LONG TERM MEMORY ENCODING

Learning Objective Topics
- Principles of Episodic Encoding
  - Levels of processing
  - Massed vs. spaced processing
  - State dependent effects
  - Transfer appropriate processing
- Mnemonics
- Encoding influences at retrieval
How can we improve MEMORY?

- How do you use your memory everyday? What techniques do you use?
  - Studying for school
  - Remember names
  - Remember list of things to do

Factors that influence memory

- *What is required for good memory performance?*

- Need to pay attention to encode information
Encoding Instructions

Intentional Encoding:

“Study these words for a later memory test”

Incidental Encoding:

“Look at these words as they are shown on the screen” (incidental encoding)

Levels of Processing

Some strategies will be more effective than others in helping you to encode words from a word list

Shallow (count syllables)
Intermediate (count words that rhyme with dew)
Deep (make a sentence with the word)
Levels of Processing

Some strategies will be more effective than others in helping you to remember things

** it’s not just the amount of practice that determines how well something is encoded **

Levels (or depth) of processing (LOP)

- The “durability of the memory trace is a function of depth of processing.” (Craik & Tulving, 1975)
- IV study condition: Shallow or deep processing
- Interpretations of LOP effect:
  - Attention on meaning
  - Association w/ knowledge
- Problems with LOP
  - Lack of objective index of depth of processing
Studying for the test

- Incidental or intentional?
- How did you study?

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Cramming

- Why doesn’t it work?

Massed & Distributed Practice: Which is better?

**Massed practice** ("cramming"): single, lengthy study session

**Distributed practice** (spaced): practice spread out over multiple study sessions

![Bar chart showing proportion recalled for cued recall and free recall, with distributed practice outperforming massed practice.](chart.png)
Why spaced is better:

- Repetition
  - Multiple memory traces
  - Multiple modality repetition
    - Visual and verbal codes for material
- Spacing effect
  - Distributed practice is best for delayed test
  - Massed practice ok for immediate test
- WHY?
  - Attention wanders over long period of time
  - Need time to consolidate info
  - Need to study under different conditions

Which do you think someone would be more likely to remember?

Chair, tree, or ball?

Why?
Benefit of distributed practice

- Spacing/Lag Effect: Greater lags between study trials yield better processing
- Deficient processing
  - Massed study sessions/short lags, pay less attention to item just studied

Benefit of distributed practice

- Encoding variability
  - Longer lags = more variable encoding
  - Memory trace from multiple routes
Three Phases of Episodic Memory

**Encoding**
- Cognitive & neural processes that initially transform an experience into a durable memory trace

**Consolidation**

**Retrieval**
- Re-accessing information stored in memory

- Items later remembered must have been successfully encoded
- Items later forgotten were not necessarily unsuccessfully encoded (also could be a retrieval failure)

Interactions between encoding & retrieval have been discussed in two primary theories:
- encoding specificity
- transfer appropriate processing
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Encoding Specificity Principle

People are more likely to recall information when it is learned and retrieved in the same context.
State-Dependent Memory

Recall best when state at encoding & at retrieval match

State-Dependent Memory

Deep Sea Divers

Recall best when location at encoding & at retrieval match
Mood-Dependent Memory

Recall best when mood at encoding & at retrieval match

Implications

- Depression
  - more likely to recall negative events

- Recovered Memories
  - recall something if in same location or mood
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Two Types of Context

Intrinsic context
- Has direct impact on the meaning of the to-be-remembered item
  - strawberry-JAM vs. traffic-JAM
Two Types of Context

**Intrinsic context**
– Has direct impact on the meaning of the to-be-remembered item
  • strawberry-JAM vs. traffic-JAM

**Extrinsic context**
– Situation has indirect effect on the to-be-remembered item
  • Mood and state dependent learning
    – learn words on land or 20 ft under water

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**Task 1:** Does the word rhyme with “link”?
**Task 2:** Make a sentence using the word.

- Mouse
- Sink
- Horse
- Canary
- Rink
- Avocado
- Pink
- Farm
- Think
- Canoe
Now:
Recall all the words that rhyme with “ink”

Mouse
Sink
Horse
Canary
Rink
Avocado
Pink
Farm
Think
Canoe

Transfer Appropriate Processing

Recall best when cognitive processes at encoding & at retrieval match
Transfer Appropriate Processing

There are interactions between the context in which you *encode* & the context in which you *retrieve* information

**different encoding strategies can be useful for different retrieval tasks**

- How do you study the for a multiple-choice exam
- How about an for an essay exam

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Moonwalking With Einstein

- http://www.youtube.com/watch?v=U6PoUg7jXsA

MEMORY EXERCISE

Recall all of the US states that you can

What strategy did you use?
- alphabetical?
- Visuo-spatial?
- Personal experience (trips)?
- Another strategy?

