Pearson New International Edition

Psychology: Core Concepts

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mirror writing—writing while looking at his hands in a mirror (Milner et al., 1968; Raymond, 1989). In fact, his *procedural* memory for motor tasks was quite normal, even though he couldn't remember learning these skills and didn't even know he knew them.

But you don't have to have brain damage like H. M. to have memories of which you are unaware. A normal memory has disconnected islands of information too. For more than 100 years, psychologists have realized that people with no memory defects can know something without knowing they know it. Psychologist Daniel Schacter (1992, 1996) calls this **implicit memory:** memory that can affect your behavior without coming into full awareness. By contrast, **explicit memory** requires conscious awareness.

implicit memory A memory that was not deliberately learned or of which you have no conscious awareness.

explicit memory Memory that has been processed with attention and can be consciously recalled.

Procedural memories are often implicit, as when golfers remember how to swing a club without thinking about how to move their bodies. Likewise, H. M.'s mirror writing was an implicit memory. But implicit memories are not limited to procedural memory—nor is explicit memory the same as declarative memory. Information in your semantic store can be either *explicit* (such as in remembering the material you have studied for a test) or *implicit* (such as knowing the color of the building in which your psychology class is held). The general rule is this: A memory is implicit if it can affect behavior or mental processes without becoming conscious. Explicit memories, on the other hand, always involve consciousness during storage and retrieval.

In striking new studies, Skotko et al. (2004) found that H. M. could learn some new semantic material through implicit channels—that is, even though he didn't know he learned it. To do this, Skotko's group exploited H. M.'s favorite pastime of doing crossword puzzles. They devised crosswords that linked new information with knowledge H. M. had at the time of his operation: For example, H. M. knew that polio was a dreaded disease, but the polio vaccine was not discovered until after his surgery, so he had no knowledge of it. Yet by working on a specially designed crossword puzzle over a five-day period, H. M. learned to respond correctly to the item, "childhood disease successfully treated by Salk vaccine." Similarly, he was able to learn that Jacqueline Kennedy, wife of assassinated President John Kennedy, subsequently became Jacqueline Onassis. This technique, then, showed that H. M.'s problem was primarily one of explicit memory.

Read H.M.'s Obituary from *The New York Times* at **MyPsychLab**

Retrieval Cues

For accurate retrieval, both implicit and explicit memories require good cues. You have some understanding of such cues if you've ever used search terms in Google or another Internet search engine: Make a poor choice of terms, and you come up either with nothing or with Internet garbage. Long-term memory works much the same way, where a successful search requires good mental **retrieval cues** (the "search terms" used to recover a memory). Sometimes the only retrieval cue required to reactivate a long-dormant experience is a certain odor, such as the smell of fresh-baked cookies you associated with visiting Grandma's house. Other times, the retrieval cue might be an emotion, as when a person struggling with depression gets caught in a maelstrom of depressing memories. In our story of Ross at the beginning of the chapter, something in his dream may have served as a retrieval cue for the memory he had long forgotten.

retrieval cue Stimulus used to bring a memory to consciousness or to cue a behavior.

On the other hand, some memories—especially semantic ones—are not so easily cued. During a test, for example, you may draw a blank if the wording of a question doesn't match the way you framed the material in your mind as you were studying. In other words, your memory may fail if the question isn't a good retrieval cue. In general, whether a retrieval cue is effective depends on the type of memory being sought and the web of associations in which the memory is embedded. The take-home lesson here? The more extensive your web of associations, the greater the chance of retrieving the information. Let's examine ways you can use this information to your advantage.

Retrieving Implicit Memories by Priming A quirk of implicit memory landed former Beatle George Harrison in court (Schacter, 1996). Lawyers for a singing group known as the Chiffons claimed the melody in Harrison's song "My Sweet Lord" was

nearly identical to that of the Chiffon classic "He's So Fine." Harrison denied that he deliberately borrowed the melody, but conceded he had heard the Chiffons's tune prior to writing his own. The court agreed, stating that Harrison's borrowing was a product of "subconscious memory." Everyday life abounds with similar experiences, says Daniel Schacter (1996). You may have proposed an idea to a friend and had it rejected, but weeks later your friend excitedly proposed the same idea to you, as if it were entirely new.

