Visual imagery

Ch 10
pp 270-279
Visual imagery

- Historical question: Imageless-thought debate
- Is imagery different from perception?
  - Do they share the same mechanisms?
- Is imagery spatial or propositional (based on language)?
- What are the obstacles to study imagery?
- How are mental images stored in memory?
- What tasks are used to study imagery?
Mental rotation

- Shepard & Metzler (1971)
- Complex drawing – Judge if same shape with various rotations
- Greater rotation then the longer to make judgment
Kosslyn’s Expmts

- Mental scanning
  - Mentally search for another part of boat
  - How long to mentally travel between 2 pts on a map
- Size in visual field
  - Can you see detail on animal depending on small/large image
- Mental-walk task
  - Move to object; when does image overflow?

Conclusion: Spatial correspondence between perception and imagery
Imagery debate

• Mental representation
  – Spatial representation (Kosslyn)
  – Propositional representation (Pylyshyn)

• Tacit-knowledge explanation
  – Unconsciously use knowledge to make judgment

• Finke & Pinker (1982): Does arrow pt to a dot?
  – Took longer for dots farther away (support for imagery)
Imagery and perception

- Perky (1910)
- Farah (1985)

(a) Create image

(b) Was target letter flashed first or second?

(c) Percent correct detection

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<thead>
<tr>
<th></th>
<th>Image same as target</th>
<th>Image different from target</th>
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<tbody>
<tr>
<td>Detection (%)</td>
<td>90</td>
<td>70</td>
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Imagery and the Brain

  - Read abstract words minus imagery
  - Occipital cortex (V1)
  - Temporal cortex
- PET and fMRI
  - Visual imagery = temporal
  - Spatial imagery = parietal
- Single neuron recordings
  - Same activation for perception and imagination
- Similar areas used for perception and imagery
- But… case studies

Activity in striate cortex
LeBihan et al., (1993)
Cognitive maps

- How far is it to the library from here?
- How many miles is it to your home “as the crow flies”?
- Cognitive map:
  - Mental representation of the environment
- Research questions
  - How do we create mental maps from verbal descriptions?
  - How do we represent visuo-spatial information?
  - Are the cognitive maps accurate, and if not what typical errors do we make?
You are at the Jefferson Plaza Hotel, where you have just taken the escalator from the first to the second floor. You will be meeting someone for dinner in a few minutes. You now stand next to the top of the escalator, where you have a view of the first floor as well as the second floor. You first look directly to your left where you see a shimmering indoor fountain about 10 yards beyond a carpeted walkway. Though you cannot see beyond the low stone wall that surrounds it, you suppose that its bottom is littered with nickels and pennies that the hotel guests have tossed in. The view down onto the first floor allows you to see that directly below you is a darkened, candle-lit tavern. It looks very plush, and every table you see seems to be filled with well-dressed patrons. Looking directly behind you, you see through the window of the hotel’s barbershop. You see an older gentleman, whose chest is covered by a white sheet, being shaved by a much younger man. You next look straight ahead of you, where you see a quaint little gift shop just on the other side of the escalator. You’re a sucker for little ceramic statues, and you squint your eyes to try to read the hours of operation posted on the store’s entrance. Hanging from the high ceiling directly above you, you see a giant banner welcoming the Elks convention to the hotel. It is made from white lettering sewn onto a blue background, and it looks to you to be about 25 feet long.
Answer the following

• Now imagine you have turned to face the barbershop.
• What is above your head?
• What is below your feet?
• What is ahead of you?
• What is behind you?
• What is to your right?
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Creating a mental map

• Franklin & Tversky (1990)
  – Presented 10 scenes each with 5 objects
  – Specify objects in several locations
  – DV: how long to respond to question

• Results:
  – Fastest to answer “above” or “below”
  – Little longer to answer “ahead” or “behind”
  – Slowest to answer “left” or “right”

• Conclusions:
  – Knowledge vs. imagery
  – Mental models have biases to “up” or “down”
Cognitive map studies

• Methodologies to study mental maps

• Directions
  – Describe how to get to a location

• Map creation
  – Rate map accuracy

• Learn hypothetical map
  – Estimate distance between locations
  – Describe setting given place on map
Learning from a map
Learning from a map

• Imagine you are standing at Position 3, facing Position 4. Point to Position 1.
• Imagine you are now standing at Position 1, facing Position 2. Point to Position 4.
• Why is second question more difficult?

• Representation:
  – Relationship among locations or picture-like image?
Cognitive Maps

• Draw a picture of the Wofford campus
• Label the buildings and spaces
Cognitive maps

- How accurate is your mental map if you never have seen a physical map?
- What distortions do you think you make?
- Distance
- Shape
- Relative position
- Heuristic: general problem-solving strategy
  - Easier to remember ideal than precise version!
Distance

• Methodology: Hypothetical map learning
• Dependent variable
  – Estimate distance between pairs of locations
• Independent variables
  – # intervening cities (Thorndyke, 1981)
  – Semantic categories (Hirtle & Mascolo, 1986)
  – Landmarks v nonlandmarks (McNamara & Diwadkar, 1997)
• Conclusion
  – Context and learned associations affects distance judgments
Shape

• What is angle at which Evins St and Church St meet?
• Draw street running through campus.
• Systematic distortion: tend to be more regular than they really are
• Angles
  – 90 degree angle heuristic
• Curves
  – Symmetry heuristic
Relative position

• Which city is farther west – San Diego, CA or Reno, NV?
• Which city if farther north – Philadelphia, PA or Rome, Italy?
Relative position

Rotation heuristic

Alignment heuristic
Cognitive maps

- We store more “regular” representations than real world image.
- May miss important details that make maps unique.
- Regularizing reduces memory load and provides approximation.
- What is relationship to top-down vs. bottom-up processing?