Visual and Auditory Recognition

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Sensation versus Perception

- **Sensation**:

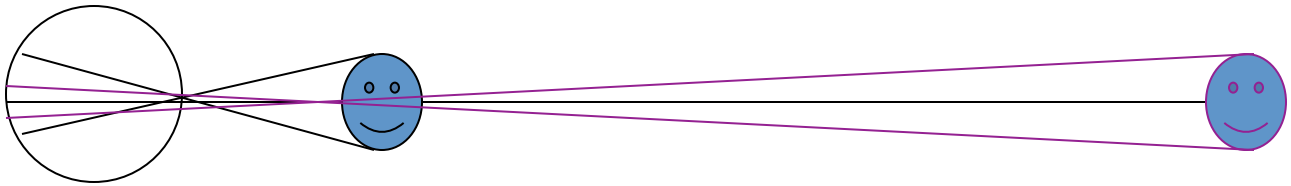
  The reception of energy from the environment, and its initial encoding into the nervous system.

- **Perception**:

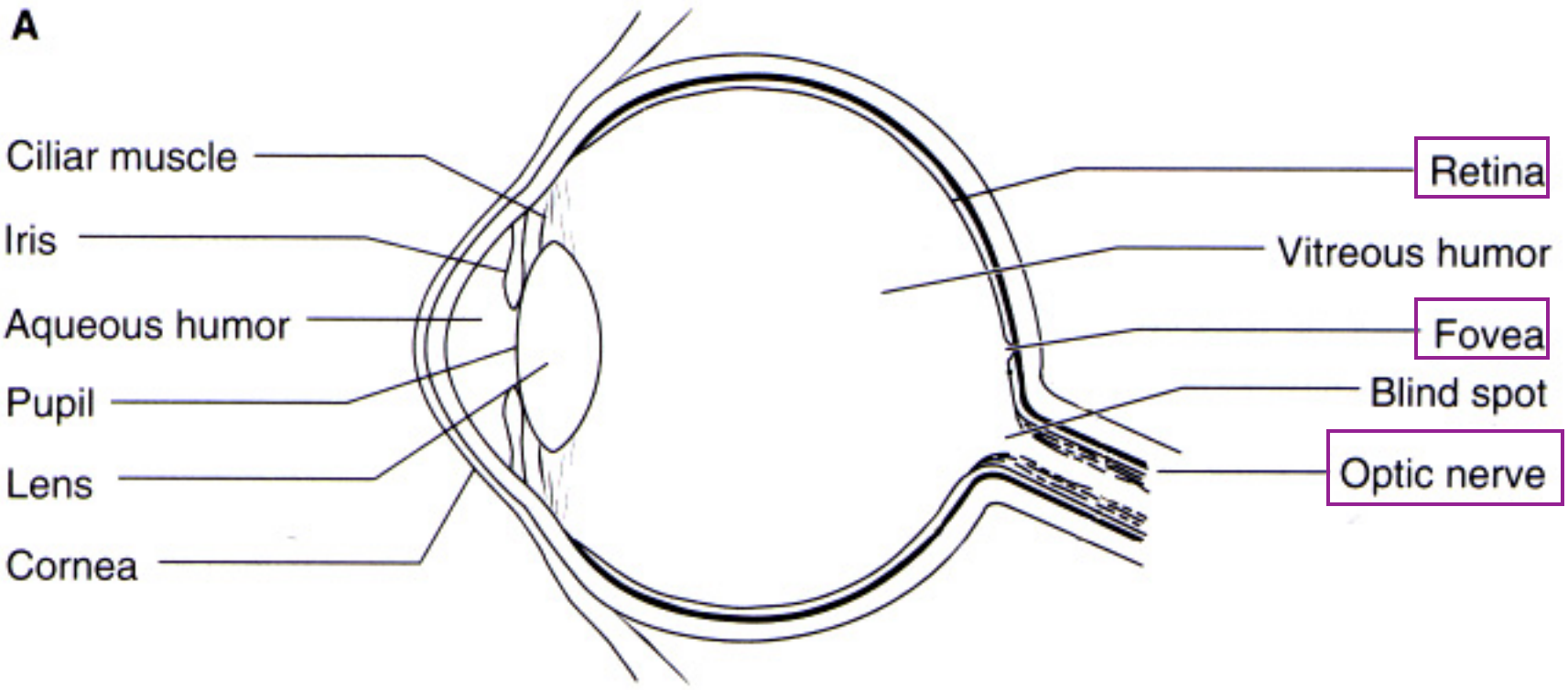
  The process of interpreting and understanding sensory information.

Visual Angle

- Refers to size of images on the retina
- Changes as a function of distance from object, and actual size of object



Visual Perception: The Eye



The Fovea

- Light from direct focus lands in the fovea
- Contains almost all cones

- **Acuity** -- accurate, precise vision -- is best in the fovea

- Rods are abundant at the sides (periphery) of the fovea

Gathering Visual Information

- **Saccades**:
  - Rapid eye movements
  - Last between 25 and 100 msec
  - While the eye is moving, no visual information is taken in

- **Fixations**:
  - Pauses between saccades
  - The eye takes in visual information during fixations

