Cognitive Psychology

Lecture 6: Long-term Memory part I

Outline for today

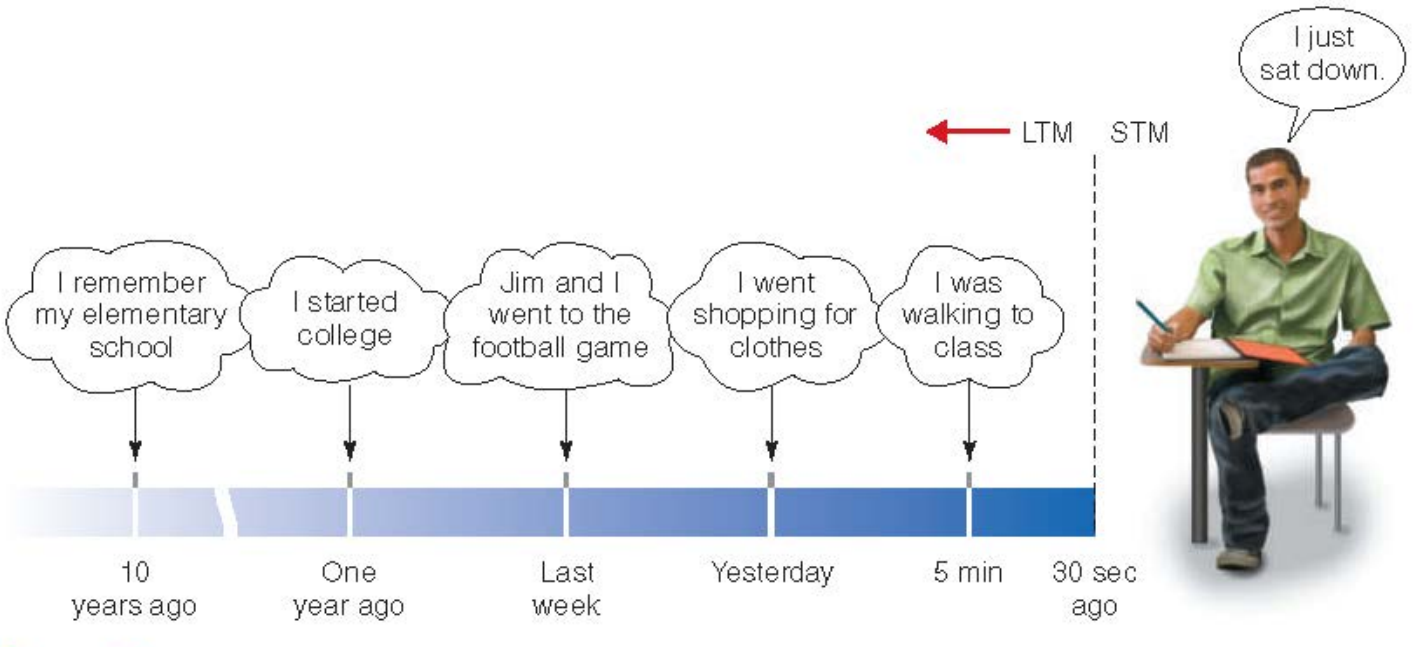
- Long-Term Memory (LTM)
  - How it differs from STM/WM
  - How it interacts with STM/WM
  - Types of LTM
    - Implicit
    - Explicit

What is long-term memory?

- “Archive” of information about past events and knowledge learned
- Works closely with working memory
- Storage stretches from a few moments ago to as far back as one can remember
- More recent memories are more detailed

What is long-term memory?

- LTM covers a span that stretches from about 30 seconds ago to your earliest memories
  - Why 30 seconds ago?



LTM interacts with STM / WM

She went to the Met with her Uncle

I just saw the Matisse exhibit at the Met with my Uncle

STM ⇄ LTM

Her uncle lives in CA

The Met is in NY

He must have flown here

Matisse is an artist

She likes art

LTM interacts with STM / WM

- Remember these words:

Green

LTM interacts with STM / WM

- Wait…. Keep trying to remember those words

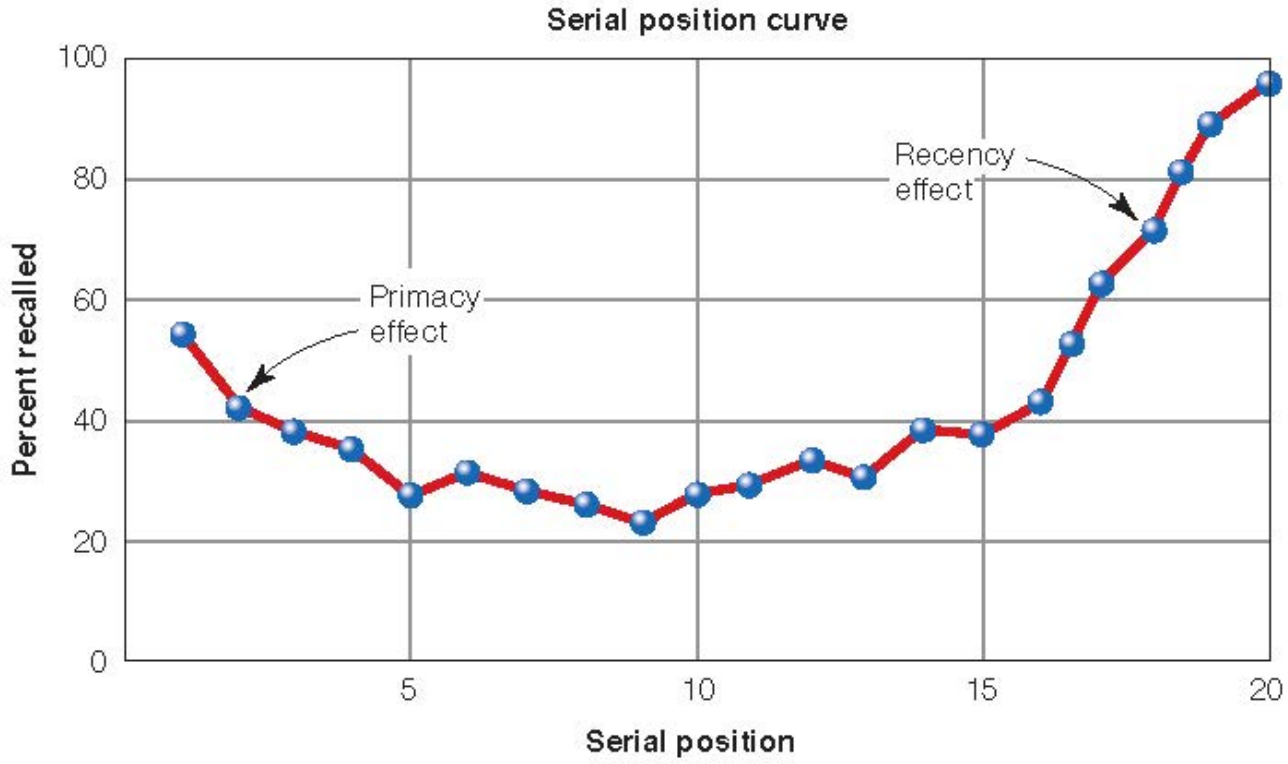
LTM interacts with STM / WM

- Write down as many as you can remember

LTM interacts with STM / WM

The serial position curve

1. Blink
2. Clear
3. Plant
4. Allow
5. Troop
6. Apple
7. Dream
8. Field
9. Green



LTM interacts with STM / WM

Primacy effect:

