



Learning 1

How best to learn
or

Why this course has chapter tests
and a cumulative final!



The Classical Conditioning Zap was due before class today. Please indicate your status with respect to this Zap.

Choose one

- A. I completed it with no problems
- B. I completed it but I was not sure I did it correctly
- C. I was able to get a Zap code but I had problem doing the Zap that kept me from completing it
- D. I had a problem getting a working Zap code
- E. I have not tried to do this Zap.



The Classical Conditioning Zap

Choose one

- A. Helped me understand how conditioning works
- B. Did not add much to what I learned from the text
- C. Was just confusing to me or difficult to use
- D. I have not yet done this Zap



- Which study method described below will help you do better on the questions based on the textbook in the chapter test a week from Friday?
 - A. Reading the text, underlining the important ideas, later re-reading the text, and then, just before the test, looking at the underlined passages.
 - B. After reading the text, summarizing the important concepts for a friend.



- Imagine that you are trying to learn a list of vocabulary words for an exam next week in your foreign language class. Which will be most important for your ability to remember these new words then?
 - A. The number of times you read through the list studying each word.
 - B. The number of times you test yourself on each word (e.g., with flash cards)

“Learning” versus “Memory”

- Assumption underlying traditional “**Learning**” research:
“All learning depends on essentially the same mechanisms (i.e., mechanisms of association), then for research purposes it may not matter very much what forms of learning we choose to study, because the lessons we will draw from our research and the principles we will uncover should be the same whether we're scrutinizing simple cases of learning or far more complex ones.”
Text page 261
- “**Memory**” research looks at more complex learning



Consider these two statements

1. Learning occurs primarily when people are exposed to and thus encode knowledge and experiences.
2. Retrieval of learned information can be used to measure learning, but retrieval does not itself produce learning.

Choose one

- A. Both statements are true
- B. Statement 1 is true but 2 is false
- C. Statement 2 is true but 1 is false
- D. Both statements are false



Assumption: Learning Results from Study

- Experiments studying the learning of complex materials are typically structured *Study – Test Study – Test Study – Test*
- Implicit assumptions
 - Learning occurs during the study periods
 - Tests are *merely* assessment tools

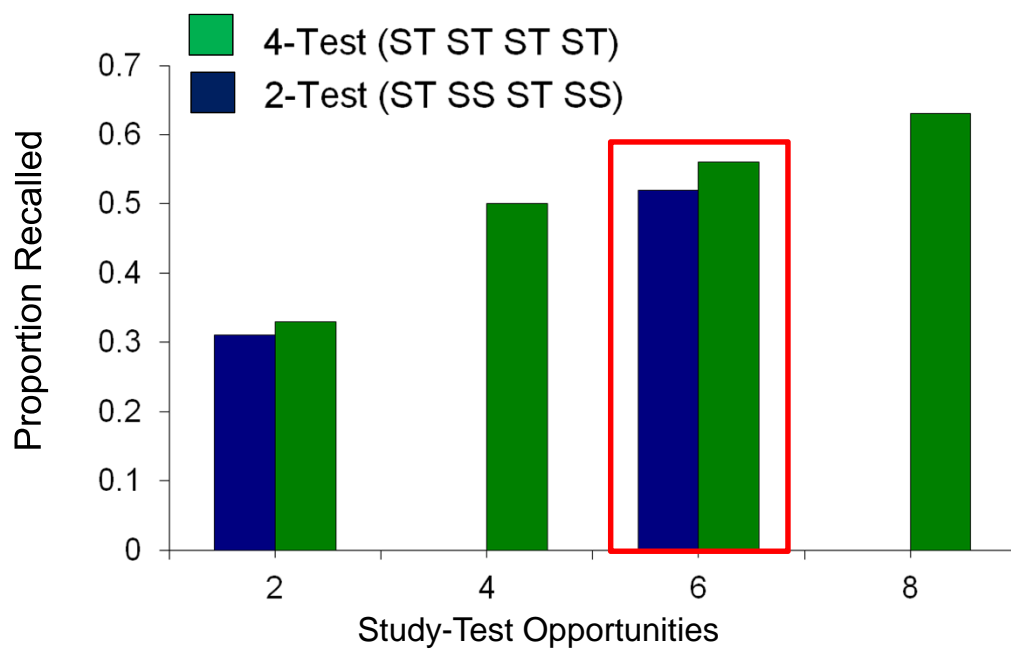
Zaromb & Roediger (*Memory & Cognition*, 2010)

