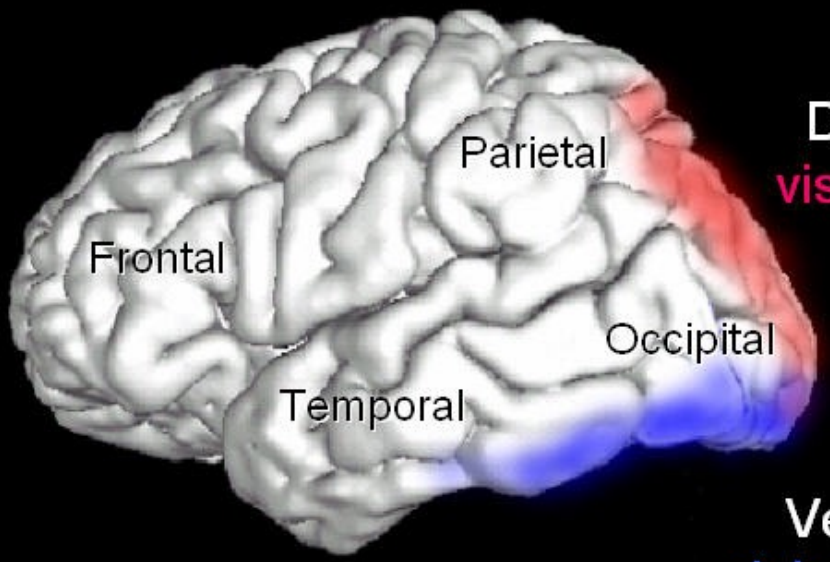


Dorsal stream:
vision-for-action

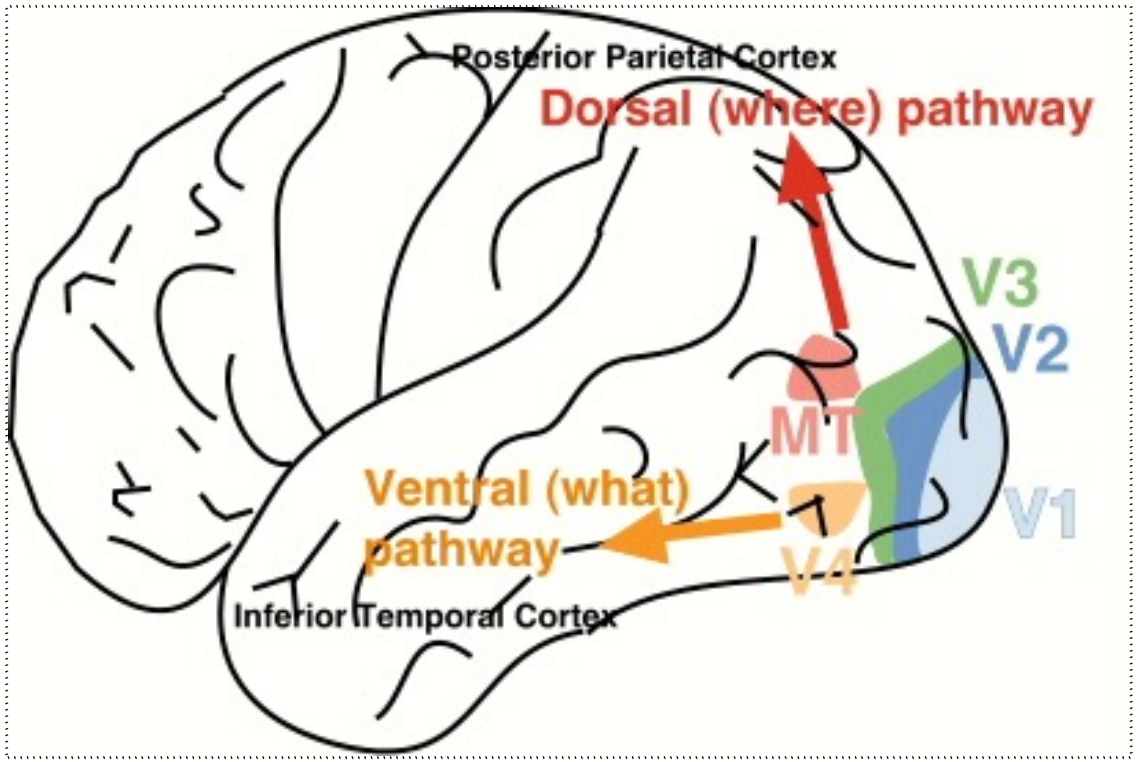
Ventral stream:
vision-for-perception

The Ventral Visual Stream

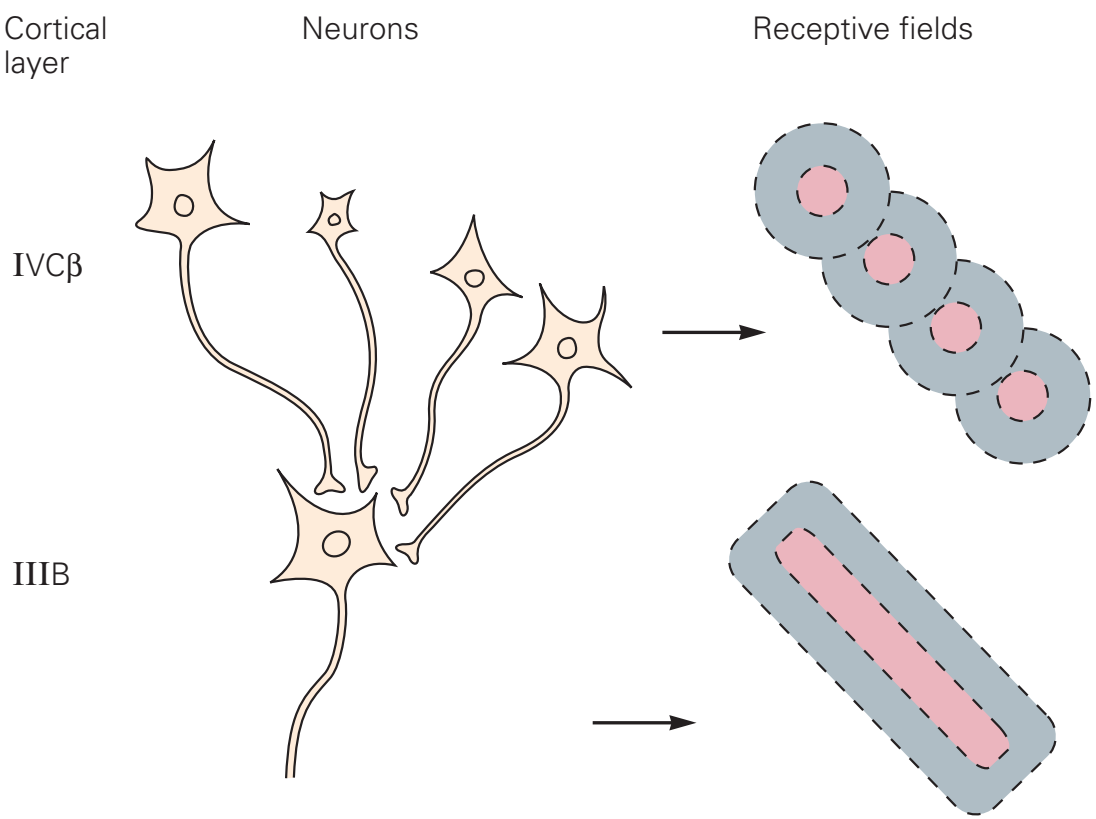
MEDS 470 / NRSC 500B