- Better performance for words early in the list
  - Early > Middle

- The earlier on the list the word is, the more time you have to rehearse it
  - Therefore, stored in LTM

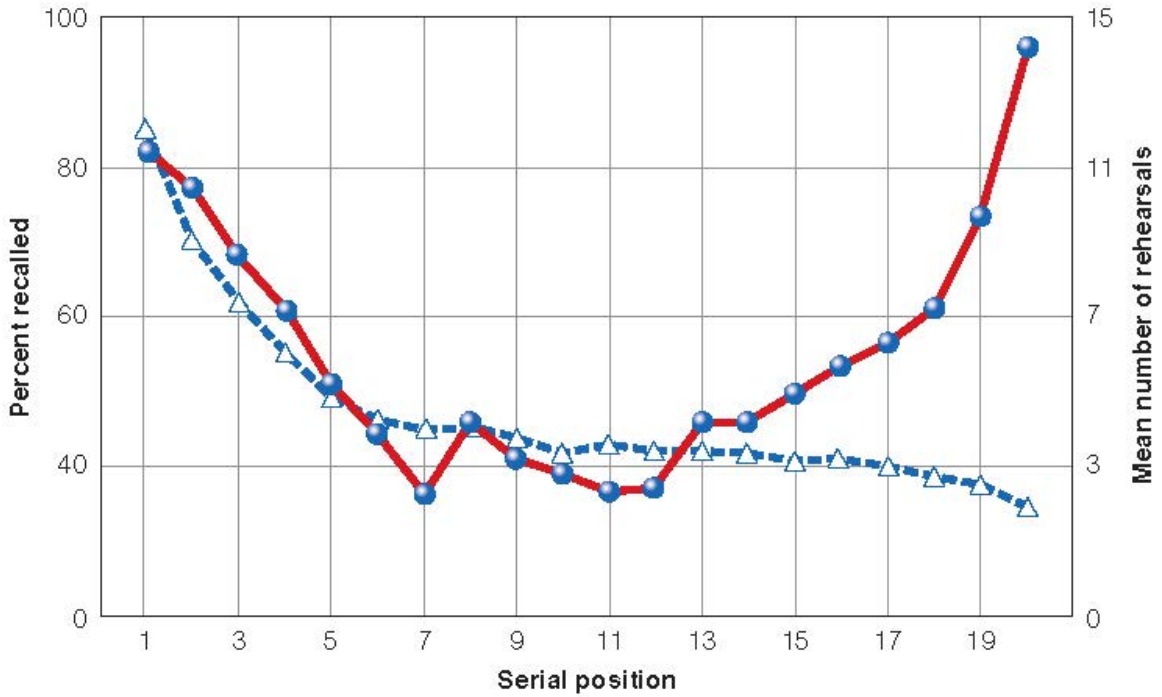


Figure 6.4 Results of Rundus's (1971) experiment. The solid red line is the usual serial position curve. The dashed blue line indicates how many times the subjects rehearsed (said out loud) each word on the list. Note how the rehearsal curve matches the initial part of the serial position curve. *(Source: D. Rundus, Analysis of rehearsal processes in free recall,* Journal of Experimental Psychology, *89, 63–77, Figure 1, p. 66, 1971.)*

LTM interacts with STM / WM

Recency effect:

- Better performance for words at the end of the list
  - Late > Middle

- These items are still in short-term memory
  - If you add 30-second delay to the end of the list, this effect goes away

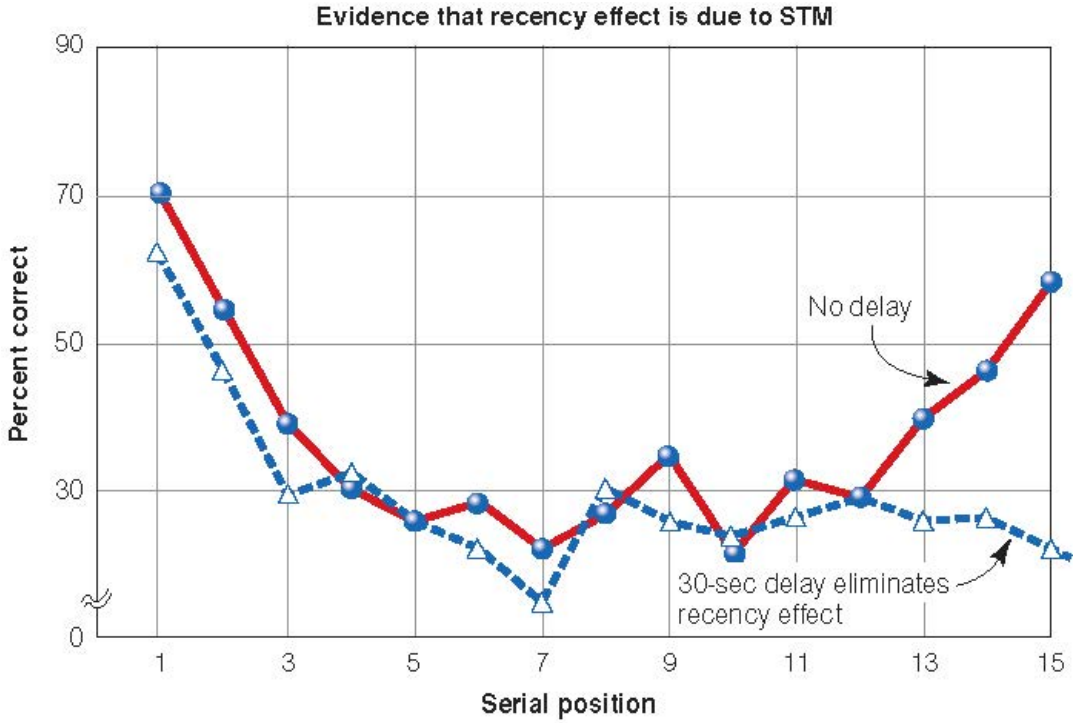


Figure 6.5 Results of Glanzer and Cunitz's (1966) experiment. The serial position curve has a normal recency effect when the memory test is immediate (solid red line), but no recency effect occurs if the memory test is delayed for 30 seconds (dashed blue line). *(Source: M. Glanzer & A. R. Cunitz, Two storage mechanisms in free recall,* Journal of Verbal Learning and Verbal Behavior, *5, 351–360, Figures 1 & 2. Copyright © 1966 Elsevier Ltd. Republished with permission.)*

Comparing LTM & STM / WM

How is information represented or "coded" in memory?

Table 6.2: Examples of Coding in Short-Term and Long-Term Memory

CODE	SHORT-TERM MEMORY	LONG-TERM MEMORY
Visual	Holding an image in the mind to reproduce a visual pattern that was just seen (Della Sala, page 138)	Visualizing what the Lincoln Memorial in Washington, D.C., looked like when you saw it last summer
Auditory	Representing the sounds of letters in the mind just after hearing them (Conrad, page 135)	A song you have heard many times before, repeating over and over in your mind
Semantic	Placing words in an STM task into categories based on their meaning (Wickens, page 157)	Recalling the general plot of a novel you read last week (Sachs, page 159)

Comparing LTM & STM / WM

Wickens, 1976

- How do we know that words are coded semantically in memory?

