Form perception

Gestalt ideas of form perception

Objects close together tend to unite perceptually into groups

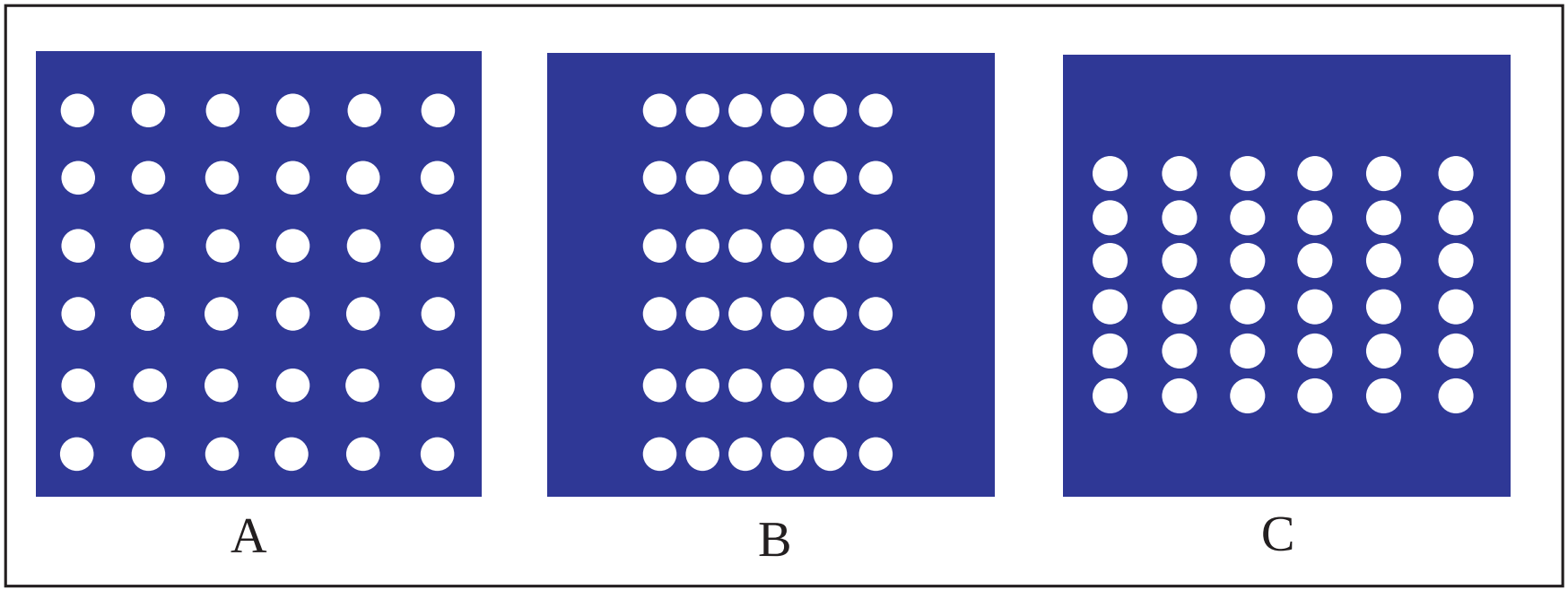


Figure by MIT OCW.

Objects similar in shape and size tend to group together

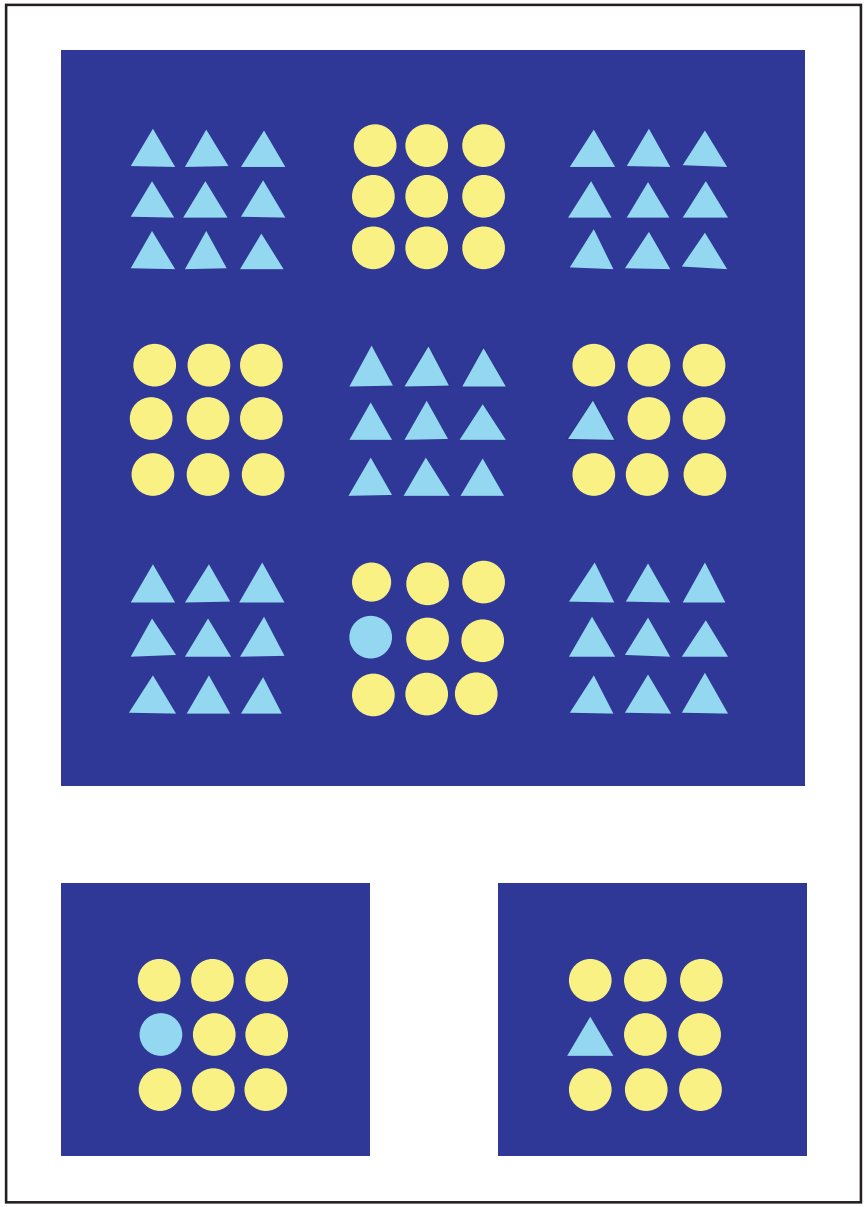


Figure by MIT OCW.

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 segmens 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

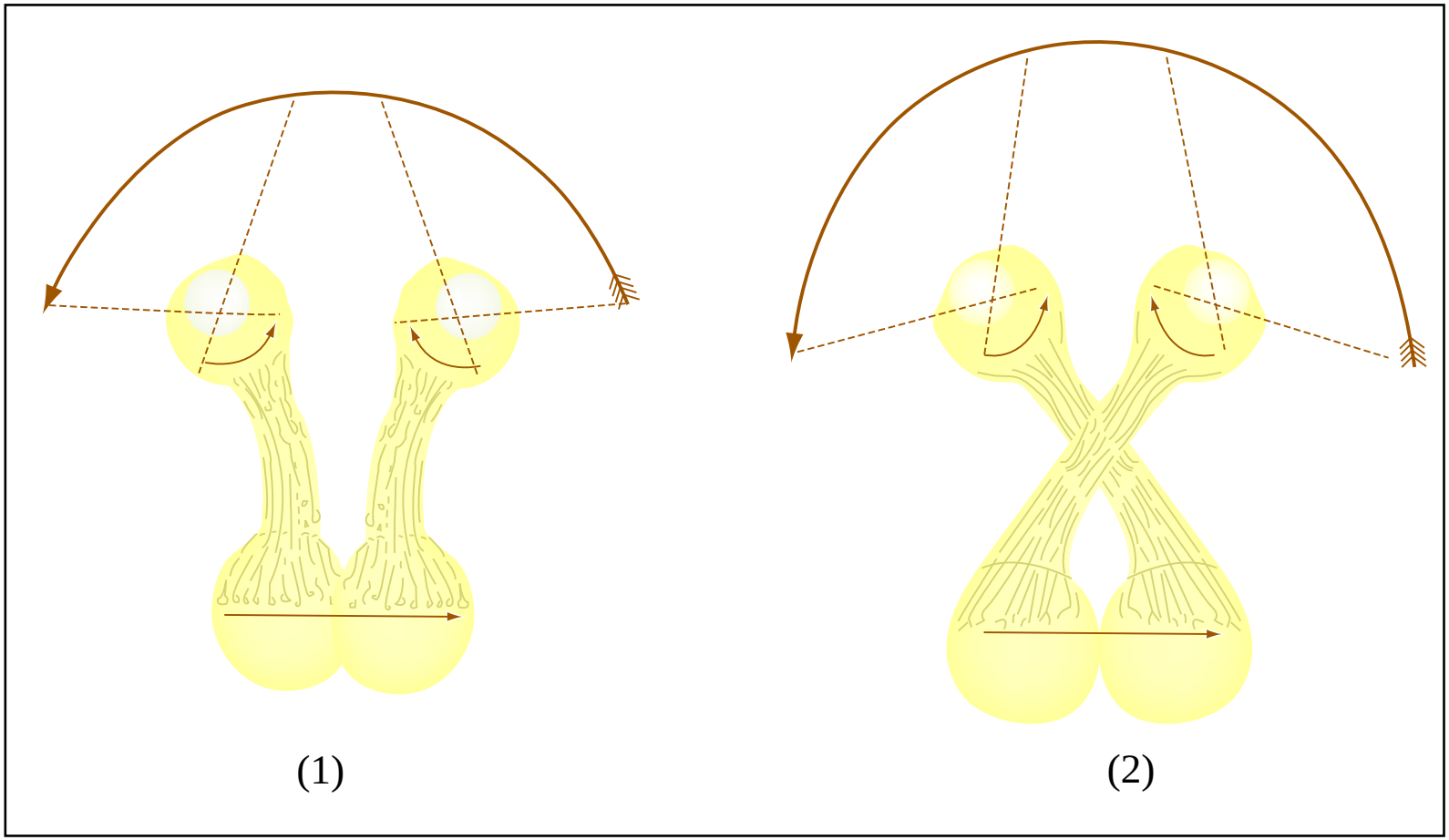
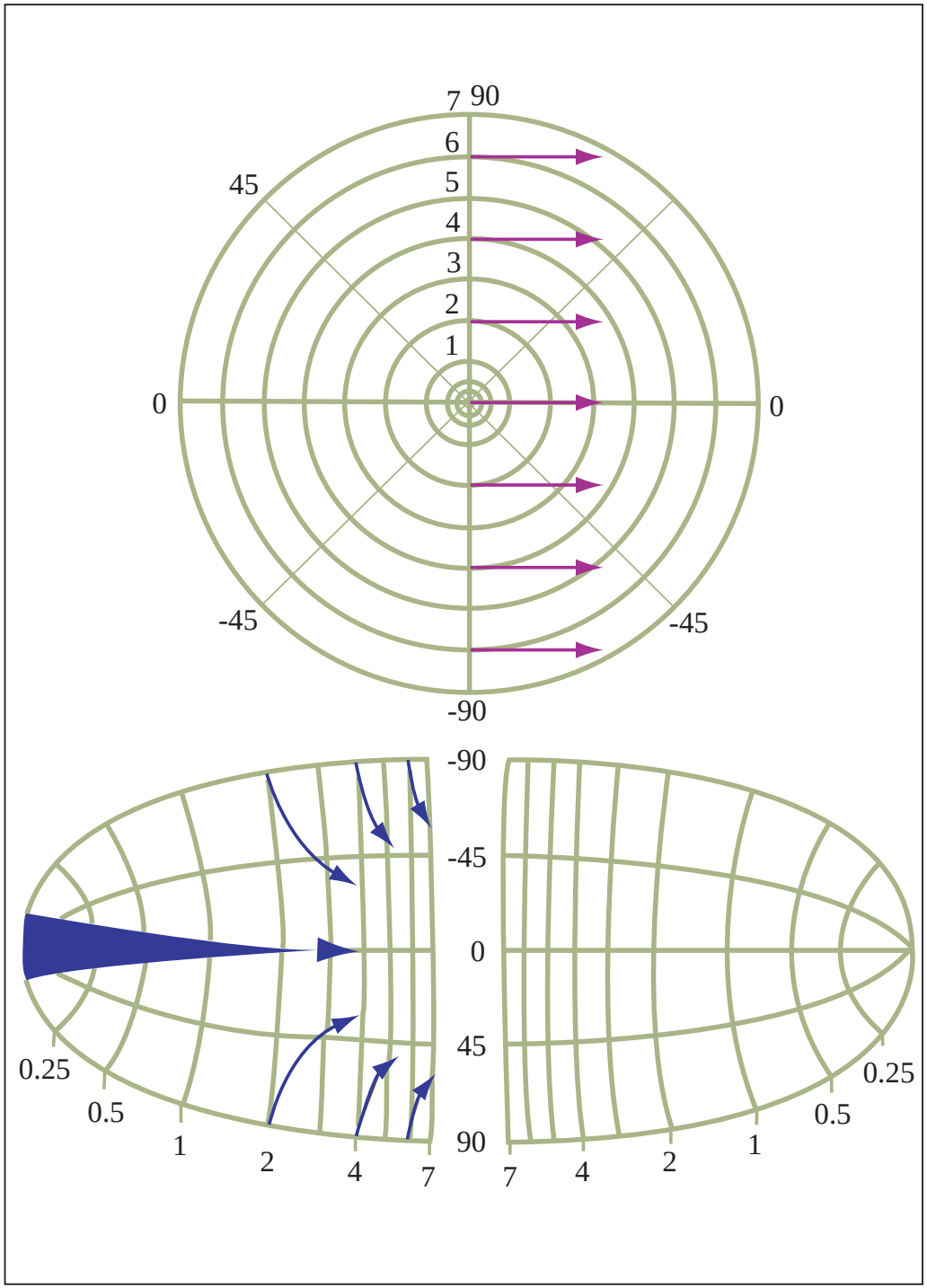


Figure by MIT OCW.

