Recognition

Gnosia

Recognition: gnosia

Vision: knowing what is where?

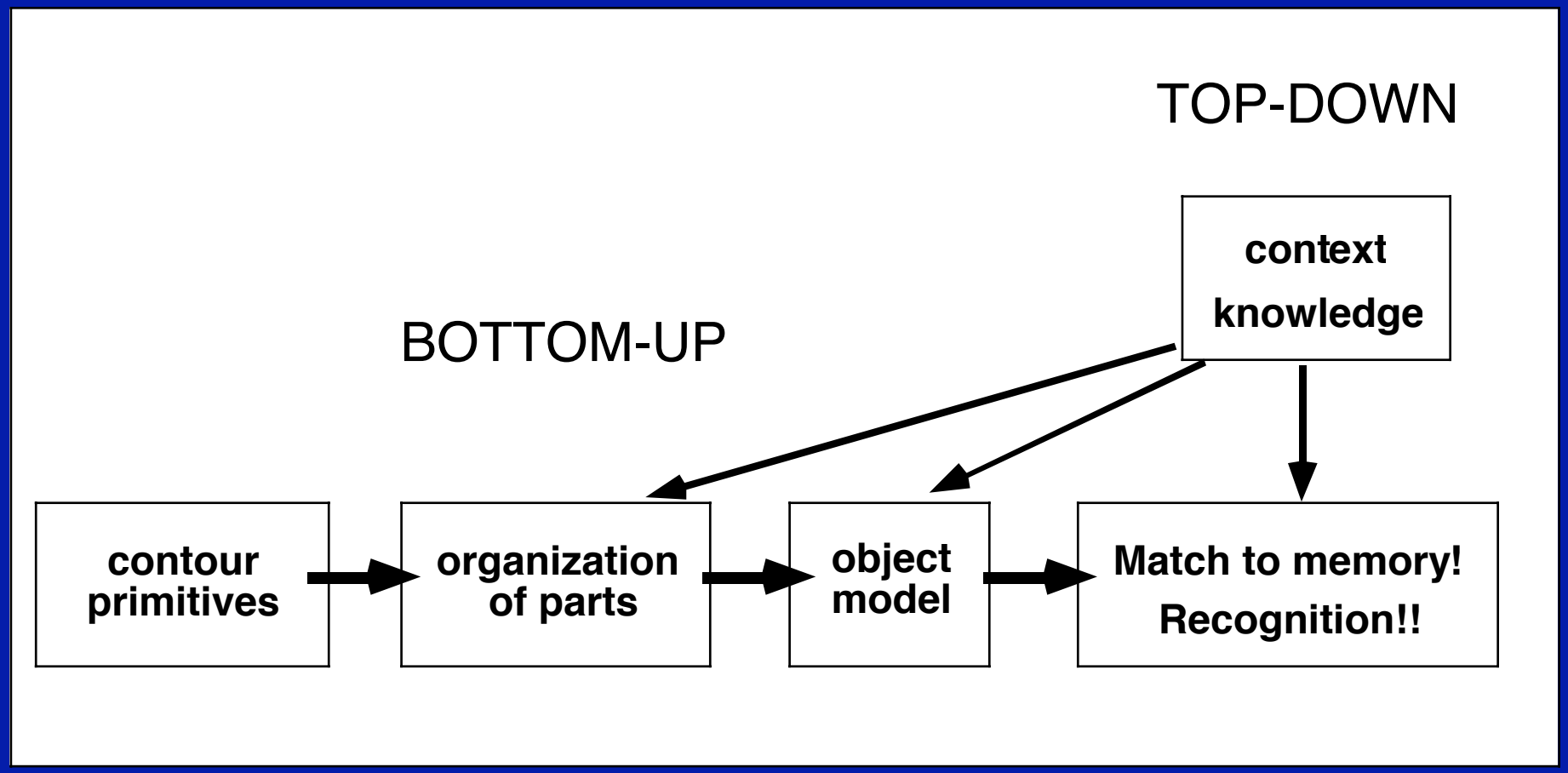
Bottom-up and top-down strategies

E E e E e E E e e

Figure 5.6 ▮ Your ability to recognize each of these views as being of the same chair is an example of viewpoint invariance.

(a) (b)

Figure 5.34 ▮ (a) A familiar object. (b) The same object seen from a viewpoint that obscures most of its geons. This makes it harder to recognize the object.


TOP-DOWN
context knowledge
BOTTOM-UP
contour primitives
organization of parts
object model
Match to memory! Recognition!!

Bottom up approach

Primitives – features
Structural analysis
Recognition By Components —Biederman

Bottom up approach

Primitives – features:

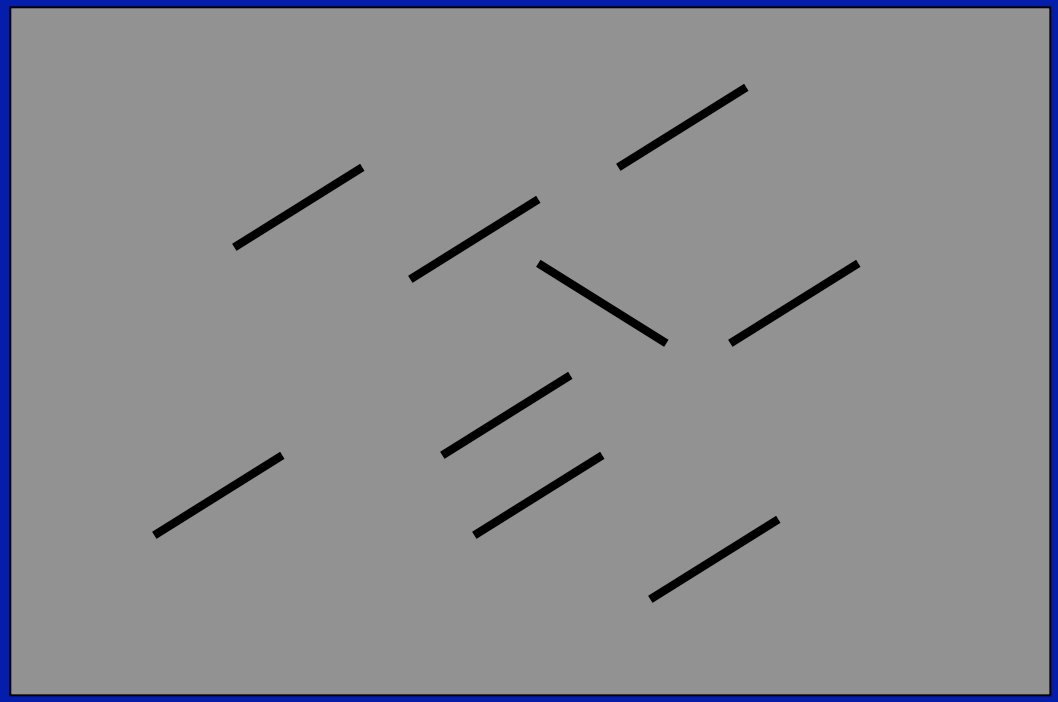
Hubel and Wiesel

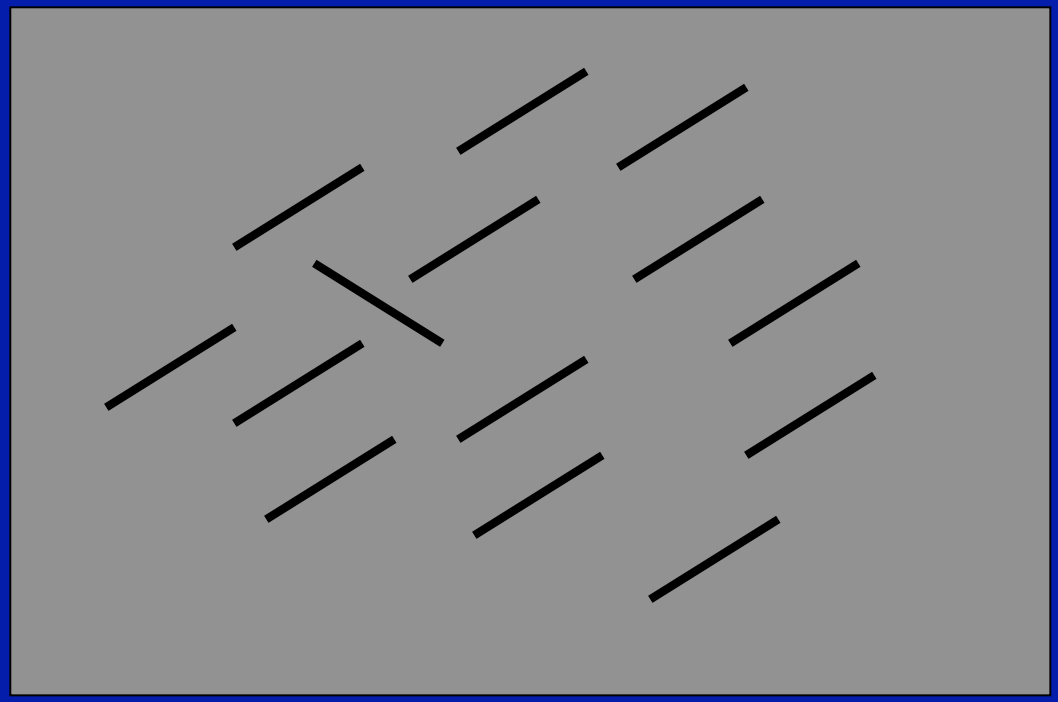
Treisman

Anne Treisman

Shape Features:

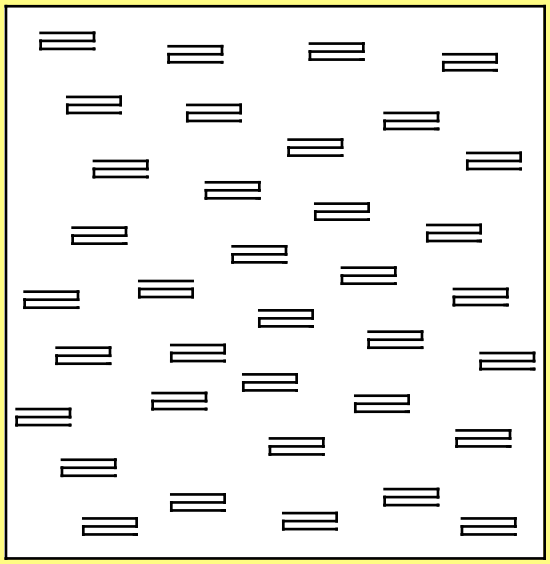
Orientation | Size | Terminator | Curvature



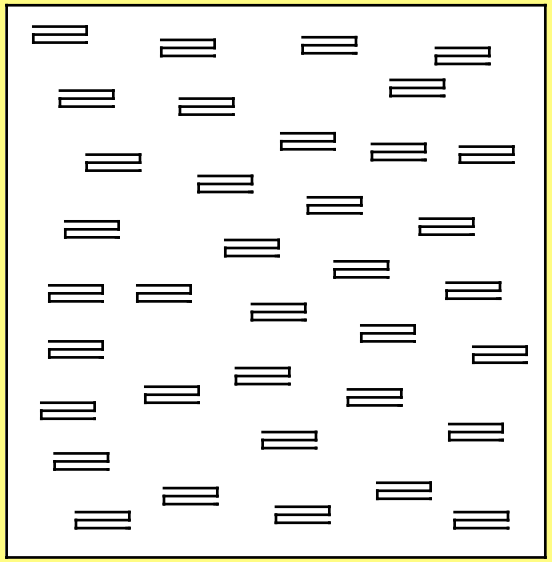


NO POP OUT

TARGET



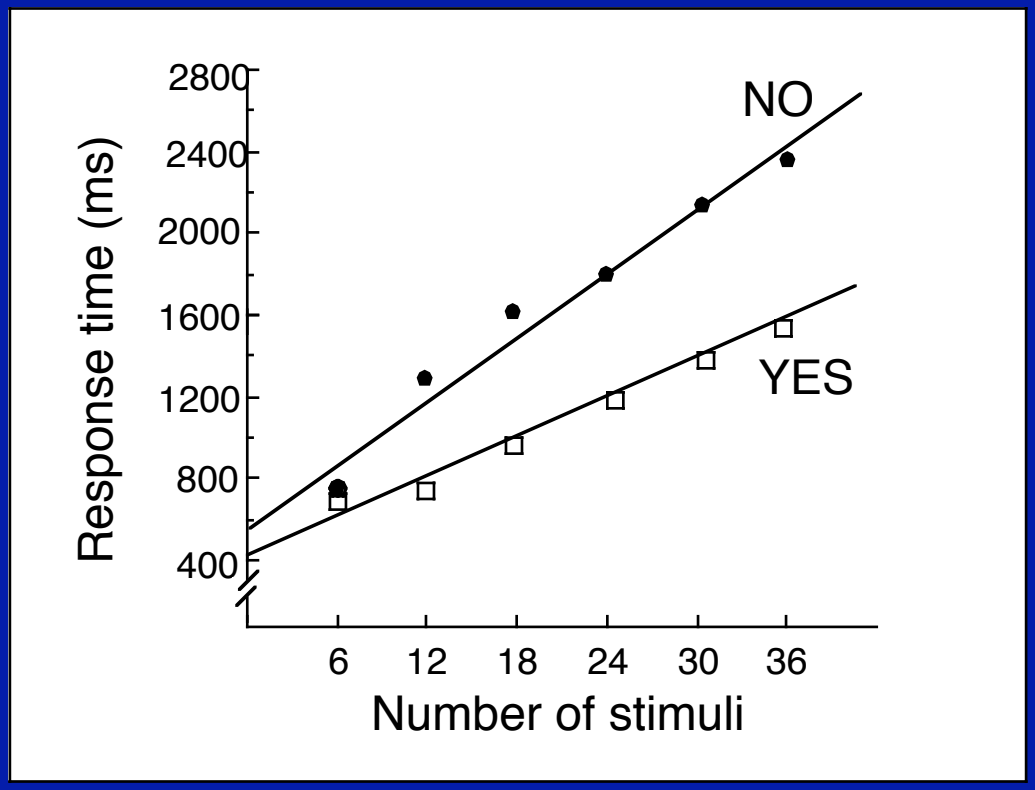
N = 36



YES

NO

NO POP OUT


Response time (ms)
2800
2400
2000
1600
1200
800
400
NO
YES
6
12
18
24
30
36
Number of stimuli

Structural analysis

laws of Gestalt:

- simplicity
- similarity
- proximity
- common fate

figure-ground grouping

simplicity

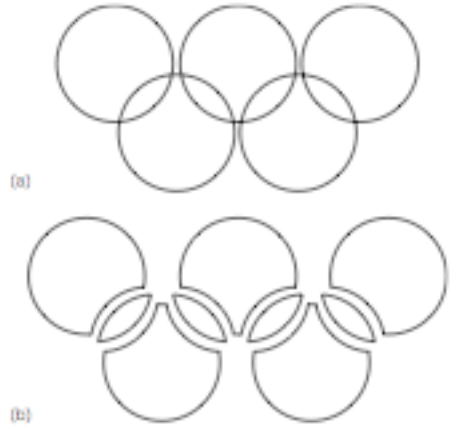


Figure 5.13 ▮ (a) This is usually perceived as five circles, not as the nine shapes in (b).

common fate

Figure 5.15 ▮ Ballet anyone? As the Pittsburgh Pirates' Humberto Cota takes a lead off first base, he becomes perceptually linked to the St. Louis Cardinals' Albert Pujols because of the similar orientations of their arms, legs, and bodies.

