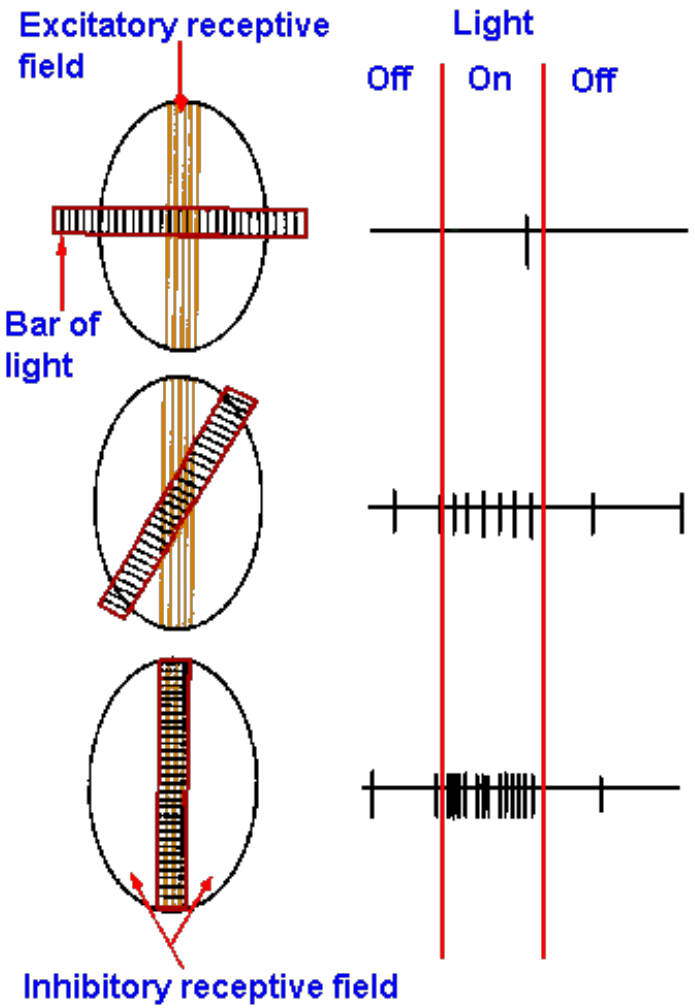
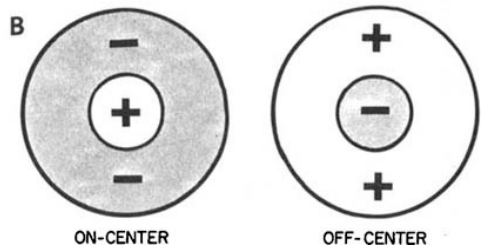
# Receptive fields



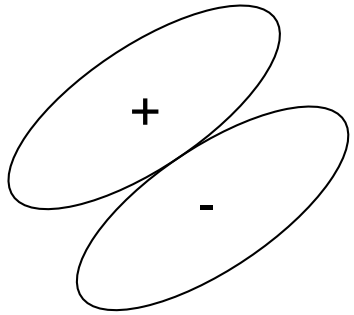

"Bar detector"

primary visual cortex (V1)




retina

"Spot detector"