Cortical layout of neurons activated by arrows

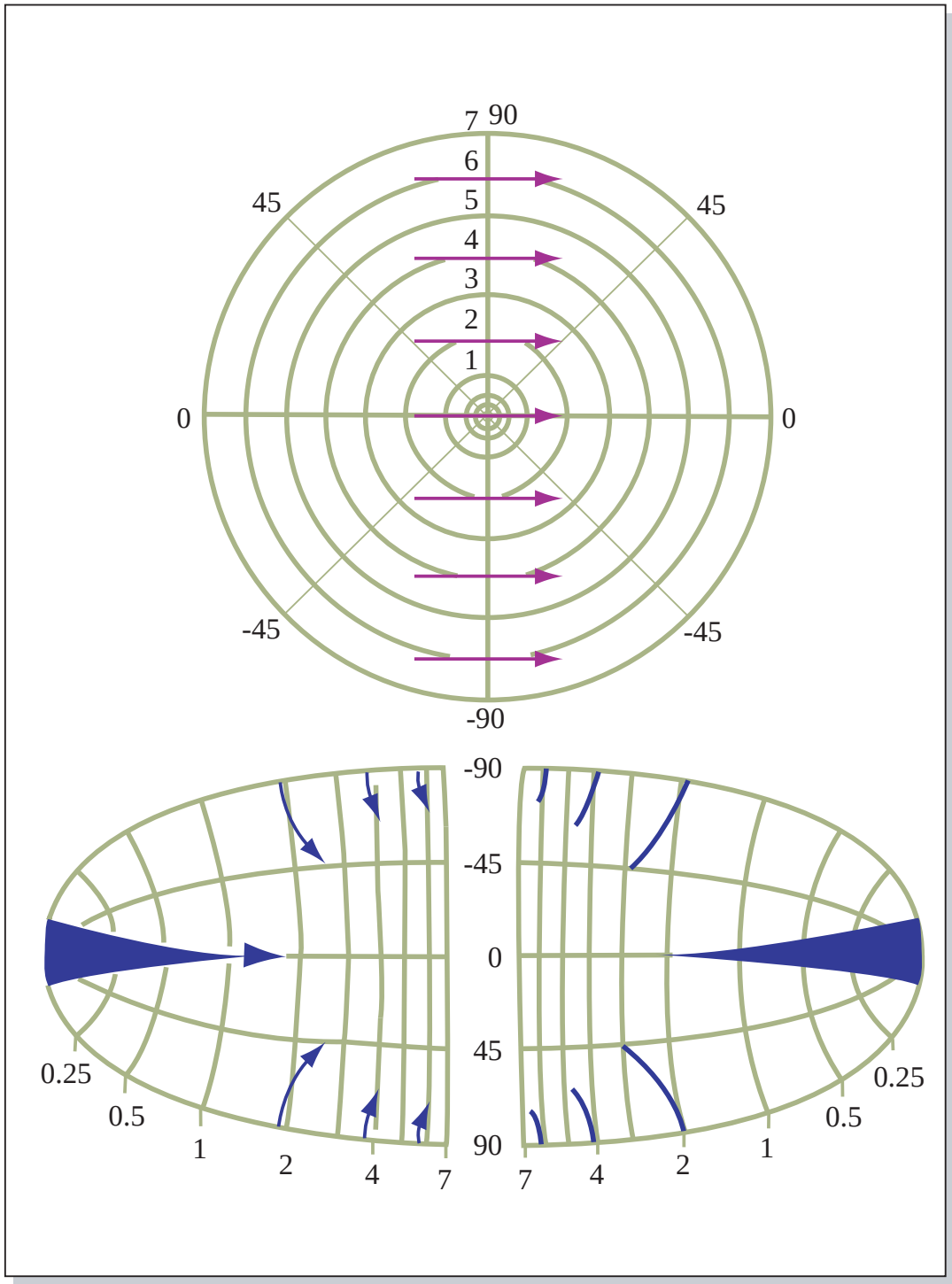
monkey



all arrows in contralateral hemifiel

Figure by MIT OCW.

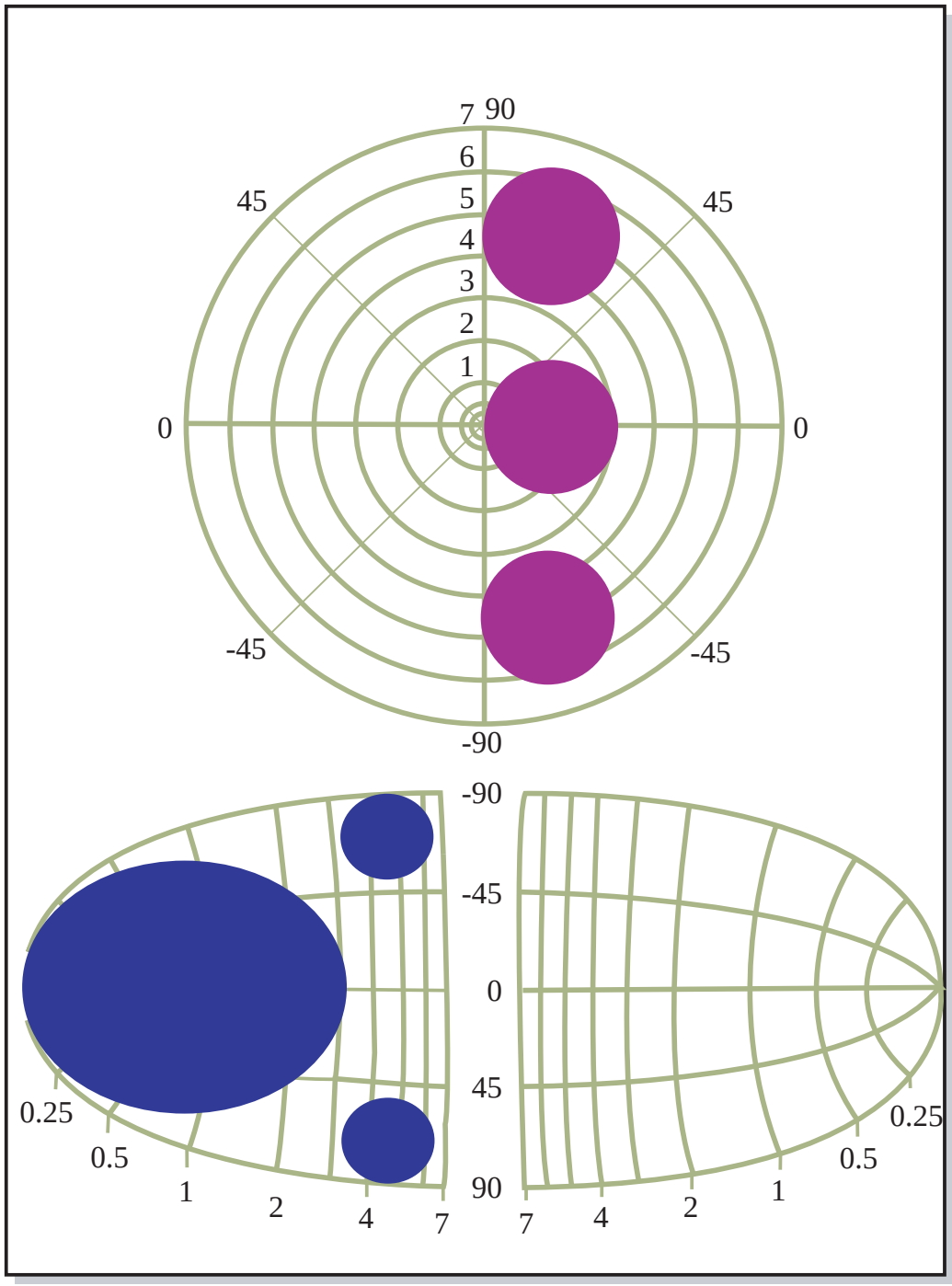
Cortical layout of neurons activated by arrows



arrows across midline

Figure by MIT OCW.

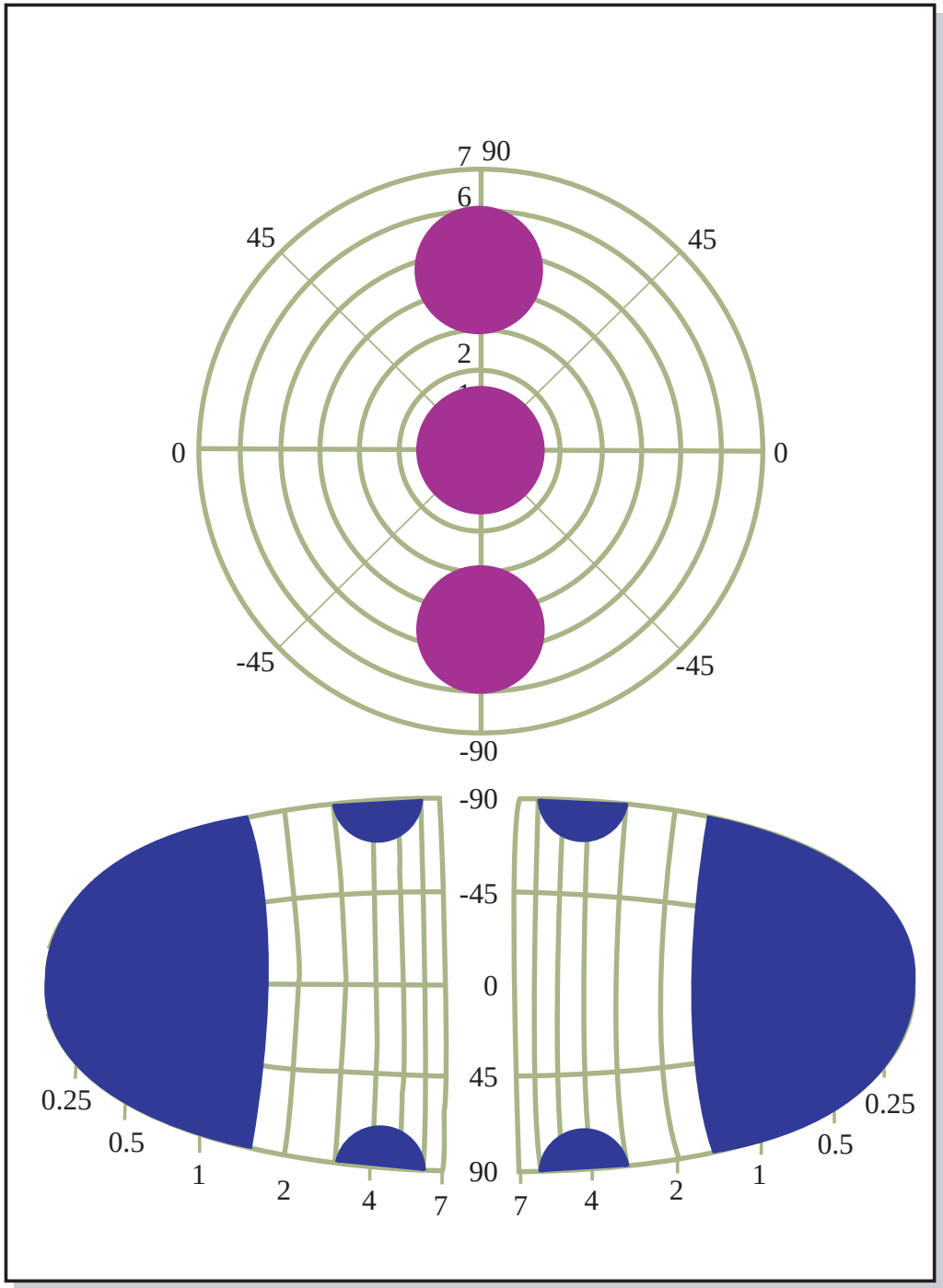
Cortical layout of neurons activated by disks



disks in one hemifield

Figure by MIT OCW.

