Senior Moments 2: Fact, Fiction, and Fixes

Short-term memory, Working memory, Working Memory Training
Catherine Weir, Summer term 2015

Pick up handout and pencil - we will be doing cognitive exercises
F, F, and F

Fact:
  a) Working memory is one aspect of cognition that tends to decline with age.

Fiction:
  a) Memory is a single process.

Fix:
  a) Training on working memory is likely to improve working memory scores.
Recap from last class

Encode info - Store info - Retrieve info

Memory failures may also indicate memory efficiency.

Attitudes about aging influence memory:
- Older adults with negative attitudes about senior memory tend to do worse on memory tasks (and report feeling older).

Prospective memory: remembering what you plan to do without prompting -- turning off coffee maker when going on trip; attending your wedding   Task 2

1. What were the 3 types of prospective memories?
2. What was an effective retrieval strategy?
3. How did interruptions affect prospective memory?

1. Event cue best.
2. Imagine doing task.
3. Interrupted memory worse.
Ideas about how memory is organized

  - Short-term memory: short here means *a few seconds*
  - *Examples*: Remembering a phone number, combination lock, or sentence.
- Updated version of memory model that takes account of more research findings.

Task 3 Memory Span
WORKING MEMORY - updated version of STM

Memory not only STORES information, it PROCESSES information, Baddeley & Hitch, 1974

ILLUSTRATIONS when we use our WORKING MEMORY

Math: \( (2 \times 3) - 2 = 5 \) T / F?

Logic: letter sequence (AB or BA), statement about sequence, you decide True / False

- B A A follows B True / False
- B A B is followed by A True / False
- A B B does not follow A True / False

Language processing

- a. Where there’s a will, I want to be in it.
- b. In a democracy, it’s your vote that counts. In feudalism, it’s your count that votes.
Evidence for SEPARATE kinds of memory: Working Memory differs from Long-term Memory

Cognitive tests: different factors affect WM & LTM. Rhyming words are hard to remember in the short term; rhyming does not influence long term memory very much.

Different brain regions are active for the different modules of memory. Frontal regions are important in Working Memory.

Brain damage: Some patients (anoxia, encephalitis) cannot learn words, but working-memory span is same as non-patients. Others (surgery) can remember long-term material but have impaired working-memory span.
Brain scan data from GMU labs
Strenziok, Greenwood, Santa Cruz, Thompson, Parasuraman 2013

Had to drop the graphics to reduce size of file for DocStore. This was a scanned picture of brain scan data for working memory and episodic memory (one of the pieces of Long-Term Memory)
WORKING MEMORY: Important Findings

1. Rapid forgetting: e.g. XRQ items

2. Middle of list of unrelated words forgotten more than ends. Consistent with interference as a major cause of forgetting

Glanzer & Cunitz, 1966
Limited Capacity of Working Memory. MEMORY SPAN

- What type of material - digits 9.3 items, letters 7.3
- Length of words - greater memory span for shorter words. hint, verb (6.7 words) vs. advantage, occasion (5.1 words)

Mueller et al. 2003

- Chunking the material - A I C S R I I B F Miller, 1956

Stretch Break - 2 minutes
Working memory has many subunits

- CENTRAL EXECUTIVE - controls attention (what you select to see, to hear, to touch, ...); doesn’t store. *Flashlight in dark*
- VISUAL-SPATIAL SKETCHPAD - stores spatial information briefly - *recall map while following friend’s conversation*
- BUFFER (EPISODIC BUFFER) - stores/combines information briefly from parts of working and long-term memory. *(2 X 3) - 2 = 4*
- PHONOLOGICAL LOOP - stores speech information briefly - *listening to sentence while remembering/generating own*
Neural evidence:
Different places in brain for different elements of working memory
Smith & Jonides 1999

Visual-spatial sketch pad
Memory for images of objects (pink)
Memory for location of objects (blue)
Frequent cognitive method to study Working Memory: Memory when doing 2+ things at once

Dual task studies: Play chess and do something else.