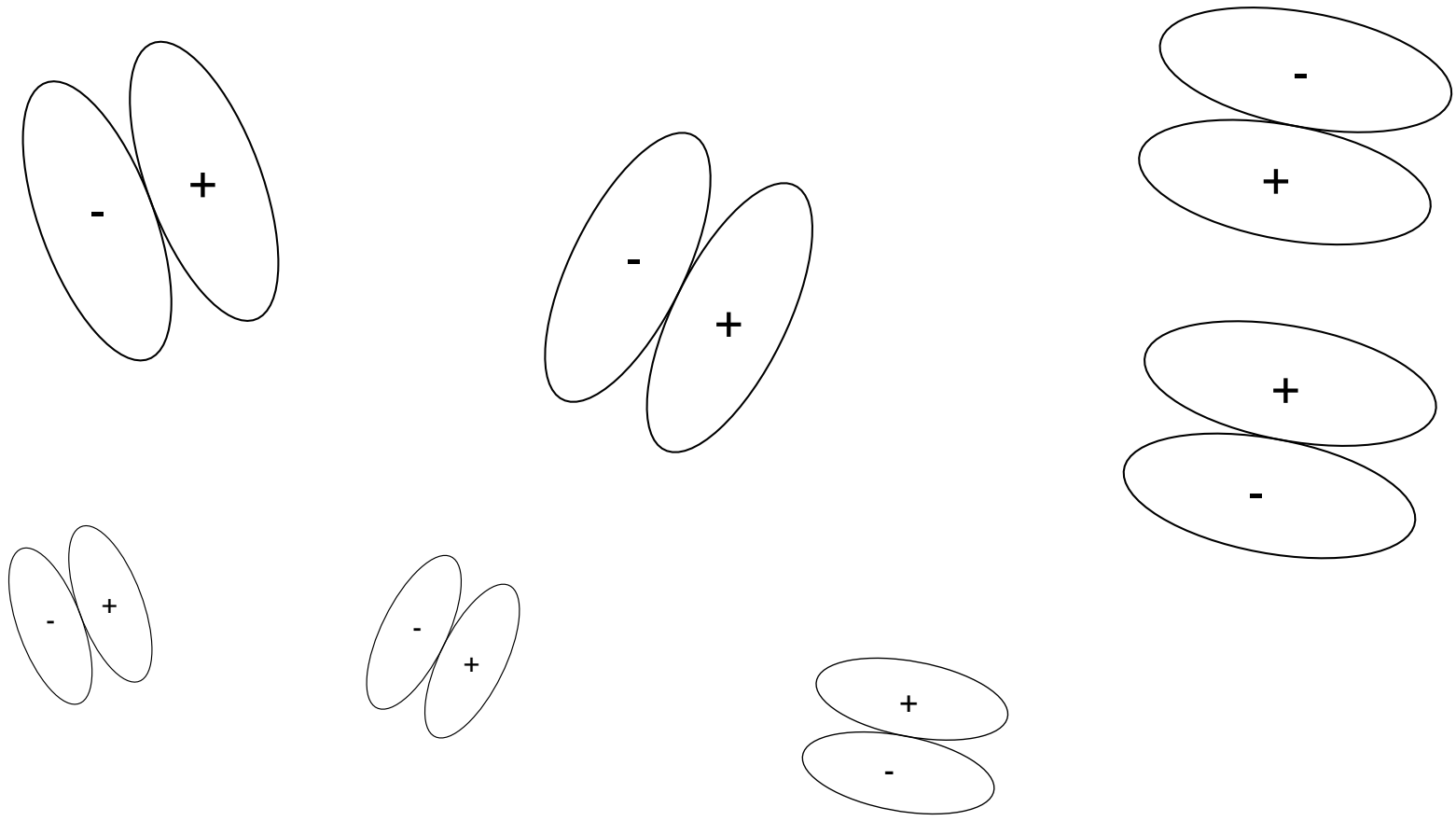


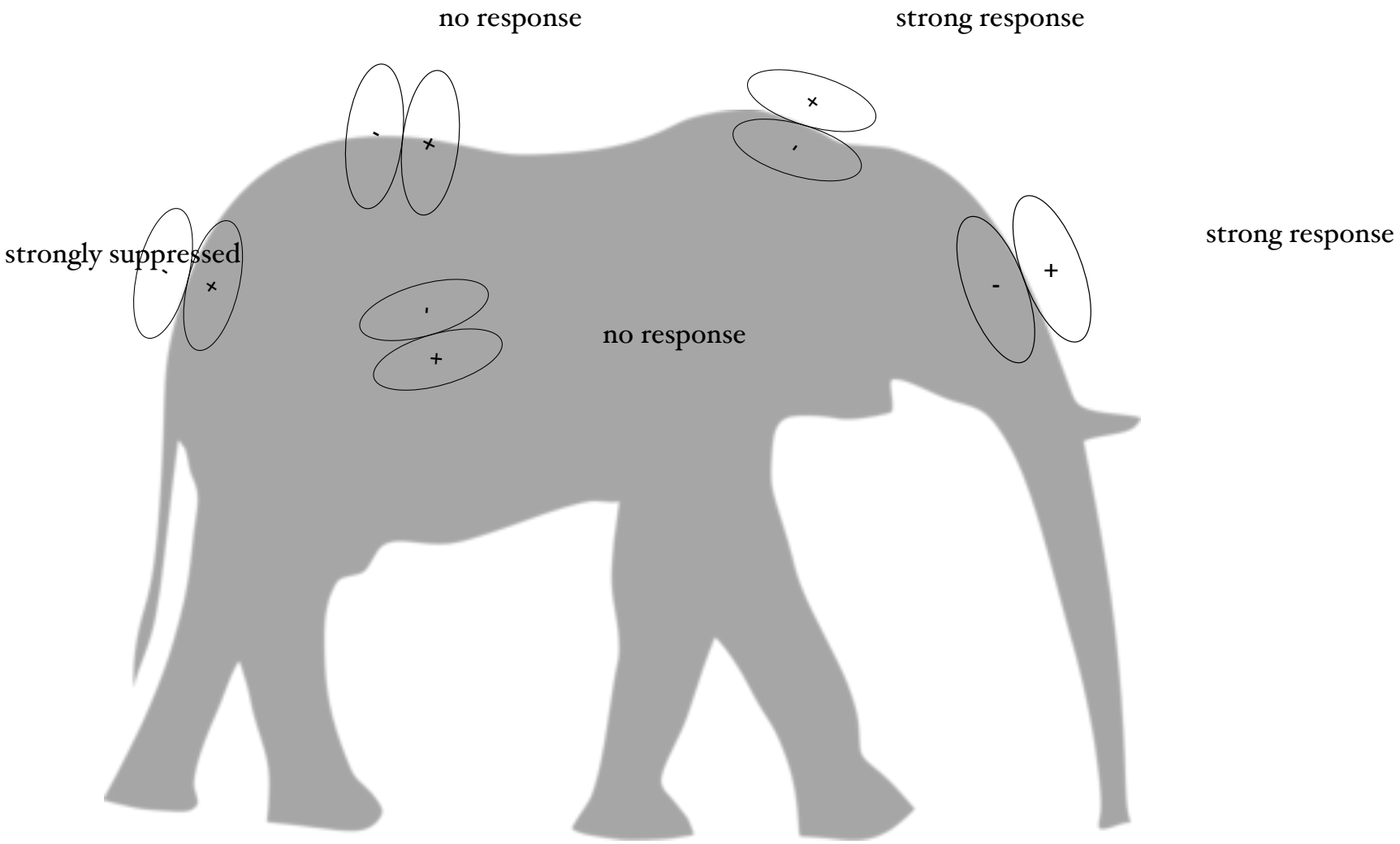

primary visual cortex (V1)

