Long term memory

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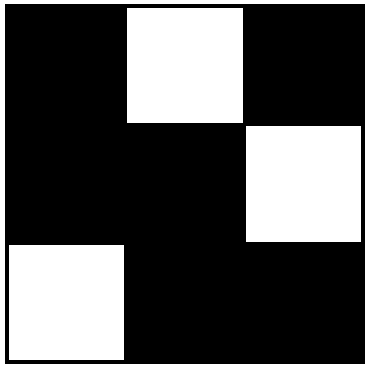


Long term memory (LTM)

- Iconic memory lasts for 1 sec
- Short term memory lasts for 10 sec
- Anything we need to do beyond this is long term memory
- Visual LTM is not anything unique, similar to other kind of information storage from which we retrieve information
- Examine different types of memory and look for visual equivalents

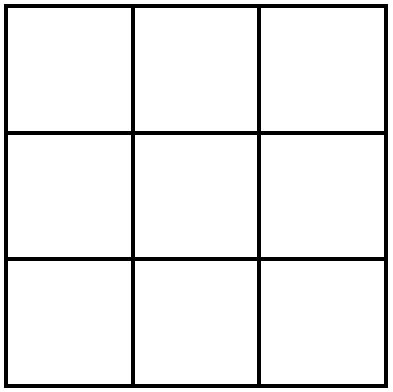
Long term memory

- Types of long term memory
  - Semantic memory (Concepts and abstract information)
    - “Hammers are a kind of tool”, “Triangles have three sides”
  - Procedural memory (Steps to perform an action, HOW)
    - “You use a hammer by swinging it like this”
    - Develop skills and execute common task, no rediscovery
  - Episodic memory
    - “Last time I used a hammer, the following happened:”
    - Visual routines, helps to narrate events even long time ago
  - Visual analogs to all of the above

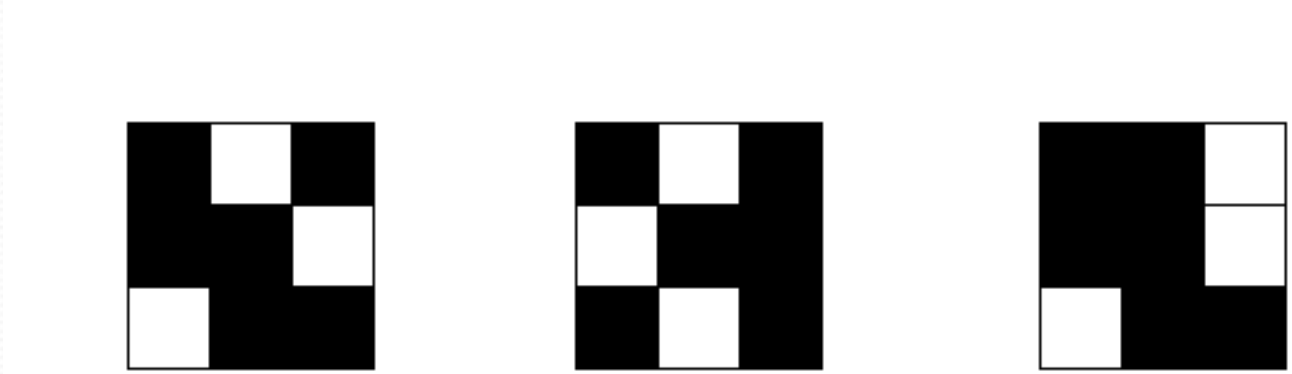
Procedural Memory

- Visual routines
  - Ullman '84
  - Primitive routines that are combined into higher level routines.
    - Shifting the focus
    - Indexing
    - Bounded activation
    - Boundary tracing
    - Maxing

