

# **Imaging Predictions: Mental Imagery as Mental Emulation**

**Multisensory Predictive Learning  
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# Quiz

“ When mental imagery occurs? ”

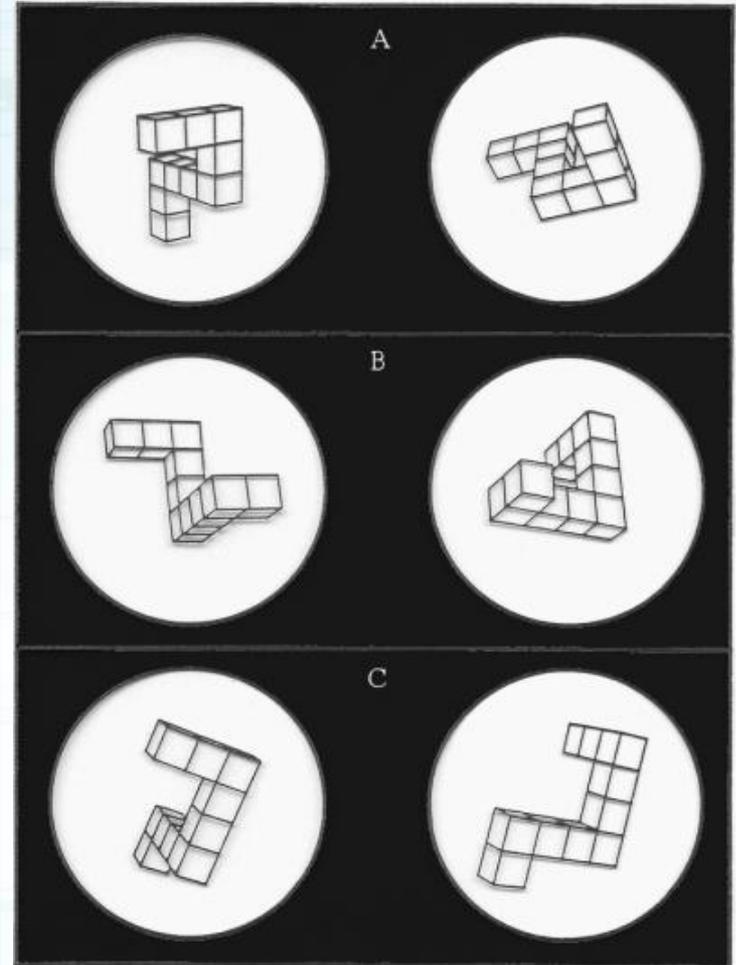
# Outline

- **What is Imagery?**
- **What Imagery Does?**
  - The Function of Mental Imagery
  - Representations and Processes used in Imagery
  - How is imagery realized physically in the brain?
- **Mental Emulation**
- **Imagery & Emulation**
- **Conclusion**

# What is Imagery?

- **Mental Rotation**

- The ability to rotate mental representations of two-dimensional and three-dimensional objects.  
(Shepard and Metzler, 1971)
  1. Create a mental image of an object
  2. Rotate the object mentally until a comparison can be made
  3. Make the comparison
  4. Decide if the objects are the same or not
  5. Report the decision



Some of the stimulus figure pairs used by Shepard & Metzler (1971)

# What is Imagery?

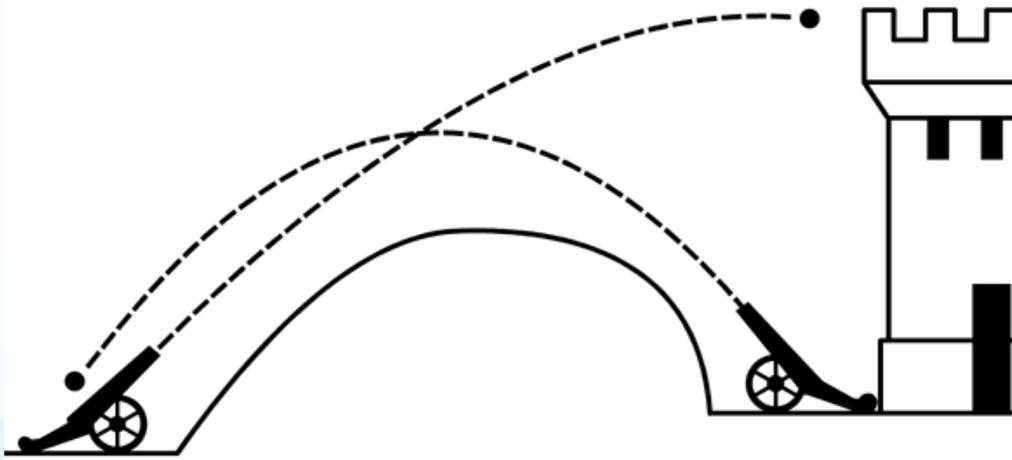
- **Mental Imagery**

- Mental imagery occurs when a representation of the type is present but the stimulus is not actually being perceived.
  - Distinct object-based imagery (shapes and colors)
  - Spatial imagery (locations)
  - Auditory imagery
  - Proprioceptive/Kinesthetic imagery (bodily sensation of movement)