Cortical layout of neurons activated by disks



disks across midline

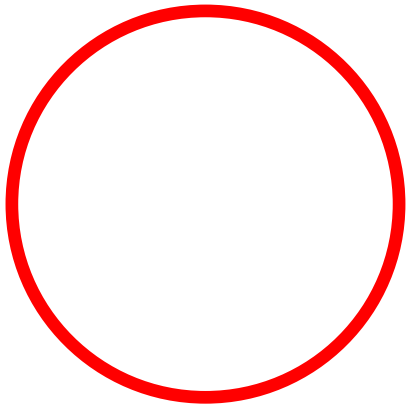
Figure by MIT OCW.

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



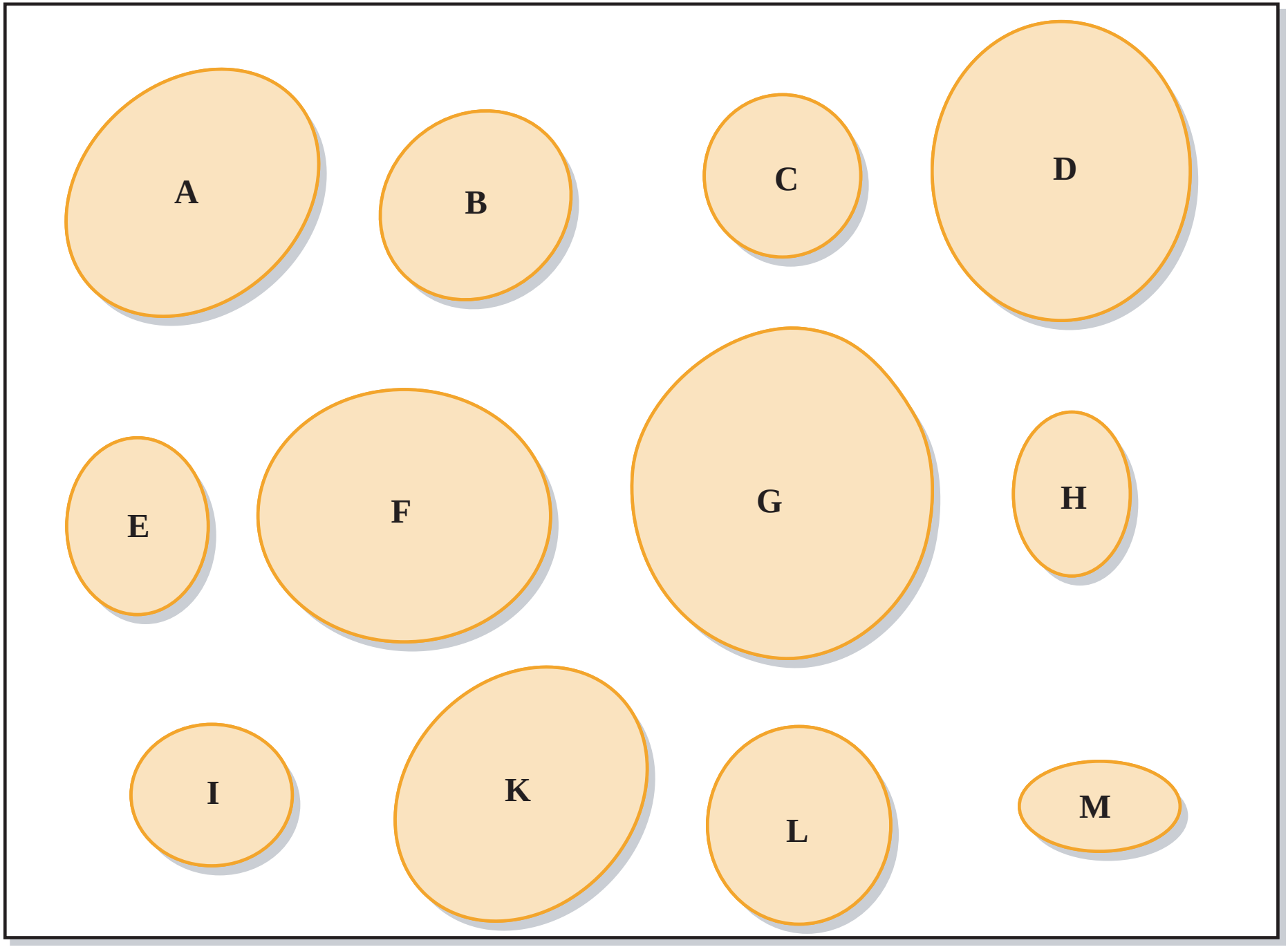


Figure by MIT OCW.

Spatial frequency analysis

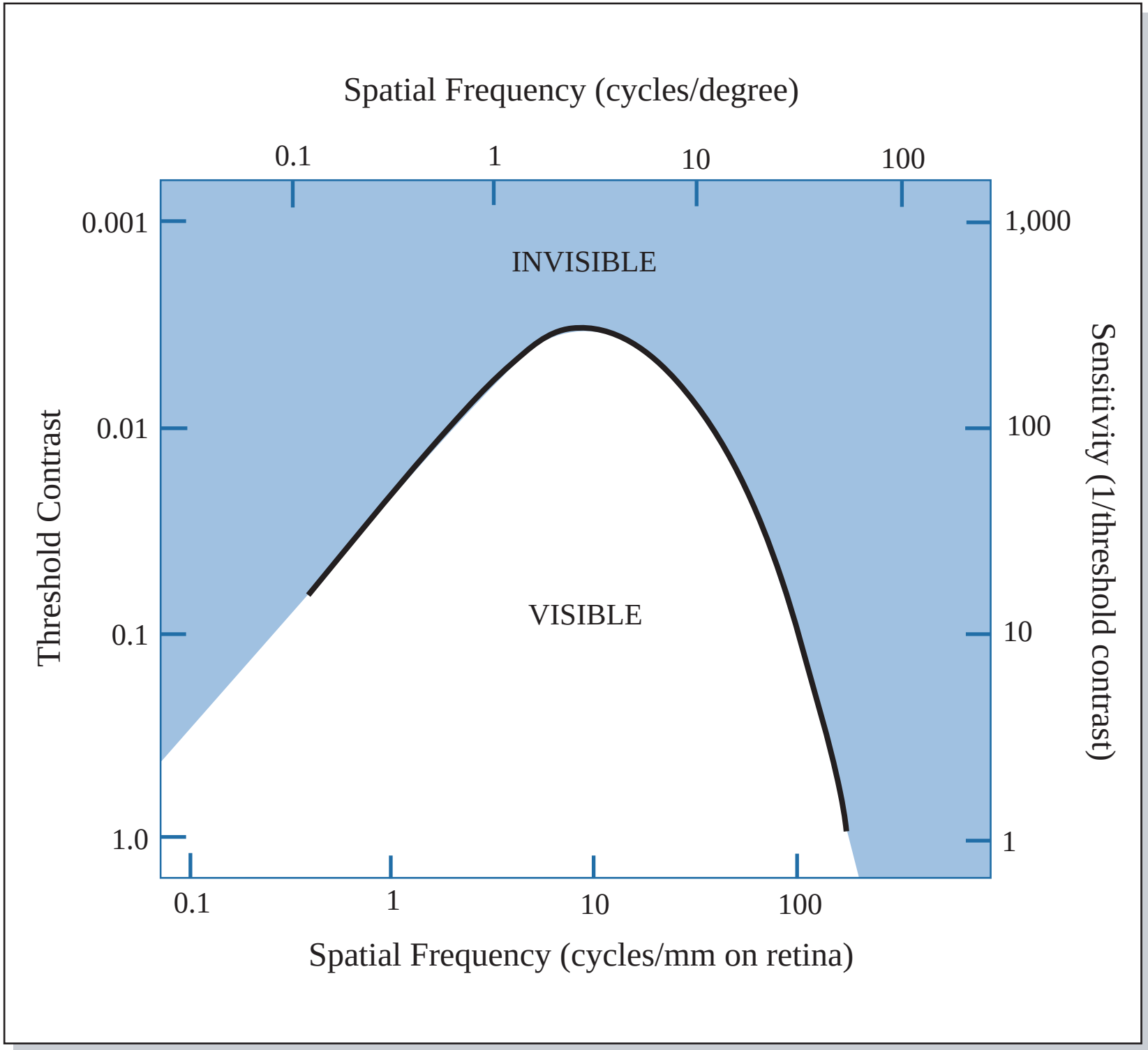
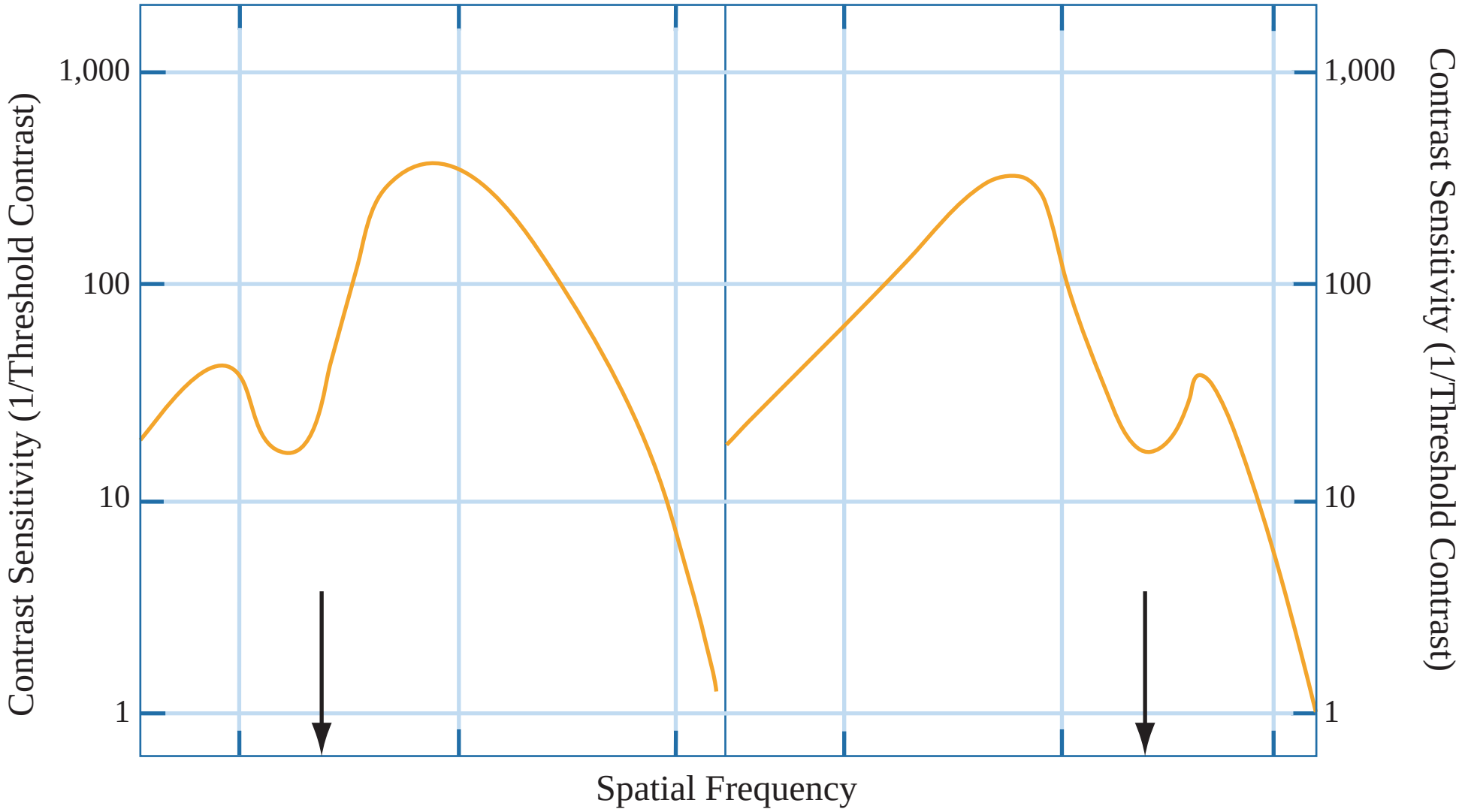


Figure by MIT OCW.

Frequency-specific adaptation



Frequency specific adaptation

Figure by MIT OCW.

