

# The Cognitive Approach

Reaction to Behaviorism which had following problems:

Could not explain complex behavior

Perception

Language

High-level thought

Attention

# **The Cognitive Approach: Mind is Active Process**

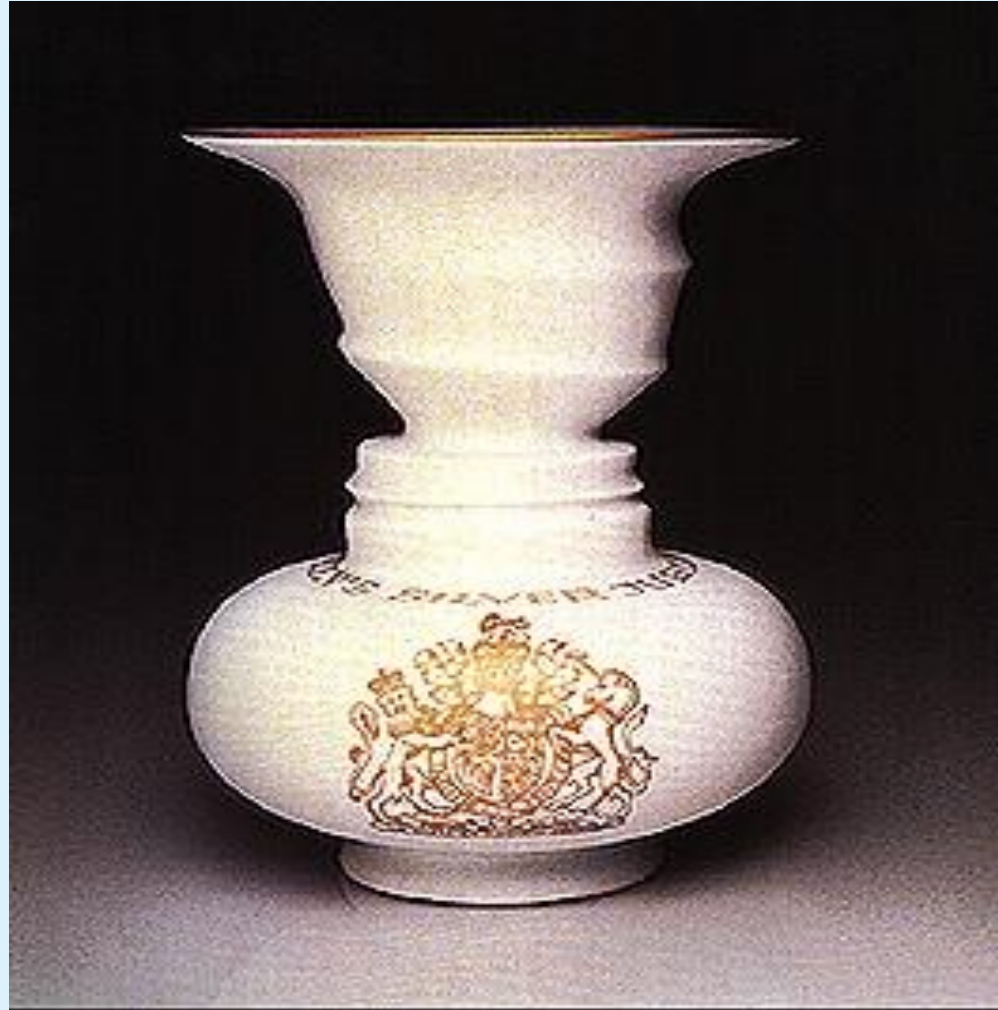
Reaction to Behaviorism which considered brain as passive

The cognitive approach considered mind as active process

For example, perception is an active process...