# What Imagery Does?

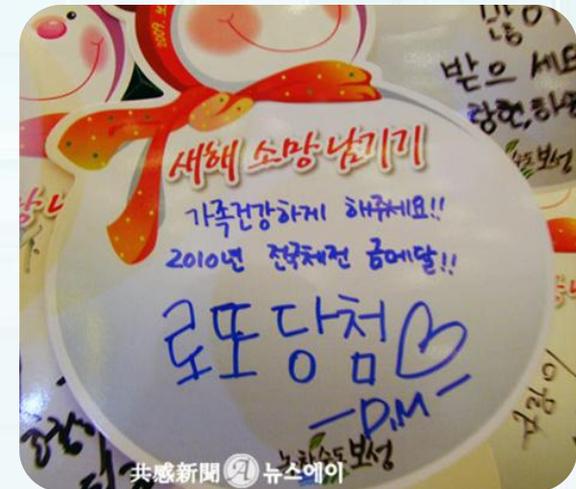
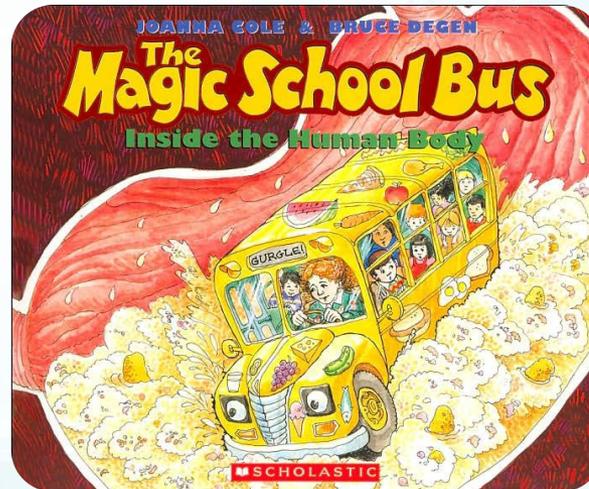
- **The Function of Mental Imagery**

- To generate specific predictions based upon past experience
- To make explicit and accessible the likely consequences
- The ability to simulate what one would perceive in a specific situation.



# What Imagery Does?

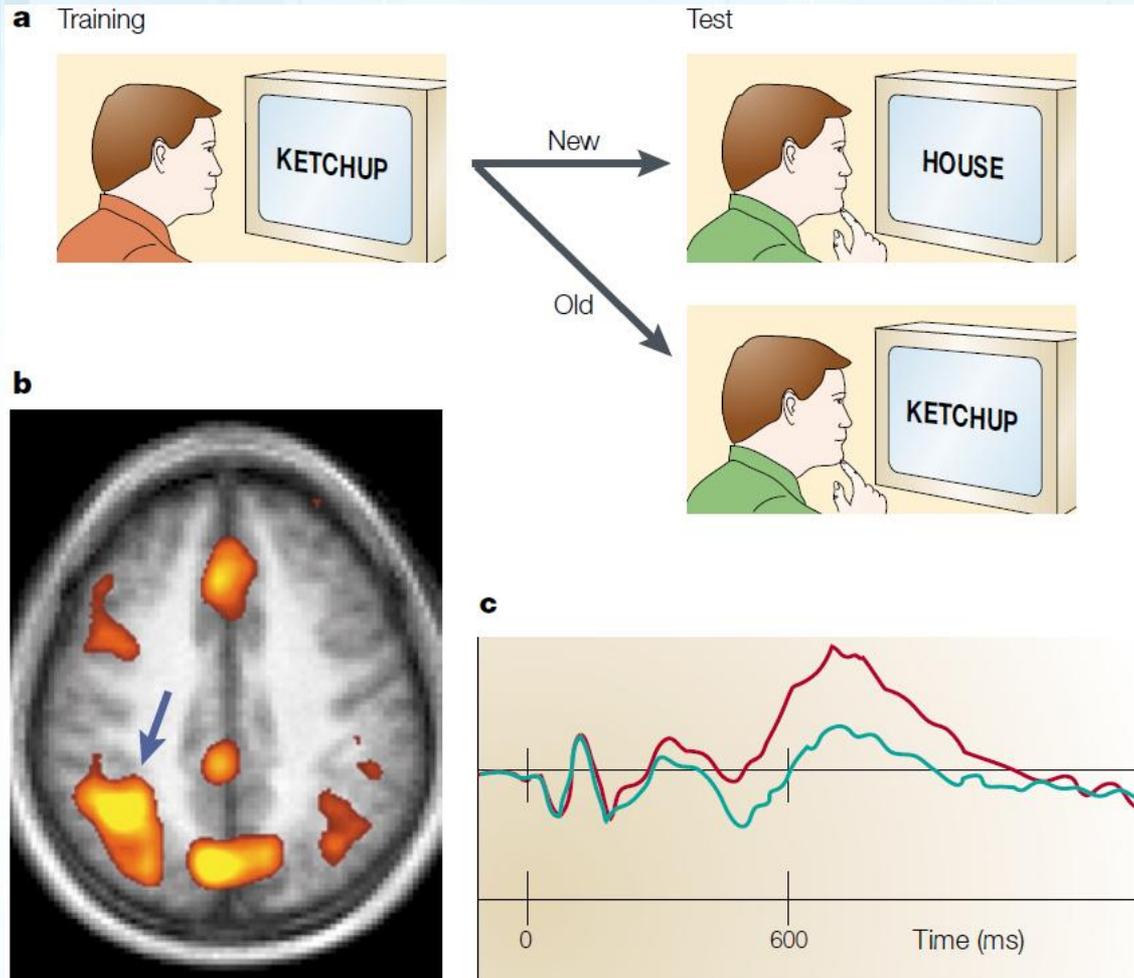
- **The Function of Mental Imagery**
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# What Imagery Does?