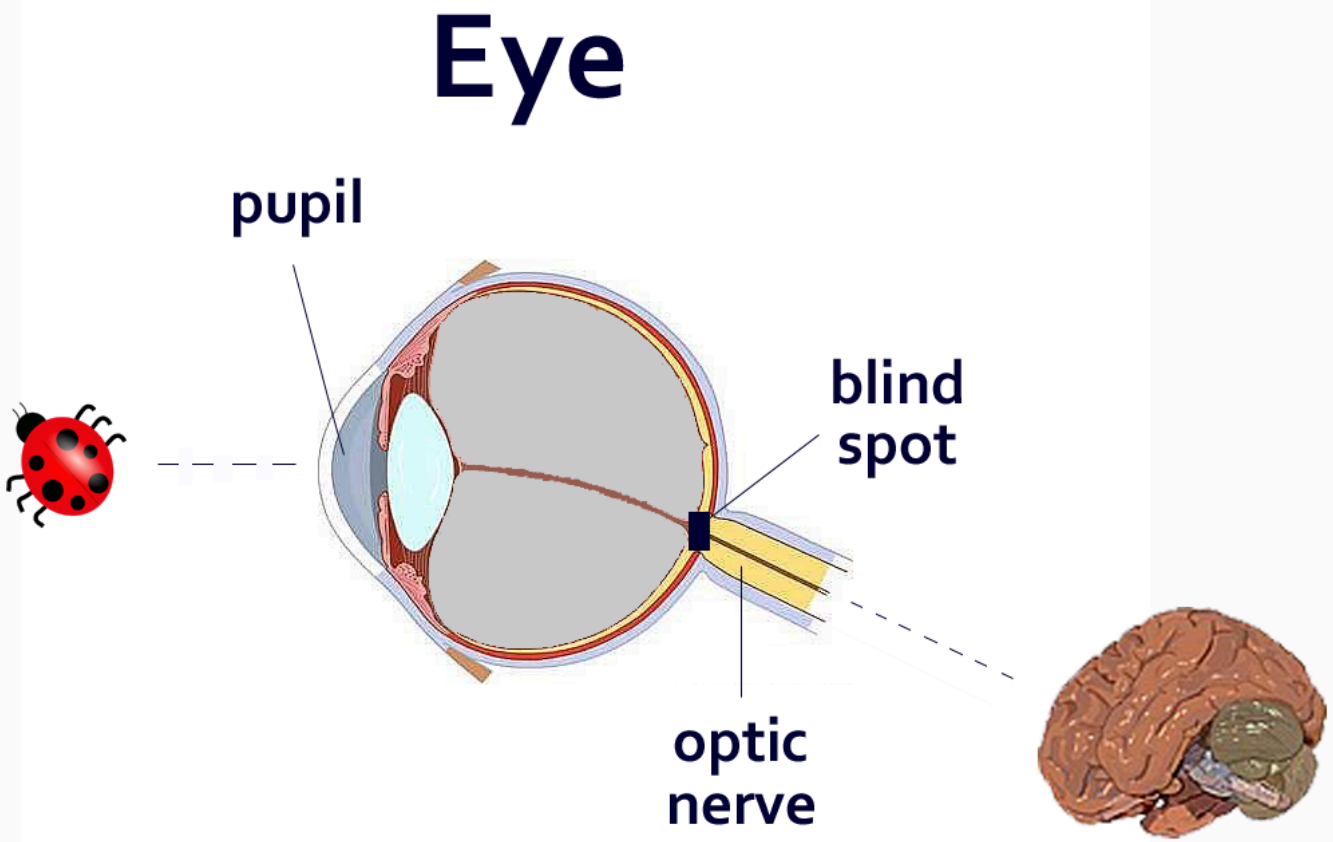
Visual Sensory Memory

- Also known as **Iconic Memory**
- A temporary visual **buffer** that holds visual information for very brief periods of time
- **Visual persistence**: The apparent persistence of a visual stimulus beyond its physical duration (e.g., lightning flash)

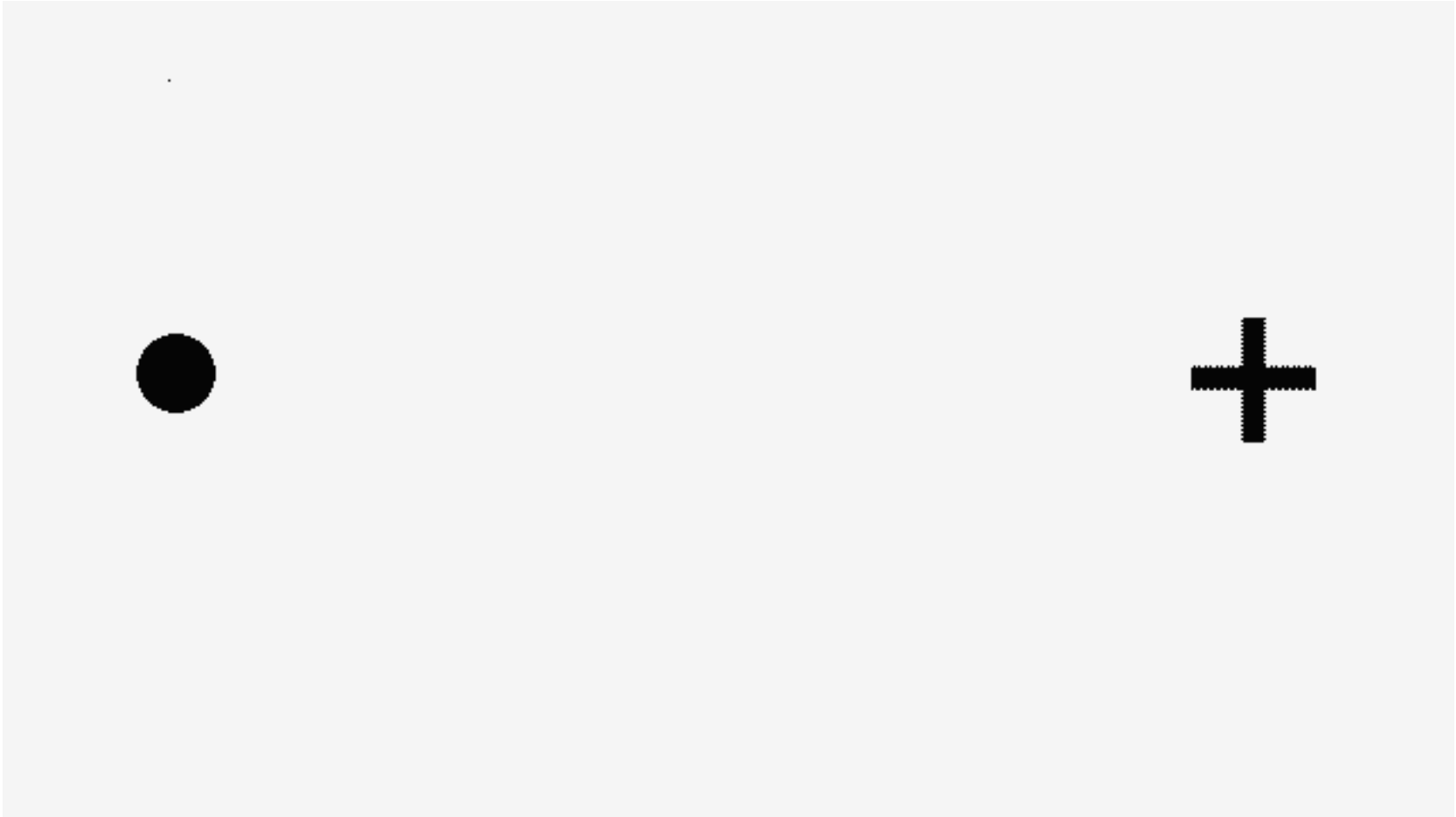
What are the characteristics of visual sensory memory?

- How many pieces of information can it hold?
- How long is a “brief period of time?”
- What factors might affect its capacity or holding time?

The blind spot!



Finding your blind spot!