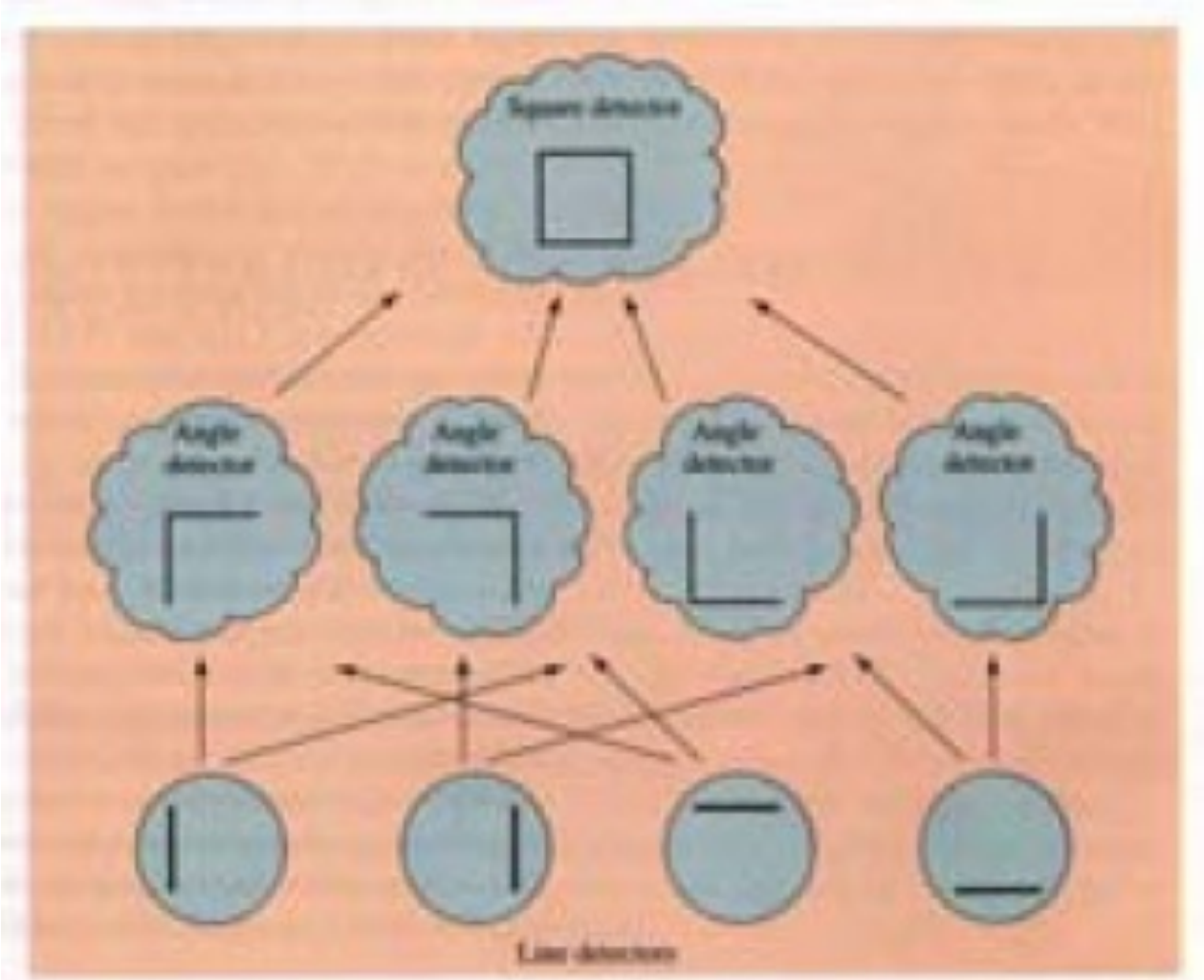
Dr. Olav E. Krigolson

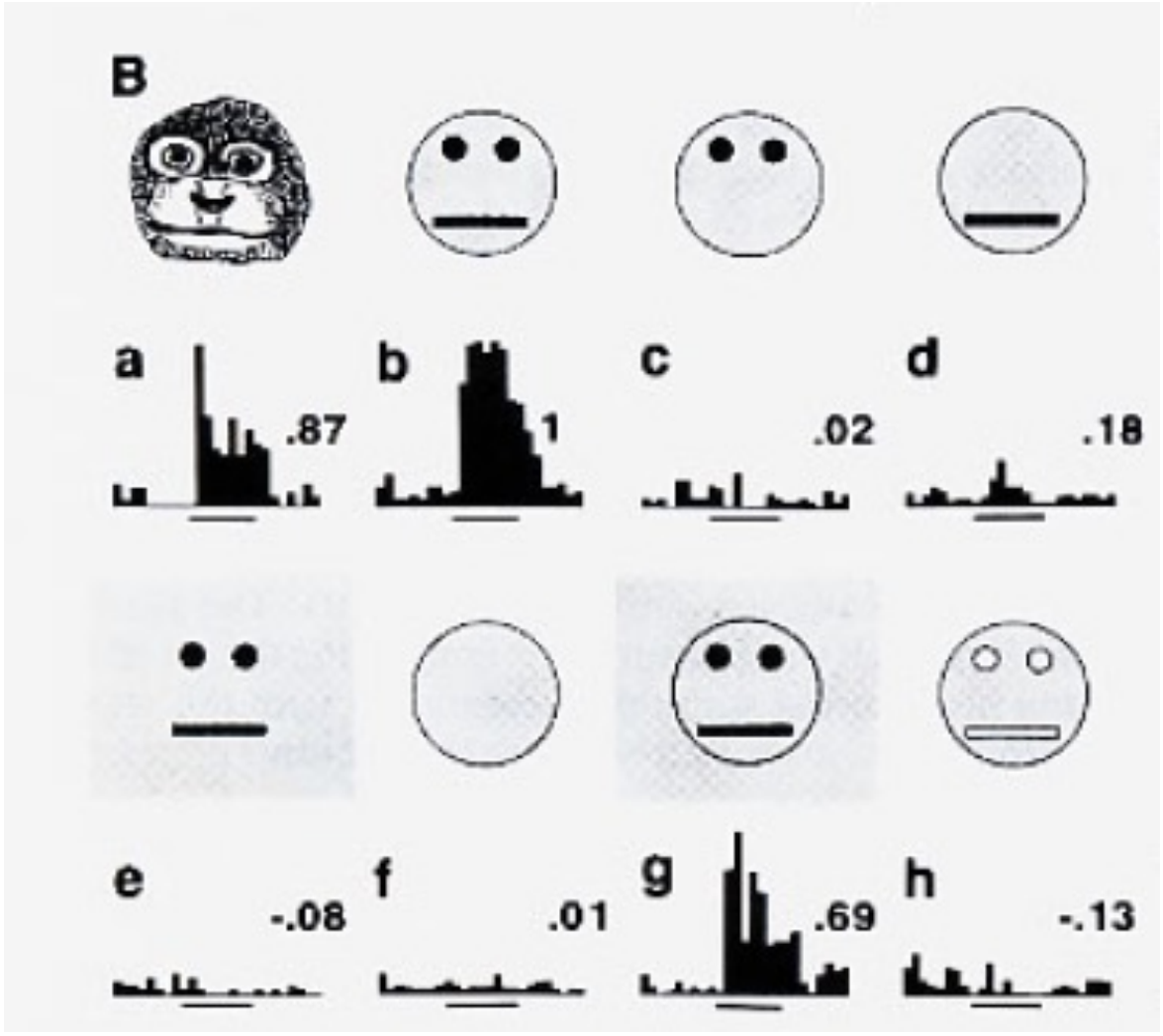
The Ventral Visual Stream

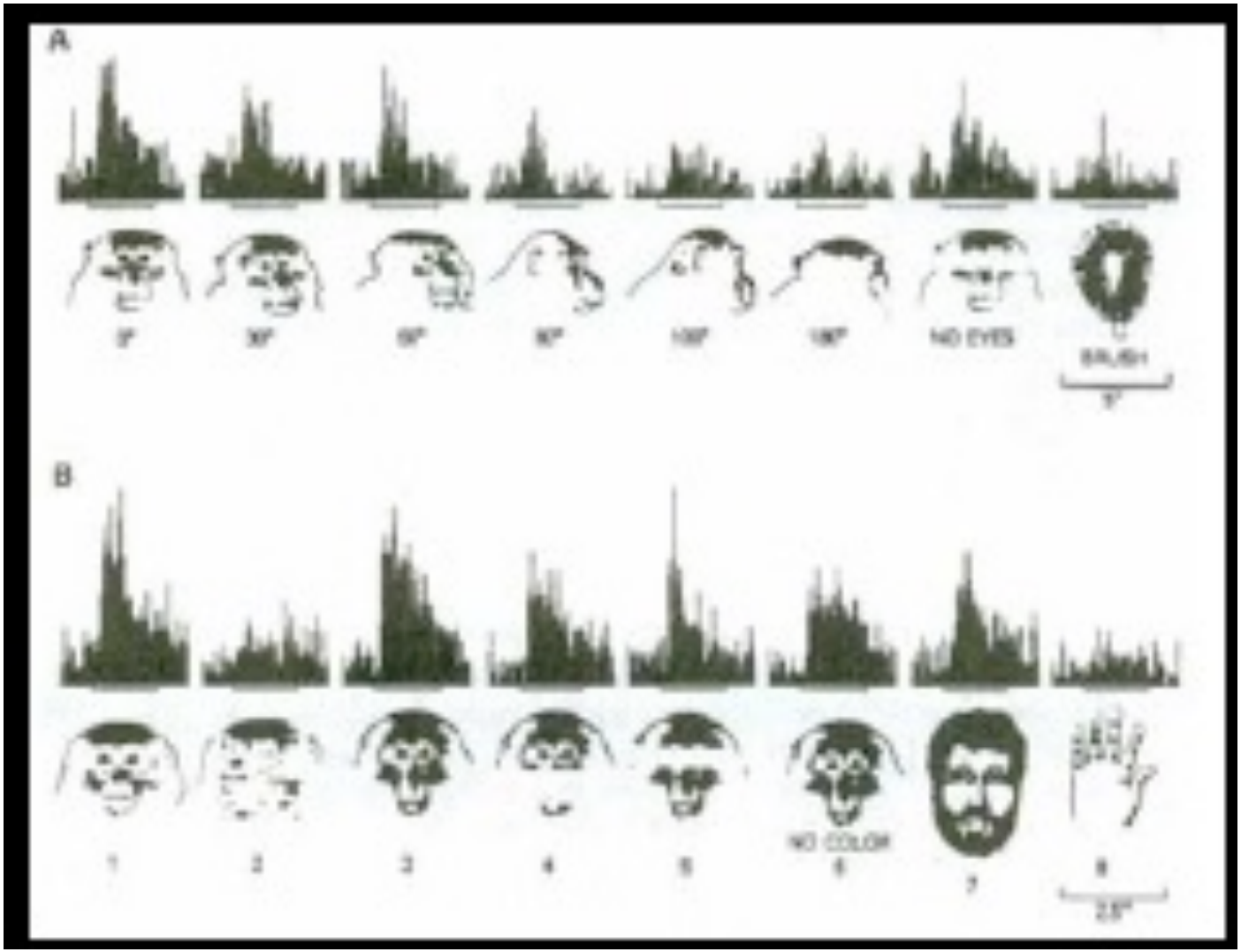

Posterior Parietal Cortex
Dorsal (where) pathway
V3
V2
MT
V1
Ventral (what)
pathway
V4
Inferior Temporal Cortex