"Edge detector"

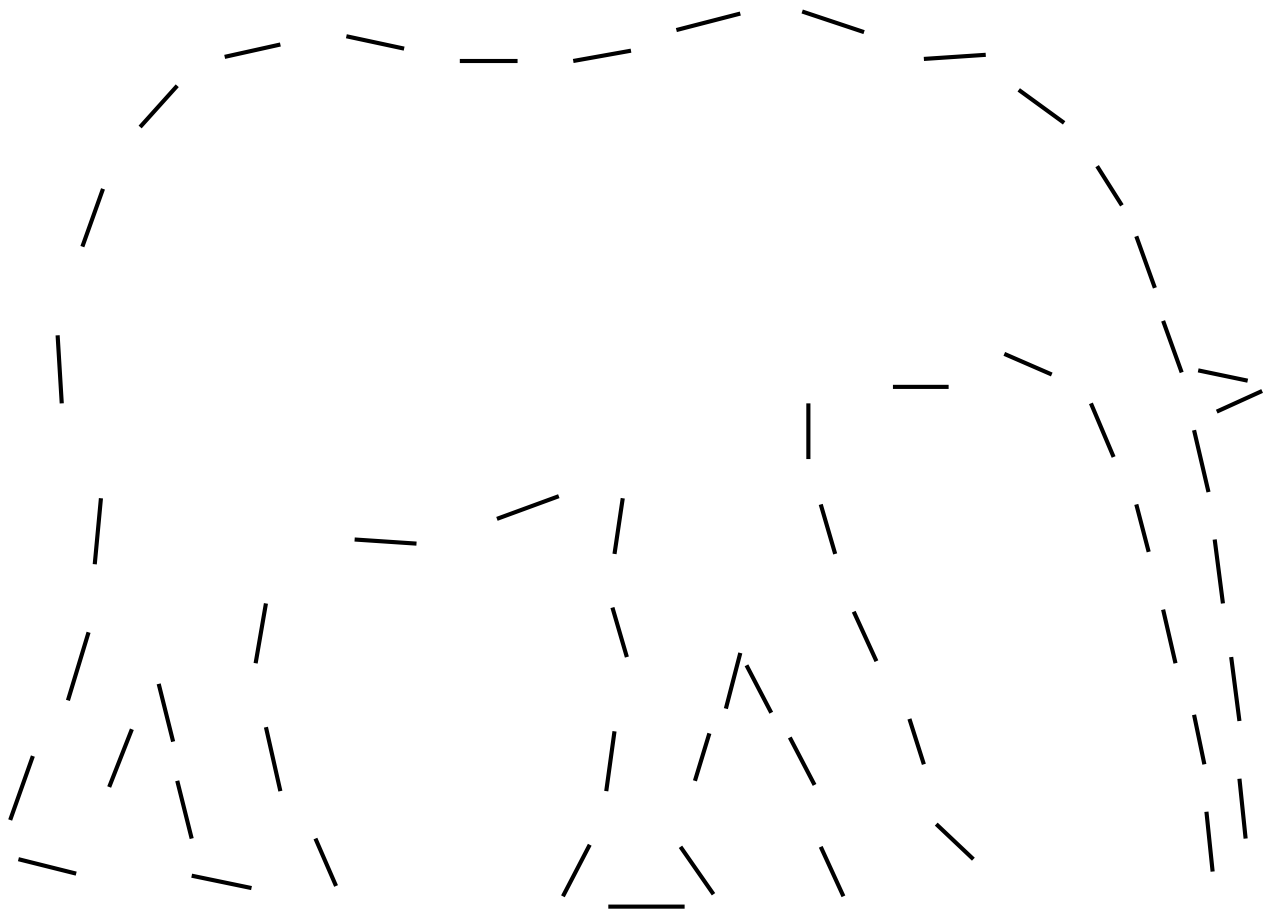
Lateral inhibition = competition between neighboring areas

# V1: Edge detectors everywhere!
# Every orientation x every position x every size x....



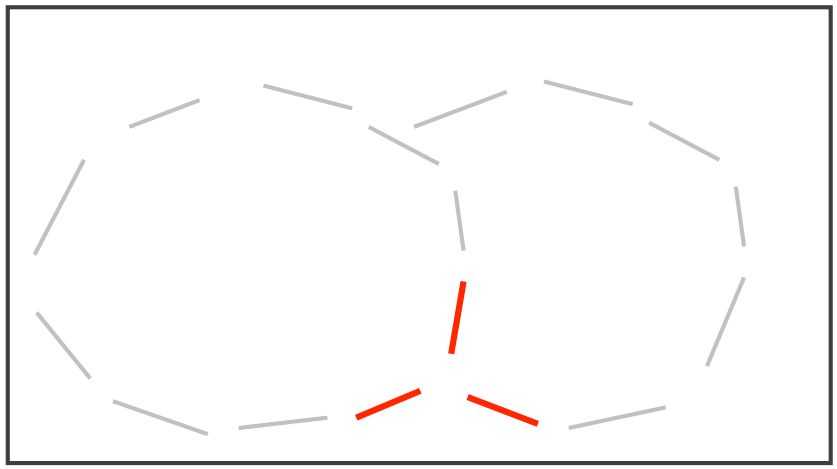

no response
strong response
strongly suppressed
strong response
no response

# Edge map -- Map of strong V1 responses



# Perceptual grouping

- Perceptual grouping is the organization of the raw elements of visual image into larger units, like contours, surfaces, and objects.