Recall



Recognition

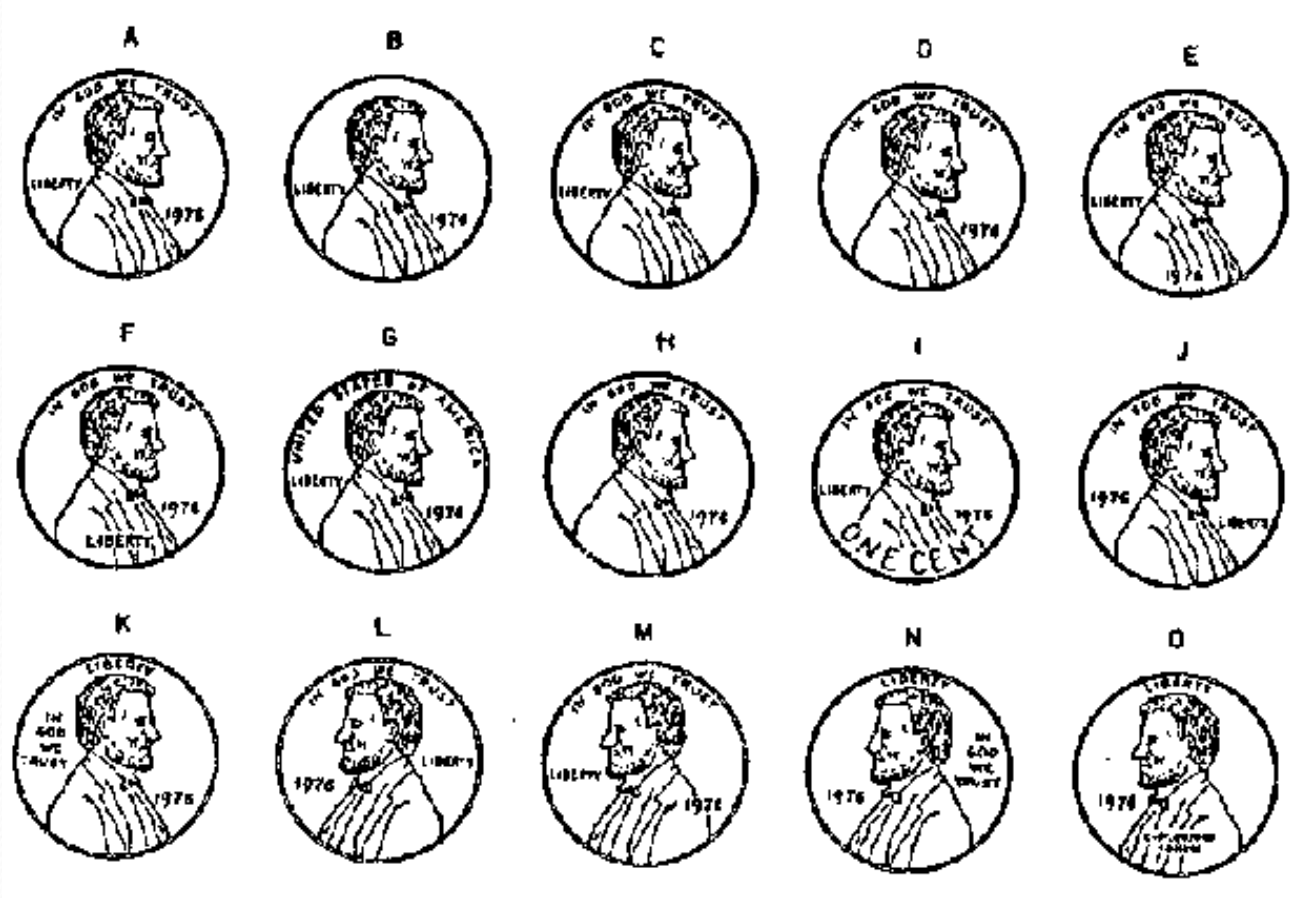


You recognized, you could not recall

Recall vs Recognition

- How do they affect each other?
- How are they affected by content?
  - Similar content in RSVP makes recall difficult
  - Unique content makes it easier
- How does distractors aid or inhibit?
  - What are considered distractors?

Unexpected results of recognition



Unexpected results of recognition

- Only 43% can recognize the penny correctly
  - They must have seen thousands of them
- Other factors affect recognition
  - E.g. Attention

Mnemonic aids

- Visual imagery is often used as a mnemonic device.
  - We can remember lists of abstract items more readily if we associate them with visual images.
  - The technique involves associating the list with a series of connected images.
    - This technique is known have been used by Roman orators.

