

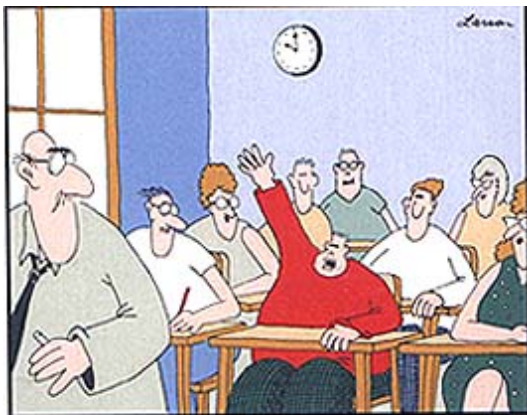
Notes on Effective Learning

Based on
make it stick

The Science of Successful Learning
Brown, Roediger & McDaniel, 2014

September 25, 2018

There is no such thing as a full brain



"Mr. Osborne, may I be excused?
My brain is full."

There is no known limit to the capacity for learning

- 2010 Simon Reinhard memorized 300 random words in 15 minutes.
- 2008 Ben Pridmore memorized 884 shuffled playing cards in 30 minutes.
- 2010 Boris-Nikolai Konrad memorized 201 names and faces in 15 minutes.

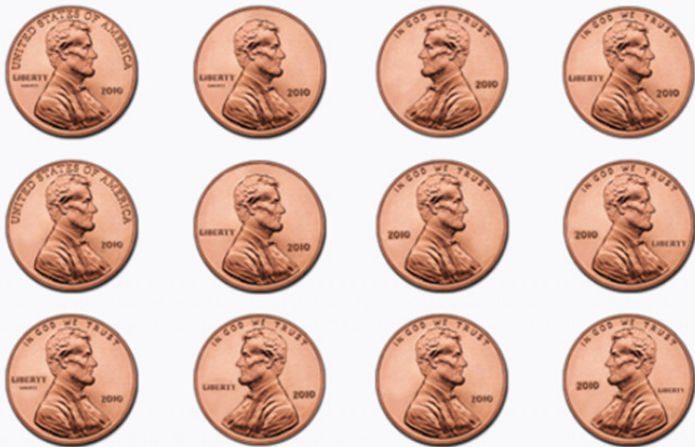
Learning changes your brain

- Every time you learn something you **change your brain**.
 - Most learning involves reinforcing connections between neurons.
 - The hippocampus, important in long-term memory, actually creates new neurons throughout your life.
- But these things happen in your brain *only if they have to*.
- When learning is hard, you're improving your brain.

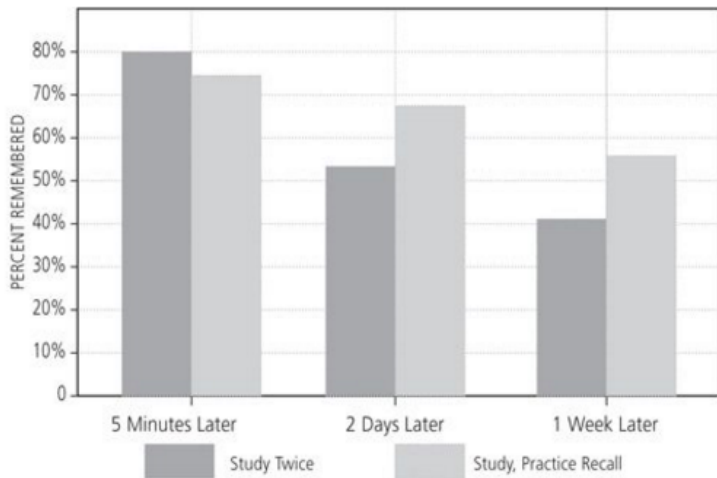
Learning: you're doing it wrong

- Learning is best when it's *effortful*.
- We are *poor judges* of when we are learning well.
- *Repeated exposure* does not lead to learning.

Which penny is real?