In such real-life situations it can be hard to say what prompts an implicit memory to surface. Psychologists have, however, developed ways to "prime" implicit memories in the lab (Schacter, 1996). To illustrate, imagine you have volunteered for a memory experiment. First, you are shown a list of words for several seconds:

assassin, octopus, avocado, mystery, sheriff, climate

Then, an hour later, the experimenter asks you to examine another list and indicate which items you recognize from the earlier list: twilight, assassin, dinosaur, and mystery. That task is easy for you. But then the experimenter shows you some words with missing letters and asks you to fill in the blanks:

c h _ _ _ _ n k, o _ t _ _ u s, _ o g _ y _ _ _, _ l _ m _ t e

It is likely that answers for two of these pop readily into mind, *octopus* and *climate*. But chances are that you will be less successful with the other two words, *chipmunk* and *bogeyman*. This difference is due to **priming**, the procedure of providing cues that stimulate memories without awareness. Because you had been primed with the words *octopus* and *climate*, they more easily "popped out" in your consciousness than did words that had not been primed.

CONNECTION

Priming is also a technique for studying nonconscious processes.

priming A technique for cuing implicit memories by providing cues that stimulate a memory without awareness of the connection between the cue and the retrieved memory.

Retrieving Explicit Memories

Anything stored in LTM must be "filed" according to its pattern or meaning. Consequently, the best way to add material to long-term memory is to associate it, while in working memory, with material already stored in LTM. We have called that process *elaborative rehearsal*. Encoding many such connections by elaborative rehearsal gives you more ways of accessing the information, much as a town with many access roads can be approached from many directions.

Meaningful Organization

One way of retrieving information from explicit memory involves getting the general idea or *gist* of an event, rather than a memory of the event as it actually occurred. Suppose you hear the sentence, "The book was returned to the library by Mary." Later, when asked if you heard the sentence, "Mary returned the book to the library," you may indeed mistakenly remember having heard the second sentence. This happens because we tend to remember the meaning or sense of the words—the **gist**—rather than the exact words themselves.

gist (pronounced *JIST*) The sense or meaning, as contrasted with the exact details.

If you'll forgive us for repeating ourselves, we want to underscore the practical consequences of LTM being organized by meaning. *Storing new information in LTM usually requires that you make the information meaningful while it is in working memory.* This means that you must associate new information with things you already know. Sometimes it is important to remember all the details accurately (as in memorizing a mathematical formula), while at other times the important thing is to remember the gist (as when you read the case study of H. M.). In attempting to remember the gist, it is especially important to think of personal examples of the concepts and ideas you want to remember. (Are you getting into the habit of identifying personal examples of chapter concepts yet?)

Recall and Recognition

Explicit memories can be cued in two primary ways. One involves the kinds of retrieval cues used on essay tests; the other involves cues found on multiple choice tests. Essay tests require **recall** or retrieving a memory with minimal retrieval cues. That is, on an essay test, you must create an answer almost entirely from memory, with the help of only minimal cues from a question such as, "What are the two ways to cue explicit memories?"

recall A retrieval method in which one must reproduce previously presented information.

Recognition, on another hand, is the method required by multiple-choice tests. In a recognition task, you merely identify whether a stimulus has been previously experienced. Normally, recognition is less demanding than recall because the cues are much more complete. Incidentally, the reason people say, "I'm terrible with names, but I never forget a face," is because recall (names) is usually tougher than recognition (faces).

recognition A retrieval method in which one must identify present stimuli as having been previously presented.

The police use recognition when they ask an eyewitness to identify a suspect in a lineup. The witness is required only to match an image from memory (the crime) against a present stimulus (a suspect in the lineup). And what would be a comparable recall task? A witness working with a police artist to make a drawing of a suspect must recall, entirely from memory, the suspect's facial characteristics.

Of course, recognizing a previously recognized stimulus doesn't necessarily mean that stimulus matches the current context. We run into this problem on multiple-choice exams when several options offer concepts we have learned, but only one of them is a match to the particular question. Similarly, suspects have been falsely identified in police lineups by eyewitnesses if, for example, police have shown the eyewitness books of mug shots that include one or more of the suspects in the lineup. In these cases, eyewitnesses can mistakenly identify a suspect because they recognize him from the mug shot book rather than the actual crime (Weiner et al., 2003). Thus, although recognition generally produces more memories than recall, it also is more likely to produce false positives—or, in this case, false memories.