Channel model

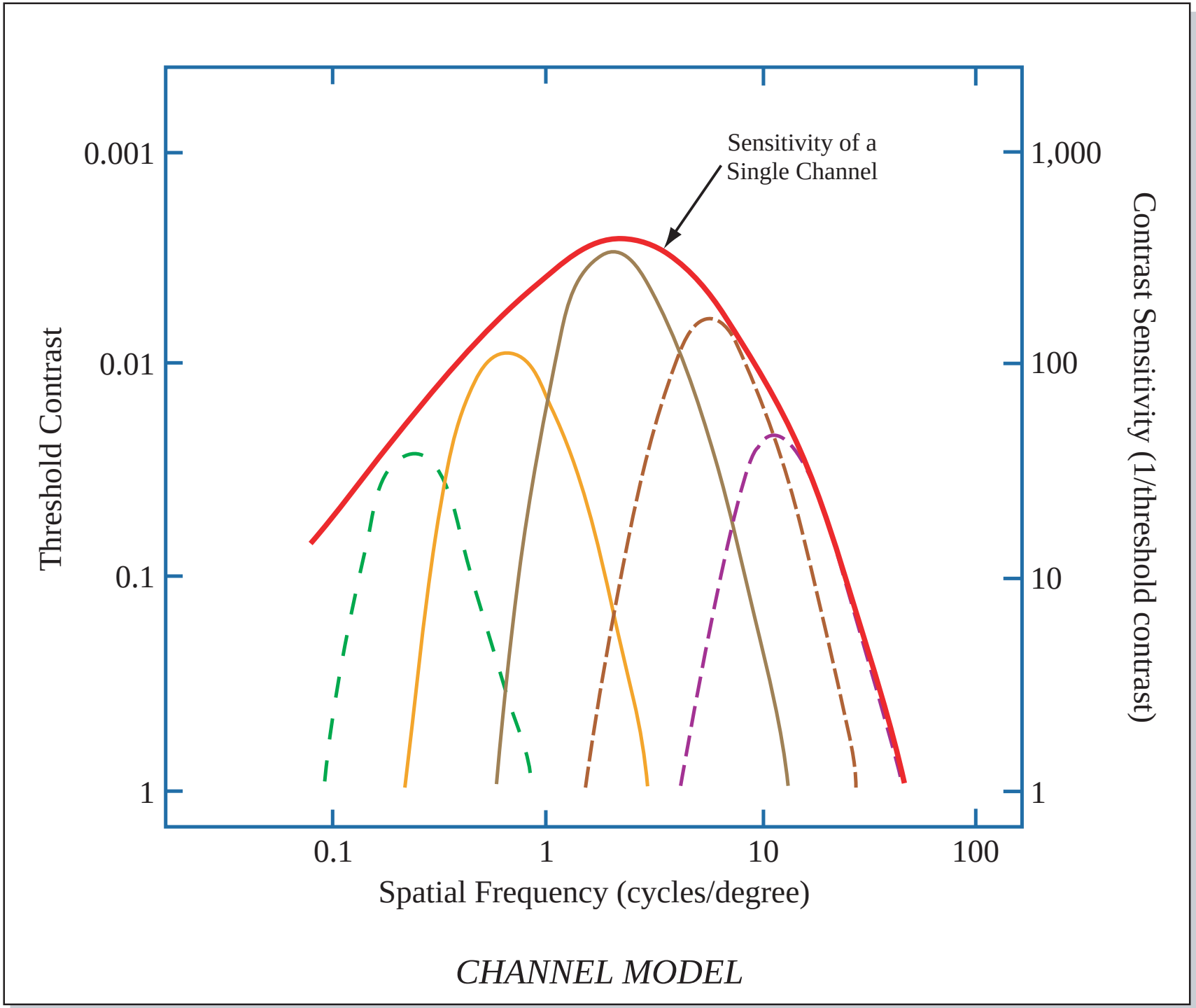


Figure by MIT OCW.

Shape-selective responses in inferotemporal cortex

IT neuron response to various shapes

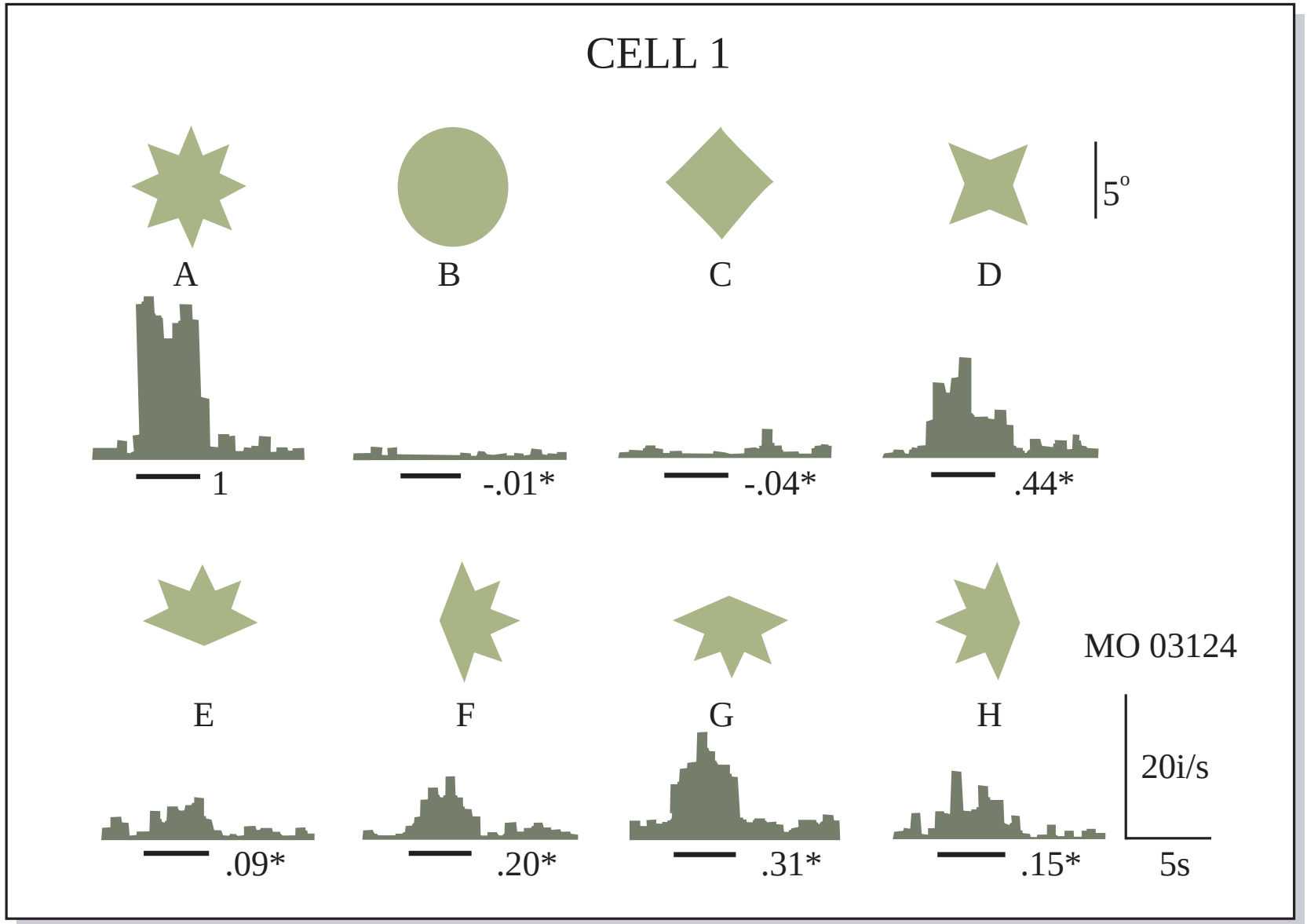


Figure by MIT OCW.

IT neuron response to various shapes

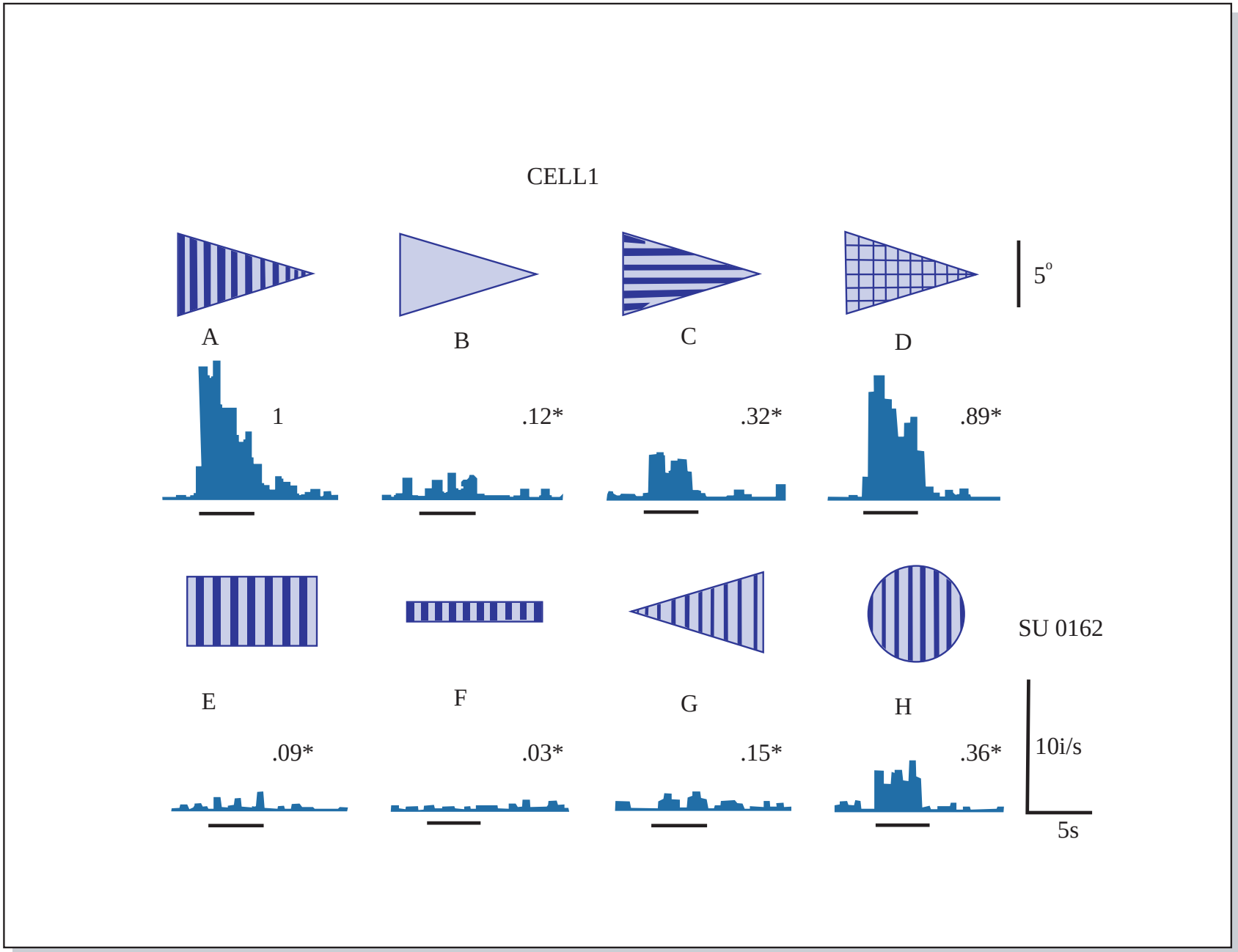


Figure by MIT OCW.

