Module 23:
Forgetting and Memory Construction

Overview

Sections

- Forgetting as Encoding Failure
- Forgetting as Storage Failure
- Forgetting as Retrieval Failure
- Memory Construction

Learning goals

Students will be able to:

1. Explain how encoding failure leads to forgetting.
2. Discuss the forgetting curve and how decay relates to forgetting.
3. Describe how interference and motivated forgetting can cause forgetting through retrieval failure.
4. Discuss how the misinformation effect can lead to false, constructed memories.

Vocabulary

Previewing Key Terms and Key People:

encoding
storage
retrieval
permastore memory
proactive interference
retroactive interference
repression
misinformation effect
Hermann Ebbinghaus (1850–1909)
Sigmund Freud (1856–1939)
Elizabeth Loftus (1944–)

"I forgot." When was the last time you used this simple, two-word phrase? Did it relate to a forgotten assignment? A chore you should have done? A friend's birthday? We all suffer from memory lapses fairly regularly. In this module, we show what psychology has learned about forgetting.

We process information into our memory through three stages: **encoding** (getting information into memory), **storage** (retaining that information), and **retrieval** (getting the information back out after it's been stored). When we say, "I forgot," we could be describing a failure at any of these three stages: lack of encoding *or* ineffective storage *or* inability to retrieve what has been adequately stored. Forgetting is complicated!

encoding
Process of getting information into the memory system.

storage
Retention of encoded information over time.

retrieval
Process of getting information out of memory storage.

Forgetting as Encoding Failure

THINKING CRITICALLY *Can we forget what we have not encoded?*

The cafeteria in my school is in the basement. Its roof is held up by a series of pillars. By the time students reach my class as juniors and seniors, they have been in that room hundreds of times, both for lunch and for study halls. When I quiz them on the number of pillars in the cafeteria, however, fewer than half of them can correctly recall that there are 8. Students guess as few as 2 or as many as 15. How can it be that these bright young people do so poorly remembering something they have seen so often? Despite numerous exposures to the 8 pillars, few students encode this information into memory because it is relatively unimportant to them. As long as there are enough pillars to hold up the roof (an issue of trust for almost everyone), they don't care how many there are.

We all fail to encode information in our environment, as you can see if you try this simple quiz. On the back of a U.S. penny, you will find the value listed as "one cent."

- What is the similar value statement on the back of a dime? How about on a quarter?
- Which way does Lincoln face on the penny—to the left or to the right? (After you answer this question, try your luck at identifying the real penny in Figure 23.1.)
- Which way does Jefferson face on the nickel?
- Finally, which way does Washington face on the quarter?

Think of how many hundreds of times you have seen and used these coins. Yet unless you have an interest in coin collecting, you may not be able to answer any of these questions. (You can find the answers on page 446.) You probably haven't *forgotten* the answers. Rather, you never bothered to encode this information, because you don't need to know these details to be able to spend the coins.

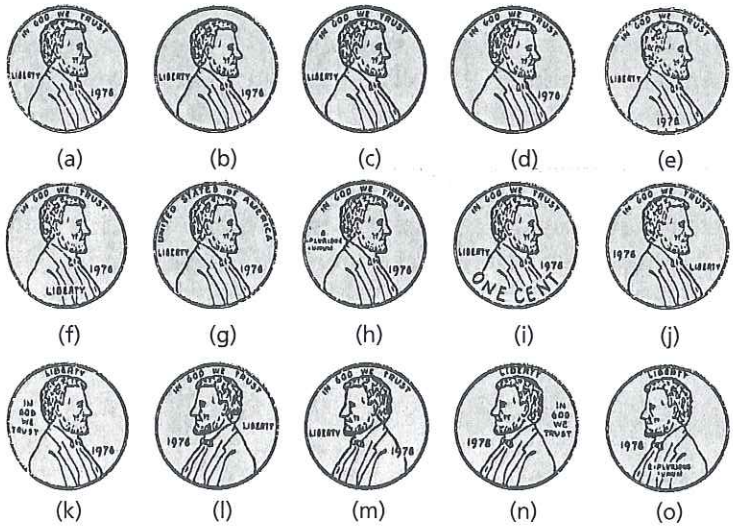


Figure 23.1 How Can You Remember What You Haven't Encoded? Can you pick out the real deal? (See page 448 for the answer.) Most of us can't because we've never bothered to encode this information. The penny spends just as well whether we can identify the correct version or not. (From Nickerson & Adams, 1979.)

>> Answers to the questions in the list about coins on page 445: A dime reads "one dime," a quarter reads "quarter dollar," Lincoln faces to his left, and both Jefferson and Washington face right.

Encoding failure may contribute to the increasing "forgetfulness" some older people experience. As we age, the parts of the brain active during encoding respond more slowly (Grady & others, 1995). Older people may forget where they left their eyeglasses or what time to take their medication because they did not succeed in encoding the information.

