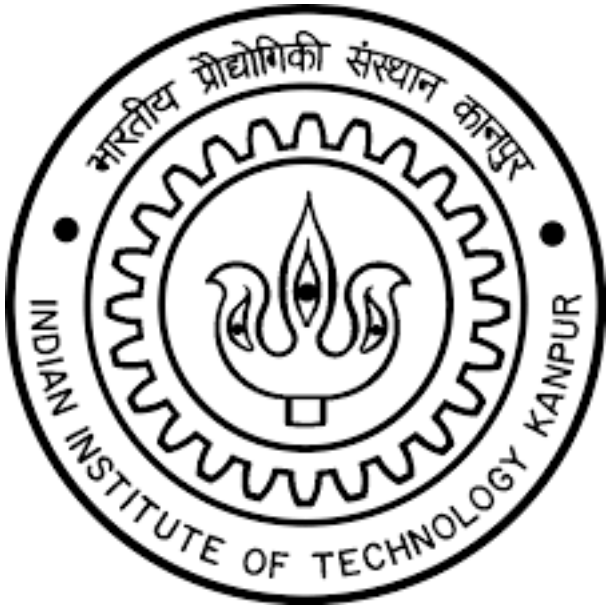

Indian Institute of Technology
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In Collaboration
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Presents

Course Title:

Basic Cognitive Processes

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Lecture 33: Memory - V

Types of Long Term Memory

- The two main division of LTM are **explicit memory** & **implicit memory.**

- **Explicit Memory** consists of **episodic memory**, i.e. memory for personal experiences and **semantic memory** i.e. stored knowledge and memory for facts.

- **Implicit Memories** are memories that are used without awareness, so the contents of implicit memories cannot be reported (Smith & Grossman, 2008).

- Implicit Memories are of three types:
    - **Priming** - change in response to a stimulus caused by the previous presentation of the same or a similar stimulus. an example of priming would be finding it easier to recognise words that are familiar or that have been recently seen compared to words that have been rarely encountered.
    - **Procedural Memory**: is the memory for doing things. e.g. typing notes
    - **Classical Conditioning** is a form of learned memory.