B

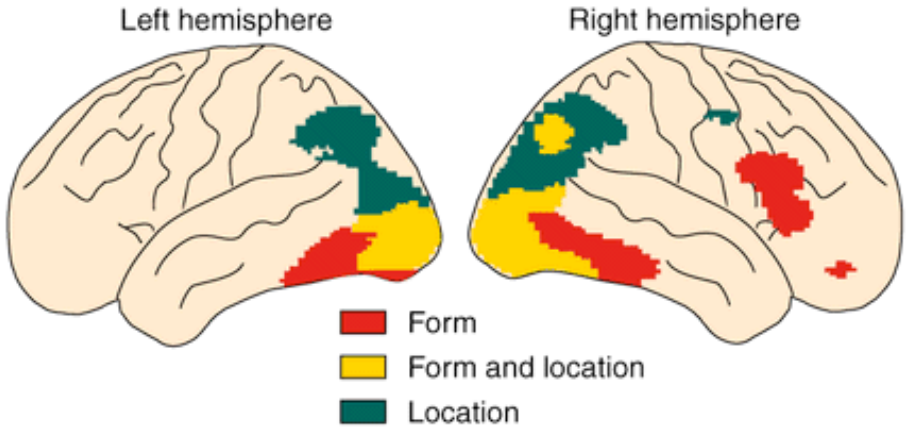



Square detectors
Angle detectors
Angle detectors
Angle detectors
Angle detectors
Line detectors