- Subjects learned lists of 50 words
- Across 3 subject groups, Es manipulated the number of **S**tudy and **T**est intervals

ST	ST	ST	ST	4 Study, 4 Test
ST	SS	ST	SS	6 Study, 2 Test
SS	SS	SS	SS	8 Study, 0 Test

- After 48 hours there was retention test

Learning Phase Results

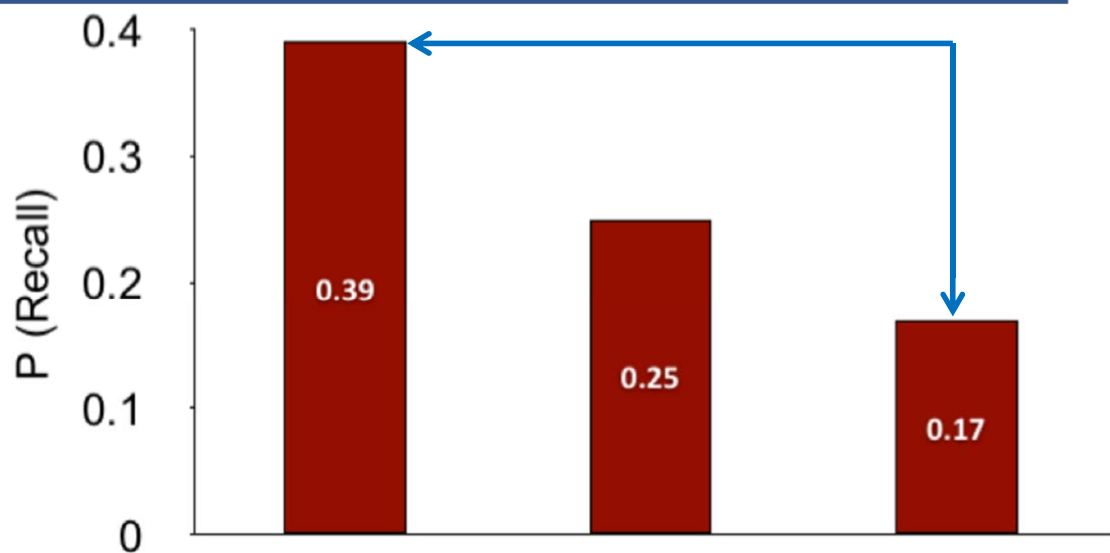


Learning 1

Psych 9B -- PSB 11B

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Retention Results 48 Hours Later



Number of Study Periods 4

6

8

Number of Test Periods 4

2

0

Learning 1

Psych 9B -- PSB 11B

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Complete the statement below to make the best summary of the results from the Zaromb & Roediger (2010) experiment?

Replacing study opportunities with test opportunities _____ performance in the learning phase but _____ retention 48 hours later.

Choose one

- A. Increases / Decreases
- B. Does not change / Increases
- C. Decreases / Does not change
- D. Decreases / Decreases
- E. Does not change / Does not change

