

Form perception

Gestalt ideas of form perception

Objects close together tend to unite perceptually into groups

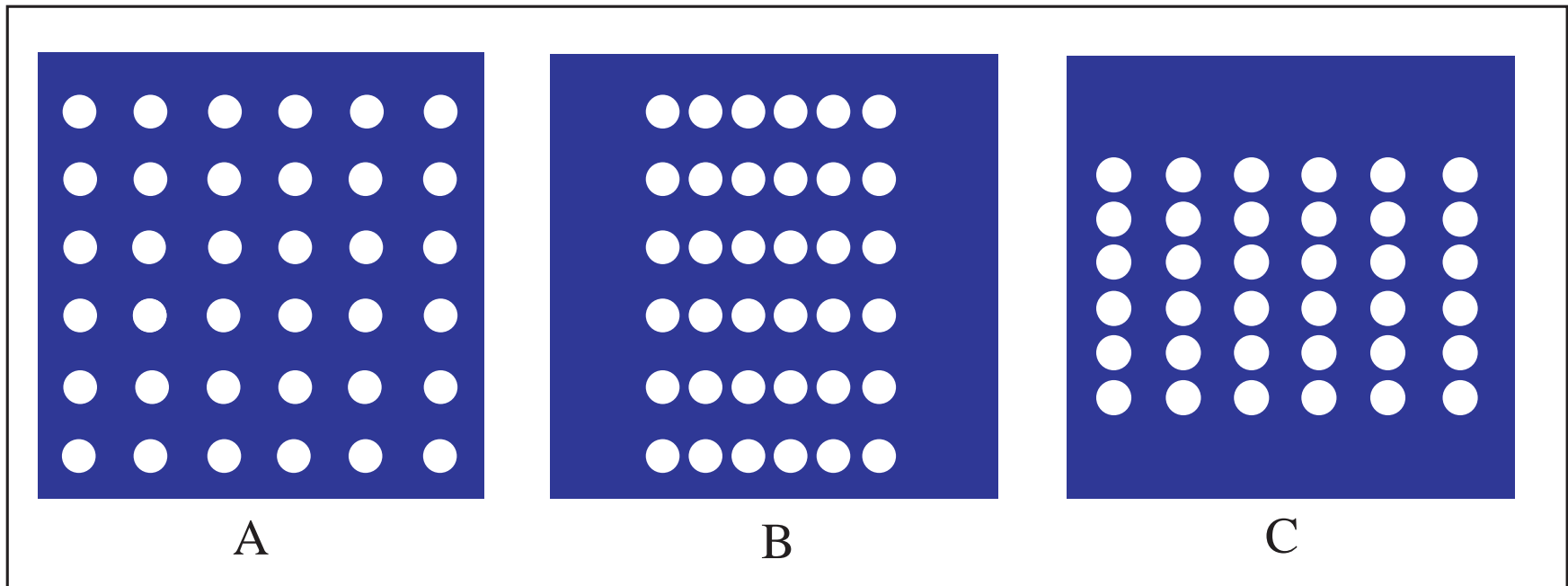


Figure by MIT OCW.

Objects similar in shape and size tend to group together

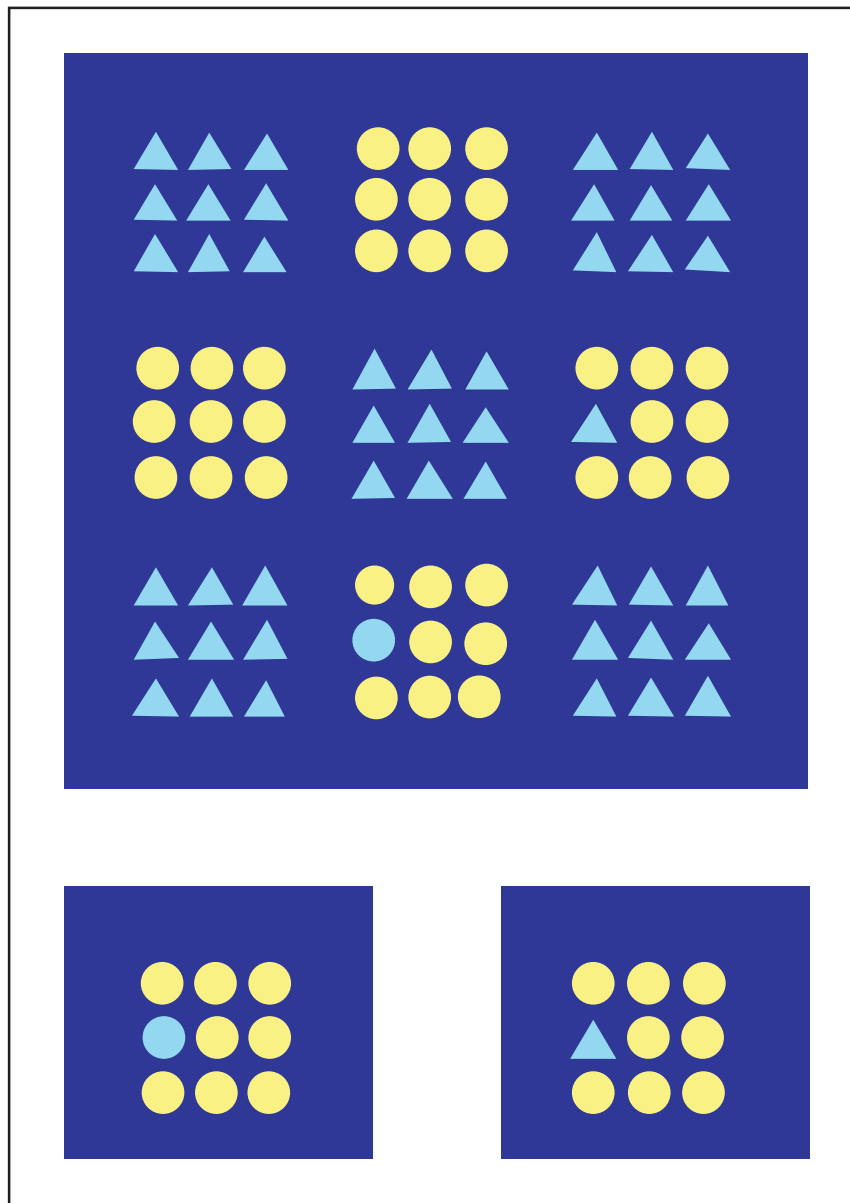


Figure by MIT OCW.

Objects that move together in the same direction
and same velocity are grouped together

Three general theories of form perception:

1. Form perception is accomplished by neurons that respond selectively to line segments of different orientation.
2. Form perception is accomplished by spatial mapping of the visual scene onto visual cortex.
3. Form perception is accomplished by virtue of Fourier analysis.

Orientation of line segments and spatial frequency

Topographic mapping

Cajal's scheme for retinal connections

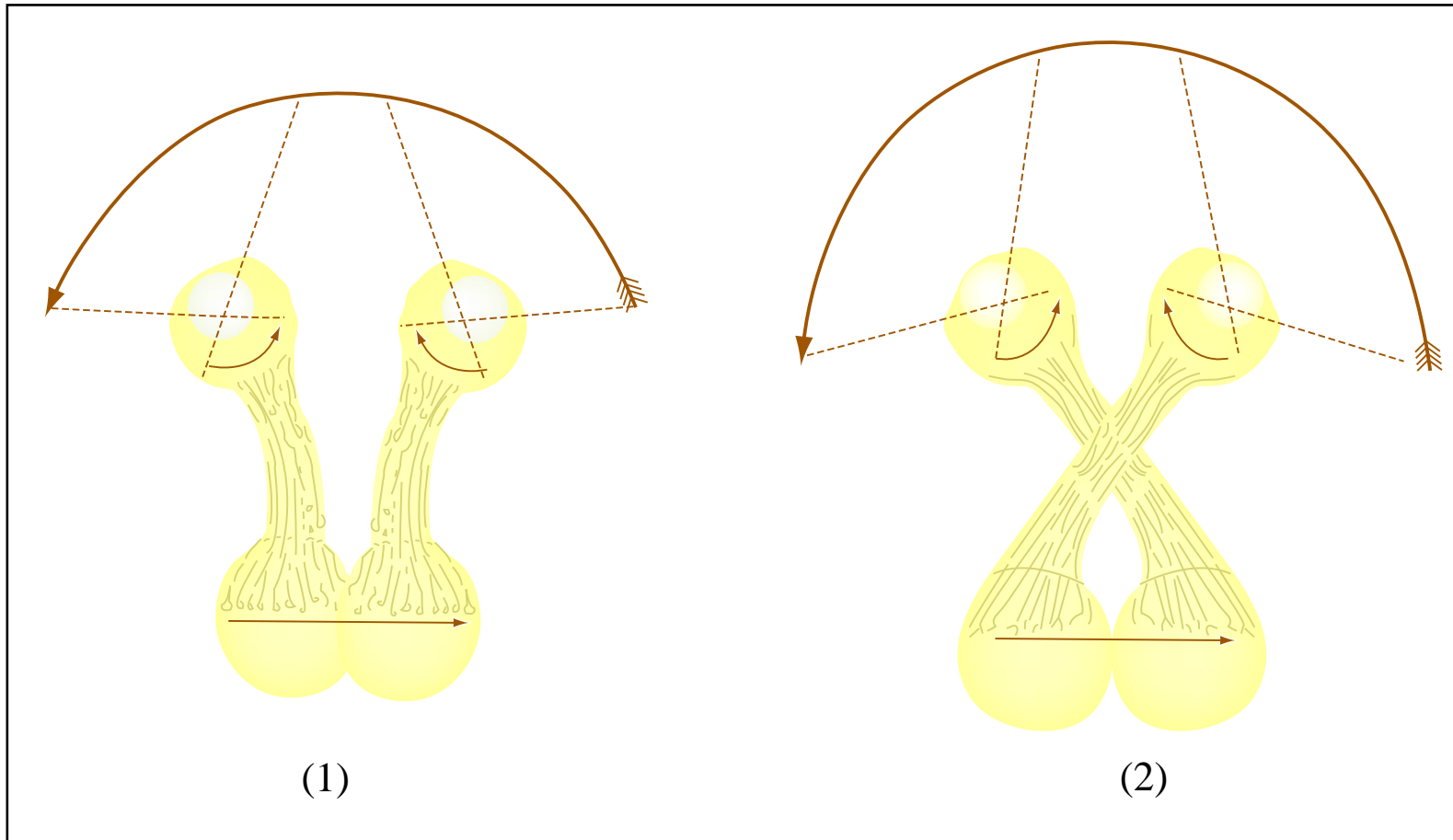
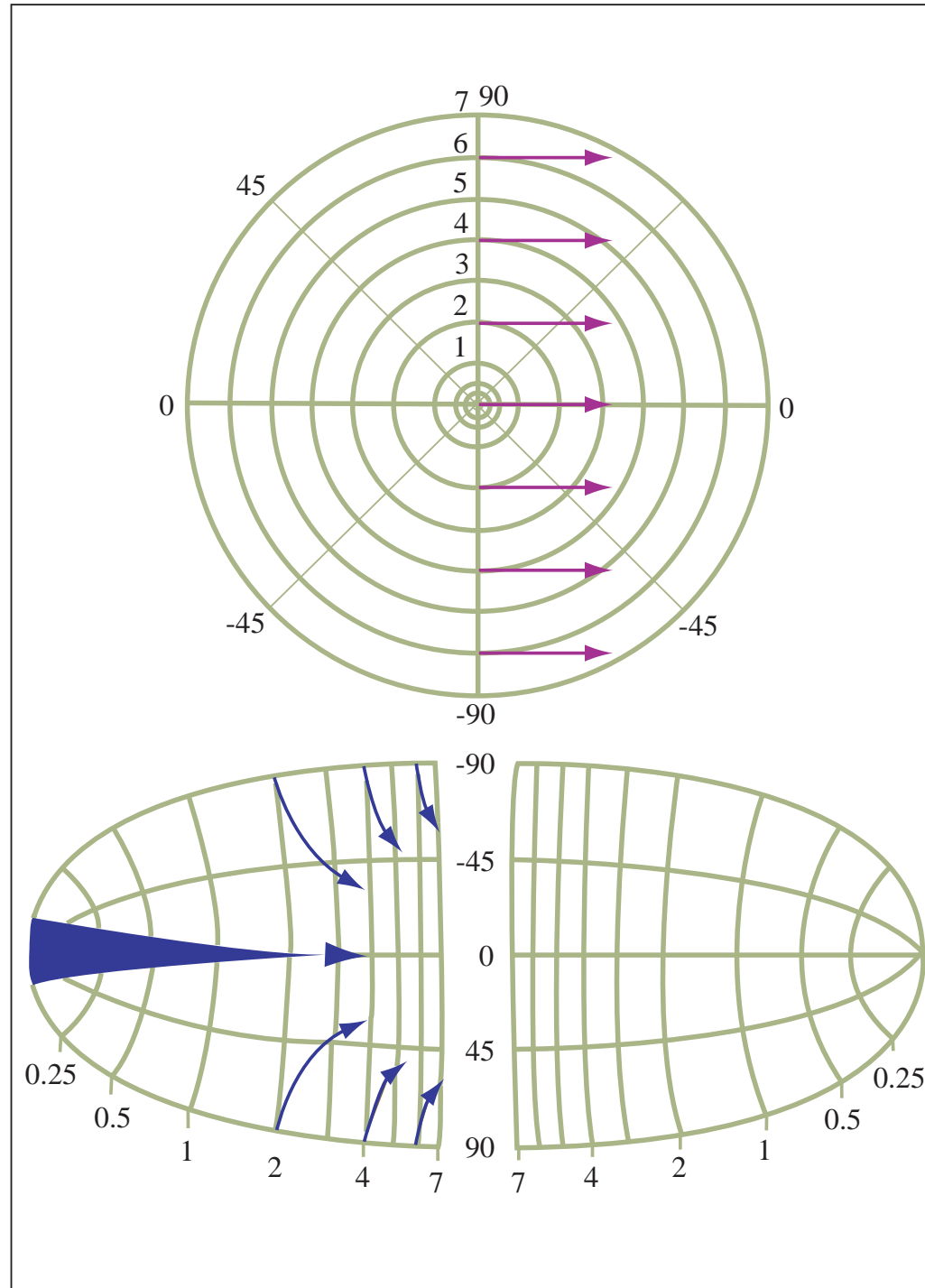