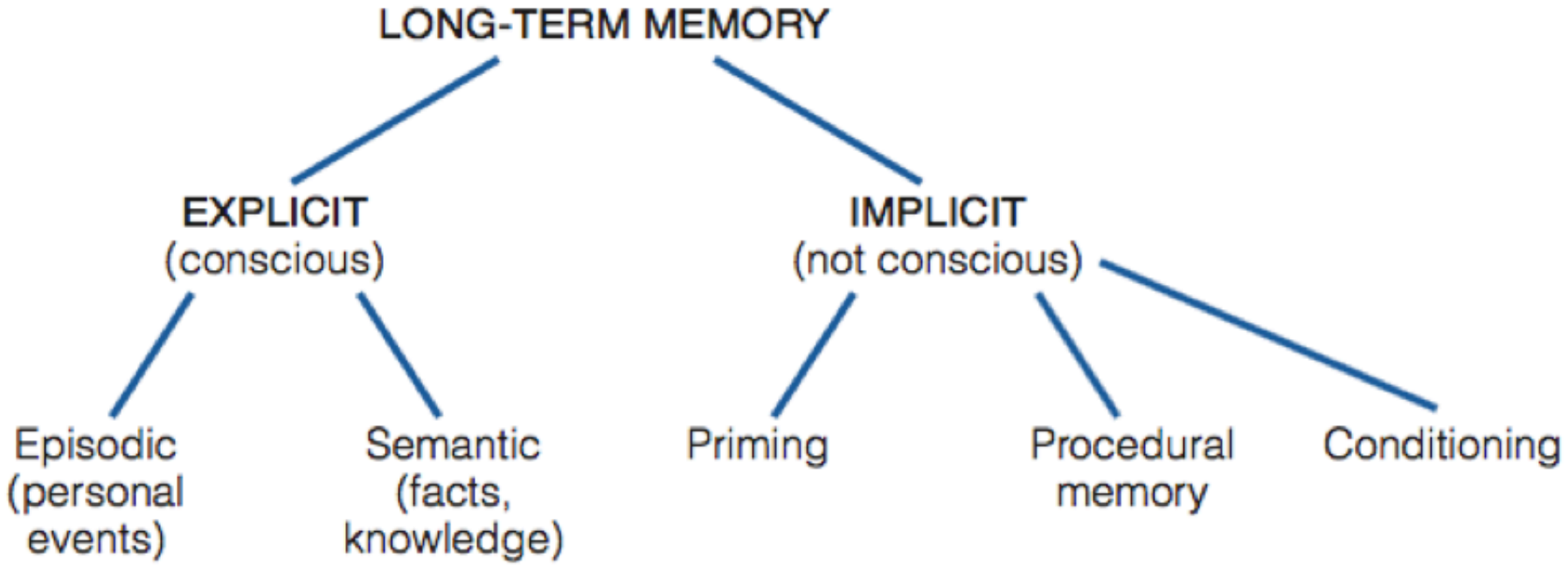
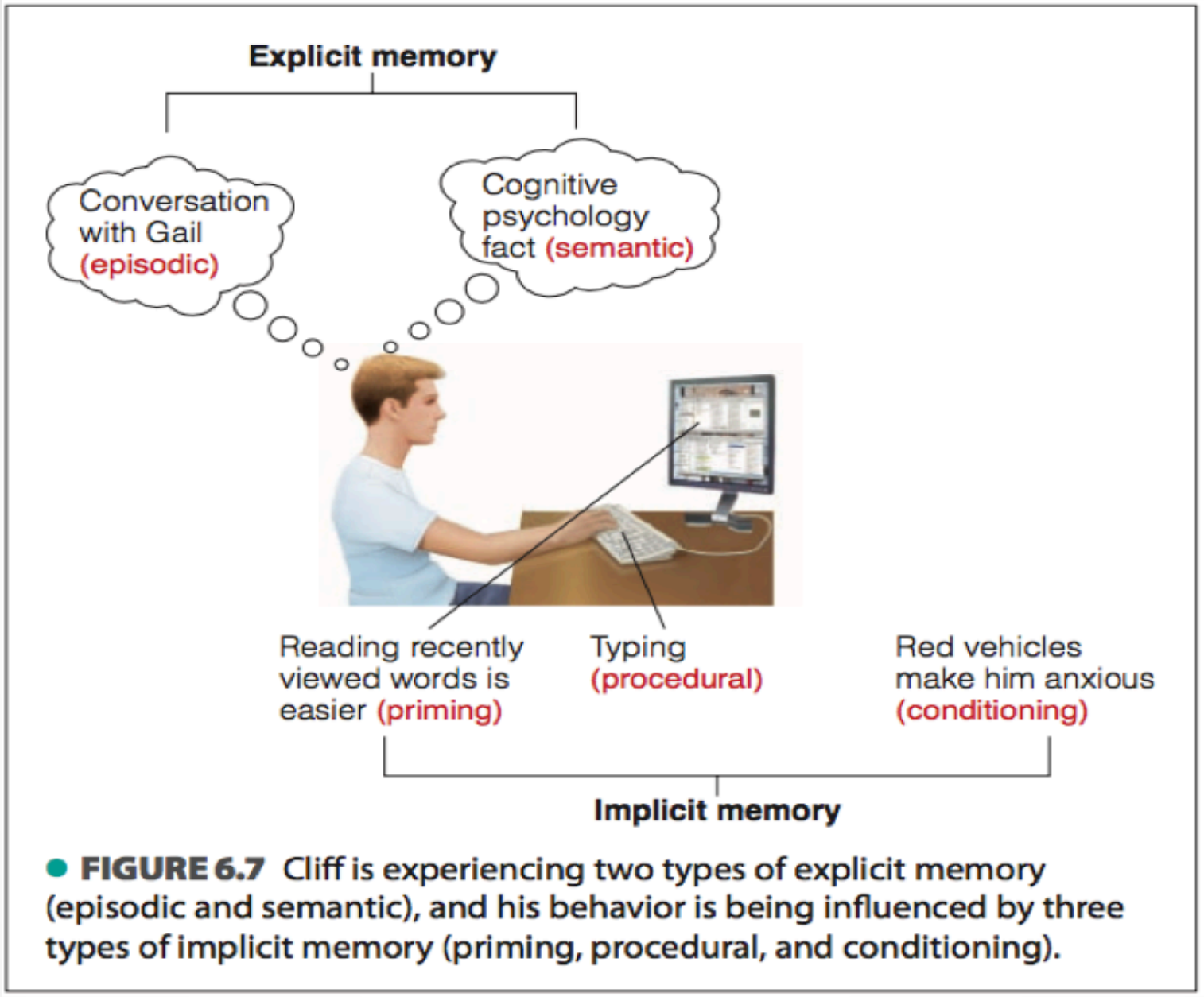


FIGURE 6.6 Long-term memory can be divided into explicit memory and implicit memory. We can also distinguish between two types of explicit memory, episodic and semantic. There are a number of different types of implicit memory. Three of the main types are priming, procedural memory, and conditioning.

Image: Goldstein (2010). Cognitive Psychology: Connecting Mind, researh & Everyday Experience. *Wadsworth Publishing.* (Fig. 6.6, p. 156)



● **FIGURE 6.7** Cliff is experiencing two types of explicit memory (episodic and semantic), and his behavior is being influenced by three types of implicit memory (priming, procedural, and conditioning).