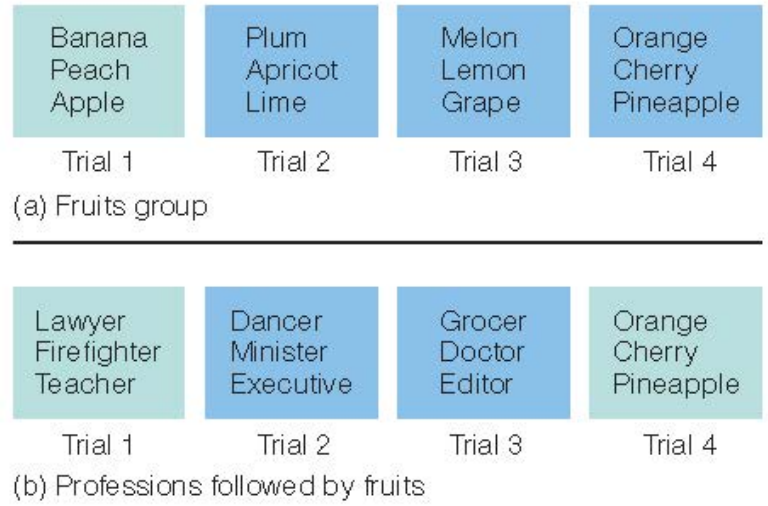
- Memory task with words from categories
  - Category 1: Fruits
  - Category 2: Professions

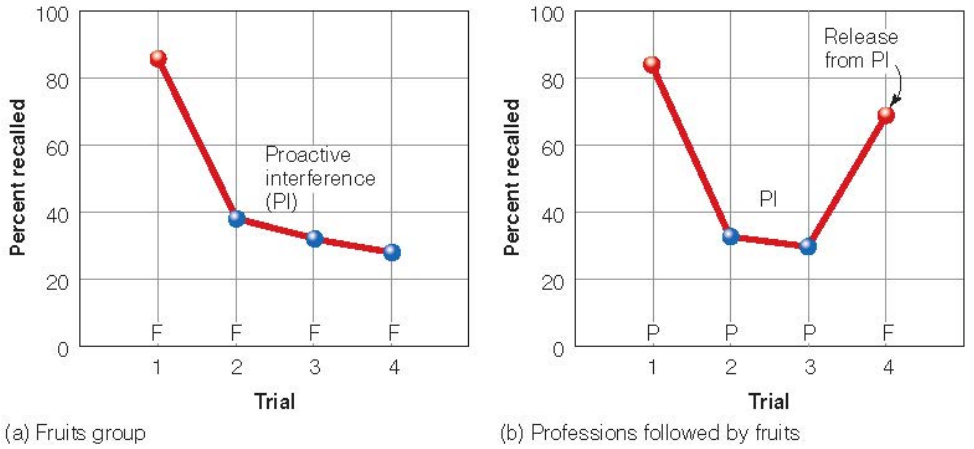
Comparing LTM & STM / WM

Wickens, 1976

- How do we know that words are coded semantically in memory?

- Proactive interference can caused by word meaning
- Proactive interference is ”released” if you shift categories





Methodological note

- Recall: generate on own
  - What sentences did you hear/see?
  - E.g., fill-in-the-blank tests

- Recognition: judge stimulus as old/new
  - Did you see this sentence?
  - E.g., multiple choice tests

Comparing LTM and STM / WM

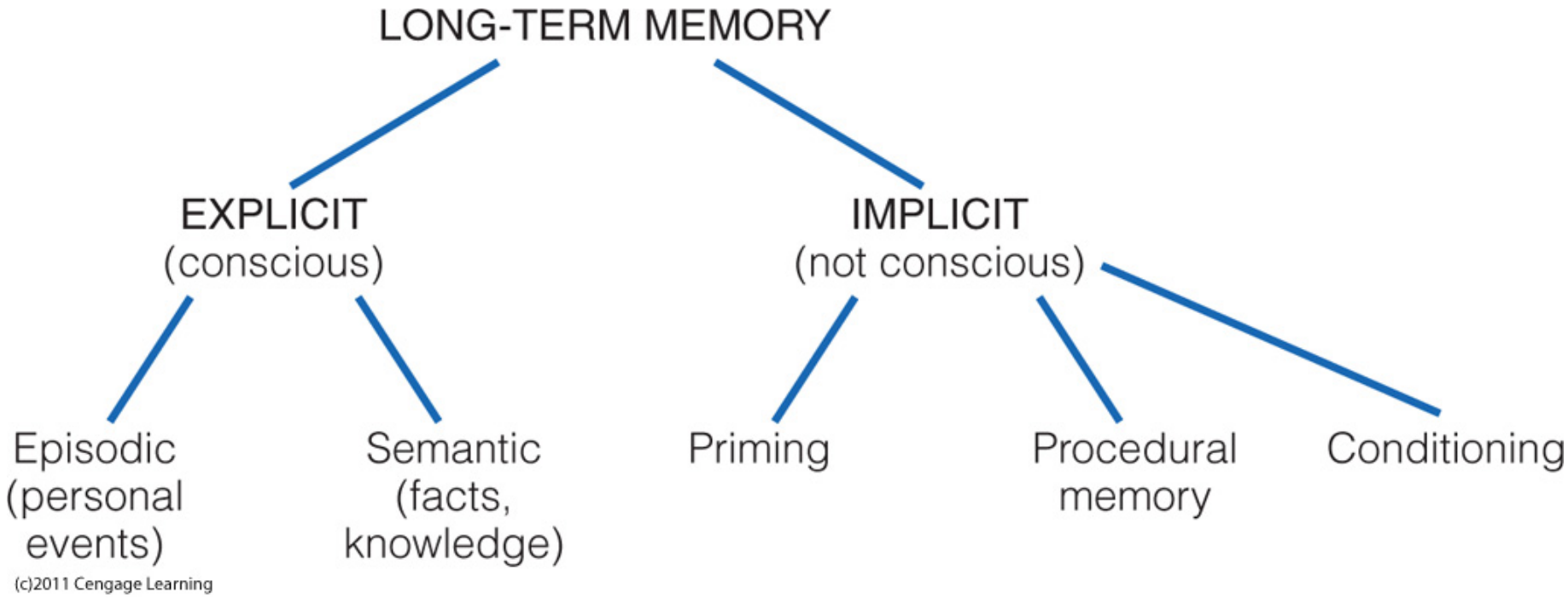
- How do we know that these “types” of memory systems are caused by different mechanisms that can act independent?