The Waterfall Illusion

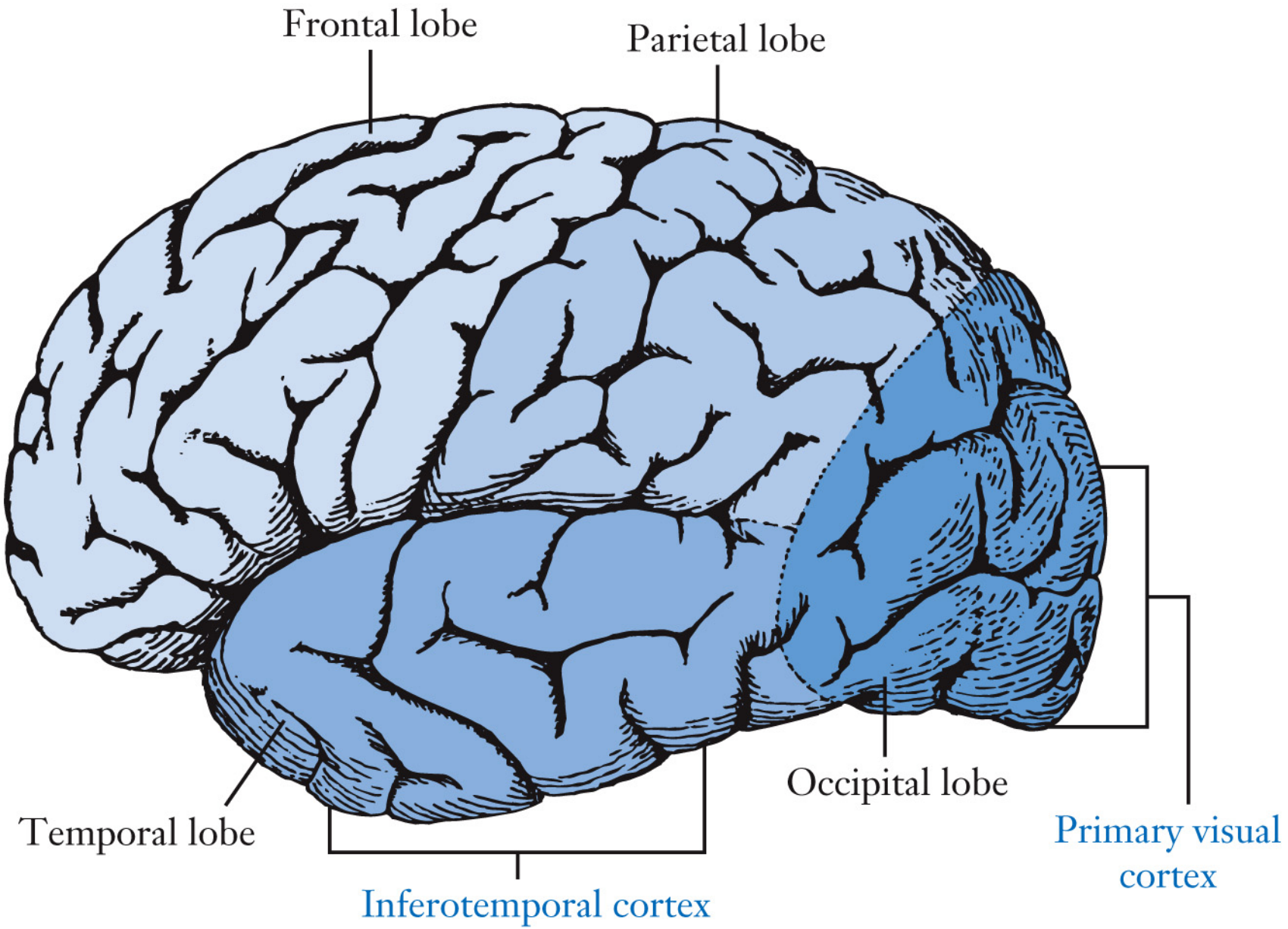
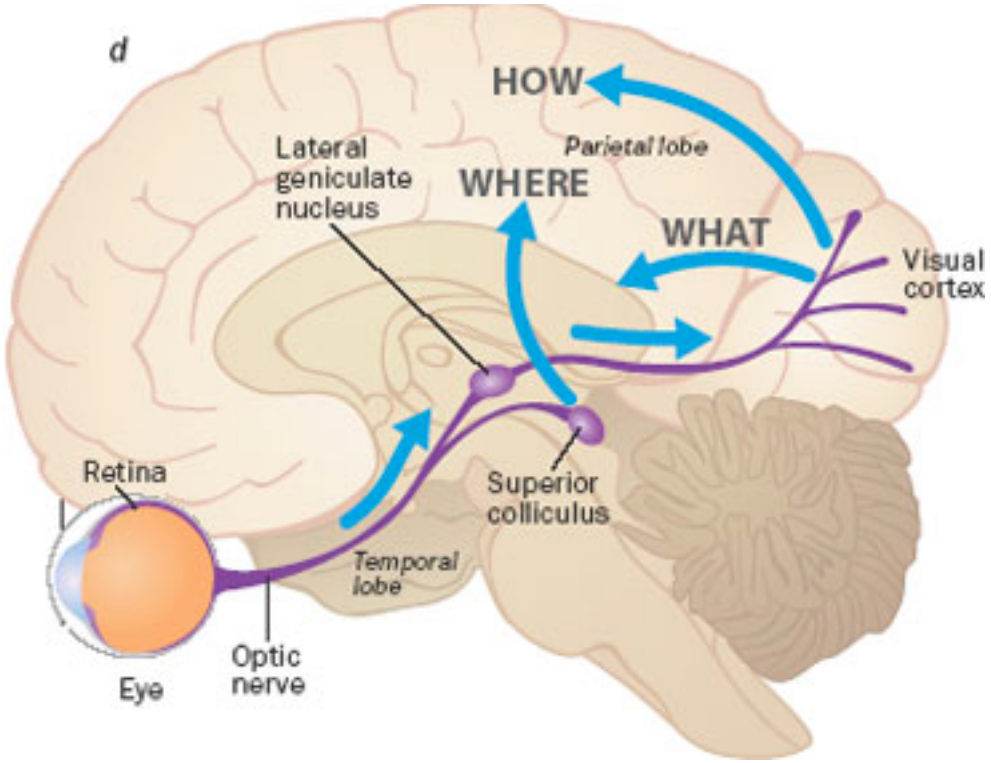


Figure 2.1

Visual Pathways



What? Where?

Nonconscious Vision

- Blindsight:
  - https://www.youtube.com/watch?v=R4SYxTecL8E

- Subthreshold processing (subliminal perception)

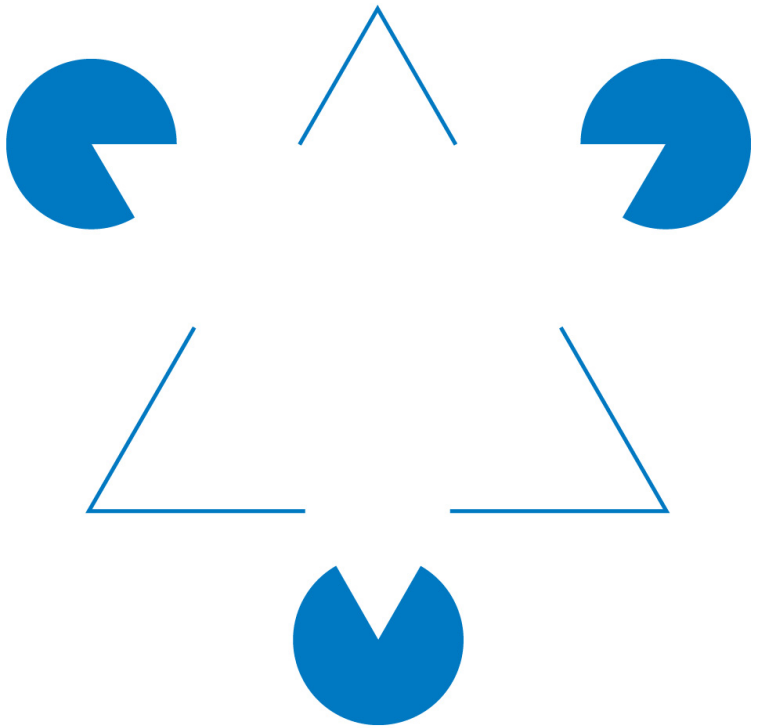
Overview of Visual Object Recognition

- **Organization in Visual Perception**
  - Gestalt Psychology
    - figure
    - ground
    - ambiguous figure–ground

Overview of Visual Object Recognition

- **Organization in Visual Perception**
  - Illusory Contours

"more than the sum of the information in the distal stimulus."