THINKING CRITICALLY SUMMARY *One common reason we forget is encoding failure—we never encoded the information into our memory system because the information wasn't perceived as important.*

Forgetting as Storage Failure

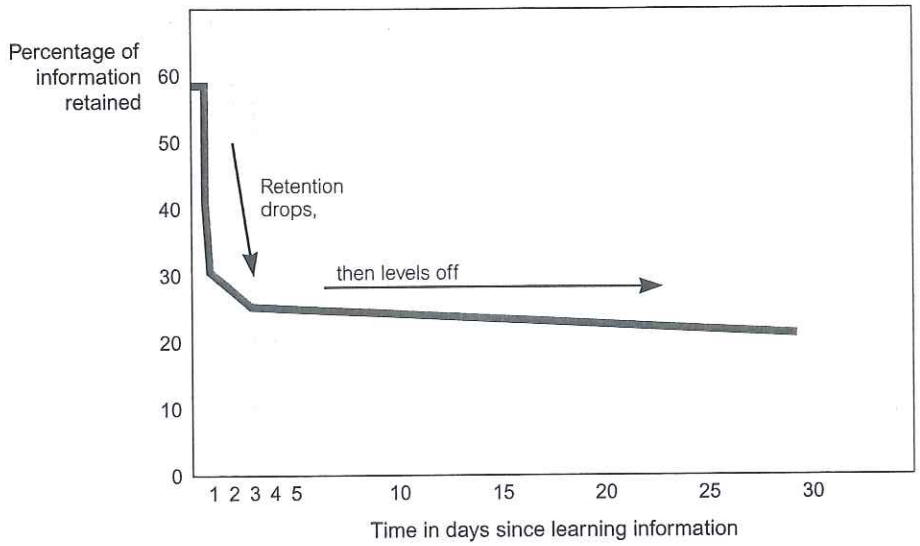
THINKING CRITICALLY *Do memories fade over time?*

I've long been fascinated by the compost pile that we keep behind our house. A never-ending stream of grass clippings, leaves, weeds, egg shells, grapefruit rinds, celery stalks, and other organic rubbish makes its way into the pile, only to rapidly decompose to a small fraction of its original bulk. Are memories like that, decaying like the material in the compost pile?

This idea of decay is consistent with the results obtained by **Hermann Ebbinghaus** (1885), famous for his early studies of memory. His "forgetting curve" (see Figure 23.2) indicates that most forgetting happens rapidly and then levels off. Most memory loss occurs in the first few days (just as it does in the compost pile) and then slows considerably. More recent research has looked at the process of forgetting far beyond the 30 days Ebbinghaus examined (Bahrick, 1984) (see Figure 23.3). The researcher was interested in how well people remembered the vocabulary they had learned in Spanish class decades earlier.

Hermann Ebbinghaus (1850–1909)
German philosopher who conducted pioneering memory studies.

permastore memory
Long-term memories that are especially resistant to forgetting and are likely to last a lifetime.




Bettman/Corbis

Figure 23.2 The Forgetting Curve Hermann Ebbinghaus demonstrated more than a century ago that most forgetting occurs soon after learning. After a steep initial drop, we retain most of the remaining information. (Adapted from Ebbinghaus, 1885.)

He found that most vocabulary was lost in 3 years but that after that initial loss the forgetting curve leveled off. Words people remembered after 3 years were likely to remain in their memories a quarter-century later. The term **permastore memory** is used to describe these long-term memories that are especially resistant to forgetting and are likely to last a lifetime.

We still don't know enough about how long-term memories are stored in the brain to understand whether they actually decay with time. The work on permastore seems to indicate that some memories do not decay. It will be interesting to see whether future research demonstrates a change in the physical storage of the memories that decay. What we do know for sure is that we sometimes forget because we are unable to retrieve memories that are still stored.

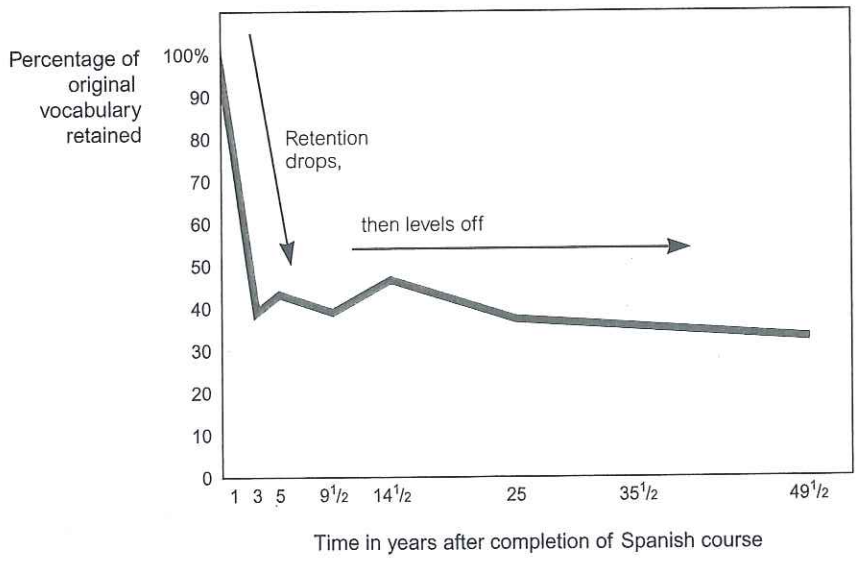


Figure 23.3 Permastore Memory This graph shows how well people retained Spanish vocabulary they had learned in school a half-century earlier. Note that although the timeline differs, this forgetting curve has the same shape as the one in Figure 23.2, which Ebbinghaus identified. (Adapted from Bahrick, 1984.)