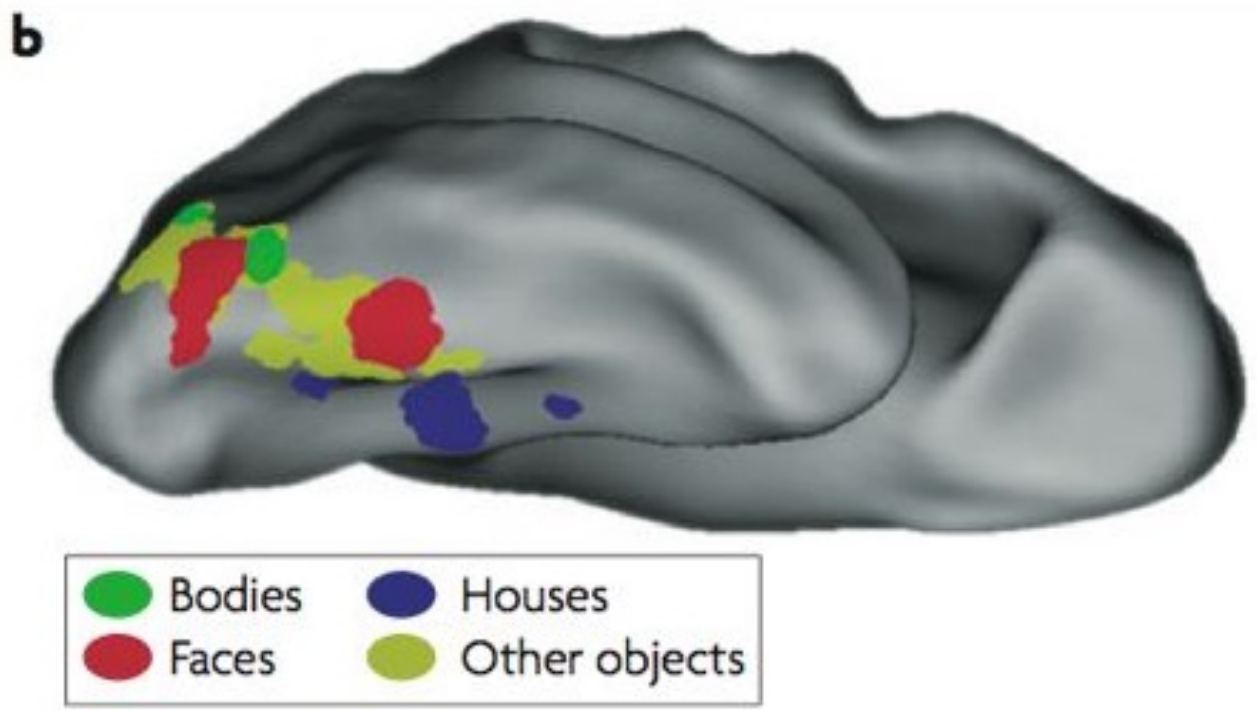

B
a
.87
b
1
c
.02
d
.18
e
-.08
f
.01
g
.69
h
-.13

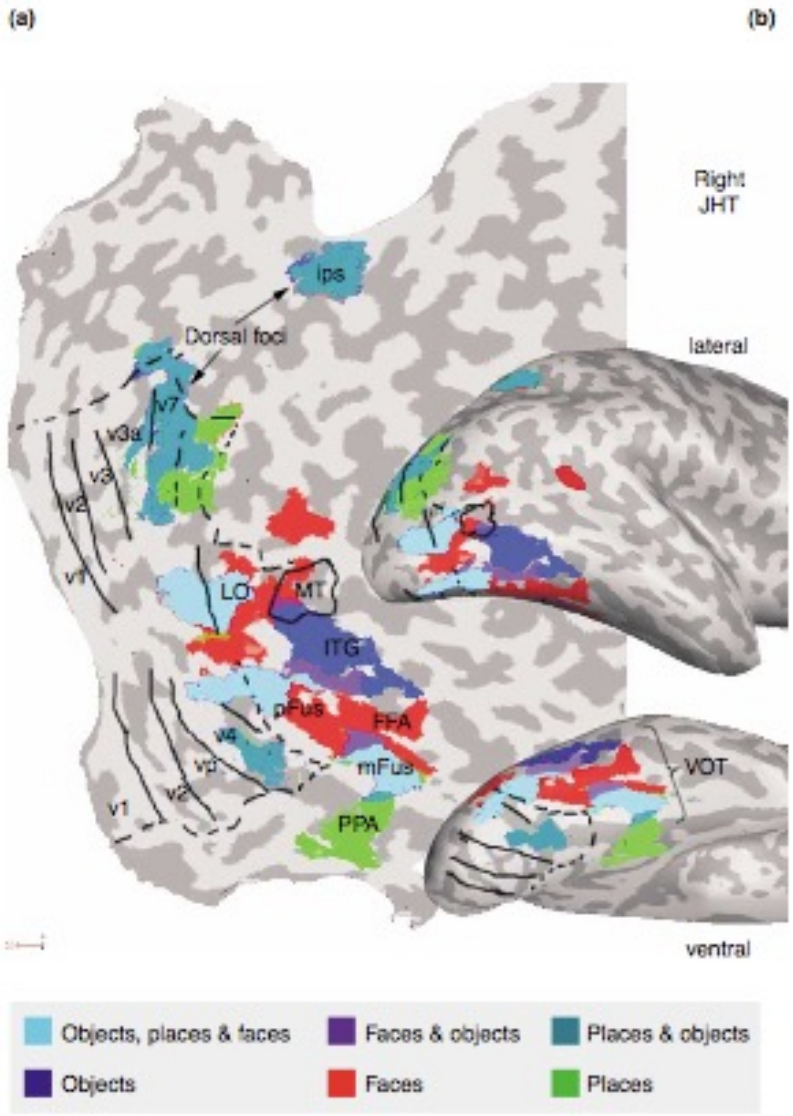

A
NO EYES
B
NO COLOR

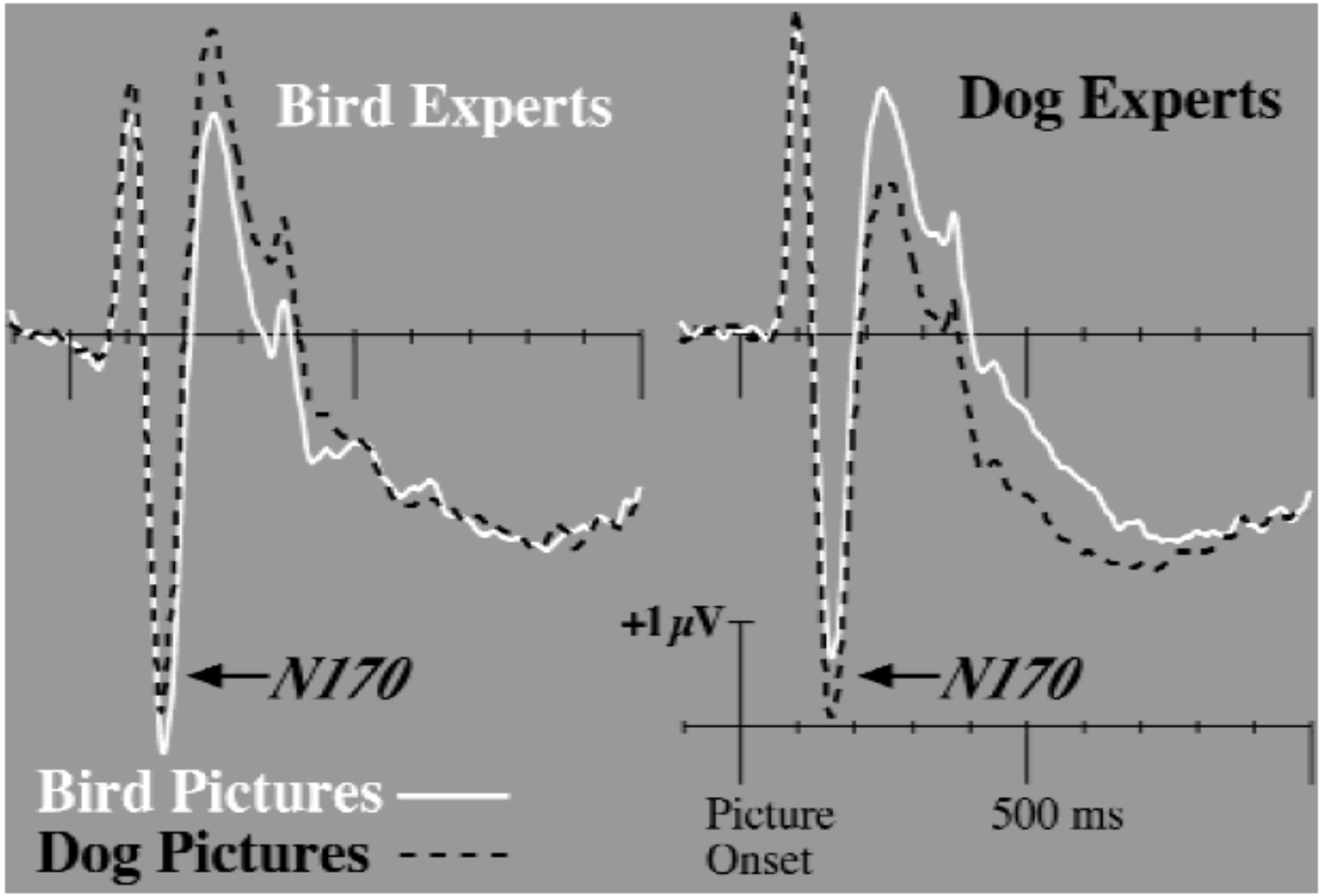
▶ Responses to Objects and Location

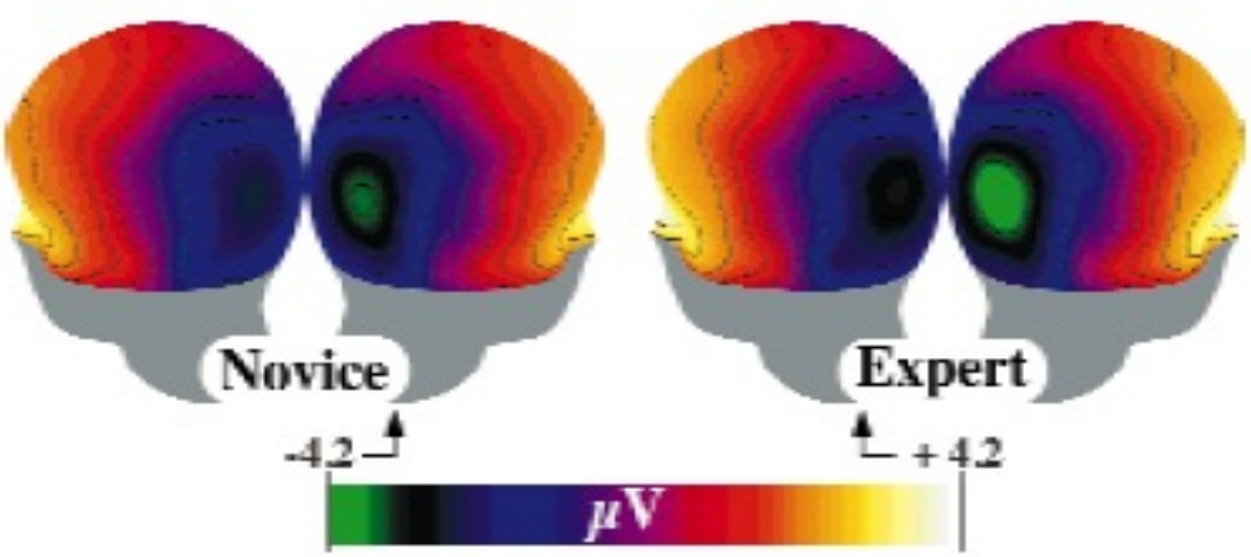


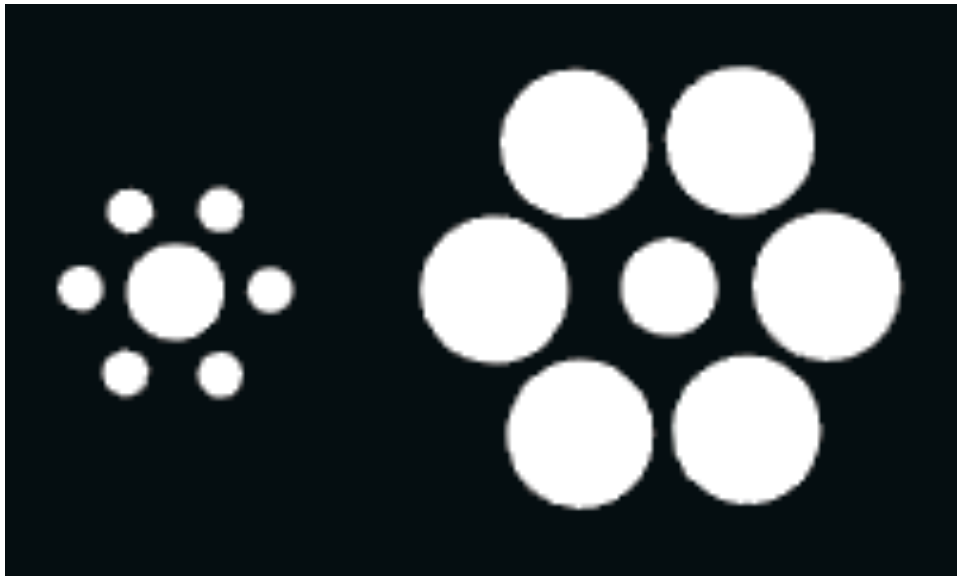
Source: Adapted from Haxby, J.V., Horwitz, B., Underleider, L.G., Maisog, J.M., Pietrini, P., and Grady, C.L. *Journal of Neuroscience,* 1994, *14*, 6336–6353.