PABLO PICASSO


PASS

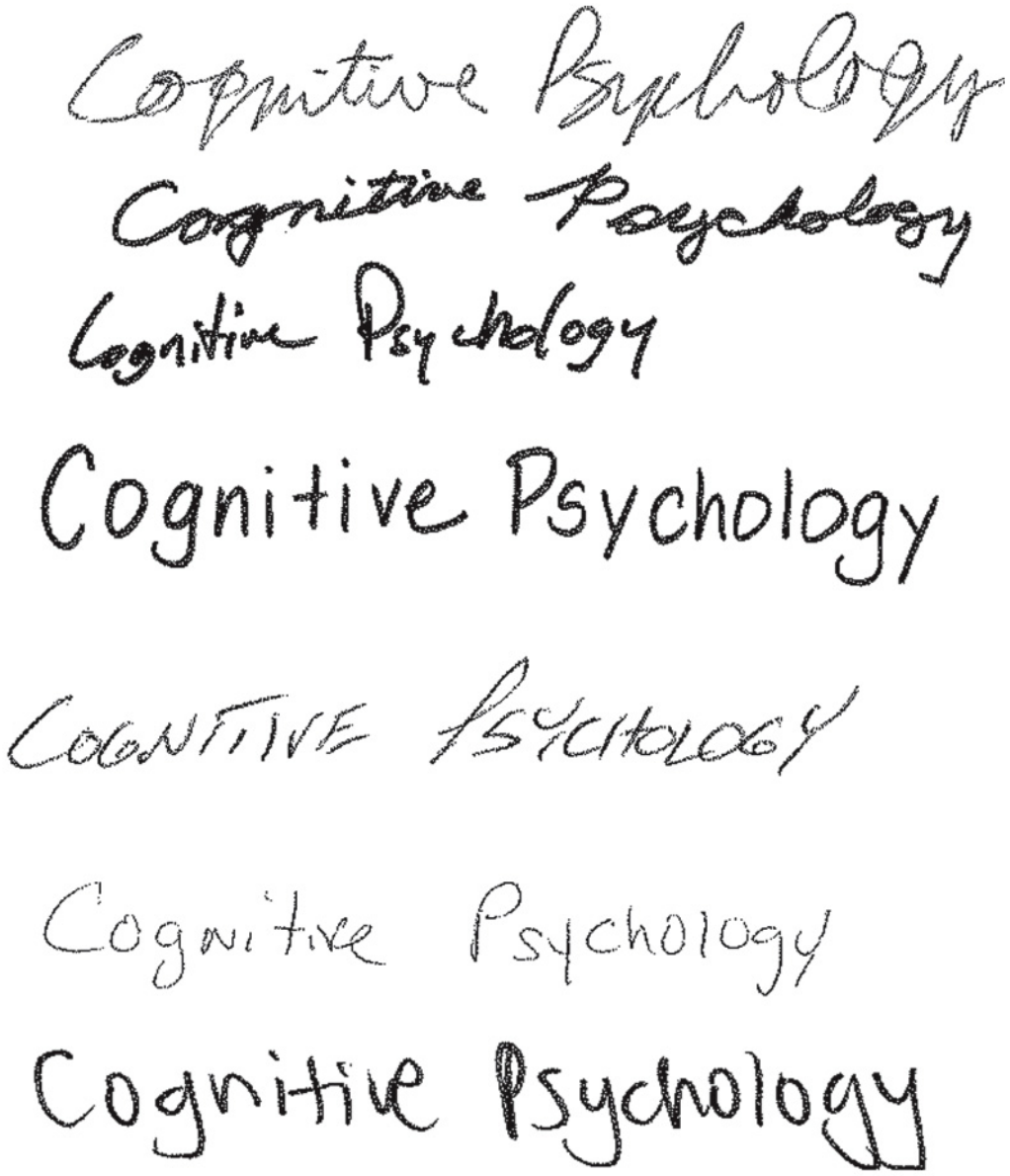


Figure 2.4

Overview of Visual Object Recognition

- **Theories of Visual Object Recognition**
  - templates

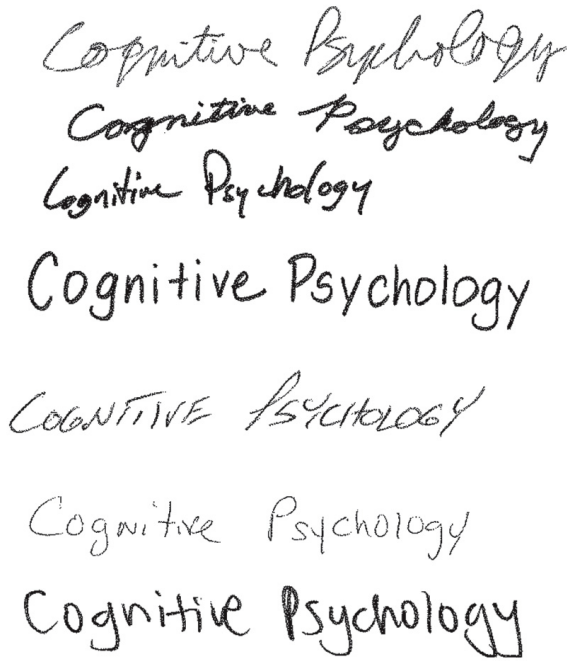


Figure 2.4

Overview of Visual Object Recognition

- **Theories of Visual Object Recognition**
  - ***Feature-Analysis Theory***
    - distinctive feature
    - compare new letter to stored list of distinctive features

Features	A	E	F	H	I	L	V	W	X	Y	Z	B	C	D	G	J	O	P	R	Q
Straight																				
horizontal	+	+	+	+		+					+				+					
vertical		+	+	+	+	+				+		+		+				+	+	
diagonal/	+						+	+	+	+	+									
diagonal\	+						+	+	+	+									+	+
Closed Curve												+		+			+	+	+	+
Intersection	+	+	+	+					+			+						+	+	+
Symmetry	+	+		+	+		+	+	+	+		+	+	+			+			

Demonstration 2.2

Overview of Visual Object Recognition

- **Theories of Visual Object Recognition**
  - ***Feature-Analysis Theory***
    - Eleanor Gibson's research
    - time required to decide if two letters are different
    - recognizing letters and numbers on envelopes

Overview of Visual Object Recognition

- **Theories of Visual Object Recognition**
  - ***Feature-Analysis Theory***
    - Hubel and Wiesel's research
    - measure response of single neuron to simple visual stimulus
    - retinal region and orientation
    - feature detectors

Overview of Visual Object Recognition

- **Theories of Visual Object Recognition**
  - ***Feature-Analysis Theory***
    - Problems with feature-analysis approach
    - complex shapes in nature
    - relationship between features
    - distortion of features with movement