# The Active Mind: Factors Affecting Perception

- 1) Image
- 2) Previous Experience
- 3) Goal
- 4) Variability

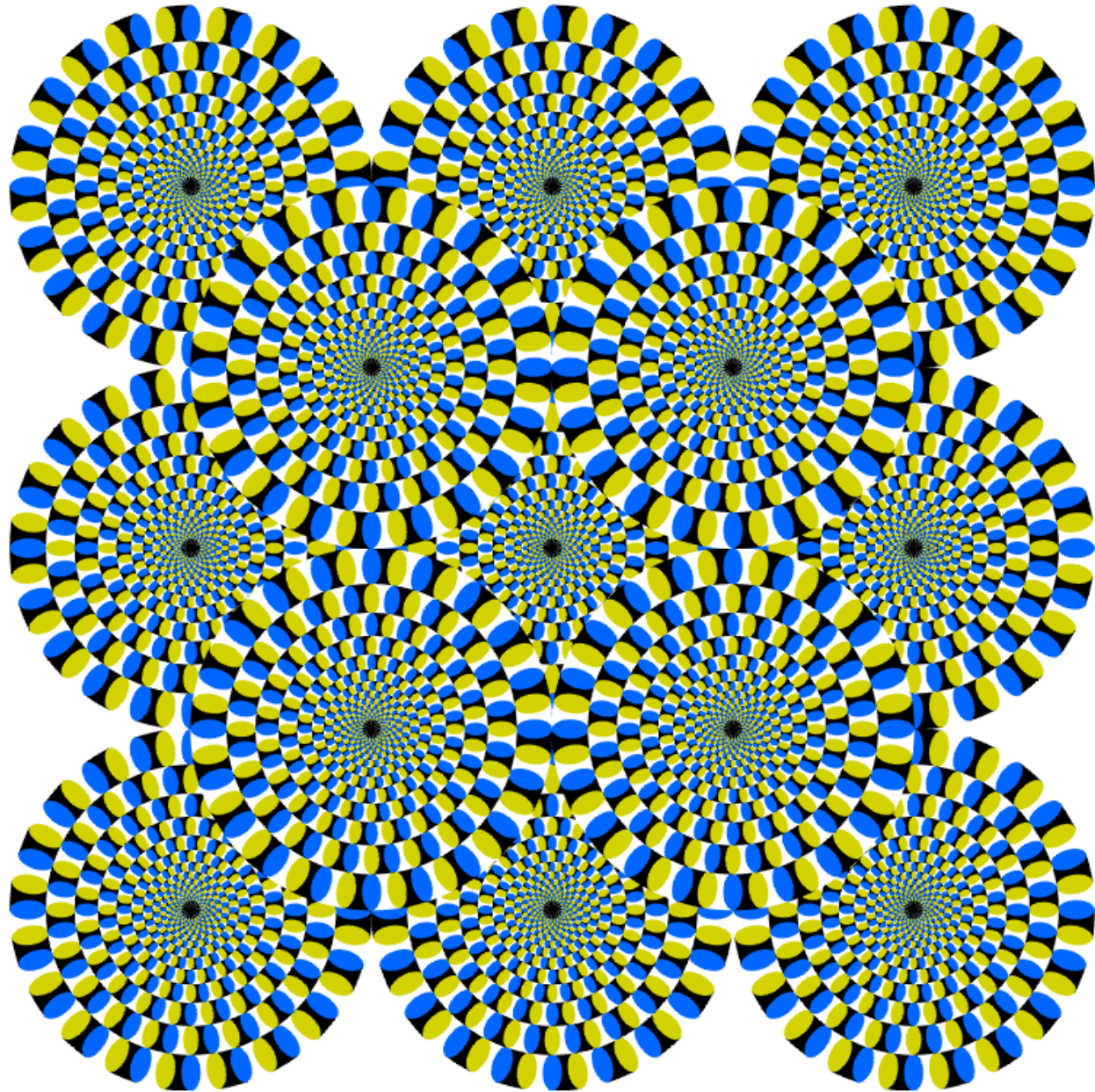


# The Active Mind: Factors Affecting Perception

- 1) Image
- 2) Previous Experience
- 3) Goal
- 4) Variability



# The Active Mind: Another Example





# Using New Technologies to Study the Active Mind

Brain Imaging

Positron Emission Tomography

Functional Magnetic Resonance Imaging

Personal Computer made accessible to many more people

Mind as computer metaphor grew in strength

Neuroscience: Hubel and Wiesel

There are neurons in the brain that respond selectively  
to specific kinds of stimuli in the environment!