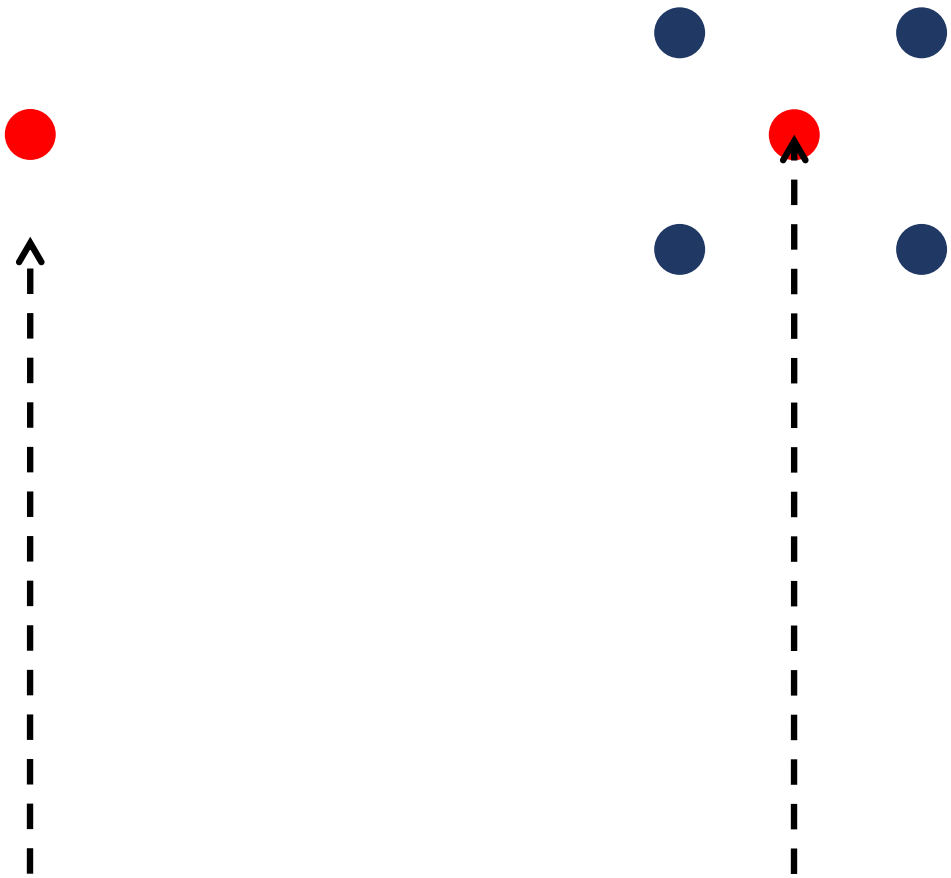

b
Bodies
Faces
Houses
Other objects


(a)
(b)
Right
JHT
lateral
ventral
ips
Dorsal foci
V7
v3a
v3
v2
v1
LO
MT
ITG
pFus
FFA
v4
vo
mFus
v2
v1
PPA
VOT
Objects, places & faces
Faces & objects
Places & objects
Objects
Faces
Places


Bird Experts
Dog Experts
N170
N170
+1 μV
Bird Pictures
Dog Pictures
Picture
Onset
500 ms


Novice
Expert
-42
+42
μV





"What" Pathway

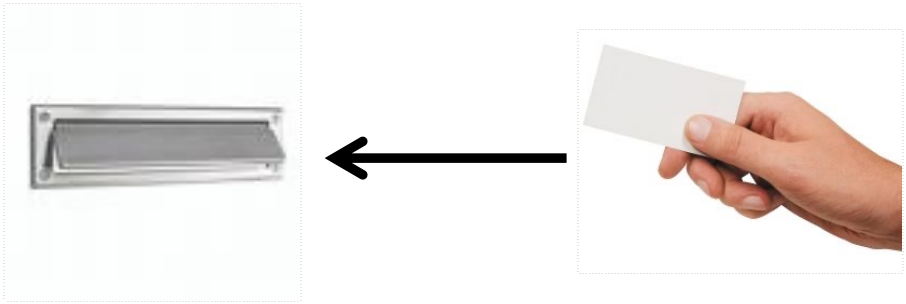
Visual Agnosia

Representation	Deficit
Form/Shape	Apperceptive Agnosia
Objects	Associative Agnosia
Faces	Prospopagnosia

Apperceptive Agnosia

Patient DF

Exp 2 - Orientation and Action Task



Task: Put card into mail slot

Associative Agnosia

Overt/Covert Awareness

flip open

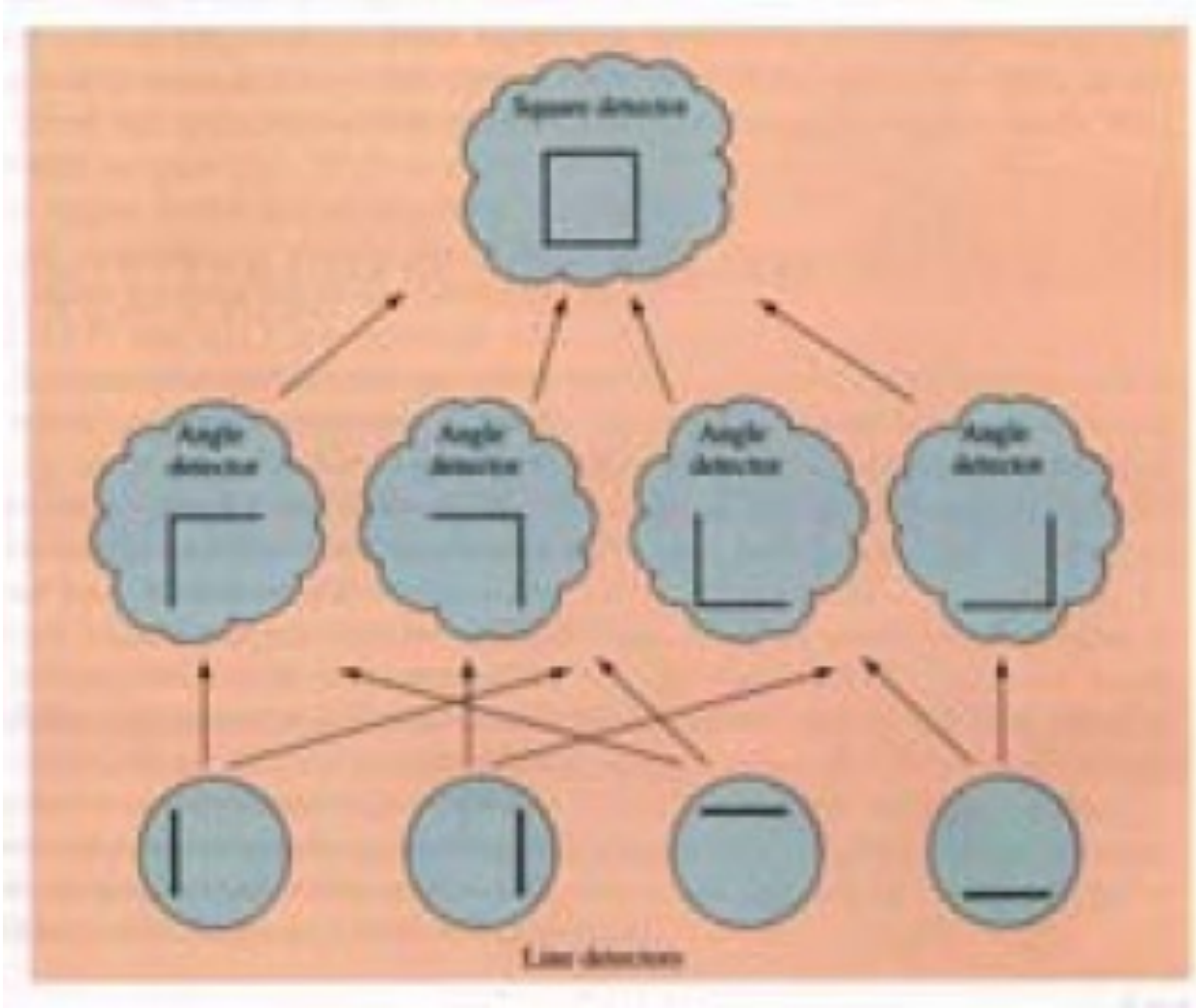
buttons

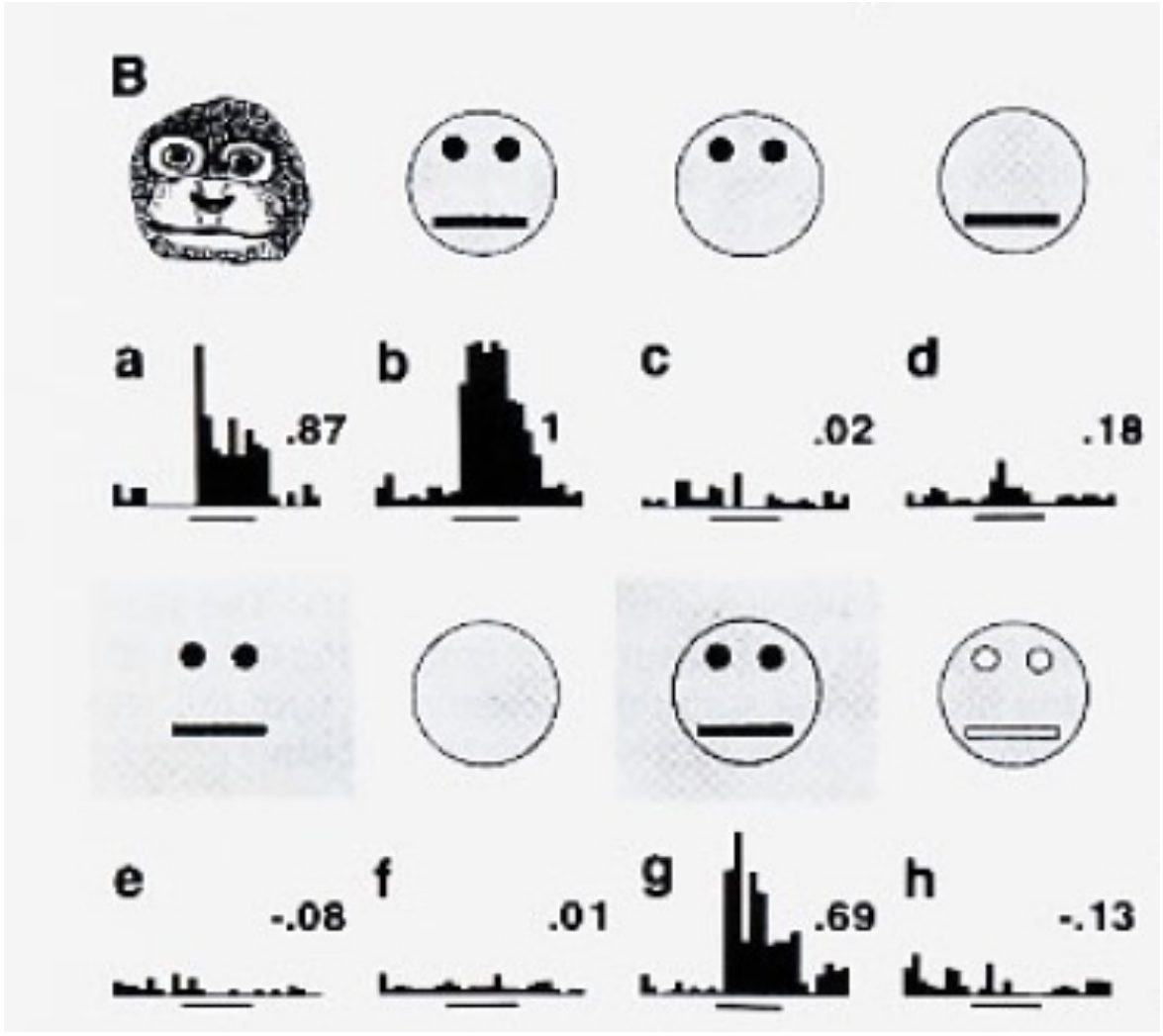
Some device?