16 line segments?
Or 2 objects?

Local vs. global processing

Top-down vs. bottom-up processing

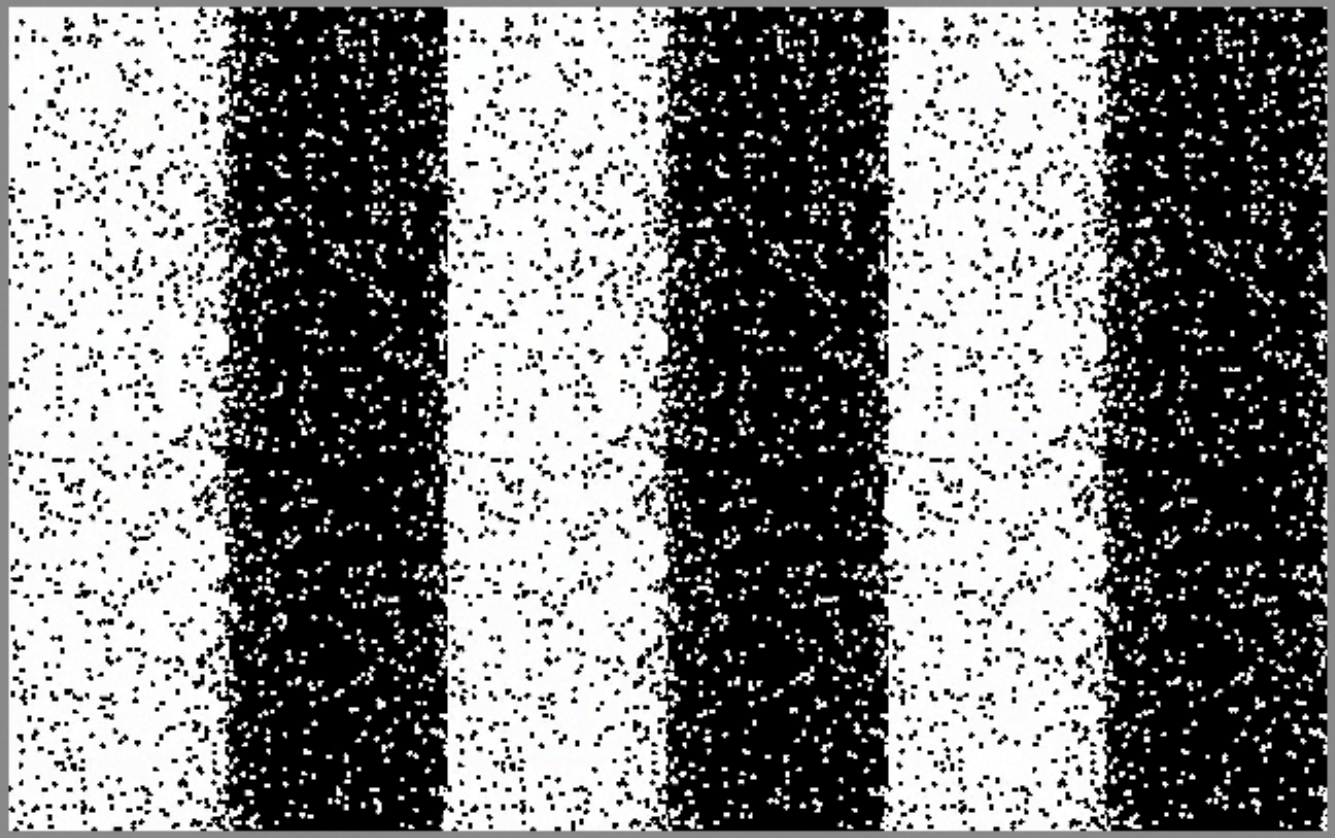
# Gestalt perceptual organization

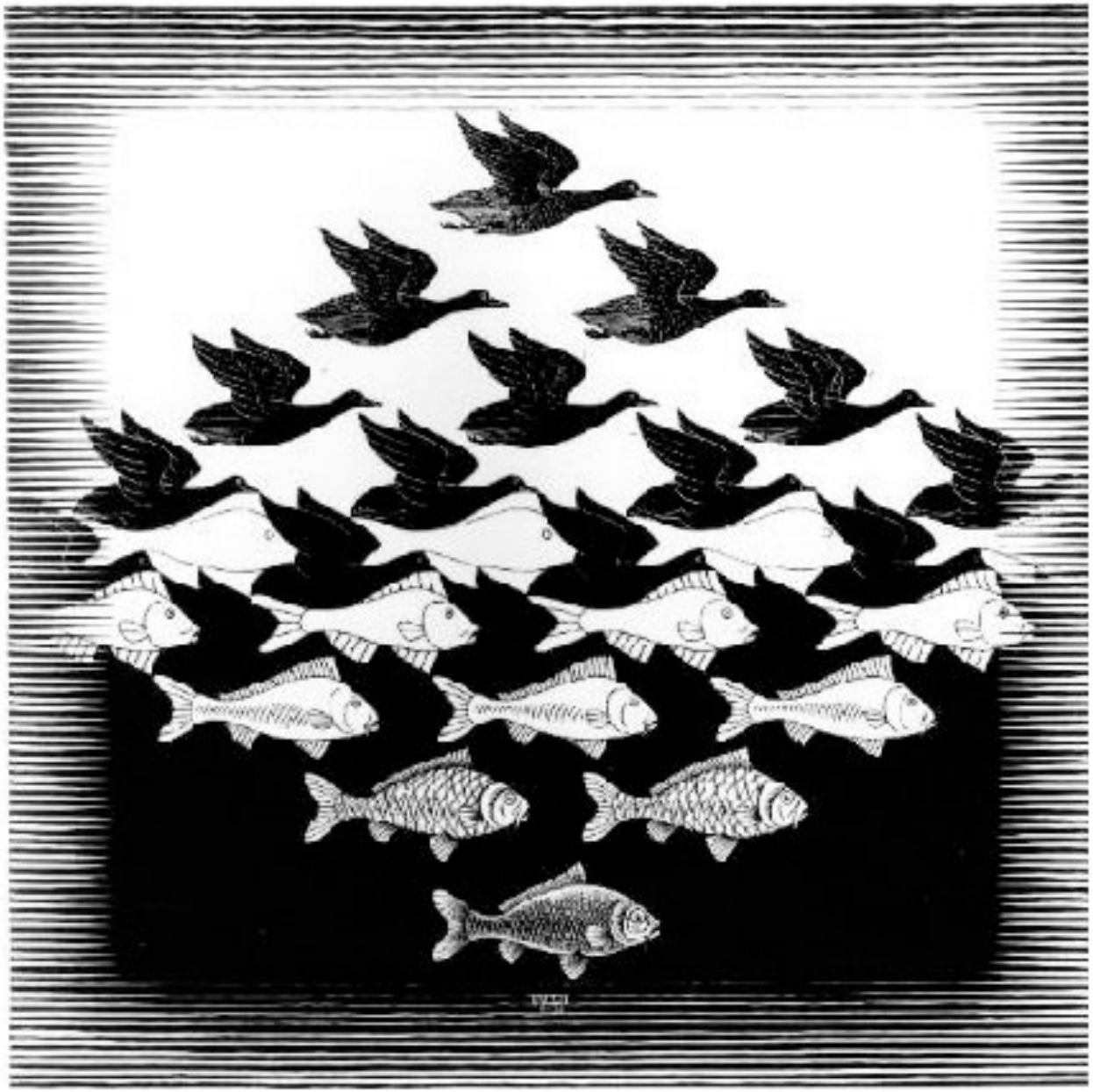
- The Gestalt psychologists (Germany, 1920s) emphasized the "whole" (Gestalt)
