

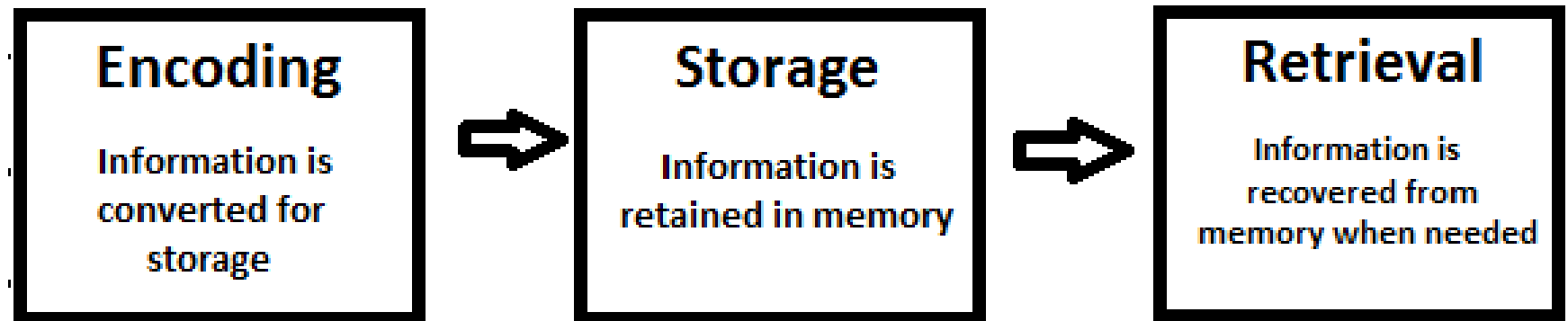
Learning and Remembering

PSY 3319: Cognitive Psychology

PPT Slides: 5

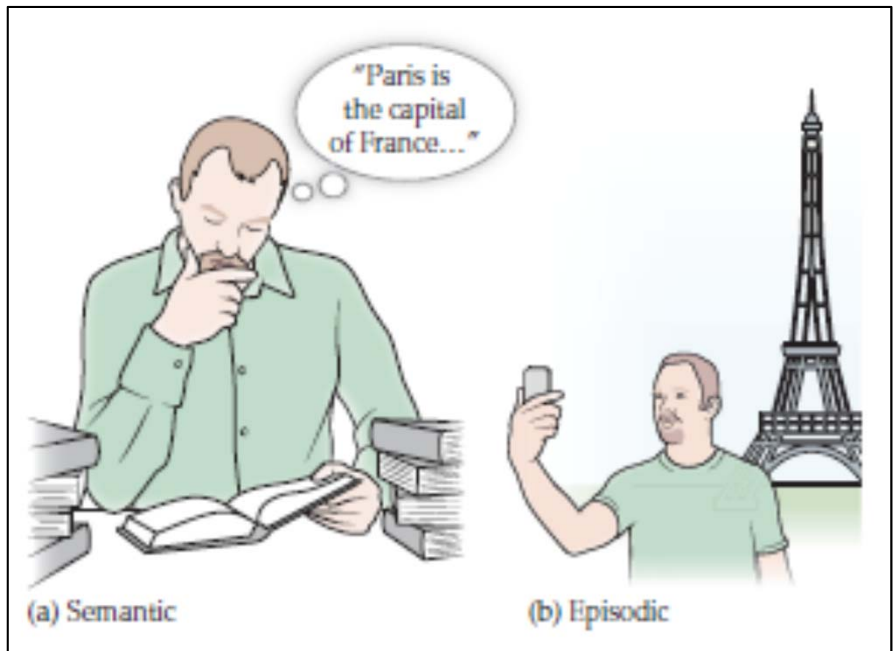
Professor Kit Cho

3 Steps of Memory



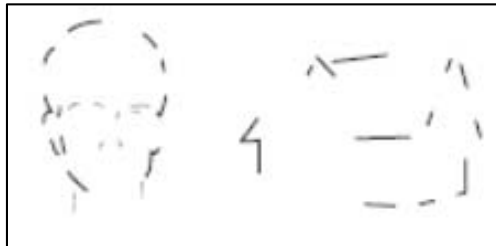
Main Types of Long-Term Memory

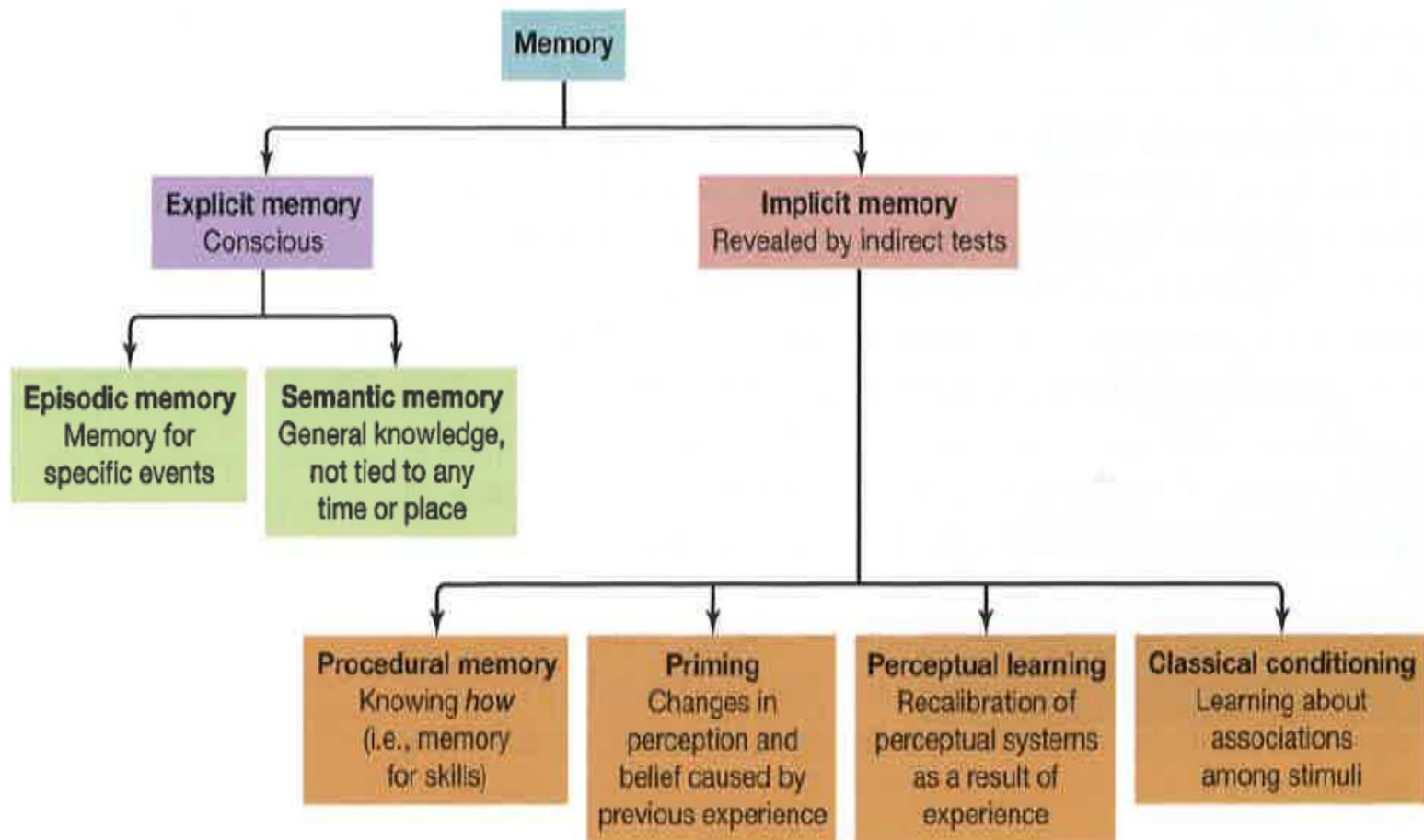
- Explicit/Declarative: Consciously retrieved
 - Semantic: Memory of world knowledge (“I know that...”)
 - I know that UHD is located in Houston, Texas
 - I know that the first President of the U.S. is George Washington
 - Episodic: Memory of a specific event (reliving an experience; “I remember...”)
 - First day of school at UHD
 - Interview for most recent job



Main Types of Long-Term Memory

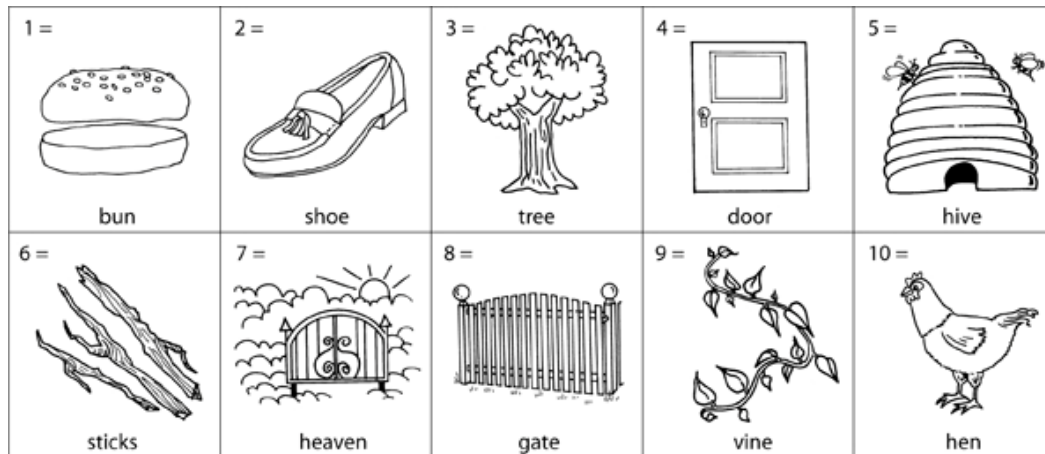
- Implicit/Non-declarative: Automatic retrieval of knowledge
 - Procedural skills: Swimming, riding a bike, driving
 - Priming
 - In LDT you are faster to indicate “CAT” is a word when preceded by “DOG” rather than “CHAIR”
 - More likely to describe someone as “caring, nice, warm, gentle” when holding a warm (vs. cold) mug
 - Conditioning: Ivan Pavlov’s dogs automatically salivated when hearing a bell
 - Perceptual Learning: Recalibration of visual system based on previous experience





Encoding Information: Mnemonics

- Conscious memory aids (strategy) used to remember information
- Peg word mnemonic: Associate targets to a set of sequence of mental pegs



Mnemonics: Method of Loci

- Targets are placed along a familiar route
 - As you mentally walk through this route, you recall the objects
 - Also referred to as “mental palace”
 - Used by professional mnemonists