- Double dissociation

Table 6.3: A Double Dissociation for STM and LTM

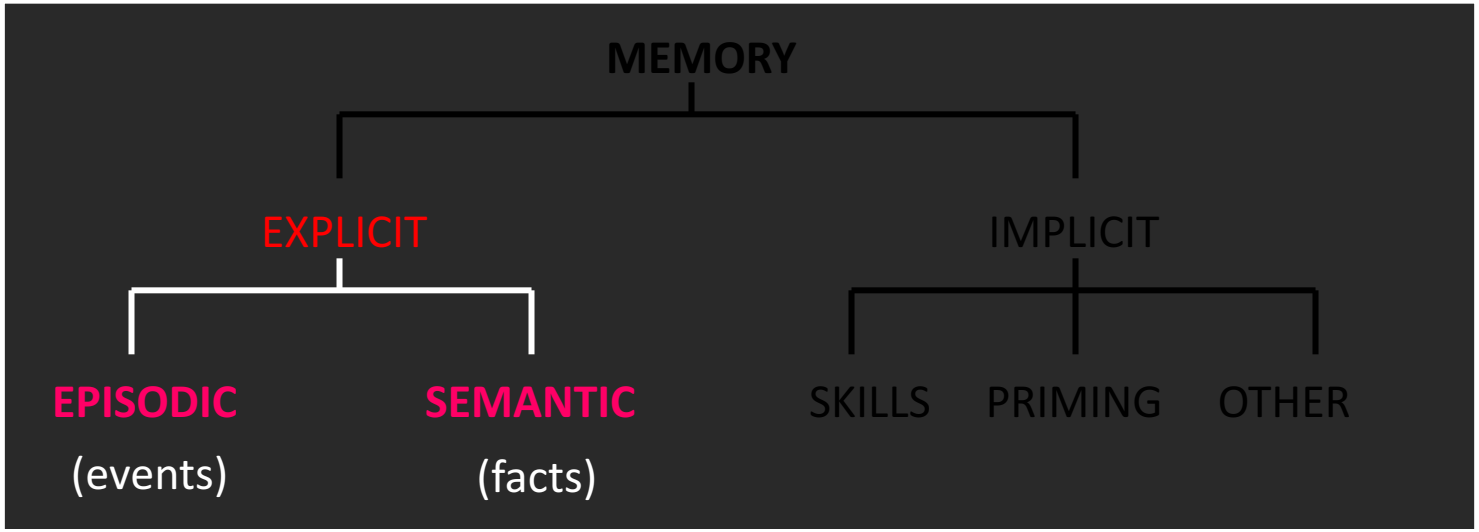
PATIENT	STM	LTM
H.M. and Clive Wearing	OK	Impaired
K.F.	Impaired	OK

Types of Long-Term Memory



Explicit memory

- **EPISODIC MEMORY**: Memory for Past Events that are Specific in Place and Time
  - (e.g. your 16th Birthday Party)
- **SEMANTIC MEMORY**: General World Knowledge
  - (e.g. George Washington was the first president of the United States)



Explicit Memory

- Episodic involves mental time travel
  - No guarantee of accuracy
- Semantic does not involve mental time travel
  - General knowledge
- Episodic memories can be come semanticized

Explicit Memory

- Episodic and semantic show a double dissociation

Table 6.4: A Double Dissociation for Semantic and Episodic Memory

PATIENT	SEMANTIC	EPISODIC
K.C.	OK	Poor
Italian woman	Poor	OK

Explicit Memory

- Episodic and semantic show a double dissociation
  - K.C.
    - Can remember facts like his brother died
    - Cannot remember personal experiences, like how he heard about his brothers death
  - Italian Woman
    - Cannot remember facts, meanings of words
    - Can remember events in her life; things she had done that day, that week, etc.

Explicit Memory

Interactions between episodic and semantic memory

- Knowledge (semantic memories) can guide our experiences
  - Changes how we attend, how we perceive
- And therefore, affects how our episodic memories develop

Explicit Memory

Interactions between episodic and semantic memory

- Episodic can be lost, leaving only semantic
- “Semanticization of remote memories”
  - Acquiring knowledge may start as episodic but then “fade” to semantic
  - E.g., Do you remember where you were when you learned the capital of Vermont? How about the capital of France?
  - E.g., High School Graduation:
    - Who
    - What
    - Where
    - When

Explicit Memory

- Semantic can be enhanced if associated with episodic
  - Autobiographical memories
  - Personal semantic memories

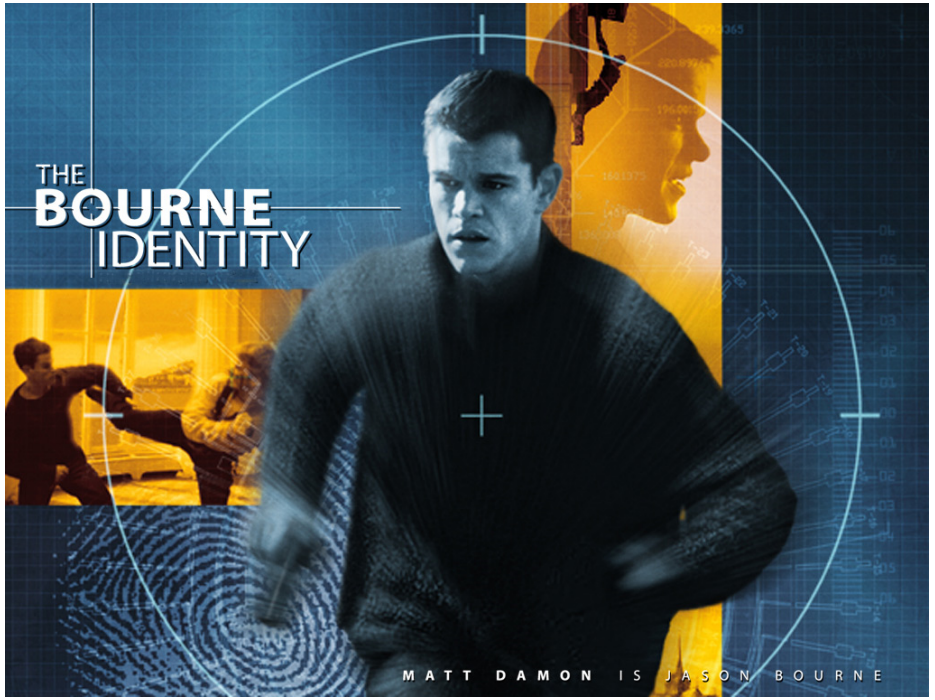
Table 6.5: Types of Long-Term Memory

TYPE	DEFINITION	EXAMPLE
Episodic	Memory for specific personal experiences, involving mental time travel back in time to achieve a feeling of reliving the experience.	I remember going to get coffee at Le Buzz yesterday morning and talking with Gil and Mary about their bike trip.
Semantic	Memory for facts.	There is a Starbucks down the road from Le Buzz.
Autobiographical	People's memories for experiences from their own lives. These memories have both episodic components (relived specific events) and semantic components (facts related to these events). These semantic components of autobiographical memory are *personal semantic memories.*	I met Gil and Mary at Le Buzz yesterday morning. We sat at our favorite table near the window, which is often difficult to get in the morning when the coffee shop is busy.

- Remember these words:

