9.00 - MEMORY

Professor John Gabrieli
The *Fragile Power of Memory*
WHY DO WE REMEMBER WHAT WE EXPERIENCE?

WHY DO WE FORGET WHAT WE EXPERIENCE?
IS MEMORY LIKE A CAMERA OR LIKE A PUNCH BOWL?
BOTTOM-UP & TOP-DOWN INFLUENCES ON MEMORY

- Bottom-Up
  perceptual experience
  what we see and hear

- Top-Down
  prior knowledge, concepts, expectations, subsequent experience
  and which grows over time?
The Three-Stage Model of Memory

Image by MIT OpenCourseWare.
What letters do you see?
AQZR
TPWL
BYS
(whole-report)
What letters do you see?
middle row??
HBST
AHMG
ELWC
(partial-report)
ATTENTION & SENSORY STORES

• 12 letter display
  whole-report condition
  37% correct (4 letters)

• 12 letter display -
  tone after display (high, medium, low
  partial-report condition
  76% correct (3 letters)

• Much is sensed, but attention selects only a little to be remembered
The Three-Stage Model of Memory

- Sensory Memory
- Short-Term Memory
- Long-Term Memory

Rehearsal

Image by MIT OpenCourseWare.
SHORT-TERM MEMORY

• limited capacity
• 7+/-2 chunks
Test of Digit Span
Span of 4:  6 1 9 4
Span of 5:  3 7 8 5 2
Span of 6:  9 6 5 2 8 3
Span of 7:  4 2 6 9 8 5 1
Span of 8:  8 1 6 3 7 2 4 9
Span of 9:  6 2 5 7 3 4 9 8 1
Span of 10: 9 3 8 2 4 7 1 5 3 6
Span of 11: 5 8 1 4 7 9 3 2 6 1 7
SHORT-TERM MEMORY

- limited capacity
- 7±2 chunks
- prior knowledge defines chunks, allows for more information to be retained in memory, may also miscode information
WHERE WERE THE CHESS PIECES?
the value & price of knowledge
What letters do you see?
What letters do you see?
FBI
CIA
IBM
MTV
FBI  CIA  IBM  MTV
What letters do you see?
What letters do you see?
What words do you see?
LEAF PAPER SEAT TIRE CAR FISH ROCK WIRE WHEEL BEACH TREE BOY RADIO RULE
What words do you see?
WHILE I WAS WALKING THROUGH THE WOODS A RABBIT RAN ACROSS MY PATH
LEAF PAPER SEAT TIRE CAR FISH ROCK WIRE WHEEL BEACH TREE BOY RADIO RULE (13)

WHILE I WAS WALKING THROUGH THE WOODS A RABBIT RAN ACROSS MY PATH (13)
The Three-Stage Model of Memory

Sensory Memory → Short-Term Memory → Long-Term Memory

Rehearsal

Image by MIT OpenCourseWare.
LONG-TERM MEMORY or SECONDARY MEMORY

- serial position effect
  - primacy (LTM)
  - recency (STM)

- encoding and depth of processing
- organization
- encoding specificity
- passive forgetting vs. interference
- proactive interference
- retroactive interference
- memory for gist
- flashbulb memories
- false memories
Memory Test
1. Mailbox
2. Sardine
3. Shotgun
4. Peacock
5. Credit
6. Detail
7. Flicker
8. Airline
9. Spinach
10. Clarinet
Primacy Effect = LTM  Recency Effect = STM

Free recall as a function of serial position and duration of the interpolated task.

Ebbinghaus’ Curve of Forgetting

Image by MIT OpenCourseWare.
If word is in CAPITAL LETTERS, Tap left hand

If word is in lower case letters, Tap right hand
zebra
CAR
TABLE
mosquito
MONKEY
train
DESK
termite
BUS
wasp
camel
SOFA
WHAT WERE THE WORDS?
If word names a LIVING thing, 
Tap left hand 

If word names a non-living thing, 
Tap right hand
WHAT WERE THE WORDS?
<table>
<thead>
<tr>
<th>Appearance</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shallow Encoding</td>
<td>Deep Encoding</td>
</tr>
<tr>
<td>Poor Memory</td>
<td>Good Memory</td>
</tr>
</tbody>
</table>