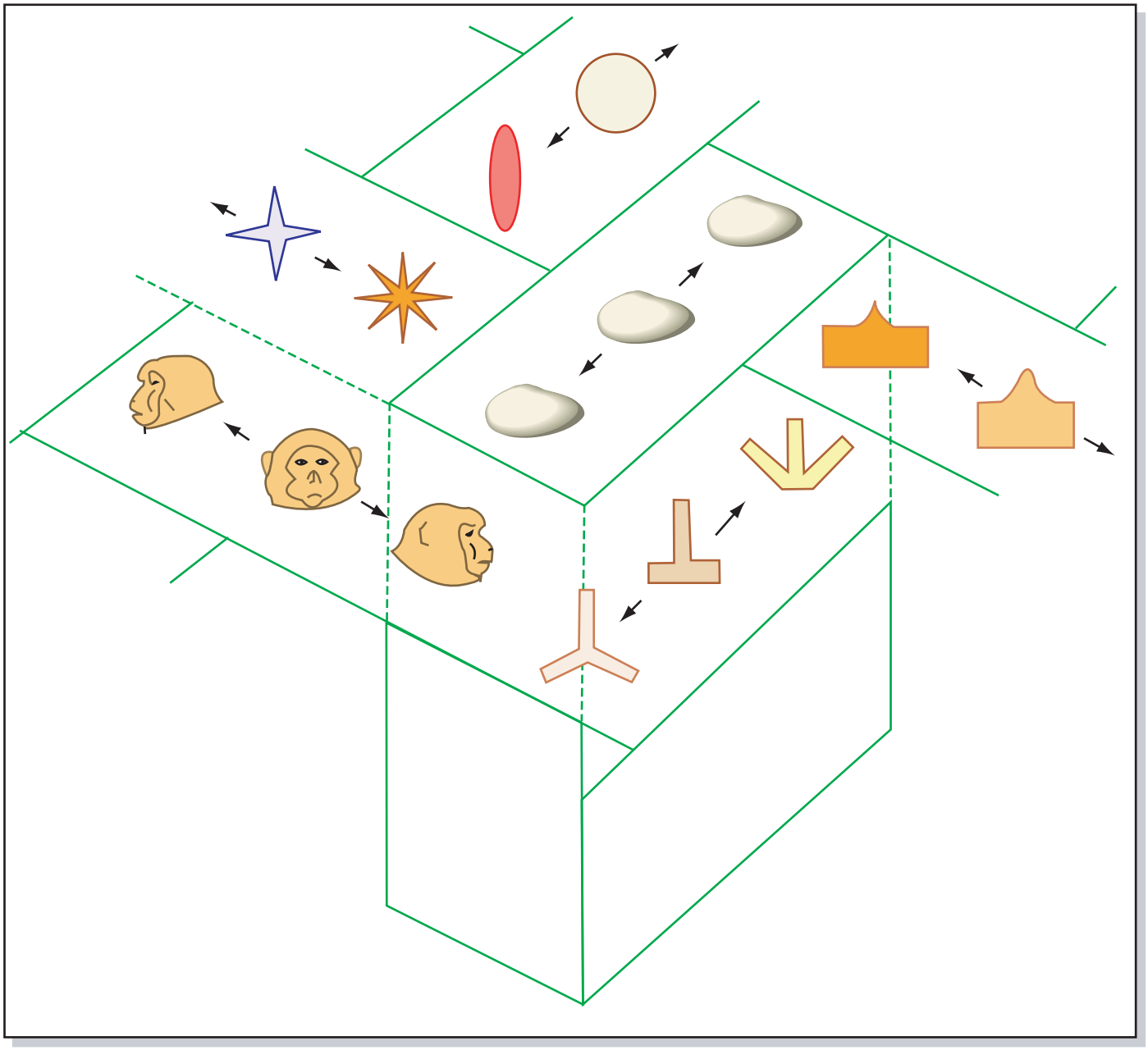


Figure by MIT OCW.

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

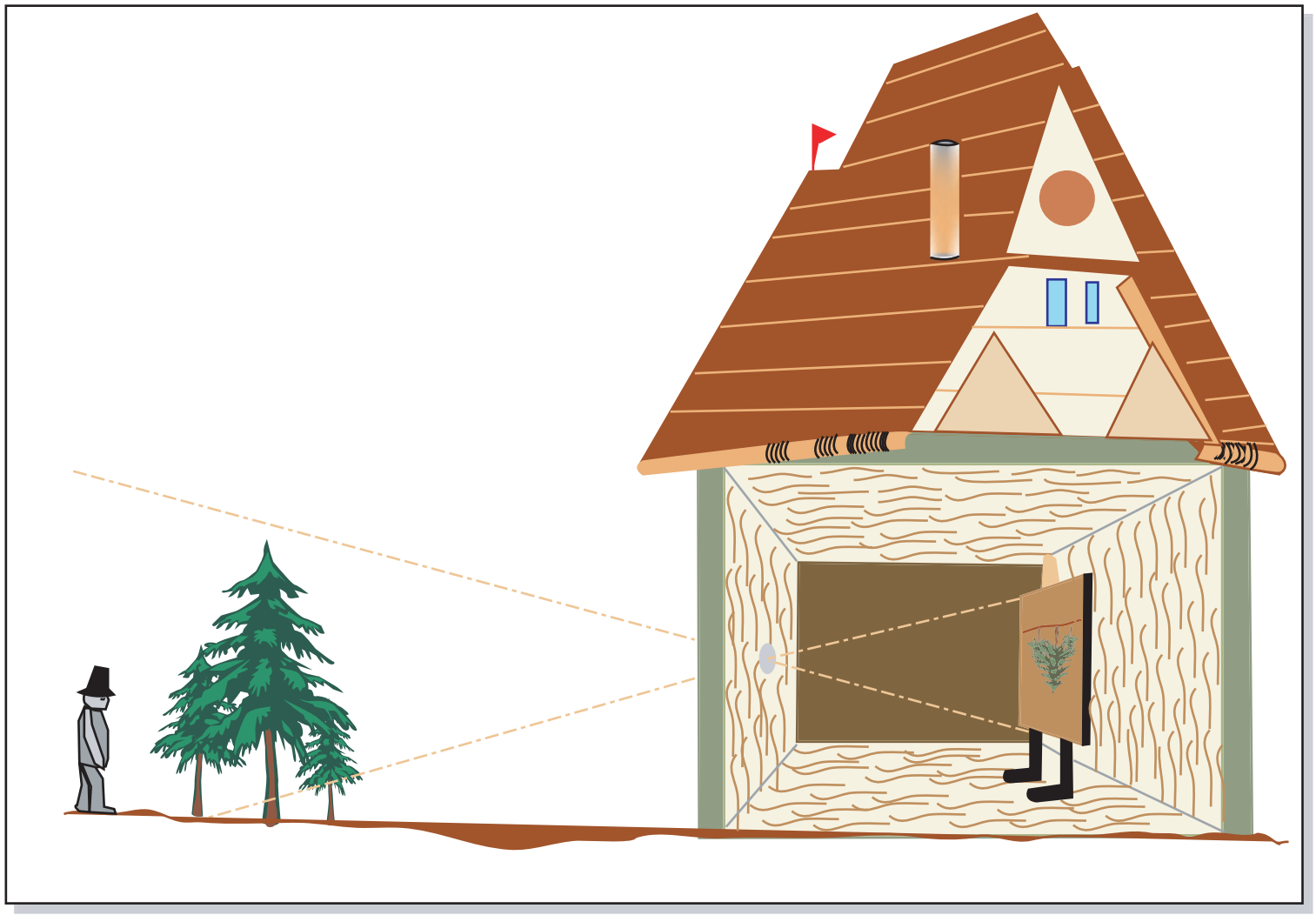
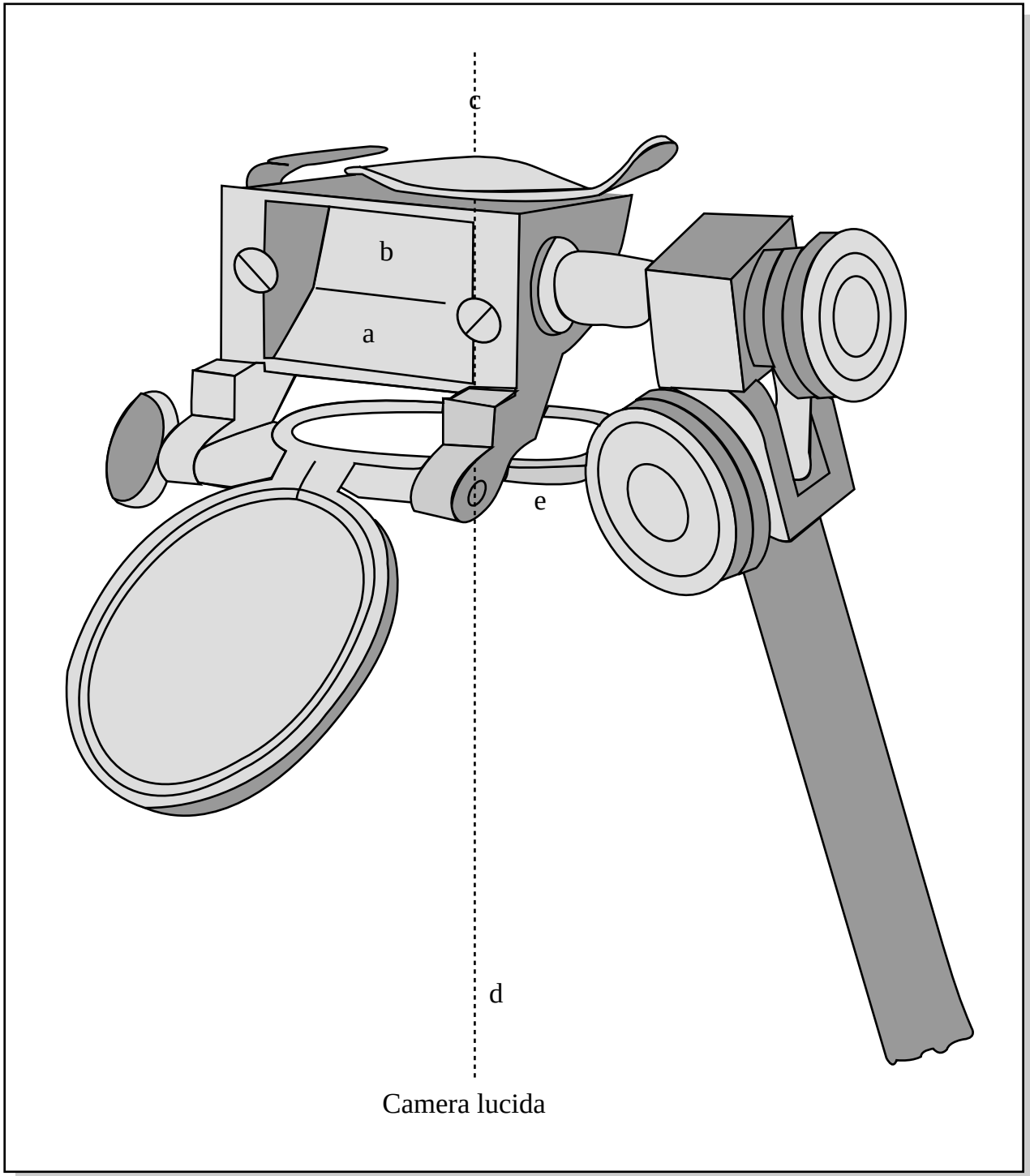


Figure by MIT OCW.

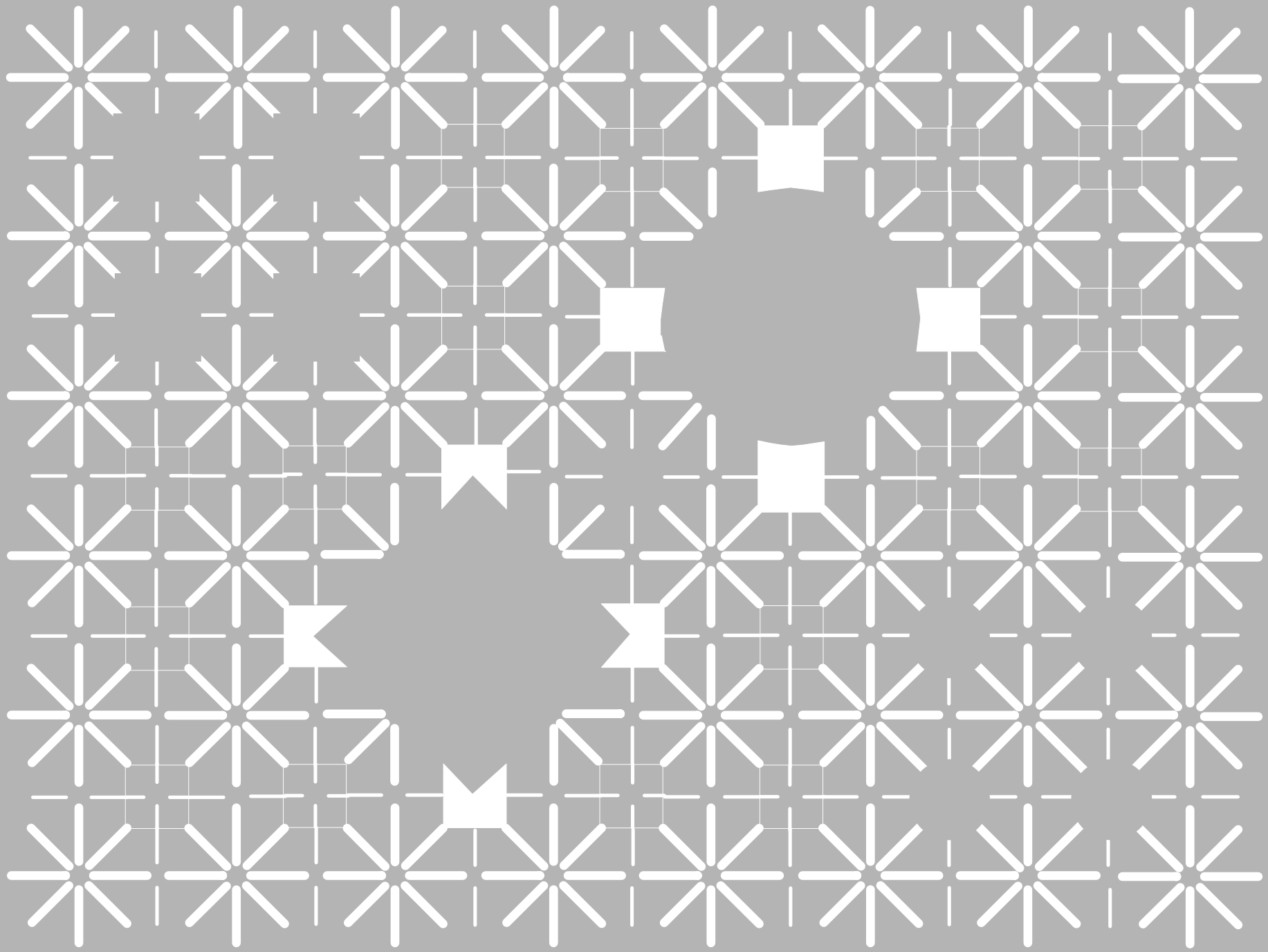
Camera obscura



Camera lucida

Figure by MIT OCW.