Charles Gupton/Corbis

>> Answer to the penny exercise (Figure 23.1) on page 446: Penny "a" is the real penny.

THINKING CRITICALLY SUMMARY *Sometimes we forget because of a failure in our storage system. Ebbinghaus's research (and more recent research) indicates that some memories do decay. Most of this forgetting happens in the first few days after we "learn" the information. Ebbinghaus graphed the decay of memories in the "forgetting curve." Memories that survive this initial period and continue to last for years are called permastore memories and are so resistant to decay that we are likely to remember them as long as we live.*

Forgetting as Retrieval Failure

THINKING CRITICALLY *Is it possible to lose access to some memories in long-term memory?*

Retrieval failure probably accounts for most of our forgetting. You've encoded and stored the information. It's in there, but you can't get it out. Sometimes this is true because the memory you're after is being disrupted by *interference.* Other times you may have a reason to not remember, creating *motivated forgetting.*

Interference

Interference is a retrieval problem that occurs when one memory gets in the way of another. Have you ever traveled in a car from one city to another, happily listening to music on your favorite radio station? As you approach the new city, you may find that the music begins to turn into some other kind of music you'd never listen to. The two types of music will compete for your attention because two stations with similar radio frequencies are sharing the airwaves. If neither is strong enough to dominate, interference occurs and you won't be able to receive either station clearly.

A similar thing happens with memories. When an older memory disrupts the recall of a newer memory, you experience **proactive interference** (see Figure 23.4). Have you ever moved and had to learn a new phone number? When you get the new number, you sit down and rehearse it until you commit it to memory.

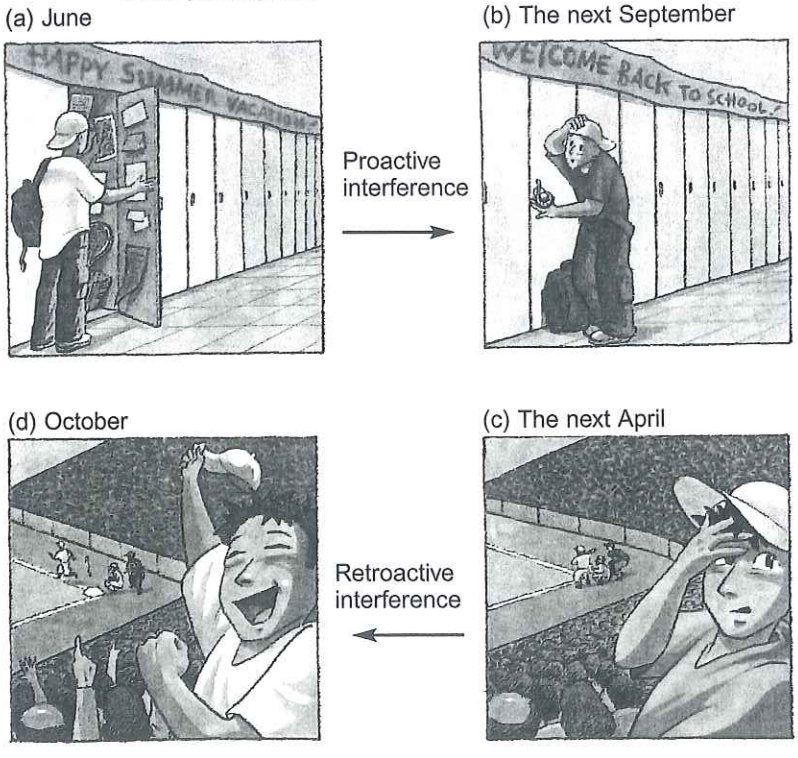


Figure 23.4 Scenes of Interference (a) Because his memory of last year's locker combination produces proactive interference, (b) this boy can't remember this year's combination. (c) He gets so caught up in the details of this year's game that (d) retroactive interference prevents him from remembering the details of last year's game.

Later on, however, when somebody asks you for your new number, you may be unable to retrieve it. When you follow the retrieval pathway in your brain to "my phone number," the only number you can find is the old one. Your earlier learning is interfering with your retrieval of the more recent information—your new number. Here are some other examples of proactive interference:

- Remembering last year's locker combination proactively interferes with remembering this year's combination.
- Calling your current girlfriend's house on the phone and asking to speak to your *former* girlfriend. (This actually happened to me when I was in high school—not a pleasant experience!)
- Remembering the word for something in the first foreign language you studied but not being able to recall the word for that item in the most recent foreign language you studied.

proactive interference
When an older memory disrupts the recall of a newer memory.

retroactive interference
When a more recent memory disrupts the recall of an older memory.

