Two store model

PSY 200

Greg Francis

Lecture 14

Why it is difficult to win a pizza at Little Caesar's.

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Memory

- Simple view
  - memory is a container of past impressions and knowledge
  - memories can leak-out, decay away
- Not very realistic
  - need to explain *why* memories disappear

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Simple view

- The container theory of memory does not explain, for example,
  - why some memories are very long lasting (my childhood car trips to Utah)
  - why some memories are very brief (my wife asks me to take out the trash)
- We are not going to get a full theory of memory, but we can start to get an outline
  - and identify some misconceptions about memory

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Ebbinghaus' experiments

- First memory experiment (1885)
- Measure how long it takes to learn a list of nonsense syllables *perfectly*
  - NOF, QAP, HOS, LEQ, FIK, MEC, KIJ, HOM, NEM, MOJ
- How long does the memory last?
- In what form does the memory last?
- How does it affect future behavior?
- Does it help relearn the list at a later time?

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Ebbinghaus

- Relearn the list at later points in time
  - a different list each time
- Measure how long it takes to *relearn* the list
- Calculate savings

$$\text{Savings} = \frac{Time_{original} - Time_{relearn}}{Time_{original}}$$

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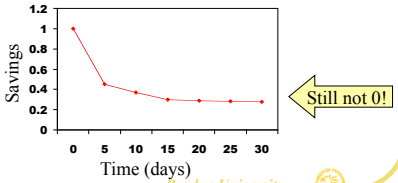
Forgetting curve

- Savings =1
  - subjects do not need to relearn, perfect memory
- Savings=0
  - subjects show no evidence of earlier learning



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Significance

- Ebbinghaus' results suggest that memories can last a very long time, in some form
  - Memories were believed to be "stored" in a memory system and did not just fade away (otherwise, the curve should not asymptote above zero)
  - Memory loss was believed to be due to interference of other memories
- Other experiments challenge this view

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Memory task

- See (or hear) a trigram of consonants
- Report it back in order
- Ebbinghaus' results suggest good memory until other letters are also memorized

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Retention

- Peterson & Peterson (1959)
  - Brown (1958)
- Give subjects trigram
  - ask them to count backwards by 3's and then recall trigram

WRM

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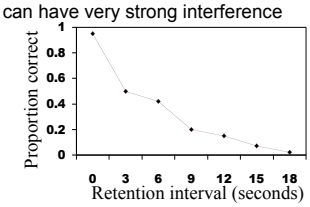
Retention

- Vary duration of counting backward
- Numbers are *different* from letters, you might not expect any interference
  - but they can have very strong interference

Suggests some memories last only a few seconds!



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Retention

- The results of the Brown-Peterson study suggest that some aspects of forgetting are *process driven*
  - keeping a memory "active" requires effort
  - if you are distracted by another task, you cannot apply the effort to keep the memory
  - similar to our observations about attention and processing

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Retention

- The results of the Brown-Peterson study also suggest that some aspects of forgetting are *passive*
  - even if you are distracted, you can recall the trigram if only a short time has passed
  - if many seconds have passed, while you are distracted, you cannot recall the trigram
  - memory has "decayed", or something like decay, while you were doing the distracting task

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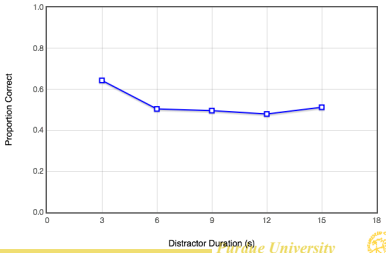
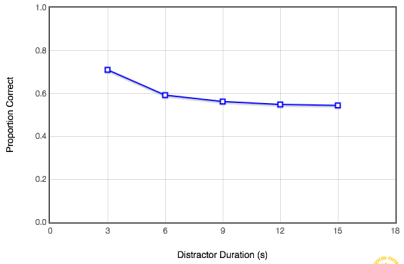
Retention