Figure by MIT OCW.

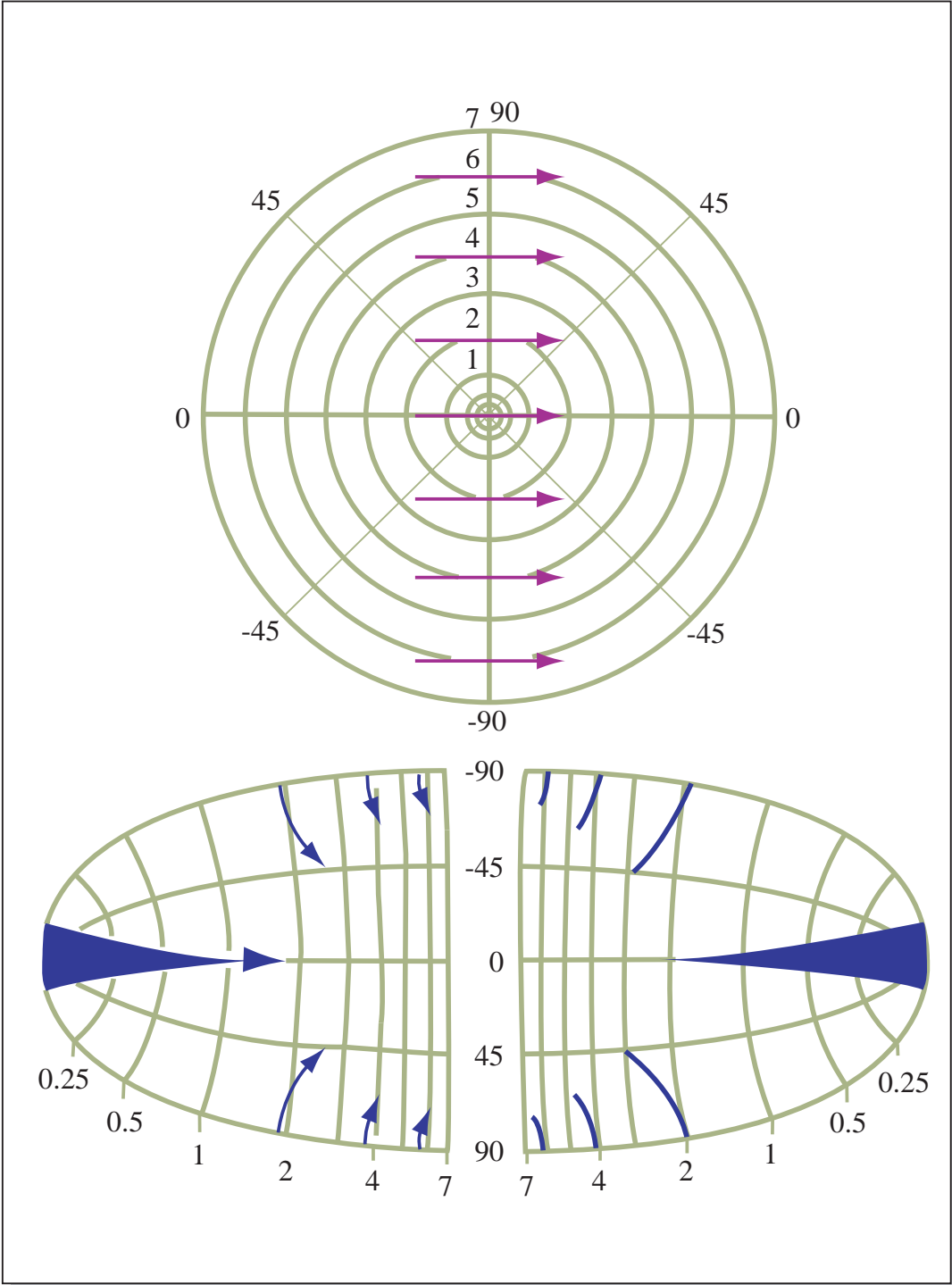
Cortical layout of neurons activated by arrows

monkey



all arrows in
contralateral
hemifield

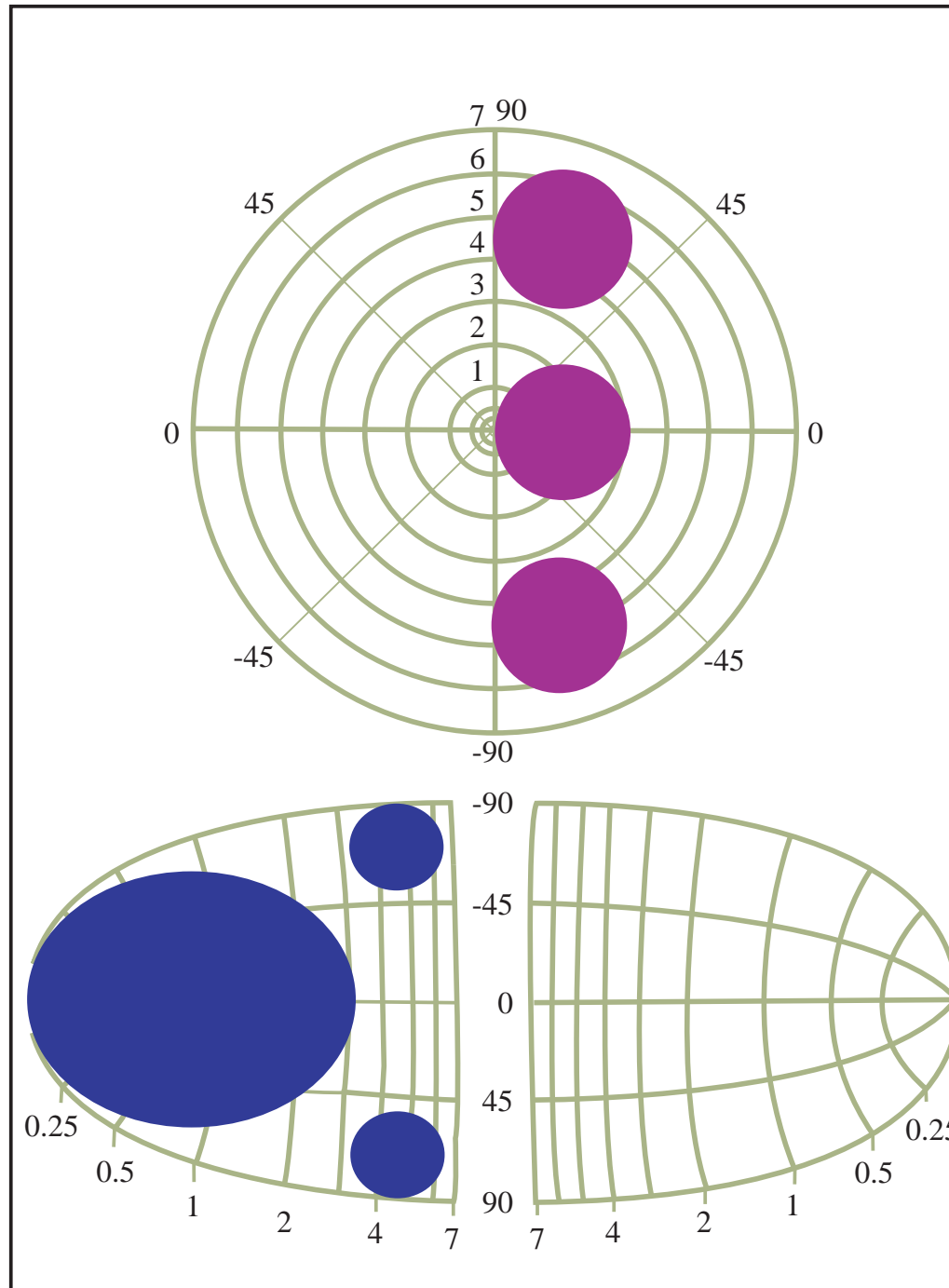
Cortical layout of neurons activated by arrows



arrows across
midline

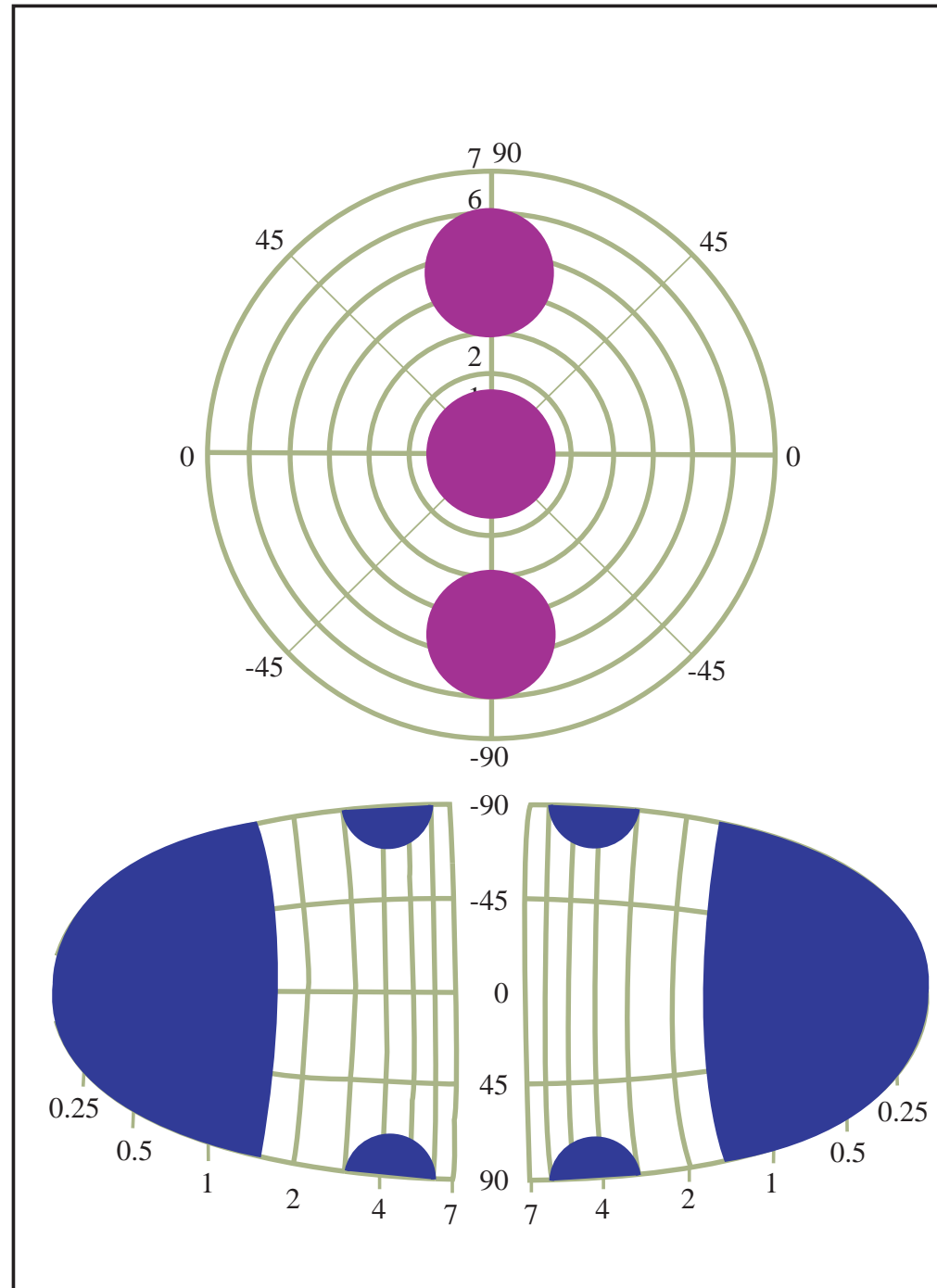
Figure by MIT OCW.