The perception of subjective contours



Subjective contrours at isoluminance

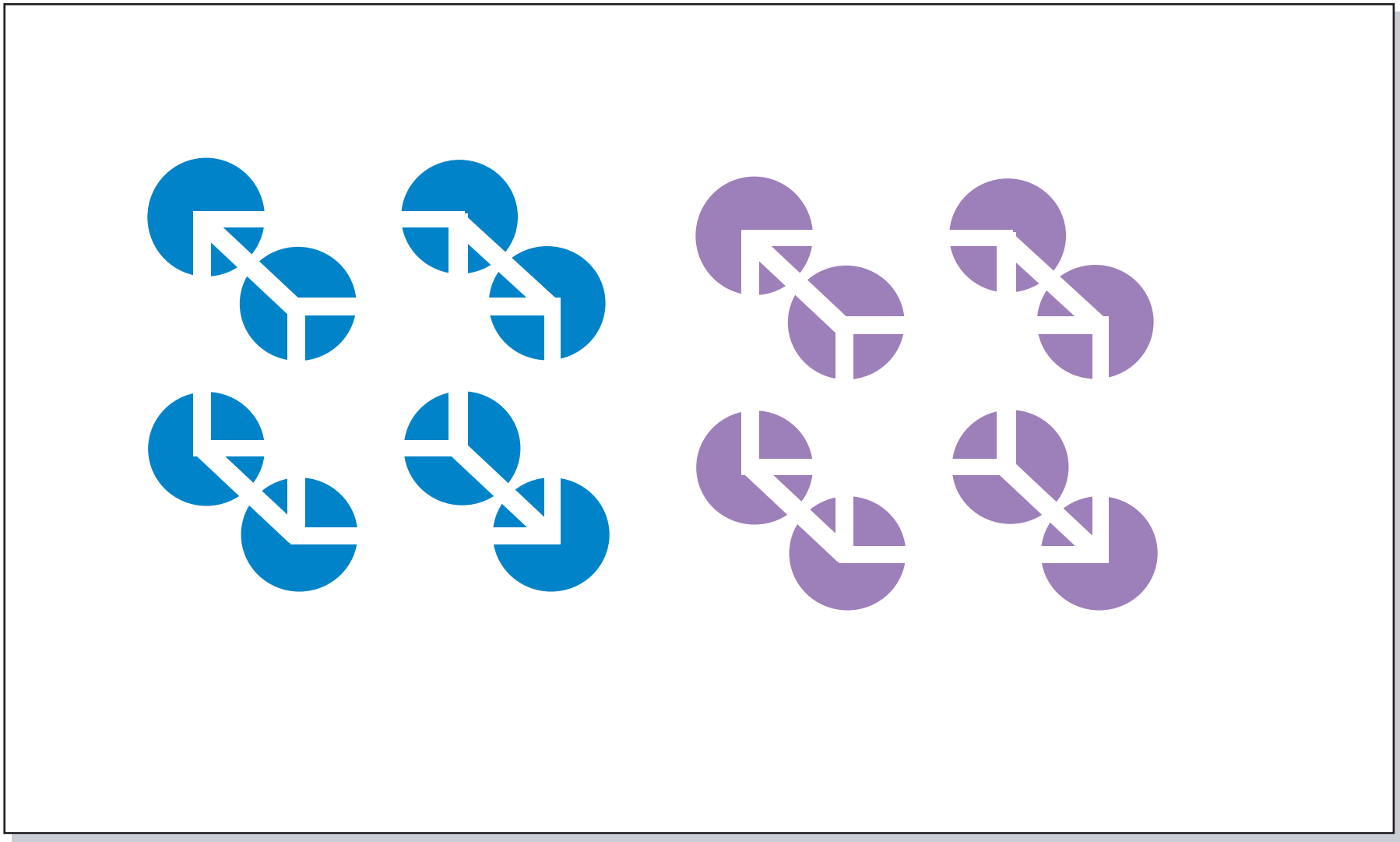


Figure by MIT OCW.

Response to subjective contours in V2

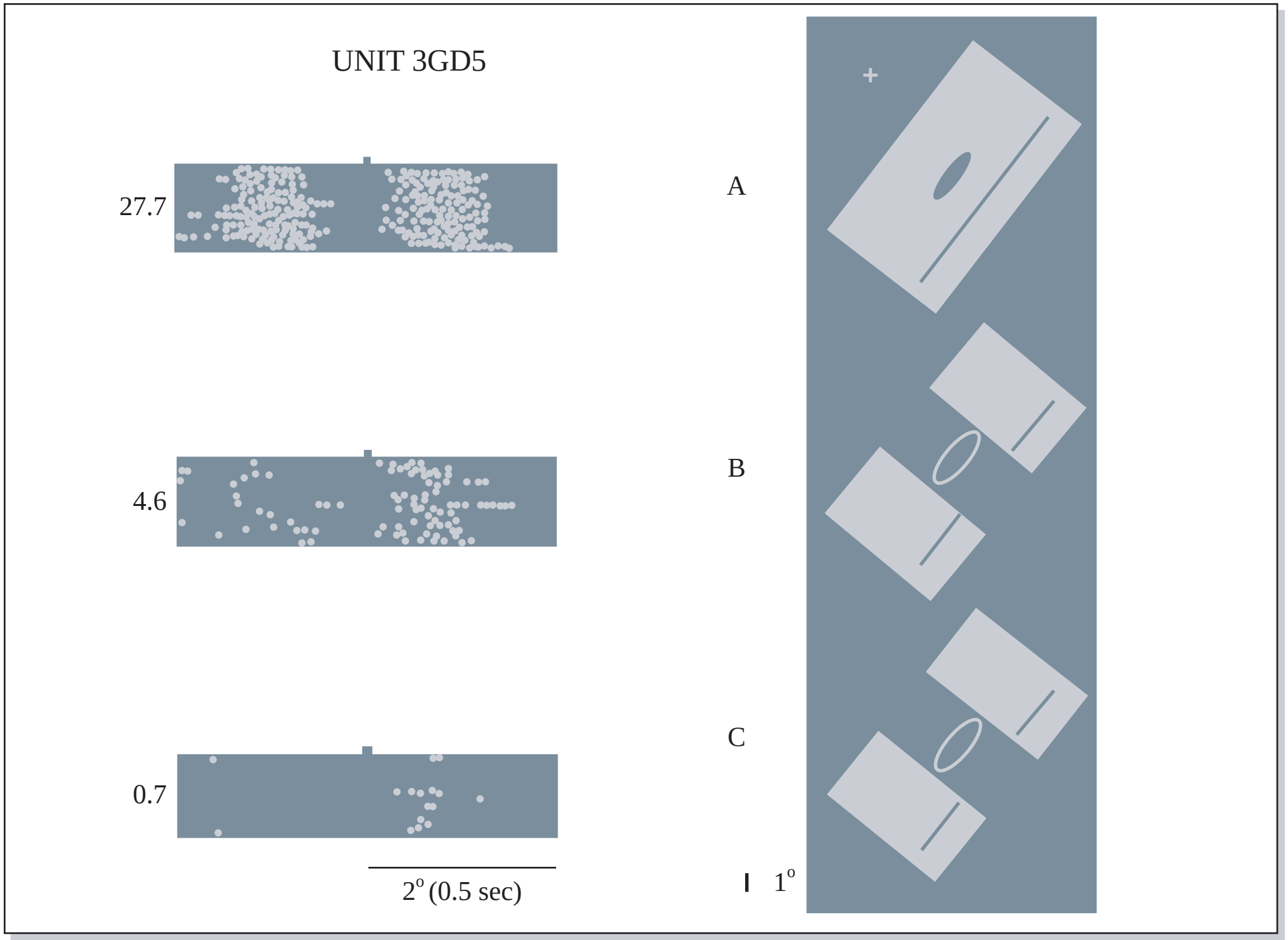


Figure by MIT OCW.

Response to subjective contours in V2

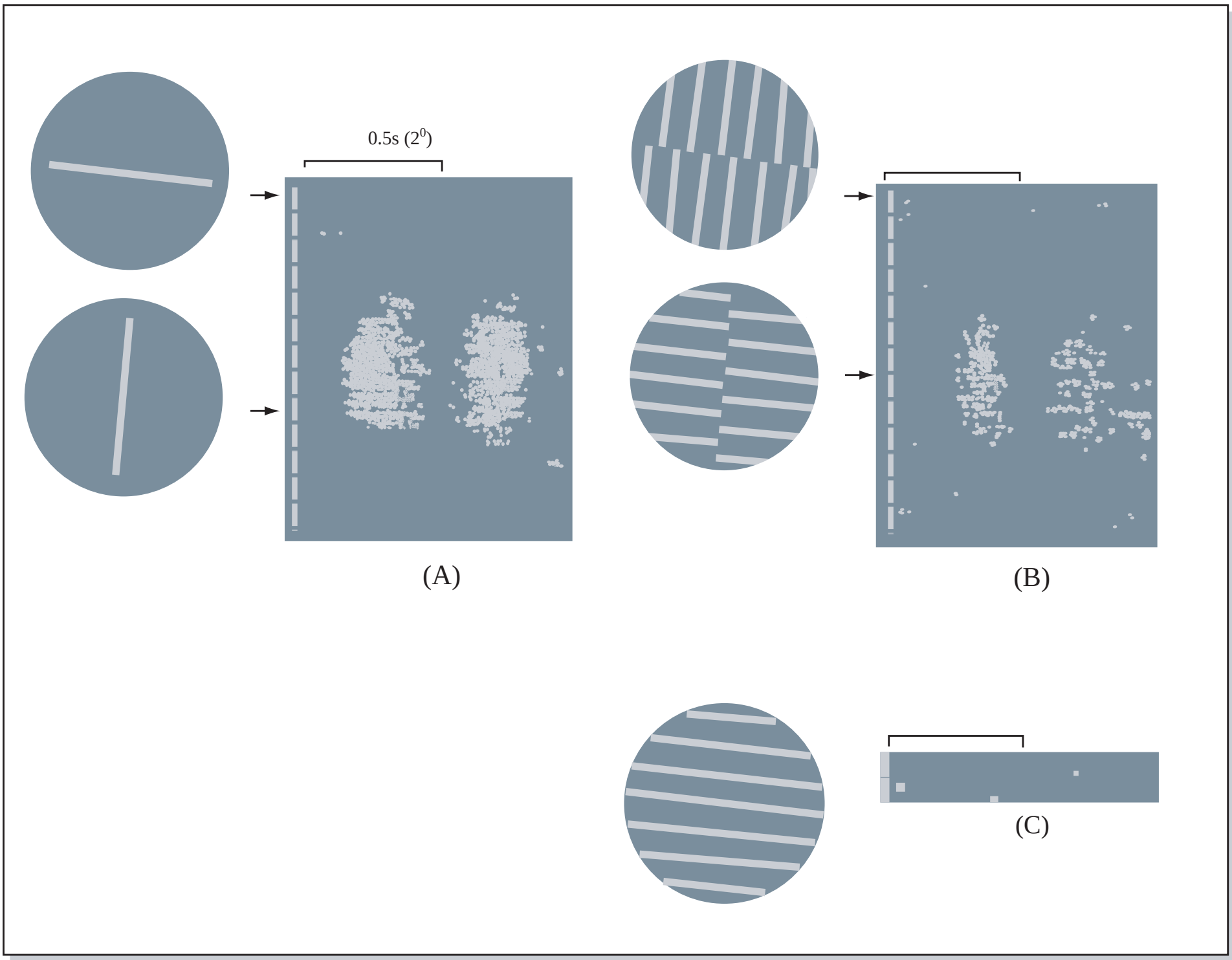
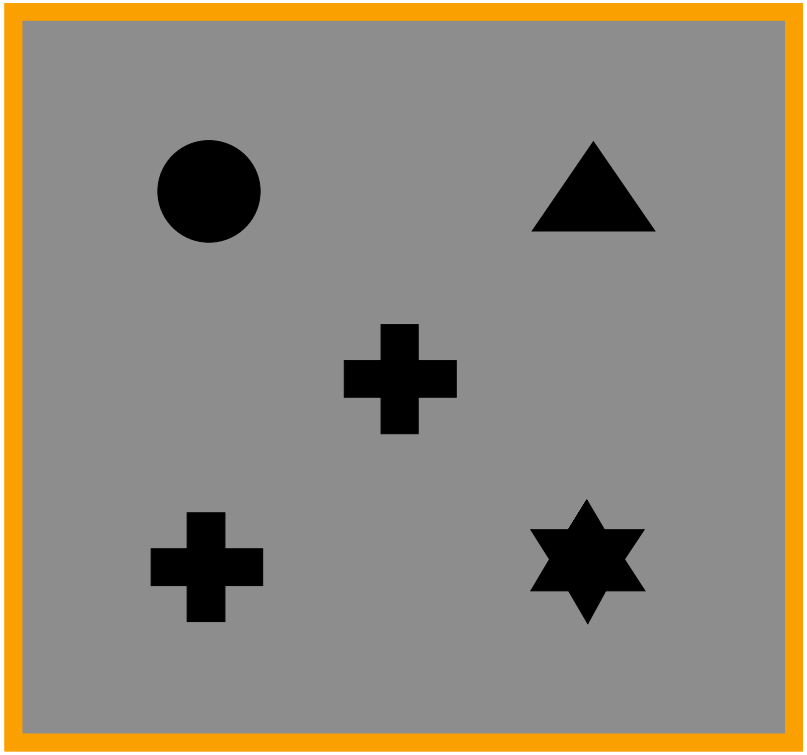


