# Memory and Cognition

## February 20, 2013

* **Capacity of STM**
  + Domain specific
    - An activity which is specific to a particular stimuli (converting numbers into times to chunk – numbers is the domain)
    - For chess players the domain is chess pieces
* **Duration of STM**
  + STM is not only limited in the amount of info it can hold, but also in how long it can hold it.
  + Rehearsal
    - You can rehearse information to keep it in your STM, or rehearse it to move it into LTM.
    - Incidental Learning
      * You do not have to actively rehearse everything that goes into your LTM.
  + **Brown-Peterson Technique**
    - An attempt to measure how long information will stay in STM if rehearsal is prevented. Measures the duration will stay your STM.
    - Theoretically if you rehearsed something indefinitely it would stay in your STM indefinitely.
    - **Rehearsal Prevention Task (Distractor)**
      * Given a number (e.g. 100) and to count backwards by 3 for a period of time. They stored those three letters in their STM but they are prevented from rehearsing them.
      * After about 15 seconds their STM was gone.
      * Rapid decay without rehearsal happens within 15 seconds.
* **Decay vs. Interference**
  + **Two theories for forgetting**
    - Decay - If information is not used then it fades away over **time**.
    - Interference – Forgetting is a direct result of more learning, presenting new material. The more similar the items, the more likely it will be to interefere.
  + **Brown-Peterson technique suggests that forgetting is caused by decay**
    - They say it’s decay b/c under interference the two items need to be closely related and numbers and letters aren’t much the same.
  + **Other studies suggests forgetting is caused by interference**
    - **Waugh & Norman (1965)**
      * If the counting backwards had interfered with your memory, the more numbers produced the more interference. If decay is occurring, then a longer time delay would result in more forgetting.
      * Subjects were given of 12 digits. *Attempt* to store 12 in their memory. The difference was one group got 1 digit per second (12 seconds), the second group heard the same list but they heard it at 4 digits per second (3 seconds). The more intervening items the more opportunity for interference.
      * If decay is occurring, then group A and B should differ because more time has elapsed in group A. Group A in theory should perform much worse.
      * If interference is occurring, then you would be influenced by the number of intervening items (not time).
      * There was no difference between group A and B. Time has absolutely no impact on forgetting, what’s important is the number of intervening items.
      * Forgetting from STM is due to interference, not time.
      * Not only had they disrupted rehearsal, but interference.
    - **Keppel & Underwood (1962)**
      * Subjects forgot at a rate that Brown-Peterson reported, only after they had been tested on multiple trials. Before that their memory was almost fine. Trial 1 was interfering with trial 2, 2 was interfering with trial 1+3, etc.
      * Anything you do to prevent rehearsal is going to introduce interference. You really need to do an interval of time that doesn’t offer rehearsal or interference.
* Retrieval from STM
  + Sternberg Paradigm
    - Subjects were presented with a small series of digits that they are asked to hold in their memory (e.g. 397 – called memory set).
    - As you are storing / rehearsing these 3 numbers you’re given a series of questions (a number), decide as quickly as possible if that number was in the memory set.
    - Do we use a parallel search or serial search?
      * Parallel Search – Every item in your memory set are available at the same time. They’re accessed in parallel.
      * Serial Search – You can only search each item at a time. If you’re looking at 9, does 9=3=no, 9=7=no=, 9=9, no. B/c you can’t access the items simultaneously, the more items you are holding in your memory the longer it should take you.
    - Serial Exhaustive Search
      * Every single item must be searched, before you can give a response
      * 9=3? -> 9=9? -> 9=7? -> 9=8?, etc
    - Serial self-terminating search
      * 9=3?, 9=9? Yes. Stop searching
      * Once you’ve found your car keys you don’t keep looking.
    - We actually use an exhaustive search in our STM, stopping is not under our control. It’s a very fast process, 38ms per item.
* **Types of Mental Representations (Codes)**
  + **Auditory codes**
    - Errors in recall
      * Iconic Memory (Visual Perception) C -> O
      * Echoic Memory (Auditory Perception) C -> V
      * STM (Presented Visually) C -> V
        + Despite being given the C being given visually, we convert it into a sound based code.
    - Phonological similarity
      * It is harder to learn a list of words when they sound alike too.
  + **Semantic codes (Meaning)**
    - Wickens (1972) – release from proactive interference
      * Subjects were given 3 words, count backwards from 100->0 by 3’s
      * The 3 words came from the same category on every trial (cat, turkey, pig) -> count backwards
      * Trial 2 (giraffe, dog, elephant), count backwards, recall
      * Over a number of trials performance decreased, trial 1 interferes with trial 2, etc
      * Refers to the fact that older information can interfere with new information.
      * If you change to something that’s not the same category, they’re essentially released from the proactive interference.
  + **Visual codes**
    - Mental rotation
      * Are objects the same shape? In class it’s a rotated R
  + **What happens to deaf individuals?**
    - The will sometime recode information into ASL. If given visually to a normal individuals they’ll rehearse with sound, they’ll convert it into ASL. Their mistake will be used on the physical nature of the hand gesture.
* **Working Memory**
  + Atkinson-Shiffer isn’t the only way people view memory. People view it as a workspace for rehearsing, making decisions, problem solving, etc. That’s why it’s called working memory. Some individuals have a bad STM for some items, but great for others.
  + Individual had a head injury from a motorcycle accident, his digit span was nearly zero he could form new memories but used a pair associate learning task. He was able to learn the association between word pairs.
  + Focus is on function on storagebed of information. System that holds onto information for other cognitive work. Decision making, problem solving,
* Components for Working Memory
  + Central Executive
    - Performs all higher level tasks – Controlling, decision-making, planning future actions, language comprehension, reasoning, retrieveal of information from LTM
    - Central Executive Controls
  + Phonological Loop
    - Phonological store
      * Responsible for translating visual information into a speech based code.
    - Articulatory Loop
      * Information can be stored here as long as information can be rehearsed at a fast rate.
      * As long as you can repeat it within 2 seconds.
  + Visuo-spatial sketch pad
    - Holding on to maintain visual image.
* **Basic Findings**
  + Dual task technique
    - Primary – Visual memory span task or letter span task
    - Secondary – Mental addition or visual imagery
    - Memory Span Task – Which filled in box changes? Letter span A row of letters
    - Can you do these tasks together or will there be issues? These tasks rely on working memory, if neither tasks interfere with each other. We can assume one task relies on visio-spatial sketch pad and one with the phonological loop. If they do interfere together, then we will see some problems.
    - If you’re asked to do visual imagery and make a judgment about the rotating R’s simultaneously, your performance will degrade rapidly. Same goes for letter span task and mental addition.