Cognition: Methods and Models

PSYC 2040

L8: Memory II

Part 1

recap: Mar 28/31, 2023

- what we covered:
  - short and long-term memory
  - Katie Byrnes!
- your to-dos were:
  - *finish:* L7 quiz/writing assignments
  - *work on:* project milestone #4

today's agenda

- feedback discussion
- tasks and memory phenomena

a demonstration

- I will read aloud a list of words for you to remember

- you will then be asked to recall these words

recall task

- a recognition task involves a study (encoding) phase and a test (retrieval) phase
- study phase: participants are exposed to stimuli
- test phase: participants are asked to actively generate all items they studied
- how would you measure memory performance? total words, intrusions, etc.

BUTTER
FOOD
EAT
SANDWICH

recall!

BUTTER

BREAD

recognition task

BUTTER
FOOD
EAT
SANDWICH

- a recognition task involves a study (encoding) phase and a test (retrieval) phase

- study phase: participants are exposed to stimuli

- test phase: participants decide whether they have seen a given item (old) or not (new)
  - some items are targets, some are foils/lures

- how would you measure memory performance?
  - the proportion of correct/old items

- limitations? pair up and discuss!

BUTTER

OLD   NEW

BREAD

OLD   NEW

recognition task: hits and false alarms

- observing only the correct responses could be misleading if the person simply answers "old" for all items

- hits and false alarms together provide a clearer picture

response	item	
	OLD (BUTTER)	NEW (BREAD)
OLD	hit	false alarm
NEW	miss	correct rejection

signal vs. noise

- the idea of hits and false alarms comes from signal detection theory with broader applications to decision-making and statistics

your data	world truth	
	true effect	noise
true effect	hit (power)	false alarm (type I error)
noise	miss (type II error)	correct rejection

activity: signal vs. noise

- groups of 2
- you will be presented with a research situation and you need to come up with a signal vs. noise formulation of the situation

activity: signal vs. noise

- a researcher is trying to understand if there are gender differences in the ability to manage money. They conduct an experiment where they record the amount of money saved by different genders in a given month.

activity: signal vs. noise

- construct the signal vs. noise table for this experiment design

	world truth	
your data	true effect ???	noise ????
true effect ???	hit (power)	false alarm (type I error)
noise ???	miss (type II error)	correct rejection

memory phenomena

- what counts as a memory phenomenon?
  - anything to do with memory!
- several phenomena have roots in associationism and/or behaviorism
  - phenomena we've already discussed?
- we will learn about these phenomena in claim-evidence fashion
- you should add on our general format when you review (IV/DV/finding/inference)!

frequency

- claim: more frequent stimuli are better remembered

- evidence: Hintzman (1969)
  - participants studied words with different exposure (two vs three times)
  - frequency did not affect recognition accuracy
    - ceiling effects: performance is extremely high or perfect
    - floor effects: performance is extremely low or at zero
  - frequency affected recognition times, i.e., more frequently encountered words were recognized faster

frequency: recall vs. recognition

- claim: the effect of frequency can vary based on the retrieval context

- evidence: Balota and Neely (1980)
  - tested participants on high and low-frequency words via recognition or recall
  - the word frequency effect/paradox
    - recall: HF words are better remembered than LF words
    - recognition: LF words are better recognized than HF words

Frequency effects in recognition and recall

Vencislav Popov (vencislav.popov@gmail.com)[1,2] & Lynne Reder (reder@cmu.edu)[1,2]

[1] Department of Psychology, Carnegie Mellon University, Pittsburgh, PA
[2] Center for the Neural Basis of Cognition, Pittsburgh, PA

Abstract
Stimulus frequency, which is often evaluated using normative word frequency, is among the variables that have the most diverse and puzzling effects on memory. Word frequency can either facilitate or impair memory performance depending on the study and testing conditions. Understanding why and under what conditions frequency has positive or negative effects on performance is crucial for understanding basic properties about the human memory system. As a result, the study of word frequency has led to the development of multiple memory models. This chapter summarizes the current knowledge concerning word frequency effects on item recognition, associative recognition, free recall, cued recall, serial recall and source memory. We also discuss how word frequency interacts with manipulations concerning presentation rate, list-composition, age of the participants, memory load, midazolam injections, response deadlines and remember-know judgements. This review of frequency effects in memory identified four major classes of empirical findings, which can be further subdivided into a total of 21 key phenomena that any theory should account for. Based on these phenomena, we identify three high-level principles that characterize the diverse effects of frequency on memory – the probe dependency principle, the dual process principle, and the resource demands principle.