Prospopagnosia

What is it like?

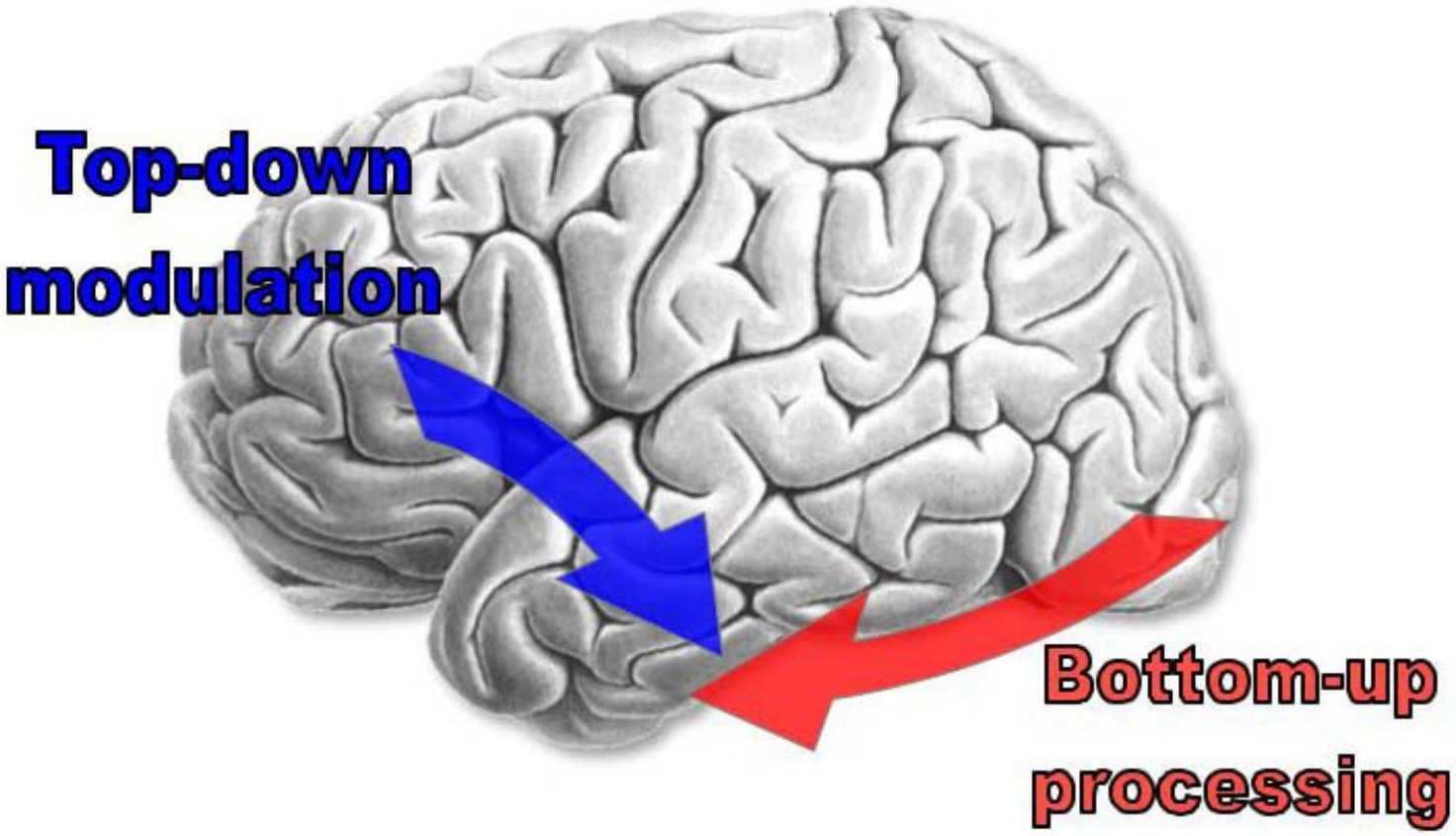
Bottom Up Processing


Square detector
Angle detector
Angle detector
Angle detector
Angle detector
Line detectors