You can also suffer from **retroactive interference,** which occurs when a more recent memory disrupts the recall of an older memory. I have had the same phone number now for more than 20 years. I have rehearsed it so well that I find it impossible to retrieve my earlier phone numbers. When I was in college, I easily retrieved my dorm phone number, but I no longer have any idea what it was. My current phone number retroactively interferes with it. There are lots of examples of this phenomenon, too:

- Your memory of your class schedule for this year has overwhelmed the schedule you followed last year.
- Your memory of current sports champions (World Series, Super Bowl, NCAA basketball, and so forth) will probably displace memories of champions from previous years.
- You can remember the sequence of buttons necessary to activate your current electronic devices (cell phone, DVD player, and so on), but you probably can't remember how to operate the ones you had 5 years ago.

Interference isn't the only thing that interferes with the retrieval of memories. Sometimes we are motivated to not retrieve.

Interference Have you ever had trouble figuring out which remote was for which device? Have you ever struggled to find an on–off button or a volume control because these functions are in different places on different remotes? Life would be simpler if we only had one remote, or at least one layout for the buttons. Interference—both proactive and retroactive—causes us to struggle as we switch from one to another.

Digital Vision/Getty Images

Motivated Forgetting

Sometimes, you have a reason to forget. The act of forgetting can provide protection from anxiety or from potentially distressing information. If you're trying to exercise more, those 2 days you were a couch potato last week might just slip your mind. If you're trying to cut calories, that candy bar your friend shared with you between classes may not make it into your daily calorie count. To remember these things would be to admit that you hadn't quite lived up to your goals. That's motivation to forget them.

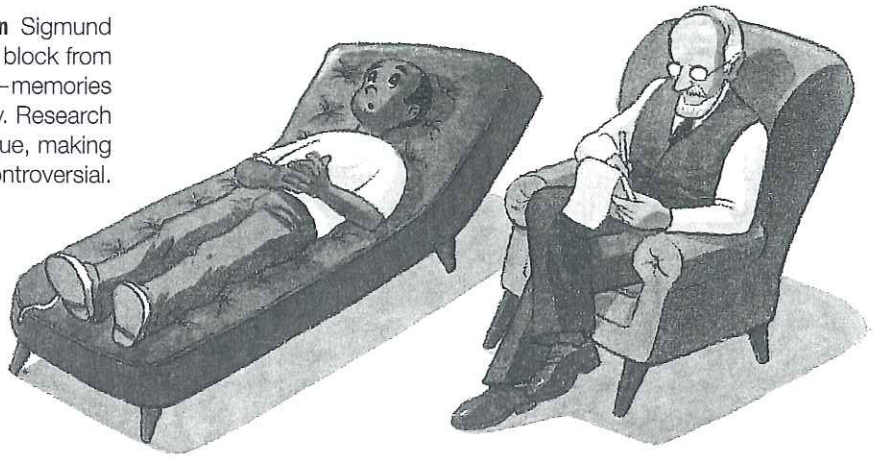


Figure 23.5 Repression Sigmund Freud argued that we block from consciousness—or repress—memories that could cause us anxiety. Research evidence is mixed on this issue, making the concept of repression controversial.

Does scientific evidence support the idea of motivated forgetting? Yes. In one experiment, students took a study skills course in which they were asked to recall their previous study habits. They remembered studying less than they actually had, which allowed them to think the study skills course was more effective (Conway & Ross, 1984).

There is less scientific support for **Sigmund Freud's** famous attempt to understand motivated forgetting through **repression,** the process of moving anxiety-producing memories to the unconscious mind (see Figure 23.5). This, he thought, may be how we protect ourselves from painful memories, although the memories continue to lurk beneath the level of consciousness and can haunt us in a variety of ways. One goal of therapy, Freud thought, is to bring these buried memories to the surface so that they can be fully understood.

Many of Freud's ideas about the unconscious mind have worked their way into the popular culture. Movies and novels often illustrate how repression is supposed to work. Despite the reality that there is little experimental evidence to support this theory, 90 percent of college students still believe that the process of repression protects people by pushing painful memories to the unconscious (Kihlstrom, 1990). Actually, stressful incidents tend to stimulate the release of stress hormones that *enhance* the encoding and storage of memories (Cahill, 1994). So, although we seem readily able to forget minor details when motivated, we are, unfortunately, more—not less—likely to remember painful events.

Sigmund Freud (1856–1939) Founder of psychoanalysis, a controversial theory about the workings of the unconscious mind.

repression In Sigmund Freud's psychoanalytic theory, the process of moving anxiety-producing memories to the unconscious mind.