- CogLab data
  - 61 subjects
  - Not everyone shows interference on this task



Retention

- CogLab data (global data set)
  - 9690 subjects



Another experiment

- Memory span
  - how many items can you correctly recall immediately after exposure?
- "The magic number 7+/-2:…"
  - Miller (1956)

Interpretation

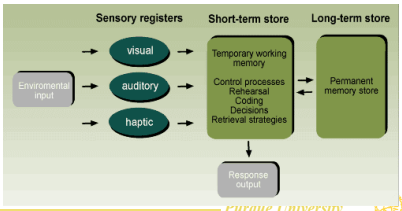
- There exist two types of memory systems
- Long Term Memory (LTM)
  - high capacity (no limit)
  - long duration (forever)
  - Ebbinghaus' experiment
- Short Term Memory (STM)
  - small capacity (~7 items)
  - short duration (seconds)
  - Memory span, Brown-Peterson

Pizza

- There used to be a Little Caesar's in W. Lafayette with a game where you could win a pizza
  - must repeat a sequence of flashing lights (changes every time)
  - The sequence gets longer until you make a mistake
  - need a sequence length >7 to win much
    - » Counts number of correct button presses
    - » 56 (sequence of 11 buttons): win a soft drink
    - » 110 (sequence of 15 buttons): win crazy bread
    - » 210 (sequence of 20 buttons): win pizza
    - » nearly impossible with STM properties
  - http://www.freegames.ws/games/kidsgames/simon/simon.htm

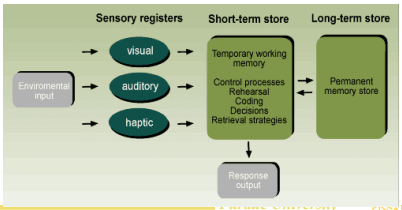
Modal Model of Memory

- Atkinson & Shiffrin (1968)
- Multiple stages of memory
- STM plays a dominant role in active memory
- Requires transfer between STM (STS) and LTM (LTS)



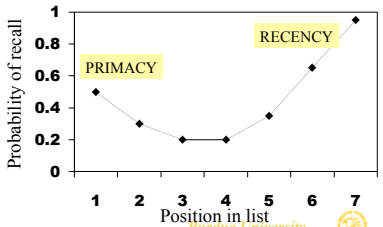
Modal Model of Memory

- When something is memorized
  - Items are first held in STM (temporary store)
  - Items *may* transfer to LTM (permanent store)
  - Takes time to transfer



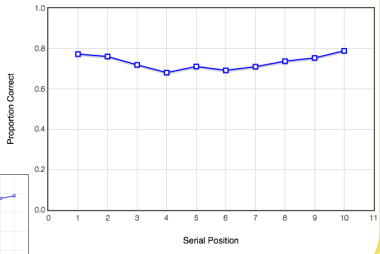
Free Recall Serial Position Curve

- Given almost any list of items
- Subjects remember the first and last few items best (free recall, not immediate serial recall)



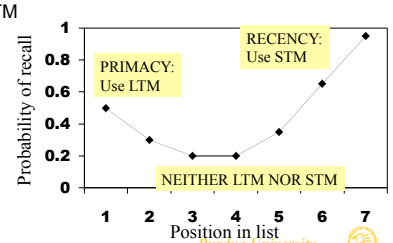
Serial position curve

- The effect of position is robust across many types of lists
  - words
  - letters
  - numbers
  - pictures…
- Here's the CogLab data
  - (66 subjects)
- Demo



Serial position curve

- In some situations the serial position curve can be explained by different properties of STM and LTM



Conclusions

- Short Term Memory (STM)
- Long Term Memory (LTM)
- STM / LTM distinction is one of the strongest conclusions of cognitive psychology
- Accounts for quite a bit of data
- Many details are unresolved

Next time

- Expansion of STM into
- Working memory
  - central executive
  - phonological store
  - visuo -spatial sketchpad
- CogLab on Sternberg search due!
- *Why there is a gate at the first floor stairway in the Psych building.*