Chess players - novices and masters

Articulatory suppression - say word “see-saw” over and over rapidly

Visual-spatial suppression - press keys on keypad in a pattern over and over rapidly

Central executive suppression - produce series of random digits

Robbins et al. 1996
Central executive

functions of Central executive

1. Planning - *steps in starting a car*
2. Coordinating mental processes - monitor to see if plan is working - *listen for engine, look at display on dashboard*
3. Inhibiting irrelevant information & sustaining attention to task - *focus on starting car, inhibit thinking of errand*

Evidence comes from

- People with dysexecutive syndrome
- People driving while talking with a passenger or using a cell phone or texting -- Strayer
Strayer studies of distractions while driving
Relating this to Working Memory

Distraction was involved in almost 25% of accidents in 2012
2012: ~3,500 died; 420,000 injured in distracted driver accidents
67% of drivers report having used cell in car in last month (US, Europe)

Distractions while driving - cognitive attention, vision, manual skills
Texting (sending & receiving): 23 times as likely to have accident
Cell phone conversation: very distracting
Books on tape/ radio / music: little distraction when hazard occurs
Passenger: actually help to direct attention to driving
Visual-spatial Sketchpad

Two kinds of information in this part of working memory.

- Memory for what object is (Visual aspect - form, color)
- Memory for where object is (Spatial aspect - location)

Students could do a spatial task at the same time as playing computer games only after much practice with *Space Fortress*. Logie 1988

Capacity of sketchpad is about 4 objects: when deciding if one thing in an array has been changed.
Visual information stays in system briefly

- How long does an image stay in the visual system? Sperling called this iconic memory? Sperling, 1960s
  
  **Icon lasts up to ½ second**

What can you recall from this briefly - presented grid of letters

**

R W F K

T X Z N

C B D Y
Processing language in Phonological Loop – “ECHO”

Listen to someone saying telephone number. Then dial it on a phone. We hear the sounds” when dialing. Try it.

Best memory for beginning of information.

Good memory at end of information stream if info is non-speech. Crowder, 1972

703 455 1154
Phonological similarity effect - when words share a sound, the working memory scores are lower.  
Baddeley, 1966

Studies with articulatory suppression while doing memory task: muttering “the-the-the” while learning words. If phonological loop is part of learning, then worse memory with “the-the” than without.
Episodic buffer

Buffer to combine information from phonological loop, sketchpad, and long-term memory.

14 + 18 + 22

Memory study showing long-term memory influences working memory recall. Darling & Havelka, 2010

Task: remember random digits in order.

Different ways of presenting digits

1. Presented in one place visually
2. Arranged along a horizontal line
3. On a keypad similar to that on telephones.

Long-term familiarity with presentation method influences the memory (in Episodic Buffer), then the keypad condition will be best.

The students had better recall memory in the 3rd condition.
Training to Improve Working Memory
KARBACH & VERHAEGEN 2014; HURLEY 2013 SMARTER (BOOK)

“Making Working Memory Work” -
- Declines with age without intervention.
- Inconsistent findings about how to overcome losses

Combined results of ~50 studies
- Studies considered working memory training.
- Older adults were 60+ years when trained
  - Trained group compared to Active or Passive control group.
  - Older adults compared to younger adults in some studies.

Card matching test
RONNBERG ET AL. 2014
Comparing Training Groups

1. Training groups improved more than either active or passive control group on the task in the training (by ½ SD).
2. No statistical difference between active & passive controls.
3. Group comparisons: Improvement on non-trained tasks was greater for trained groups than for control groups.

Training group might practice memory strategy like chunking items

Active control group might do crosswords or rate artworks.

Passive control might participate in socials.
Summary of Working Memory Research

1. Working Memory Findings
   a. Rapid forgetting --- make recall immediate
   b. Better memory for information at start of list - put important stuff first
   c. Chunk items together -- draw on previous experience

2. Working Memory subunits
   a. Central executive - avoid irrelevant material, focus on task at hand
   b. Visual spatial sketchpad - practice to extend memory span
   c. Phonological loop - choose verbal items that do not share a sound
   d. Episodic buffer - rely on previous experience, practice this
F, F, and F

Fact:

a. Memory has several modules for different aspects of remembering: Working memory (WM), Long-term Memory (LTM).

b. Working memory involves processes for performing tasks as well as places to store information. WM predicts IQ scores fairly well.

Fiction:

a. All memory declines with age.

b. If you forget the middle of a phone number when dialing, you might have Alzheimer’s Disease.

c. Memory is a single process.

Fixes:

a. Training on working memory tasks improves working memory.

b. Good memorizers learn strategies like chunking items & use the strategy when they need to remember.