Episodic visual memory

- Dual coding theory (Paivio '69)
  - Two linked storage systems
    - Visual\imagistic
    - Verbal\audio
  - Imageable words are stored in both locations and are easier to recall.
  - Problem: Doesn't work the other way around.
    - Subjects who describe images are less likely to recognize them.
    - Verbal overshadowing when working with faces

Unusual forms of memory

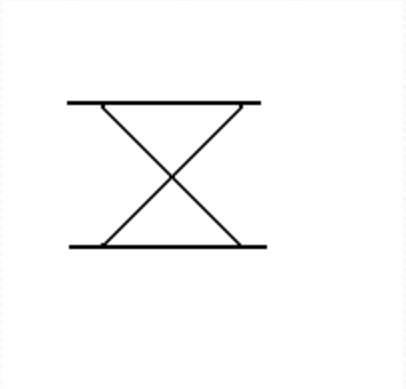
- Photographic Memory
  - Found in less than 7% of children and decreases with age.
  - Images are experienced differently from normal memory images.
- Menemonists
  - Those with extraordinary memory often had a visual component to their experiences which was sometimes disorienting.

Unusual forms of memory.

- Amnesia
  - Retrograde amnesia
    - Involves loss of past memories.
  - Anterograde amnesia
    - Involves inability to form new memories.
    - Short term memory unaffected.

Distortion effect on visual information

- Table or hourglass?



- Memory of object depends on the description attached to it
- "When did you hear the gunshot?" is bad question
  - Even if no gunshot, it starts feeling like a gunshot

Distortion effect on visual information

- Subjects shown video tape of automotive collision.
  - The subjects estimated the speed of the cars.
    - Produced higher estimation of speed when told the cars smash together rather than hit.
- Similar results in other experiments.
  - Subject shown a green car driving through a stop sign.
  - Visual memory of the scene changes depending if the subjects are asked “Did the blue car go through the stop sign?” or “Did the green car drive through the yield sign”?

Distortion effect on visual information

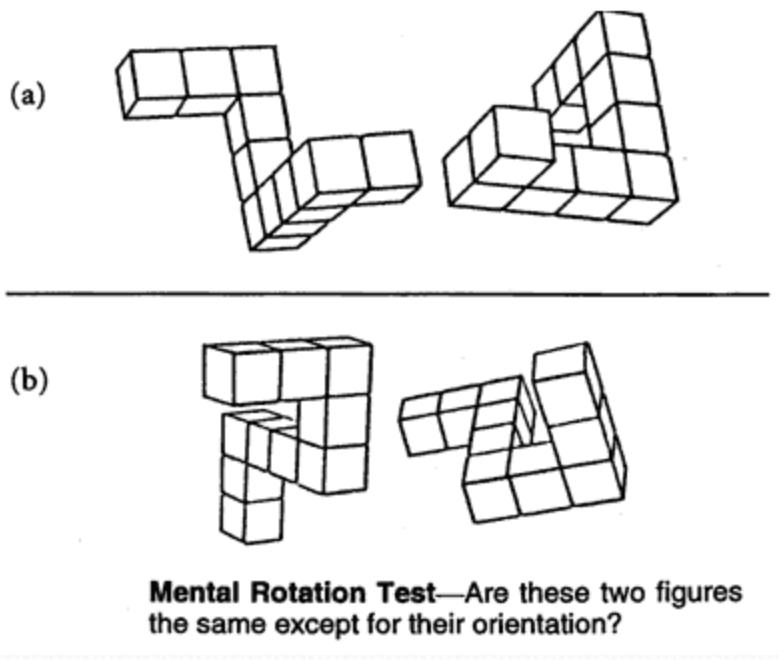
- Two theories on what is happening.
  - Misinformation distorts or changes the original memory.
  - Misinformation creates a false memory
- Argument against the first theory is that the misinformation is only biasing the subjects who retained no clear memory of the event.

What is LTM?

- Are images in memory symbolic representations or essentially pictures in the head?
- Analog – Set of pictures in head
  - + Supported by photographics memory cases
  - - Cannot tell details
  - - Impossibility of retrieval without metadata
  - - Seems to be interpreted
- Propositional - Made of abstract verbal propositions
  - Gets reconstructed upon retrieval

How do you decide?