Cortical layout of neurons activated by disks



disks in one
hemifield

Cortical layout of neurons activated by disks



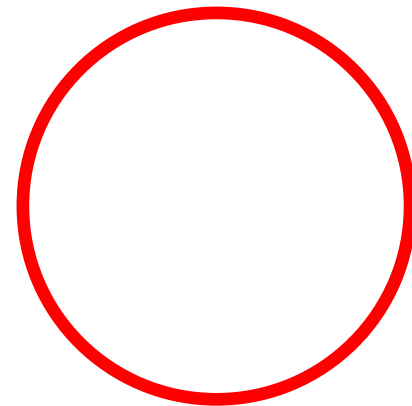
disks across
midline

The Giotto Story:

When Pope Benedict, the 12th, in 13th Century set out to have the walls of the great cathedral of St. Peter redecorated, he sent messengers all over Italy to find out who were the best painters. Specimen were gladly given. When a messenger came to Ambrogio Bondone **Giotto** (1267-1337), he did not provide a sample painting. Instead, he took a sheet of paper and a pencil dipped in red color, and drew a perfect circle. "Here is your drawing," he said. The Pope, upon examining all the productions submitted, chose Giotto without hesitation.

To this day in Tuscany there is the saying:

The round O of Giotto



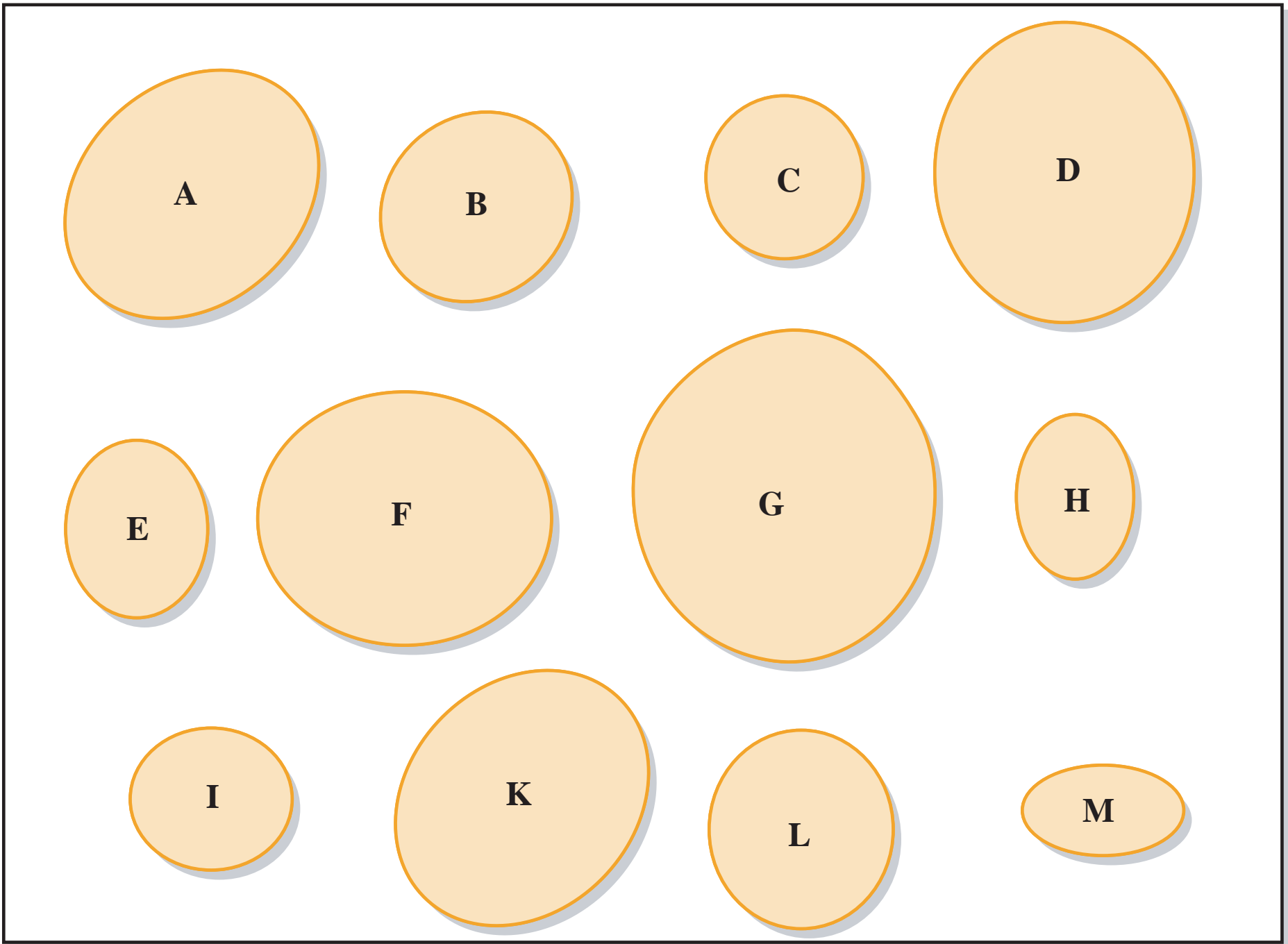


Figure by MIT OCW.

Spatial frequency analysis

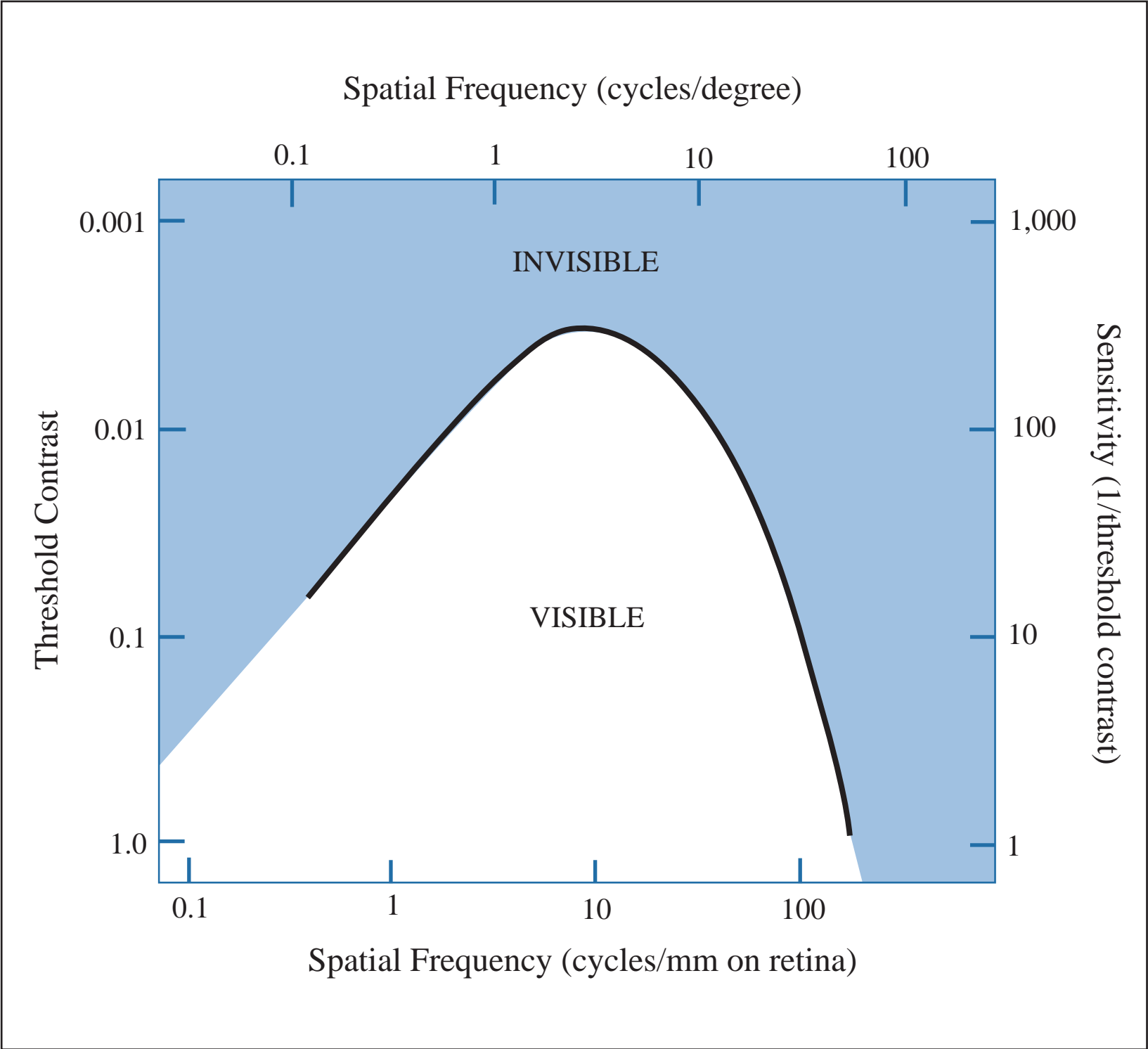
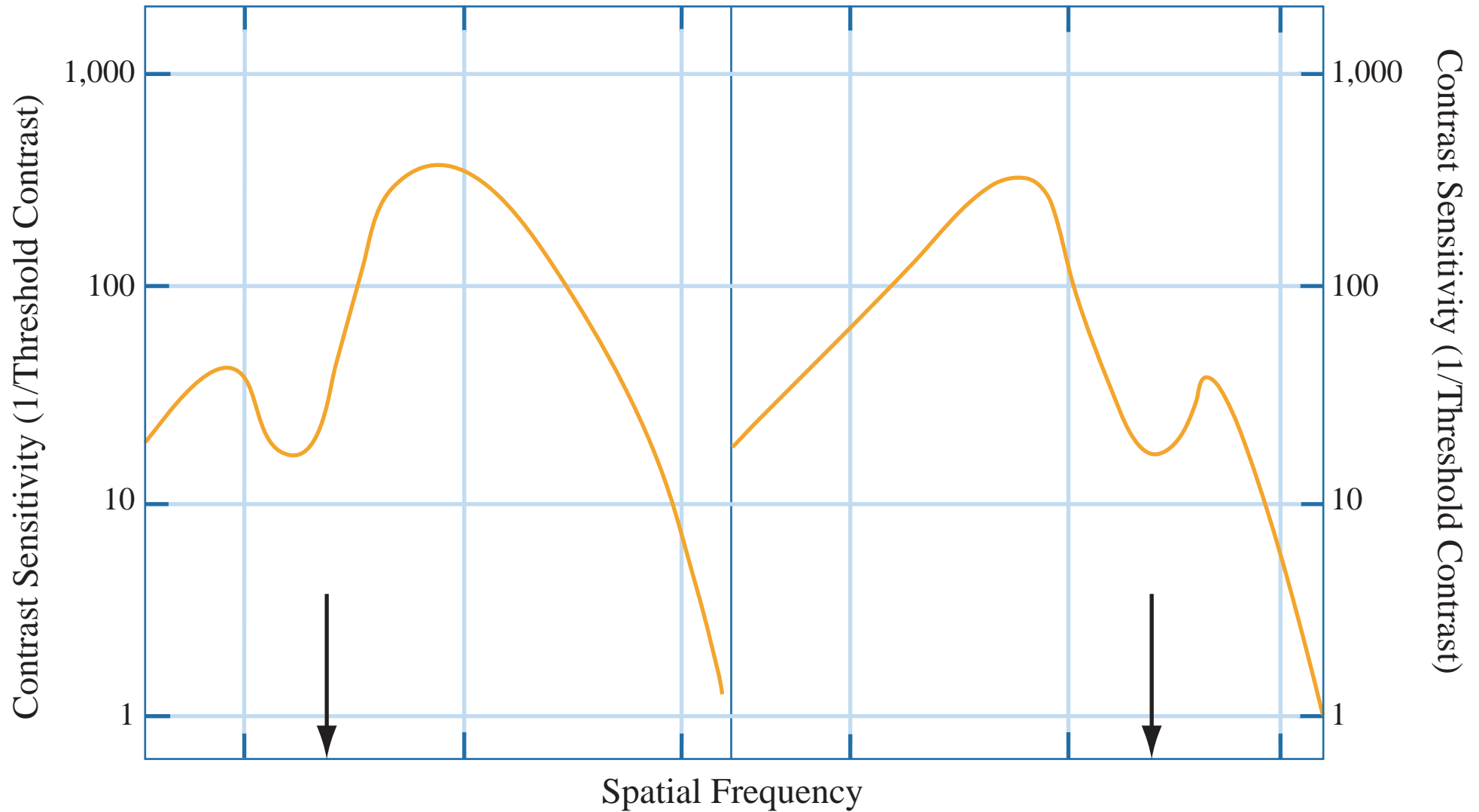