similarity

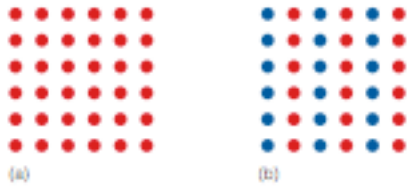
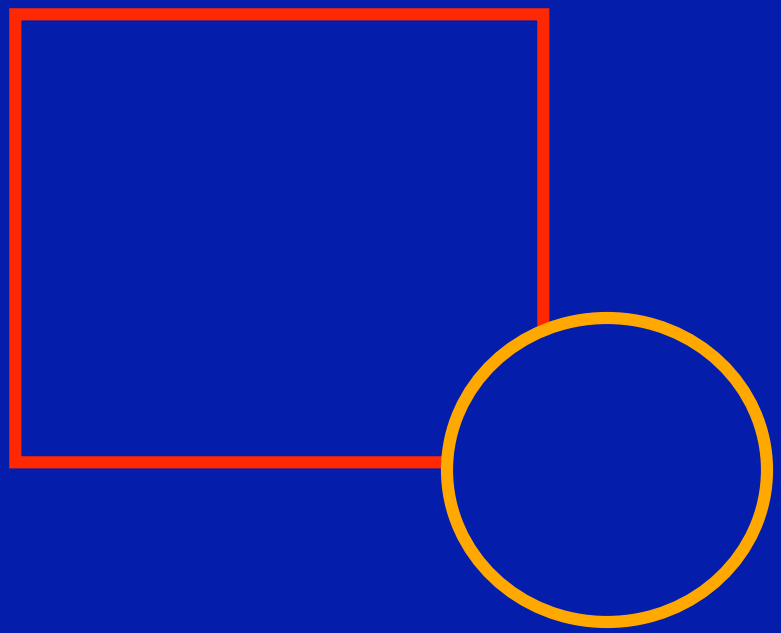
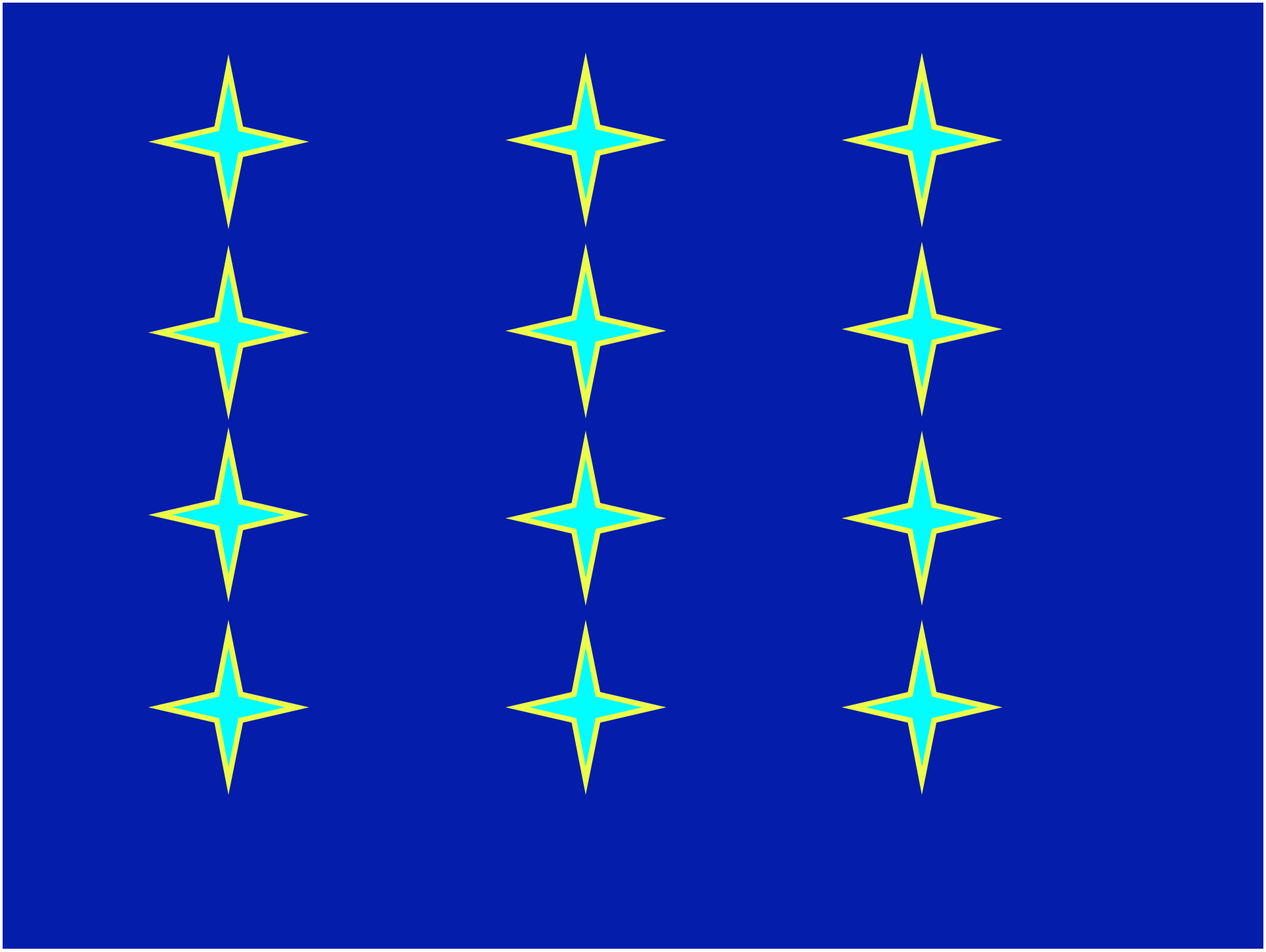


Figure 5.14 ▮ (a) Perceived as horizontal rows or vertical columns or both. (b) Perceived as vertical columns.



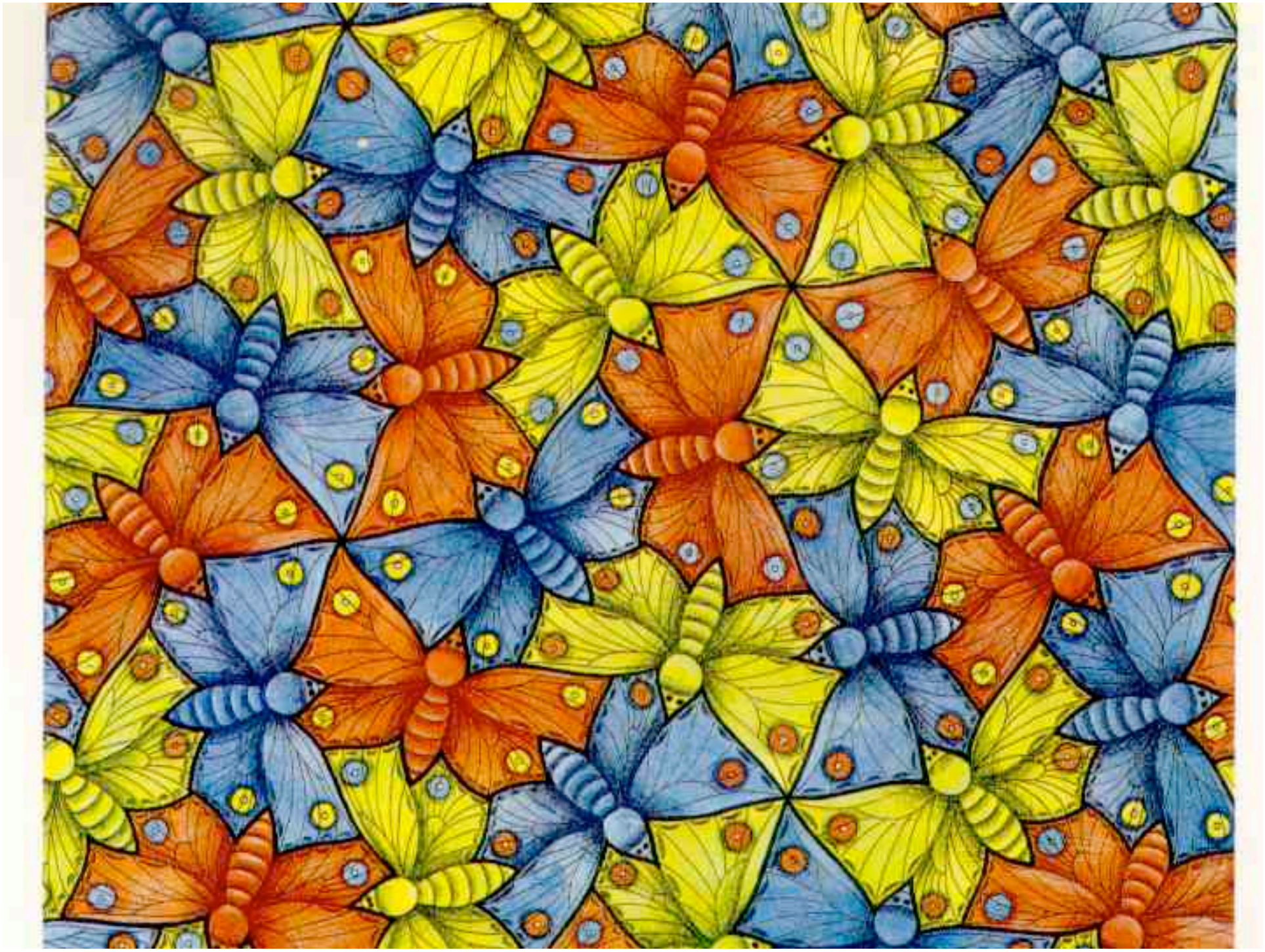
A
B
C



Snedden, Robert. What is an Amphibian. San Francisco: Sierra Club Books for Children, 1993

Figure 5.17 ▮ We perceive this pattern as continuous interwoven strands because of good continuation.