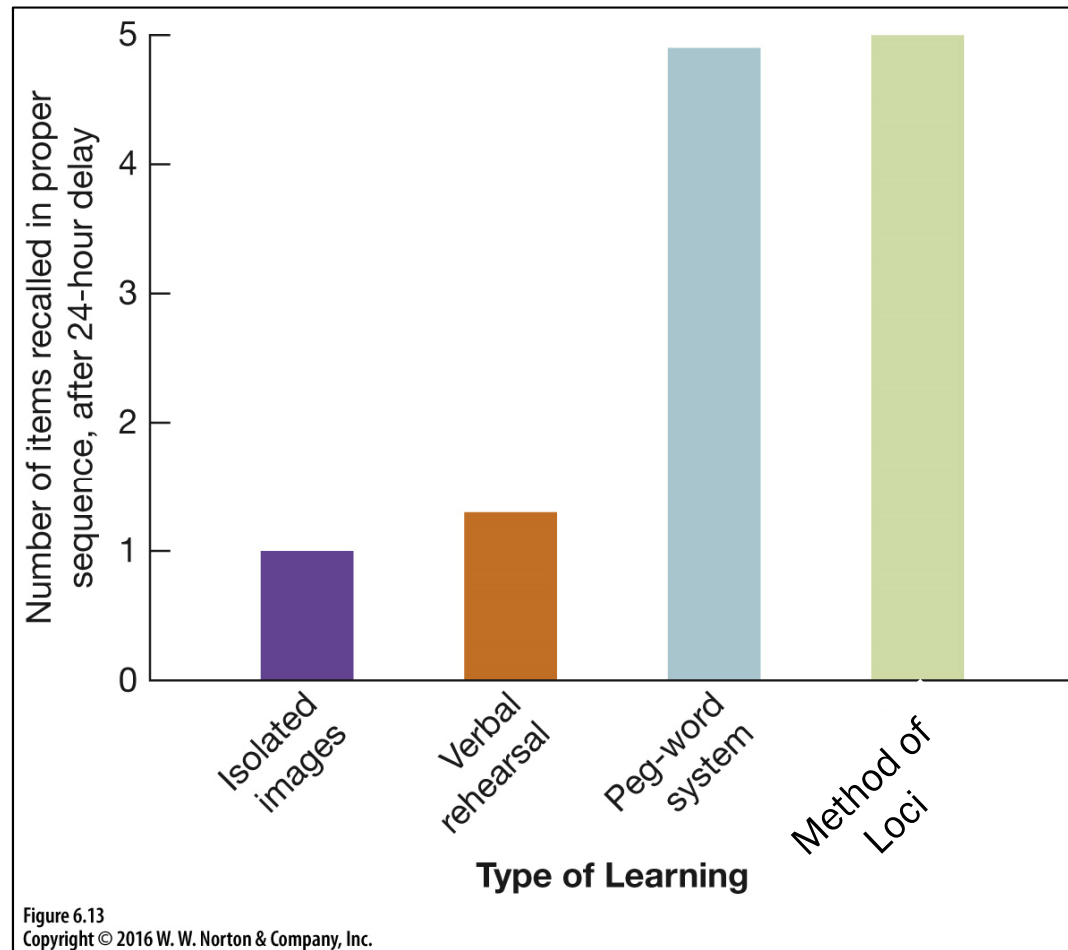


Encoding Information: Mnemonics

- Why are mental pegs effective?
 - imagery encoding (Allen Pavio, dual-code theory)
 - structure
- Roediger (1980) compared 4 different imagery mnemonics
 - Separate mental images
 - Method of loci
 - Pegword method
 - Control (no imagery instructions)

Encoding Information: Mnemonics

- Results: Loci = Peg > Imagery = Control

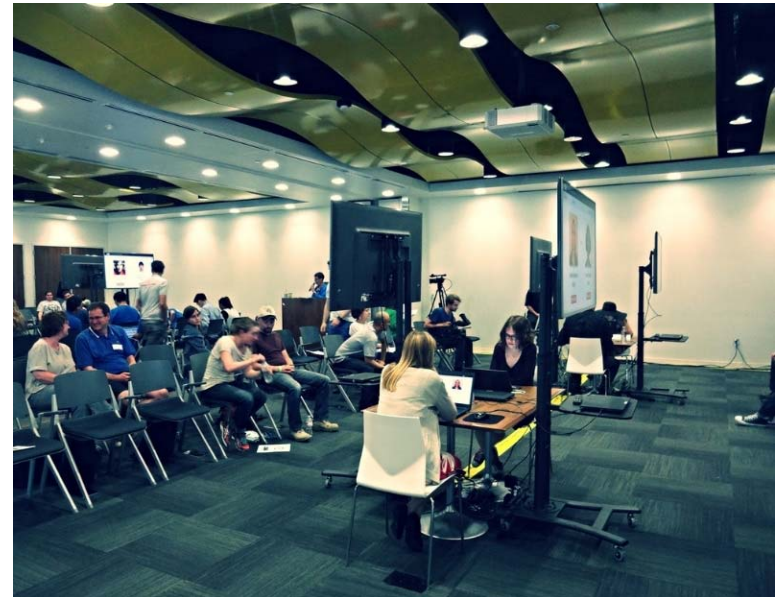


- Only effective for concrete words. Why?

Memory Tournaments are Real!



The Tournament is in San Diego!



Memory Champion: Nelson Dellis

- Résumé
 - US Memory Championship: 1st place in 2014 & 2015
 - World Memory Championship: 8th place in 2014
 - Can memorize a (shuffled) deck of cards in: 41 seconds
 - Can memorize 303 digits in 5 minutes
- Method of Loci (aka memory palace) demonstration



STORAGE

- The brain naturally absorbs spatial information
- The more Journeys you have, the more storage space you have in your brain
- Journeys can be as big or small as you want them to be



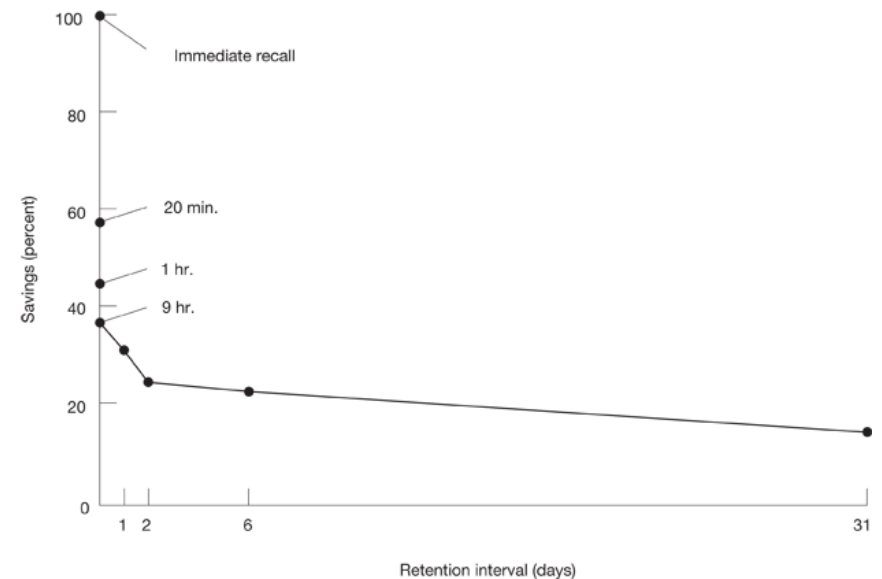
BRING THE FAMILY ADDRESS

26TH ANNUAL CONVENTION | SAN FRANCISCO, CA, USA | MAY 22-25, 2014

**Make It Stick: How Memory Athletes Perform
and How their Techniques Can Help You**

Ebbinghaus

- Studied how quickly he forgot nonsense syllables
- Task
 - Studied nonsense syllables until one perfect recall
 - Waited a specified period of time (retention interval) to see forgetting rate (forgetting curve)



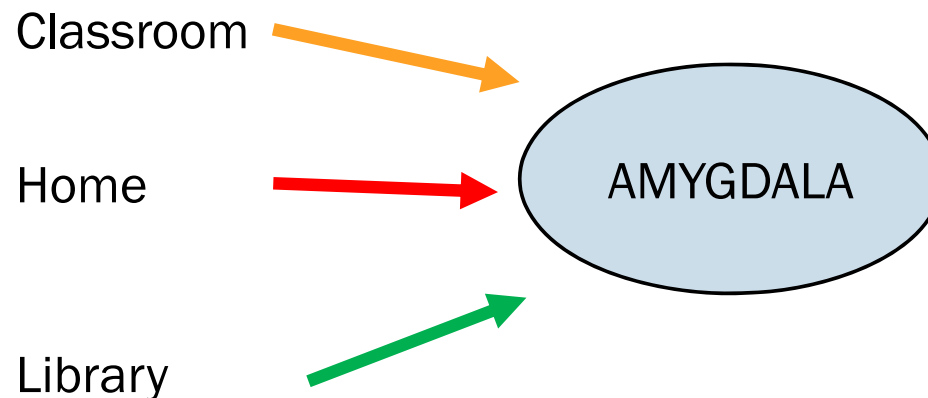
- Assessed how many trials it took to relearn the list (savings)

Forgetting

- Sometimes people can remember information that they were unable to recall earlier
 - Reminiscence
- Hypermnesia: Remembering MORE information over time

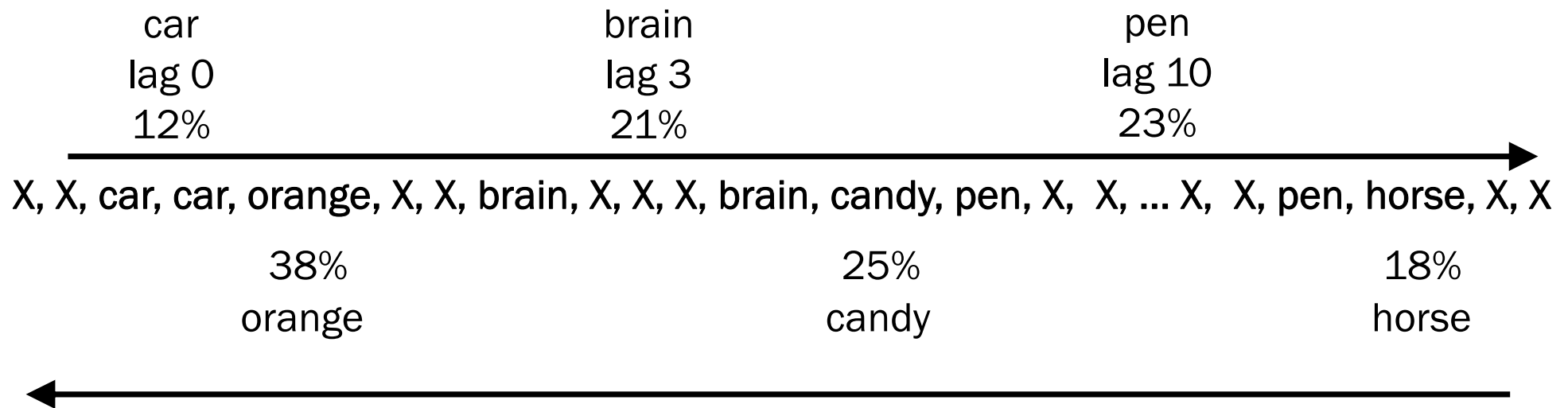
Massed vs. Space Repetition

- Spacing effect
 - Spaced > Massed repetition
 - Spreading out your study sessions is more effective than cramming
- Superiority of distributed repetition due to:
 - Deficient processing of 2nd presentation (P2) in massed repetition
 - Encoding variability in distributed repetition
 - More retrieval routes created



Spacing Effect: Inattention for P2

- Evidence for P2 inattention for massed repetition (Elmes, Greener & Wilkinson (1972))



(1) Spacing effect

(2) Memory for word appearing after repeated word decreases with lag due to inattention

Spacing Effect: Motivation?