# Cognitive Psychology: Human Information Processing

Scientific Method is primary tool

But also uses

- Modelling

- Computer Simulation

  - Compare model behavior to human behavior

  - Process of model creation is problematic

Created process models

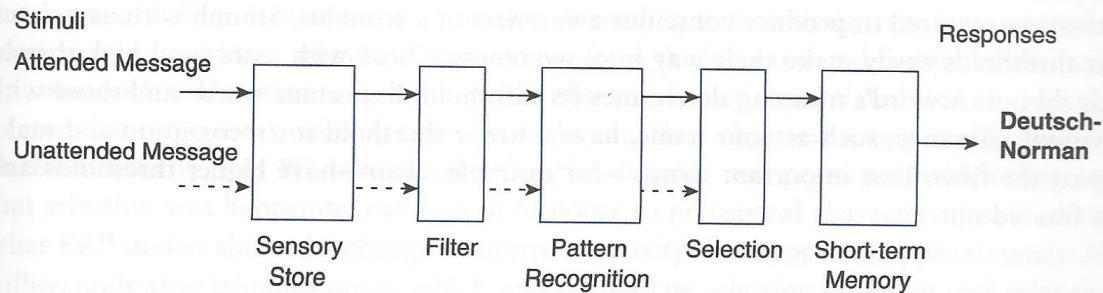
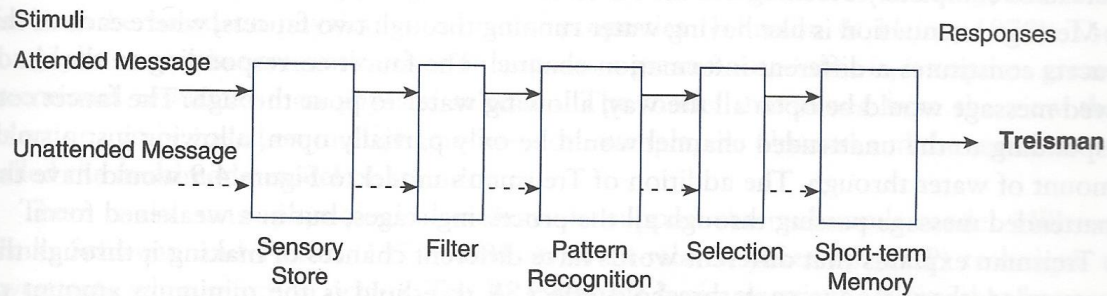
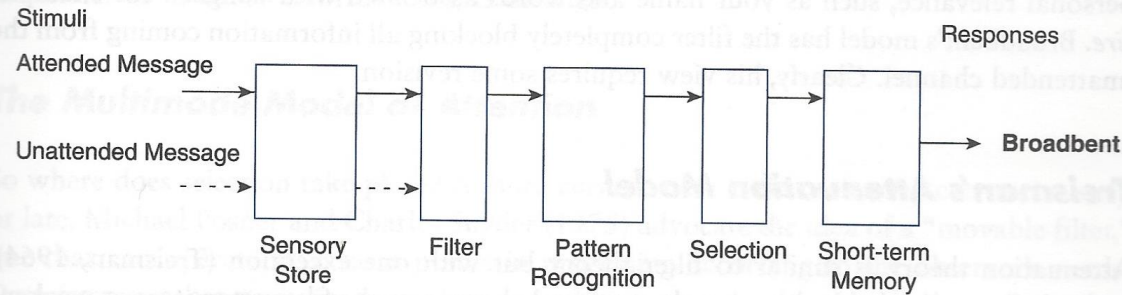
# Process Models of Attention: Use Dichotic Listening Task

One ear repeats (“shadows”) message -> Attended  
Other ear hears unattended message

What gets filtered out of unattended message?



# Process Model Example



Source: Adapted from Reed (2000).

# Which Model is Correct?

All of them!

Attention is flexible and can change how much processing can happen depending on needs of task

Referred to as 'Multimode theory of attention'

# Visual Illusions: The Key to the Story

“The Moon is Following ME!”

Inputs to motion system:

Retinal motion (function of actual distance and  
actual motion)

Distance perceived

Our own motion perceived

Retinal Motion = 0 (moon is 240,000 miles away)

WRONG Perceived distance = 1 mile

Illusion = Moon is following me

# More Amazing Illusions That Reveal the Visual Machinery

## Motion after-effect

Neurons that detect motion act in opposition

Some signal inward motion

Some signal outward motion

Normally when looking at stationary things

they balance – net signal = 0 so

no motion is perceived

# More Amazing Illusions That Reveal the Visual Machinery

Watch a display spiralling inward

Adaptation to inward neurons occurs after a while (turn down the volume!)

When you stop looking at the spiral

Normal balance is upset because

inward motion neurons are listened to less

outward motion neurons are listened to more

Result: Exploding faces!