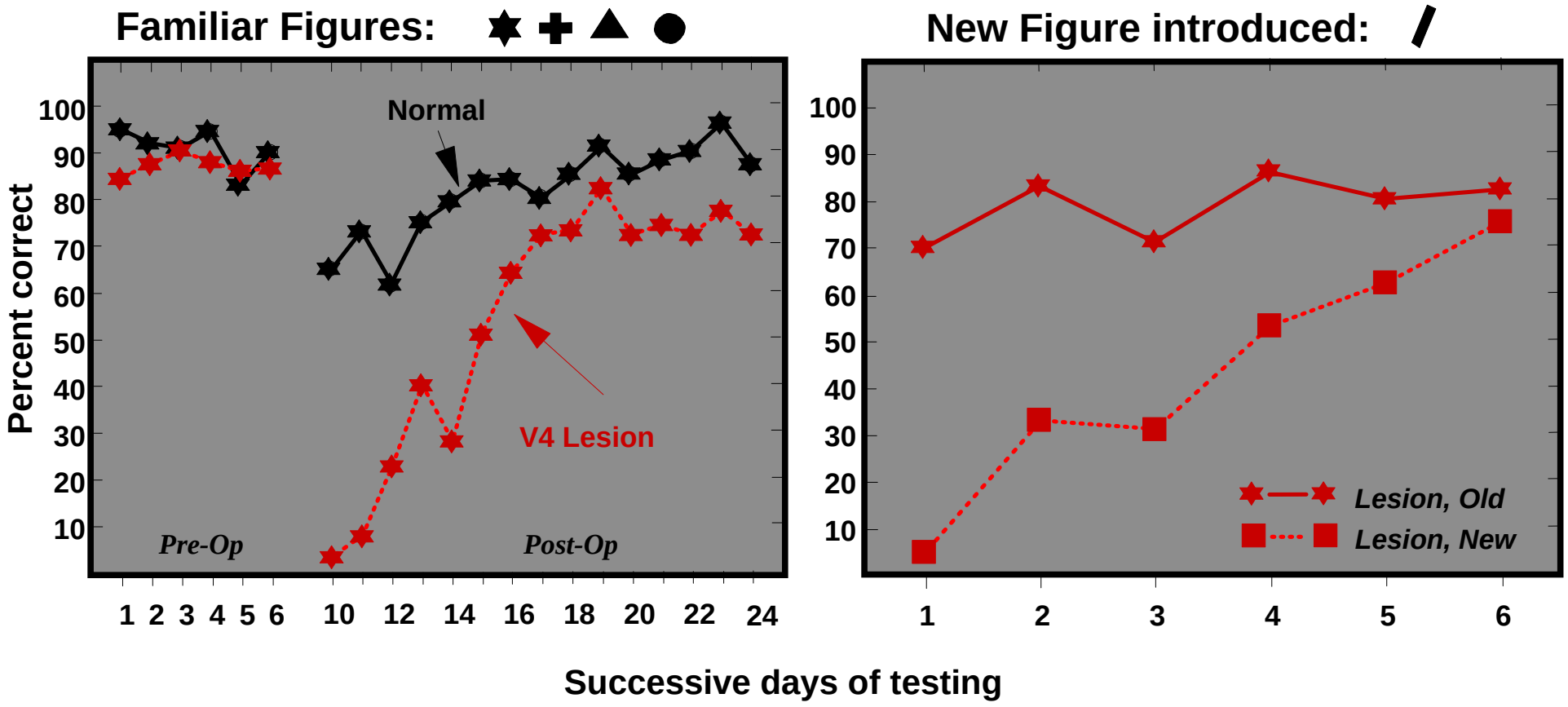
Figure by MIT OCW.

The effects of V4 and MT lesions on intermediate vision

Match to sample task



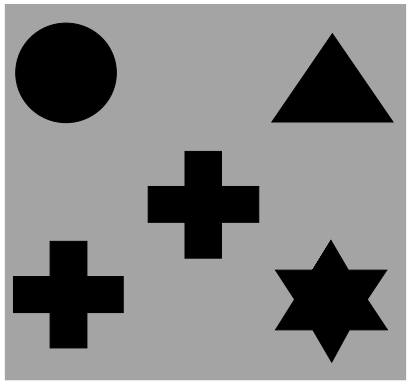
The effect of V4 lesions on object matching



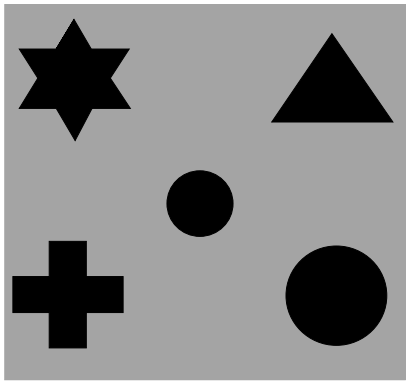
Intermediate vision tasks

SIZE

A



B



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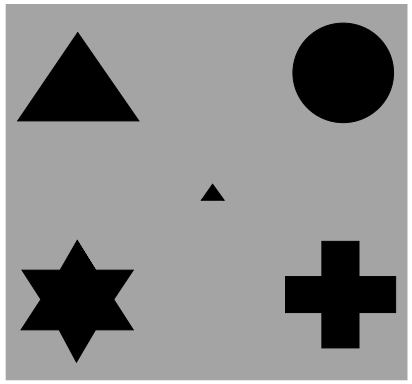
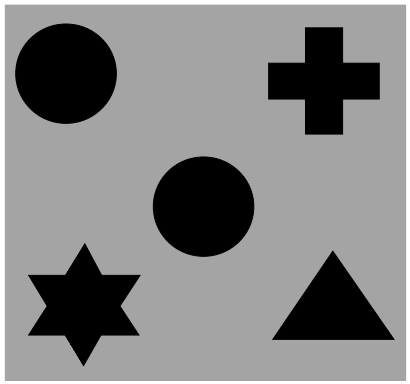


OCCLUSION

A



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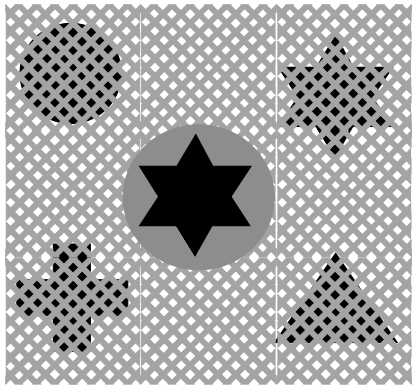

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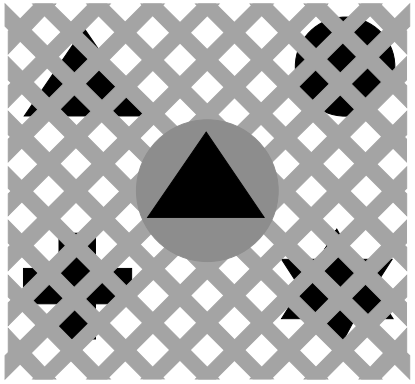
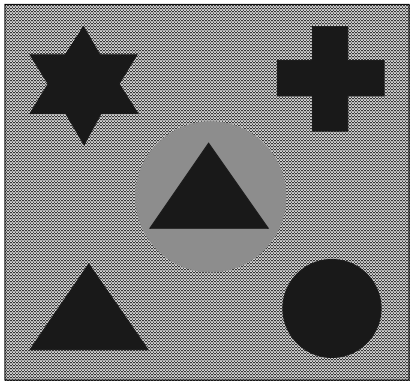


CONTOUR

A



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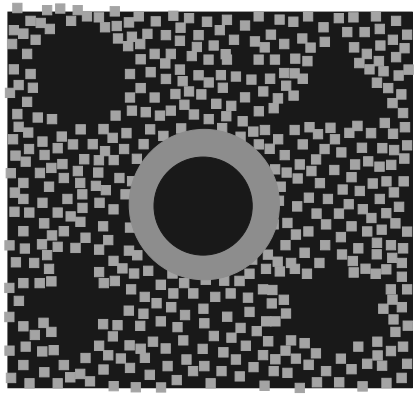

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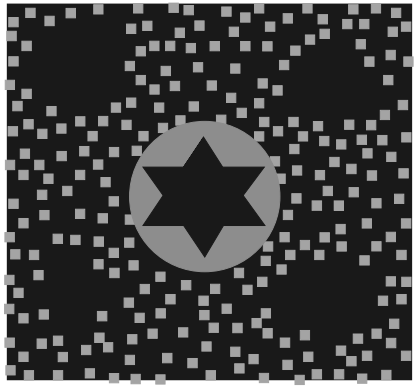
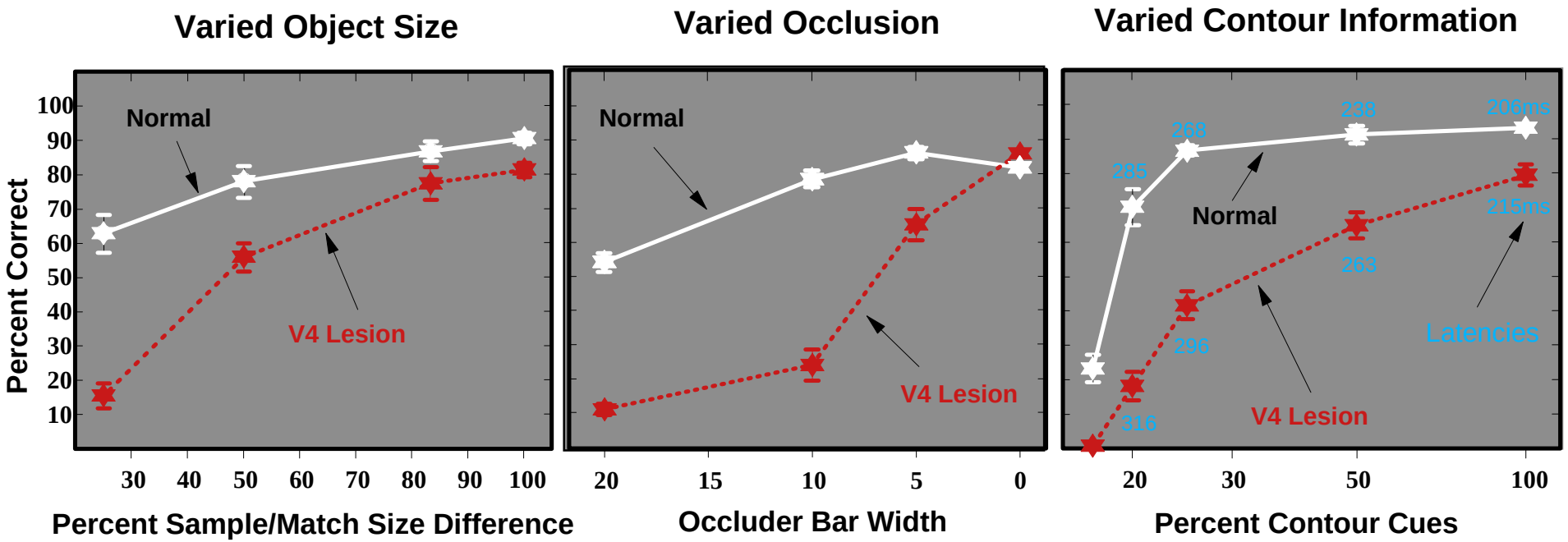
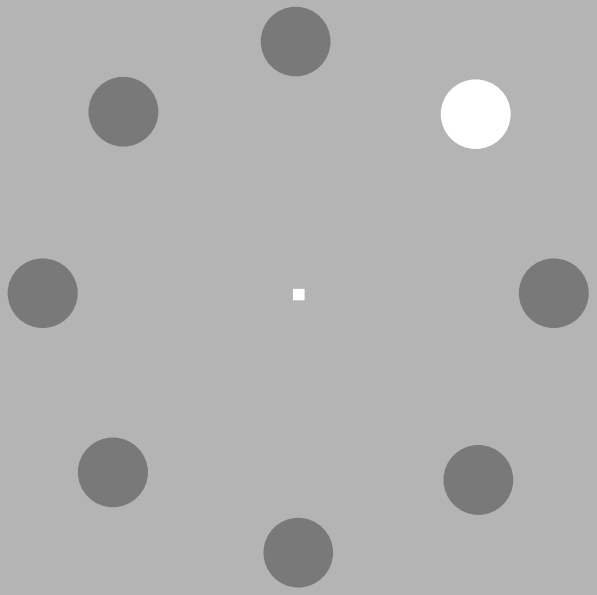