- Analog
  - Transformations can be done on images
  - Small increments of rotation till matches the second image
  - Linear with rotation angle
- Propositional
  - No need for transformation
  - Flat response with angle



Mental Rotation Test—Are these two figures the same except for their orientation?

How do you decide?

- Analog
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  - Small increments of rotation till matches the second image
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- Propositional
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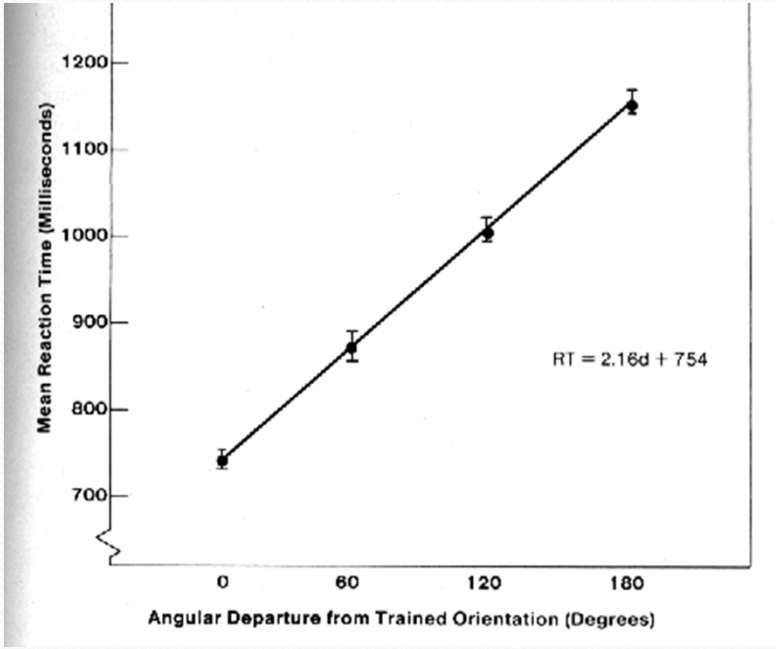


Other evidences

- Other kinds of mental transformation support analog position.
  - Bigger images take longer to rotate.
- Scanning across images occurs in linear time.
  - Time to mentally scan between two points on the island varies depending on distance and size of image.

Other evidences

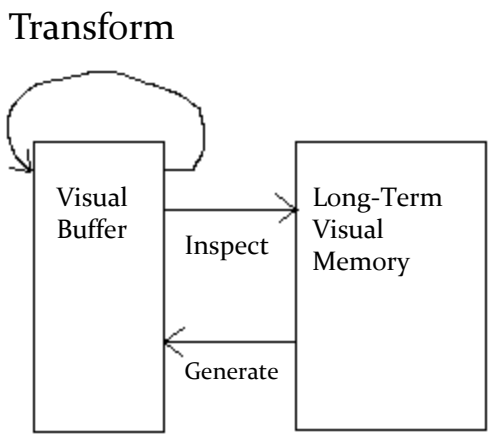
- Mental Psychophysics
  - Subjects told to “zoom in” on their mental image until the mental image overflowed the boundaries and this point, subjects estimate distance from image.
  - From this, the angle of the mental viewing field can be estimated.
  - Mental image ~20% to ~60%
    - Normal vision 120% vertical and 180% horizontally.

Evidence for Propositional Theory

- Reinterpreting the duck\rabbit image.
- Subjects unable to reinterpret the mental image but were able once they drew it.
- Support for propositional theory.
  - Disputed as too complex.
  - Simple mental images able to be reinterpreted.

Kosslyn's Model of imagery

- Need a hybrid approach that incorporates both analog and propositional positions.
- Three components:
  - Visual Buffer.
  - Long Term memory.
  - Image Operations.



Imagery and perception

- How connected are visual perception and imagery?
- Behavioral studies.
  - Attempting to form visual images degrades perception.
    - Implies both share similar mechanisms.
- Neurophsychological
  - Damage to perceptive ability often correlated with difficulty in forming visual images.
  - Brain activity shows similar areas of excitation in both activities.