Popov, V., & Reder, L. (2020). Frequency effects in recognition and recall.

presentation rate and spacing

- claim: repetitions and spacing improve memory retention

- evidence: Melton (1970)
  - participants studied words at different presentation rates (1.3, 2.3, and 4.3 seconds), and spaced repetitions (0, 2, 4, 8, 20, 40)
  - recall improved with longer presentations, more repetitions, and greater spacing between repetitions
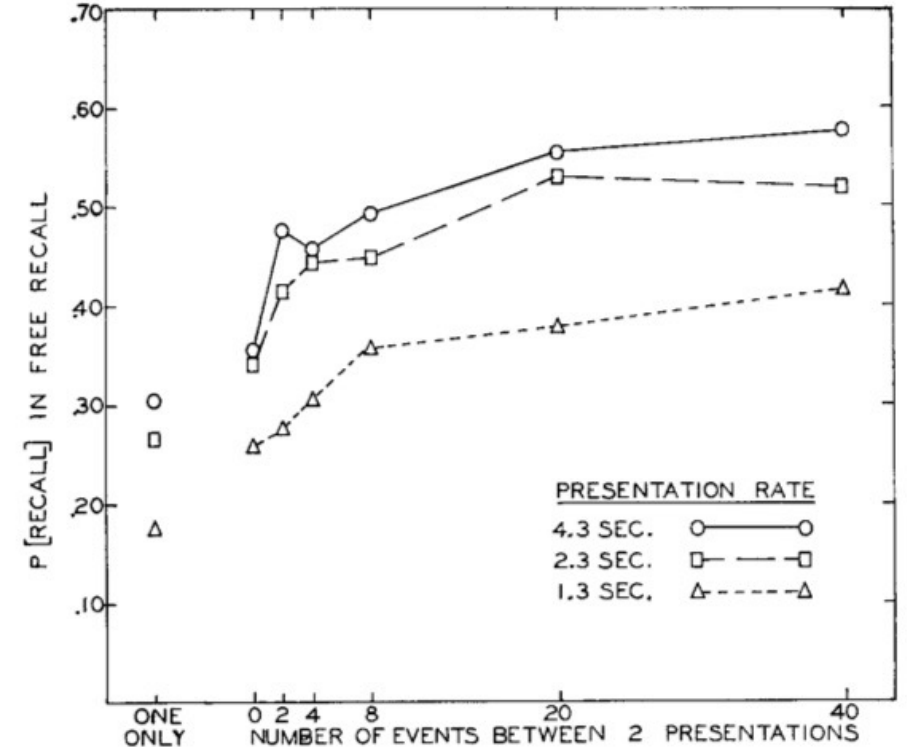
retroactive interference

- claim: newer events influence prior learning

- evidence: Postman (1952)
  - original learning: participants encoded 24 nonsense syllables and were tested
  - interpolated learning: 24 new nonsense syllables (experimental group) OR New Yorker magazine (control group)
  - final phase: participants were tested on original syllables
  - participants were better on original test than final test
  - experimental group showed more forgetting than control group, due to interference from the second list of nonsense syllables

- activity in pairs: what would a plot of these findings look like?

proactive interference

- claim: prior learning influences new learning

- evidence: Underwood (1957)
  - a "meta-analysis" of several studies
  - y-axis: percent of items recalled from a current list
  - x-axis: number of previous lists learned
  - recall was worse as more lists were learned before current list