- "The whole is different from the sum of its parts"
- This led to a number of Gestalt principles concerning how the visual image is perceptually organized

# Figure and ground

Rubin, 1936

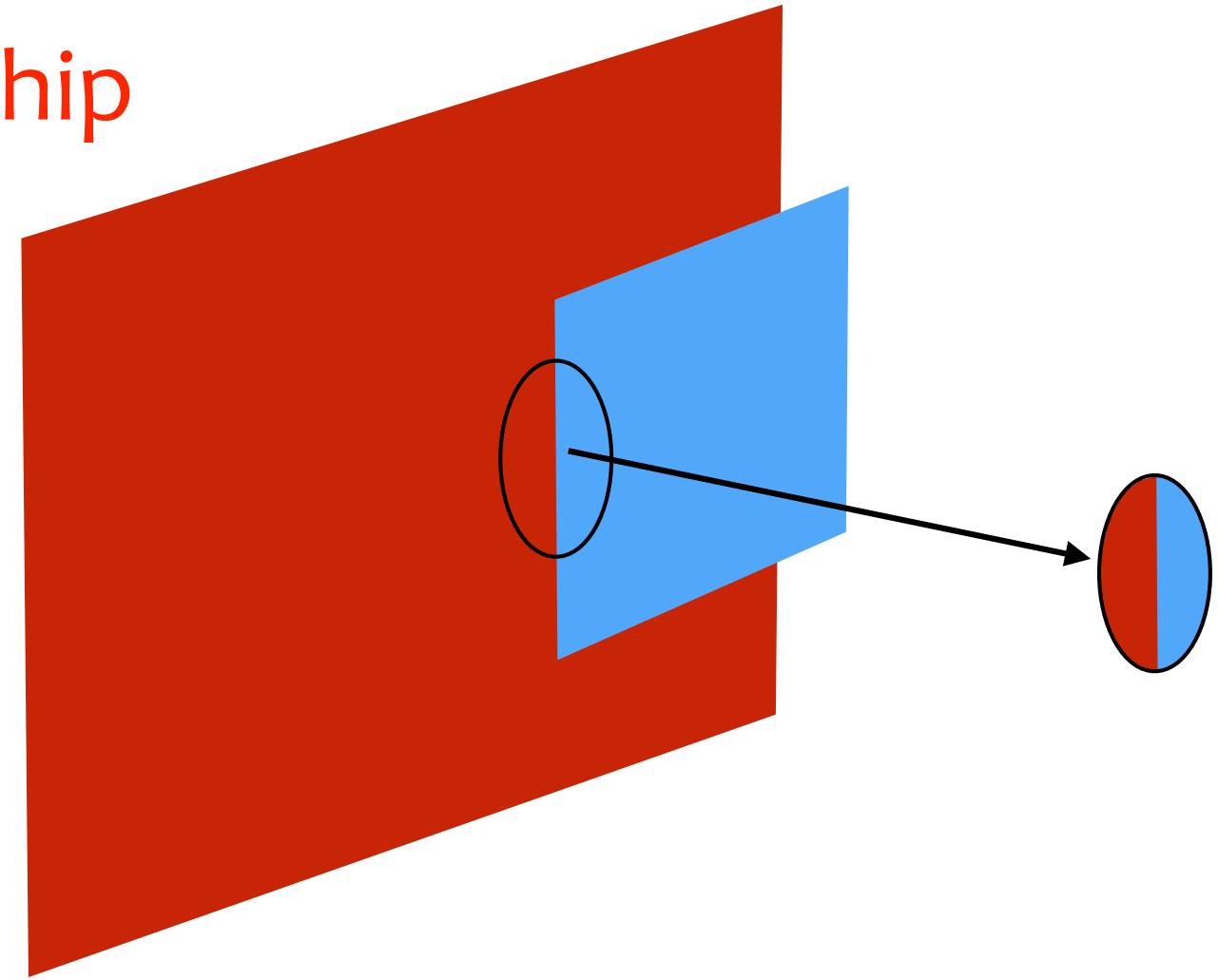
Each boundary separates one region that is closer (figure) and another that is farther (ground)