Is massed P2 deficient processing under attentional control?
Hintzman, Summers, Eki & Moore (1975)

- Task: Tone with some items indicates monetary (\$) reward for remembering
- Hypothesis A: If massed deficiency is under conscious control, tone should help massed more than spaced
- Hypothesis B: If massed deficiency is not under conscious control, tone should help massed same as or less than spaced
- Results: helped massed & spaced same amount deficiency not under conscious control

Spacing Effect: Encoding Variability

- Role of encoding variability (Gartman & Johnson, 1972)
 - Encoding the same word with different meanings
 - More retrieval routes to recall target

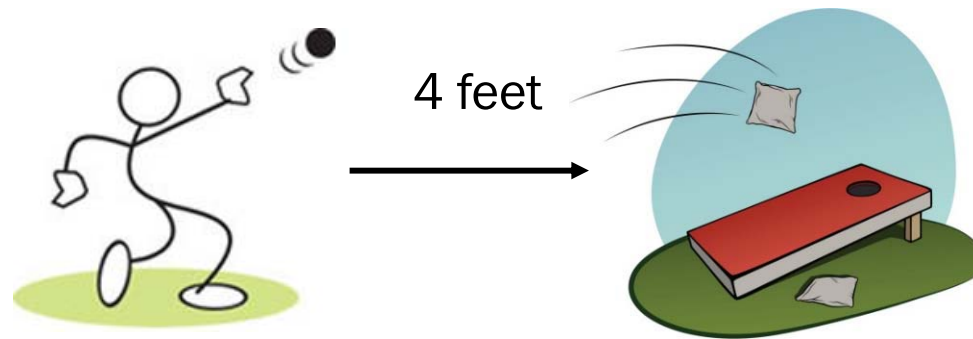
Used homographs (words with two distinct meanings but spelled the same)

	Lag 2	Lag 13	Diff.
Control (no context) (ant insect <u>foot</u> ... spy telephone <u>foot</u>)	22%	54%	32%* (large spacing effect)
Same meaning (leg neck <u>foot</u> ... arm hand <u>foot</u>)	30%	38%	8% (memory performance low; small spacing effect)
Different meaning (leg neck <u>foot</u> ... inch meter <u>foot</u>)	72%	77%	5% (memory performance high; no spacing effect)

- Results favor encoding variability interpretation

Encoding Variability and Motor Learning

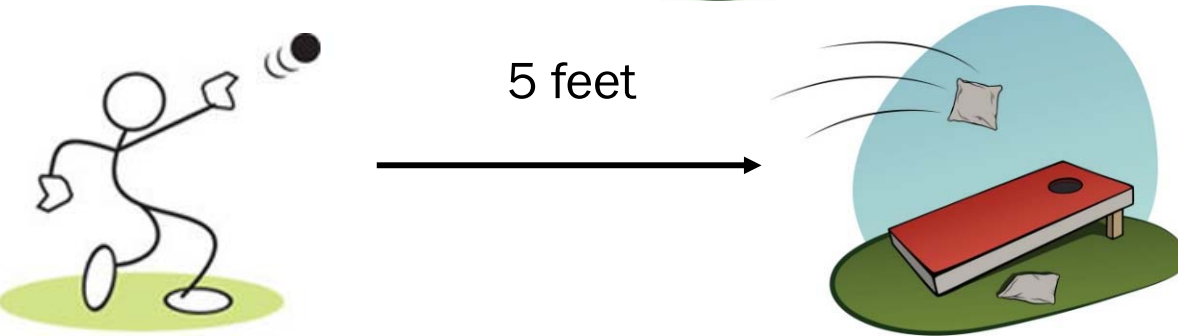
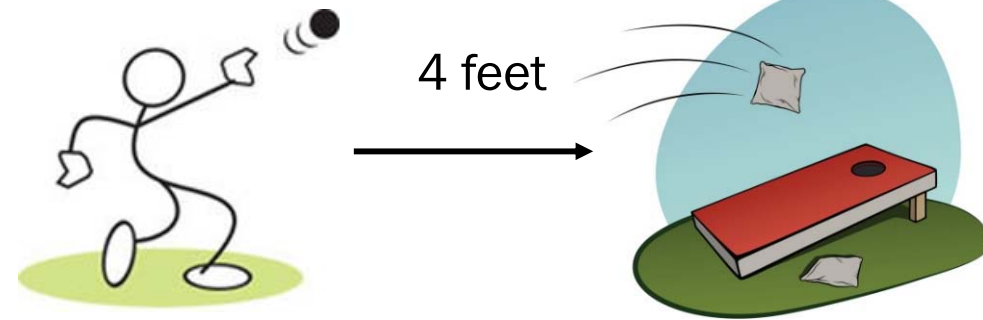
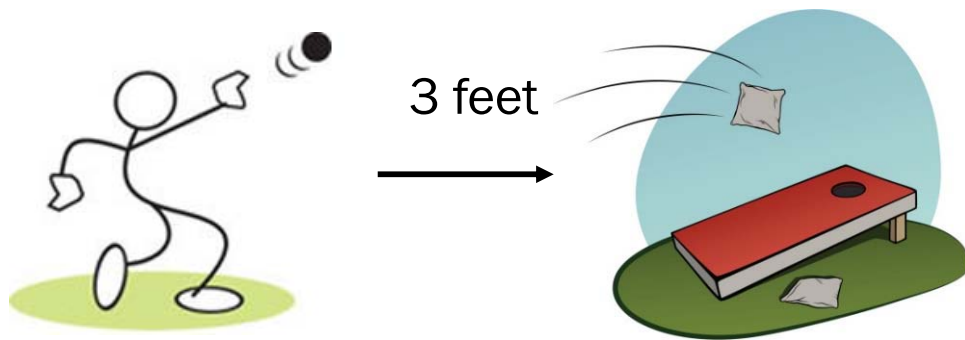
- Kerr and Booth (1978)
- 8 year olds & 12 year olds trained in a bean bag tossing task
 - Task: Throw bean bag positioned 4 feet away, with participants vision occluded



Encoding Variability and Motor Learning

- Two types of training
 - Variable Training

Fixed Training



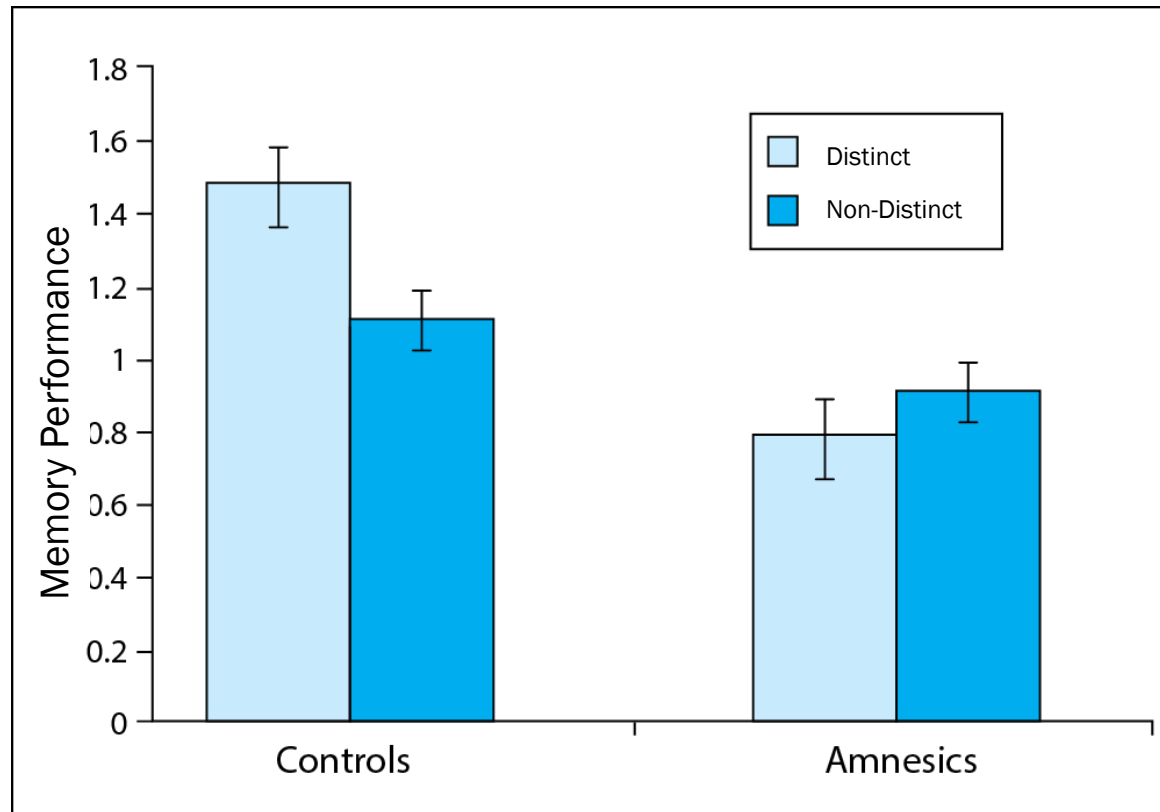
- The variable group did better at the final test (throwing bean bag) from 4 feet away even though they haven't had any practice at that distance!!

Distinctiveness: von Restorff Effect

- Memory is better for information that is different from the rest (i.e., information that “stands out”)
- Two types of distinctiveness
 - Physically distinct
 - a single word written in colored ink with other items written in black ink
 - a single word given in a voice that differs from the voice of all other list items given in the same voice
 - Conceptually distinct
 - single fruit among all sports

Distinctiveness: von Restorff Effect

- Distinctive item more strongly activated in hippocampus
- No distinctiveness effect in amnesiacs



von Restorff Effect: Encoding or Retrieval?

- Originally thought von Restorff effect an encoding effect
- Evidence that it is a RETRIEVAL effect

Early Condition

Yoga
Teach
Arrow
Weight
Jump
Scream

Middle Condition

Teach
Arrow
Yoga
Weight
Jump
Scream

Late Condition

Teach
Arrow
Weight
Jump
Scream
Yoga

- Occurs whether distinctive item early or late in study list (Hunt, 2009, Memory)
 - If due to encoding, you would expect Middle & Late > Early

Two Types of Rehearsals

- Committing studied information to long-term memory.
- Maintenance (shallow) rehearsal
 - Low-level, repetitive information recycling
 - Rehearsal in articulatory loop without involvement of central executive (Nairne, 1983)
- Elaborative rehearsal
 - A more complex kind of rehearsal that uses meaning to help store and remember information

Depth (Level) of Processing

- Craik and Lockhart (1972)
 - Memory depends on quality of processing, not quantity of processing

LEVELS OF PROCESSING

The deeper the level of processing, the higher the probability that an item is retrieved

PHYSICAL

Visually apparent features of the letters

word
TABLE

question
Is this written in capital letters?

