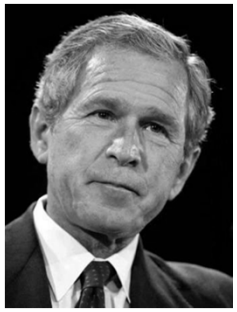
Mental Imagery



Questions About *Visual* Imagery

- ***Question 1:*** **Do visual images exist?**
  - **Introspection & some simple RT data.**
- ***Question 2:*** **Are images like pictures or words?**
  - **Scanning, rotating, and zooming visual images.**
- ***Question 3:*** **Does visual imagery engage the same processes used in vision?**
  - **Interactions between imagery & perception.**
  - **The neural bases of visual imagery.**
- ***Question 4:*** **How are images stored in memory?**
  - **Dual-coding (Pavio) & Image-file theory (Kosslyn).**

Effects of Imagery on Performance

Kosslyn (1976)

Group 1: "Form an image of a cat"

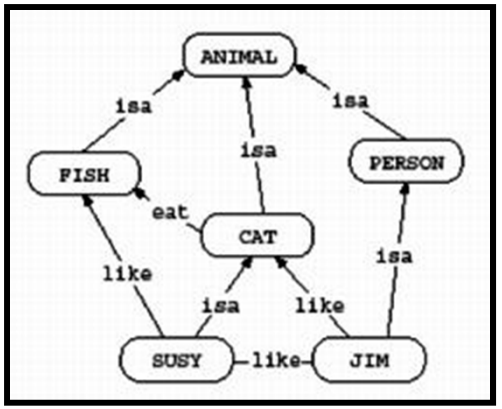
Does a cat have a head?

Does a cat have claws?

Group 2: "Think about a cat"

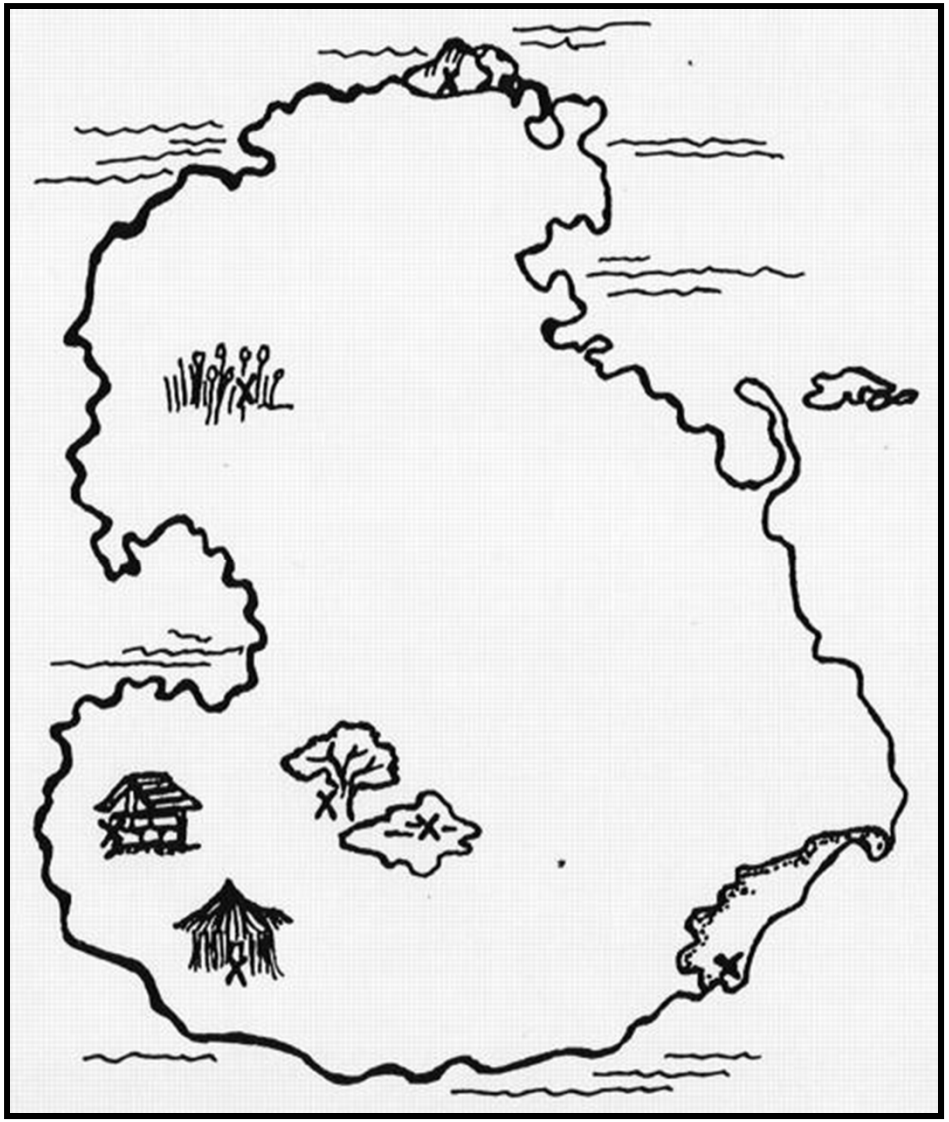
Does a cat have a head?

Does a cat have claws?