- zebra
- CAR
- TABLE
- mosquito
- MONKEY
- train
- DESK
- termite
- BUS
- wasp
- camel
- SOFA

- SPIDER
- chair
- FOX
- TRUCK
- lamp
- BEE
- tiger
- boat
- RABBIT
- tractor
- bed
- BUTTERFLY
The effect of context on recall of word lists. Words learned underwater are best recalled underwater, and vice versa. (From Godden and Baddeley, 1975)
<table>
<thead>
<tr>
<th>Serve</th>
<th>Educate</th>
<th>Lawyer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Serve</td>
<td>Educate</td>
<td>Lawyer</td>
</tr>
<tr>
<td>Career</td>
<td>Vacuum</td>
<td>Writer</td>
</tr>
<tr>
<td>Dust</td>
<td>Designed</td>
<td>Scrub</td>
</tr>
<tr>
<td>Physician</td>
<td>Home</td>
<td>Plumber</td>
</tr>
<tr>
<td>Skilled</td>
<td>Purchase</td>
<td>Creative</td>
</tr>
</tbody>
</table>
## RESPONSIBILITIES

<table>
<thead>
<tr>
<th>CAREER</th>
<th>HOME</th>
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</thead>
<tbody>
<tr>
<td>PROFESSIONAL</td>
<td></td>
</tr>
<tr>
<td>LAWYER</td>
<td>CHILD CARE</td>
</tr>
<tr>
<td>PHYSICIAN</td>
<td>FOOD</td>
</tr>
<tr>
<td>TEACHER</td>
<td>PURCHASE</td>
</tr>
<tr>
<td>SKILLED</td>
<td></td>
</tr>
<tr>
<td>PLUMBER</td>
<td>VACUUM</td>
</tr>
<tr>
<td>ELECTRICIAN</td>
<td>BATHE</td>
</tr>
<tr>
<td>CARPENTER</td>
<td>EDUCATE</td>
</tr>
<tr>
<td>CREATIVE</td>
<td>DUST</td>
</tr>
<tr>
<td>WRITER</td>
<td>COOK</td>
</tr>
<tr>
<td>ARTIST</td>
<td>SCRUB</td>
</tr>
<tr>
<td>DESIGNER</td>
<td>ENTERTAIN</td>
</tr>
<tr>
<td>HOUSEWORK</td>
<td>SERVE</td>
</tr>
</tbody>
</table>

*Memory better after semantically organized display than after random display*
Ebbinghaus’ Curve of Forgetting

![Ebbinghaus’ Curve of Forgetting](Image by MIT OpenCourseWare)
WHY DO WE FORGET?

passive forgetting?
or
interference?
Proactive and Retroactive Interference

Proactive Interference

Information being learned currently

Interferes

Information learned previously

Retroactive Interference

Information being learned currently

Interferes

Information learned previously

Image by MIT OpenCourseWare.
Retroactive Interference

The classic Jenkins & Dallenbach (1924) result, showing higher recall of nonsense syllables for two subjects who slept after acquisition versus remaining awake after acquisition.
PI (18 sec)

banana 138
peach
apple

plum 245
apricot
lime

melon 97
lemon
grape

orange 189
cherry
pineapple

doctor 177
teacher
lawyer
Ability of warned versus unwarned subjects to remember a wording difference that affected meaning versus style. (Adapted from Wanner, 1968)
door
glass
pane
shade
ledge
sill
house
open
curtain
frame
view
breeze
sash
screen
shutter

window
IS MEMORY LIKE A CAMERA
OR LIKE A PUNCH BOWL?
BOTTOM-UP & TOP-DOWN INFLUENCES ON MEMORY

• Bottom-Up
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• Top-Down
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expectations, subsequent experience
and which grows over time?
THE MIND OF A MNEMONIST