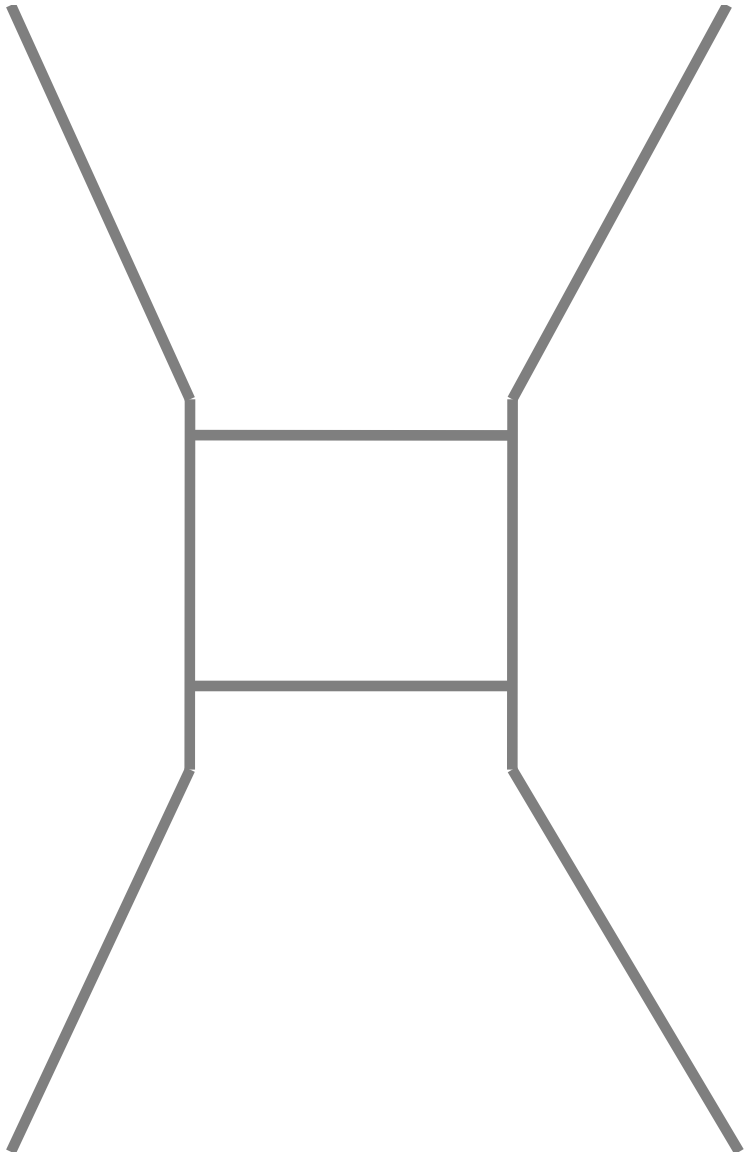

B
a
.87
b
1
c
.02
d
.18
e
-.08
f
.01
g
.69
h
-.13

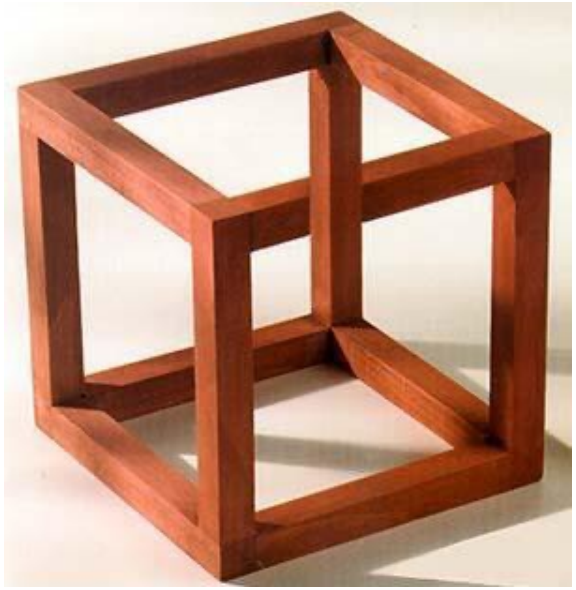
Bottom Up: Feature Analysis

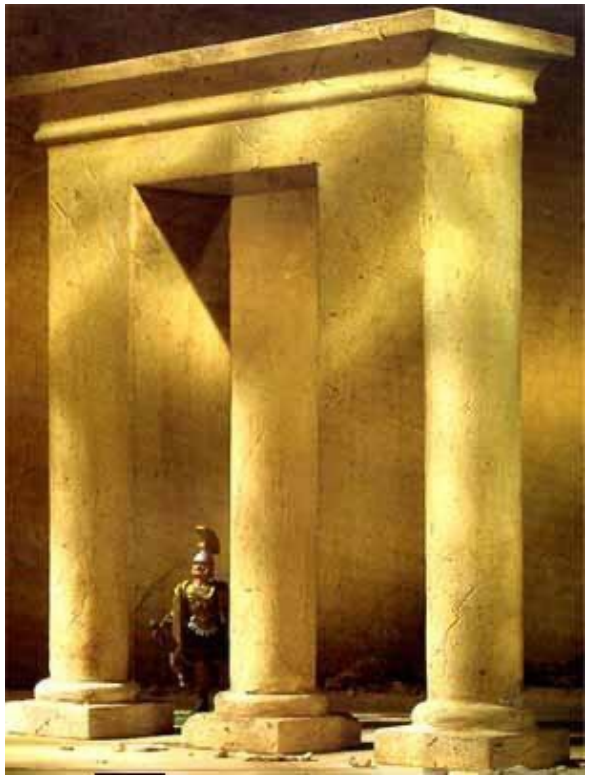
- analysis of simple features lead to identification