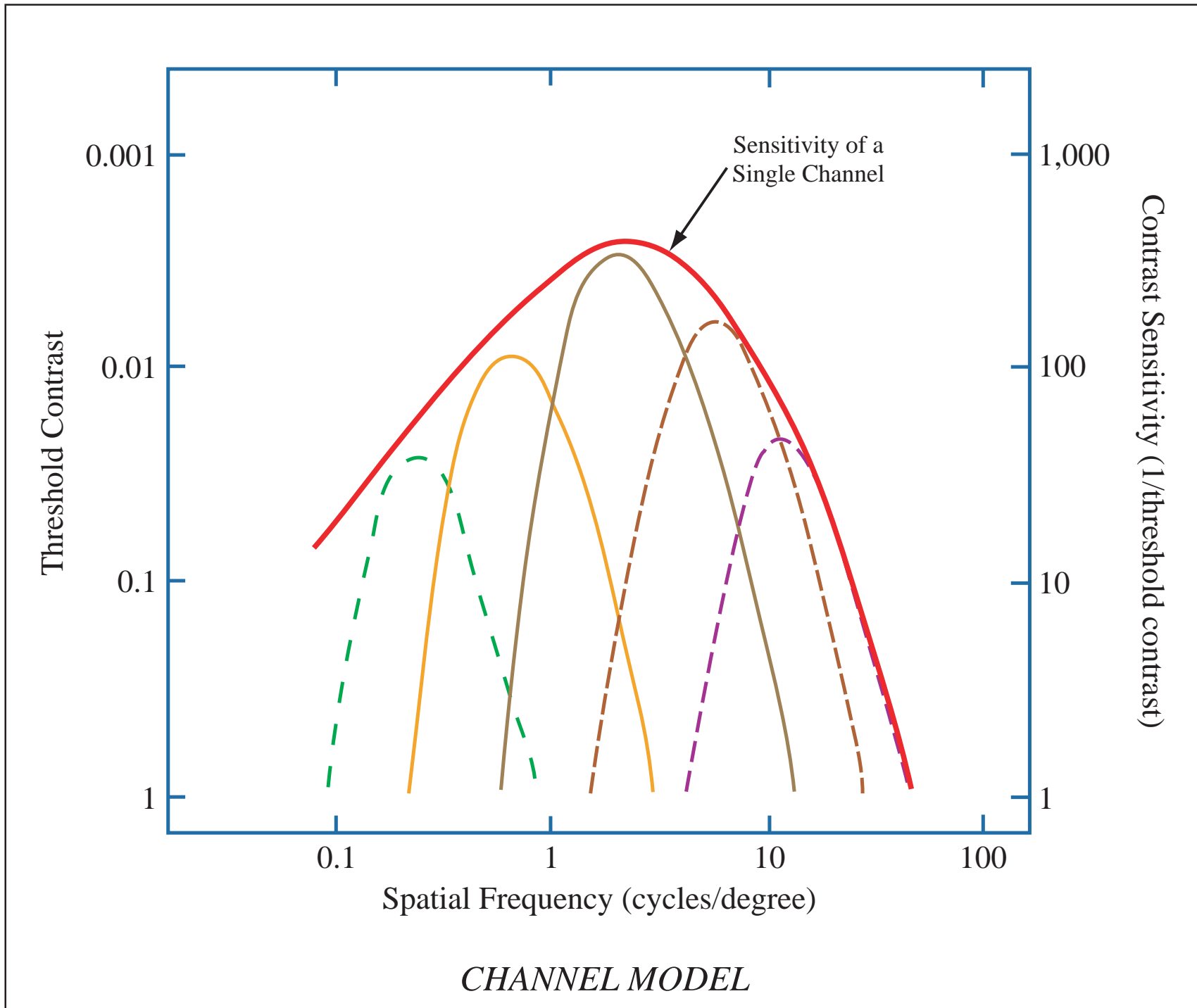
Figure by MIT OCW.

Frequency-specific adaptation



Frequency specific adaptation

Channel model



Shape-selective responses in inferotemporal cortex

IT neuron response to various shapes

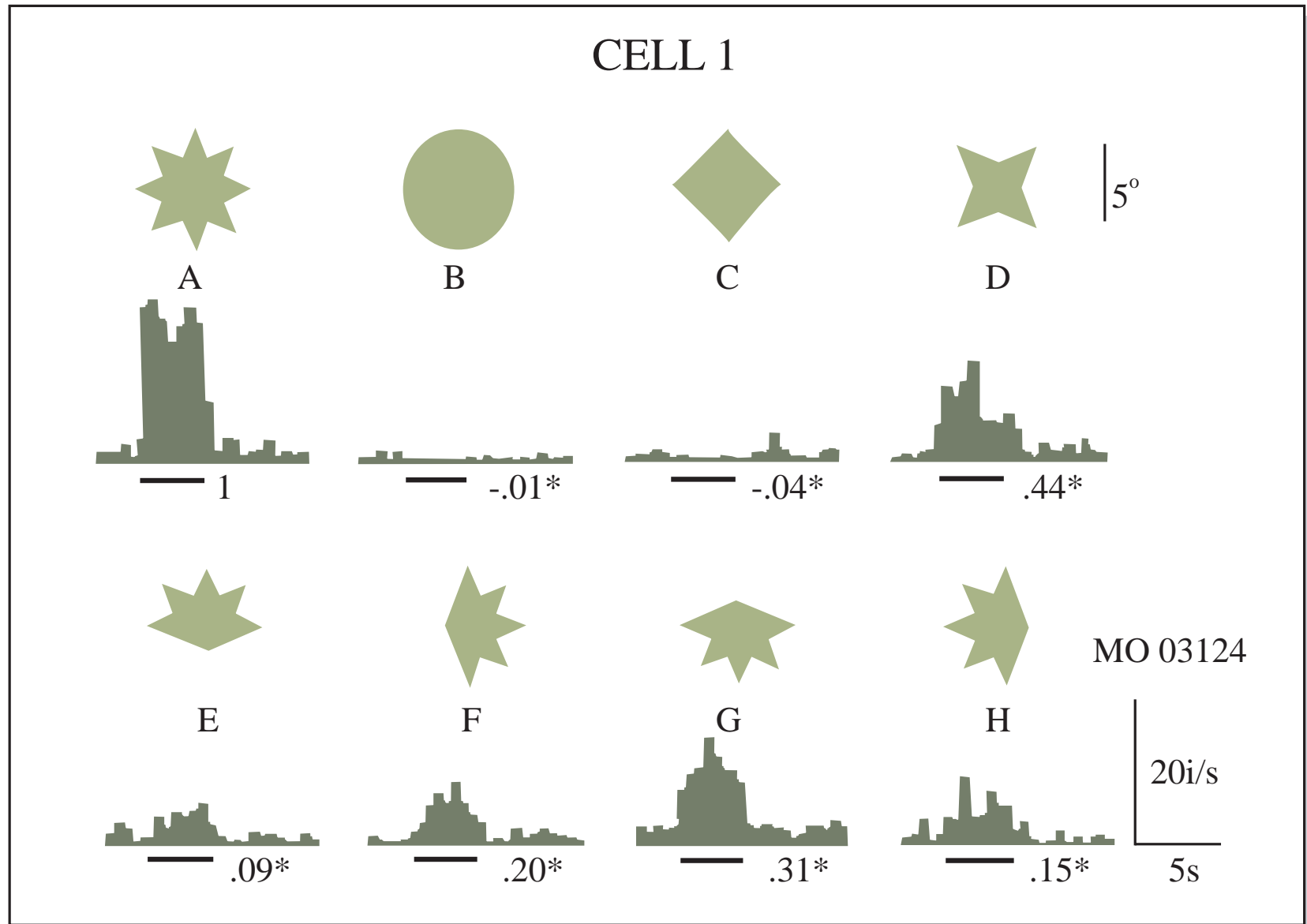
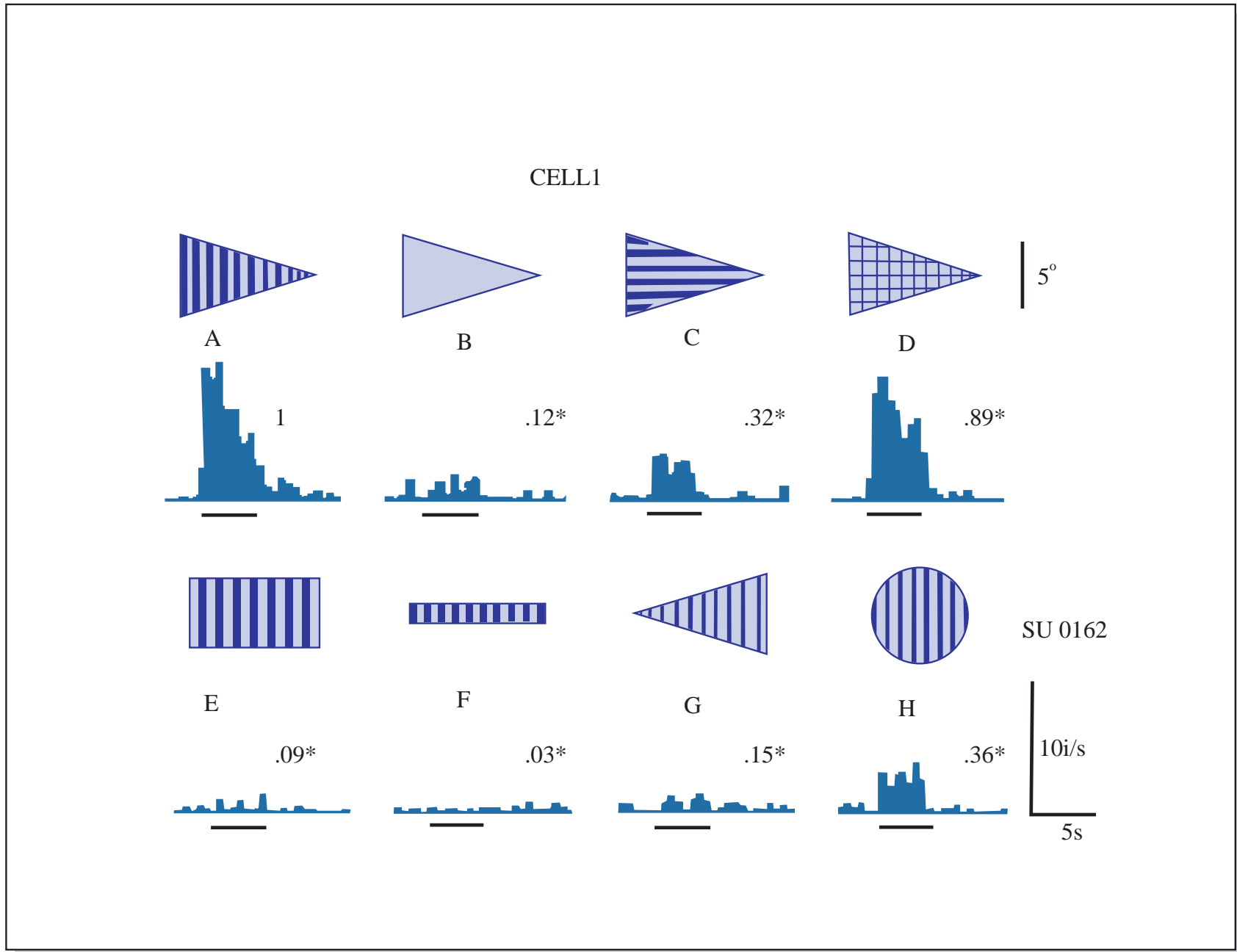


Figure by MIT OCW.