# Recognizing Objects

## Template Matching

- Match image to memory

- Works great if image is stimulus variability is low

- Unfortunately this is mostly not the case (viewpoint changes)

## Feature Detection Theory

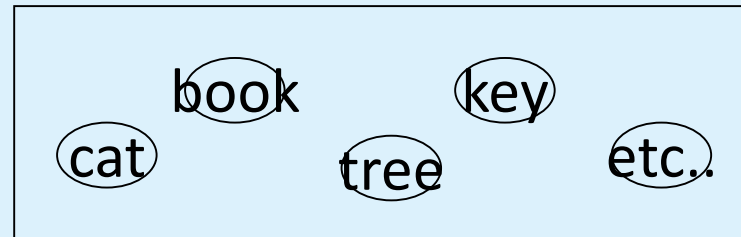
- More flexible than template but does not define feature well

## Recognition by Components

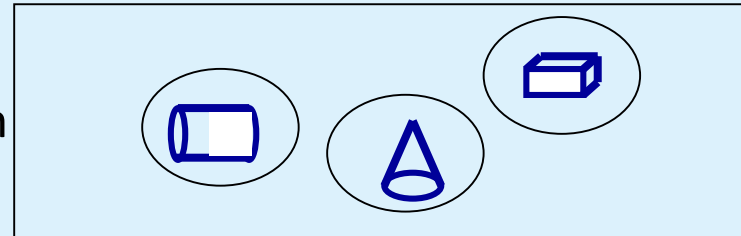
- Uses 3 dimensional volumetric pieces to match image to memory

- Well defined representations

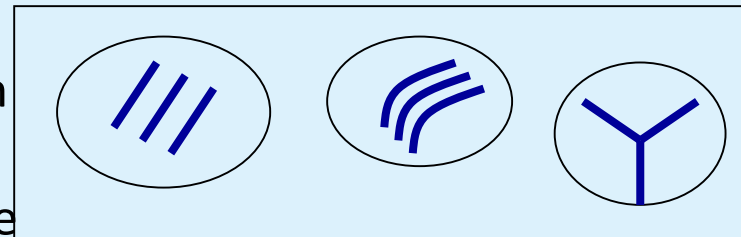
# Recognition by Components



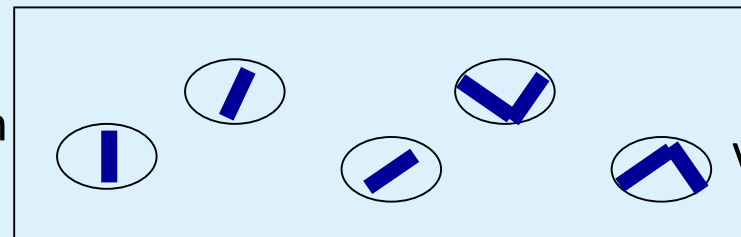
view-point invariant



view-point invariant



view-point invariant



view-point dependent

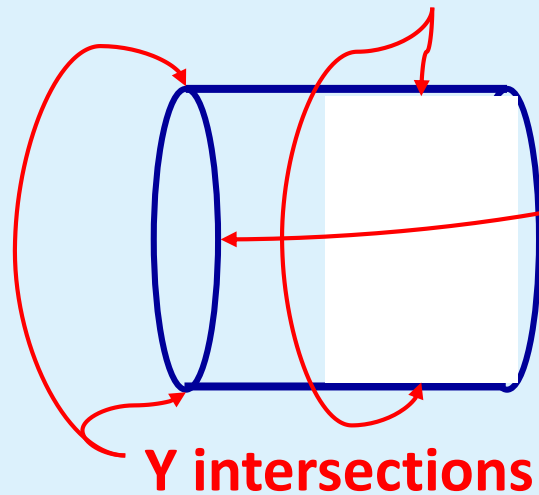
mental representation  
of geons

mental representation  
of non-accidental  
properties of an image

mental representation  
of bars of light



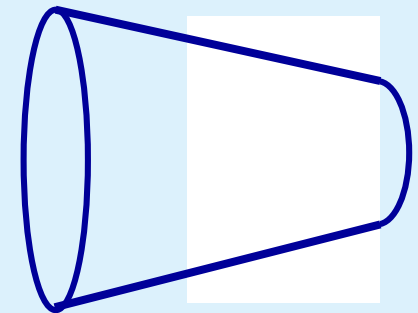
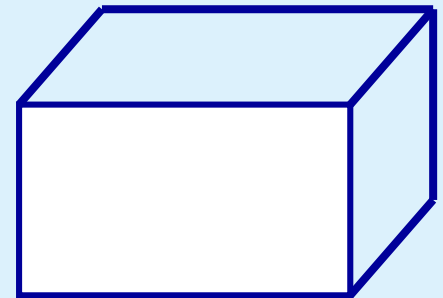
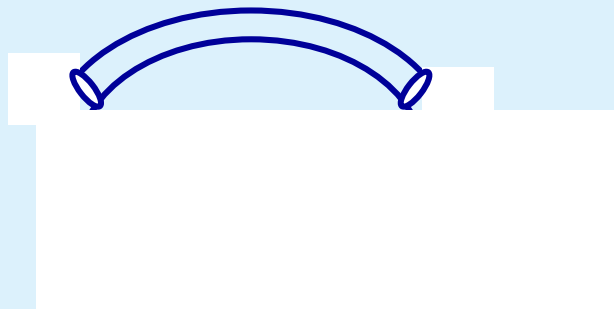
# Recognition by Components