Figure 5.20 ▮ *The Forest Has Eyes* by Bev Doolittle (1985). Can you find 12 faces in this picture?



V1 neuron

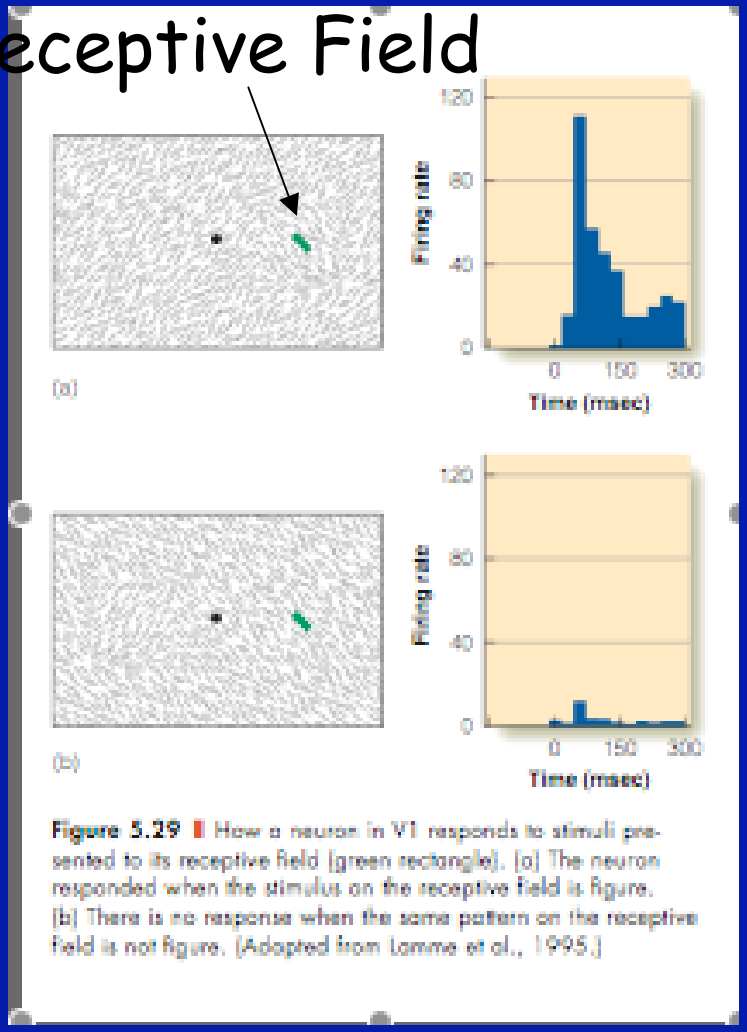


Figure 5.29 How a neuron in V1 responds to stimuli presented to its receptive field (green rectangle). (a) The neuron responded when the stimulus on the receptive field is figure. (b) There is no response when the same pattern on the receptive field is not figure. (Adapted from Lamme et al., 1995.)

Neuron's response when the stimulus on the RF is FIGURE

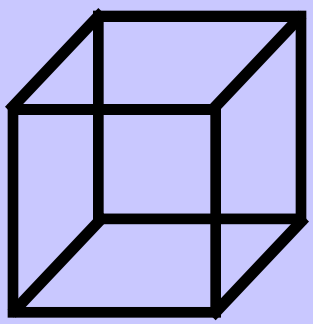
Neuron's response when the same pattern on the RF is NOT FIGURE

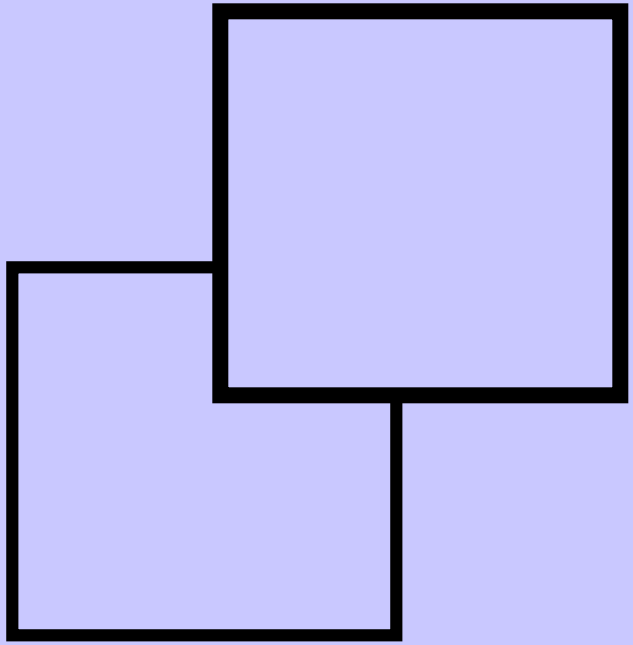
Lamme, V. A. F. (1995). The neurophysiology of figure-ground segregation in primary visual cortex. *Journal of Neuroscience, 15,* 1605-1615.

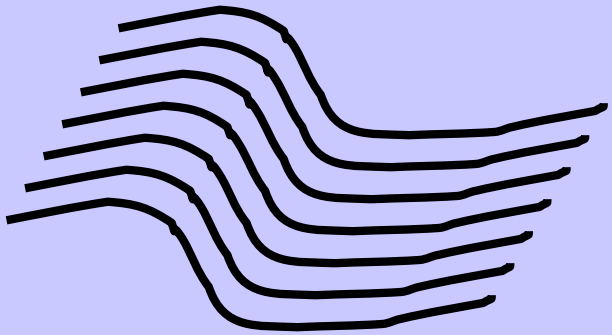
Structural analysis

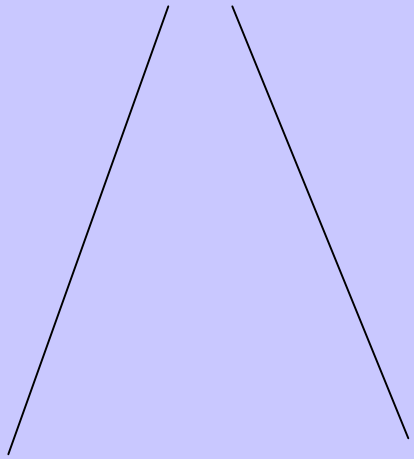
types of connections:

- T junction --> occlusion
- X junction --> transparency
- shadow --> depth
- curvature --> depth
- perspective --> depth