The effect of V4 lesions on object transformations

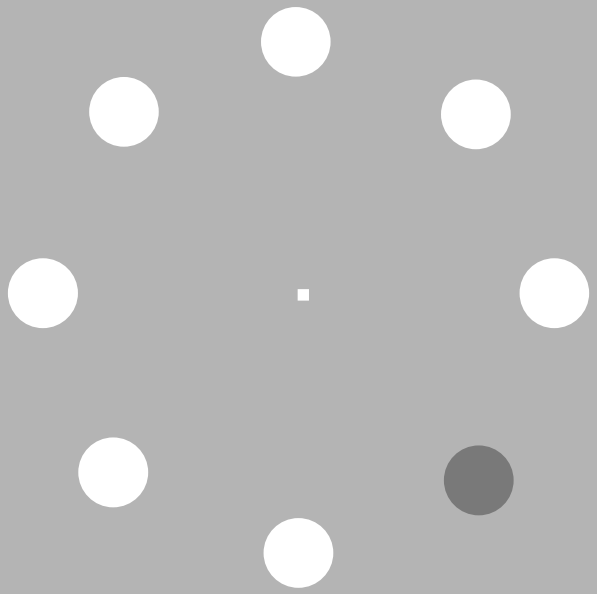


Greater and lesser brightness discrimination

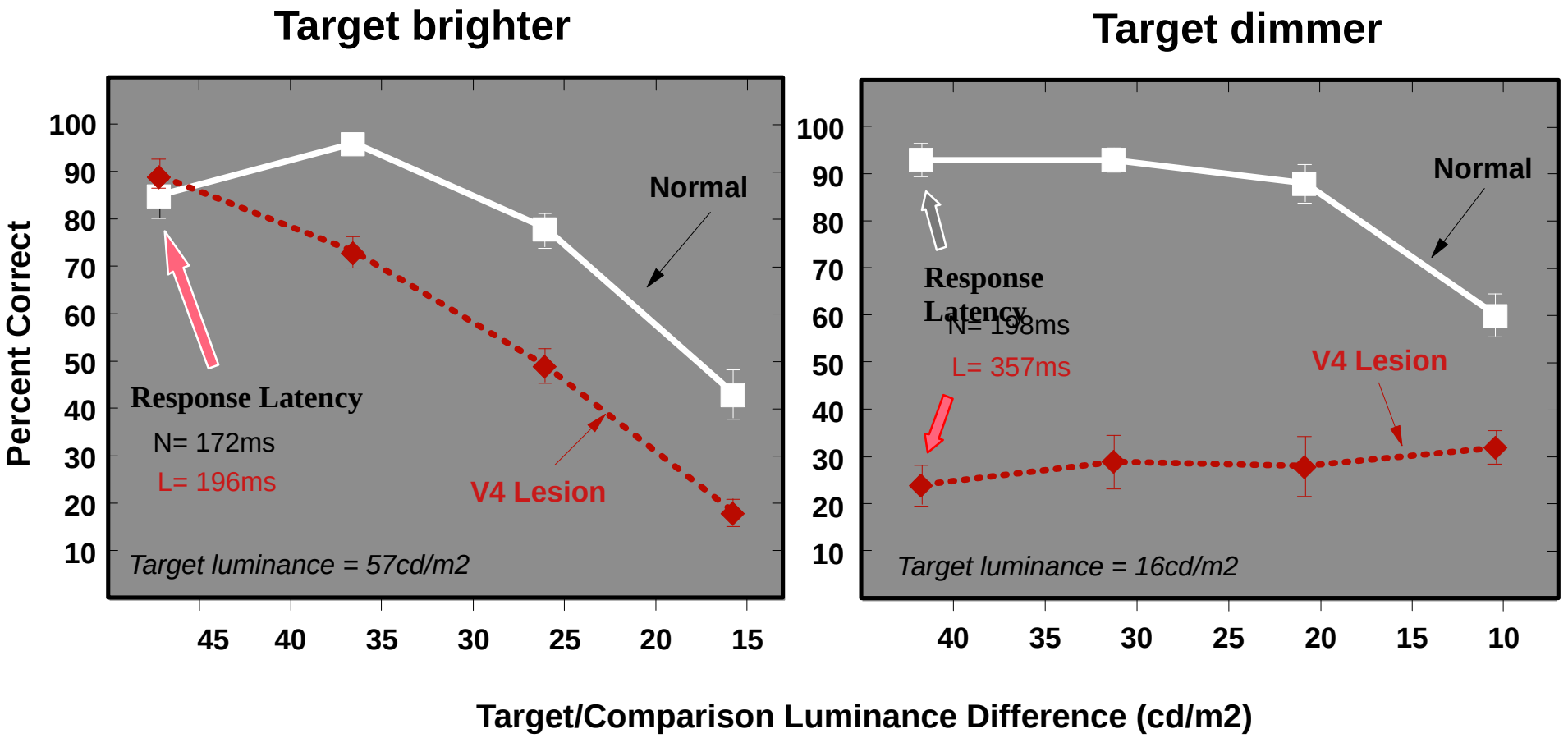
Target Brighter



Target Dimmer

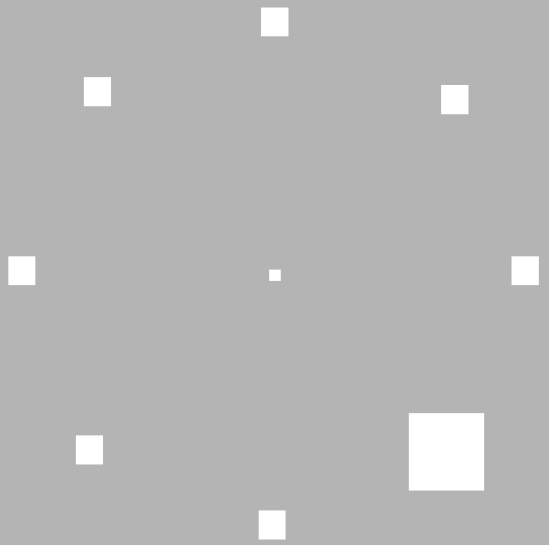


Brightness discrimination, greater and lesser targets

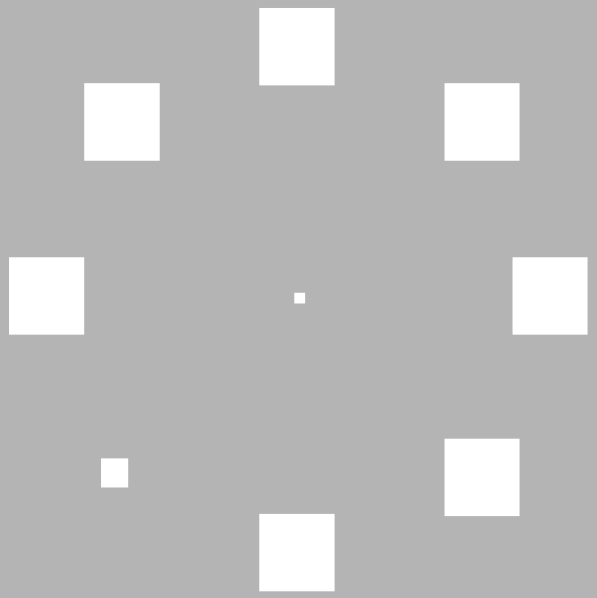


Greater and lesser size discrimination

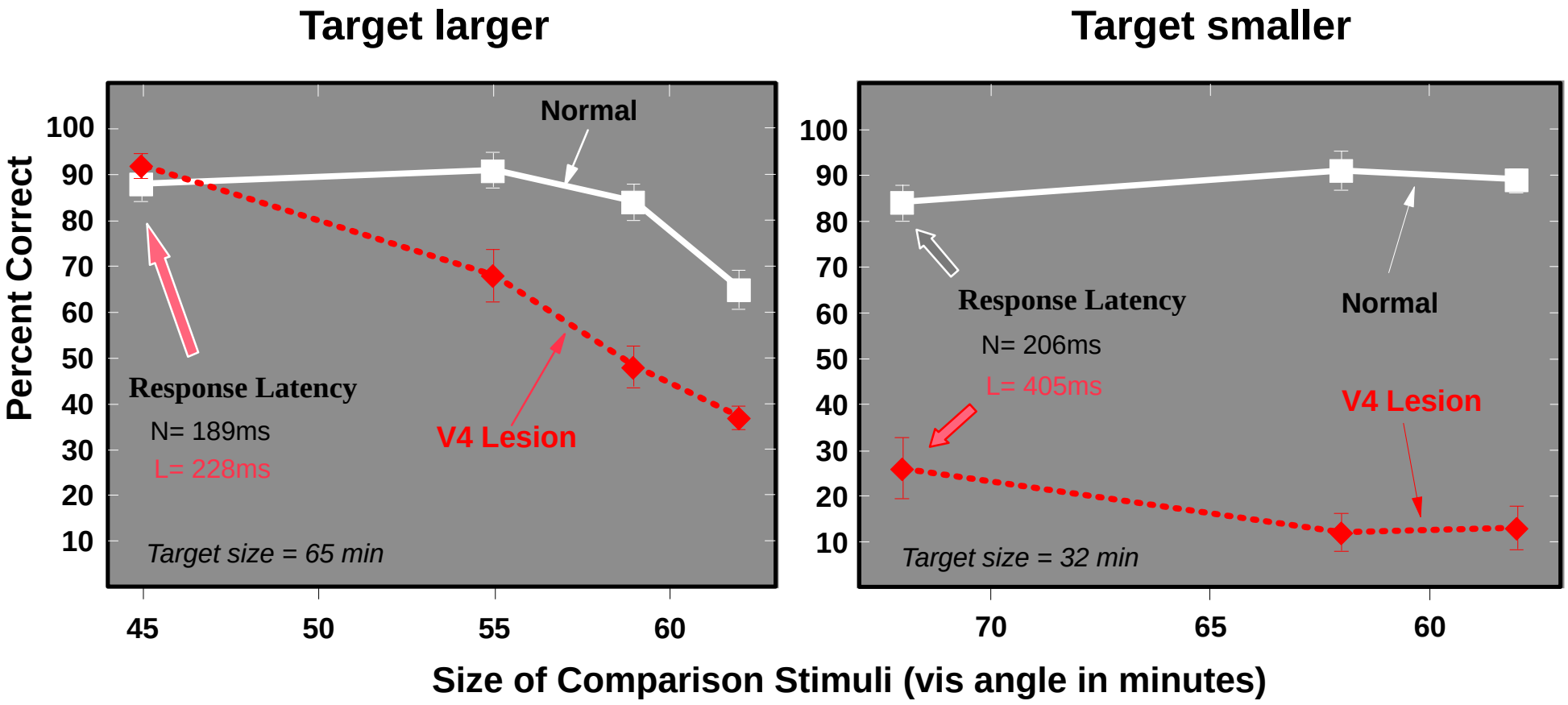
Target Larger



Target Smaller



Size discrimination, greater and lesser targets



Summary, form:

1. Three theories of form precessing in the brain are (a) analysis by orientation of line segmens, (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.

V4 and IT

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