Image: Goldstein (2010). Cognitive Psychology: Connecting Mind, researh & Everyday Experience. *Wadsworth Publishing.* (Fig. 6.7, p. 157)

Episodic and Semantic Memory (Explicit)

- Acc. to Tulving, the defining property of the experience of episodic memory is that it involves **mental time travel -** the experience of traveling back in time to reconnect with events that happened in the past. For e.g. One can travel back on the evening in 2011 when India won the cricket world cup.

- Tulving describes this experience of mental time travel/ episodic memory as self - knowing or remembering.

- In contrast to the mental time travel property of episodic memory, the experience of semantic memory involves accessing knowledge about the world that does not have to be tied to remembering a personal experience.

- This knowledge can be of things like facts, vocabulary, numbers & concepts. When we experience, *semantic memory*, we are not traveling back in time to a specific event from our past, but we are accessing things that we 'know' about.

- **The Separation of Episodic & Semantic Memories**

  - **Neuropsychological Evidence**: We first consider the case of K.C., who at the age of 30 rode his motorcycle off a freeway exit ramp and suffered severe damage to his hippocampus and surrounding structures (Rosenbaum et al., 2005).

  - As a result of this injury, K.C. lost his episodic memory - he can no longer relive any of the events of his past.

  - However, he knows, that certain things happened which would correspond to semantic memory.

- He is aware of the fact that his brother died two years ago, but is not aware of the things related to his brother's death & those circumstances that he experienced then; like hearing of the situations of his brother's death etc.

- K.C. also remembers facts like where the eting utensils are located in the kitchen and the difference between a strike and a spare in bowling.

- Thus, K.C. has lost the episodic part of his memory, but his semantic memory is largely intact.

- An opposite case was that of an Italian woman who was in normal health until she suffered an attack of encephalitis at the age of 44 (De Renzi et al., 1987).

- The first signs of the problem were headaches ^ a fever, which were later followed by hallucinations lasting for upto 5 days.

- When she returned home after a 6 - week stay in the hospital, she had difficulty in recognising familiar people; she had trouble shopping because she could not remember the meaning of words on the shopping list or where things were in the store.

- She could no longer recognise famous people or recall facts such as the identity of Beethoven or the fact that Italy was involved in World War II. AA of these are semantic memories.

- Despite this severe impairment of memory for semantic information, she was still able to remember events in her life.

- She could remember what she had done during the day & things that had happened weeks or months before.

- Thus, although she had lost semantic memories, she was still able to form new episodic memories.

- These cases taken together, demonstrate a double dissociation between episodic memory and semantic memory, which supports that idea that memory for these two types of information probably involves different mechanisms.

TABLE 6.2 Dissociations of Episodic and Semantic Memory

	Semantic	Episodic
K.C.	OK	Poor
Italian woman	Poor	OK

Image: Goldstein (2010). Cognitive Psychology: Connecting Mind, researh & Everyday Experience. *Wadsworth Publishing.* (Table 6.2, p. 159)

- **Brain Imaging Evidence:** Evidence for separate mechanisms has also been provided by the results of brain imaging experiments.

- Levine et al., (2004) had participants keep diaries on audiotape describing every day personal events (example: "It was the last night our Salsa dance class…") & facts drawn from their semantic knowledge ("By 1947, there were 5,000 Japanese Canadian living in Toronto.").

- When the participants later listened to these audiotaped descriptions while in an MRI scanner, the recordings of everyday events elicited detailed episodic autobiographical memories (people's own experiences); while the other recordings simply reminded people of facts.

