

Mental imagery

- Some mental imagery phenomena
- How are mental images represented?
- Are mental images processed like visual images?

Questions

- Who wrote the Gettysburg Address?
- How do you tie your shoe?
- Which is higher, the top of a collie's head or the bottom of a horse's tail?
- How many windows are there in the place you live now?

Mental imagery

- Some information in memory is purely verbal
 - Who wrote the Gettysburg address?
- Other memories involve mental images
 - Trying to recall a procedure
 - Making novel comparisons of visual items
- What is a mental image?
 - How are mental images represented and processed?
 - Are mental images like visual images?

Mental images and real images

- Transformations of images

- Rotation



- Expansion



Transforming mental images

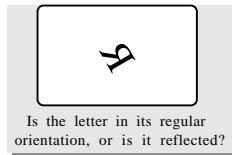
- Can mental images be transformed?

- How could we tell?

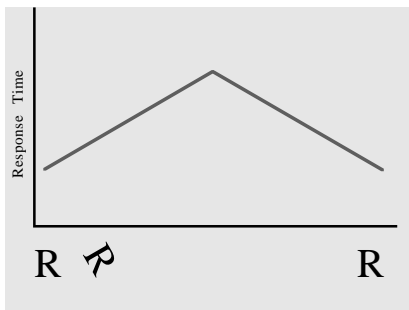
- Look at time to make some judgments.

- Mental Rotation

- Shepard, Cooper, Metzler



A typical mental rotation task



Traversing mental distance

- Kosslyn and colleagues
 - Learn a map
 - Mentally travel from one point to another
 - Measure time to make this mental trip
 - Expand the map
 - Make the trip again.
- Results
 - Time to make trip increases with distance
 - Times increase with imagined size of the map.



Making new pictures

- Pinker, Finke, Farah
 - Are images based only on memories of real objects?
- Example
 - Imagine a capital letter h and a triangle.
 - Rotate the h 90 degrees clockwise
 - Put the rotated h against the bottom edge of the triangle
 - What is it?

Limits of resolution

- Images are not as sharp as real pictures
- Form a mental image of a tiger
 - Does it have stripes?
 - How many?
- It is hard to examine details of mental images that would require eye movements.

So how are images represented?

- The analog vs. propositional debate.
 - Analog: the representation has the same structure as the thing represented
 - Using distance to represent distance in a map
- Rotation and scanning
 - Consistent with an analog representation.



Propositional representation

- A sentence-like description of the image
 - Like the structural theories of object representation
 - Describes the relative locations of parts of the image
- This may seem strange
 - Rotation and scanning data seem to argue against propositional representations
 - Yet mental images also have structure.

Put your finger above your desk. Now, imagine a cube standing on one corner directly below your finger, with the diagonally opposite corner touching your finger. Now, point to the locations of the rest of the corners in space.

How did you do?

- Many people point to four points on the same plane half way between the top and bottom corners.
 - Representation is structured by squares.

Kind of like “real” perception

- There seem to be analog and propositional aspects to processing of real images too.
 - Templates
 - Structural theories
- Are images processed with the same (brain) mechanisms as real images?

Behavioral evidence

- Facilitation and interference (Farah)
 - Have people imagine a letter (H)
 - Present something to the screen briefly (20 ms)
 - The imaged letter (H)
 - Another letter (T)
 - Nothing
 - Ask people what they saw.
- In this example, people are more likely to identify the H than the T

Brain evidence

- Patients with lesions of visual cortex that lead to perceptual problems also have problems with mental imagery.
- ERP evidence from facilitation study
 - A brain potential is seen in the posterior of the brain within 200ms of the presentation of the actual stimulus
- PET evidence: Visual imagery leads to activation of visual cortex. Auditory imagery does not.

Summary

- Mental imagery
 - Rotation and scanning data
 - Consistent with analog representation
 - Some data in favor of structural representation
- Imagery and perception
 - Behavioral evidence
 - Evidence from cognitive neuroscience