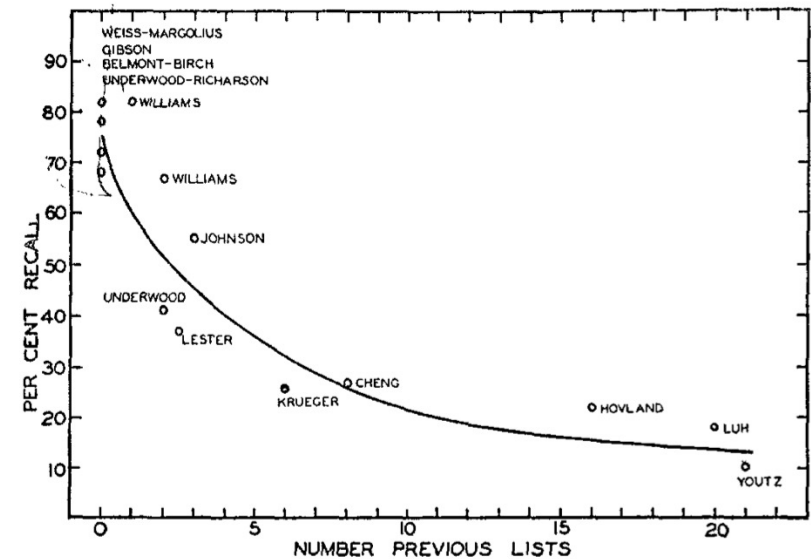INTERFERENCE AND FORGETTING   53

FIG. 3. Recall as a function of number of previous lists learned as determined from a number of studies. From left to right: Weiss and Margolius (35), Gibson (9), Belmont and Birch (3), Underwood and Richardson (33), Williams (36), Underwood (27, 28, 29, 30), Lester (17), Johnson (14), Krueger (16), Cheng (6), Hovland (11), Luh (18), Youtz (37).