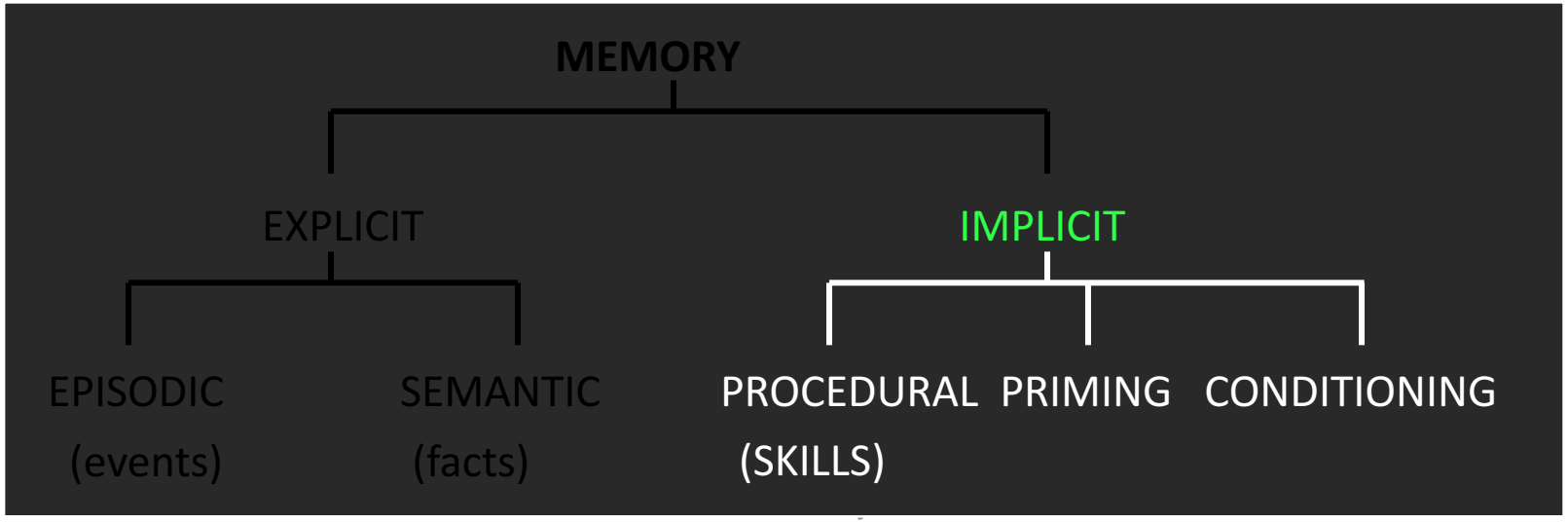
Implicit memory

"… has no idea who he is. But he has somehow retained the lightning martial-arts reflexes, fluency in a handful of languages, and the wired instincts of a superspy."



Implicit Memory

- Memory that unconsciously influences behavior



Implicit Memory

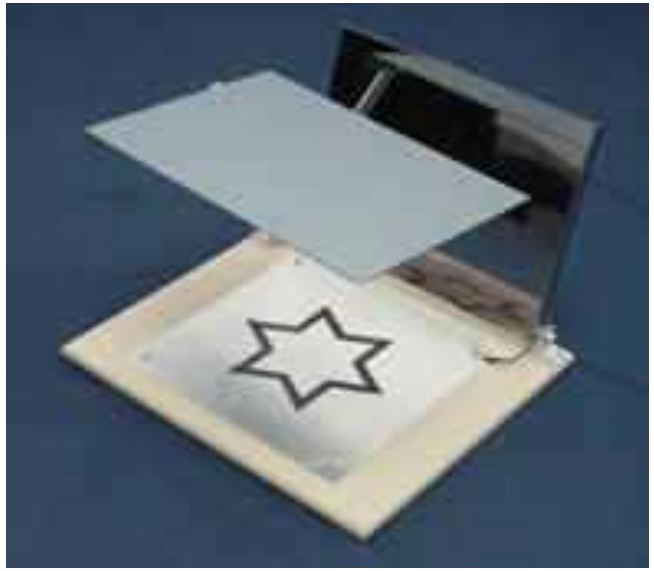
Procedural Memory

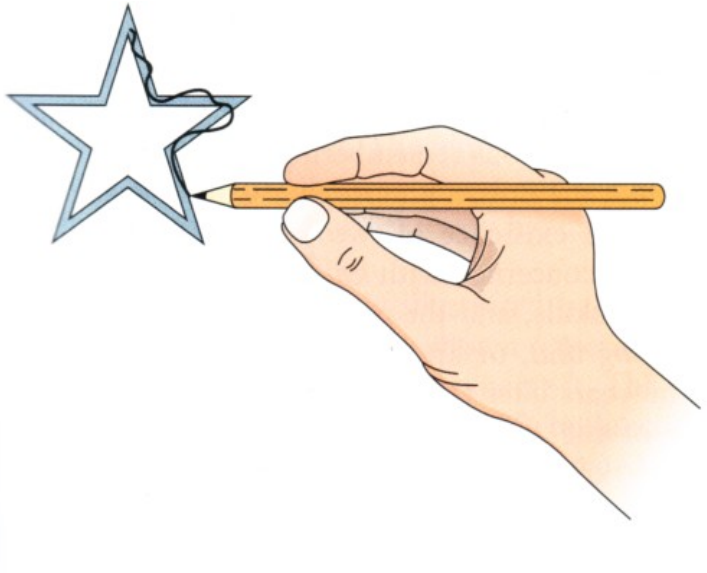
- Skill memory: memory for actions
- No memory of where or when learned
- Perform procedures without being consciously aware of *how* to do them

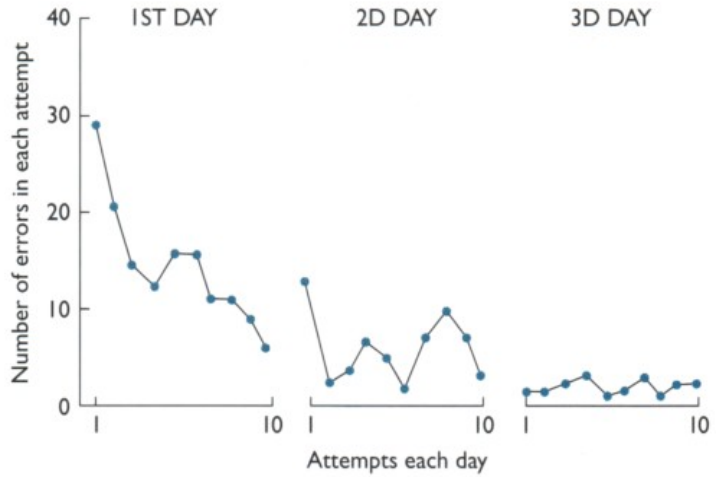
Implicit Memory

Procedural Memory

- People who cannot form new LTMs can still learn new skills (e.g., H.M.)







