a coffee filter.
- The fourth step to making coffee is to put the coffee pot in the coffee maker. To remember this step you could imagine a door that opens to reveal a coffee pot.
- The final step to making coffee is turning the coffee pot and setting it to brew. You could imagine a beehive and bees buzzing around the electrical plug to the coffee maker. One bee might lose track of where it is going and press the brew button on the coffee machine. Wait for your coffee to brew and enjoy.

3. Another technique that you can use is creating hierarchies or categories of information. Say you wanted to remember a grocery list. You need apples, chicken, pork roast, broccoli, oranges, tomatoes, corn, and ground beef. You could organize the items into three categories: protein, vegetables, and fruits (see Figure 6.8).

**SUMMARY**

Memory is constructive in nature. It is not perfect like a movie recorder. Memories are prone to retroactive and proactive interference. To study memory we commonly use word lists and word pairs through experimental methods. Not all memory is equally encoded. The levels of processing framework suggests that the accuracy of our memories depends on depth of processing. Deeper processing is achieved by elaborating on the to-be remembered information. Focusing on visual imagery and relating the new information to information that we already know are two ways to elaborate on items we may want to hold in memory. These techniques use associations to aid in the retrieval of memories from long-term memory. The testing effect suggests that we are more likely to remember information for longer when we are tested on the material rather than mere re-exposure to the material.

Memory distortions arise from interference such as stress, emotion, and failures in source monitoring. Research on memory distortions has implications for the validity of eyewitness testimonies. In addition to memory distortions, research has found that interference can lead to false memories. The ability to remember is something with which we are born; however, you can train your memory and increase the likelihood that you will remember. There are multiple mnemonic techniques that you can use to facilitate remembering such as the method of loci, the peg-word technique, and organization of information into categories.
REFERENCES


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Dr. Ellis is currently an Assistant Professor in the School of Psychology at the Florida Institute of Technology (FIT). Her primary research interests focus on the psychology of health-related decision-making with emphasis on assessment, quantitative modeling, and decision education. Specifically, Dr. Ellis is concerned with risk literacy; that is, how patients (and their health counselors) interpret and use risk information to make decisions. Some of her published research in the area shows that both medical professionals and patients misinterpret risk and that the use of simple visual aids and decision tools can quickly educate people on the statistics that can result in better decision-making. She received an Outstanding Teaching Award from her alma mater (Michigan Technological University), as well as a nomination for the school’s Excellence in Teaching Award. Dr. Ellis obtained her Ph.D. in Applied Cognitive Science and Human Factors and B.S. in Psychology from Michigan Technological University, and her M.S. in Cognitive Psychology from Kansas State University. In addition to her academic life, she frequents the university pool for fitness, and enjoys spending time with her husband, son, and dog at the beach.