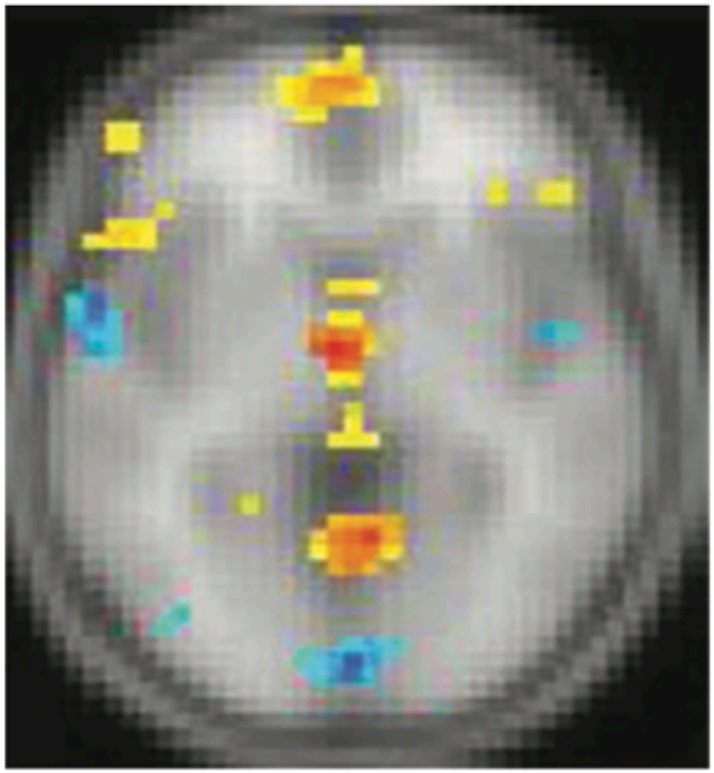


FIGURE 6.8 Brain showing areas activated by episodic and semantic memories. The yellow areas represent brain regions associated with episodic memories; the blue areas are regions associated with semantic memories. (Source: B. Levine et al., "The Functional Neuroanatomy of Episodic and Semantic Autobiographical Remembering: A Prospective Functional MRI Study," *Journal of Cognitive Neuroscience, 16,* 1633–1646, 2004 , MIT Press Journals.)

Image: Goldstein (2010). Cognitive Psychology: Connecting Mind, researh & Everyday Experience. *Wadsworth Publishing.* (Fig. 6.8, p. 159)

- The results of the experiment indicated that while there is overlap between activation caused by episodic and semantic memories, there are major differences.

- Other research has also found differences between the ares activated by episodic and semantic memory (Cabeza & Nyberg, 2000).

- **Connections between episodic and semantic memories :** The distinction between episodic and semantic memories have been extremely useful for understanding memory mechanisms.

- Although episodic & semantic memories have been shown to be connected in a variety of ways.

- For e.g. when we are learning facts (potential semantic memories), we are usually simultaneously having a personal experience such as sitting in the class or studying in the library.

- **Episodic Memories Can Be Lost, Leaving Only Semantic Memories**: One can remember a lot of times important semantic information for example that the Parliament of India consists of the Lok Sabha & the Rajya Sabha in a Civics Class.

- Years later, one might still know these facts about the parliament but forget about the situations where you learned these facts.

- **Semantic Memory Can Be Enhanced If Associated With Episodic Memory:** For example: If knowledge about the facts associated with high school graduation has personal significance, it will be remembered better.

- Westmacott & Moscovitch (2003) showed that participants have better recall for names of public figures, such as actors, singers & politicians, whom they associate with personal experiences.

- **Semantic Memory Can Influence Our Experience by Influencing Attention:** For example: Abhishek & Aditi are watching a game of cricket.

- Later, Aditi remembers the details of the play, for example the Batsman X was caught on square leg while playing a pull shot to a spinner. However, Abhishek does not remember this information, he just remembers that the batsman got out.

- Aditi could recall better because she was the member of the college girls cricket team while Abhishek hs never been fond of cricket much.

Priming, Procedural Memory & Conditioning

- **Priming:** occurs when the presentation of one stimulus (the priming stimulus) changes the response to a subsequent test stimulus (the test stimulus), either positively or negatively, which causes an increase in speed or accuracy of the response to the test stimulus or decrease in the speed or accuracy of the response.

- One type of positive priming, **repetition priming,** occurs when the test stimulus is the same oas or resembles the priming stimulus. For example: seeing the word *bird* may cause you to respond more quickly to another representation of the word *bird* than to a word you had not seen.

- ***Conceptual Priming*** occurs when the enhancement caused by the priming stimulus is based on the meaning of the stimulus. For example, presentation of th word *furniture* might cause you to respond faster to a later presentation of the word chair.

- Many experiments have been done in which researchers have demonstrated implicit memory using techniques. An example is provided by an experiment by Peter Graf & coworkers (1985), who tested three groups of participants: 1) eight amnesia patients with Korsakoff's syndrome and two patients another form of amnesia 2) patients without amnesia who were under treatment for alcoholism and 3) patients without amnesia who had no history of alcholism.

- Graf & coworkers presented list of words to their participants and asked them to rate each word on a scale of 1 to 5 based on how much they liked each word (1 = like extremely; 5 = dislike extremely).

- This caused participants to focus on rating the words rather than on committing the words to memory.

- Immediately after rating the words in the lists, participants were tested in one of two ways: (1) a test of explicit memory, in which there were asked to recall the words they had seen & (2) a test of implicit memory, in which they were presented with 3 - letter fragments and were asked to add a few letters to create the first word that came to their mind.