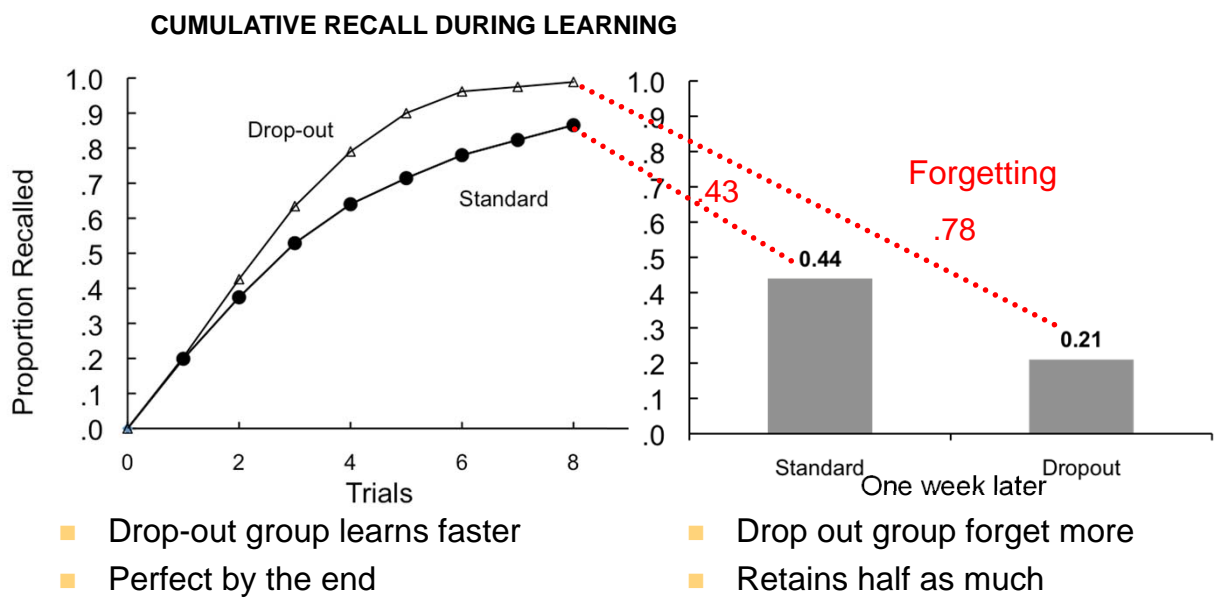
The Testing Effect

- Testing not only assesses what we know, but changes it
- Many studies show that testing can enhance later performance more than additional study
 - Recent review: Roediger & Butler (*Trends in Cognitive Science*, 2011)

Can We Make Learning More Efficient?

- Studying words on a list that we have already “learned” seems inefficient
- Alternative: Stop studying words once they have been recalled
- Karpicke & Roediger (*Journal of Memory & Language*, 2007)
 - 40-word lists
 - 8 study-test learning trials
 - Final test one week later
 - Two conditions
 - Standard condition: All 40 words studied and tested on each trial
 - Drop out condition: Once a word is recalled it is not studied or tested again

Results



Principle of “Desirable Difficulties”

- Bob Bjork: “Often conditions that make learning slower and more difficult enhance later retention.”
- What in the standard condition fosters better retention versus the Drop-Out procedure?
 - ☐ Increased study opportunities?
 - ☐ Increased test (retrieval) opportunities?
 - ☐ Or both?

Karpicke & Roediger (*Science*, 2008)

- Subjects were given 4 Study-Test trials to learn lists of 40 Swahili-English word pairs

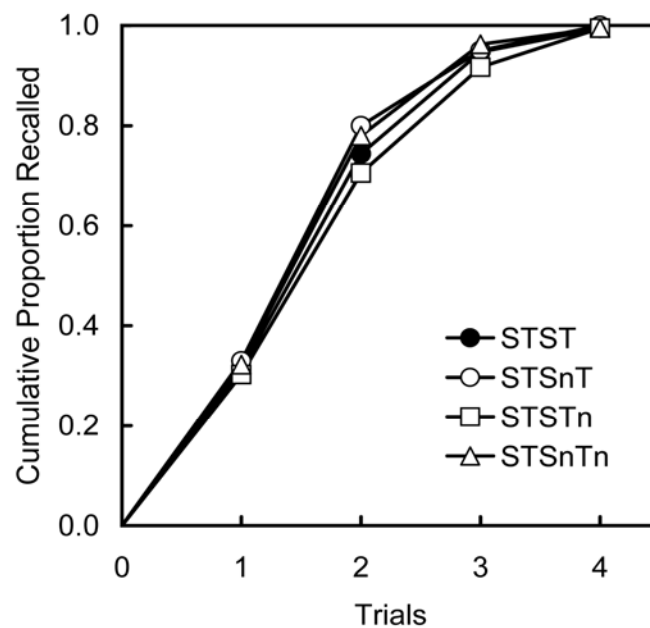
Study: *mashua – boat* *lesa - scarf*
 Test: *mashua – ???* *lesa - ???*