These strategies are all mnemonics
**What are Mnemonics?**

Conscious strategies used to improve
- the amount of information that can be retrieved
- the accuracy of the retrieved information

Typically use highly overlearned organizational schemes and visual imagery

**What else have we studied that could be considered a mnemonic?**
Examples of Mnemonics

- Dual Coding Technique
- Image Name Mnemonic
- Key Word
- Method of Loci
- Peg word

Mnemonics: Dual-coding technique

- Dual-coding hypothesis
  - Verbal representation
  - Visuospatial rep.
- Example acronym:
  - The Great Lakes: HOMES
- Effective visualization
  - Interactive
  - Vivid
  - Bizarre
Learn the following list by creating a vivid and bizarre interaction of the 2 items.

• Road – flower
• River – table
• Bird – fruit
• Rain – rock
• Dress - money
• Cow - paper
• Box – garden
• Book – cup
• Ice – train
• Fence – letter
• Egg – chair
• Paint - hammer

RECALL as many words as possible.

• Road –
• River –
• Bird –
• Rain –
• Dress –
• Cow –
• Box –
• Book –
• Ice –
• Fence –
• Egg –
• Paint –
Image–name mnemonic

• Use mnemonic to remember name with face
  • Think of vivid word that sounds like name
  • Link word with person’s appearance

• Example
  • Rodney Flanery
  • Image: Football player with rod in his knee, so benched and wearing flannel to stay warm

• Create one for your own name!

Keyword mnemonic

• Use to learn new or foreign language words
  • Think of vivid word that sounds like to-be-remembered word
  • Link vivid word with meaning

• Example
  • “Pato” – spanish for duck
  • Image: Pot on top of Donald duck’s head
Method of Loci

- Used by Greek orators
  - Combines imagery and organization

- 1: Memorize familiar locations in natural order
- 2: Create visual image of word with each location
- Recall: take a “mental walk”

- “In the first place…”

Method of Loci: Campus Map

WoFFORD COLLeGE

Campus Map

Campus map by Scott Cunningham.
First, memorize the locations in order…

Olin
DuPre
Main
Snyder
Library
Carlisle
Daniel
Milliken
Burwell
Shipp

Then link each TBR item with location…

Olin       Apple
DuPre      Piano
Main       Hammer
Snyder     Cake
Library    Planet
Carlisle   Pizza
Daniel     Kite
Milliken   Bus
Burwell    Butterfly
Shipp      Scissors
Then take mental walk through locations to remember each item…

- Apple
- Piano
- Hammer
- Cake
- Planet
- Pizza
- Kite
- Bus
- Butterfly
- Scissors

- Why helps?
  - Organized
  - Visualization
  - Locations are retrieval cue
  - Associations
  - Deep processing (meaning)

- Helpful for serial learning
  - But can also remember out of order

- Need distinct locations
- Need strong association

Peg-word technique

- 1: Use memorized concrete nouns
  - Rhyming helps to remember words and order

- 2: Create visual image of target word with peg-word
Why mnemonics work

- Attention
  - Ensure encoding
- Rehearsal
  - Spaced repetition
- Depth of processing
  - Make info meaningful
  - Notice similarities and differences
  - Use existing knowledge – top-down effects
- Elaboration
  - Think about meaning and make info distinctive
- Generation
  - Make it personal
- Dual-coding cues
  - Verbal and visual representations
- Organization
  - “chunks”
- Retrieval cues

Limitations of Mnemonics

- Time consuming
- Difficult to deal with abstract material
- Need creative ability
- Interference effects (if using same mnemonic)
- Doesn’t help memory in general
- Does not necessarily help understanding of material
- Need to practice mnemonics!
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Self-reference effect

• Rogers et al. (1979)
  • Is memory improved if information is related to yourself?
• Method
  • Shallow: Is the word long?
  • Self-reference: Does the word describe you?
• Results
  • Better memory for self-reference condition
• Conclusion
  • YES!
  • Why?
Generation effect

- Mantyla’s (1986) method
  - Study 600 nouns
  - Generate cues
    - Generate 3 words associated w/ each word
  - Retrieval cues
    - See 3 words associated w/ each word
  - Surprise recall test
    - “w/o study”: performed just test
- Results
  - Better recall for self-generated cues
- Application to studying?


- Why does testing effect occur?
- Applications?
Long-term memory

• “How does info become encoded/stored in LTM?”
  - Rehearsal/practice
  - Levels of processing
  - Forming connections or associations
  - Imagery
  - Self-reference effect
  - Generation effect
  - Organization of info

• “How do we retrieve info from LTM?”
  - Retrieval cues
  - Encoding specificity / State dependent learning
  - Transfer appropriate processing

How to study more effectively
(according to cognitive psychologists!)

• Elaborate
  - Levels of processing effect
• Generate and test yourself
  - Come up with your own questions and then answer them
• Organize
  - Create (generate!) outlines to form a framework
  - Chunk information
• Take breaks
  - Use “distributed” practice (w/ short breaks)
  - Sleep
• Match learning and testing conditions
  - Study same place as test OR study in many different locations
• Avoid “illusions of learning”
  - “Don’t mistake ease and familiarity with knowing”