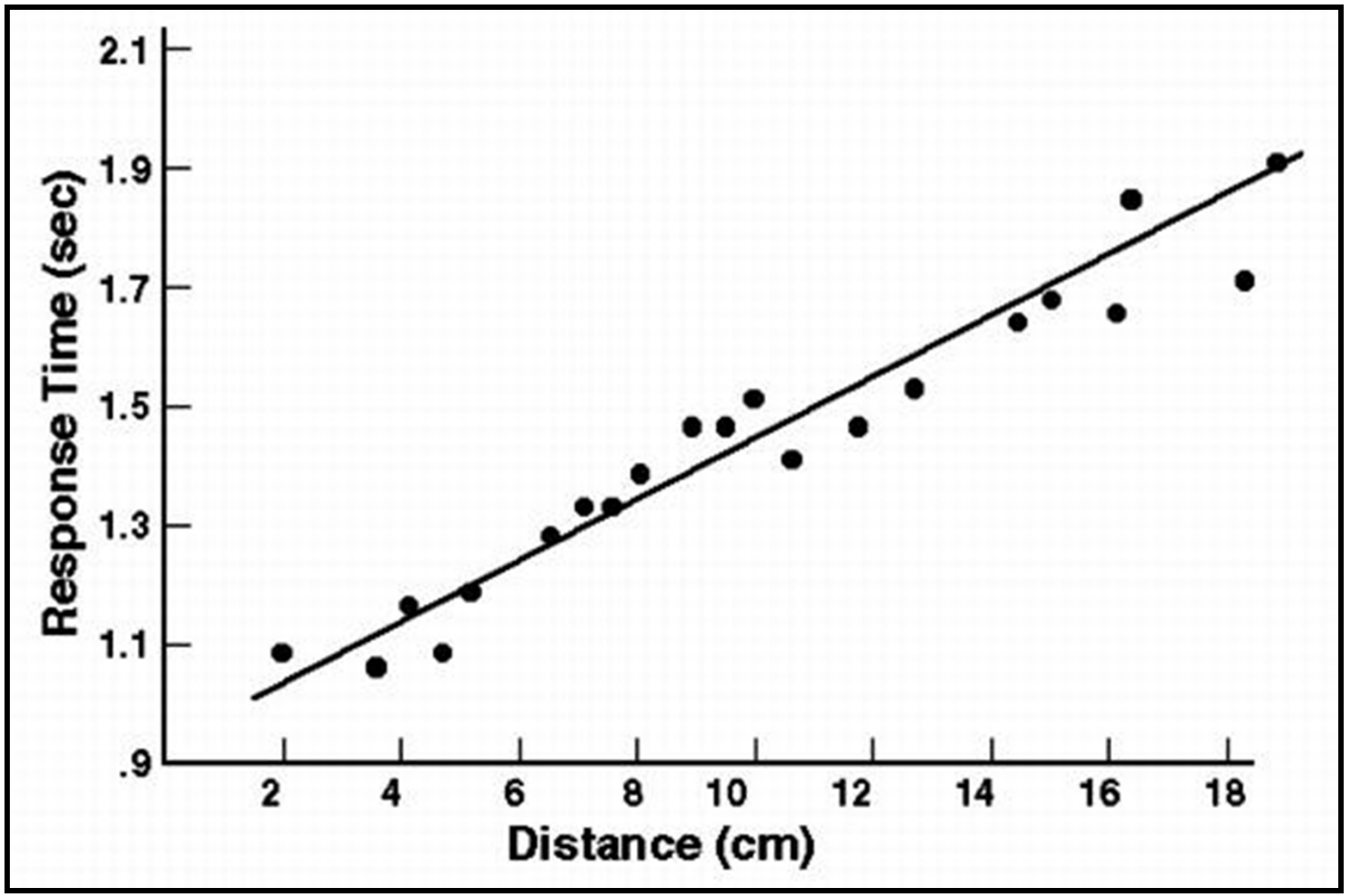
Scanning Images: Mental Travel

Kosslyn, Ball, & Reiser (1978)



- Subjects memorize map along with specific landmarks.
- Then asked to imagine traveling between landmarks, pressing a button when they arrived at their destination.

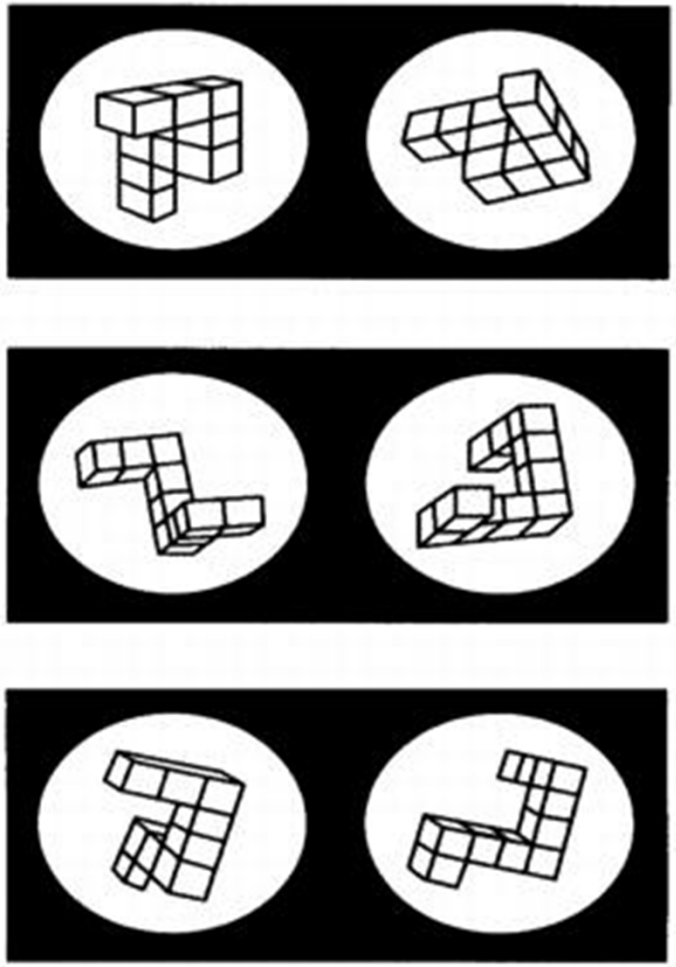
Scanning Images: Mental Travel

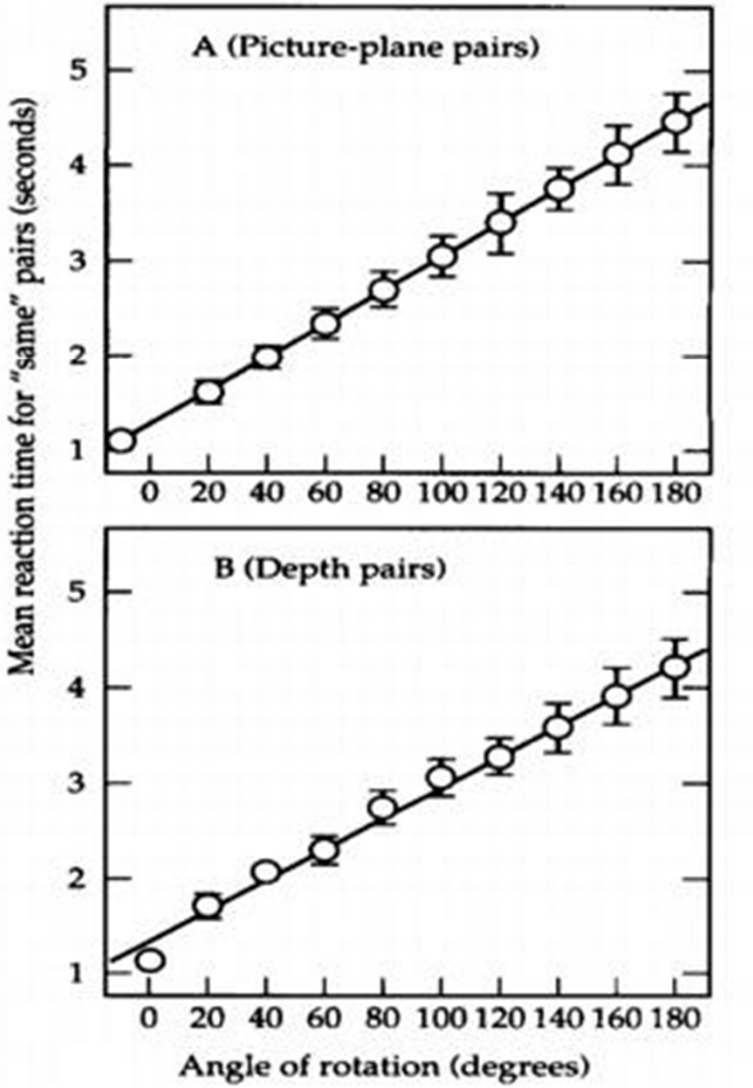


This linear relation suggests that people are operating on an image in a similar way to operating on a picture.

Mental Rotation (Shepard & Metzler, 1971)

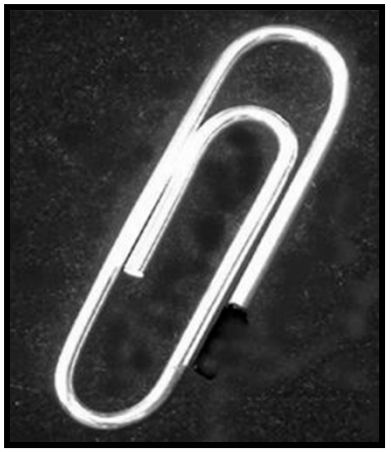
Same shape or different shape?