- Different subjects learned in 4 conditions

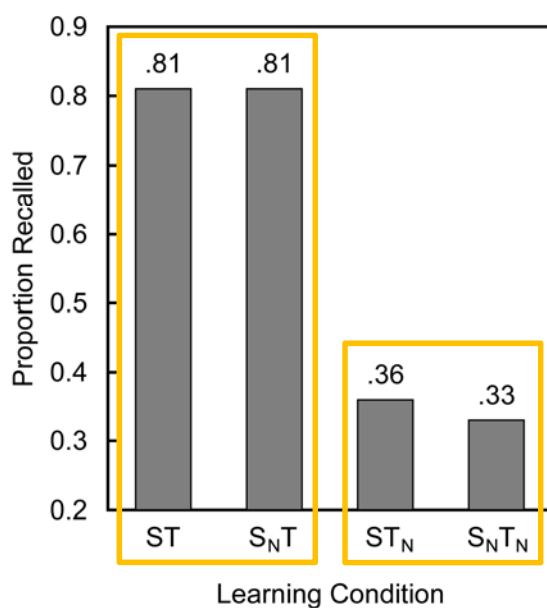
- ➡ 1. Study and test all
- ➡ 2. Study all, test only nonrecalled
- ➡ 3. Study only nonrecalled, test all
- 4. Study and test only nonrecalled

ST	ST	ST	ST
ST	ST _N	ST _N	ST _N
ST	S _N T	S _N T	S _N T
ST	S _N T _N	S _N T _N	S _N T _N
	↑ ↑	↑ ↑	↑ ↑

Learning Phase Results



Results One Week Later

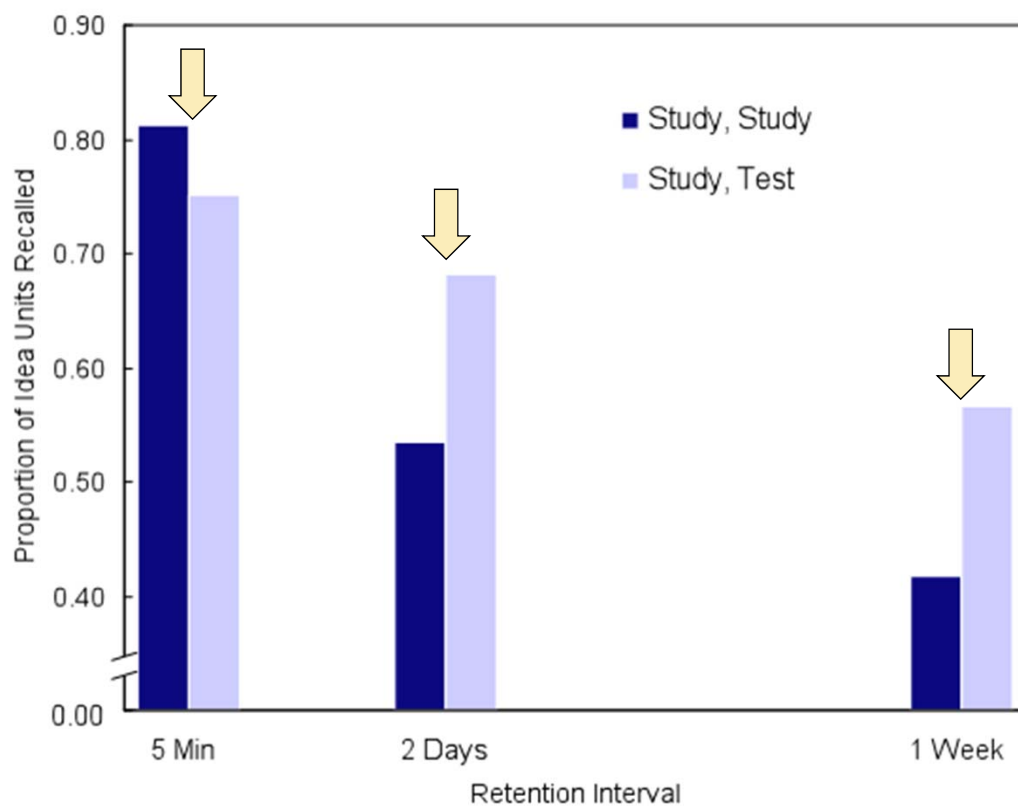


- Repeated retrieval is the key to long-term retention
- Beyond initial study, study trials do not seem to matter much
- Testing of memory not only assesses what we know, but improves it.