Overview of Visual Object Recognition

- **Theories of Visual Object Recognition**
  - ***The Recognition-by-Components Theory***
    - Irving Biederman
    - geons
    - combining geons to form meaningful objects
    - fMRI research

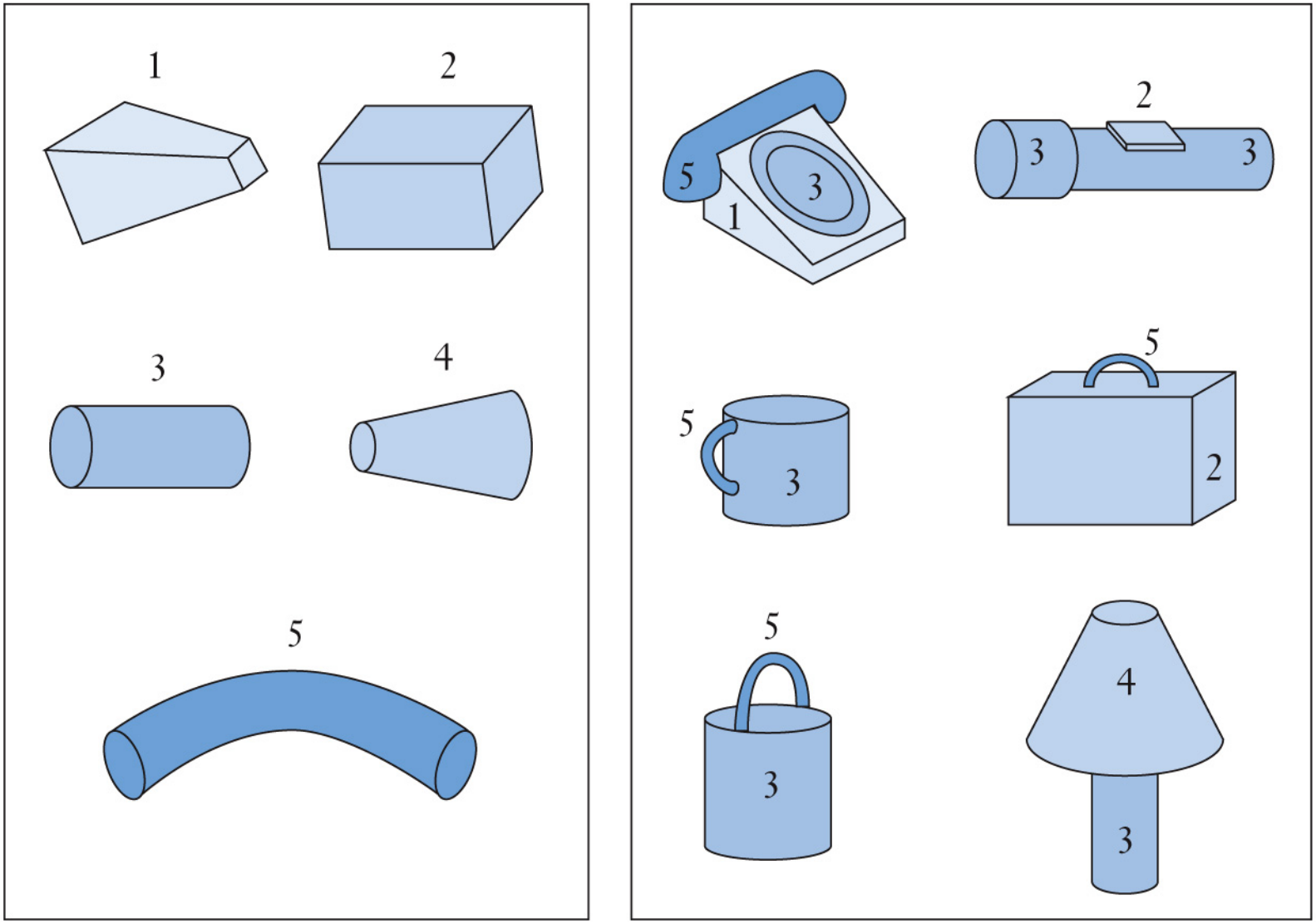


Figure 2.5

Overview of Visual Object Recognition

- **Theories of Visual Object Recognition**
  - ***The Recognition-by-Components Theory***
    - Modifications
    - need to account for quicker recognition with standard viewpoint compared with different viewpoint
    - viewer-centered approach—store multiple views of objects, rather than a single view

THE MAN RAN.

Demonstration 2.3

Top-Down Processing and Visual Object Recognition

- Bottom-Up Versus Top-Down Processing
  - bottom-up processing—emphasizes stimulus characteristics
  - top-down processing—emphasizes concepts, expectations, memory

Top-Down Processing and Visual Object Recognition

- **Top-Down Processing and Reading**
  - Context helps us recognize letters of the alphabet during reading.
  - We don't read letter-by-letter.
  - Analyzing all the individual features in the letters of words would be too much work for the perceptual processes.

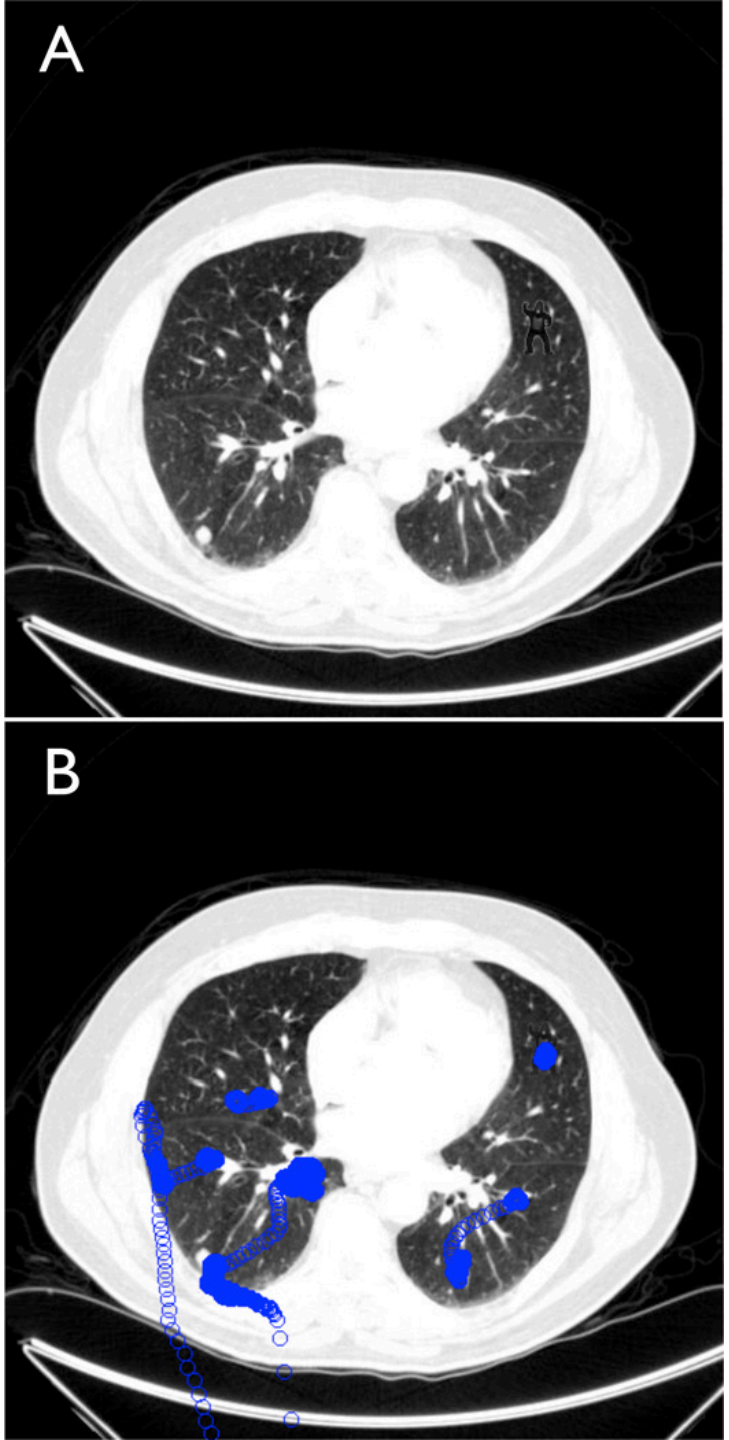
Top-Down Processing and Visual Object Recognition