THINKING CRITICALLY SUMMARY *Some forgetting may occur because we lose access to memories in storage. Sometimes, new information interferes with memories of information we learned a while ago (retroactive interference). Information we learned in the past can interfere with our memories of information we learned more recently (proactive interference). Also, we may be motivated to forget some information because remembering it will cause stress. Some experiments demonstrate how motivated forgetting can occur, but most researchers agree that Freud's idea of repression does not match current research results.*

Memory Construction

THINKING CRITICALLY *Are our memories accurate?*

Many people believe that memories are like DVD discs. As long as you can find the right disc to replay, you can access the recorded memory. Not so. Retrieving a memory is more like building a jigsaw puzzle (see Figure 23.6). That's because of the way we store memories. When you commit an event to memory, your brain breaks the memory into tiny pieces. Some pieces are invariably lost, so when you try to reassemble the puzzle, there are holes. Like a creative carpenter, your brain builds new pieces to fill those gaps. The new pieces may or may not represent what was there originally, but once they take their place in the assembled puzzle, you have no way of determining whether they are real or fictional.

Shall we try it? You need a piece of paper and a pencil. When you're all set, give yourself 30 seconds to commit to memory as many of the following words and phrases as possible. Don't continue reading until you've spent your 30 seconds memorizing:

textbook, all-nighter, quiz, flashcards, review, lecture, vocabulary, GPA, outline, essay, notes, semester exam, due date, grading scale, assignment, unit test, memorize, class project, handouts, tutor, chapter guide

Now, in whatever order you can, and without referring to the original list, see how many of the words you can write on your paper. Take as long as you like. Then go back and check your list against the original. Chances are you will have remembered quite a few of the items. You are also likely to have left off some items—that was a lot to learn in 30 seconds. Now, without looking at the list, answer these four questions:

1. Was the word *lecture* on the list?
2. Was the word *grading scale* on the list?
3. Was the word *study* on the list?
4. Was the word *school* on the list?

Study and *school* were not on the original list, but people often "remember" them anyway.

If you said *study* and *school* were on the original list, you might be thinking that we fooled you. After all, these two words seem to belong on this list. That's just the point. As you struggled with the difficult memory task and the follow-up questions, you began to speculate on items that reasonably belonged on the list. Now you have a problem—which items were really there at first, and which were imagined? Your memory was constructed out of some things that were real and some that were not, and distinguishing between the two categories will now be difficult.

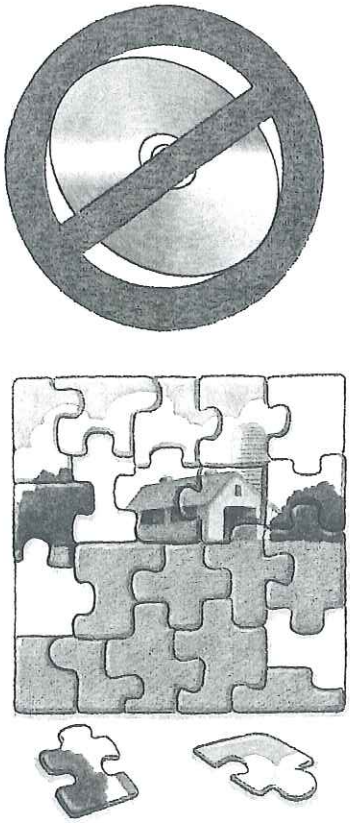


Figure 23.6 How Does Memory Work? Memory is less like a DVD disc than like a jigsaw puzzle with missing pieces. Your brain "manufactures" new pieces to fill the holes and construct a complete memory.

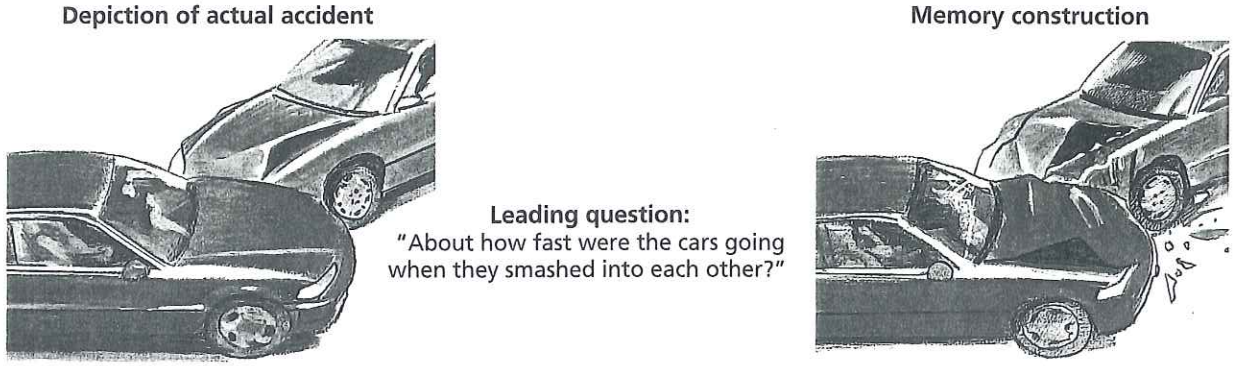


Figure 23.7 The Nature of Memory What we remember depends partly on the wording of the questions we are asked. People who were asked questions about cars "smashing" remembered a worse collision than those who were asked questions about cars "hitting" each other. (From Loftus, 1979.)