M.C. Escher: *Sky and Water I* 1938 woodcut

# Border ownership



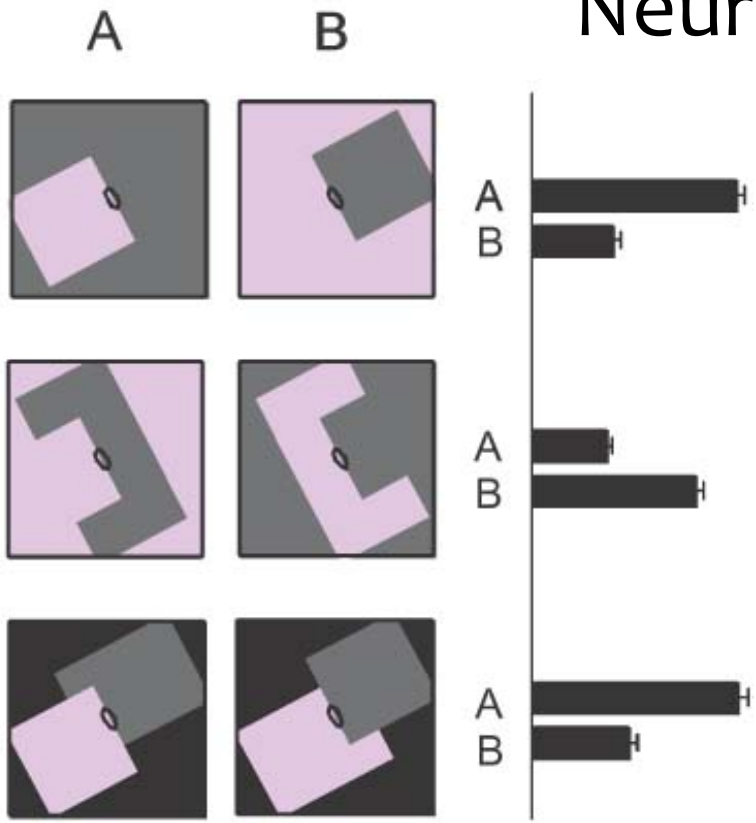
The figural (blue) side of the boundary "owns" the boundary, because

1. the figure actually ends there, while
2. the ground side continues behind the figure

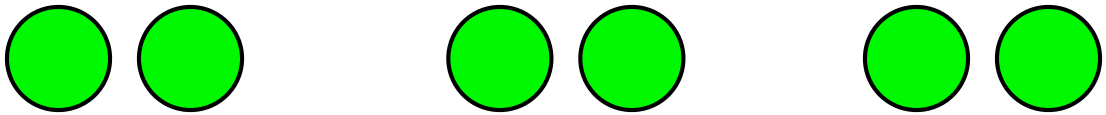
# Cells in Visual Area 2 (V2) are sensitive to F/G

Stimulus

Neural response (V2 cell)