- **Representations and Processes used in Imagery**
  - Imagery relies on perceptual representations.
  - Imagery invokes four distinct types of processes:
    1. memorial processes retrieval → episodic information encoding
    2. imagery processes draw on retrieved episodic information
    3. automatic associative processes guide the imagery realistically
    4. top-down executive processes direct the processes that initiate, inspect, manipulate, and terminate the imagery.

# What Imagery Does?

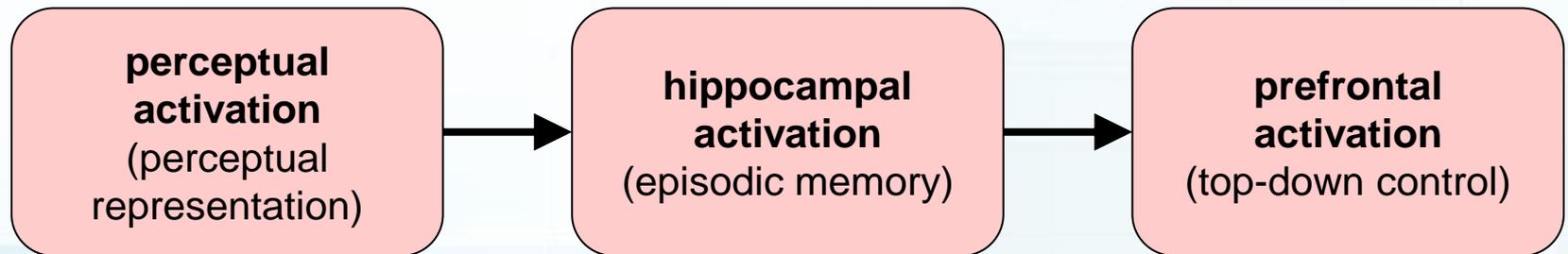


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# What Imagery Does?

- **How is imagery realized physically in the brain?**
  - The neural mechanisms that underlie imagery depend on the content and purpose of particular instances
    1. Imagery activates perceptual cortices in a predictably specific manner
    2. Imagery activates a broad and diverse set of brain regions
    3. The activation of the distinct regions unfold following the temporal sequence of imagery processing



# Mental Emulation

- **Mental Simulation**

- Many different contexts on mental simulation

Self-regulation

Mental practice

Decision making

Mechanical reasoning

Consciousness

Creativity

Social cognition

Affective regulation

- Mental Simulation is “epistemic devices” (Fisher, 2006)

→ It make available or generate knowledge

- Mental Simulation operates by sequential analogy

→ The simulation mimics the corresponding steps of the represented situation

# Mental Emulation

- **Mental Emulation**

- Emulative simulations (c.f. instrumental simulation)

- In the instrumental simulations, the algorithms differ from the processes.
- Emulative simulations rely on algorithms that mimic the processes that transform successive states of that event.

# Imagery & Emulation

- **Similarities between Imagery and Emulation**
  - Predictive function
  - Perceptual representation
  - Neural implementation
- **Advantages of Imagery-based Mental Emulation**
  - Imagery evokes similar association, can generate accurate predictions
  - Imagery can reveal conceptual knowledge that informs prediction
  - Imagery can aid prediction by creating implicit memories.

# Conclusion

- Mental imagery plays a key role in many forms of mental simulation, specifically in emulative simulations.
- Imagery simulate what one would perceive in a specific situation.
- Imagery used to retrieve memories and to predict the future.
- Mental images are a way to move the world into the head and then to run models to observe possible implications for the actual world.
- Imagery and simulation should be studied together.



**Thank-you**