PHONOLOGICAL

Sound combinations associated with letters

word
CAT

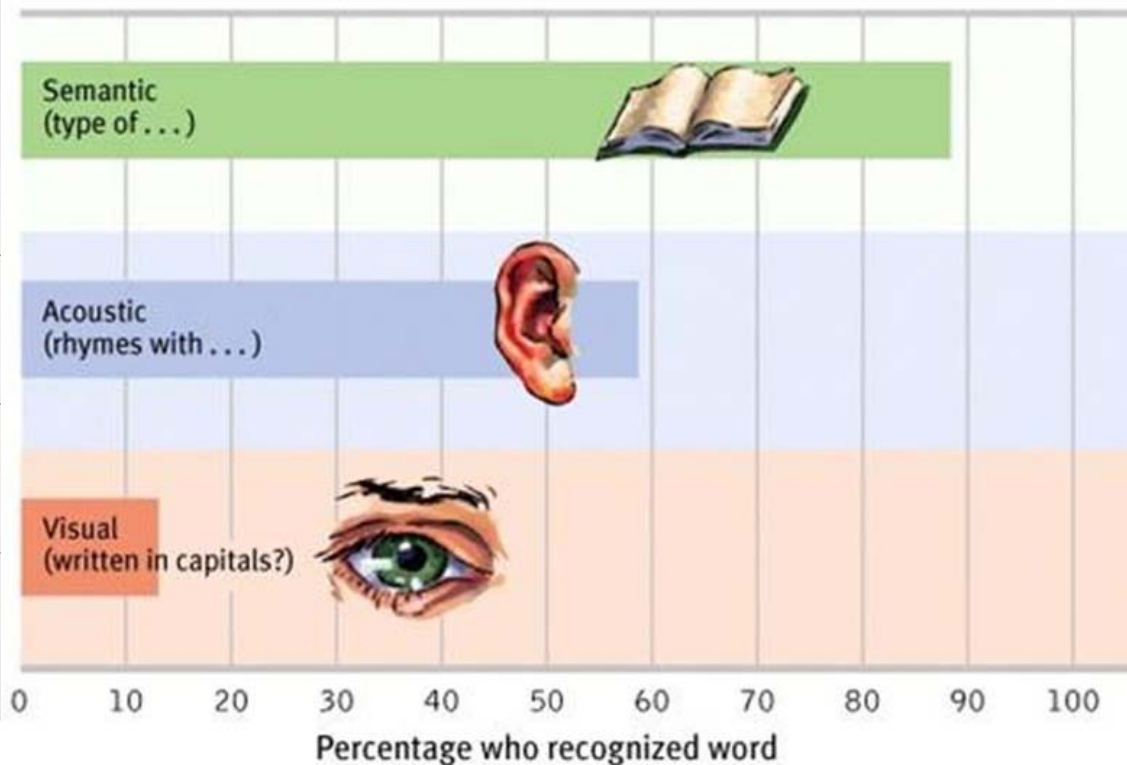
question
Does this rhyme with MAT?

SEMANTIC

Meaning of the word

word
POMERANIAN

question
Is the word a type of dog?



Depth (Level) of Processing

- Increase processing time for the shallow task...
 - Structural Task: give pattern of consonants and vowels (e.g., "brain" = CCVVC)
 - Semantic Task: does a word fit in a sentence? (e.g., "The man threw a ball to the ____ (child)." Yes)
- Results
 - Processing time: Structural (1.70 s) > Semantic (0.83 s)
 - Memory Performance: Structural (57%) < Semantic (82%)
- Conclusion
 - Processing depth more important than processing time
 - Deep incidental > shallow intentional

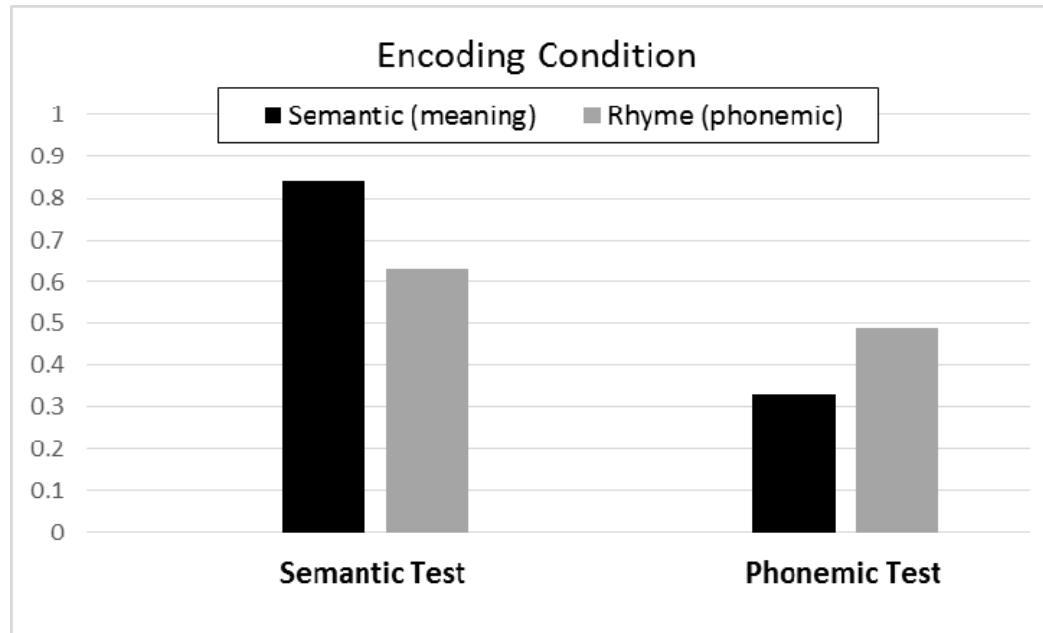
Challenges to Depth of Processing: Must Take Retrieval into Account

Morris, Bransford & Franks (1977)

- Type of encoding (incidental)
 - Semantic: Can it fly? EAGLE (“yes”)
Is it an eating utensil? FLOOR (“no”)
 - Phonemic: Does it rhyme with mate? EIGHT (“yes”)
Does it rhyme with stall? TREE (“no”)
- Levels of processing framework predicts better episodic memory for semantic (deeper) encoding.
- Two retrieval conditions
 - Standard “yes/no” RGN eagle (“yes”) ankle (“no”)
 - Rhyme “yes/no” RGN legal (“yes”) tank (“no”)

Encoding/Retrieval Interactions

Morris, Bransford & Franks (1977) Results



Standard
LOP effect

Diff **+ .21**

- .16

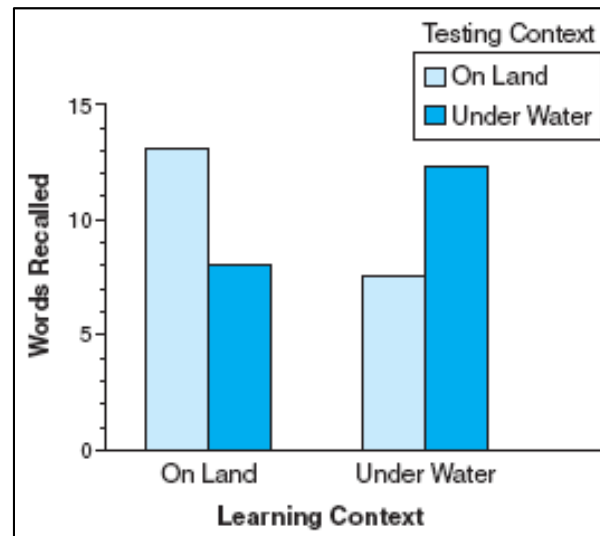
Reverse
LOP effect

Conclusions

- (1) Levels-of-processing effect depends on retrieval condition
- (2) Data support transfer appropriate processing (TAP)
- (3) Standard RGN based on semantics

Encoding Specificity Principle

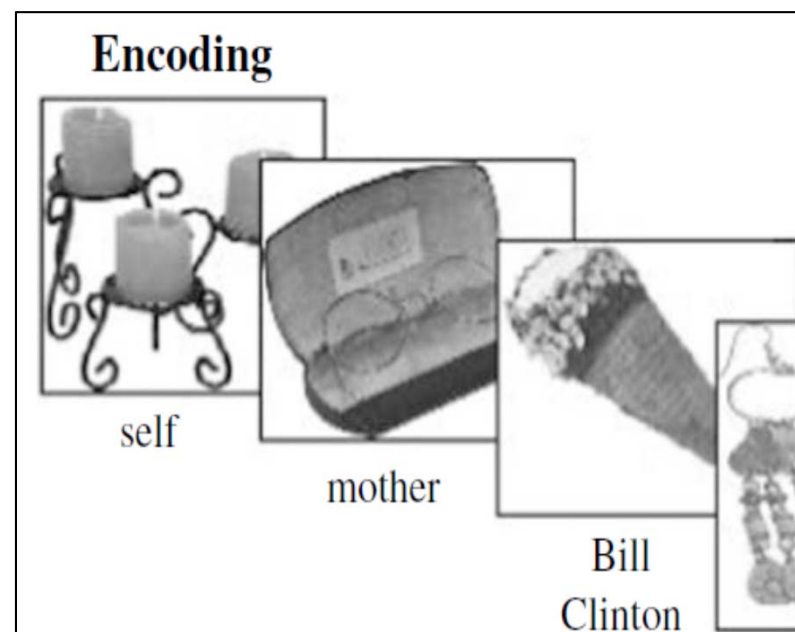
- Information is better remembered when the retrieval context matches the encoding context
 - Contextual information is stored as part of the memory trace
 - The context serves as a retrieval cue
- Context-dependent learning (Godden & Baddeley, 1975)
 - Participants studied a list of words either on land (the beach) or underwater
 - Participants had to free-recall words either on land or underwater



- Context effects are not limited to environmental context
- State-dependent learning (Goodwin et al., 1969)
 - Participants learned words under a sober or intoxicated state
 - Tested under sober vs. intoxicated state
 - Participants recalled more words when learning state matched retrieval state matched
- Mood-Congruent Learning (Bower, Monteiro, & Gilligan, 1978)
 - Memory is better when a person's mood at encoding and retrieval are similar
- Context-dependent effects are not robust
 - Smith (1988) outshining hypothesis: strong retrieval cues usurps beneficial effects of contextual reinstatement
 - For example, context effect greatest for free recall, intermediate for cued-recall, and weakest for recognition

Other Methods to Enhance LTM

- Self-reference (Bellezza, 1992; Serbun et al., 1992): Information that is related to you
 - People asked to remember buying items for themselves, their mother, or a familiar Stranger (Bill Clinton)



- Generation (Slamecka & Graf, 1978): Information that a person generates is better remembered than information that is simply heard or read.
 - hot – c _ _ _ > hot – cold; TEST memory for word “cold”

Other Methods to Enhance LTM

- Action observation effect (Englecamp & Zimmer, 1985): Memory is better for observed actions than for corresponding verbal statements (pick up the toothpick, drink the water...)
- Enactment (Steffens, 2007): Memory is better for actions that are actually carried out compared to those that are simply described
 - Can occur through the intention to perform the action
 - If subjects are told they will later act out a procedural script even though they do not actually act it out, they are better able to recognize words that appeared in the script (Badets, Blandin, Bouquet & Shea, 2006; Steffens, 2007)

What type of deep processing produces best memory?