distinctiveness: Von Restorff

```
laf -- rig
  # -- +
dok -- pir
 89 -- 46
red square -- green square
zül -- dap
  S -- B
tög -- fem
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- claim: memory is better for distinctive items

- evidence: Von Restorff (1933)
  - participants were tested on 5 lists
  - lists used counterbalancing to ensure that effects were not influenced by the characteristics of items of order, but only the composition of the list (context)
  - "isolated" pairs were better remembered than massed items across all lists, i.e., distinctive pairs were better remembered

LIST 1

4 NONSENSE 3 MASSED
1 SYMBOL
1 NUMBER
1 COLOR   } ISOLATES
1 LETTER

fan effect

Table 1
Examples of Experimental Material in the Fan Experiment of J.R. Anderson (1974)

Material studied	Target probes	Foil probes
A hippie is in the park.	3-3. A hippie is in the park.	3-1. A hippie is in the cave.
A hippie is in the church.	1-1. A lawyer is in the cave.	1-3. A lawyer is in the park.
A hippie is in the bank.	1-2. A debutante is in the bank.	1-1. A debutante is in the cave.
A captain is in the park.	—	2-2. A captain is in the bank.
A captain is in the church.	—	—
A debutante is in the bank.	—	—
A fireman is in the park.	—	—
A lawyer is in the cave.		
—		
—		
—		

Note. Dashes indicate more items.

- claim: items with greater number of associates (higher fan) are recognized slower than items with lower number of associates (lower fan)

- evidence: Anderson (1974)
  - participants studied concepts (persons and locations) with 1, 2, or 3 facts (fan)
  - test featured target and foil probes and recognition or rejection time was measured
  - targets took longer to recognize if the person/location had a greater fan
  - foils took longer to reject than targets but also longer for sentences with concepts with larger fans
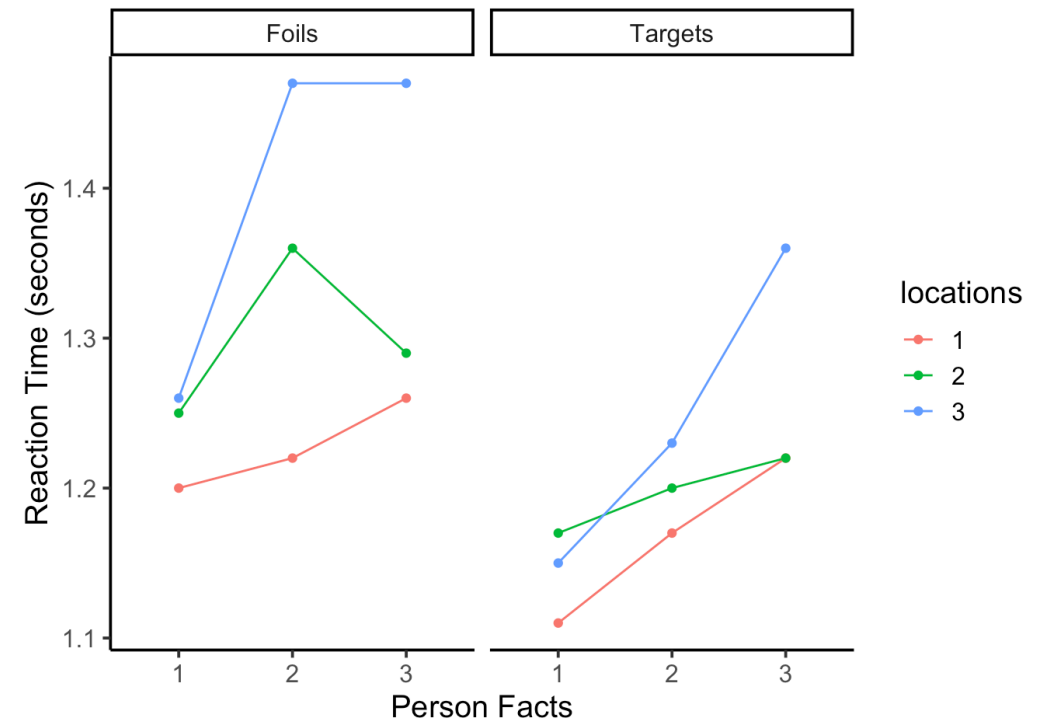
meaningfulness: self-reference

- claim: relating information to yourself improves retention

- evidence: Rogers et al. (1977)
  - participants encoded lists of adjectives via 4 conditions (structural, phonemic, semantic, and self-reference)
  - recall for adjectives was highest for the self-reference condition

Table 1
Examples of the Rating Tasks

Task	Cue question	Manipulation
Structural	Big letters?	The adjective was either presented in the same size type as the question or twice as large.
Phonemic	Rhymes with xxxx?	xxxx was a word that either rhymed or did not rhyme with the adjective.
Semantic	Means same as yyyy?	yyyy was either a synonym or unrelated word to the presented adjective.
Self-reference	Describes you?	Subjects simply responded *yes* or *no* to indicate the self-reference quality of the presented adjective.

