how many windows in total for all the bedrooms in your family’s house?
Dual-coding Hypothesis

• Memories can be stored visually and verbally
  – By default, memories are semantic, but using imagery during rehearsal establishes a spatial/visual memory
    • better memory for concrete nouns (e.g., book) than abstract nouns (e.g., truth)
    • Interacting images work better than separate images
Long-Term Visual Memory

- Reflects general principles of LTM
  - e.g., perceptual schema
    - Boundary extension

Figure 11.14
Mental Imagery

- Imagery can exist for any perceptual modality, although most research concerns visual imagery.

- Is imagery perceptual/spatial, or does it reflect verbal/propositional information?
  - Imagery can be influenced by verbal information, but this doesn’t mean that it’s verbal.
  - The majority of studies find that imagery is non-verbal.
    - Demonstrated by ‘equivalence’ between imagery and reality.
      - Transformational, Perceptual, Attentional, Spatial and Structural.
Transformational Equivalence

• image transformations are like physical transformations
  – mental rotation (Shepard & Metzler, 1971)
  • 3D rotation of unknown objects
Demand Characteristics

(maybe people just wait?)

• Use delays to monitor rotation progress
  – Difficult to explain with waiting strategy
Zooming Transformation

• Does a mouse have whiskers?
Perceptual Equivalence

- Imagery uses perceptual processes
  - Perceptual interference
  - Brain damage eliminates both perception and imagery
    - A prosopagnosic cannot imagine someone’s face
  - Brain imaging studies: same areas for imagery and perception
    - More brain tissue active when participants imagine larger objects
    - Faces, places, motion, etc.

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<th>Percentage of Detections</th>
<th>Visual signal</th>
<th>Auditory signal</th>
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<tr>
<td>While visualizing</td>
<td>61%</td>
<td>67%</td>
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<td>While maintaining an auditory image</td>
<td>63%</td>
<td>61%</td>
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<th>Percentage of False Alarms</th>
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<td>While maintaining an auditory image</td>
<td>3.6%</td>
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Visual vs. Spatial

• Object imagery task (blue)
  – same areas for visual identification

• Mental rotation imagery task (yellow)
  – same areas for spatial attention
Attentional Equivalence

Unilateral neglect patient can only imagine the right side of the plaza.
Spatial Equivalence

- spatial relations are preserved in images
  - scanning within a learned map
  - same results for blind participants
  - map learned by touch
London – Side by Side
Structural Equivalence

- images are constructed just like real objects/drawings
  - images with more complex descriptions take longer to form
  - detailed images take longer to form
Study this duck
Verbal Information can affect Images

• Unlike pictures, it is difficult to reinterpret images
  – Think about that duck. What else could it be?

• Spatial layout influenced by propositional information
  – Which is farther west: San Diego or Reno?
    • California west-of Nevada
  – Which is farther north: Montreal or Seattle?
    • Canada north-of U.S.A.
Images can be changed by their Labels

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<th>Stimulus figures</th>
<th>Word list II</th>
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