IT neuron response to various shapes



Intermediate level vision

Basic visual capacities

color

brightness

pattern

texture

motion

depth

Intermediate visual capacities

constancy

selection

recognition

transposition

comparison

location

The Art World

Secret Knowledge

by

David Hockney

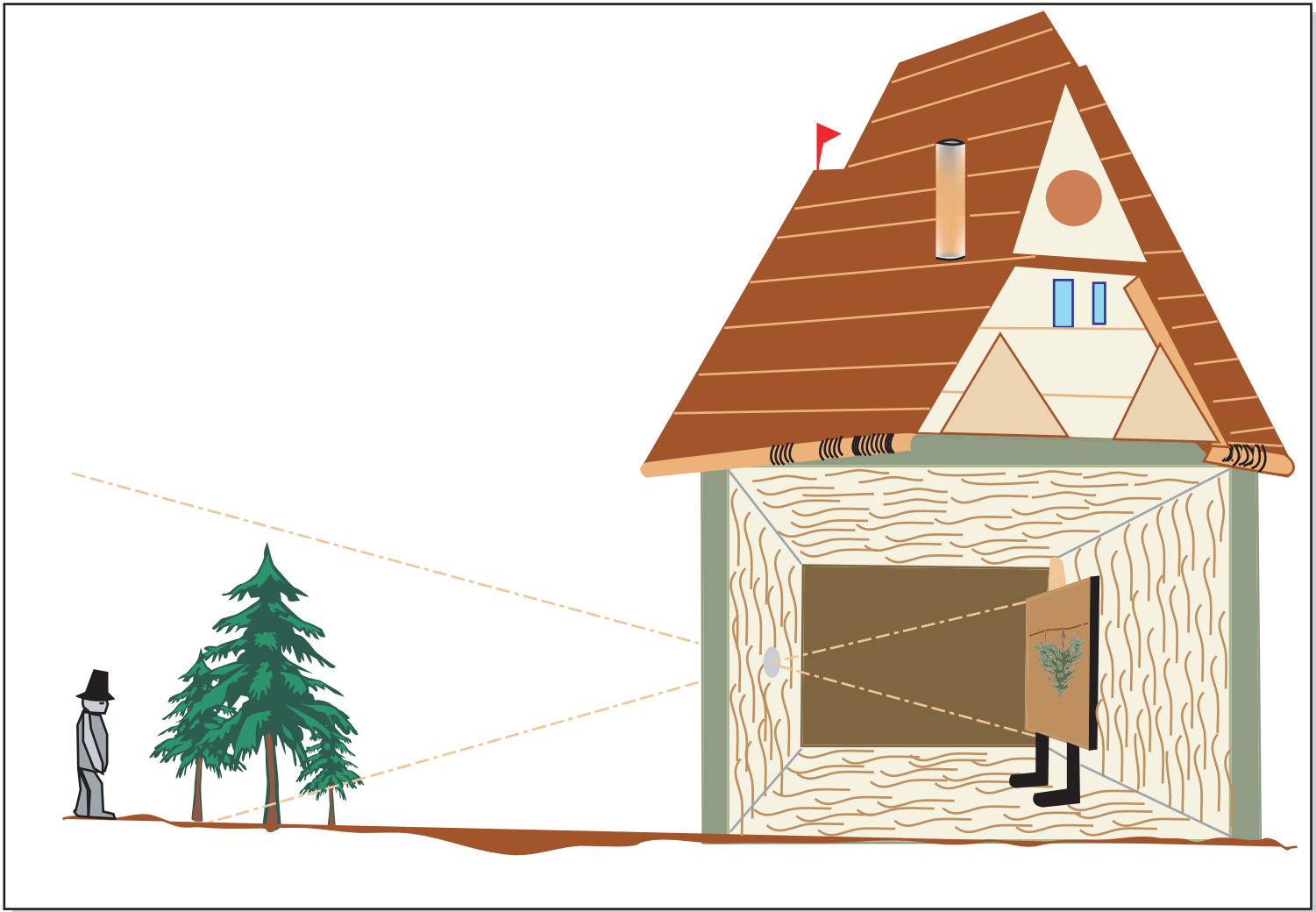
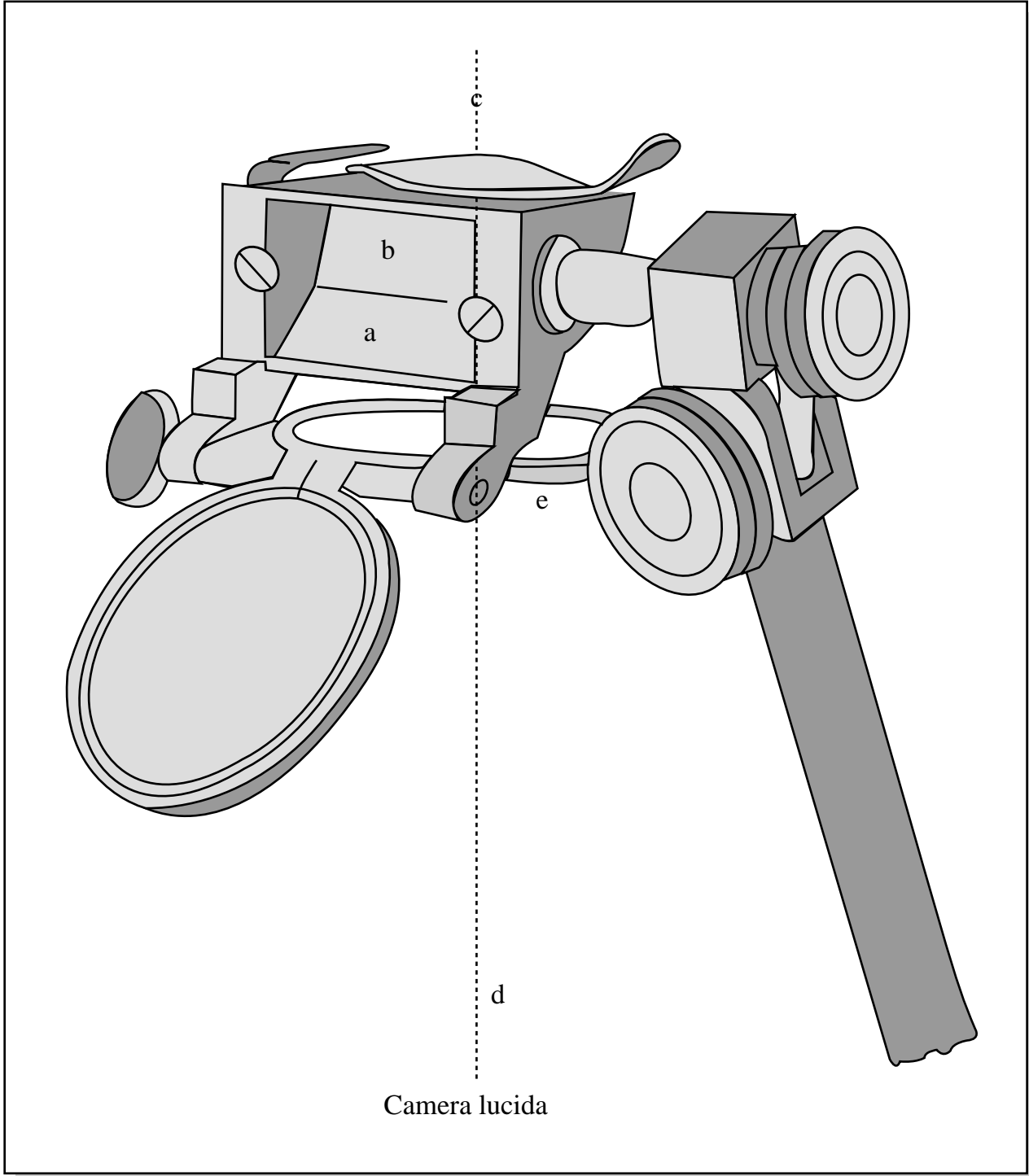


Figure by MIT OCW.

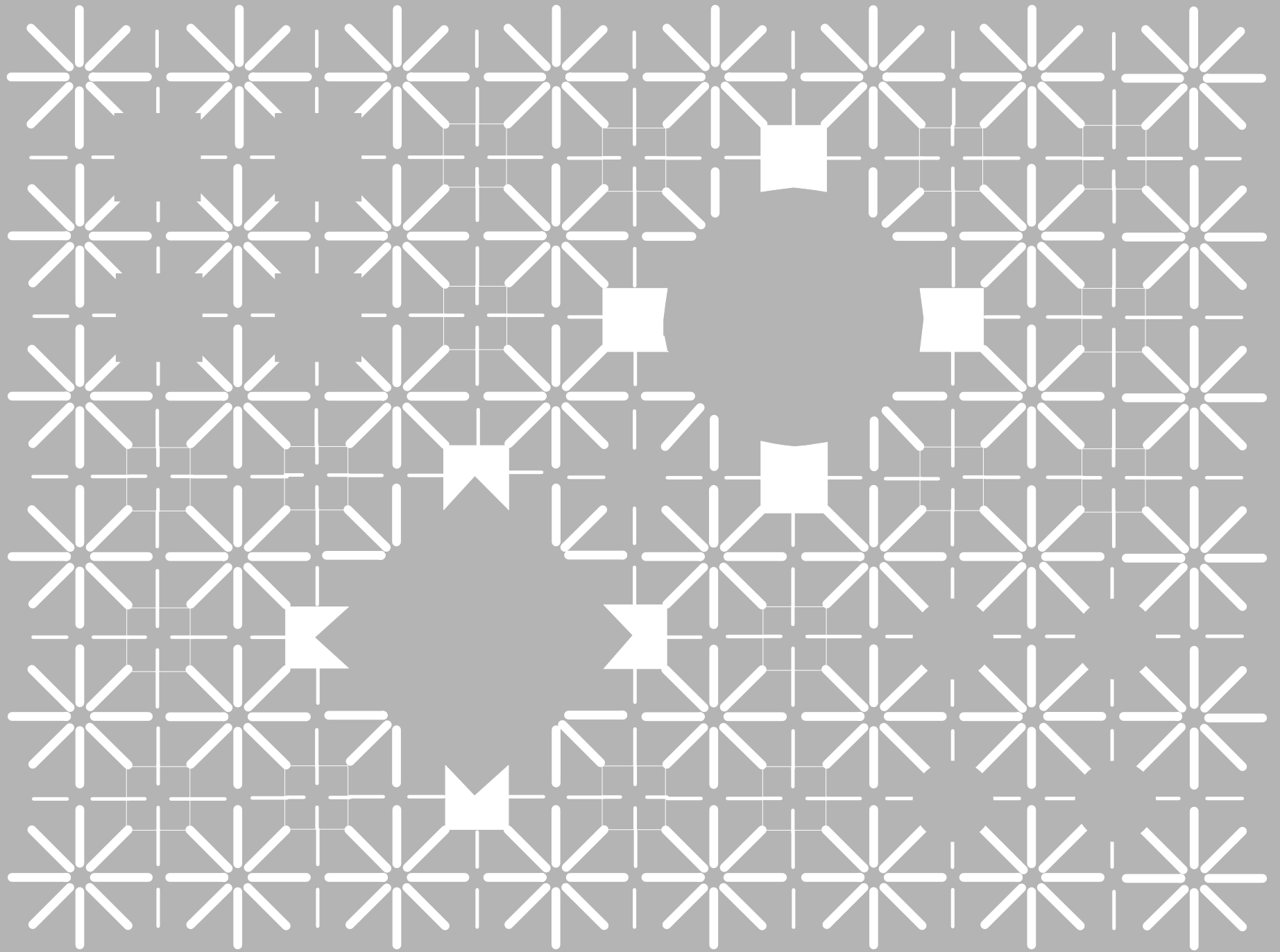
Camera obscura



Camera lucida

Figure by MIT OCW.