Mental Zooming (see Kosslyn, 1983)



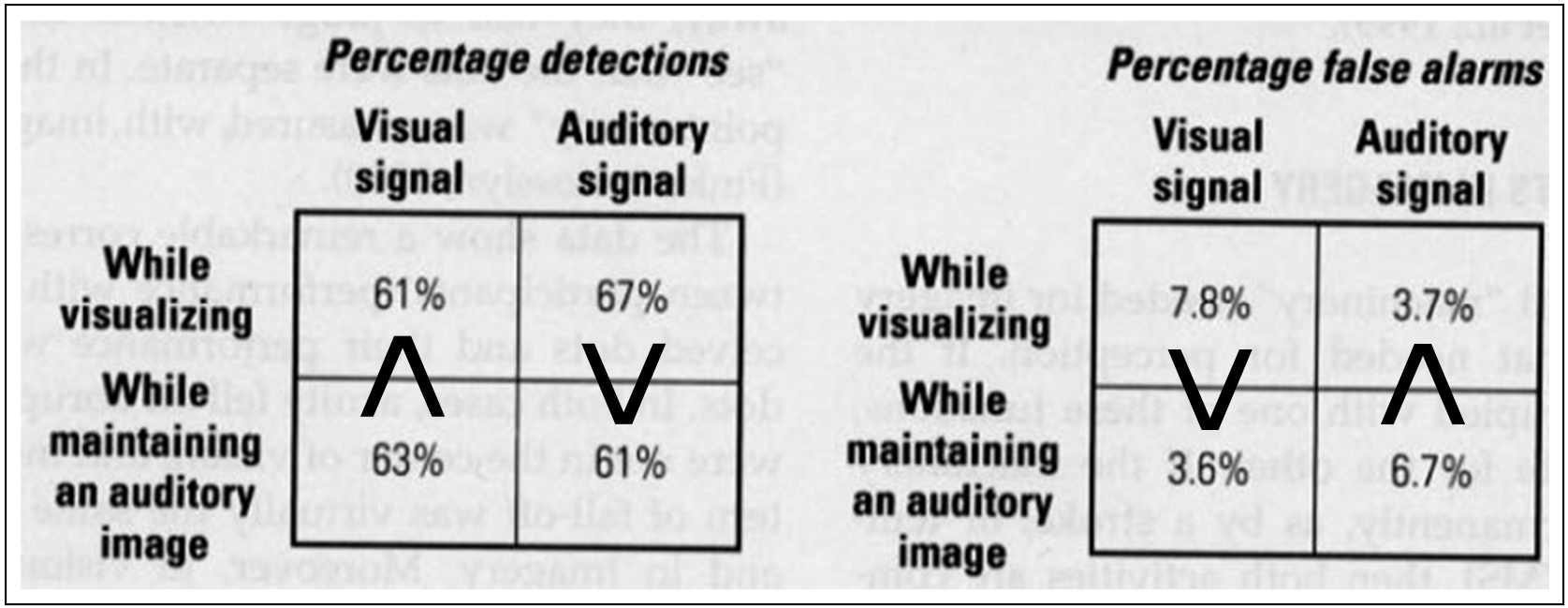


- S's told to imagine a mouse next to *either* (a) an elephant or (b) a paper clip.
- Asked "Does the mouse have whiskers?"
- Subjects faster in the paper clip condition.

Don't have to zoom the image as much!

Perception/Imagery Interactions: Interference Effects (Segal & Fusella, 1970)

- S's asked to detect a faint visual or auditory signal, while maintaining a visual or auditory image.



Percentage detections

	Visual signal	Auditory signal
While visualizing	61% ∧	67% ∨
While maintaining an auditory image	63%	61%

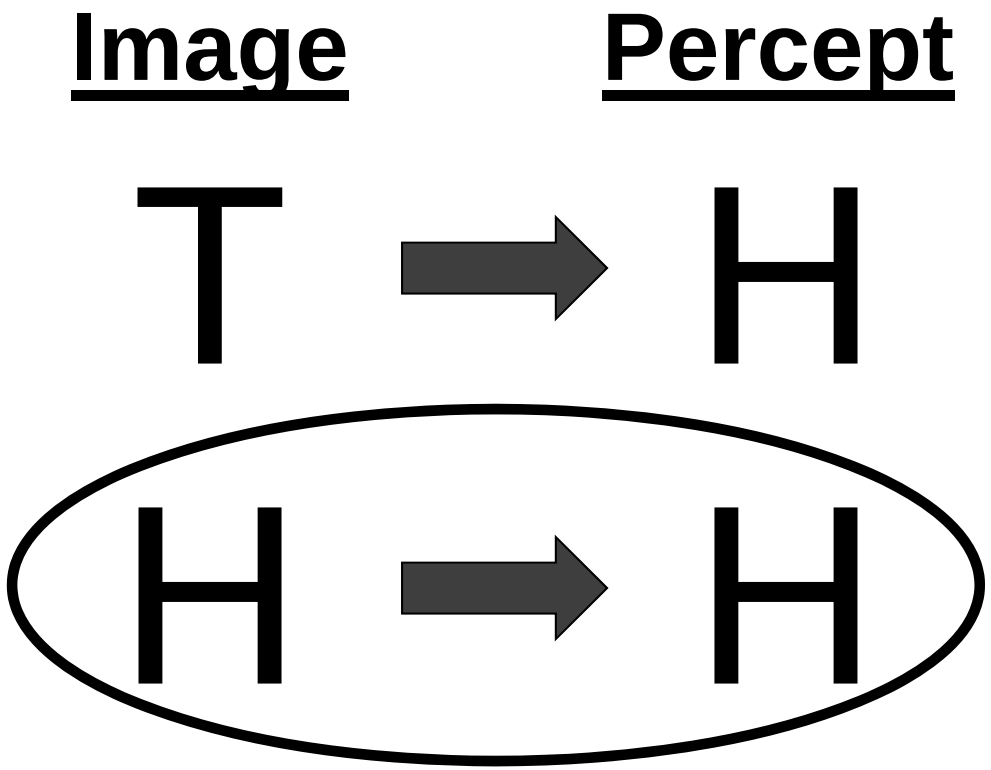
Percentage false alarms

	Visual signal	Auditory signal
While visualizing	7.8% ∨	3.7% ∧
While maintaining an auditory image	3.6%	6.7%

Interactions between imaging & perceiving suggest that the two activities share processes.

Perception/Imagery Interactions: Facilitation Effects (Farah, 1985)

Can visualization pave the way for perception?



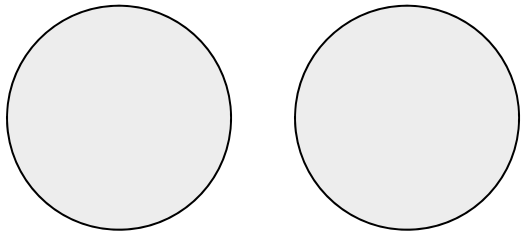
- Participants told to imagine an H or T.
- Then asked to identify a letter presented in noise.
- Identification was enhanced when imaging the target.