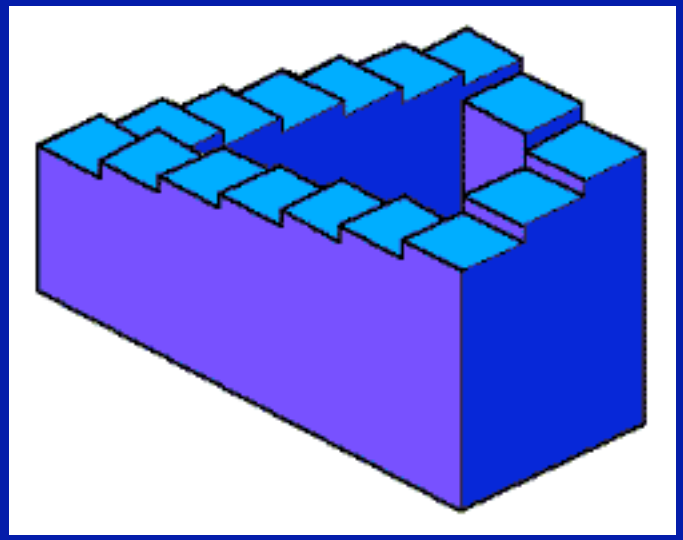


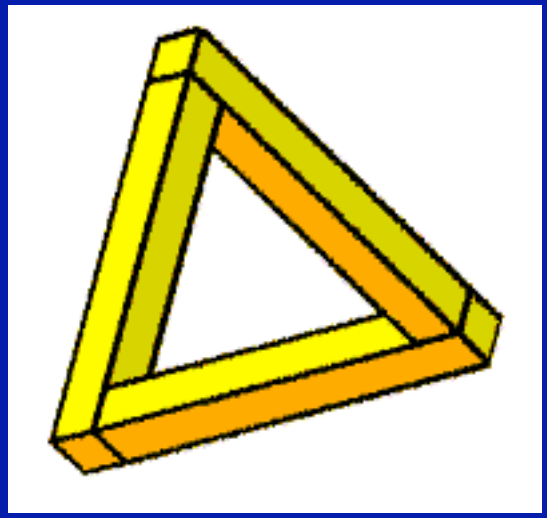


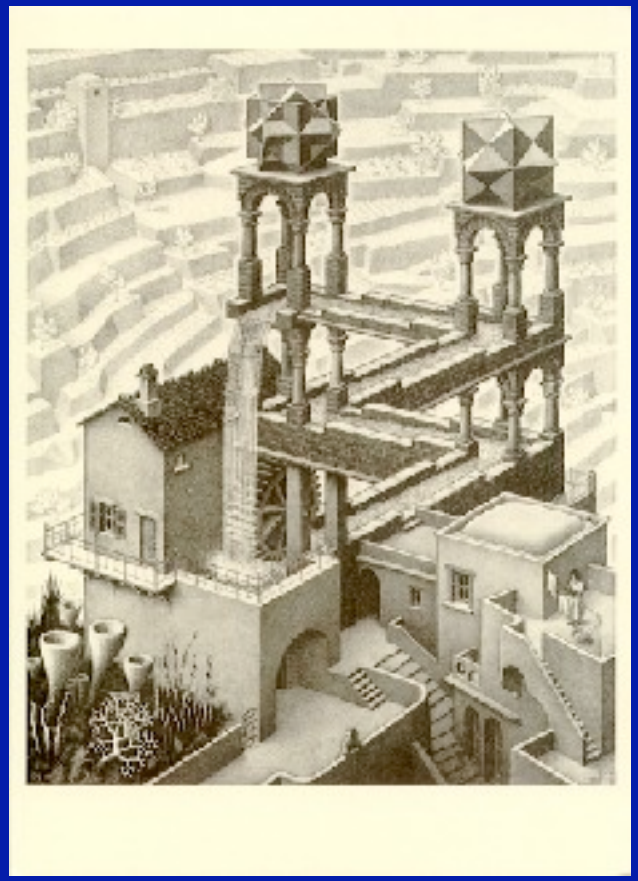


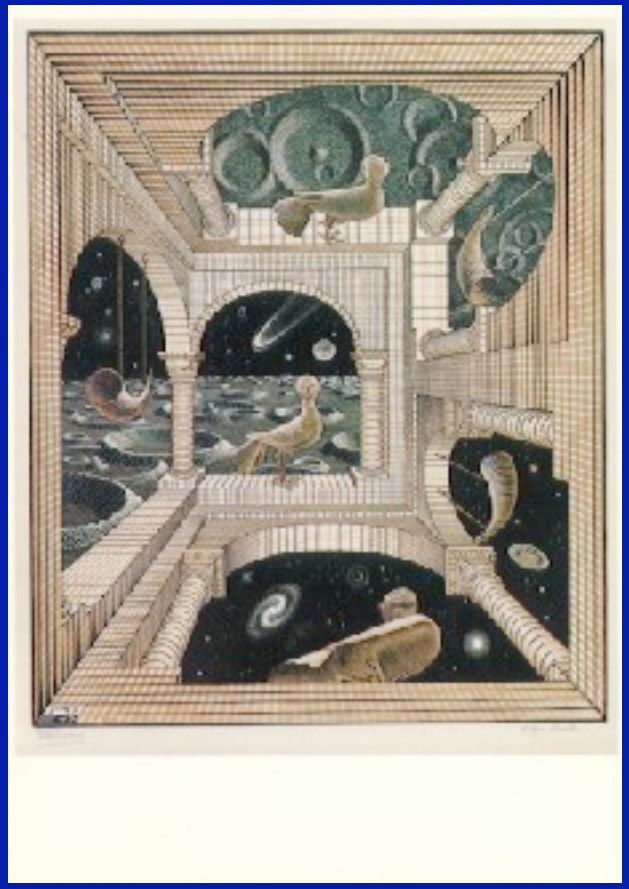


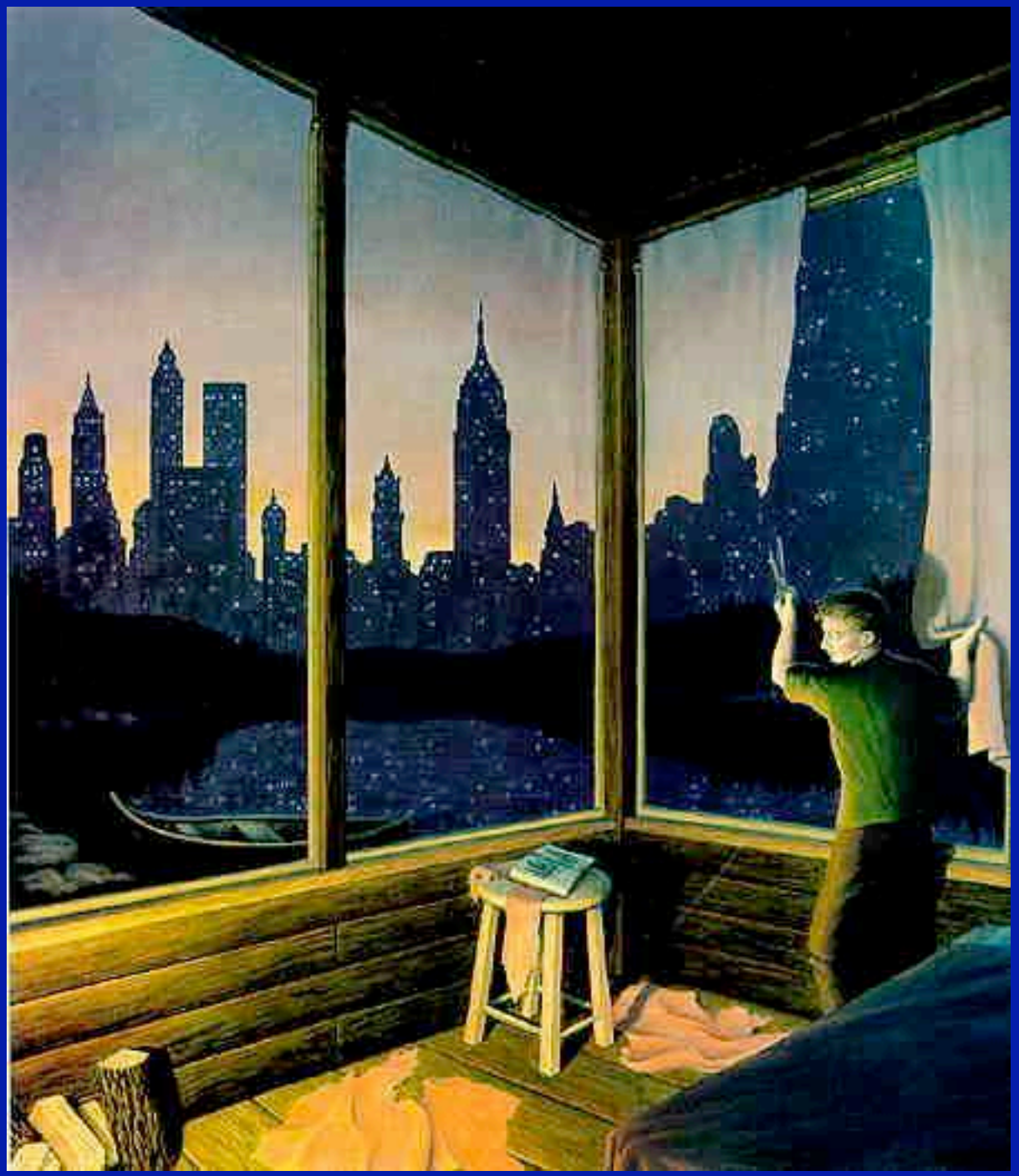
Why are these images impossible?