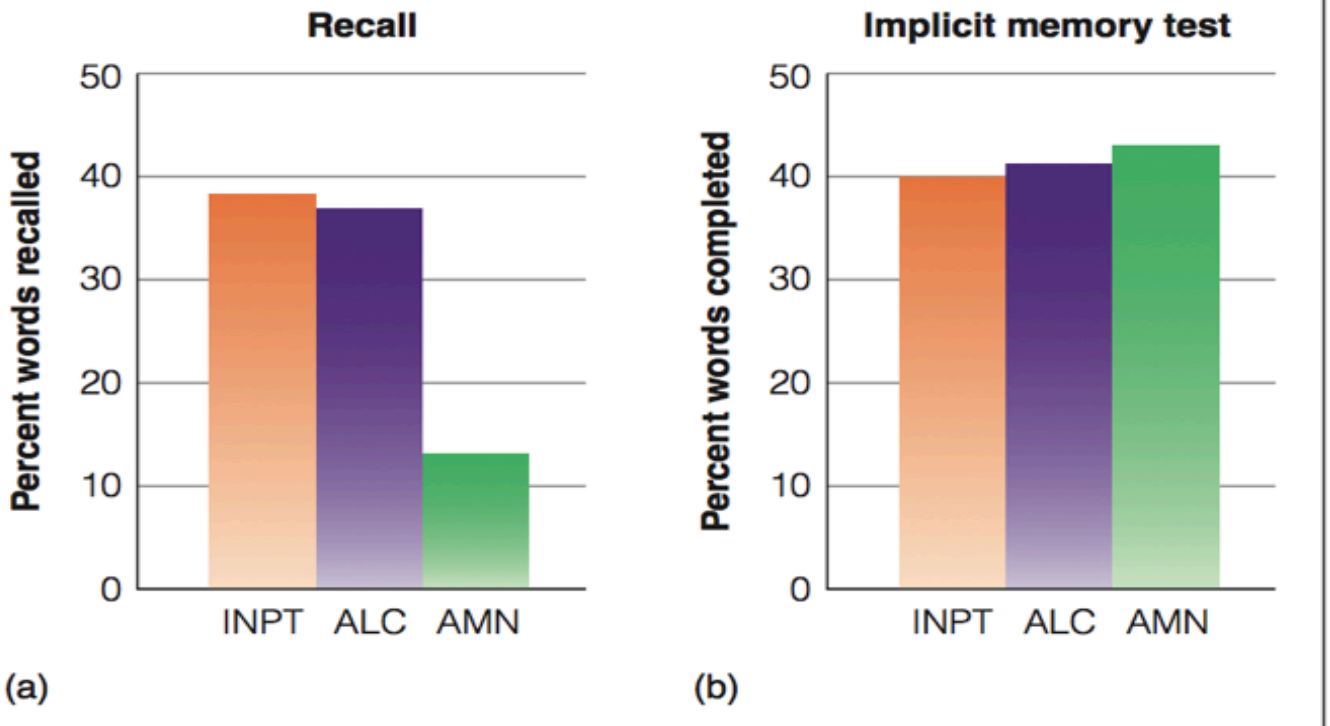


FIGURE 6.10 Results of the Graf et al. (1985) experiment. (a) The results of the recall test indicate that the amnesic patients (AMN) did poorly on the test compared to the medical inpatients (INPT) and the alcoholic controls (ALC). (b) The results of the implicit memory test, in which the task was to complete three-letter word stems, shows that the amnesic patients performed as well as the other patients. (Source: P. Graf, A. P. Shimamura, & L. R. Squire, "Priming Across Modalities and Priming Across Category Levels: Extending the Domain of Preserved Function in Amnesia," *Journal of Experimental Psychology: Learning, Memory, and Cognition, 11*, 386–396, 1985.)

Image: Goldstein (2010). Cognitive Psychology: Connecting Mind, researh & Everyday Experience. *Wadsworth Publishing.* (Fig. 6.10, p. 162)

- The results of the recall experiment showed that the amnesia patients had poor recall compared to the two control groups.
- This poor recall confirms the poor explicit memory associated with their amnesia.
- But the result of the implicit memory test, tells a different story: these results indicate the percentage of primed words that were created in the word completion test; demonstrates that the amnesia patient performed just as well as the controls.
- This shows that priming can occur even when there is little explicit memory for words.

- Another example, of repetition priming in a person with brain damage was presented in an experiment by Warrington & Weiskrantz (1968), who tested 5 patients with Korsakoff's syndrome.

- The researchers presented incomplete pictures, such as the ones in Fig 6.11 and the participants's task was to identify the picture.