Nairne, Pandeirada & Thompson (2008, *Psych. Sci.*) compared:

- 1) Pleasantness ratings
- 2) Imagery ratings (how easy to image)
- 3) Self-reference ratings (how easily does it bring to mind something that happened to you in your life)
- 4) Intentional learning (learn these words)
- 5) Generation (nkife) + pleasantness
- 6) Survival relevance ratings

1-5 rating scale

Used the same 32 unrelated concrete words from
32 semantic categories for all groups

truck juice silver door car silk diesel shoes orange broccoli sword teacher mountain finger
whiskey bear apartment pan pepper aunt flute cathedral soccer sock book chair snow
screwdriver emerald eagle

Free Recall

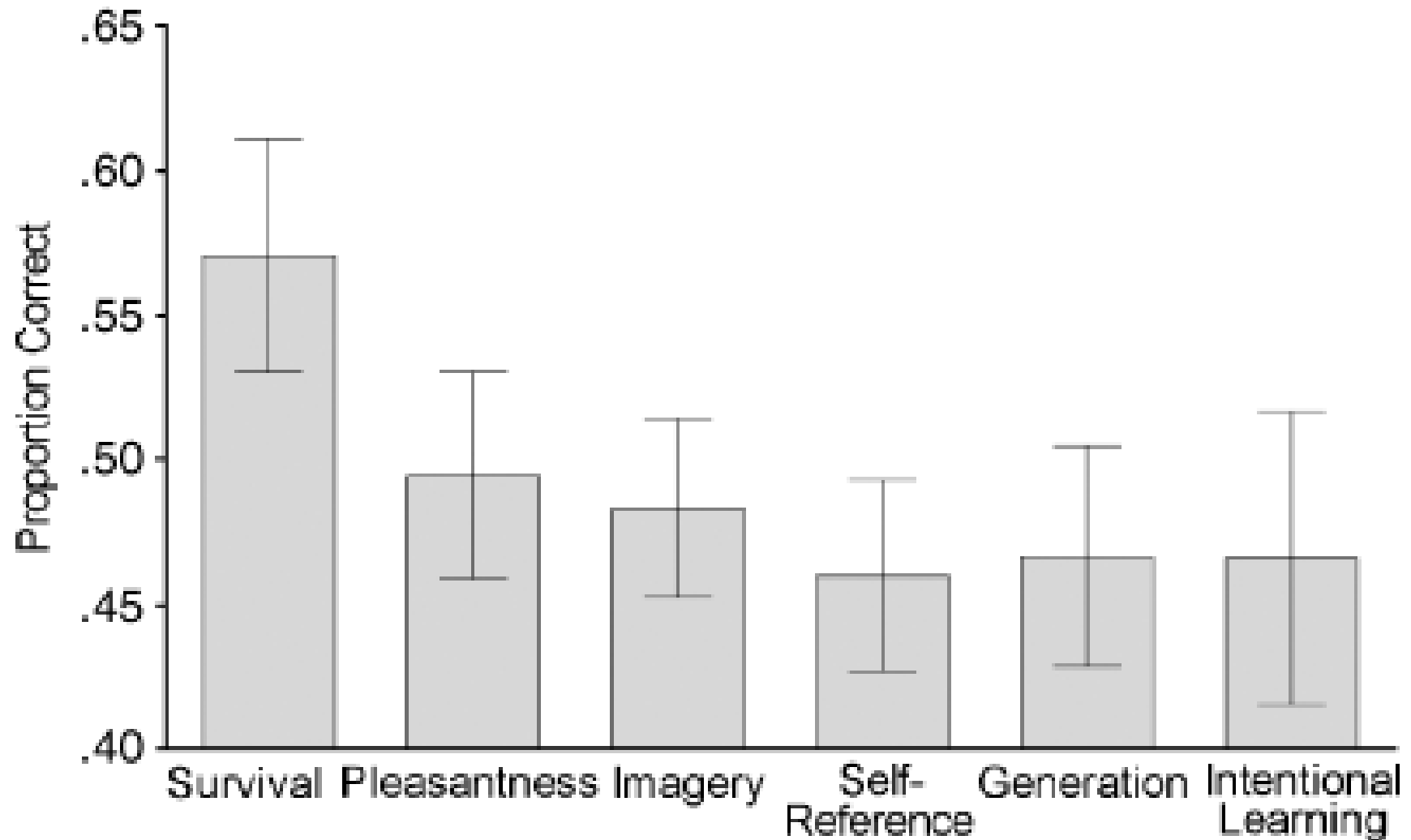
What type of deep processing produces best memory?

Nairne, Pandeirada & Thompson (2008, *Psych. Sci.*)

Survival relevance instructions

In this task, we would like you to imagine that you are stranded in the grasslands of a foreign land, without any basic survival materials. Over the next few months, you'll need to find steady supplies of food and water and protect yourself from predators. We are going to show you a list of words, and we would like you to rate how relevant each of these words would be for you in this survival situation. Some of the words may be relevant and others may not—it's up to you to decide.

What type of deep processing produces best memory?



Nairne (2010, Cog. Psych.) Four Experiments

Is effect due to a schematic script and/or ancestral survival?

Ancestral Predator. Imagine that you are stranded in the **grasslands** of a foreign land, without any basic survival materials. You have recently received word that a dangerous **predator** has been seen in the area. You will need to avoid and/or escape from the **predator** to ensure your survival. Rate how relevant each word would be in your attempt to avoid the **predator**.

Modern Attacker. Imagine that you are stranded in the **city** of a foreign land, without any basic survival materials. You have recently received word that a dangerous **attacker** has been seen in your area. You will need to avoid and/or escape from the **attacker** to ensure your survival. Rate how relevant each word would be in your attempt to avoid the **attacker**.

Ancestral Infection. Imagine that you are stranded in the **grasslands** of a foreign land, without any basic survival materials. You have recently been hurt and a dangerous infection might be developing. You will need to search and find relevant **medicinal plants** to ensure your survival. Rate how relevant each word would be in your attempt to cure the infection.

Modern Infection. Imagine that you are stranded in the **city** of a foreign land, without any basic survival materials. You have recently been hurt and a dangerous infection might be developing. You will need to search and find relevant **antibiotics** to ensure your survival. Rate how relevant each word would be in your attempt to cure the infection.

Nairne & Pandeirada (2010, Cog. Psych.) Four Experiments
Is effect due to a schematic script and/or ancestral survival?

Ancestral Food gathering. Imagine that you are stranded in the **grasslands** of a foreign land, without any basic survival materials. You have not eaten for several days and it's important for you to gain nourishment. You will need to search for and **gather edible plants** to ensure your survival. Rate how relevant the word would be in your attempt to obtain nourishment.

Modern Food gathering. Imagine that you are stranded in the **city** of a foreign land, without any basic survival materials. You have not eaten for several days and it's important for you to gain nourishment. You will need to search for and **buy food** to ensure your survival. Rate how relevant each word would be in your attempt to obtain nourishment.

Moving. Imagine that you are planning to **move to a new home** in a foreign land. Over the next few months, you'll need to locate and purchase a new home and **transport your belongings.** Rate how relevant each word would be for you in accomplishing this task.

Nairne & Pandeirada (2010, Cog. Psych.) Four Experiments

Is effect due to a schematic script and/or ancestral survival?

Results

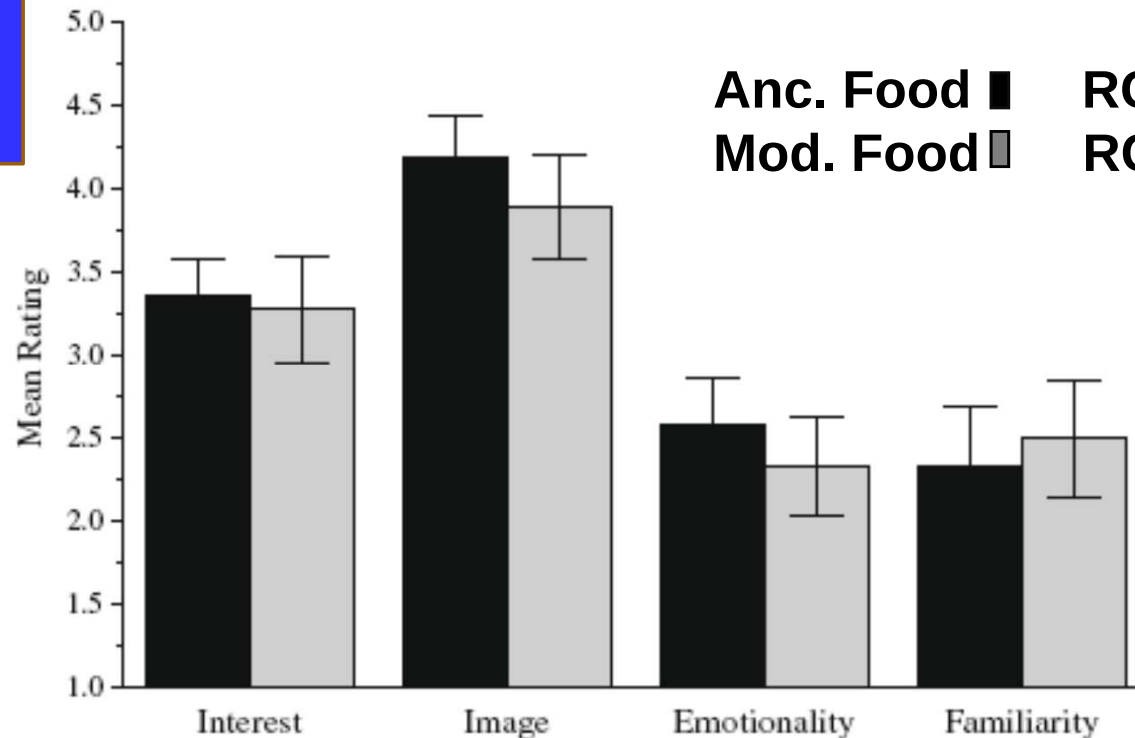
- (1) No consistent relation between recall, ratings and RTs
- (2) Ancestral predator > Modern attacker = Moving
- (3) Ancestral infection > Modern infection = Pleasantness
- (4) Anc. food gathering > Modern food gathering = Pleasantness

For ratings and RTs:

Anc. Food = Mod. Food

Anc. Food ■ RCL = .54

Mod. Food ■ RCL = .43



Data show
ancestral
effect but no
script effect

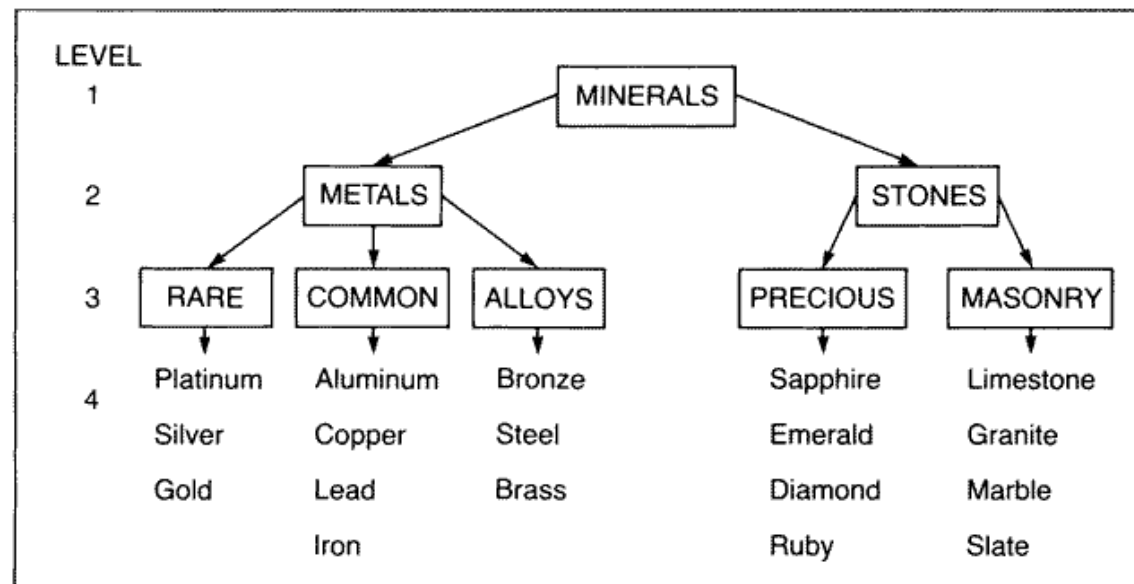
Ancestral effect not
due to extraneous
differences in
interest,
emotionality, etc.