The perception of subjective contours



Subjective contours at isoluminance

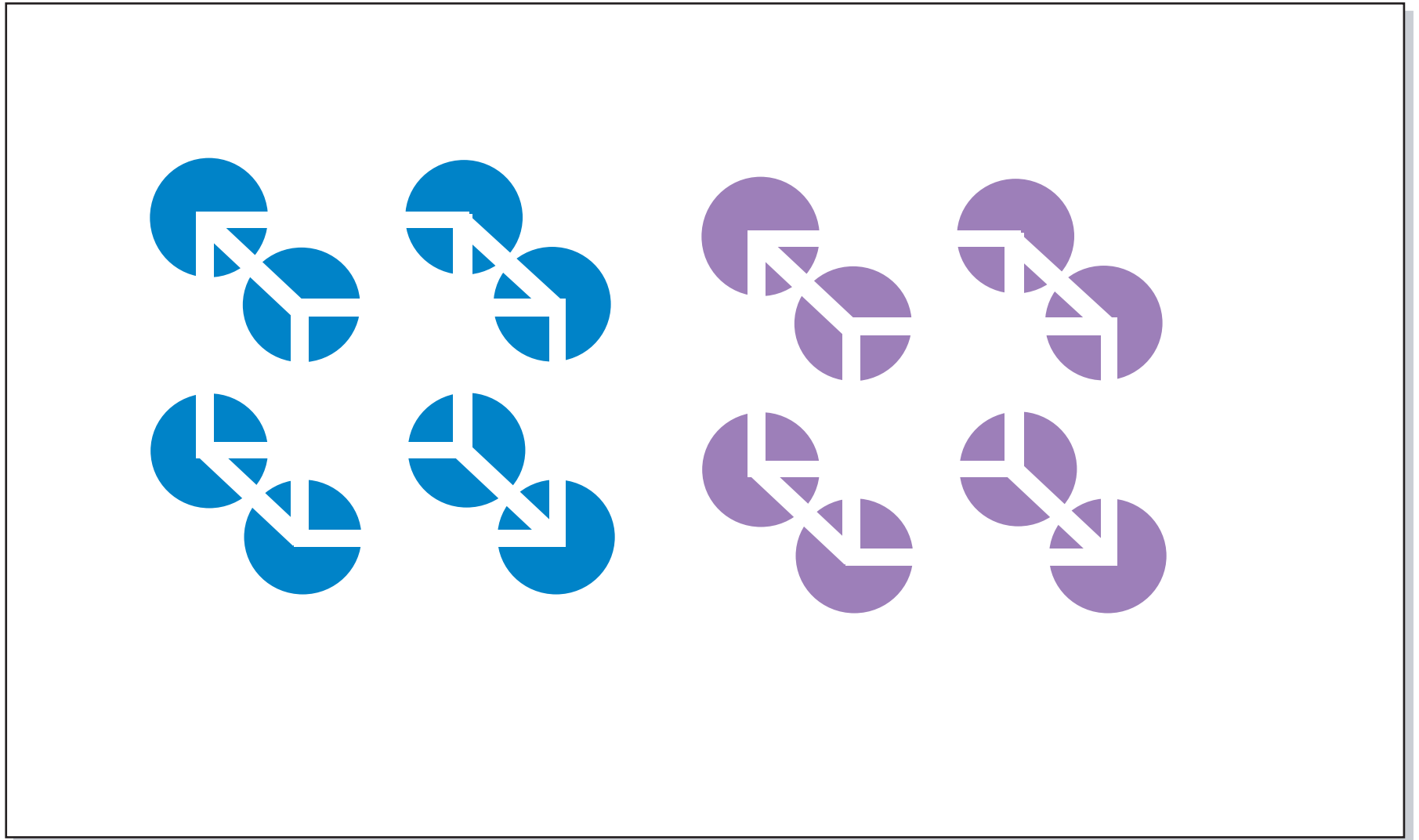


Figure by MIT OCW.

Response to subjective contours in V2

UNIT 3GD5

27.7



4.6

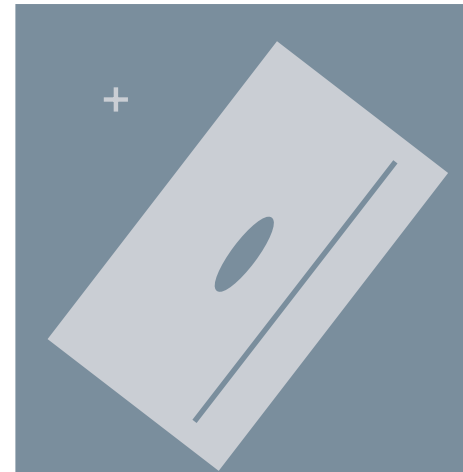


0.7

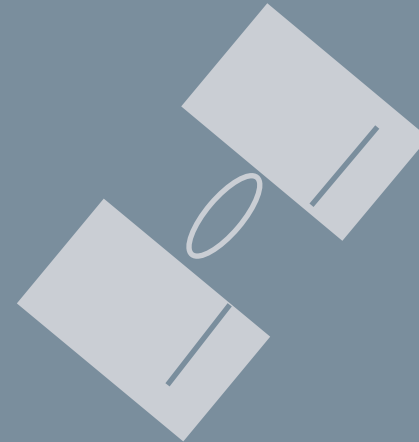


2° (0.5 sec)