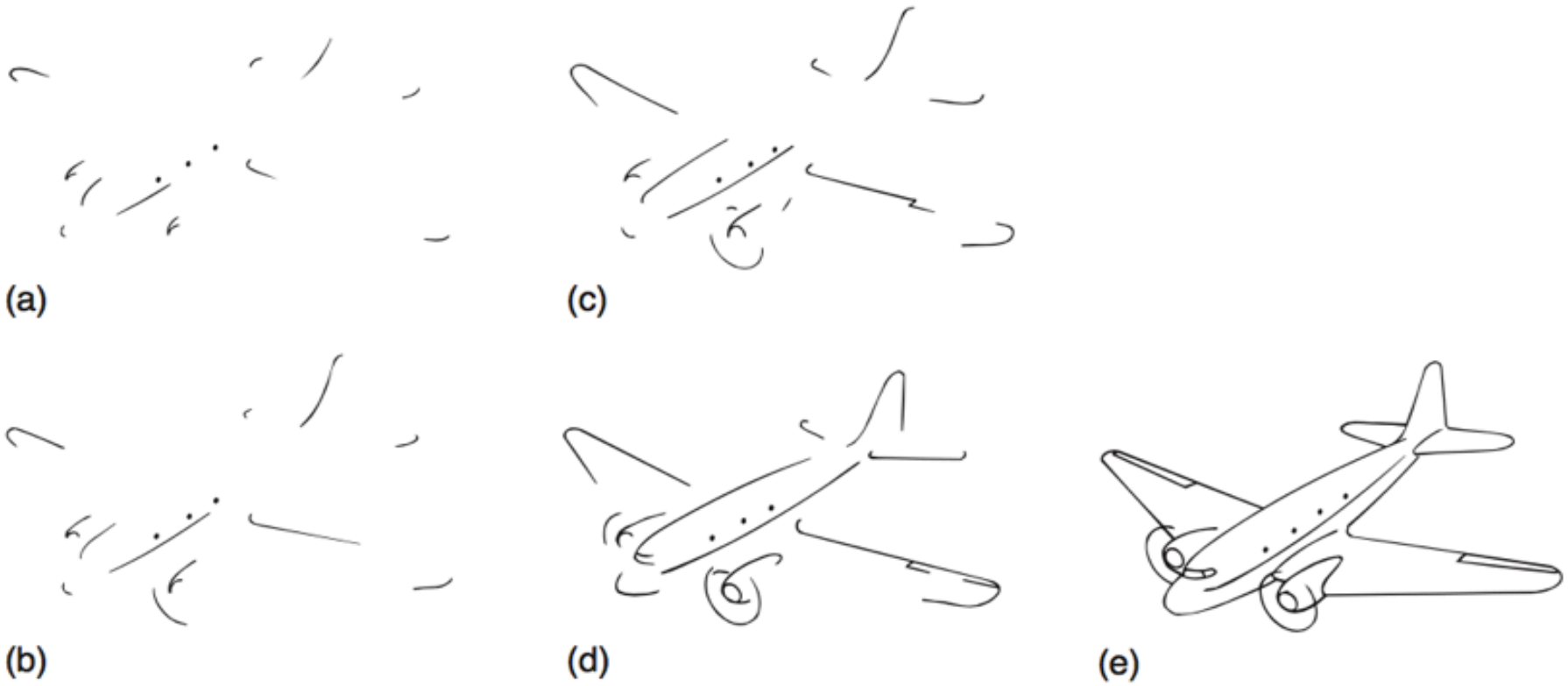


FIGURE 6.11 Incomplete pictures developed by Gollin (1960) that were used by Warrington and Weiskrantz (1968) to study implicit memory in patients with amnesia.

(Source: E. K. Warrington & L. Weiskrantz, "New Method of Testing Long-Term Retention With Special Reference to Amnesic Patients," *Nature, London, 217,* March 9, 1968, 972–974, Figure 1. Copyright © 1968 Nature Publishing Group. Republished with permission.)

Image: Goldstein (2010). Cognitive Psychology: Connecting Mind, researh & Everyday Experience. *Wadsworth Publishing.* (Fig. 6.11, p. 163)

- The results shown in Fig 6.12 indicate that by the third day of testing these participants made fewer errors before identifying the pictures than they did at the beginning of training, even though they had no memory for any of previous day's training.

- The improvement of performance represents an effect of implicit memory because the patients learned from experience even though they could not remember having the experience.