OVERALL SUMMARY FOR SURVIVAL PROCESSING

- (1) Occurs in both recall and recognition and in between- and within-subjects designs (Nairne, Thompson & Pandeirada, 2007, *JEP:LMC*)
- (2) Ancestral Survival > Modern Survival
- (3) Not tied to ancestral sex-differentiated hunter-gatherer roles (Nairne, Pandeirada, Gregory & Van Arsdall, 2009, *Psych. Sci.*)
 - (a) hunting, food gathering, vs. scavenge hunting scenarios
(between subjects)
 - (b) hunting = food gathering > scavenge hunting
 - (c) no interaction with male/female

Factors that Improve LTM: Organization

- Bower et al. (1969)
 - People studied a list of words with or without an organizational structure four times.



Conditions	Trial 1	Trial 2	Trial 3	Trial 4
Random	18.3%	34.7%	47.1%	62.5%
Organized	65%	94.7%	100%	100

Organizational Encoding Processes

Semantic relatedness

Try to remember:

horse knife fork lion tiger spoon apple tennis banana hockey
baseball grape

- (a) better in free recall than if words all unrelated
- (a) related items are clustered together in free recall output (category clustering)

Two components of encoding

■ Item-specific processing

- (a) process items in terms of their individual characteristics
- (b) enhances item distinctiveness
- (c) reduces category clustering in output
- (d) reduces memory for order information

■ Relational processing

- (a) process items in terms of their interrelations
- (b) enhances (typically semantic) organization
- (c) enhances category clustering in output
- (d) enhances memory for order information (and free recall of short lists of unrelated words, which subjects typically try to recall in order at intermediate retention intervals)

Evidence for the distinction between

Item - specific vs. relational processing Einstein & Hunt (1980)

- Two encoding tasks: category sorting (relational processing) vs. pleasantness rating (item-specific)
- Two kinds of materials: related items taken from established semantic categories (e.g., fruits, sports) vs. unrelated words that could fit into ad hoc categories (things to take on vacation)

Results

- Semantically related items: pleasantness > category sorting
- Unrelated items: category sorting > pleasantness

Conclusions

- Semantically related words invite relational processing, item-specific processing induced by pleasantness ratings adds to the already strong relational processing
- Unrelated words invite item-specific processing, relational processing induced by category sorting adds to the already strong item-specific processing

Long - Term Memory: Encoding effects

Mulligan (2002, *PBR*)

- A number of encoding manipulations enhance recall by enhancing item-specific processing (but at the same time reduce relational processing)
- These manipulations have larger effects in within-subject designs than in between-subject designs (because a contrast between distinctive vs. nondistinctive processing is needed to make something distinctive)
 - Generation
 - Enactment
 - Bizarre imagery
 - Orthographic distinctiveness (kept, tsar vs. kelp, tear)

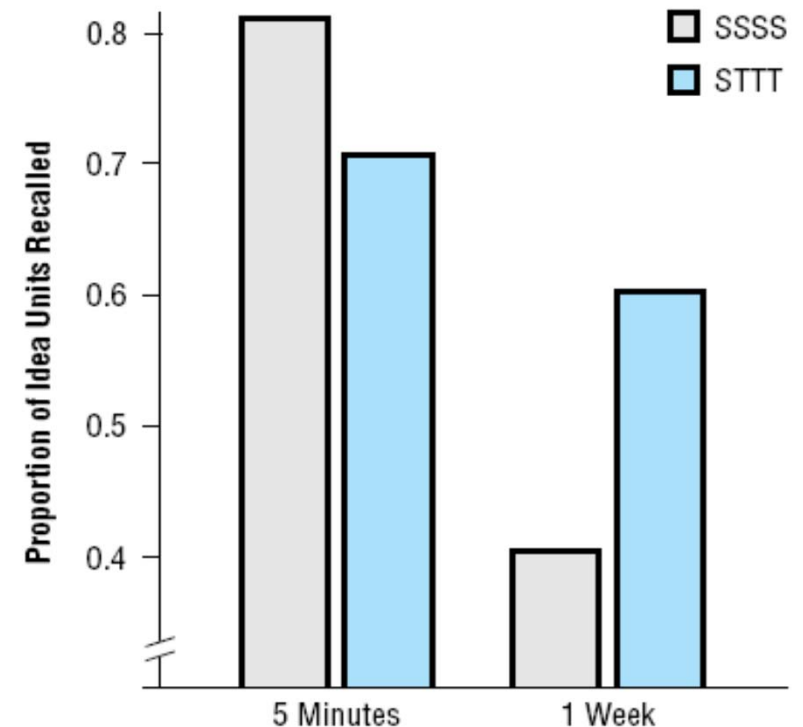
The Testing Effect

(Roediger & Karpicke, 2006)

- How effective is restudying the materials over and over again?
- Participants studied essays on “the sun” & “sea otters”
 - (1) Two different “study” conditions
 - Studied the passage 4 times (SSSS)
 - Studied the passage only once then received 3 successive free-recall tests (STTT)
 - (2) Final test administered
 - 5 minutes later
 - 1 week later (This group was also asked to give confidence ratings.)

Roediger & Karpicke (2006, *Psych. Science*) Results

- At 5 min retention interval (RI)
SSSS > STTT
- At 1 week RI
SSSS <<< STTT
- SSSS more confident that they'll
Remember the information 1-week later
than the STTT group (4.8 vs. 4.0)



Conclusions

- (1) Repeated study better at very short RI; at long RIs, retrieval practice/testing much better!!
- (2) Repeated study gives students the false sense of confidence that they know more than what they actually do know

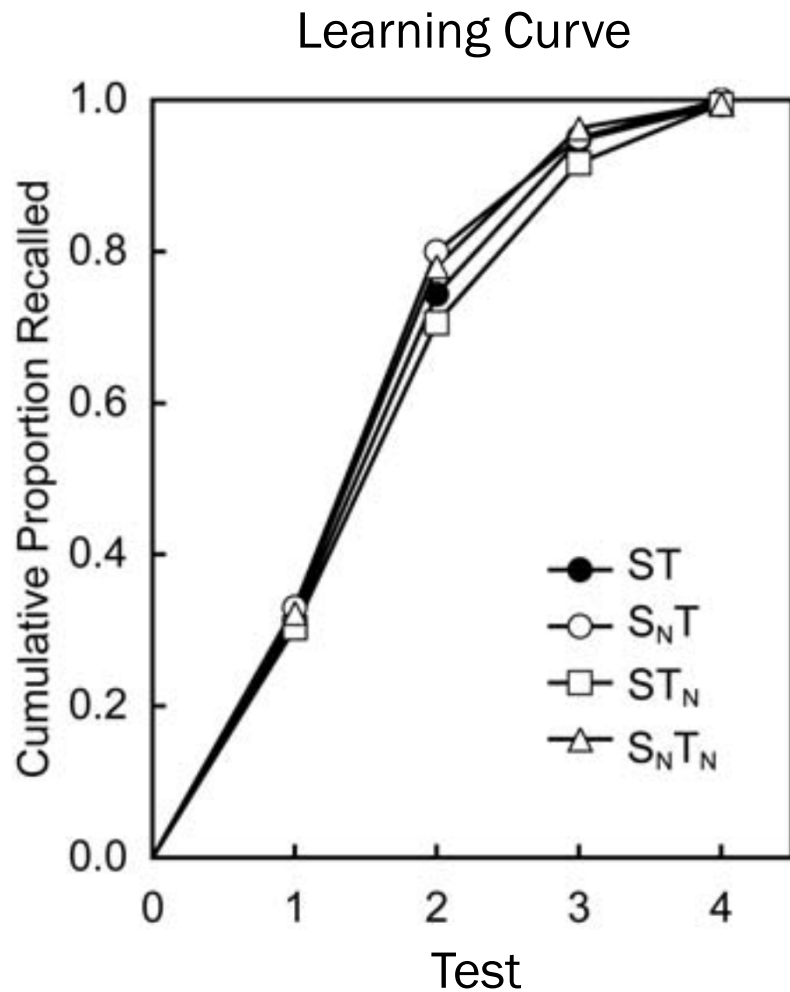
Most Efficient Way to Study

- Testing improves learning much more quickly than does restudy, saving you time
- Karpicke & Roediger (2008, *Science*): Procedure
 - Participants learned 40 foreign language vocabulary paired associates under one of four study-test conditions
 - Swahili-English pairs (e.g., mashua-boat)
 - Four study-test cycles

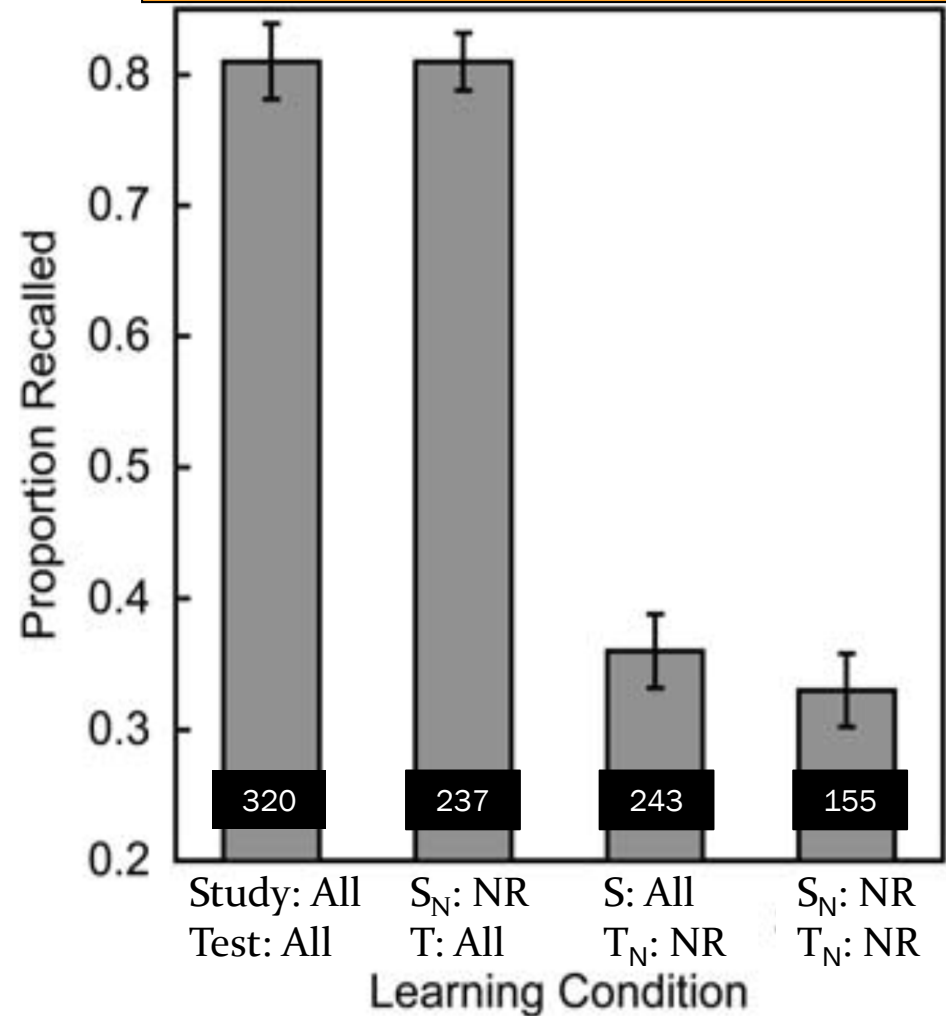
Group	1 S	1 T	2 S	2 T	3 S	3 T	4 S	4 T	Total # of Trials
Study: All Test: All	40	40	40	40	40	40	40	40	320
Study: NR Test: All	40	40	26.8	40	8.0	40	2.0	40	236.8
Study: All Test: NR	40	40	40	27.9	40	11.8	40	3.3	243.0
Study: NR Test: NR	40	40	27.1	27.1	8.8	8.8	1.5	1.5	154.8