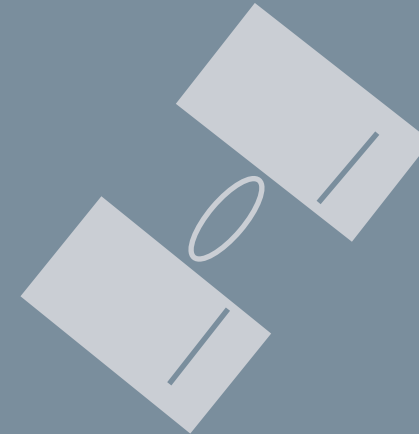
A



B

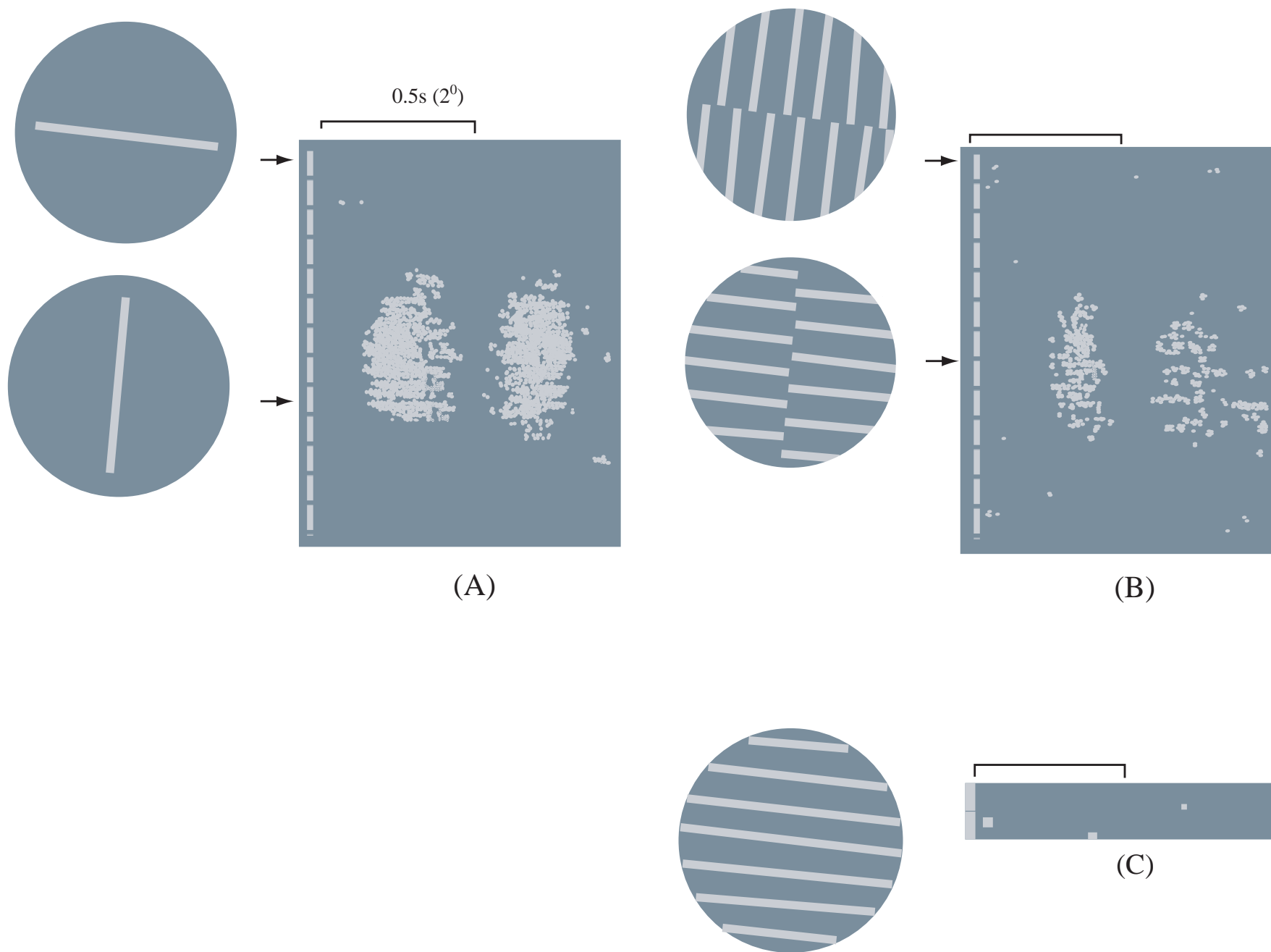


C



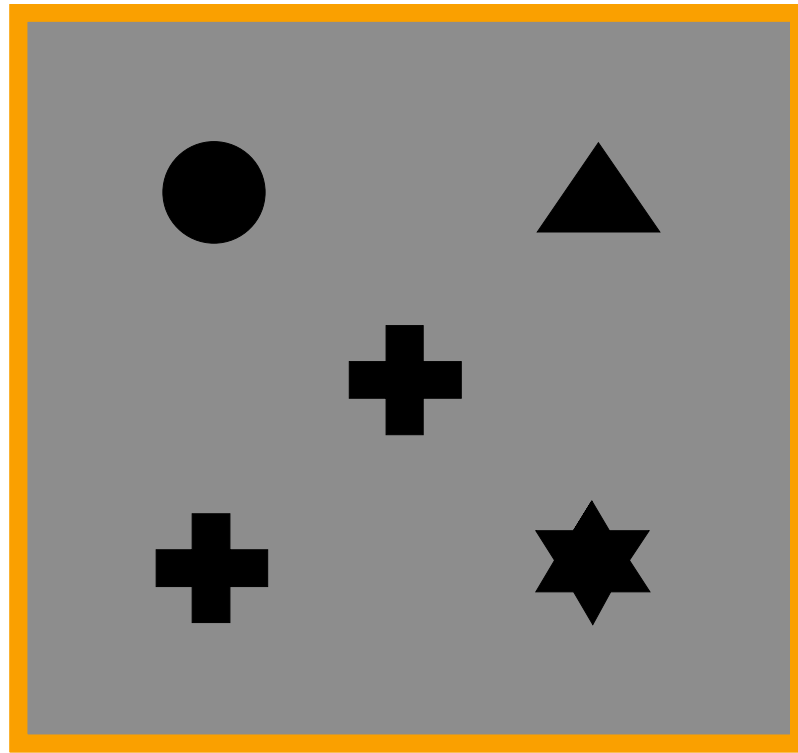
1°

Response to subjective contours in V2

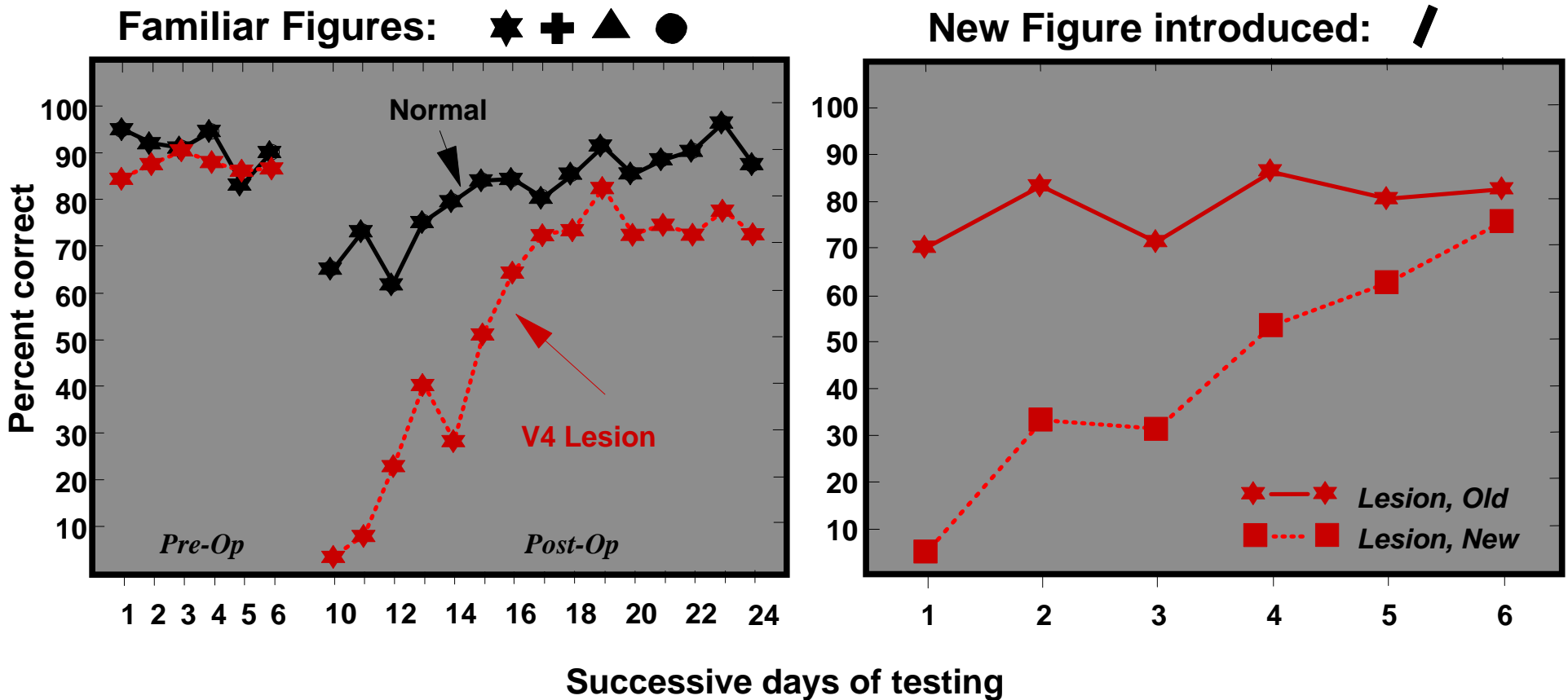


The effects of V4 and MT lesions on intermediate vision

Match to sample task

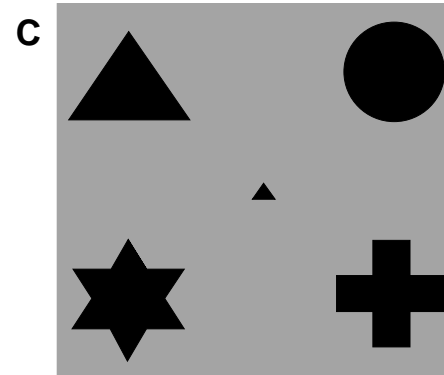
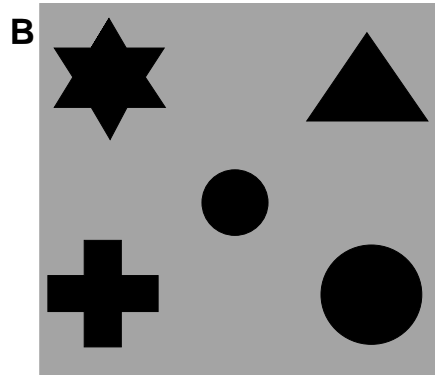
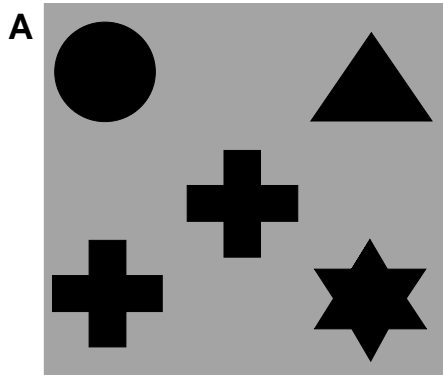


The effect of V4 lesions on object matching

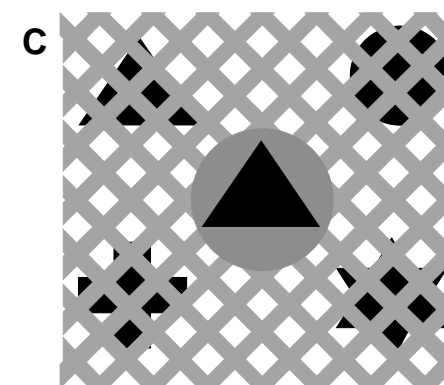
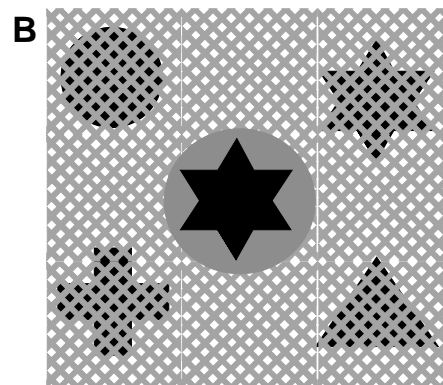
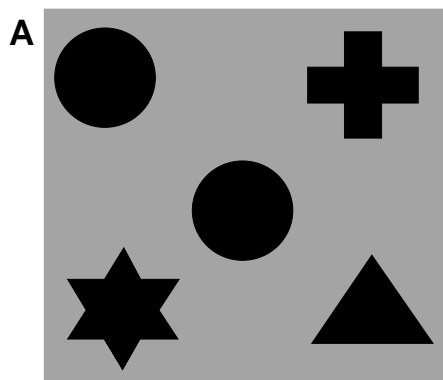


Intermediate vision tasks

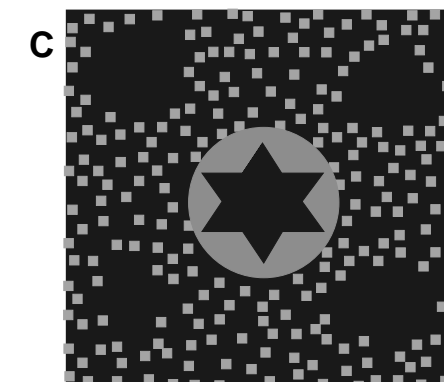
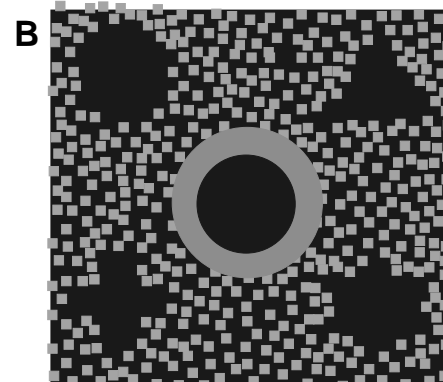
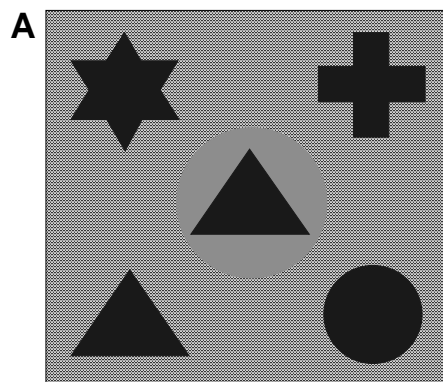
SIZE