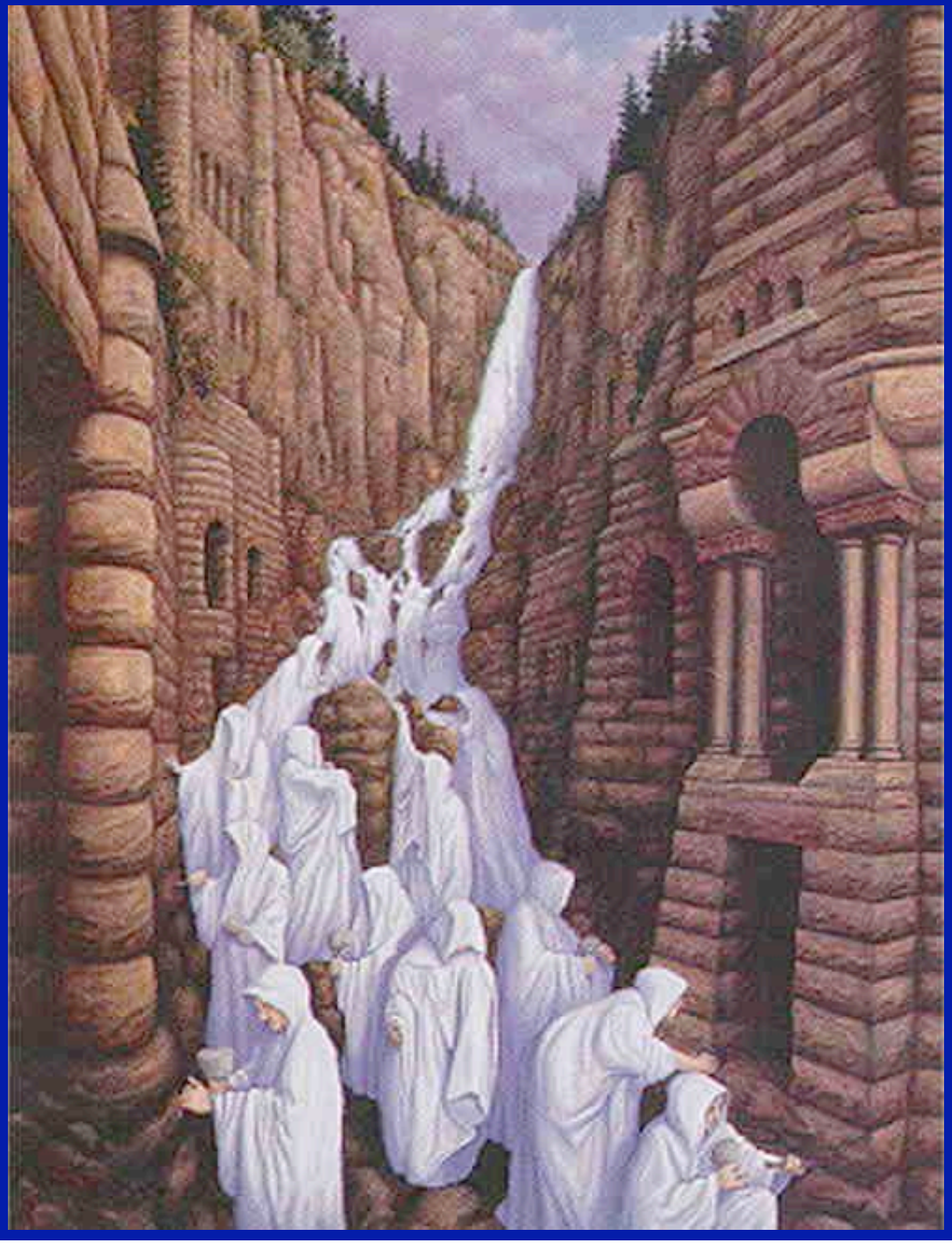


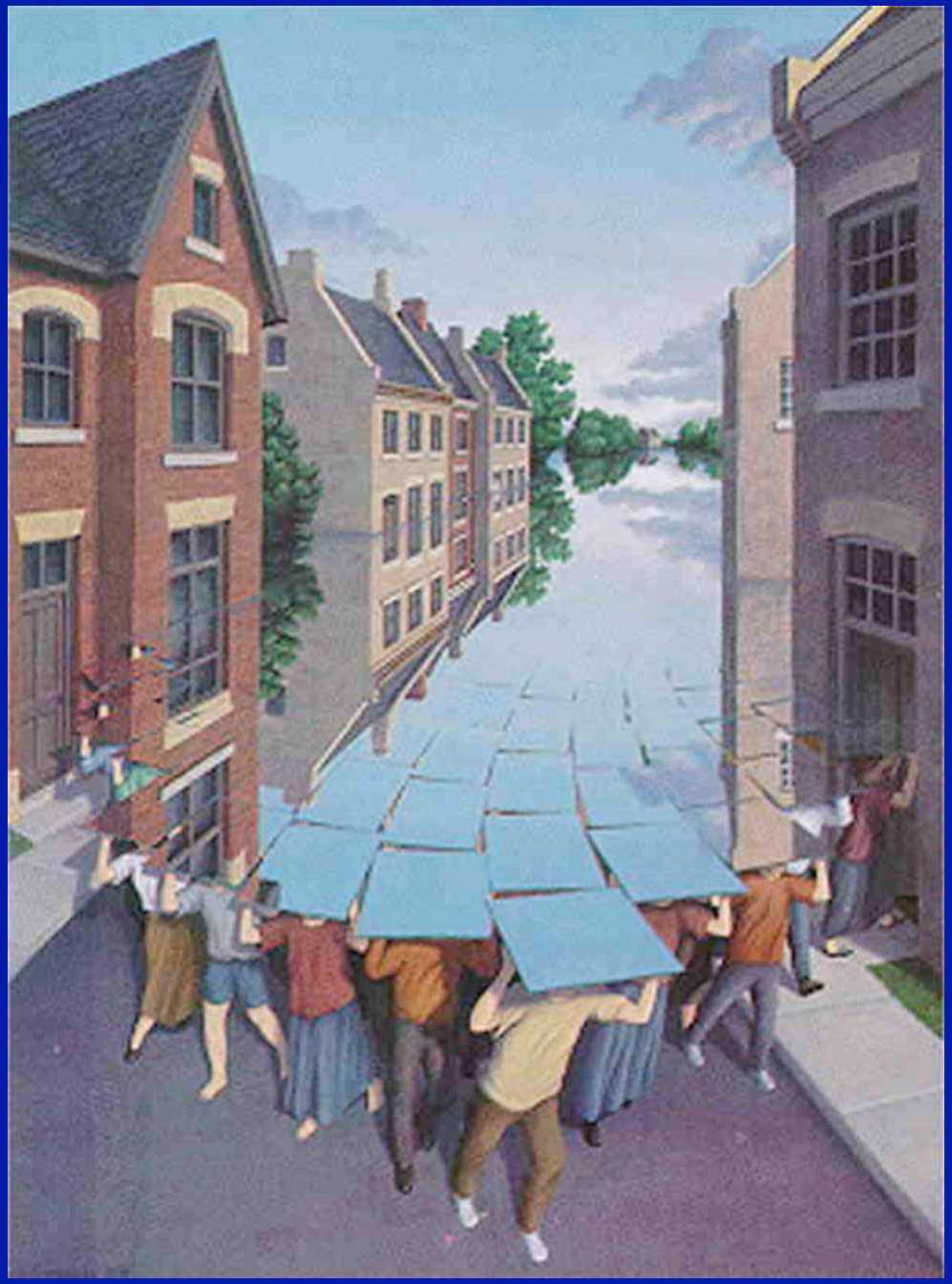










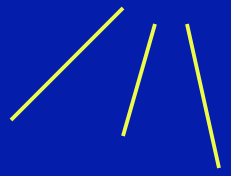


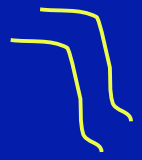
Recognition By Components

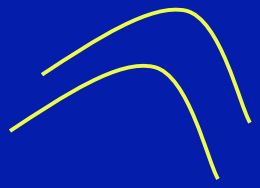
Biederman

Biederman: Recognition by Components (Geons)