curved, parallel

corner

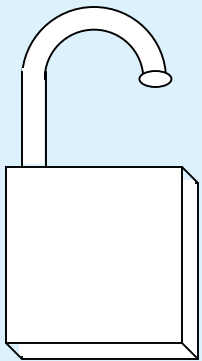
Y intersections



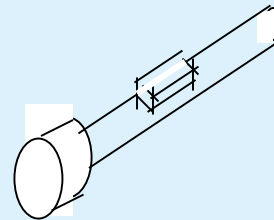
# Evidence for Geons

## Experiment 1: Visual Priming

**Reaction Time: 900 ms.**



(response)



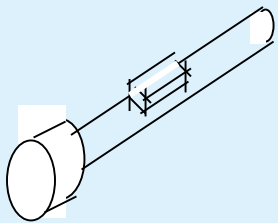
(response)

time

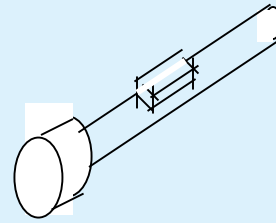
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(response)



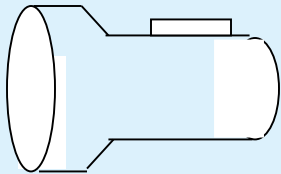
(response)

time

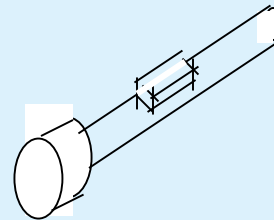
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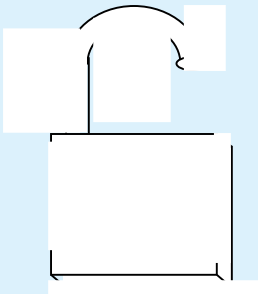
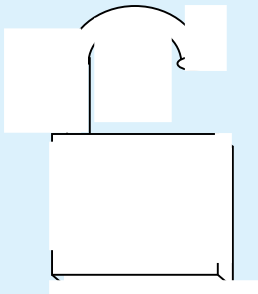
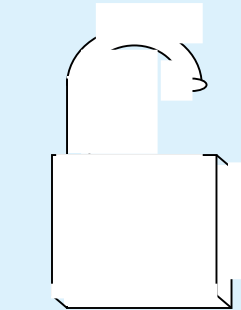
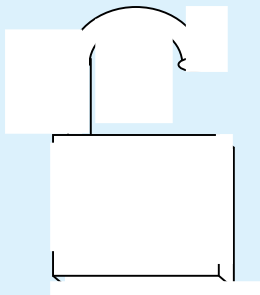
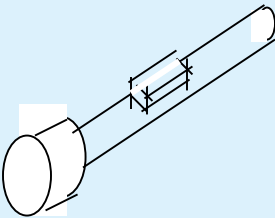
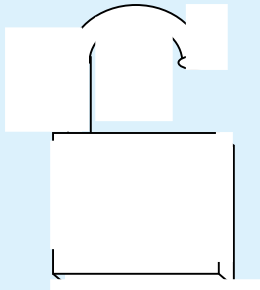
(response)



(response)

time

# Evidence for Geons: Priming Results

First	Second	Shared?				Time
		Lines Edges	Geons	Basic Cat.	Response	
		Yes	Yes	Yes	Yes	700 ms
		No	Yes	Yes	Yes	700 ms
		No	No	No	No	900 ms

# Evidence for Geons

**First**

**Second**

**Shared?**

Lines Edges	Geons	Spec. Cat.	Basic Cat.	Resp Time
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Yes	Yes	Yes	Yes	Yes <b>700 ms</b>
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No	No	Yes	Yes	Yes <b>800 ms</b>
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No	No	No	Yes	Yes <b>800 ms</b>
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# Recognition by Components

## Limitations

Recognizing quadrupeds

Recognizing cars

Briefcases versus suitcases

Recognizing faces

Faces are special and recognized by separate system