Implications for Sports? Other activities?

Acuity Effects in Imagery

- ***Visual acuity*** is the ability to see fine detail.

Two-Point Acuity

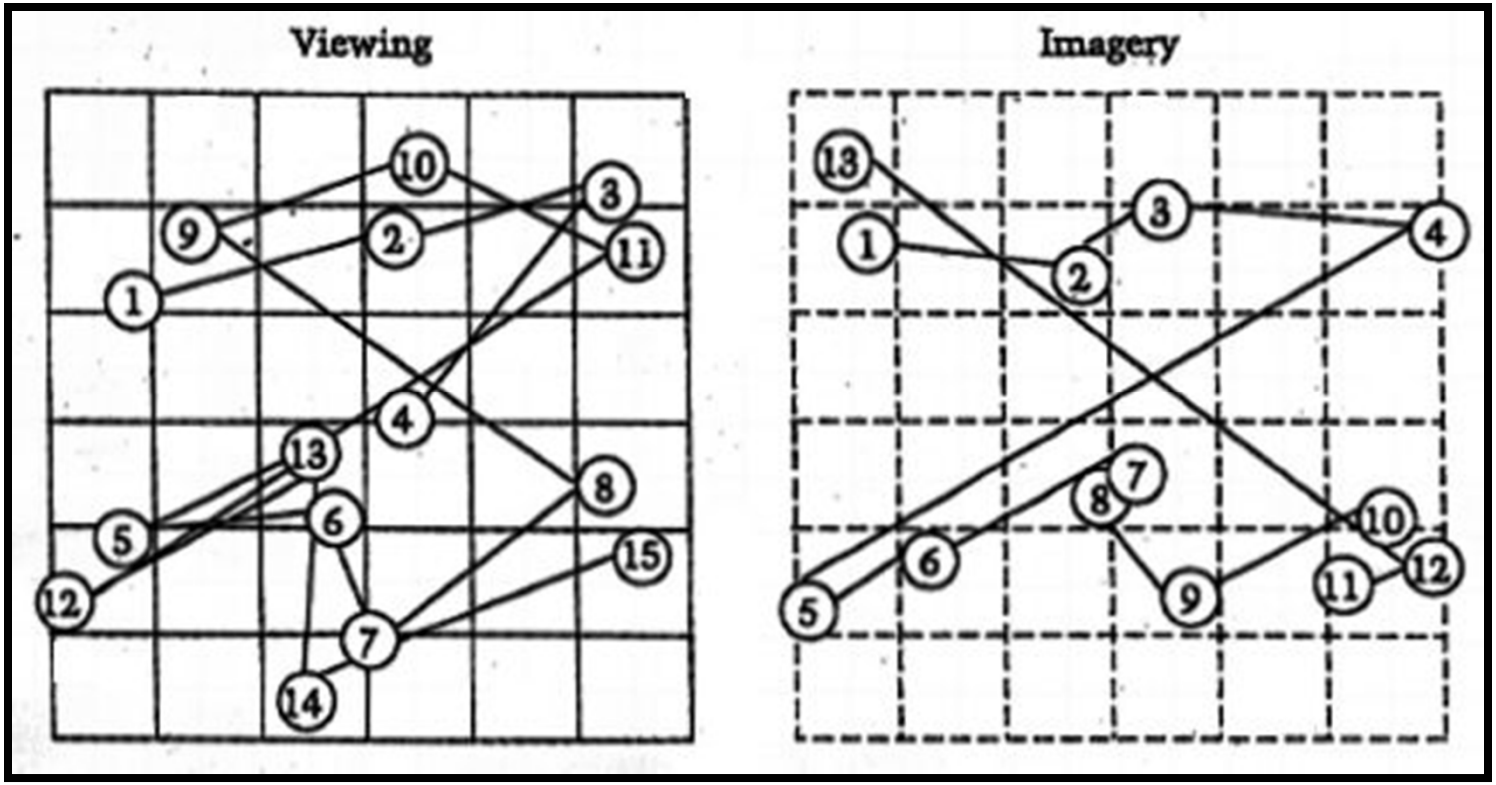


- Two-Point Acuity is much greater at the center of the visual field than in the periphery.
- Finke & Kosslyn (1980) asked S's to imagine two dots, then look away until they blurred together.

Results showed high correspondence between acuity measured with real dots & imagined dots – suggesting that imagery is based on perception.

Eye Movements During Imagery

- Participants' eye movements recorded as they scanned real and imaged matrices & pictures.

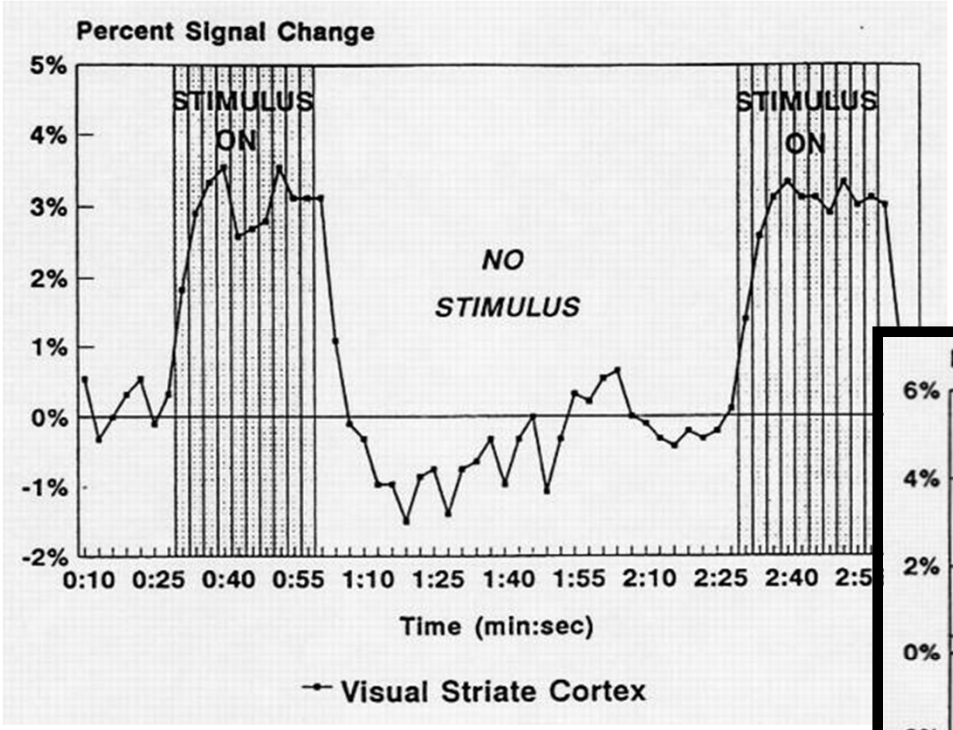


Eye movements & fixations when inspecting images are correlated with those used during perception.