Psychologist **Elizabeth Loftus** of the University of California Irvine, was the first to demonstrate in the laboratory this tendency t construct memories. She and her colleague John Palmer (1974) showe participants a film of a car accident (see Figure 23.7). They varied th wording in their questions, asking one group, "How fast were the car going when they *smashed* into each other?" and the other, "How fas were the cars going when they *hit* each other?" This seemingly mino difference was enough to produce significantly greater speed estimate by the "smashed" group. The researchers were able to alter memor simply by the way they phrased the question, and the participants wer never aware of the manipulation.

Loftus and Palmer demonstrated another important aspect of mem ory a week later, when they asked participants whether they recalle seeing broken glass at the scene of the accident. The "smashed" grou was more than twice as likely as the "hit" group to recall broken glass There was no broken glass. The question led participants to construc memories of broken glass, because this is a reasonable outcome of a accident, especially one in which the cars had "smashed." Incorporatin misleading information into a memory, as occurred here, is known a the **misinformation effect.**

Elizabeth Loftus Loftus is a memory researcher who established that we mentally construct our memories in a way that makes inaccuracies likely.

Courtesy of Elizabeth Loftus

Hundreds of experiments have verified the tendency to construc memories. Misinformation can cause a hammer to be recalled as screwdriver and breakfast cereal to be recalled as eggs, among a myri ad of similar transformations (Loftus & others, 1992). And the mor time that passes before the misleading information is provided, th greater the misinformation effect will be (Loftus, 1992). Even askin students to imagine that something happened, like breaking a windo with their hand, led a quarter of the questioned students to later recal that the event was real (Mazzoni & Memon, 2003).

Think for a minute about how important this finding is. If memor can be altered by the way questions are asked, this has major implica tions for courtroom testimony. A skillful attorney can actually change witness's memory by carefully wording the questions, and the witnes will probably be unaware of the manipulation. When you realize tha eyewitness testimony is one of the most damning kinds of evidence in

criminal trial, you can see that everyone involved—particularly the jury—should be aware of the basic processes that control memory and forgetting. This is just one of many reasons psychology is such a relevant course.

The media spotlight has been shining on two related areas of interest in recent years: children's testimony in alleged cases of child abuse and recovered memories of abuse. Let's look at what researchers have learned about these two important topics.

Elizabeth Loftus (1944–) Psychologist at University of California, Irvine, whose research established the constructed nature of memory.

misinformation effect Incorporating misleading information into a memory of an event.

Children's Recall

Child abuse occurs with alarming regularity, and people who abuse children must be identified and prosecuted as the criminals they are. Yet as important as it is to punish abusers, we must also protect innocent adults from being falsely accused of crimes they did not commit—a situation that also happens regularly. When people are charged with child abuse, their innocence or guilt may be determined by the testimony of young children. Is such testimony reliable? Are children's memories accurate? Let's look at some evidence.

Researchers who have set out to intentionally alter children's memories have been remarkably successful, especially in demonstrating the misinformation effect. Two of the leading researchers in this area (Ceci & Bruck, 1993) were able to plant false memories in preschoolers by interviewing them once a week for 10 weeks and repeatedly asking questions like, "Can you remember going to the hospital with a mousetrap on your finger?" Eventually, a large number of the children constructed stories that ended with mousetraps and hospital visits. The stories were false but convincing, and they were almost impossible to distinguish from true memories.

Researchers have established two general principles about children's memory (see Figure 23.8). First, children's memories grow more accurate with age. Compared with older children and adults, preschool-age

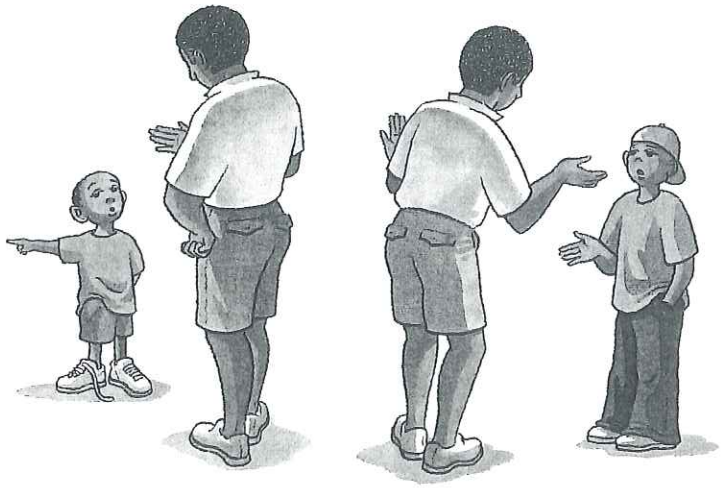


Figure 23.8 The Accuracy of Children's Recall This adult is likely to obtain less accurate information from the child on the left because that child is younger. Older children recall events more accurately than younger children do. Children's memories are also more accurate if the adult uses words the child can understand and refrains from using leading or suggestive questions.

Laura Dwight/PhotoEdit, Inc.

Eager to Please Children crave the approval of adults. This attempt to please makes it more likely that children will remember things the way they think an adult wants them to.

children are more susceptible to suggestion—and therefore less accurate—90 percent of the time (Bruck & Ceci, 1999). For example, studies report that younger children are more likely than older children to falsely report that someone had licked their knee or that something "yucky" had been put in their mouth.