Implicit Memory

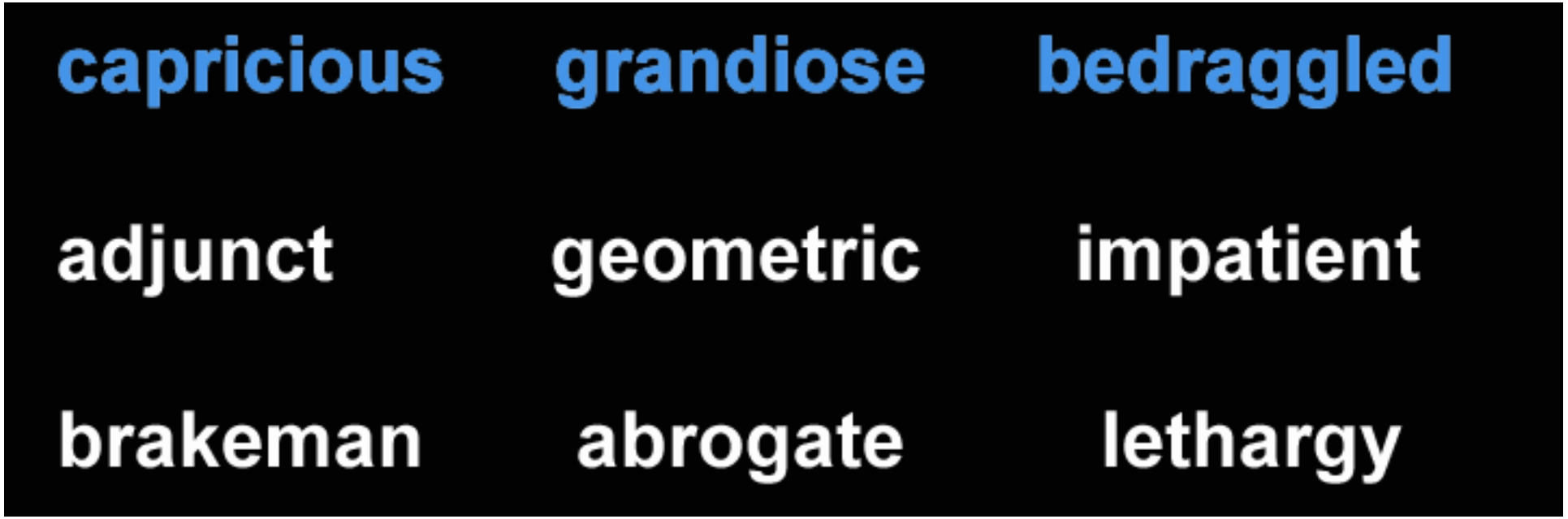
Procedural Memory

- Reading mirror reversed text

Implicit Memory

Procedural Memory

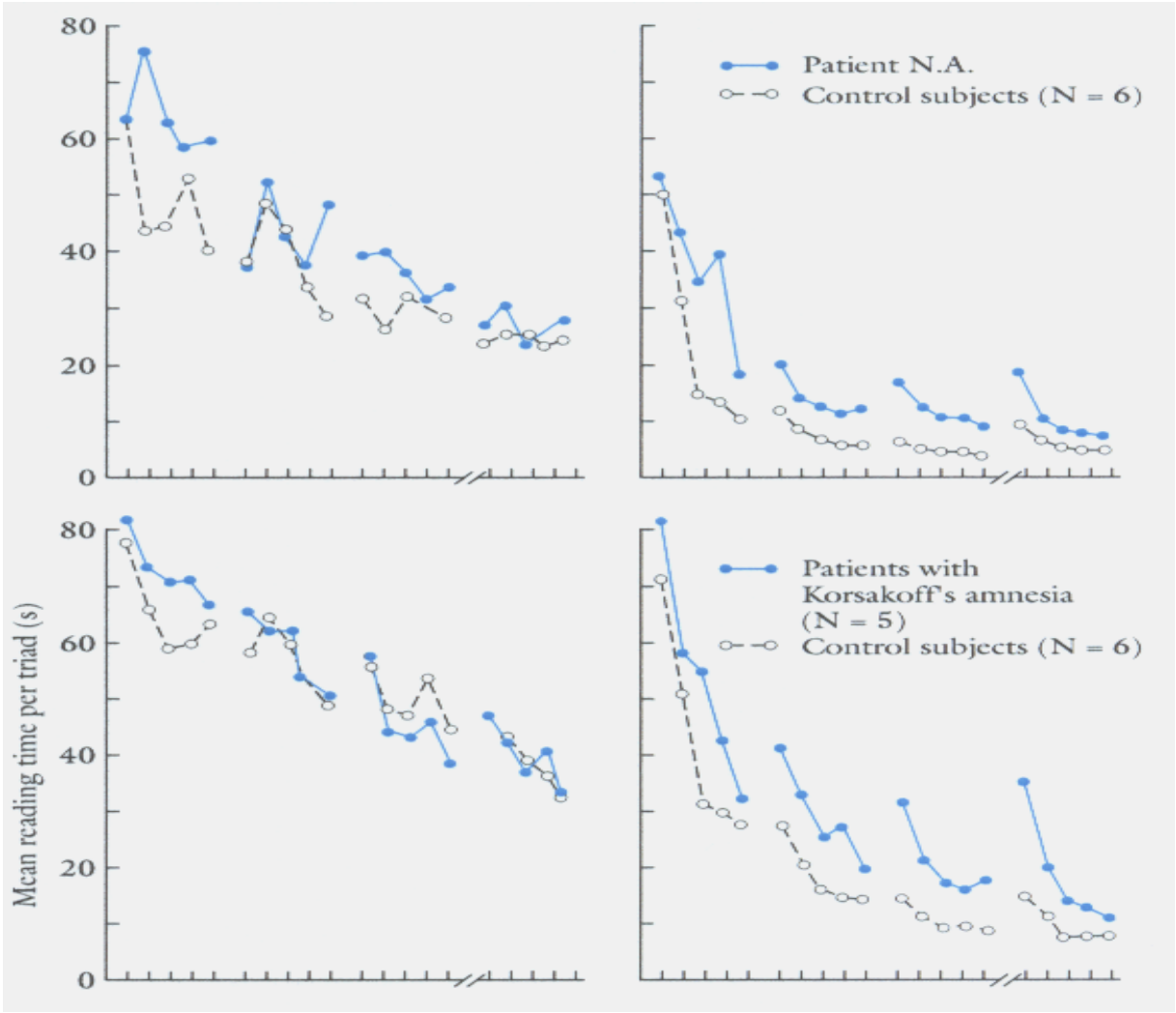
- Reading mirror reversed text



Cohen & Squire, 1980

NON-REPEATED WORD TRIADS:

brakeman
abrogate
lethargy



REPEATED WORD TRIADS

capricious
grandiose
bedraggled

AMNESIC PATIENTS ACQUIRED THE MIRROR READING SKILL NORMALLY, BUT DID NOT BENEFIT AS MUCH FROM REPETITION

→ CAPRICIOUS

RESONATE

CIRCUMVENT

DINOSAUR

→ GRANDIOSE

→ IMPATIENT

ALLOCENTRIC

→ GEOMETRIC

AMNESIC PATIENTS <u>CANNOT</u> DO THIS; THAT IS, THEY CANNOT REMEMBER WHICH WORDS WERE PART OF THE LIST

Implicit Memory

Word Stem Completion:

Ele____

Did you write element? Elephant?

Implicit Memory

Priming

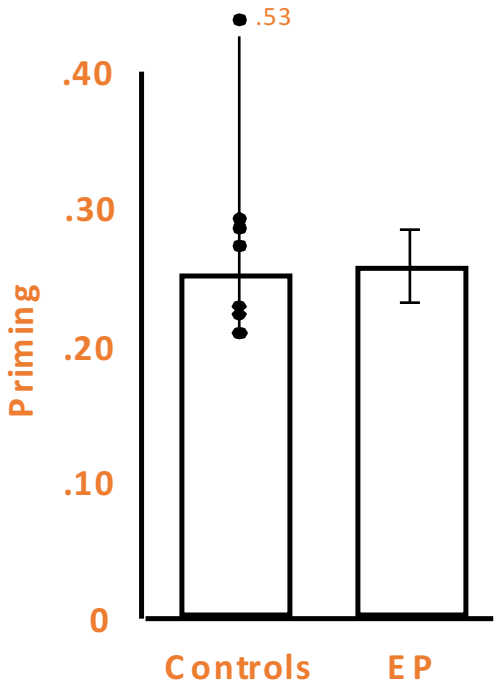
- Presentation of one stimulus (the prime stimulus) changes the way a person responds to another stimulus (the probe stimulus)
- E.g., earlier I presented a list with “element”

Study list:	Stem Completion (Implicit)	Recognition (Explicit)
mother	ele _____	element or elephant
garden		
absent		
element		
etc.		