Other Factors Affecting Retrieval

We have seen that the ability to retrieve information from explicit declarative memory depends on whether the information was encoded and elaborated to make it meaningful. You won't be surprised to learn that alertness, stress level, drugs, and general knowledge also affect retrieval. Less well known, however, are the following, which relate to the context in which you encoded a memory and also the context in which you are remembering.

Encoding Specificity The more closely retrieval cues match the form in which the information was encoded, the better they will cue the appropriate memory. For example, perhaps you saw your psychology professor at the grocery store, but needed a moment to recognize who she or he was because the context didn't cue you to think "psychology professor." On the other hand, talking to a childhood friend may have cued a flood of memories you hadn't thought about for years. These two experiences illustrate the **encoding specificity principle,** which says successful recall depends on how well retrieval cues match cues present when the memory was encoded.

encoding specificity principle The doctrine that memory is encoded and stored with specific cues related to the context in which it was formed. The more closely the retrieval cues match the form in which the information was encoded, the better it will be remembered.

So, one important thing you can do in studying for exams is to anticipate what retrieval cues are likely to be on the test and organize your learning around those probable cues. Students who merely read the material and hope for the best may have trouble. In fact, this is such a common problem that psychologist Robert Bjork (2000) has suggested teachers introduce "desirable difficulties" into their courses to encourage students to encode the material in multiple ways. What are desirable difficulties? Bjork argues that by giving students assignments that require them to interact with the material in many different ways—projects, papers, problems, and presentations—professors help students build a greater web of associations into which a memory is embedded—and the more connections there are, the easier it becomes to cue a memory. If your own professor doesn't do this, what can you do to create more associations with the concepts you are learning?

Mood and Memory Information processing isn't just about facts and events; it's also about emotions and moods. We use the expressions "feeling blue" and "looking at the world through rose-colored glasses" to acknowledge that moods bias our perceptions. Likewise, our moods can also affect what we remember, a phenomenon called **mood-congruent memory.** If you have ever had an episode of uncontrollable giggling, you know how a euphoric mood can trigger one silly thought after another. And at

mood-congruent memory A memory process that selectively retrieves memories that match (are congruent with) one's mood.

Alexander Raths/Shutterstock

Because mood affects memory, people with depression may remember and report more negative symptoms to a physician. As a result, their treatment may differ from that given to patients with the same condition who do not have depression.

prospective memory The aspect of memory that enables one to remember to take some action in the future—as remembering a doctor's appointment.

the other end of the mood spectrum, people with depression often report that all their thoughts have a melancholy aspect. In this way, depression can perpetuate itself through retrieval of depressing memories (Sakaki, 2007).

Not just a laboratory curiosity, mood-congruent memory can also have important health implications. Says memory researcher Gordon Bower, "Doctors assess what to do with you based on your complaints and how much you complain" (McCarthy, 1991). Because people with depression are likely to emphasize their medical symptoms, they may receive different treatment from that dispensed to more upbeat individuals with the same disease. This, says Bower, means physicians must learn to take a person's psychological state into consideration when deciding on a diagnosis and a course of therapy.

Prospective Memory One of the most common memory tasks involves remembering to perform some action at a future time—such as keeping a doctor's appointment, going to lunch with a friend, or setting out the garbage cans on the appointed day. Psychologists call this **prospective memory.** Surprisingly, this important process of remembering to remember has received relatively little study. We do know a failure in prospective memory can have consequences that range from merely inconvenient and embarrassing to horrific:

> After a change in his usual routine, an adoring father forgot to turn toward the day care center and instead drove his usual route to work at the university. Several hours later, his infant son, who had been quietly asleep in the back seat, was dead (Einstein & McDaniel, 2005, p. 286).

How could such a terrible thing happen? The father probably became distracted from his intended task and fell into his customary routine. In situations like this, when people have to remember to deviate from their usual routine, they typically rely on *continuous monitoring,* which means trying to keep the intended action in mind. Continuous monitoring, however, can be easily derailed by distraction or habit. So if you find yourself in that situation, your best bet is to use a reliable prompt—which for the father may have meant placing his briefcase in the backseat with his child. Another good technique involves thinking of a specific cue you expect to encounter just before the required task. The father, for example, might have visualized a prominent landmark he would see just before the turn off his usual route and then focused on that landmark as a memory cue.