(A Little Book About a Vast Memory)
• Mnemonist - S.
• A.R. Luria studied S for 30 years
• at 30, editor noticed that S. took no notes but had verbatim recall - sent S. to Luria
<table>
<thead>
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<th>6</th>
<th>8</th>
<th>0</th>
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</thead>
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<td>3</td>
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<tr>
<td>1</td>
<td>6</td>
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<td>1</td>
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<td>1</td>
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<td>2</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>1</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- Studied for 3 minutes
- Recall numbers in 40 sec
- Same rate of recall months later
- Faster left than right, down than up
- Had to reinstate episode "see" room, "hear" voice
- Errors were visual (3/8)
- Could recall such lists 15 years later
imagery & synesthesia

• if S. heard noise while imaging he would see "puffs of steam" or "splashes" on the image
• converted auditory to visual experience, tones to colors
• could change resting pulse of 70-72 to 100 or 64, temperature of hand by 2 degrees
• problems in attending to message vs. voice, recognizing faces or voices in varied expression, abstract ideas, metaphors
• how to get rid of memories? write down and burn notes - active imaging of nothing
life & career

• professional mnemonist
• music school teacher
• vaudeville actor
• efficiency expert
• treated people with herbs, wife, son
FLASHBULB MEMORIES

- Emotion important in determining what we remember - surprise & arousal
  - Kennedy assassination
  - Challenger Disaster
  - OJ Simpson verdict
  - 9/11 attack

  place
  ongoing activity
  source of news
  own feelings
  emotions in others
  aftermath

Studies that test right after and a year later:
  - better remembered, but susceptible to distortion
  - over-confident
Eyewitness Testimony

see slides

sports car/intersection/turns/hits pedestrian

YIELD SIGN or STOP SIGN

questions

"Did another car pass the red Datsun while it was stopped at the yield sign?" (consistent)

"Did another car pass the red Datsun while it was stopped at the stop sign?" (inconsistent)

"Did another car pass the red Datsun while it was stopped ?" (neutral)

Which slide did you see?
Loftus study

Planting lost-at-mall memories

Jim, graduate student, “reminds” younger brother Chris of losing Chris in a mall when Chris was five, and an older, tallish man bringing him back.

Two days later, Chris says, “I was with you guys for a second and I think I went over to look at the toy store, the Kay-bee toy, and, uh, we got lost and I was looking around, and I thought, ‘uh-oh. I’m in trouble now.’ You know. And then I…I thought I was never going to see my family again. I was really scared, you know. And then this old man, I think he was wearing a blue flannel, came up to me…he was kind of old. He was kind of bald on top…he had a ring of grey hair…and he had glasses.”
MEETING BUGS BUNNY AT DISNEYLAND

• 120 people see an ad for Bugs Bunny at Disneyland to evaluate ads (all had been there) meet? shake hand? - frequent (1/3) recall of Bugs Bunny during visit to Disneyland
dark October night
woman hitchhiker picked up on Pacific Highway South 10 miles outside of Seattle
man turns into isolated dirt road, rapes her, leaves her by the side of the road
24 hours later she looks at array of photos, picks Steven Titus - he is convicted
few months later, another man is arrested for a series of rapes - she sees picture and realizes this is the real rapist
Titus released - lost all his money, job, fiancee, reputation - 4 years pursuing a lawsuit - dies 11 days prior to trial of a heart attack - 10 months later his estate gets $2.8M
80,000 trials/year rely mainly on eyewitness testimony - of 1,000 wrong convictions, about half involved eyewitness errors
Woman at home in Australia.

Raped in her home.

Identifies Donald Thompson, a renowned Australian psychology who studies eyewitness memory biases.

Donald Thompson was on the TV live at the same time as the woman was raped. She had been watching the program.
September 22, 1969
• Susan Nason - 8 years old - missing and found murdered on October 31, 1969

November 1989
• Eileen Franklin remembers that her father murdered Susan Nason

November 30, 1990
• George Franklin found guilty
"If you think you were abused and your life shows the symptoms, then you were."

- Do you feel you have to control your emotions?
- Are you afraid of anger?
- Do you have blocks of your childhood that you can't remember? Do you have a sense that "something happened?"
- Do you have problems with alcohol, drugs, food, migraines, or back pain?

"When someone asks you, "Were you sexually abused as a child?" there are only two answers: One of them is "Yes," and one of them is "I don't know." You can't say "No."

- Roseanne on "Oprah"