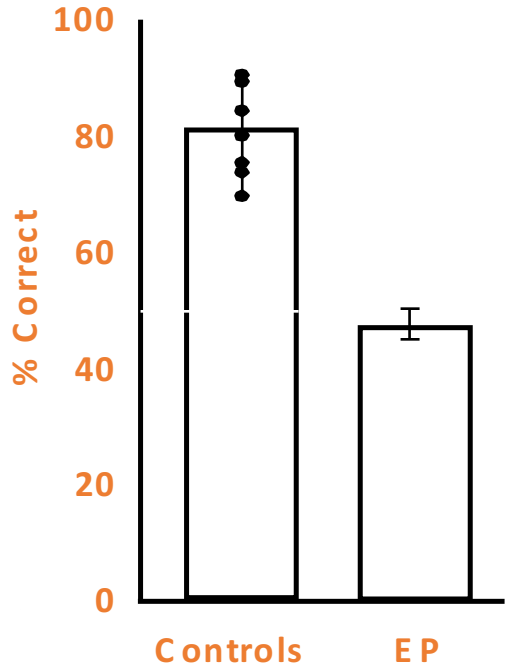
Implicit Memory

Priming

Stem Completion



Recognition



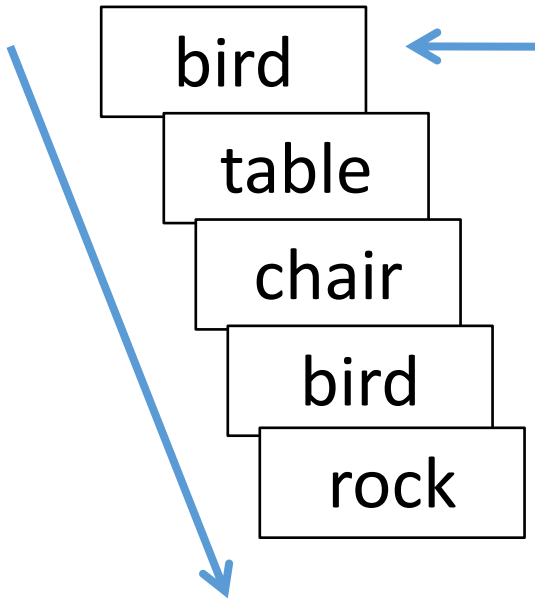
PRESERVED PRIMING IN AMNESIA

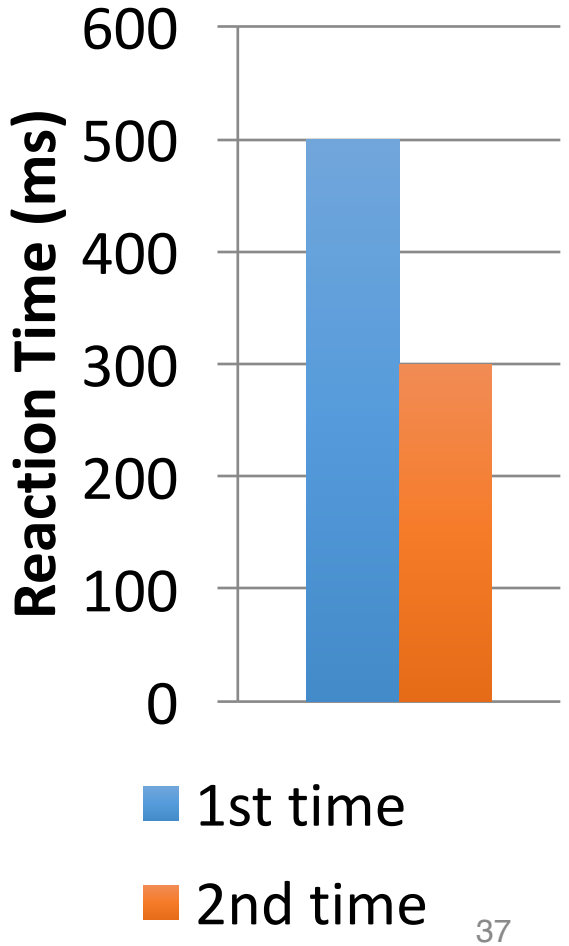
Implicit Memory

Priming

- Repetition priming
  - Or perceptual priming
- Task: Press button when you see a living object

- *of course..
  - It's only implicit if you don't explicitly remember seeing "bird" before

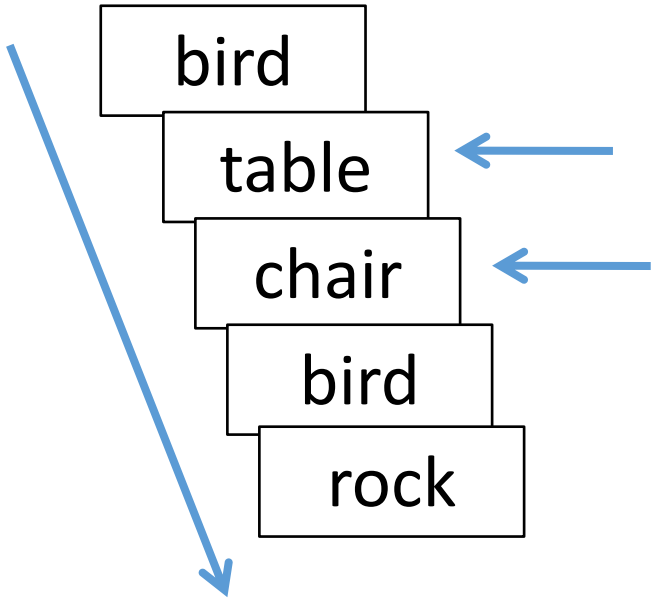


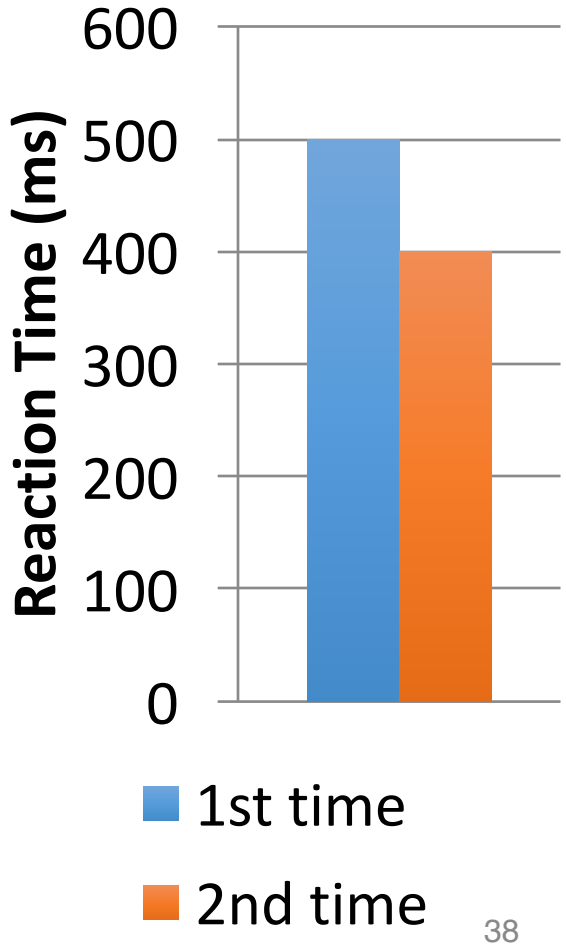


Implicit Memory

Priming

- Conceptual priming
- Task: Press button when you see a non-living object





Implicit Memory

Priming

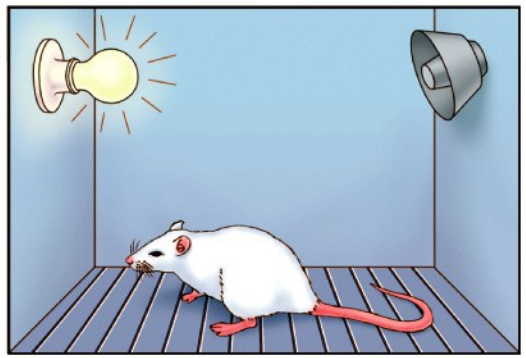
- E.g., Propaganda effect:
  - More likely to rate statements read or heard before as being true
  - Implications for advertisements