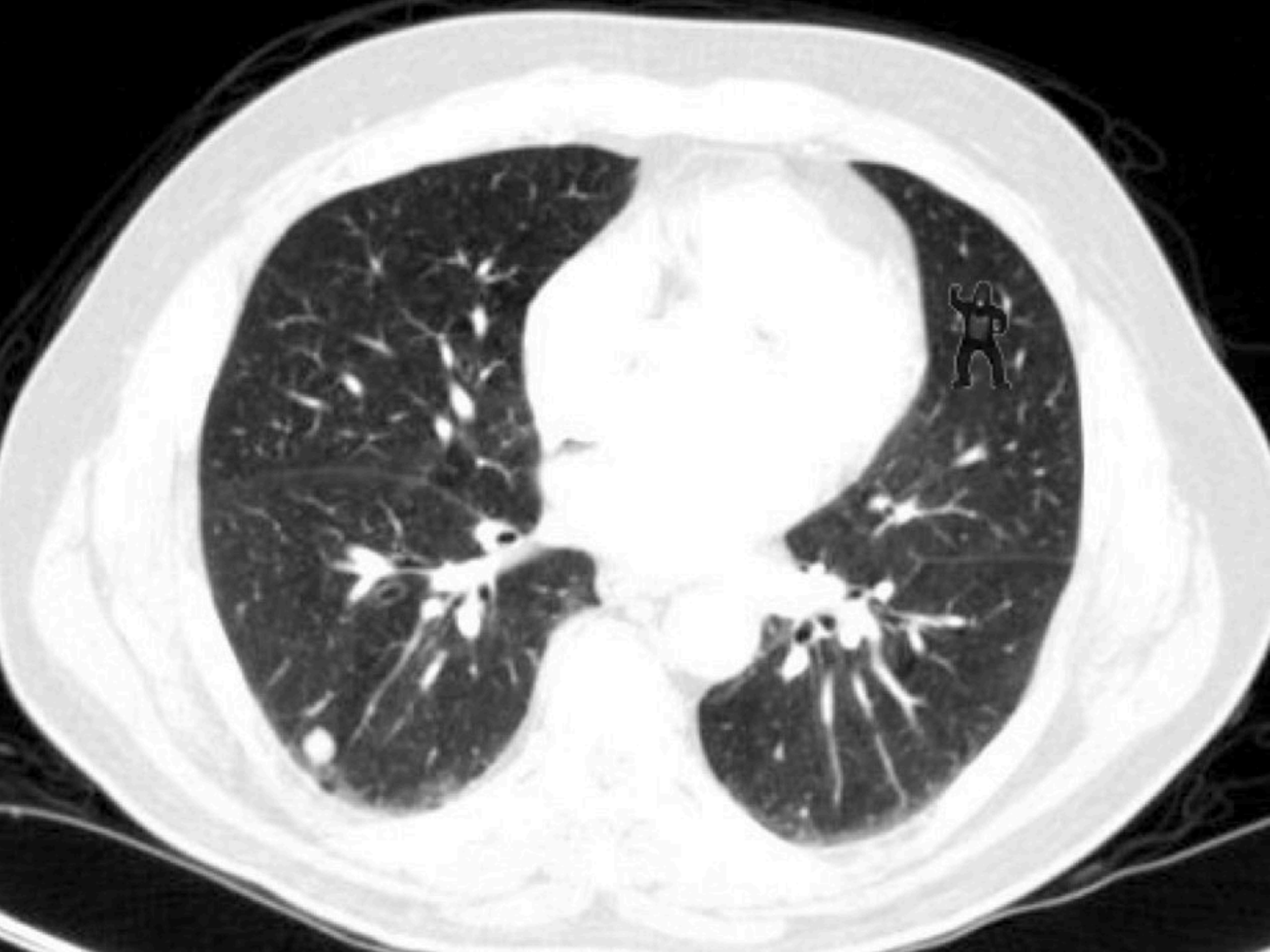
- **Top-Down Processing and Reading**
  - Incorrect lettering
  - word superiority effect

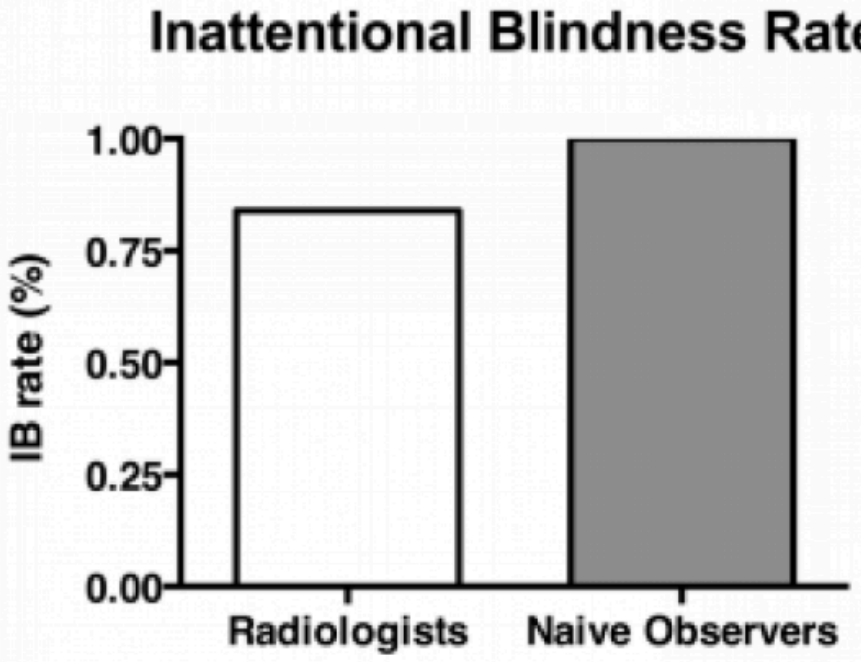
I cnduo't bvleiee taht I culod aulaclty uesdtannrd waht I was rdnaieg. Unisg the icndeblire pweor of the hmuan mnid, aocdcrnig to rseecrah at Cmabrigde Uinervtisy, it dseno't mttaer in waht oderr the lterets in a wrod are, the olny irpoamtnt tihng is taht the frsit and lsat ltteer be in the rhgit pclae. The rset can be a taotl mses and you can sitll raed it whoutit a pboerlm. Tihs is bucseae the huamn mnid deos not raed ervey ltteer by istlef, but the wrod as a wlohe. Aaznmig, huh? Yaeh and I awlyas tghhuot slelinpg was ipmorantt! See if yuor fdreins can raed tihs too.