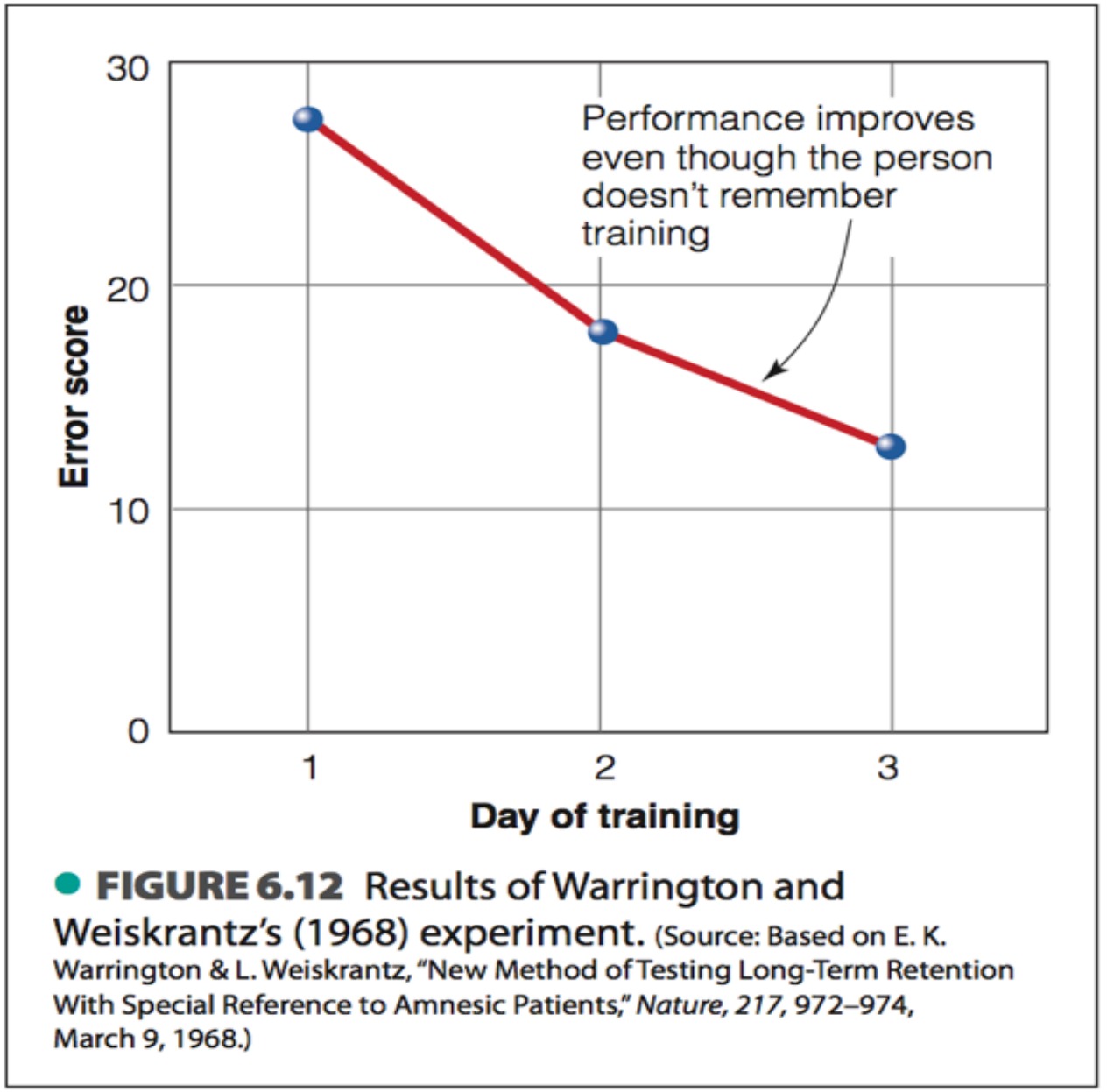


FIGURE 6.12 Results of Warrington and Weiskrantz's (1968) experiment. (Source: Based on E. K. Warrington & L. Weiskrantz, "New Method of Testing Long-Term Retention With Special Reference to Amnesic Patients," *Nature, 217,* 972–974, March 9, 1968.)

Image: Goldstein (2010). Cognitive Psychology: Connecting Mind, researh & Everyday Experience. *Wadsworth Publishing.* (Fig. 6.12, p. 163)

- **Procedural Memory**: Also called *skill memory* because it is memory for doing things that usually require action.

- The implicit nature of procedural memory has been demonstrated in amnesia patients who can master a skill without remembering any of the practice that led to this mastery. For example: H.M. practiced a task called *mirror drawing,* which involves copying a picture that is seen in mirror.

- After days of practice H.M. became quite good at mirror drawing, though each time he did it, he thought he was practicing for the first time.