Does Testing Help Retain Material in Prose Passages?

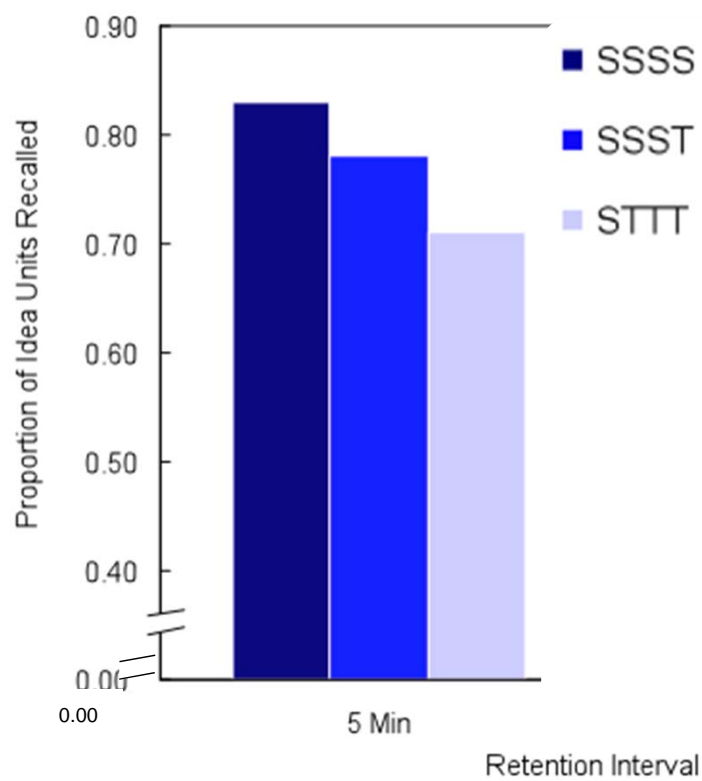
- Roediger & Karpicke (2006, *Psychological Science*)
 - Studied retention of 250-word prose passages
 - They studied 6 conditions

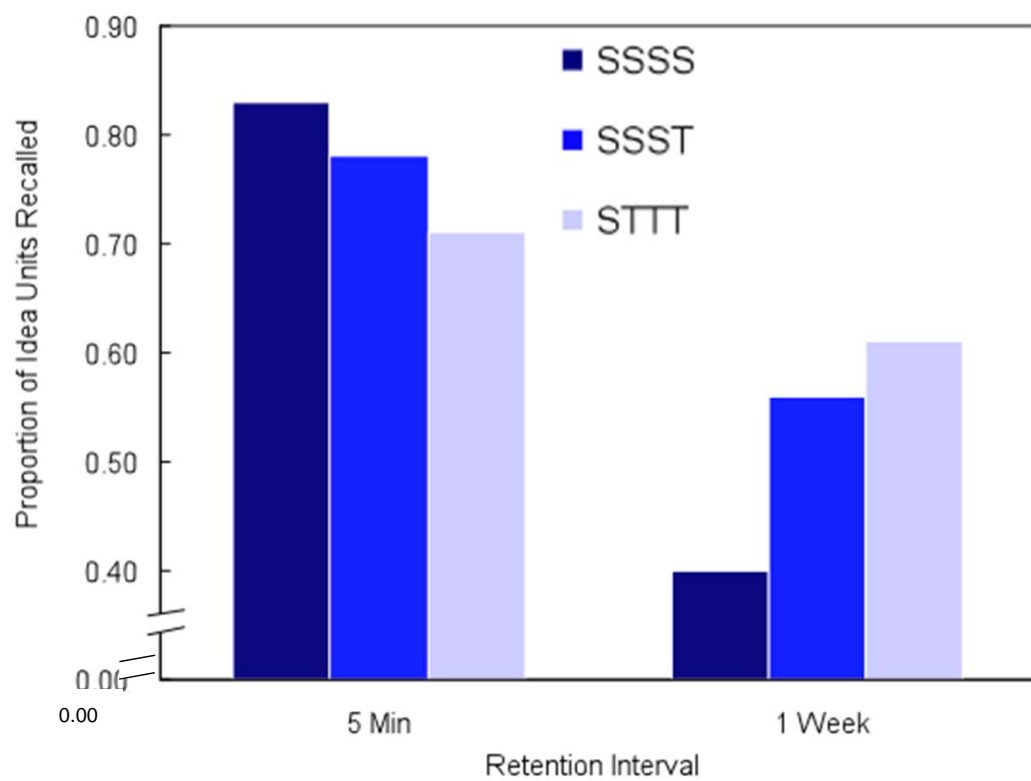
Retention Interval	Study – Study	Study Test
5 Minutes	✓	✓
2 Days	✓	✓
1 Week	✓	✓