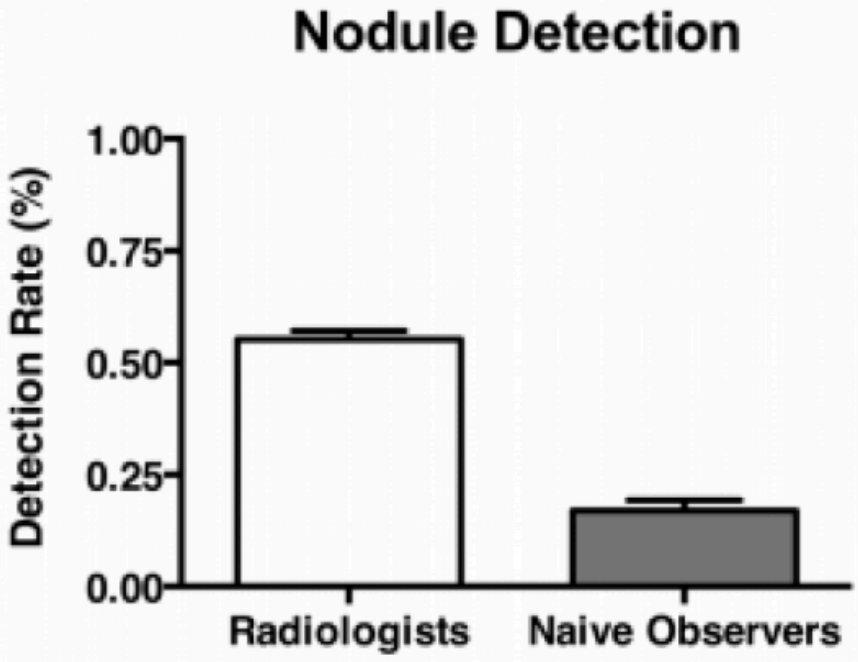
Smart mistakes?

- http://www.dansimons.com/videos.html
- https://www.youtube.com/watch?v=VkrrVozZR2c


A
B




Inattentional Blindness Rate
IB rate (%)
1.00
0.75
0.50
0.25
0.00
Radiologists
Naive Observers


Nodule Detection
Detection Rate (%)
1.00
0.75
0.50
0.25
0.00
Radiologists
Naive Observers

Specialized Visual Recognition Processes

- should be a challenging task
- need to recognize faces from different angles, in different settings, with different expressions

Specialized Visual Recognition Processes

- **Recognizing Faces Versus Recognizing Other Objects**
  - face perception as "special"
  - Tanaka and Farah—facial features in context vs. isolation
  - feature identification vs. holistic (recognition) approach
  - gestalt

Specialized Visual Recognition Processes

- **Neuroscience Research on Face Recognition**
  - prosopagnosia
  - fusiform face area in temporal cortex
  - face recognition cells in monkeys
  - fMRI studies
    - brain's response to faces in upright and upside-down positions
    - face-inversion effect

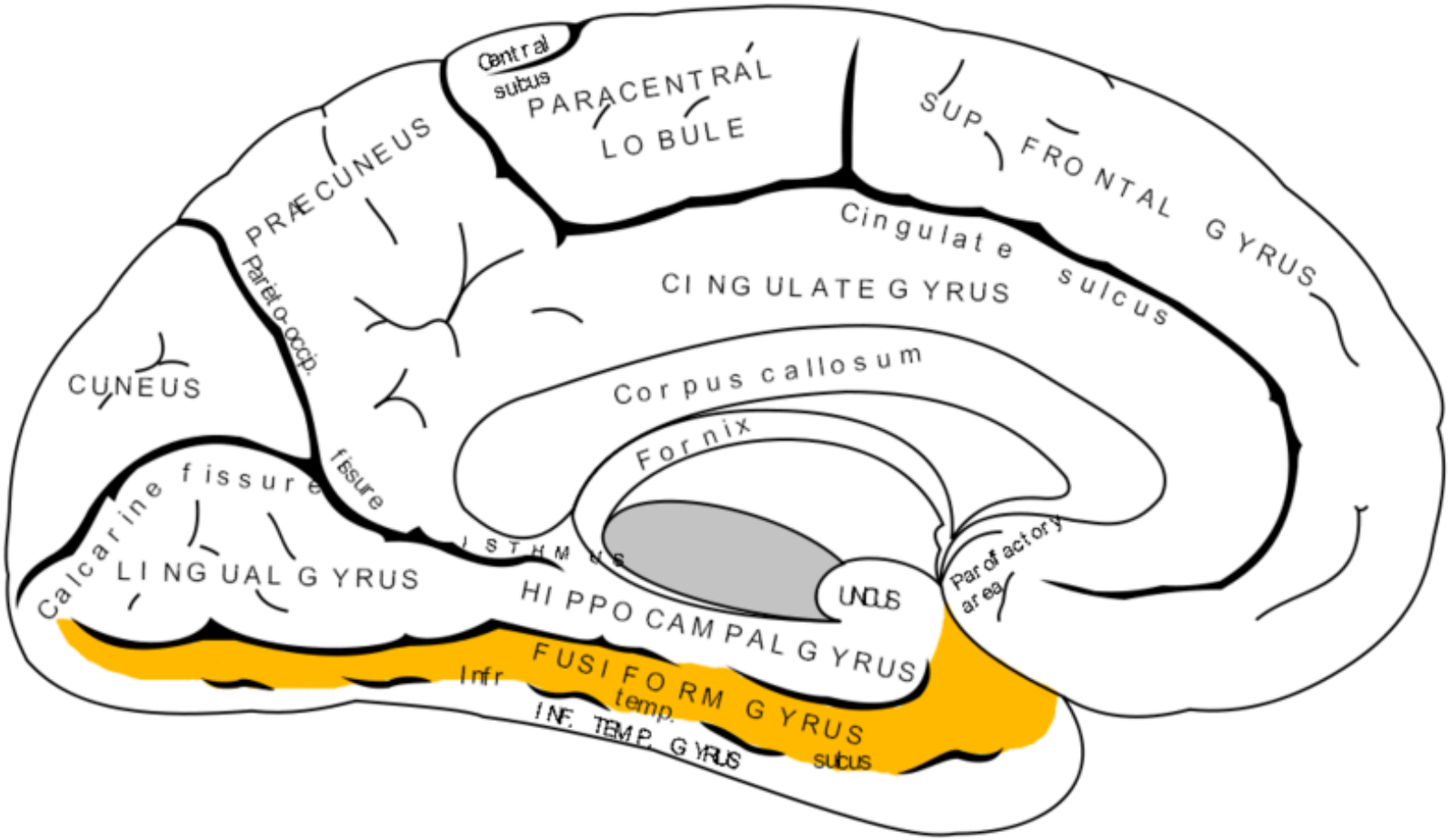
Specialized Visual Recognition Processes