Implicit Memory

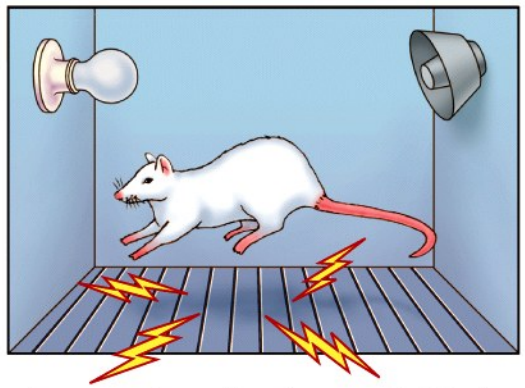
Classical Conditioning

- Pairing a neutral stimulus (does not elicit response naturally) with a reflexive response so that the neutral stimulus eventually elicits that response
- E.g., fear conditioning
  - Learning in which a neutral stimulus takes on acquires aversive properties by virtue of being paired with an aversive event.
  - Famous case of little Albert

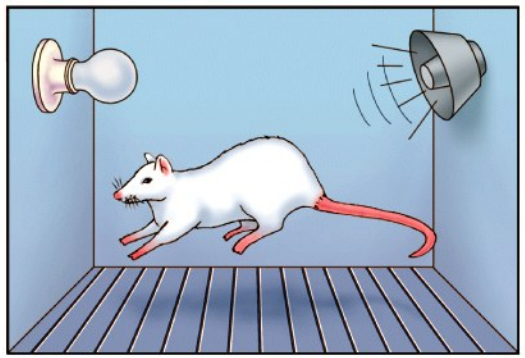
(a) Before training



Light alone (CS): no response

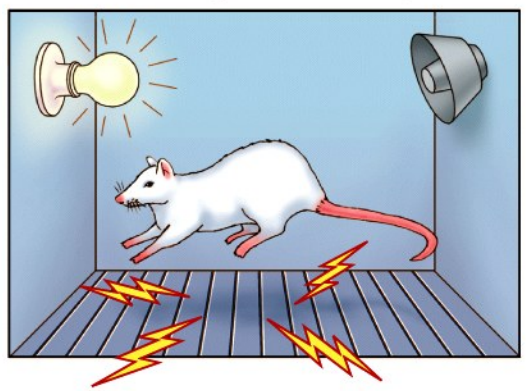


Foot shock alone (US_1): normal startle (UR)



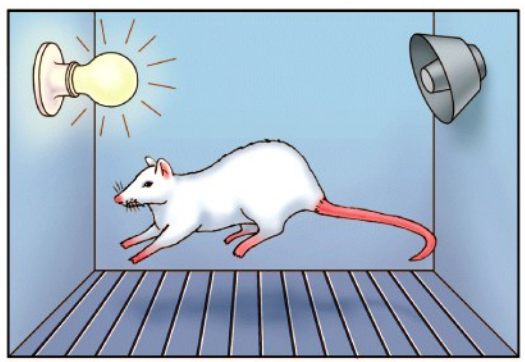
Loud noise alone (US_2): normal startle (UR)

(b) During training

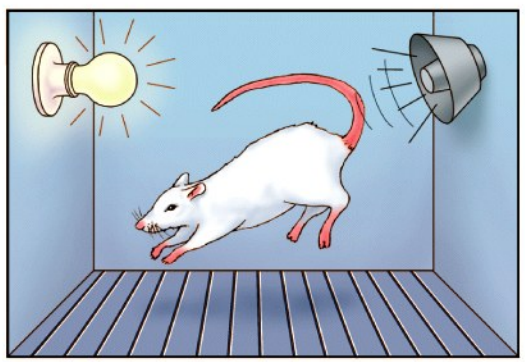


Light and foot shock: normal startle (UR)

(c) After training

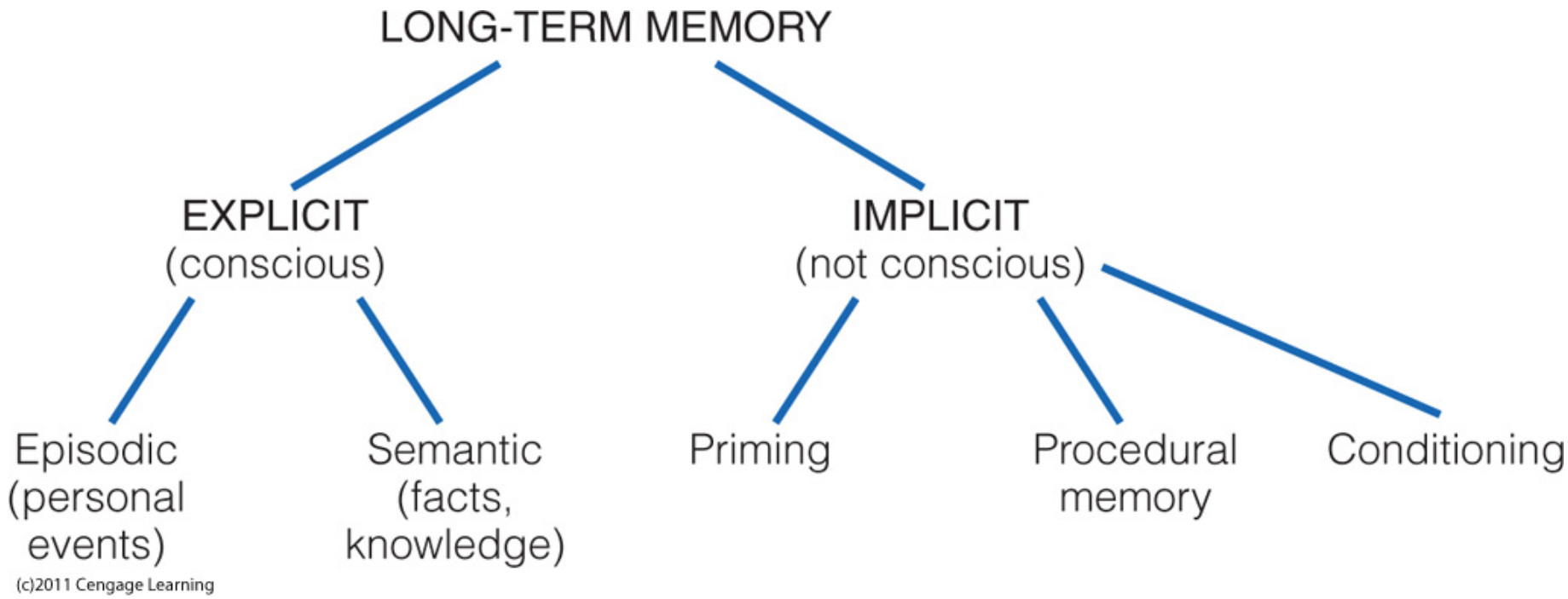


Light alone: normal startle (CR)



Light and sound but no foot shock: potentiated startle (potentiated CR)

Summary


LONG-TERM MEMORY
EXPLICIT
(conscious)
IMPLICIT
(not conscious)
Episodic
(personal
events)
Semantic
(facts,
knowledge)
Priming
Procedural
memory
Conditioning
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