If One Test Improves Retention, are More Tests Better?

- 6 groups of students read 250-word prose passages
- Three learning conditions
 - Pure Study: S S S S
 - One Test: S S S T
 - Three Tests: S T T T
- Two retention intervals: 5 minutes vs. 1 week





Summary: Two Common but Incorrect Beliefs about Learning

- Learning occurs primarily when people encode knowledge and experiences.
 - Misleading/No. Although learning occurs when we initially encode information repeated exposure to the same material does little to improve lasting retention
- Retrieval of learned information can be used to measure learning, but retrieval does not itself produce learning.
 - No. Retrieval (testing) of information plays an important role improving our memory for material – even without feedback.



Testing Improves Performance on “Inference” Questions

Butler (*Journal of Experimental Psychology: Learning, Memory, and Cognition*, 2010)

- Participants read a passage from science texts
- Then either re-read the passage or were asked non-inference questions about it
e.g. “Approximately how many bat species are in the world?”; answer “More than 1000.”
- Final recall required inferences
e.g., “There are 5,500 species of mammals in the world. Approximately what percent of all mammal species are species of bat?”; answer: Approximately 20%.
- Final recall was much better for the group tested initially

Testing Improves Inferences Across Domains

- Butler (2010) also found better transfer across knowledge domains.
- For example, compared with re-reading the passage
 - Initial testing on questions about the difference between the wing structure of bats versus that of birds
 - Led to improved performance on a final question asking how military aircraft modeled after a bat wing would differ from traditional aircraft.



Testing Midway through a Passage Improves Recall

- Wissman, Rawson, & Pye (*Psychonomic Bulletin & Review*, 2011)
 - Participants read a text passage organized into three loosely related sections
 - After finishing each of the first two sections, some participants had to recall what they had just read
 - Everyone was asked to recall the content of the final section
- Those who did recall after the first two sections did substantially better on the test of the final section
 - The initial tests appear to have improved *metacognitive awareness* and encouraged the adoption of more effective encoding strategies



Two other findings (for which I haven't shown you the data)

- Feedback enhances the testing effect
- Effortful retrieval produces the greatest testing effects

Practical Implications for this Course

- Lots of retrieval practice!
 - Chapter tests
 - Clicker questions
 - Cumulative, final exam
- How to study
 - Spaced retrieval practice
 - Review questions
 - Highlighting?