Craig Aurness/Corbis

The Washington Monument is an example of a tapered stone object that is topped by a pyramid-shaped point. Can you recall the name for such objects? Or is it "on the tip of your tongue"?

TOT phenomenon The inability to recall a word, while knowing that it is in memory. People often describe this frustrating experience as having the word "on the tip of the tongue."

[PSYCHOLOGY MATTERS]

On the Tip of Your Tongue

Answer as many of the following questions as you can:

- What is the North American equivalent of the reindeer?
- What do artists call the board on which they mix paints?
- What is the name for a tall, four-sided stone monument with a point at the top of its shaft?
- What instrument do navigators use to determine latitude by sighting on the stars?
- What is the name of a sheath used to contain a sword or dagger?
- What is the name of a small Chinese boat usually propelled with a single oar or pole?

If this demonstration works as expected, you couldn't remember all the answers, but you had a strong sense you had them somewhere in memory. You might say that the answer was "on the tip of your tongue." Appropriately enough, psychologists refer to this near-miss memory as the **TOT phenomenon** (Brown, 1991). Surveys show that

most people have a "tip-of-the-tongue" (TOT) experience about once a week. Among those who watch *Jeopardy*, it may occur even more frequently. And, according to a recent study, deaf persons who use sign language sometimes have a "tip of the fingers" (TOF) experience in which they are sure they know a word but cannot quite retrieve the sign (Thompson et al., 2005). Obviously, then, some fundamental memory process underlies both the TOT and the TOF phenomena.

The most common TOT experiences center on names of personal acquaintances, names of famous persons, and familiar objects (Brown, 1991). About half the time, target words finally do pop into mind, usually within about one agonizing minute (Brown & McNeill, 1966).

What accounts for the TOT phenomenon? One possibility—often exploited in laboratory studies—involves inadequate context cues. This is probably what made you stumble on some of the items above: We did not give you enough context to activate the schema associated with the correct answer.

Another possibility involves *interference:* when another memory blocks access or retrieval, as when you were thinking of Jan when you unexpectedly meet Jill (Schacter, 1999). And, even though you were unable to recall some of the correct words in our demonstration of TOT (caribou, palette, obelisk, sextant, scabbard, sampan), you may have spotted the right answer in a recognition format. It's also likely that some features of the sought-for words abruptly popped to mind ("I know it begins with an *s!*"), even though the words themselves eluded you. So the TOT phenomenon occurs during a recall attempt when there is a weak match between retrieval cues and the encoding of the word in long-term memory.

And we'll bet you can't name all seven dwarfs.

Check Your Understanding

Study and Review at MyPsychLab

1. **APPLICATION:** Remembering names is usually harder than remembering faces because names require _____, while faces merely require _____.
2. **APPLICATION:** At a high school class reunion, you are likely to experience a flood of memories that would be unlikely to come to mind under other circumstances. What memory process explains this?
3. **APPLICATION:** Give an example of mood-congruent memory.
4. **APPLICATION:** Give an example of a situation that would require prospective memory.
5. **RECALL:** A person experiencing the TOT phenomenon is unable to _____ a specific word.
   a. recognize **c.** recall
   b. encode **d.** process
6. **UNDERSTANDING THE CORE CONCEPT:** An implicit memory may be activated by priming, and an explicit memory may be activated by a recognizable stimulus. In either case, a psychologist would say that these memories are being
   a. cued. **c.** encoded.
   b. recognized. **d.** chunked.

Answers 1. recall/recognition **2.** Encoding specificity **3.** Good examples involve situations in which people who are feeling a strong emotion or mood selectively remember experiences associated with that mood. Thus, during a physical exam, a depressed person might report more unpleasant physical symptoms than would a happy person. **4.** Prospective memory involves having to remember to perform some action at a time in the future, such as taking medicine tonight, stopping at the grocery store on the way home, or calling one's parents next Friday evening. **5.** c **6.** a

4 KEY QUESTION
Why Does Memory Sometimes Fail Us?

We forget appointments and anniversaries. During a test you can't remember the terms you studied the night before. Or a familiar name seems just out of your mental reach. Yet, ironically, we sometimes cannot rid memory of an unhappy event. Why does memory play these tricks on us—making us remember what we would rather forget and forget what we want to remember?