Non accidental properties: correspondence between the world and the retina

Collinearity 

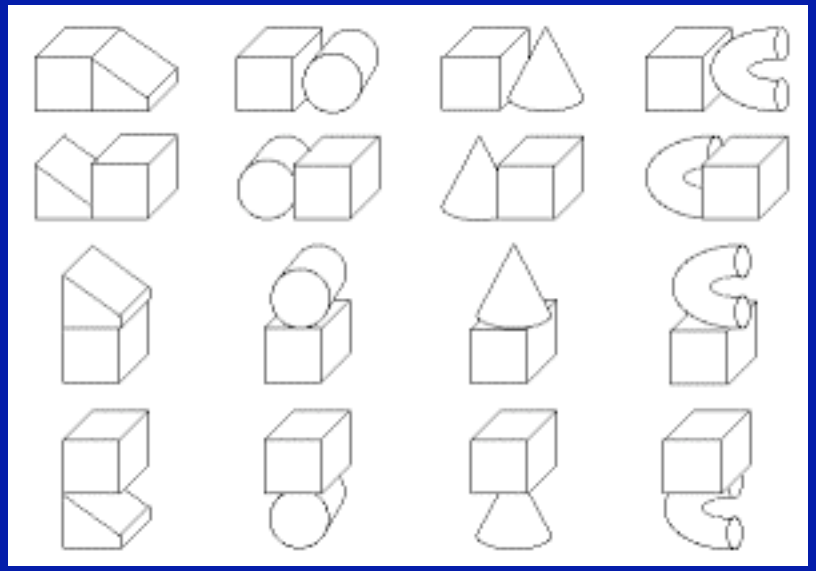
Parallelism 

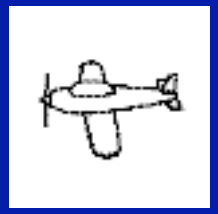
Curvilinearity 

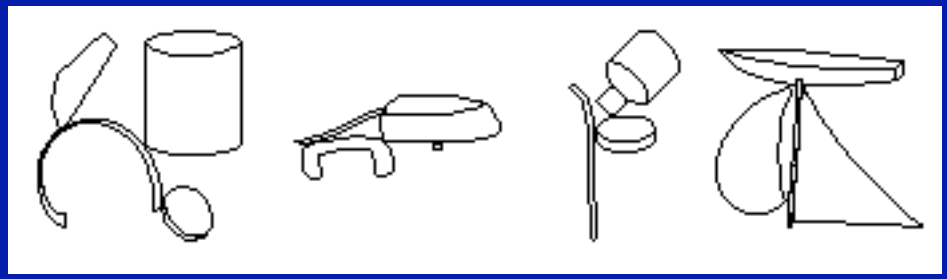
Vertices 

Symmetry 

Geons







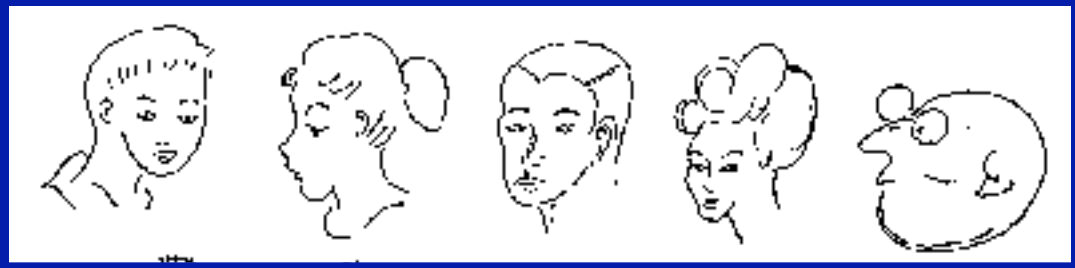
Top-down approach

memory
knowledge
familiarity
physiological state

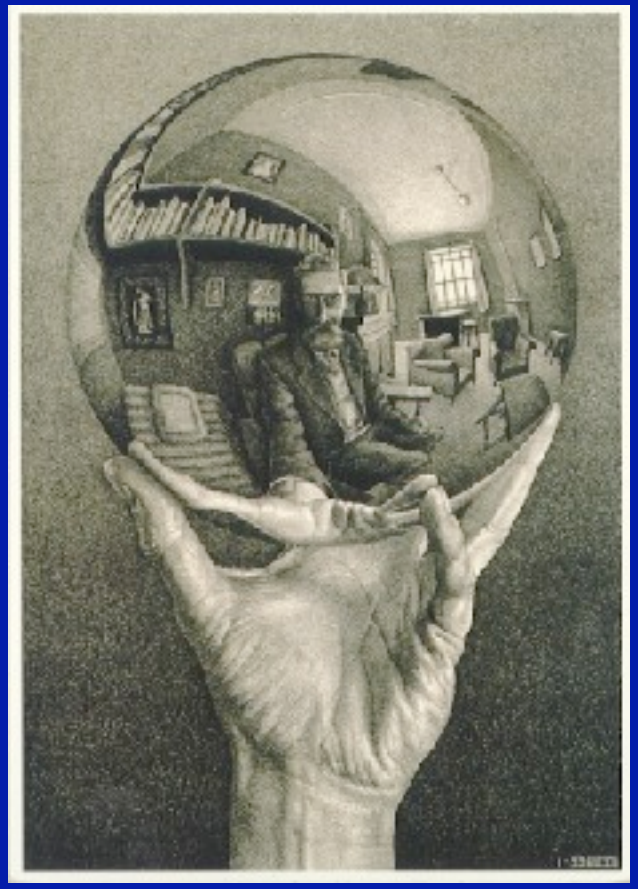
Do you see the three faces?

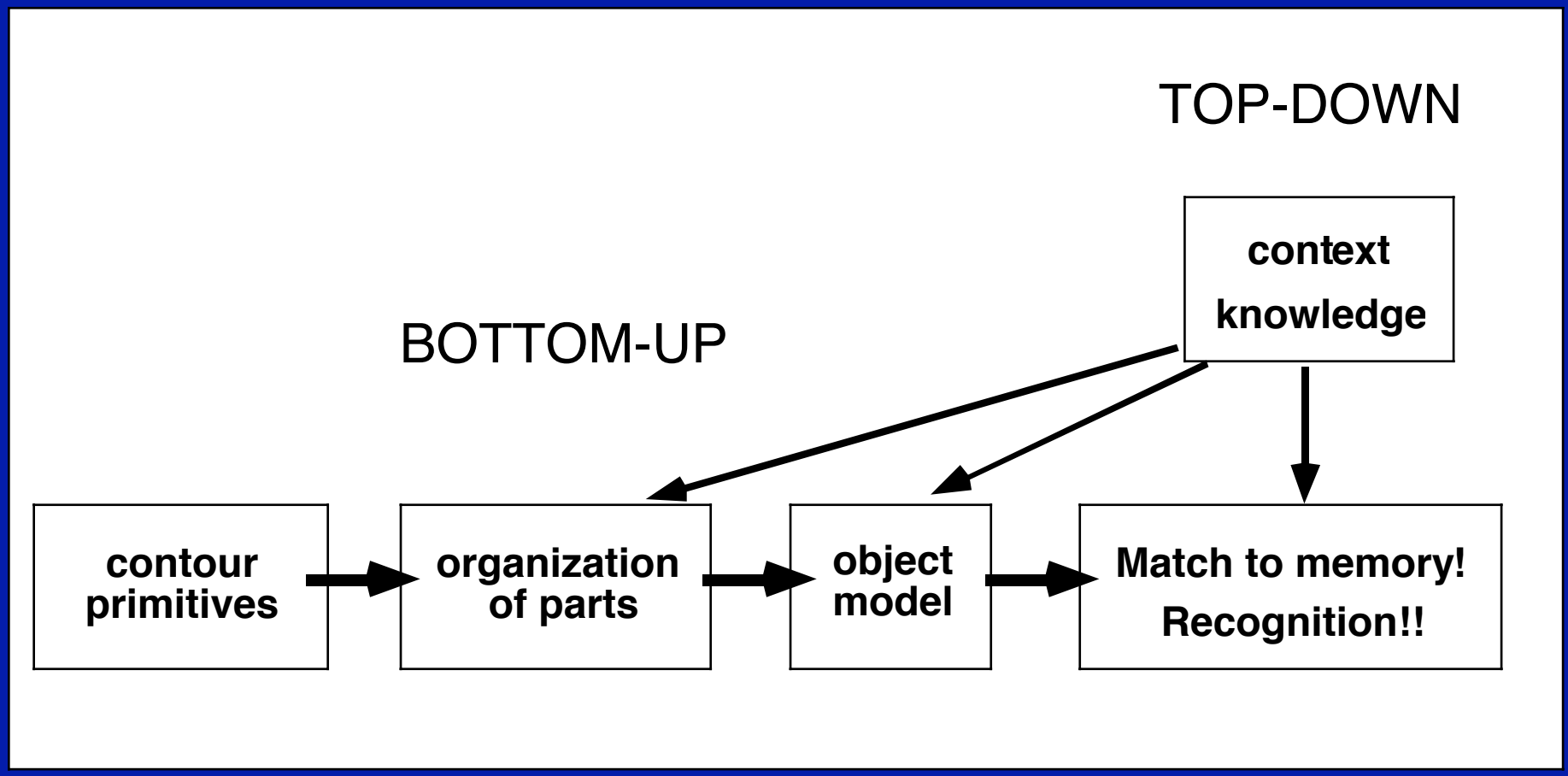
Does attention help vision?

