PSYC 5303: Theories of Learning

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Week 11 – Mental imagery

Imagery

What is a mental image?

- It is a mental representation of things that are not currently being sensed.
  - How is it like reality? How is it different?
  - Hard to study, not directly observable, and fade quickly
  - Does an image use the same neural pathways as experience?

Imagery and Memory Effects

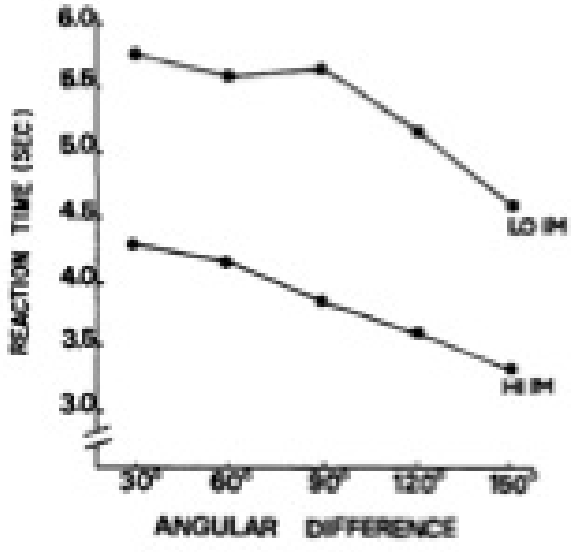
Picture superiority effect

- Shepard (1967)
  - Present 612 pictures or words with recognition test.
  - After 2 hours: 100% accuracy for pictures, 88% for words
  - After a week: 88% for both
- Standing (1977)
  - Learn 1000 words, 1000 simple pictures, or 1000 bizarre pictures
  - After 2 days: recognition 61.5% for words, 77% for pictures, 88% for bizarre pictures
- Summary: Memory for pictures is better than memory for words, especially early on!

Imagery and Memory Effects

Image scanning effect – Paivio (1978)

- Imagine these times on an analog clock face. Which of each pair has a bigger angle between the hands?
  - 4:10 and 9:23
  - 3:20 and 7:25
  - 2:45 and 1:05
  - 3:15 and 5:30
- Results:
  - RT related to angular distance: smaller angle = larger RT
  - S's who were high imagers were overall faster than low imagers



Imagery and Memory Effects

Image scanning effect

- Scanning tasks show that the farther apart two things are on an image, the longer it takes to mentally scan from one to the other (e.g., Kosslyn, Ball, & Reiser, 1978)

- Memorize this map...
- There's a hut, a tree, a rock, a lake, a well, sand, grass
- Hear the name of one object, then another. Imagine a black dot zipping from one to the other via the shortest path
- Push a button when it gets there

Imagery and Memory Effects

Image scanning effect

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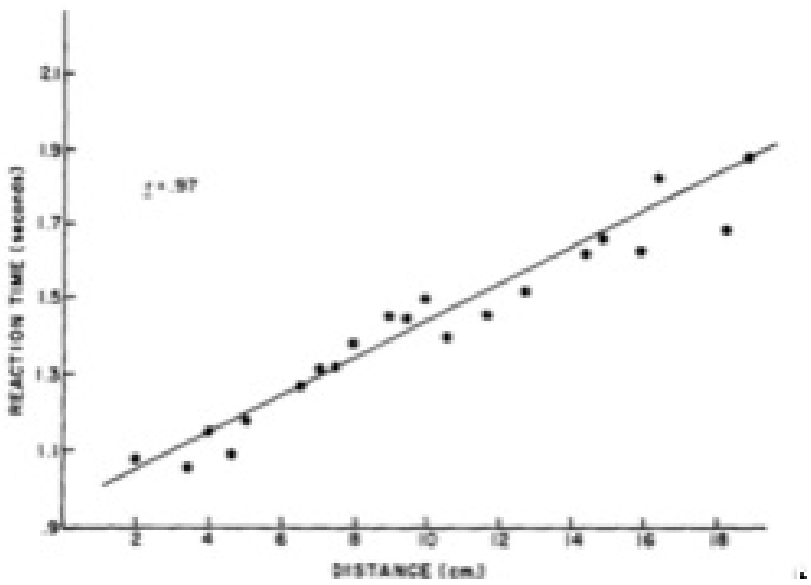

Imagery and Memory Effects

Concreteness effect

- Read a list of words
- Typically better recall for concrete items

- dollar
- cabin
- storm
- arrow
- river
- book
- peach

- justice
- franchise
- session
- incident
- hope
- cost
- mood

Explanations for image effects?