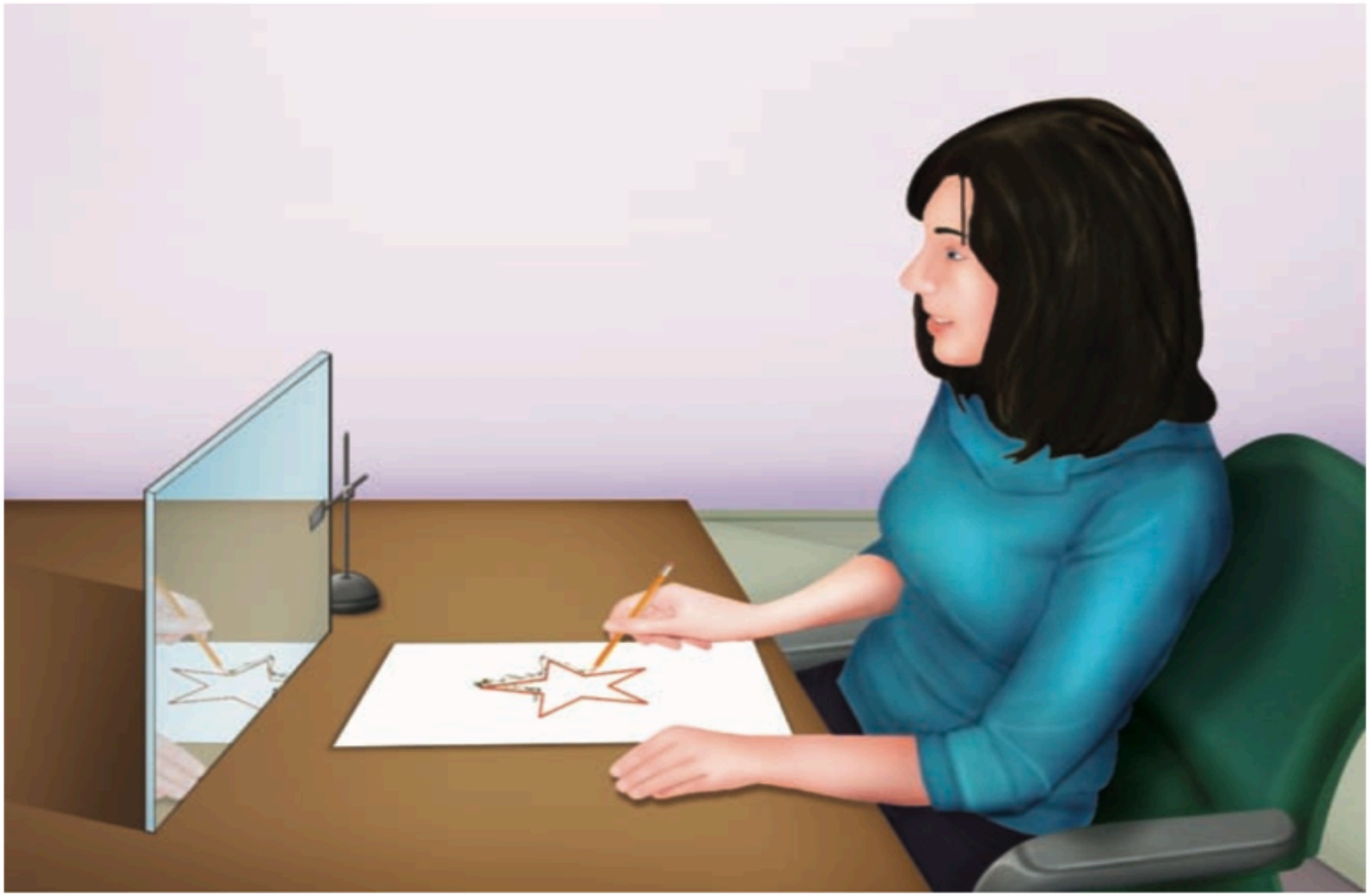


FIGURE 6.13 Mirror drawing. The task is to trace the outline of the star while looking at its image in the mirror.

Image: Goldstein (2010). Cognitive Psychology: Connecting Mind, researh & Everyday Experience. *Wadsworth Publishing.* (Fig. 6.12, p. 163)

- Other amnesia patients, as well also demonstrated no loss of procedural memory.
    - Jimmy G. could still tie his shoes.
    - Clive Wearing could still play piano.
    - K.C. , the middle – aged Italian woman, who had lost his episodic memory, now learned how to sort books in the library

- That Amnesic people can still retain skills learned in the past & even learn new skills, led to an approach of rehabilitating patients with amnesia by teaching them new tasks, that they can easily master, even though they cannot learn the episode of training (Bolognani et al., 2000; Clare & Jones, 2008).

- One can also understand the nature of implicit memory by examining their own experiences.

- For example: Do you remember how your learn to ride a cycle? Or to maintain balance while on the bike?

- **Classical Conditioning** occurs when the followingtwo kinds of stimuli are paired.
  - (a) a neutral stimulus that intially does not result in a response and
  - (b) a conditioning stimulus that results in a response.
- An example could be:
  - food > salivating response.
  - food + bell > salivating response.
  - bell > salivating response.

- Conditioning is evolutionary useful as it allows organisms to develop expectations that helps them prepare for contingencies (both good & bad).

References

- Goldstein (2010). Cognitive Psychology: Connecting Mind, Research & Everyday Experience. *Wadsworth Publishing*