According to memory expert Daniel Schacter, the culprit is what he terms the "seven sins" of memory: *transience, absent-mindedness, blocking, misattribution, suggestibility, bias,* and *unwanted persistence* (Schacter, 1999, 2001). Further, he claims these seven problems are really consequences of some very useful features of human memory. From an evolutionary perspective, these features stood our ancestors in good stead, so they are preserved in our own memory systems. Our Core Concept puts this notion more succinctly:

Core Concept 4

Most of our memory problems arise from memory's "seven sins"—which are really by-products of otherwise adaptive features of human memory.

While examining the "seven sins," we will consider such everyday memory problems as forgetting where you left your keys or the inability to forget an unpleasant experience. We will also explore strategies for improving memory by overcoming some of Schacter's "seven sins"—with special emphasis on how certain memory techniques can improve your studying. We begin with the frustration of fading memories.

transience The impermanence of a long-term memory. Transience is based on the idea that long-term memories gradually fade in strength over time.

Transience: Fading Memories Cause Forgetting

How would you do on a rigorous test of the course work you took a year ago? We thought so—because unused memories seem to weaken with time. Although no one has directly observed a human memory trace fade and disappear, much circumstantial evidence points to this **transience**, or impermanence, of long-term memory—the first of Schacter's "sins."

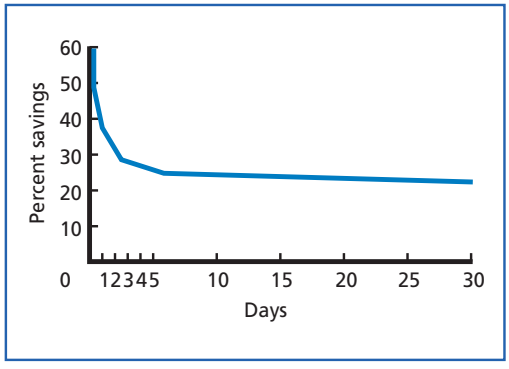

FIGURE 10

Ebbinghaus's Forgetting Curve

Ebbinghaus's forgetting curve shows that the savings demonstrated by relearning drops rapidly and reaches a plateau, below which little more is forgotten.

Source: Zimbardo, P. G., & Gerrig, R. J. (1999). *Psychology and Life,* 15th ed. Boston, MA: Allyn and Bacon. Copyright © 1999 by Pearson Education. Reprinted by permission of the publisher.

Ebbinghaus and the Forgetting Curve In a classic study of transience, pioneering psychologist Hermann Ebbinghaus (1908/1973) first learned lists of *nonsense syllables* (such as POV, KEB, FIC, and RUZ) and tried to recall them over varying time intervals. This worked well over short periods, up to a few days. But to measure memory after long delays of weeks or months, when recall had failed completely, Ebbinghaus had to invent another method: He measured the number of trials required to *relearn* the original list. Because it generally took fewer trials to relearn a list than to learn it originally, the difference indicated a "savings" that could serve as a measure of memory. (If the original learning required ten trials and relearning required seven trials, the savings was 30 percent.) By using the *savings method,* Ebbinghaus could trace memory over long periods of time. The curve obtained from combining data from many experiments appears in Figure 10 and represents one of Ebbinghaus's most important discoveries: *For relatively meaningless material, we have a rapid initial loss of memory followed by a declining rate of loss.* Subsequent research shows that this **forgetting curve** captures the pattern of transience by which we forget much of the verbal material we learn.

forgetting curve A graph plotting the amount of retention and forgetting over time for a certain batch of material, such as a list of nonsense syllables. The typical forgetting curve is steep at first, becoming flatter as time goes on.

Modern psychologists have built on Ebbinghaus's work but now have more interest in how we remember *meaningful* material, such as information you read in this text. Meaningful memories seem to fade too—though, fortunately, not as rapidly as Ebbinghaus's nonsense syllables. Current research sometimes uses brain scanning techniques, such as fMRI and PET, to visualize the diminishing brain activity that characterizes forgetting (Schacter, 1996, 1999).

CONNECTION

fMRI and PET are brain scanning techniques that form images of especially active regions in the brain.

Not all memories, however, follow the classic forgetting curve. We often retain well-used motor skills, for example, substantially intact in procedural memory for many years, even without practice—"just like riding a bicycle." Memory for foreign languages learned, but not used for a long period of time, also seems to remain relatively intact (subject to less forgetting than Ebbinghaus predicted) for as long as 50 years