Images might be:

- Analog representations
  - Mental images are essentially what they feel like...a picture in the head whose properties are like the properties of the real thing
  - Images use the same perceptual hardware you use to see
- Propositions
  - It's essentially a verbal/symbolic thing. The *feeling* that you have an image is epiphenomenal...there really isn't an image

Explanations for image effects?

Three competing models:

1. Functional-equivalency hypothesis
   - Analog representations – something like pictures, but not exactly the same
2. Conceptual-propositional hypothesis
   - No images – all propositional representation
3. Paivio's dual-coding hypothesis
   - Perhaps both image and verbal representations for some things

Explanations for image effects?

1. Functional-equivalency hypothesis
   - Shepard and Kosslyn (e.g., Cooper & Shepard, 1978; Kosslyn & Pomerantz, 1977)
   - States that imagery and perception functionally overlap
   - Evidence: mental rotation of visual stimuli
     - Relationship between time required for specific mental rotation and actual degrees of rotation
     - Visual images reflect internal representations that operate in a way that is analogous to the functioning of the perception of physical objects

Explanations for image effects?

- Images use the same perceptual hardware as vision
- Estes, Verges, & Barsalou (2008)
  - Reading words should lead to mental simulations of the words, using perceptual hardware
  - Part of this simulation is location
  - Trial:
    - Prime: *Cowboy*
    - Word: *hat* (upper location of image) or *boot* (lower location of image)
    - Target: Letter (X or O at top or bottom of screen)
  - If location is part of mental simulation, then *hat* should interfere with letters at the top (you're using that perceptual hardware). *Boot* would be opposite.
  - Results: letters in objects' typical locations took longer to identify

Explanations for image effects?

- Images use the same perceptual hardware as vision
- Zwaan & Yaxley (2003)
  - Location is part of the mental representation of words and location simulation is part of comprehension
  - Task: present a pair of words; are they related?
    - Attic
    - Basement
  - or
    - Basement
    - Attic

Explanations for image effects?

- Images use the same perceptual hardware as vision
- Zwaan & Yaxley (2003)

	Vertical							
	Experimental				Filler			
	Match		Mismatch		Related		Unrelated	
Experiment	RT	Acc.	RT	Acc.	RT	Acc.	RT	Acc.
1	1,117	92	1,169	89	1,072	89	1,282	91

- When vertical arrangements were correct, subjects were faster than when they were incorrect
- location seems to be a part of the understanding of a word

Explanations for image effects

2. Conceptual-Propositional Hypothesis (Anderson and Bower)
   - Memory is NOT like a photograph
   - We store memories as propositional interpretations of events rather than the imagery components
   - Note: Anderson and Bower explain that concrete concepts are coded by a rich set of predicates that bind concepts together:
     - e.g., *"the only difference between the internal representation for a linguistic input and a memory image is detail of information"*

Explanations for image effects

Images = Propositions: essentially a verbal/symbolic thing. The feeling that you have an image is epiphenomenal (there really isn't an image)

You SAW:

You HEARD:
"Howard just missed the save!"

- Both result in same underlying propositional representations:
  - missed(goalkeeper,ball)
  - wept(goalkeeper)
  - cursed(goalkeeper)
  - upset(EvertonFans)

Explanations for image effects

Comparing analog and propositional codes:

Analog codes:

- picture-like code
- images like perceptions, retain some sensory qualities
- relations represented implicitly
- simultaneous
- different representations for each sense

Propositional codes:

- word-like code
- images are descriptions of visual scenes
- relations represented explicitly
- sequential
- same representations for each sense

Anderson (1978): "it may not be possible to decide between imaginal and propositional representations strictly on the basis of behavioral data"

Explanations for image effects

3. Paivio's Dual-Coding Hypothesis
   - Proposed that words and images are processed separately
   - Basic tenet is that information is mentally represented either in a verbal system (propositional), a nonverbal system (analog), or both
     - Each system contains different kinds of information
     - Each concept is connected to other related concepts in the same system and the other system
     - Activating any one concept also leads to activation of closely related concepts

Explanations for image effects

3. Paivio's Dual-Coding Hypothesis – explains many image effects nicely!

- Concreteness effect – concrete items generate BOTH verbal and visual codes
- Picture superiority effect – pictures automatically coded both ways
- Imagery instructions (Schnorr & Atkinson, 1969) – paired associate learning much better under imagery instructions than rote rehearsal

Explanations for image effects

3. Paivio's Dual-Coding Hypothesis – explains many image effects nicely!

- Symbolic distance effect – easier to make judgments about items that are farther apart on a dimension than it is to make judgments about items that are close on a dimension
- TRUE or FALSE:
  - The fly is bigger than the flea (SLOW)
  - The horse is bigger than the mouse (FAST)
  - 5 is bigger than 4 (SLOW)
  - 9 is bigger than 2 (FAST)