NR = Not recalled/remembered

Roediger & Karpicke (2008, *Science*): Results



Final test: 1 week later



- Dropping restudy trials did not affect performance!
- To save time but still improve memory, engage in repeated testing.

Prose passages

(Roediger & Karpicke, 2006)

Vocabulary words

(Cho et al., 2016;
Arnold & McDermott, 2013;
Kang 2010)

Sea Otters / Sun / Bats

Swahili: wingu - cloud
Russian: medved - bear
Chinese: big - 大

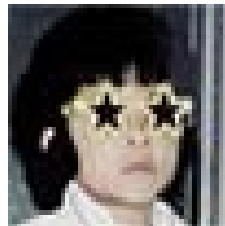
Birds

(Jacoby et al., 2010)



Face-name

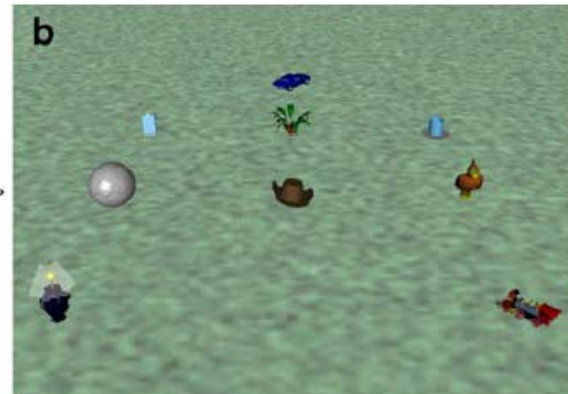
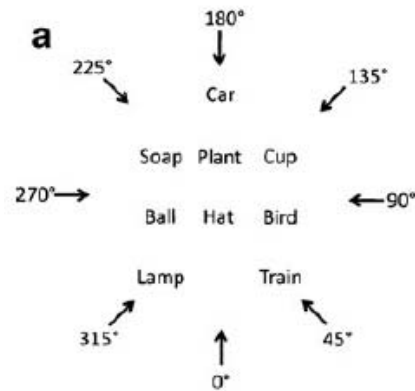
(Weinstein et al. 2011)



= Kit

Location of objects

(Carpenter & Kelly, 2012)

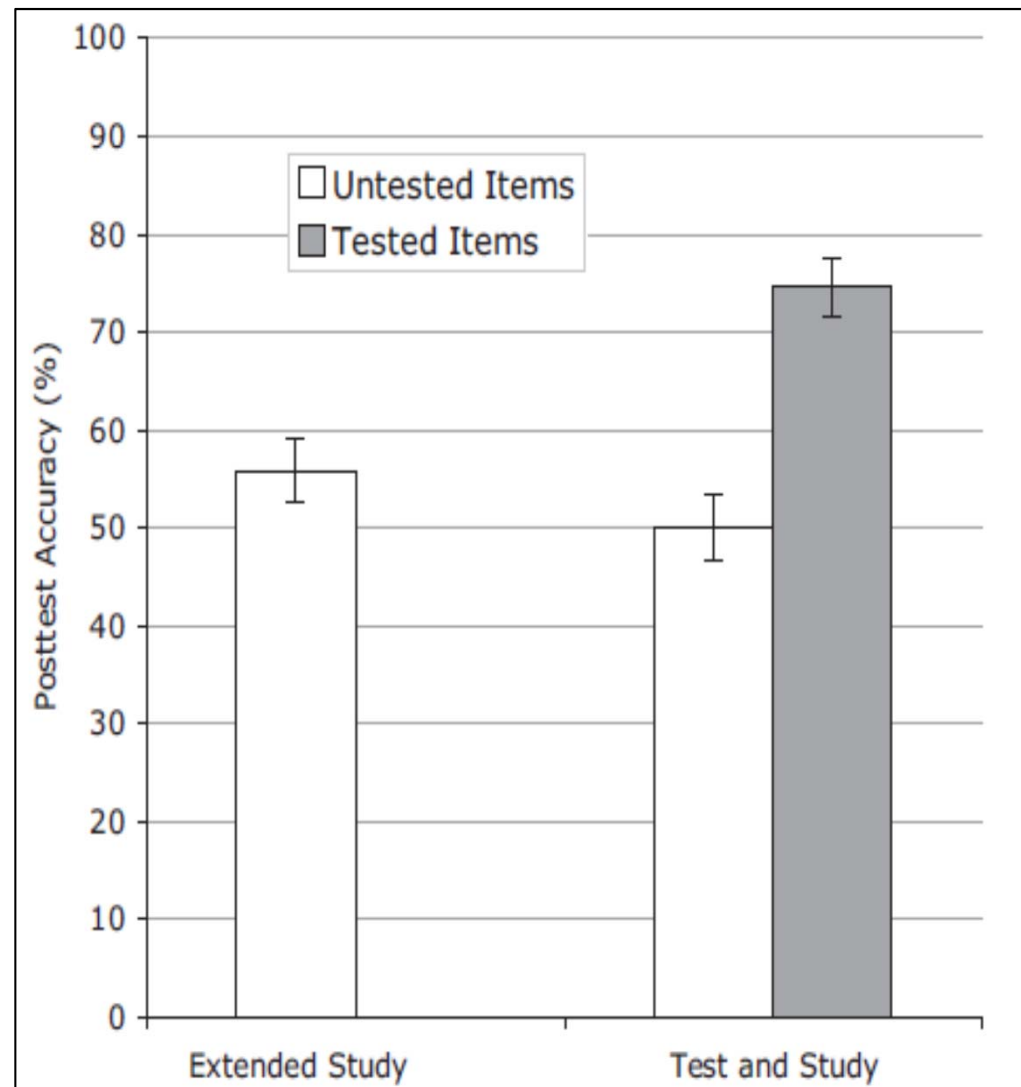


Population

3rd/4th graders (Rohrer et al., 2010); elderly (~80 years old; Tse et al. 2010)

Pretesting Effect: Benefits of UNSUCCESSFUL retrievals

- Richland, Kornell & Kao (2009)
- Read a passage and answer questions about color blindness
 - BEFORE reading passage
 - One group receive all the questions that they would be tested on
 - For half of the questions, participants tried to answer them
 - For the other half, they just read the question
 - Another group of participants were given extra time to study the passage
- All participants came back to the lab 1 week later to answer questions about the passage



- Results: Trying to answer questions about a topic before you learn about the topic improves learning.
- Tip: Before reading a chapter, try to answer the review questions in the back of the chapter first

Retrieving Information

- Why do we forget?
- Decay: Information fades from memory unless it is used
 - Law of Disuse (Thorndike, 1914)
- Interference: Competing information blocks/inhibits other information

Retrieval-Induced Forgetting

- Sometimes testing can interfere with your ability to remember related, non-tested information
 - Retrieval-induced Forgetting paradigm (Anderson, Bjork, & Bjork, 1994)
 - 3 phases

Retrieval-Induced Forgetting

Study Phase:

Study list of related items
from different categories

fruit – orange
fruit – banana
drink - scotch
drink - rum

Review Phase

Cued-recall test on half of
the items from some
categories; all items from
drink category NOT tested

fruit – or_____

Final Test Phase

Cued-recall test on ALL
STUDIED ITEMS: 3 types

(1) RP+: Tested
(fruit – orange)

(2) RP-: Same category, not
tested
(fruit – banana)

(3) NRP: Category not
tested (drink – scotch,
drink – rum)

Retrieval-Induced Forgetting: Results

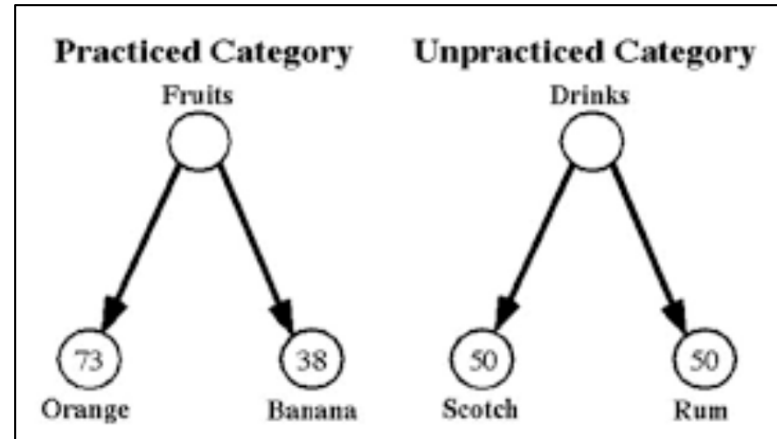
Final Test Phase

Cued-recall test on ALL STUDIED ITEMS: 3 types

(1) **RP+**: Tested
(fruit – orange)

(2) **RP-**: Same category, not tested
(fruit – banana)

(3) **NRP**: Category not tested (drink – scotch, drink – rum)



- Best memory for tested items: **RP+** - fruit-orange
- Moderate memory for non-tested items in the tested categories. (**NRP**: drink-scotch)
- WORST memory from non-tested items coming from the same category as the tested items! (**RP-**: fruit-banana)
- In order to remember, sometimes we have to forget. To retrieve and strengthen apple, which belongs to the fruit category, we have to inhibit other fruits we learned (e.g., banana)

Availability vs. Accessibility

- Retrieval failures can sometimes be due to accessibility rather than availability
 - Sometimes you need more “hints” to retrieve information
- Tulving and Thompson (1966): Retrieval cue effective to the extent that aspects of the retrieval cue was encoded during study
- Example: Light & Carter-Sobell (1970)
 - Study: raspberry - JAM
 - Test: peach - ? (good memory for JAM)
traffic - ? (poor memory for JAM)