Does our knowledge influence what we see?



Does our knowledge influence what we see?




TOP-DOWN
context knowledge
BOTTOM-UP
contour primitives
organization of parts
object model
Match to memory! Recognition!!

Anatomy & physiology

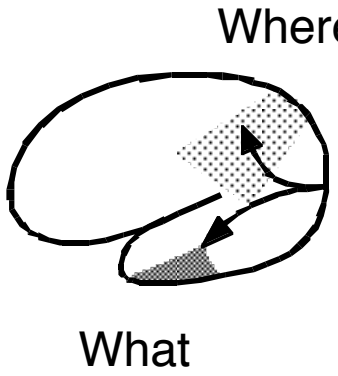
what & where systems
Minskin, Ungerleider & Marco

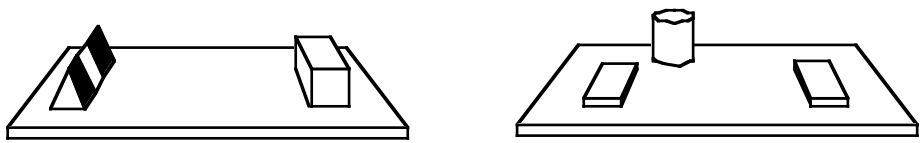
prosopagnosia
infero-temporal area: IT
face selective neurons

object agnosia: John

What and Where systems

Mishkin, Ungerleider & Macko (1983)





How system

Goodale and colleagues

"the world is out of focus to my brain"

John

1981: stroke

occipital lobes -> temporal lobes --> ventral pathway

What is wrong with John?

prosopagnosia
object agnosia
achromatopsia
no spatial orientation
problem with short-term memory with sight

What is not wrong with John?

acuity
eye movements
intelligence
first memories from sounds, smell
draw objects out of memories
copy object line by line
memory before the operation

More about his vision:

intact registration of features
trouble to put features together
no top down influence
more information = better

DF
Milner & Goodale

34 years old woman
Damage to the ventral pathway
from carbon monoxide poisoning

Visual form agnosia

DF

- Cannot copy,
  but can draw from memory
- Cannot visually match orientation
- Could "mail" an oriented paper

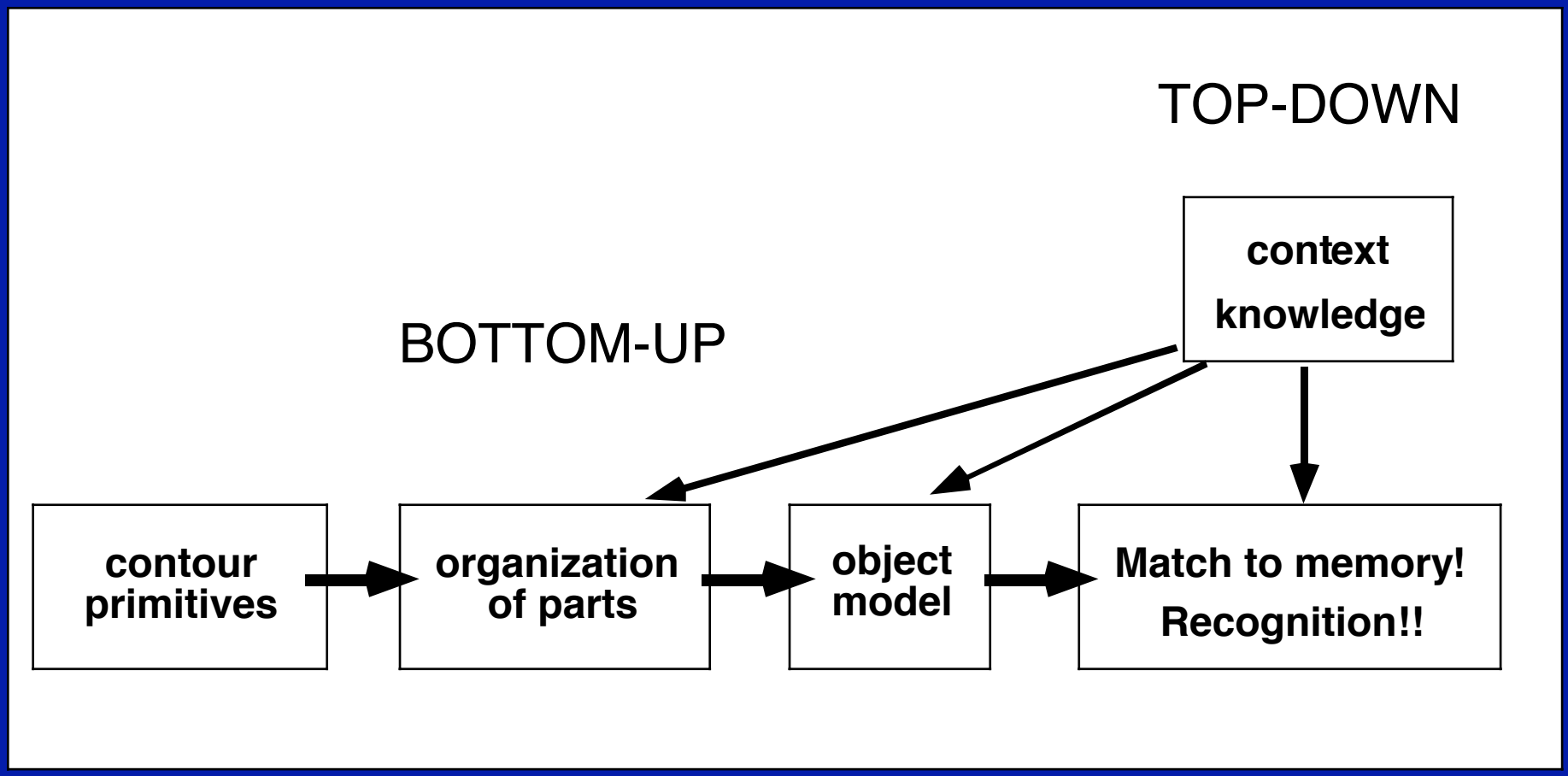
Single dissociation:

- One mechanism for judging orientation

- One mechanism for coordination of vision & action

Double dissociation:

another patient can't "mail" but is fine with judging line orientation.


TOP-DOWN
context knowledge
BOTTOM-UP
contour primitives
organization of parts
object model
Match to memory! Recognition!!