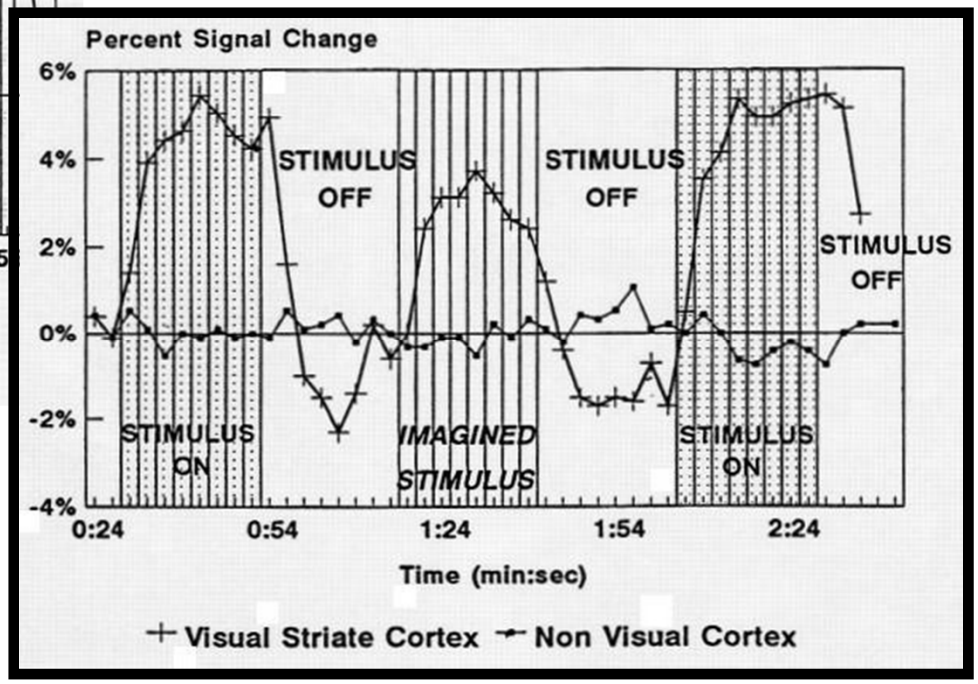
Neural Basis of Visual Imagery

- Activation studies (PET & fMRI)
- Lesion studies
  - Achromatopsia
  - What and where deficits
  - Attentional Neglect
  - Transcranial Magnetic Stimulation (TMS).

fMRI Studies



- Brain's activity recorded during perception and during imagery.



Both perception and imagery activate the primary visual areas of the brain.

Achromatopsia

- Cortical color blindness…

- also eliminates ability to form color images.
- and the ability to answer questions about the color of common objects.

What and Where Deficits

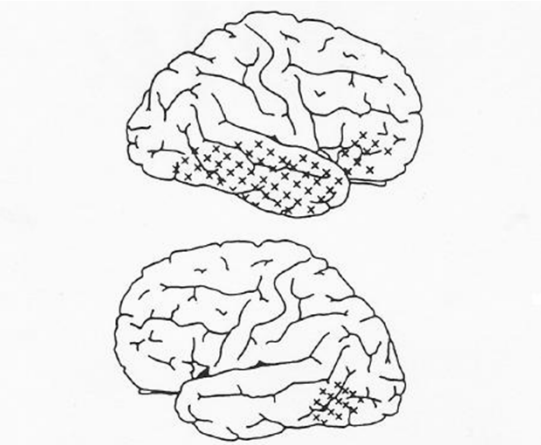
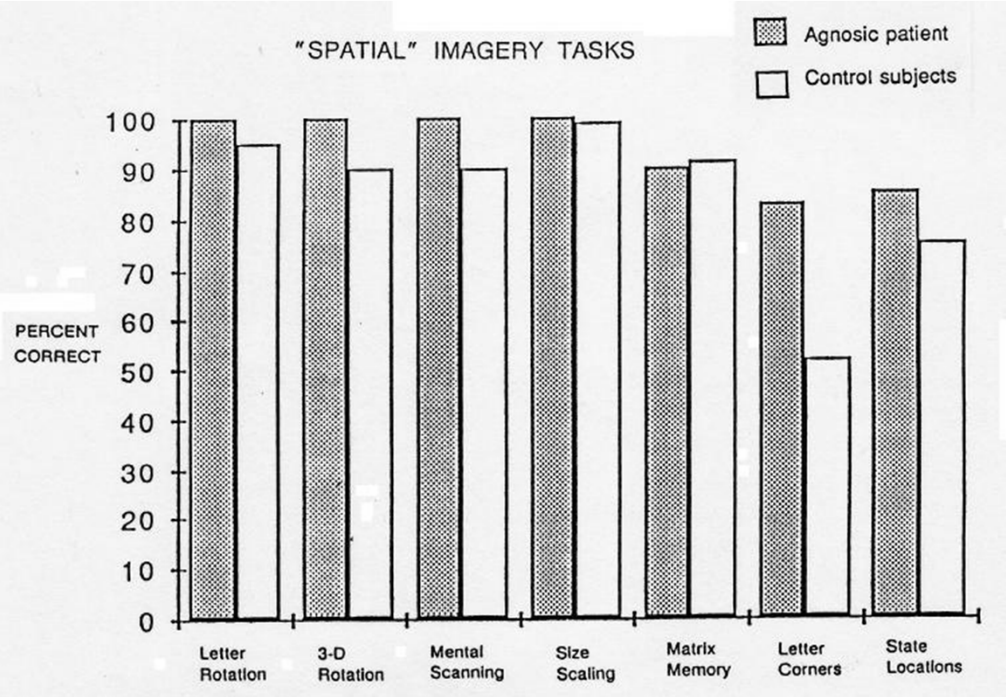
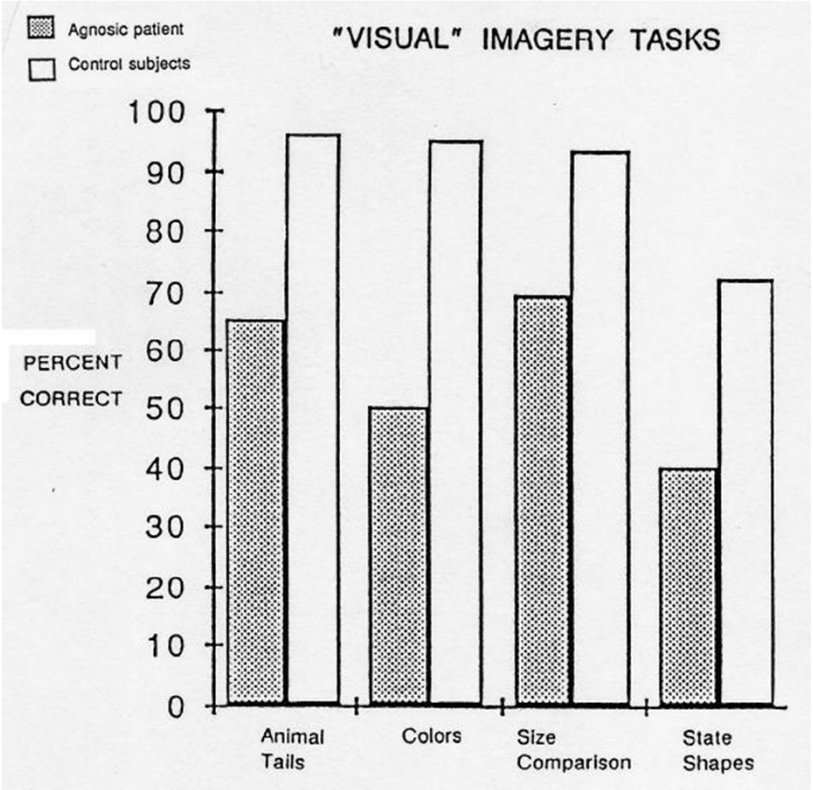


FIGURE 62.2 Diagram showing regions of damage in the brain of case L. H.