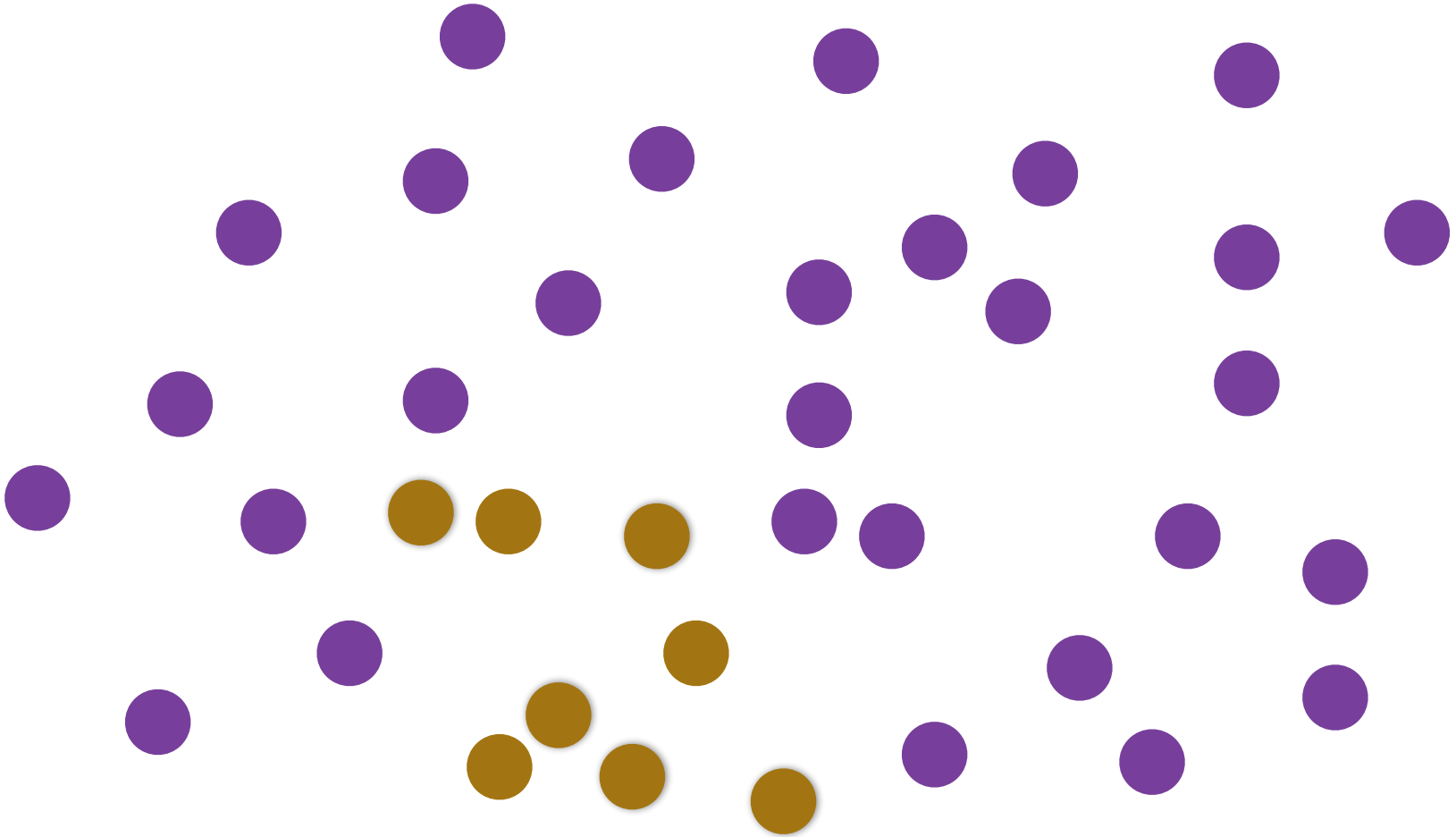
# More Gestalt principles



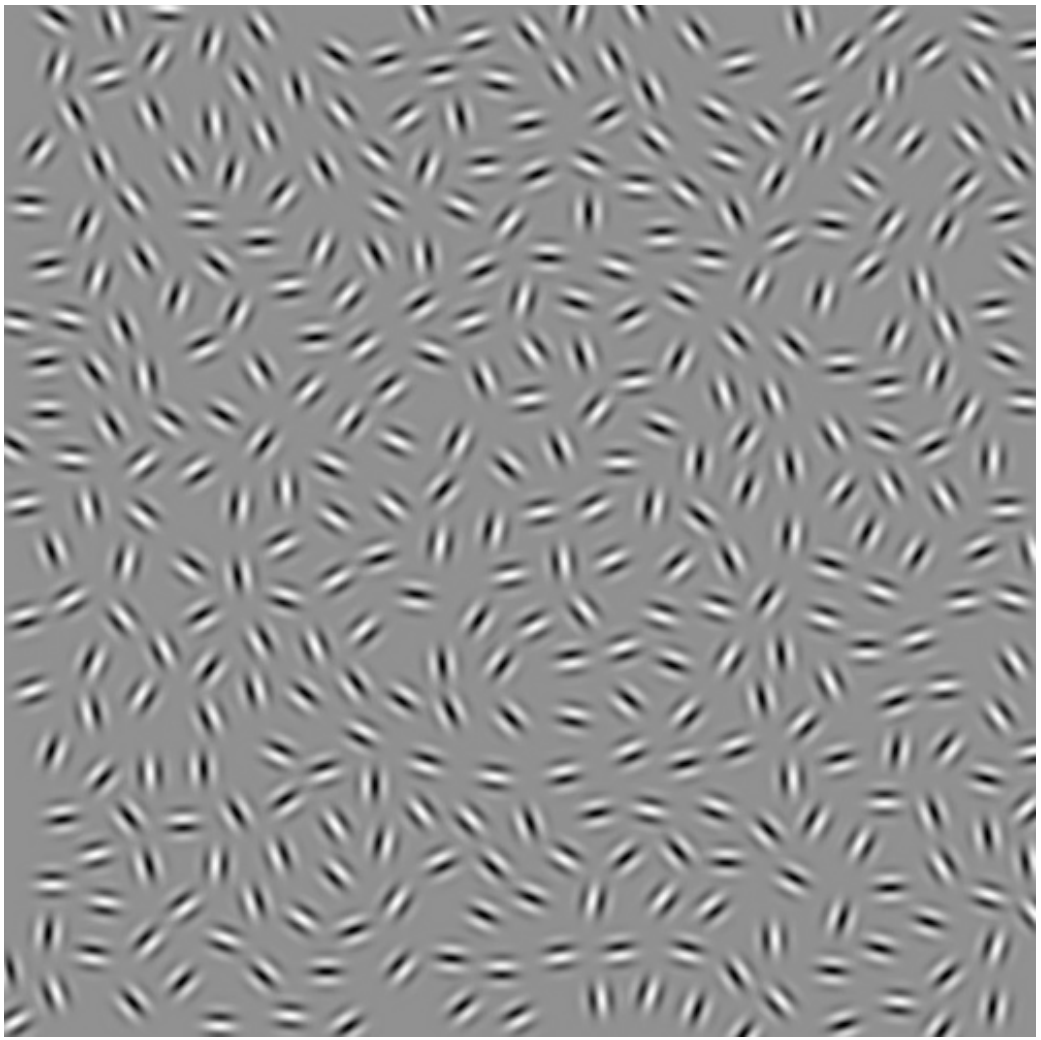
- Principle of proximity
- Principle of similarity
- Principle of common fate
- Principle of good continuation
- Prägnanz