The second and more important principle is that there are ways to minimize these false memories in children. The key is to eliminate the suggestibility and misinformation that can lead children, in their effort to please the adults asking questions, to construct false memories. One surprising example of suggestibility involved the anatomically correct dolls (dolls with realistic sexual details) that investigators often use when asking children about possible abuse. The problem is that these unusual dolls, *in and of themselves*, may suggest to children that they should talk about genital contact. In one study, researchers asked 3-year-olds to use anatomically correct dolls to illustrate how they had been touched during a doctor's examination. Although none of these children had been touched in their genital area, more than half of them reported such contact, apparently because the dolls suggested to the children that such a response was desired (Ceci & Bruck, 1993).

Knowing that young children are prone to constructing false memories, investigators should develop techniques to minimize the misinformation effect. Studies (Howe, 1997; Pipe, 1996) show that children's testimony is most likely to be accurate when the interviewing adult does the following:

- Phrases questions using words the child can understand
- Has had no contact with the child before the investigation
- Uses neutral language and does not ask leading or suggestive questions

Even children younger than 5 years can provide accurate information if these rules are followed (Pipe & others, 2004). But if interviewers violate these rules, children may construct false memories. When that happens, it will be almost impossible to undo the damage and determine what parts of the memories are real. In most cases, children who construct these memories are sincerely trying to do what is right—there is no intentional lying involved.

Recovered Memories

Perhaps you know something about recovered memories from watching the talk shows on daytime television, because this issue has received a great deal of attention in such forums. Celebrities such as Roseanne Barr have claimed that, as adults, they recovered long-repressed memories of childhood abuse. They argue that the trauma of abuse caused the memories to be repressed—buried in the unconscious mind—only to be recovered when triggered by some event years later.

The one indisputable fact in this issue is that childhood physical and sexual abuse unfortunately occur, with devastating effects on the victims. Beyond this, things become murkier. Many sincere, legitimate therapists are convinced that some of their patients have experienced such repression and that they have helped them recover these memories through therapy. Other psychologists are skeptical and worry that well-meaning therapists are leading suggestible people into constructing false memories. Can research on memory help shed light on the truth? Let's break it down into two specific questions:

1. *Can repression of memories occur?* In other words, can a memory of a traumatic event be lost from consciousness? To find out, one researcher (Williams, 1995) located more than 100 adult women who were documented victims of sexual abuse as children. When interviewed, most women did recall the abusive event, but more than a third of them were not able to. Sometimes they recalled other abusive events or were confused about the event in question. Although the victims may have been too young to remember, this research at least leaves the door open—repression of traumatic events may be possible. And, if it is possible to repress the memories into unconsciousness, it may also be possible to recover them.
2. *Can recovered memories be false?* Some therapists, unfortunately, use techniques that seem to increase the likelihood of false memories. As reports of childhood abuse became more common in the 1980s and 1990s, some therapists believed it was important to frame questions in a way that tapped into the possibility of repression. Patients were told that "denial" and "repression" could happen easily. One popular book suggested, "If you are unable to remember any specific instances . . . but still have a feeling that something abusive happened to you, it probably did" (Bass & Davis, 1988, pp. 21–22). The techniques used to "uncover" memories include hypnosis (creating a state of suggestibility and asking the patient about possible past experiences), imagery (having the patient imagine and try to re-create possible past experiences), and dream analysis (exploring the patient's dreams for hidden hints of possible past experiences). In each of these techniques, therapists make suggestions to their patients, which we now know can lead people to unwittingly construct false memories. The authority and prestige of the therapist makes these suggestions even more powerful.

These two conflicting lines of evidence leave the recovered memory debate mired in an unsatisfying and potentially dangerous lack of clarity. Memories may be created, lost, and recovered, which seems to suggest that therapy could be used as a tool to identify previously undiscovered cases of child abuse. However, recovered memories are often inaccurate, and memories relating to events that occurred before the age of 3 (before most people's brains have matured enough to be physically capable of long-term storage) are especially likely to be inaccurate. If a

Sean Roberts/The Everett Collection

Recovered Memory? The controversy over recovered memories has received widespread media attention because of the claims of entertainers like Roseanne Barr, who said that as an adult she recovered memories of childhood abuse. It has been impossible to determine under what circumstances such recovered memories are accurate or false.