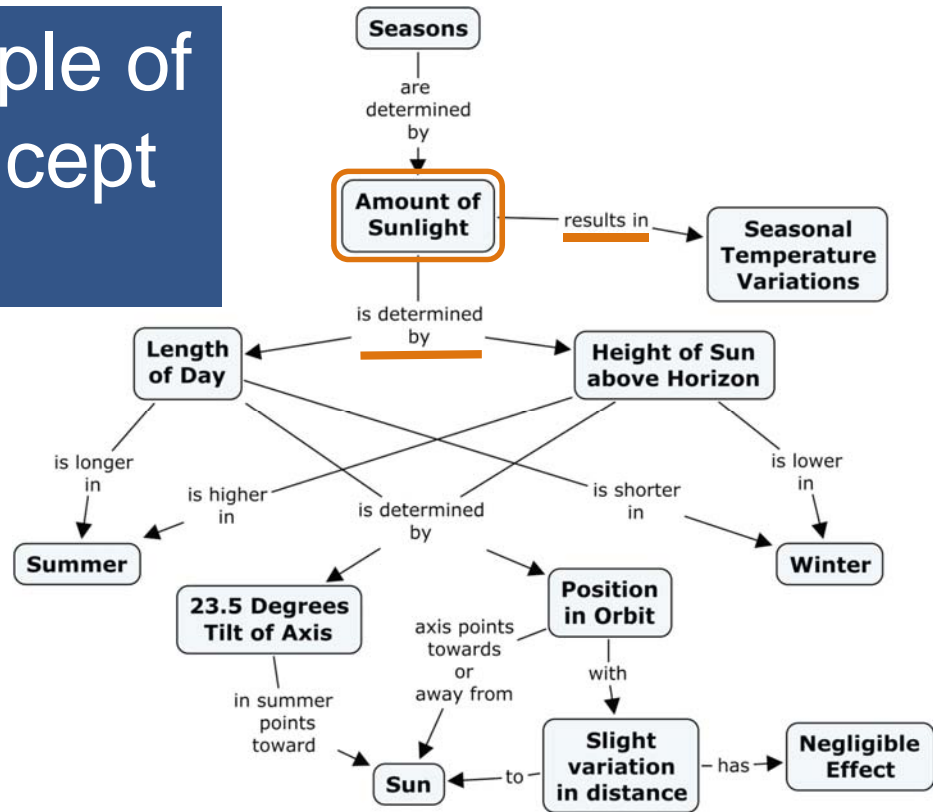


- A concept map is a way of representing relationships between ideas, images, or words in the same way that a sentence diagram represents the grammar of a sentence or a road map represents the locations of highways and towns.
- Concept maps were developed to enhance meaningful learning particularly in the sciences.

Choose one

- A. I have generated concept maps as a study tool.
- B. I have never generated a concept map, but I know what they are.
- C. I have never used a concept map and don't really know what they are.

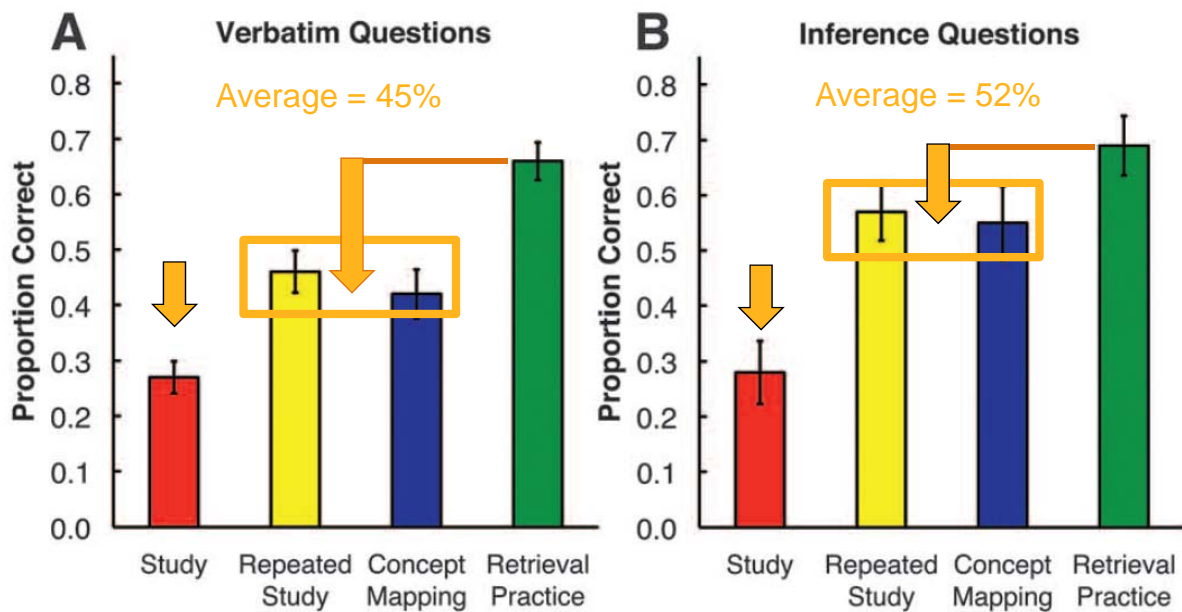
Example of a Concept Map



Is Retrieval Practice as Useful as Concept mapping?