Retrieval Cues Can Sometimes HURT Memory

- Part-set cuing effect: When memory is hurt in the presence of retrieval cues
- Roediger (1973) (see also, Rundus, 1973; Slamecka, 1968)
 - 1) Participants hear a list of 16 categories, 4 - 7 items per category (e.g., “fruit - banana grape pear peach...fish - trout haddock bass tuna cod herring salmon...”)
 - 2) Cued recall (category name + 0 to 5 studied exemplars as cues)

Retrieval Cues Can Sometimes HURT Memory

<u># of exemplar cues</u>	<u>% RCL of “tuna”</u>
0 Fish	63%
3 Fish-trout haddock salmon	56%
5 Fish-trout haddock salmon bass cod	52%

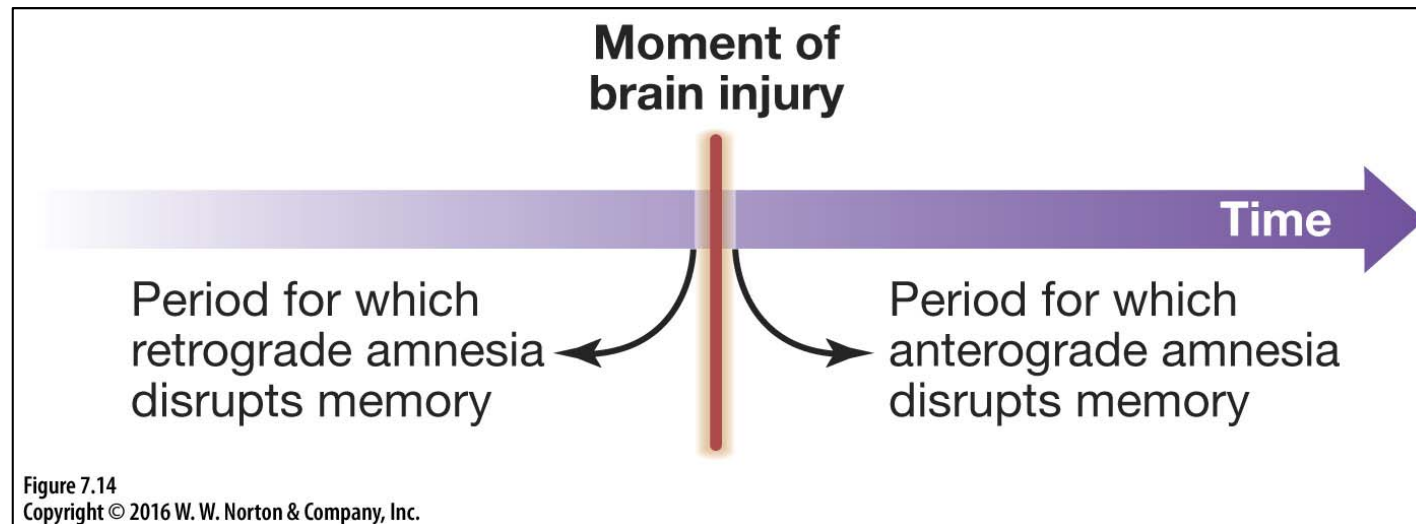
- Giving people more semantically related cues hurts memory!

Why?

- Disrupt a person's retrieval plan
- May cause the inhibition of competitor memories (the ones a person may actually want to retrieve)

Amnesia

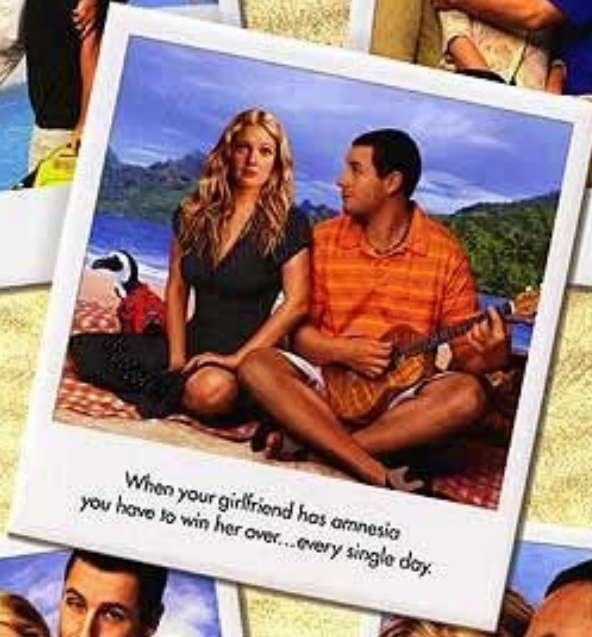
- Amnesia: Loss of memory or memory abilities caused by brain damage or disease



- Retrograde Amnesia: The loss of memory for events before a brain injury
- Anterograde Amnesia: The disruption of memory for events occurring after brain injury; that is, acquiring new long-term memories

ADAM SANDLER

DREW BARRYMORE



When your girlfriend has amnesia
you have to win her over...every single day.



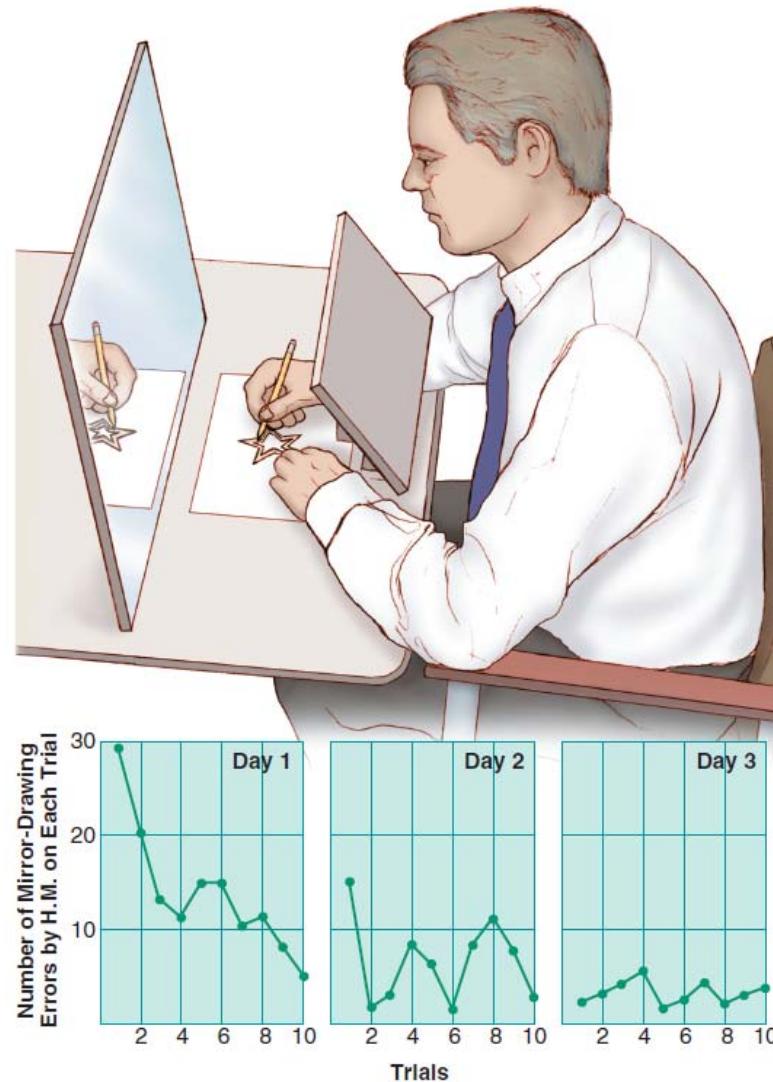
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Case Studies

- Loss of episodic but not semantic memory
 - Patient K.C.
 - Had serious brain injury, especially in the frontal regions, in a motorcycle accident
 - Loss of episodic memory
 - Semantic memory intact
- Anterograde amnesia
 - Surgery on H.M. resulted in severe anterograde amnesia (inability to form LTM)
 - H.M.'s procedural (implicit) memory was normal

H.M.'s Performance in a Tracing Task



- Objective of task is to trace object viewed through the reflection of a mirror
- Performance increased with practice, but no awareness of why that might be

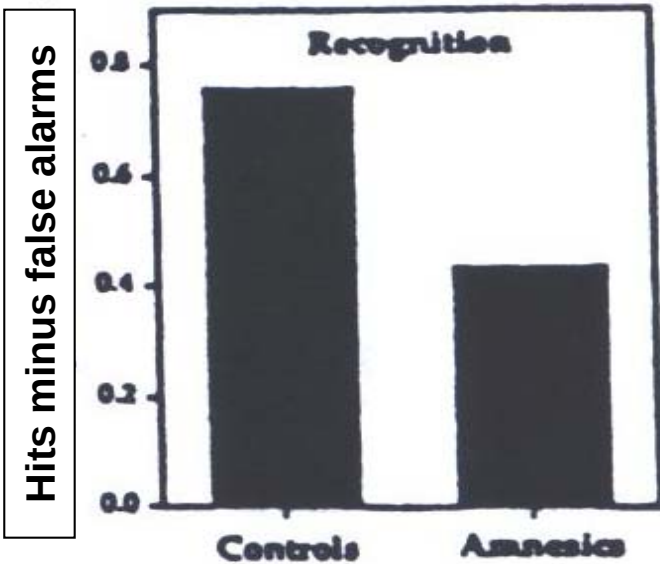
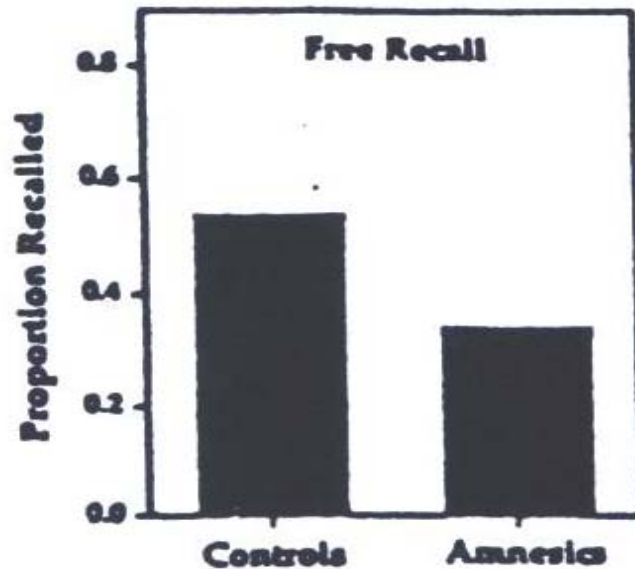
Dissociations Between Episodic Memory and Perceptual Representation System

Warrington & Weiskrantz (1970, *Nature*)

- 1) Amnesiacs (N = 4) and Controls (N = 14) study nonoverlapping lists of unrelated words (e.g., hat, phone, ankle, mug)
- 2) Different tests given after different lists at long retention intervals
 - (a) free recall (episodic memory)
 - (b) yes/no recognition (episodic memory)
 - (c) word-fragment completion (e.g., _nk_ e) (priming/implicit memory)
 - (d) word-stem completion (e.g., foot – a _ _ _) (priming/implicit memory)

Figure 1
Results of Warrington and Weiskrantz
(1970, Experiment 2)

Episodic (Explicit) Memory Tests



Priming (Implicit Memory) Tests