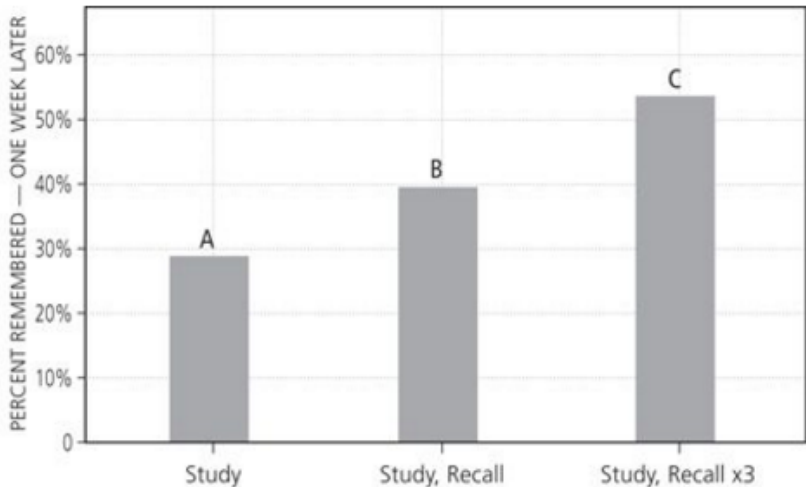


Study vs. Testing



**TWO DIFFERENT STUDY SCHEMES (STUDY TWICE VS. STUDY + TEST)
RECALL RESULTS AFTER FIVE MINUTES, TWO DAYS, OR ONE WEEK**

Testing vs. More Testing



THREE DIFFERENT STUDY STRATEGIES
RECALL RESULTS, ONE WEEK LATER

Learning: doing it right

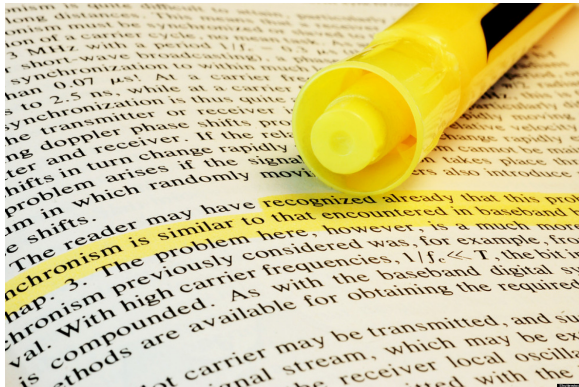
- *Retrieval practice* is far more effective.
- Flash cards are the simplest example.



- Trying to solve a problem yourself leads to better learning,
- ... even if you try before you know how
- ... even if errors are made

We are all susceptible to **illusions** of learning

- Reading and rereading the text gives the **illusion** of fluency.
- Highlighting the text gives the **illusion** of mastery.



Testing dispells illusions

- **Testing** helps calibrate our judgements.
- Only shooting an azimuth gives us the truth.



*We are what we repeatedly do.
Excellence, then, is not an act, but a habit.*
—Aristotle

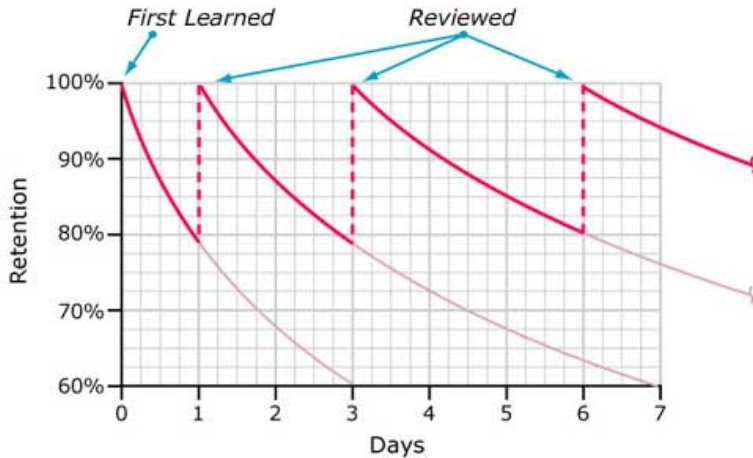
Another experiment

- Some subjects asked to memorize pairs like *foot-shoe*
- Others asked to memorize pairs like *foot-s__e*
- **Second group did substantially better.**

QUIZZING IS A LEARNING TOOL!

Spaced repetition is the most effective

Typical Forgetting Curve for Newly Learned Information



How to practice retrieving from memory

- Quiz, quiz, quiz!
- Use flash cards: www.ankisrs.net
- Use Cornell note taking system
http://lsc.cornell.edu/LSC_Resources/cornellsystem.pdf
- Look up from the book and summarize
- Invent quiz questions as you read
- Don't listen to your intuition! Shoot an azimuth!
- Space out retrieval practice, no cramming.

Relate it to your own experience

Generation: Try to answer a problem before being shown the solution.

Elaboration: Explain it in your own words and relate it to your own experience.

Reflection: Write out essays on your learning.