Damage to the "what" (ventral) pathway produces deficits in visual, but not spatial, imagery.





Attentional Neglect

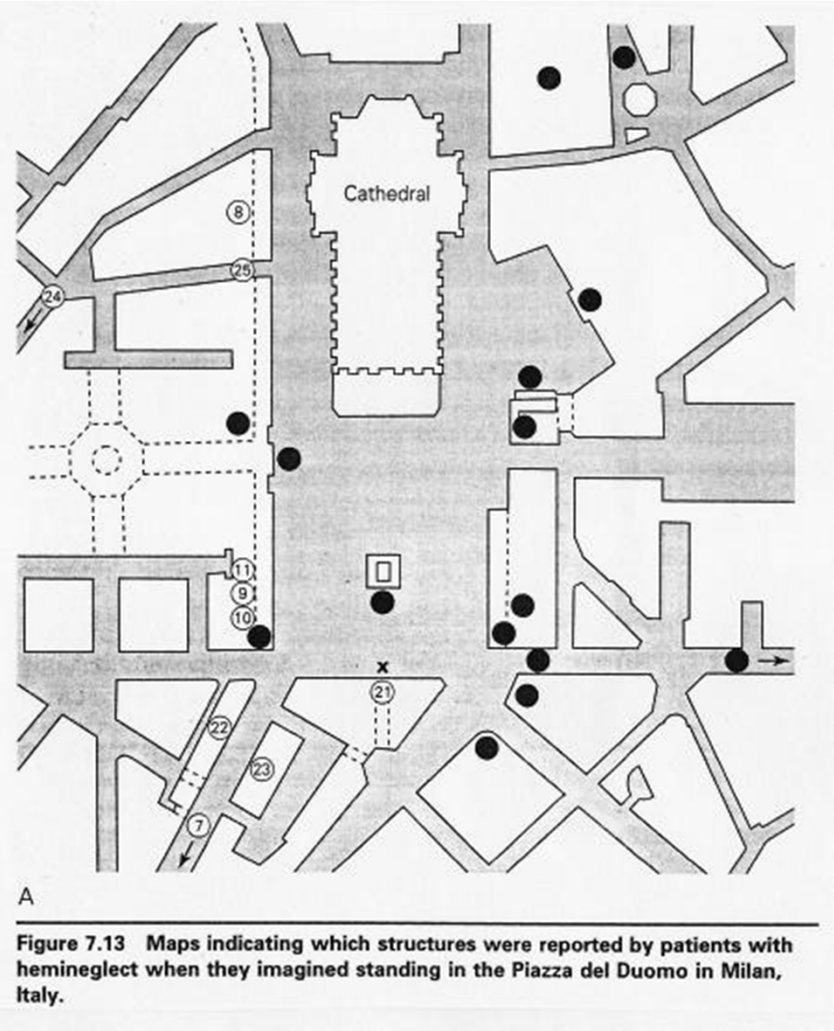


Figure 7.13 Maps indicating which structures were reported by patients with hemineglect when they imagined standing in the Piazza del Duomo in Milan, Italy.

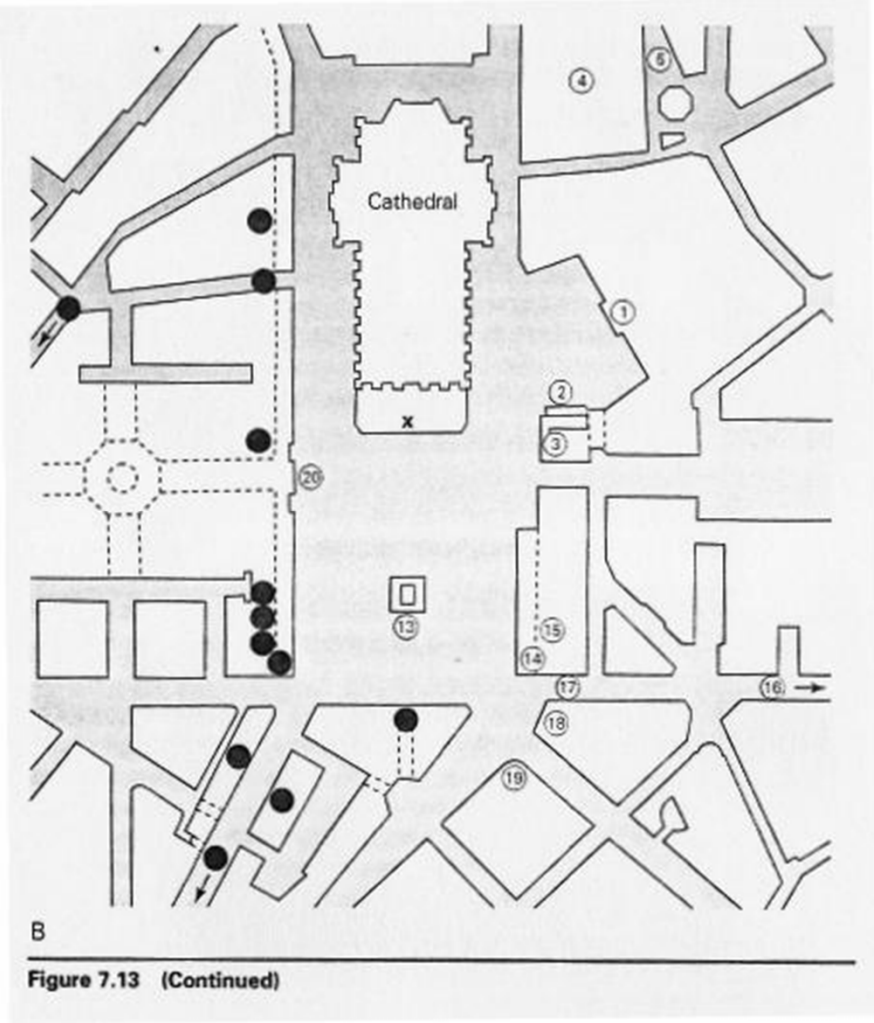
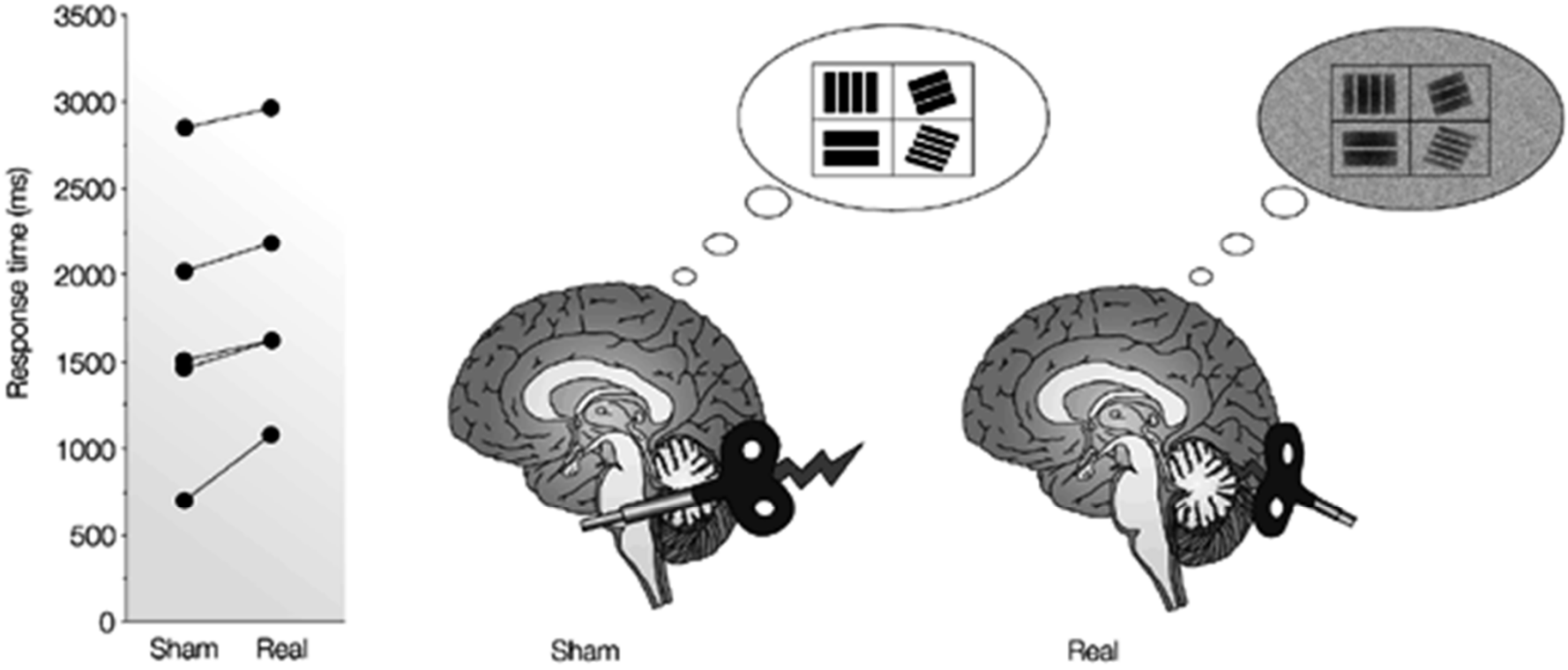