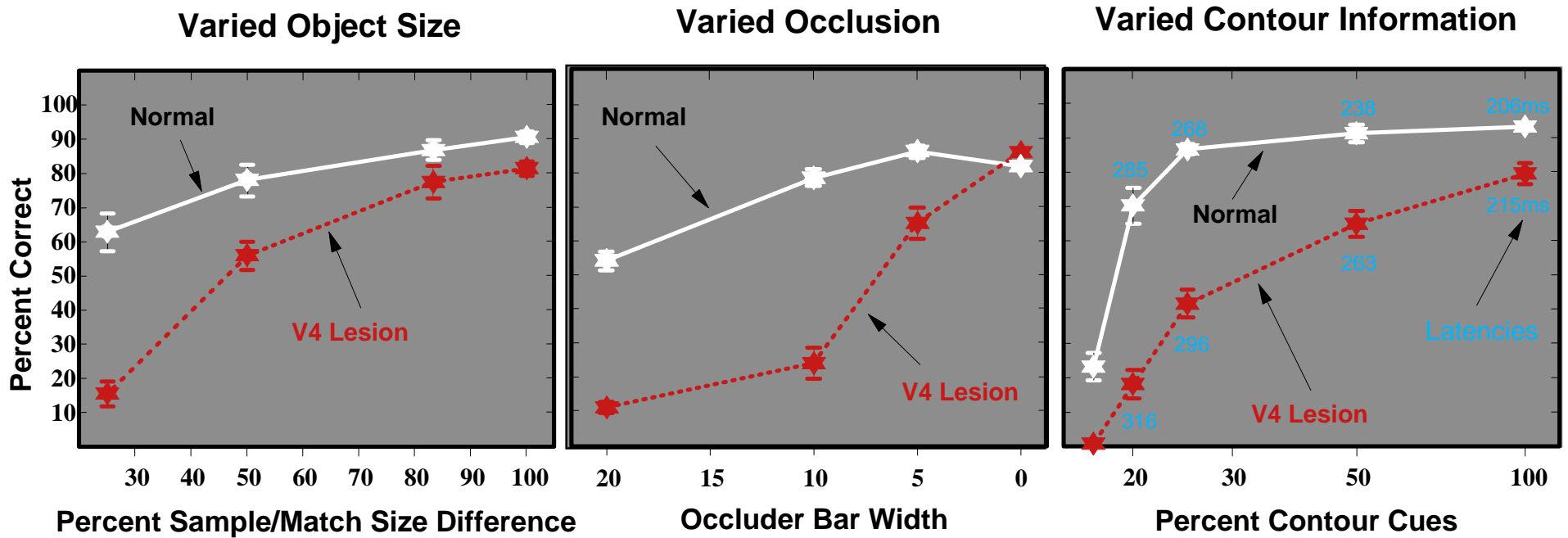
OCCCLUSION



CONTOUR

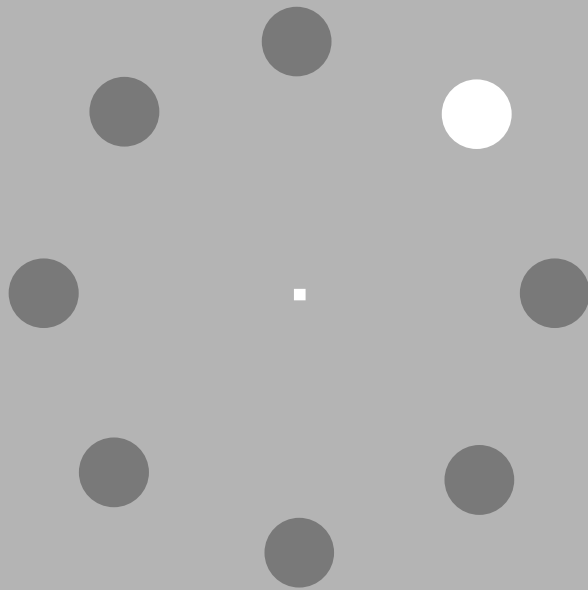


The effect of V4 lesions on object transformations

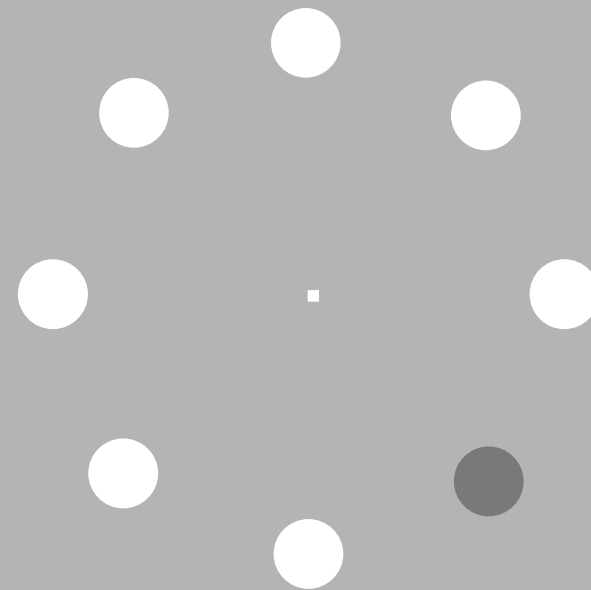


Greater and lesser brightness discrimination

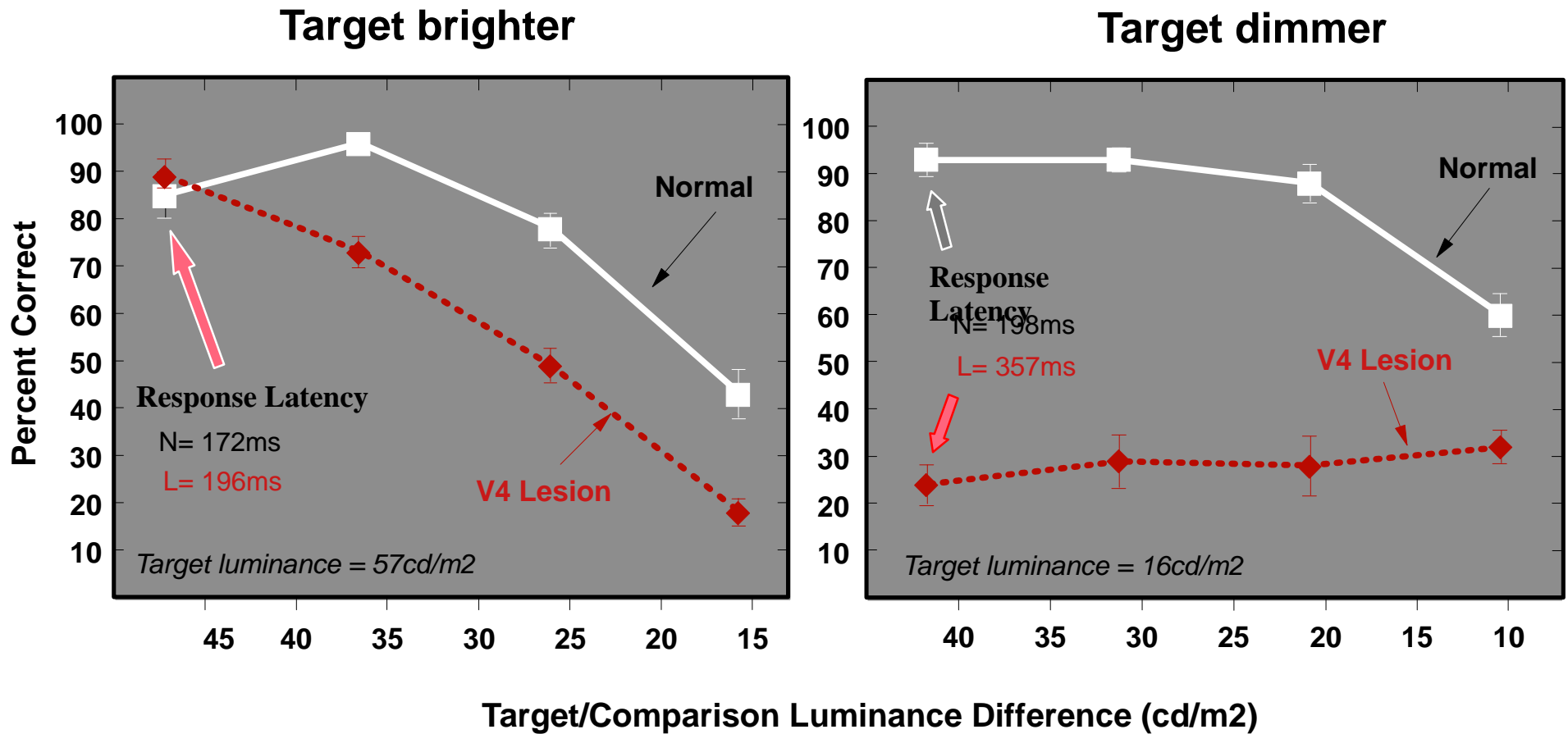
Target Brighter



Target Dimmer

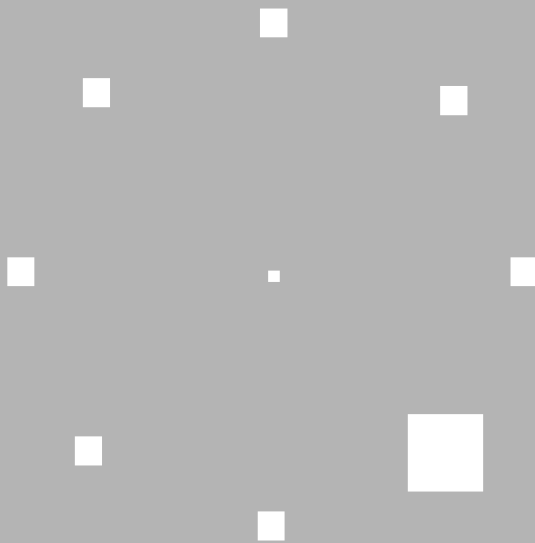


Brightness discrimination, greater and lesser targets

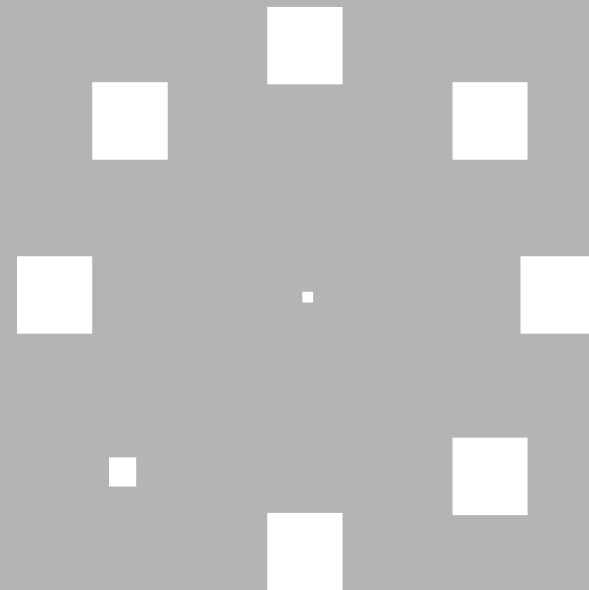


Greater and lesser size discrimination

Target Larger

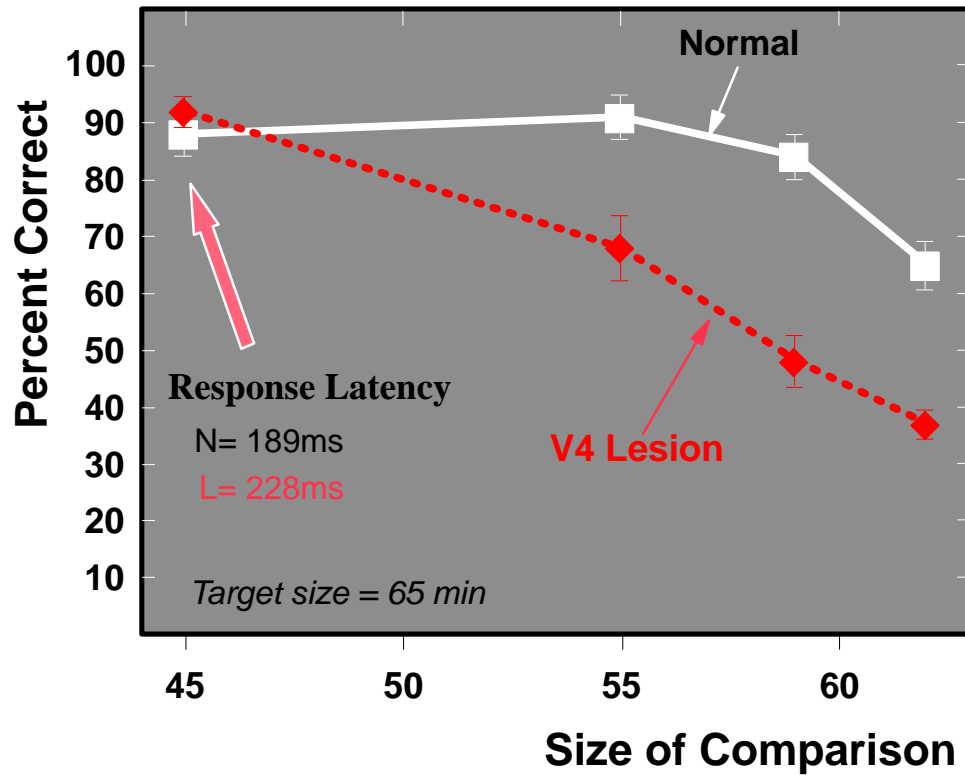


Target Smaller

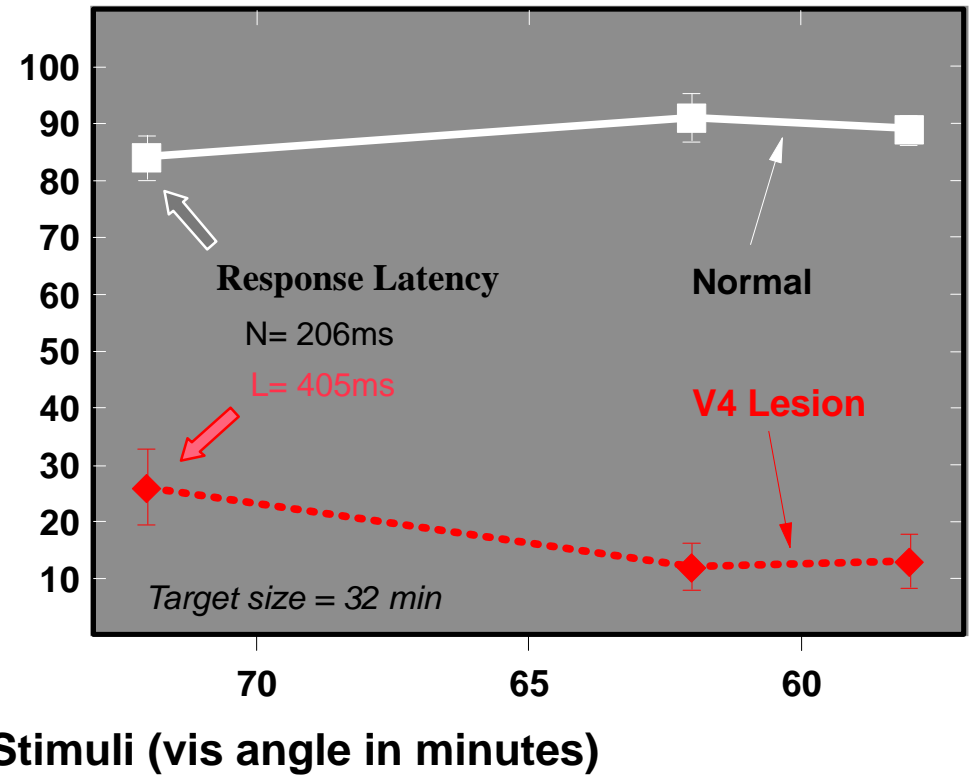


Size discrimination, greater and lesser targets

Target larger



Target smaller



Summary, form:

1. Three theories of form processing in the brain are (a) analysis by orientation of line segments, (b) spatial mapping onto a topographically organized brain region and (c) Fourier analysis.
2. Areas V2, V4 and IT play important roles in intermediate vision.
3. Neurons responding to subjective contours have been found in V2.
4. Recognition of objects transformed in various ways is compromised by lesions. V4 lesions also produce major deficits in visual learning and in selecting "lesser" stimuli.
5. Some IT neurons are selective for objects including faces, but most respond to a variety of objects whose recognition is based on the differential activity of a great many neurons.
6. How we process and deal with ambiguities in perception remains a mystery