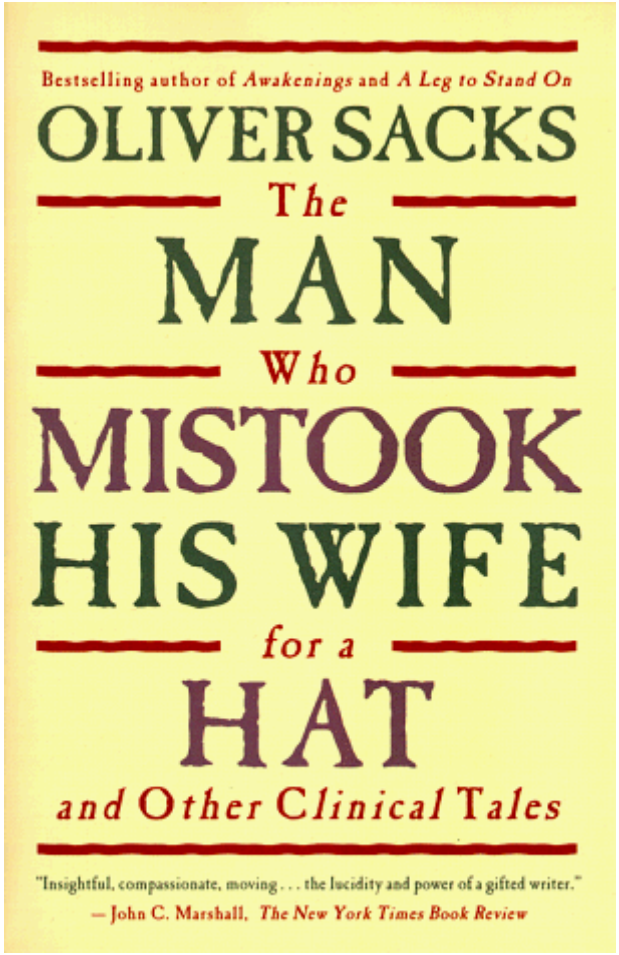
- **Neuroscience Research on Face Recognition**
    - localization of processing
    - processing of other stimuli in fusiform face area

Specialized Visual Recognition Processes

- **Applied Research on Face Recognition**
  - cashiers' judgments about ID photos
  - security surveillance systems
    - video clips of professors
    - later recognize from photos
    - familiarity and expertise

https://www.youtube.com/watch?v=vwCrxomPbtY


Central sulcus
PARACENTRAL LOBULE
SUP. FRONTAL GYRUS
PRAECUNEUS
Parieto-occip. fissure
Cingulate sulcus
CINGULATE GYRUS
CUNEUS
Corpus callosum
Fornix
Calcarine fissure
LINGUAL GYRUS
ISTHMUS
UNCUS
Parahippocampal area
HIPPOCAMPAL GYRUS
FUSIFORM GYRUS
Infr. temp. sulcus
INF. TEMP. GYRUS



prosopagnosia

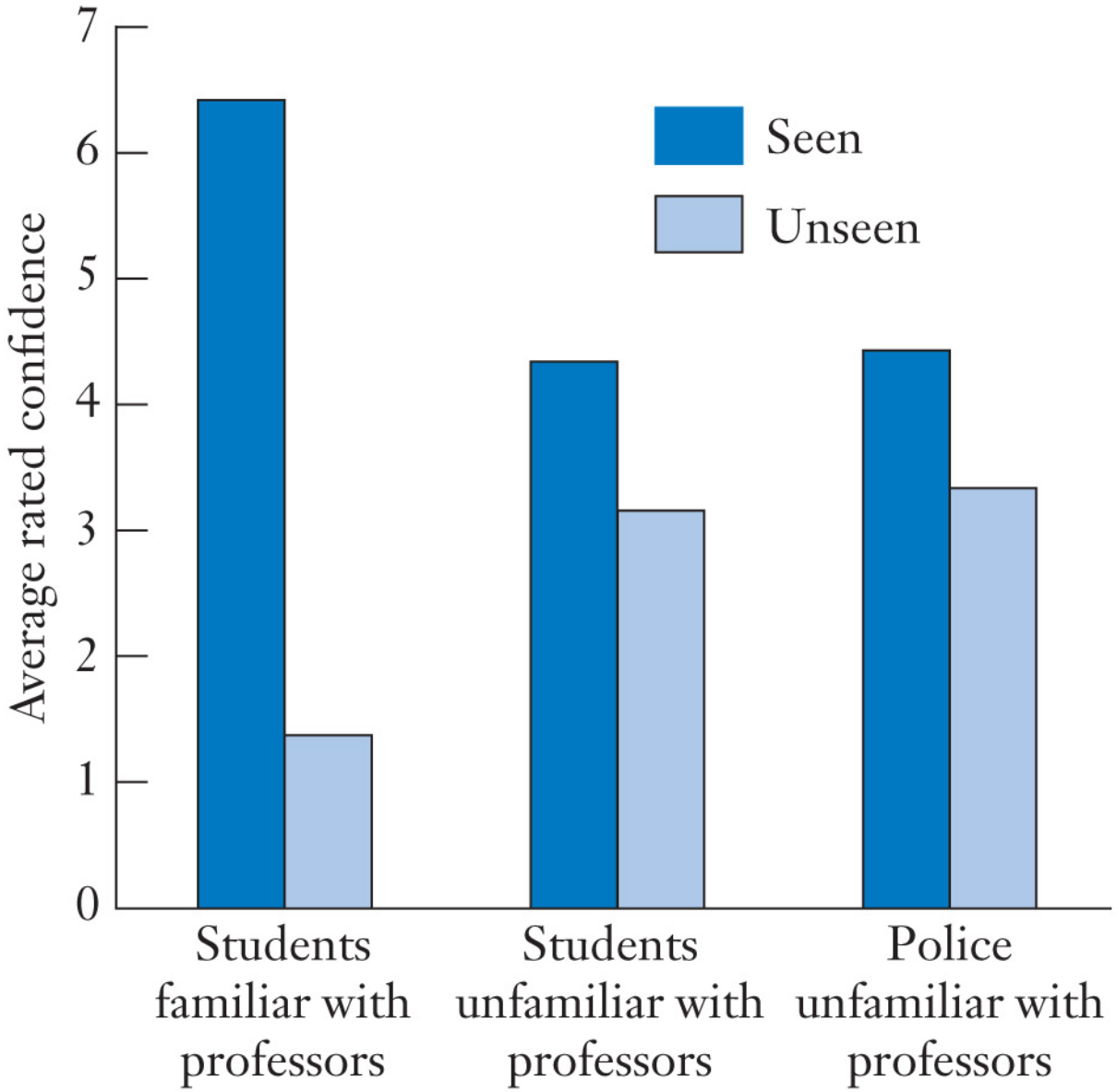


Figure 2.7