Rating	Rating task				Total
	Structural	Phonemic	Semantic	Self-reference	
	Mean recall				
yes	.28	.34	.65	1.78	3.05
no	.06	.34	.68	1.06	2.14
Total	.34	.68	1.33	2.84	5.19

generation, production, enactment

- claim: generating information can improve memory performance

- evidence: Slamecka and Graf (1978)
  - participants either generated (lamp-L???) or read words
  - generation was achieved via different methods:
    - associate (lamp-light)
    - category (ruby-diamond)
    - opposite (long-short)
    - synonym (sea-ocean)
    - rhyme (save-cave)
  - probability of recognizing a word was higher for generated words, compared to words that were read for all types of words

- production: read out loud vs. silently

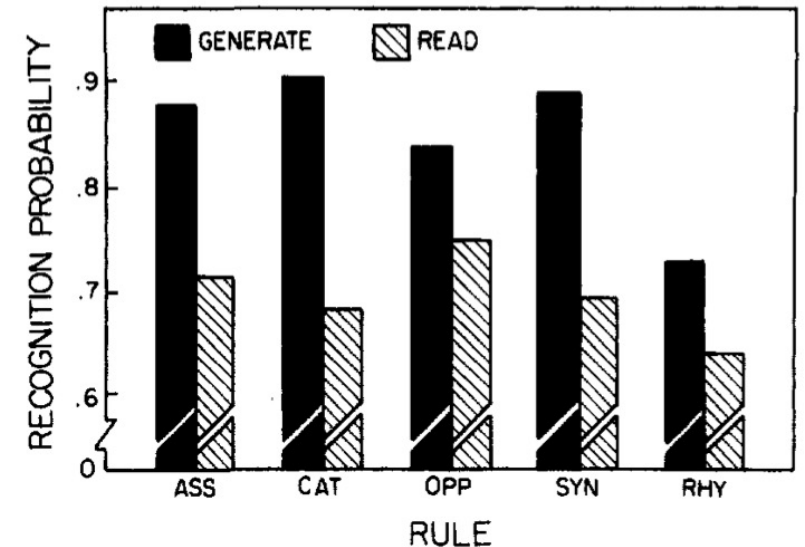- enactment: acted/imagined vs. not

Figure 1. Mean recognition probabilities for each condition for each rule of Experiment 1. (ASS = associate; CAT = category; OPP = opposite; SYN = synonym; RHY = rhyme.)

directed forgetting

- claim: specific instructions to "forget" items can lead to poorer memory performance

- evidence: Geisselman (1974)
  - participants read one sentence at a time and were told if they would be tested on the sentence (TBR) or they could forget (TBF) the sentence
  - TBF sentences produced lower recall than TBR sentences in most tests

Table 1
Probability of Sentence Retention as a Function of Sentence Type and Type of Test

Sentence Type	Test Type			
	Free Recall (Cued)	Free Recall (Control)	Sentence Completion	Multiple Choice
TBR	.74	.57	.87	.95
TBF	.40	–	.75	.92

retrieval-induced forgetting

METAL-iron
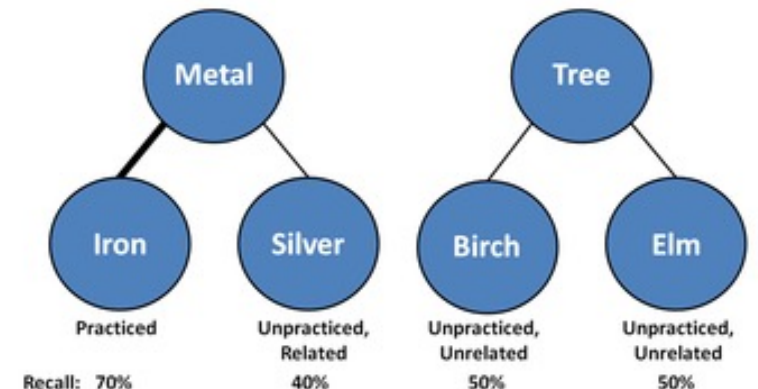TREE-birch
METAL-silver
TREE-elm

METAL-ir????

METAL-ir??
TREE-bi??
METAL-si??
TREE-e??

- claim: remembering causes forgetting of other information in memory

- evidence: Anderson, Bjork, & Bjork (1994)
  - study phase: participants first study pairs of category labels and words (METAL-iron, METAL-silver, TREE-birch, TREE-elm)
  - retrieval practice phase: a subset of items are tested (e.g., METAL-ir???)
  - test phase: all items are recalled/recognized
  - unpracticed but related items are forgotten more than the unpracticed unrelated items

Metal		Tree	
Iron	Silver	Birch	Elm
Practiced	Unpracticed, Related	Unpracticed, Unrelated	Unpracticed, Unrelated

Recall: 70%   40%   50%   50%

big takeaways

- get in groups of 3 and report key takeaways from today
- [takeaways document](#)

next class

- **before** class:
  - *finish:* L8 readings
  - *post:* conceptual question
- **during** class:
  - conceptual questions
  - memory phenomena (contd.) and principles!