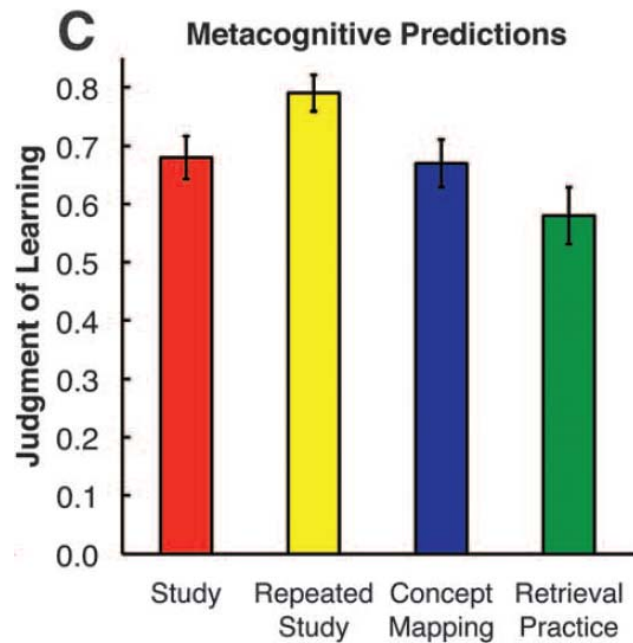
- Karpicke & Blunt (Science, 2011) asked this question using learning of passages in science textbooks
- Four learning conditions
 - ☐ Study once
 - ☐ Repeated study
 - ☐ Elaborative concept mapping condition
 - ☐ Retrieval practice
- Two types of questions
 - ☐ Verbatim
 - ☐ Inference


Retention Tested after 1 Week

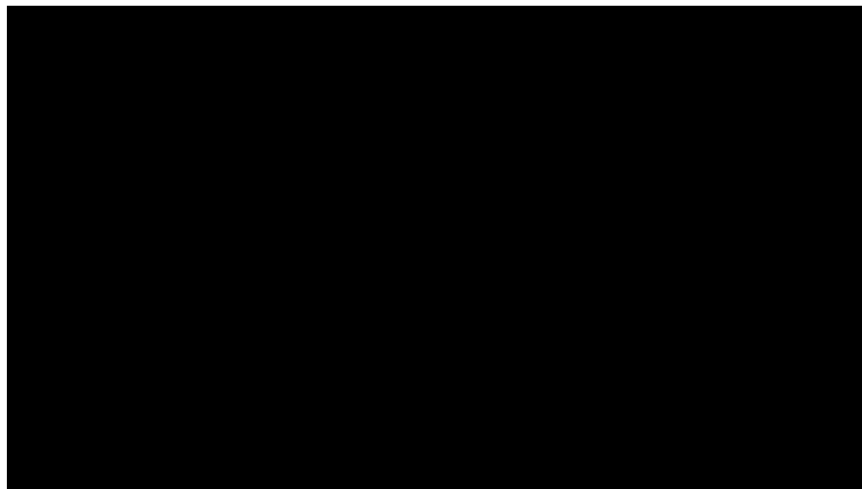


Expectations of Retention

- Subjects (students??)
 - overestimate how much of what they have learned they will retain
 - overestimate the power of repeated study
 - underestimate the power of retrieval practice



- 
- In the clip you are about to see, try to identify the US, UR, CS, and CR





■ In the clip you just watched, the US is.

Choose one

- A. The Windows chime on Jim's computer.
- B. Jim asking Dwight if he would like an Altoid.
- C. Dwight taking an Altoid from Jim.



Terminology of Classical Conditioning

Before any conditioning there are

- UR – Unconditioned response
 - Any response triggered by a stimulus before learning
 - Dwight accepting and eating the Altoid
- US – Unconditioned stimulus
 - The trigger for the UR
 - Jim's verbal offer of an Altoid

Conditioning creates

- CS – Conditioned stimulus
 - The Windows bell
- CR – Conditioned response
 - Dwight's hand reaching out in response to the bell
 - The feeling of dryness in his mouth

Looking Ahead

- Reading for Wednesday:
Gleitman: Ch. 7, pp. 278-289.
- Discussion sections start TODAY
 - Classical conditioning
 - Exam question examples
- Coffee at Phoenix Grill anyone?