Figure 7.13 (Continued)

Hemi-neglect also affects spatial imagery.

Kosslyn: TMS to Area V1 (BA17) Interferes with Imagery



Nature Reviews | Neuroscience

Shows that early visual areas play a role in imagery.

Long-Term Visual Memory

- **Memory for pictures.**
  - **The picture-superiority effect.**
  - **Schema effects.**
  - **Verbal-Visual interactions.**
- **How is visual information stored in memory?**
  - **Paivio's dual-coding theory**
  - **Kosslyn's image-file theory**

The Picture-Superiority Effect

Memory for pictures is greater than that for words.

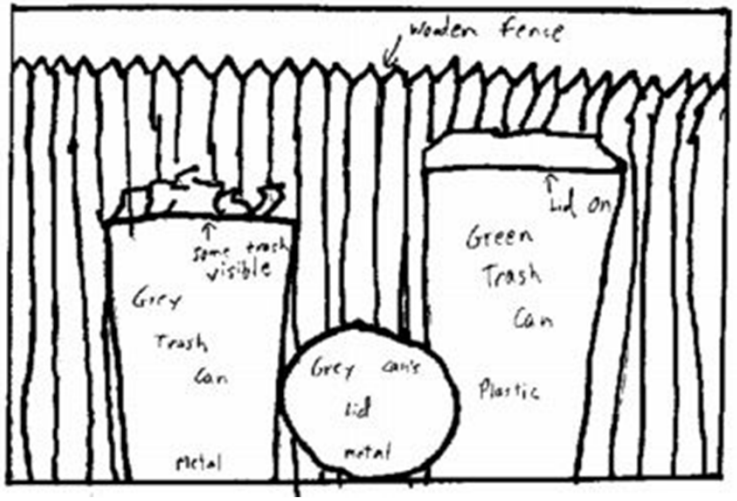
- **Shepard (1967) showed S's 612 pics for 6 sec's each & then tested 2AFC recog.**
  - **98% immediate accuracy**
  - **90% accuracy after a week**
  - **58% accuracy after 4 months**
- **Standing (1973) showed 10,000 pics (!) for 5 sec's each over 5 days & then tested 2AFC recog 2 days later.**
  - **83% accuracy in picking out old pics.**

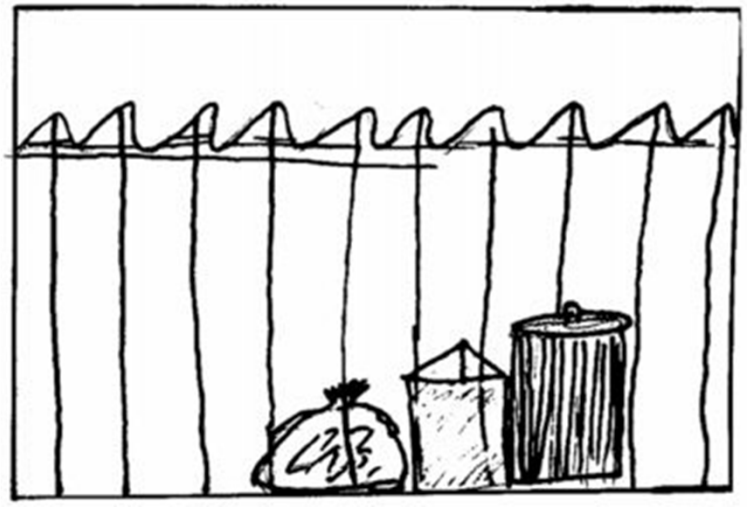
Schemas

- Toaster vs. fireplace in kitchen.

More likely to recognize change.

- Boundary extension:

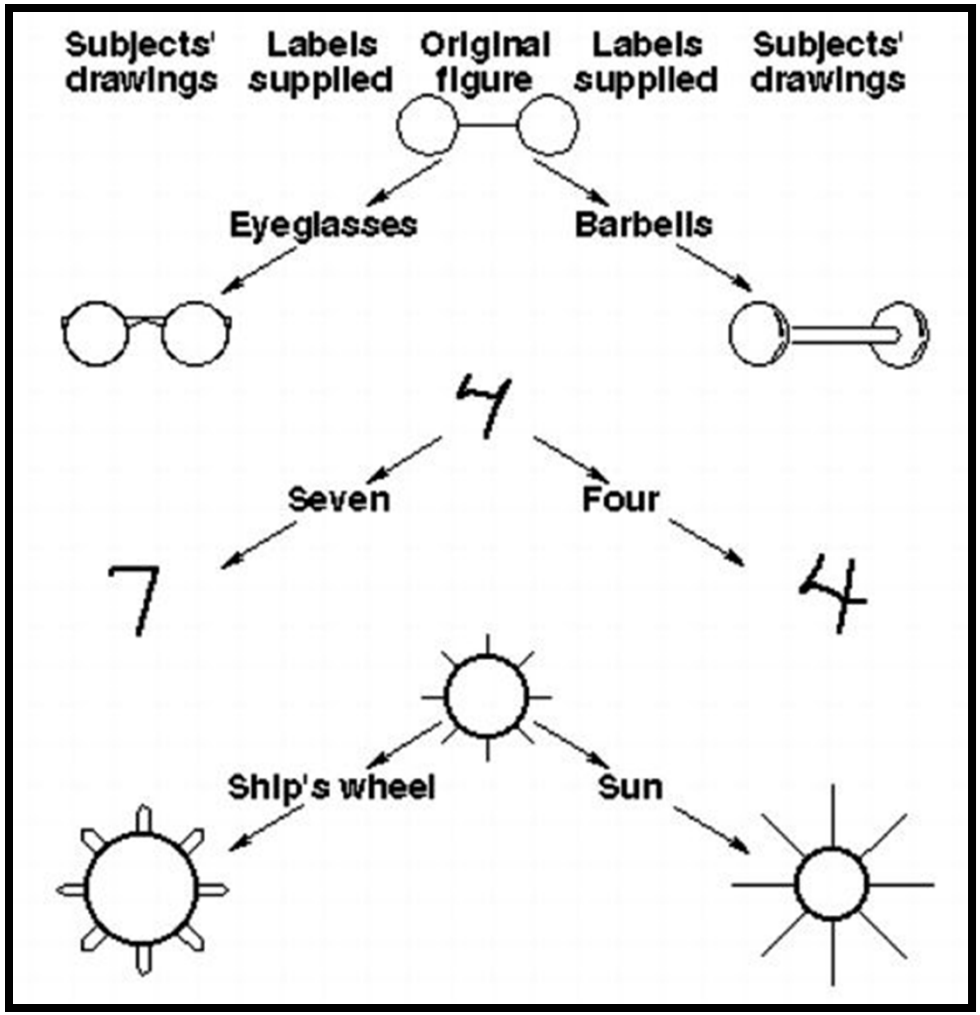




- A wider perspective, not truly seen, is often included in subjects' drawings.

Verbal-Visual Interactions

- ***Which is further north, Seattle or Montreal?***



- ***Effects of verbal labels on memory for pictures.***
- ***Verbal overshadowing:*** giving verbal labels to non-verbal perceptions or images can impair later memory performance.

Other Image-related Memory Effects

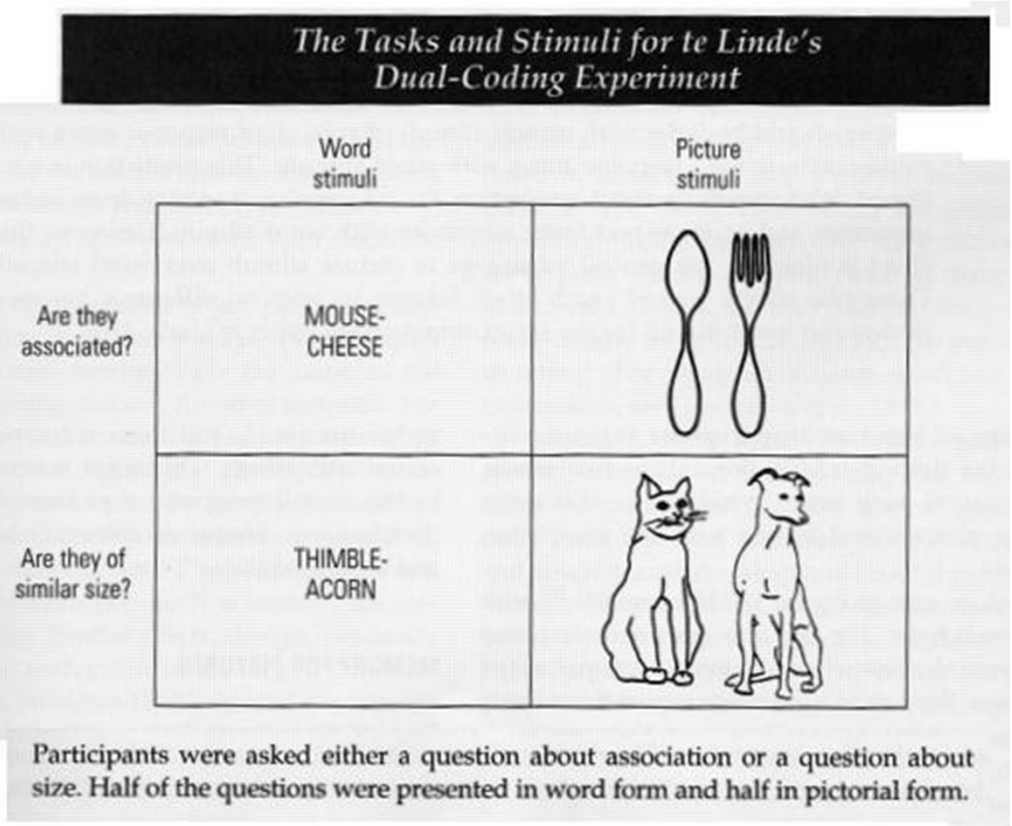
- ***Concrete words** (helicopter, mountain, etc.) are remembered better than **abstract words** (e.g., freedom, logic, etc.). Why?*

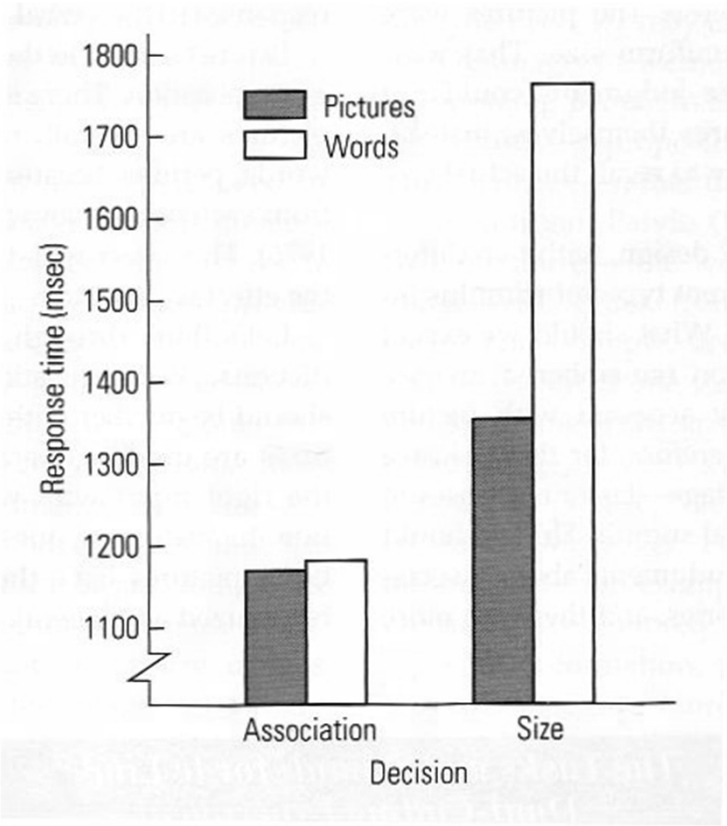
- ***High-imageability words (tree, dog, etc.) are remembered better than low-imageability words (e.g., cousin, vein, etc.). Why?***

- ***Imagery, especially interactive imagery, is a very good incidental encoding strategy. Why?***

Paivio's Dual-Coding Theory

Claims that info in LTM can be stored (coded) in two separate ways, verbally and/or as an image. The different forms may be useful in different situations.





Verbal Codes best at mediating Semantic Associations; Image Codes best at mediating size/shape info.

Kosslyn's Image-File Theory