# Principle of Similarity

## Principle of common fate



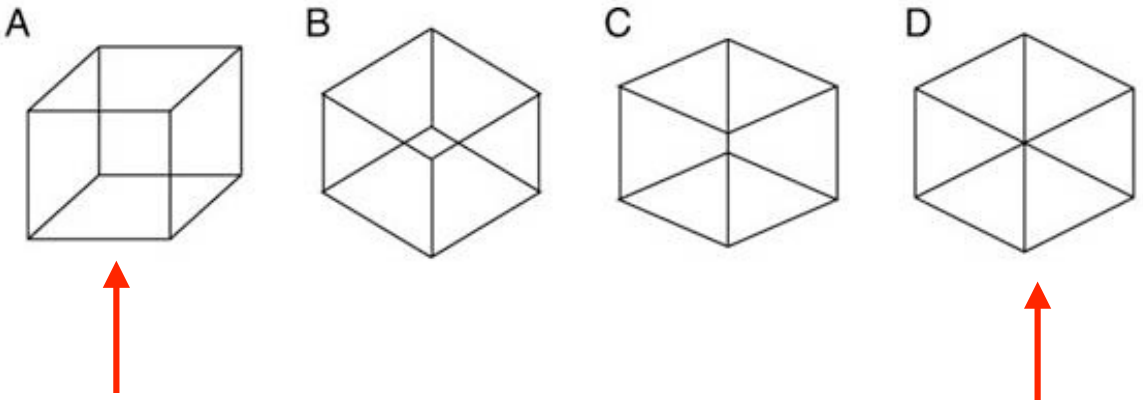
# Good continuation



Contour integration

Elongated contours are created by communication among adjacent receptive fields

# Prägnanz: prefer the simplest or most coherent interpretation



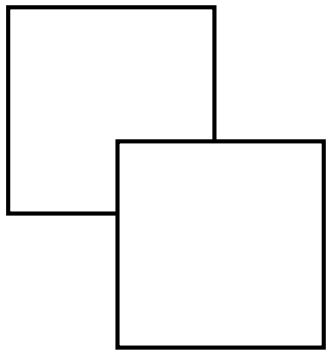

Simplicity

Complex if interpreted as 2D

Simple if interpreted as 2D

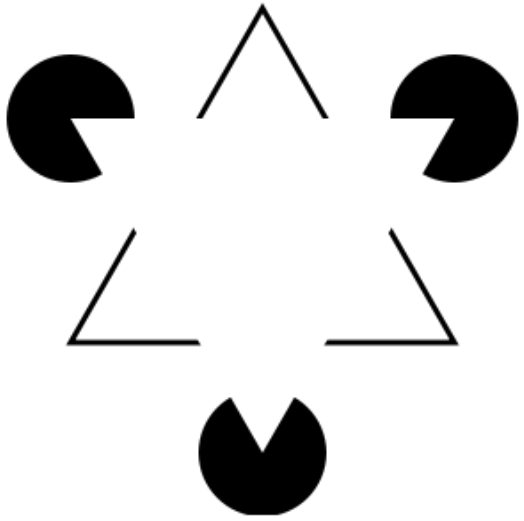
The figure is interpreted as 3D in proportion to how complex it would be to interpret as 2D

# Perceptual completion



## Amodal completion

- One object is perceived as "completing" behind the other, but is not literally seen



## Modal completion
## aka subjective contours

- One object is perceived as in front of another, inducing the visible constructed boundaries