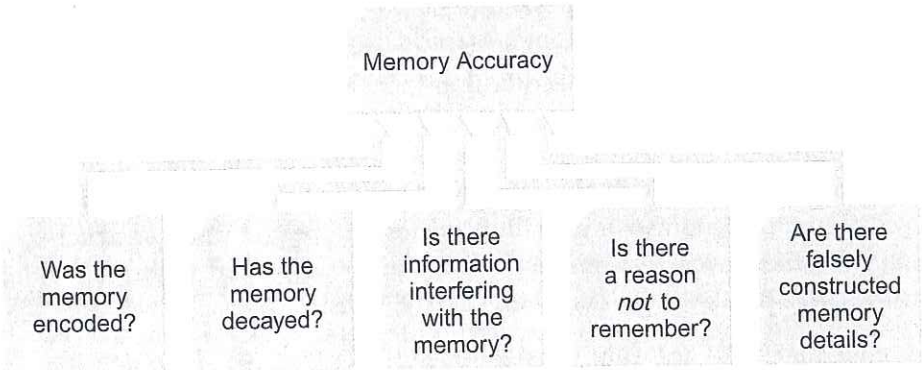


Figure 23.9 Don't Always Trust Your Memory! Why aren't memories more accurate? Many factors contribute to the complicated process of memory. When you consider all that can go wrong, maybe the remarkable thing is that our memories are as accurate as they are.

therapist suggests childhood abuse as a possible source of adult difficulties, this suggestion may function as misinformation that produces false memories.

Victims of child abuse have suffered tremendously. Yet adults falsely accused of abuse based on the "evidence" of recovered memories have suffered, too. Families have been torn apart based on unprovable allegations of childhood abuse that may or may not be true. Perhaps psychological science will one day identify a more reliable way to sort out the false memories. For now, we clearly need to be cautious and avoid jumping to conclusions about recovered memories.

Maybe it is the mysteries about memory that make it so fascinating. Our memories have tremendous power to keep the past alive. They can also deceive us (see Figure 23.9). Even experts suffer from falsely constructed memories. Famous child psychologist Jean Piaget remembered in detail an attempt to kidnap him in a park when he was a child. He had for years been grateful for his nursemaid's efforts to successfully foil the kidnapping. But as an adult, he learned that this vivid memory was false. He had constructed it from a story told by his nursemaid, who later admitted she had lied about the kidnapping attempt. We are accustomed to dealing with fact or fiction, yet memory seems to be fact *and* fiction, with no clear way to distinguish between the two types. Should we trust our memories? Yes, but we should also be aware that they are not always reliable.

THINKING CRITICALLY SUMMARY *Our memories feel accurate, but many experiments indicate that memories can change over time and are influenced in important ways. The misinformation effect can dramatically influence our memories, introducing new details and events into what we recall, which casts doubt on the accuracy of eyewitness testimony. When working with the memories of children, we need to be especially careful to not encourage false memories because children in particular are susceptible to the misinformation effect. Many researchers are investigating claims of recovered memories of child sexual abuse. Studies indicate that it is possible for victims of abuse to repress these memories, but therapists and others can easily influence patients to construct memories of abuse that never happened.*

Module 23: Thinking About Forgetting and Memory Construction

LEARNING GOAL 1: Explain how encoding failure leads to forgetting.

- A common reason for forgetting is encoding failure.
- Some information cannot be retrieved because it was not perceived as important enough to be encoded.

LEARNING GOAL 2: Discuss the forgetting curve and how decay relates to forgetting.

- Some memories decay over time.
- Hermann Ebbinghaus's research indicated that most forgetting happens rapidly after initial learning and then levels off (the forgetting curve).
- Permastore memory is used to describe long-term memories that last beyond about 3 years and are especially resistant to forgetting.

LEARNING GOAL 3: Describe how interference and motivated forgetting can cause forgetting through retrieval failure.

- Retrieval failure—caused by interference or motivated forgetting—probably accounts for most forgetting.
  - Interference occurs when information you learned in the past interferes with the recall of information you learned more recently (proactive interference) or when information you learned recently interferes with the recall of information you learned in the past (retroactive interference).
  - Motivated forgetting occurs when forgetting provides protection from anxiety or from potentially distressing information.

LEARNING GOAL 4: Discuss how the misinformation effect can lead to false, constructed memories.

- Elizabeth Loftus demonstrated the tendency to construct memories.
- The misinformation effect refers to our tendency to incorporate misleading information into a memory.
- Constructed memories and the misinformation effect have important implications for courtroom testimony, especially the accuracy of eyewitness testimony.
- Studies indicate that children may be especially prone to constructed memories and the misinformation effect.
- Reports of recovered memories (adult memories of physical and sexual abuse suffered as children) are controversial, and memory researchers continue to try to uncover the truth about this phenomenon.

Check Your Vocabulary

For each definition, choose the best-matching term from the list that follows.

Definitions

___ 1. Founder of psychoanalysis, a controversial theory about the workings of the unconscious mind.

___ 2. German philosopher who conducted pioneering memory studies.

___ 3. In Sigmund Freud's psychoanalytic theory, the process of moving anxiety-producing memories to the unconscious mind.

___ 4. Incorporating misleading information into a memory of an event.

___ 5. Long-term memories that are especially resistant to forgetting and are likely to last a lifetime.

___ 6. Process of getting information into the memory system.

___ 7. Process of getting information out of memory storage.

___ 8. Retention of encoded information over time.

___ 9. Psychologist at University of California, Irvine, whose research established the constructed nature of memory.

___ 10. When a more recent memory disrupts the recall of an older memory.

___ 11. When an older memory disrupts the recall of a newer memory.

Terms

a. encoding
b. Elizabeth Loftus (1944–)