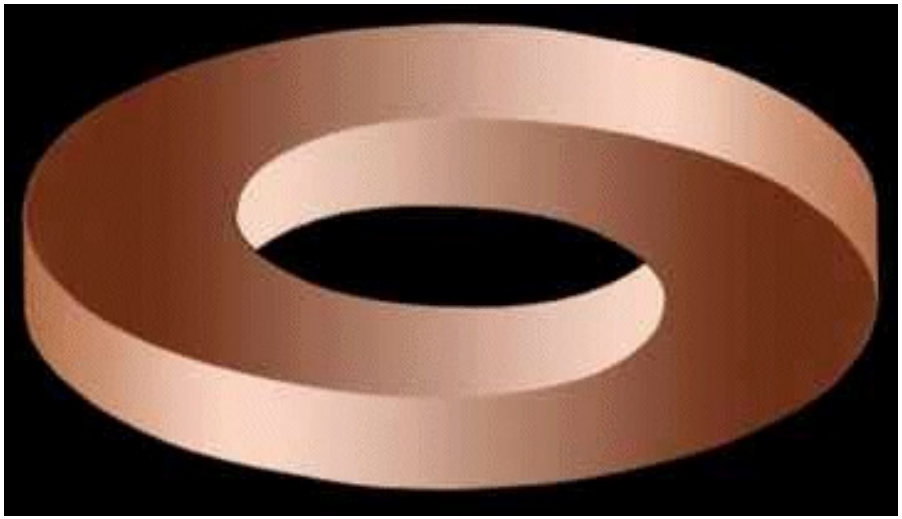

Top-down
modulation
Bottom-up
processing

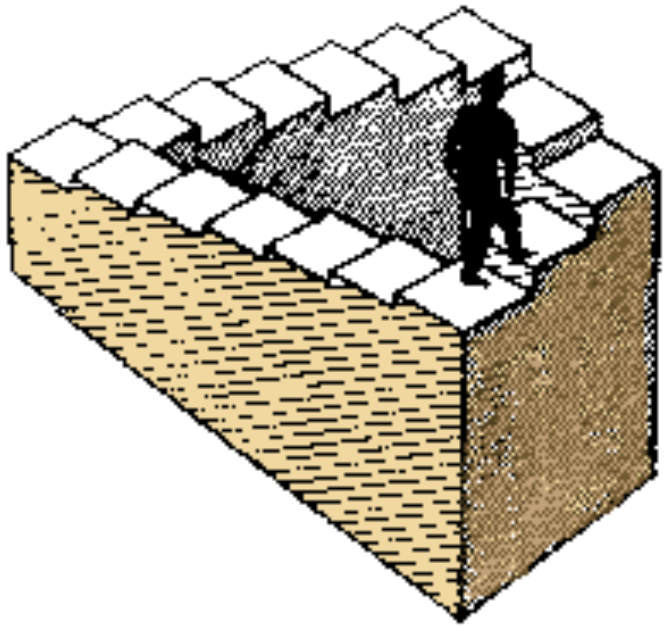
Top Down Processing

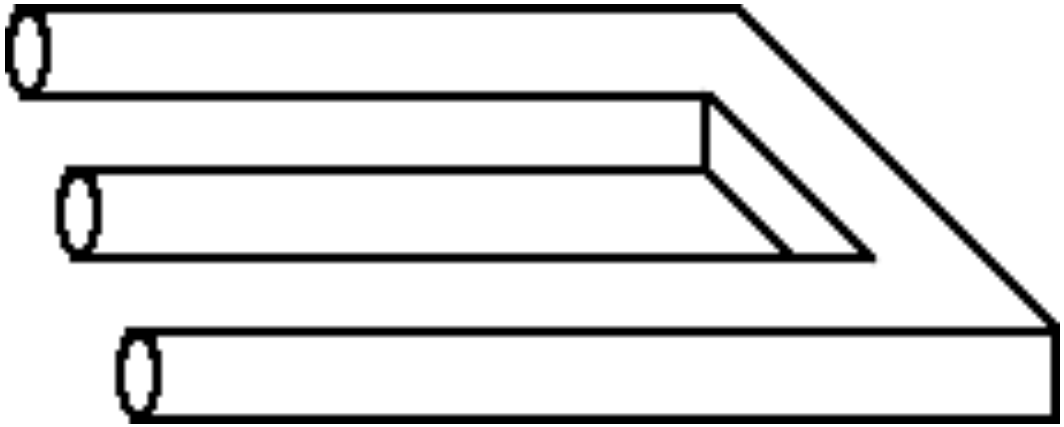


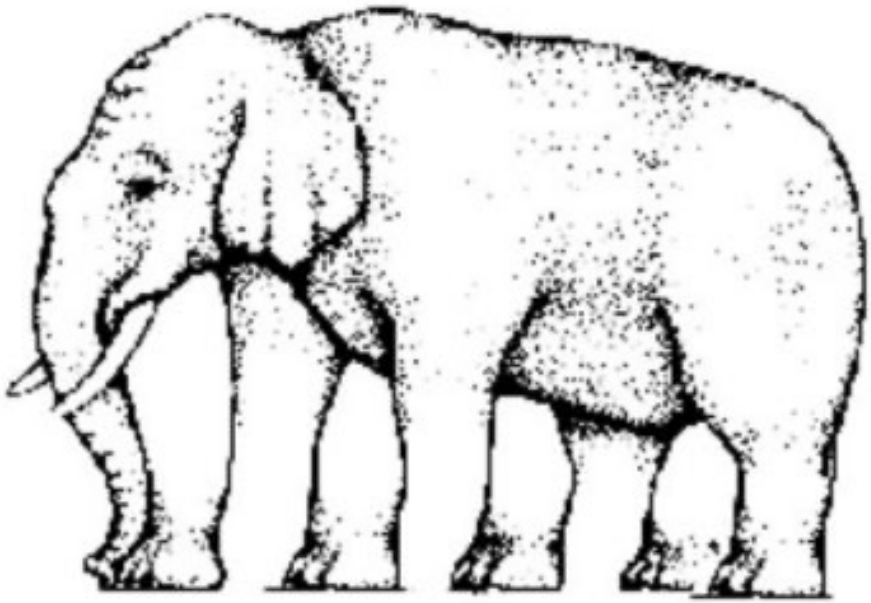


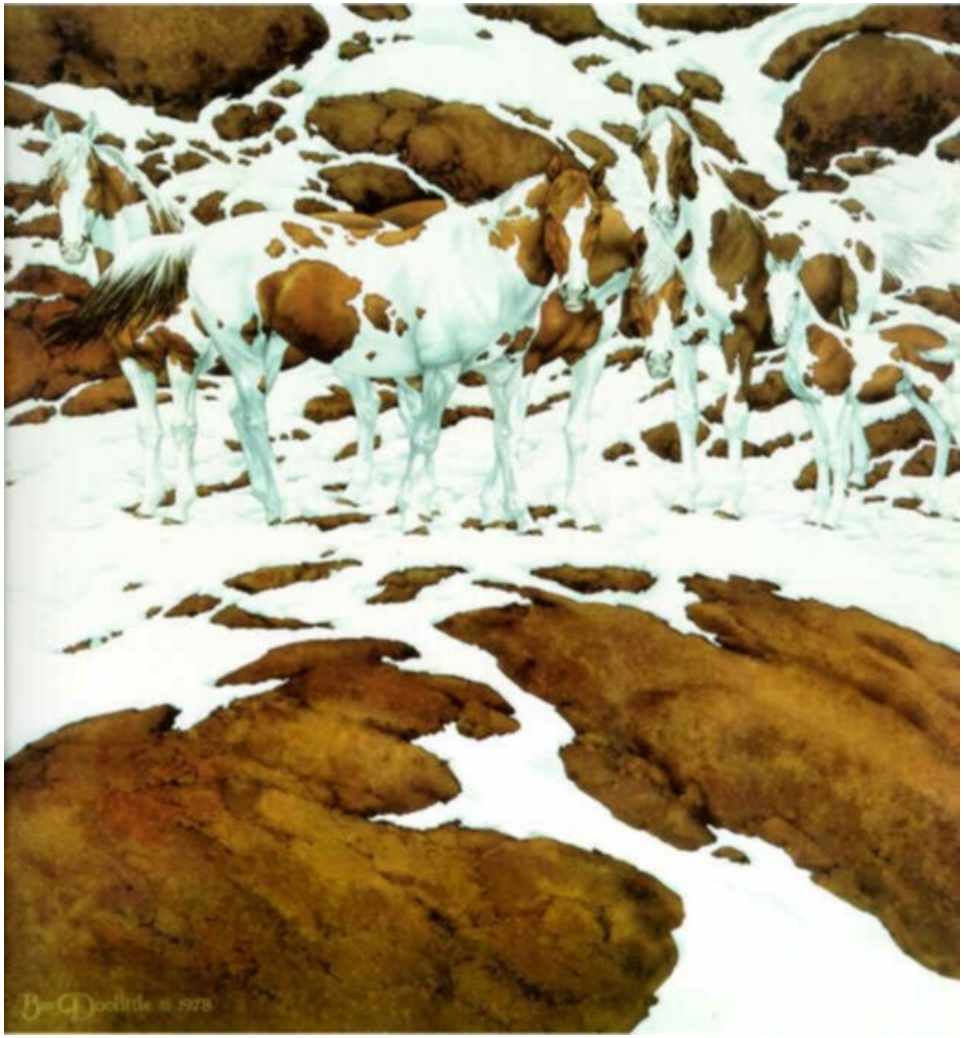


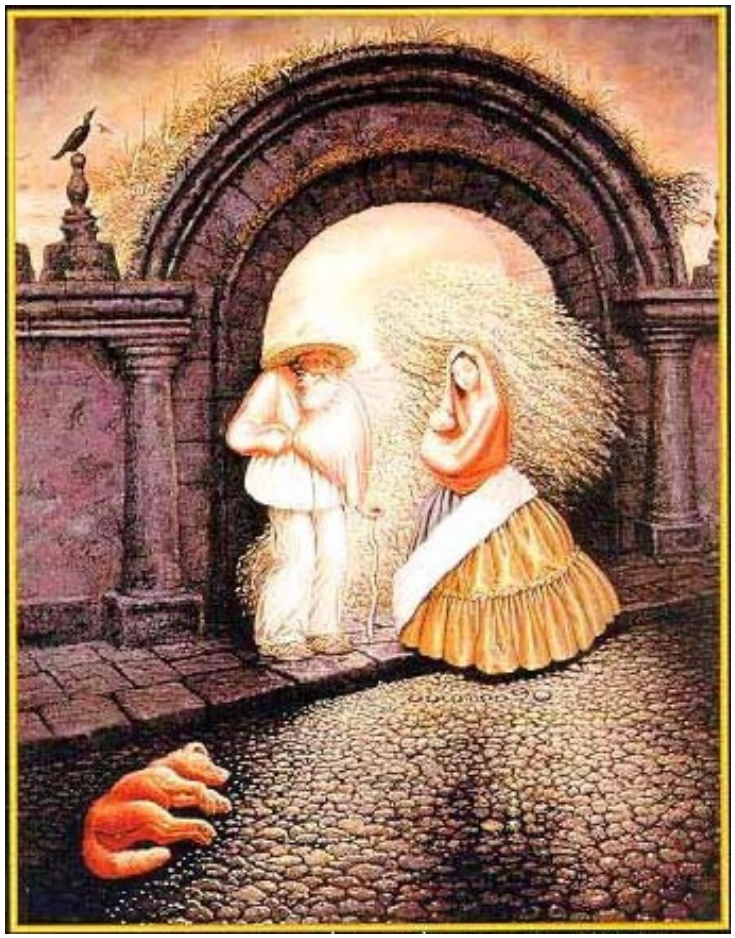


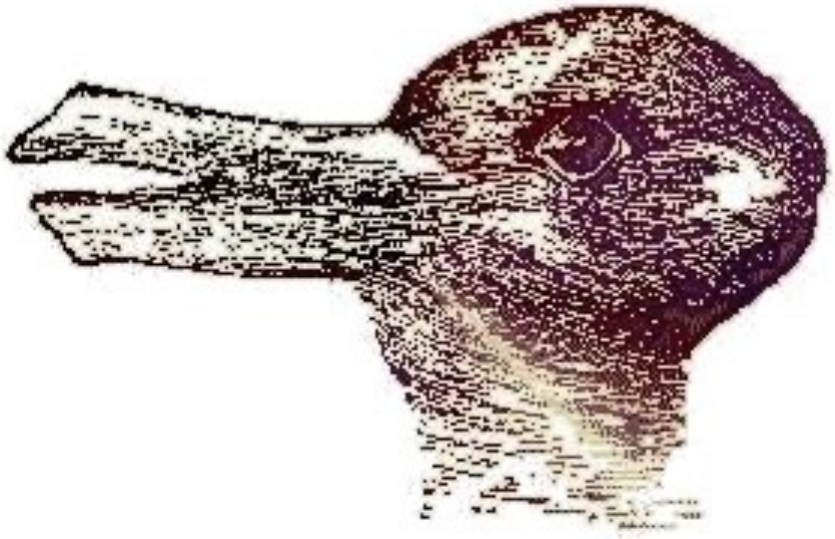


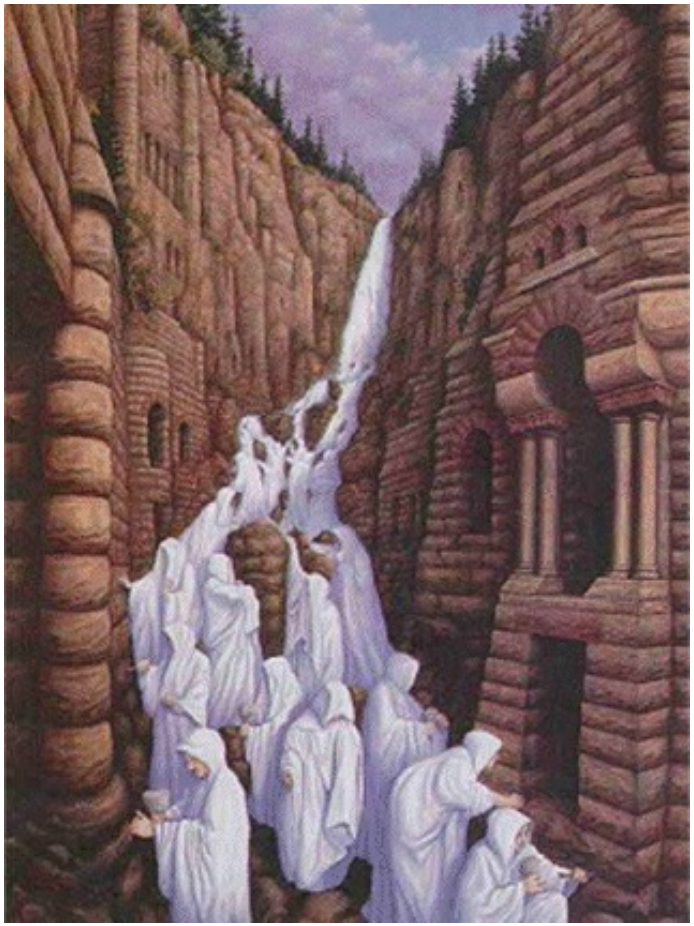


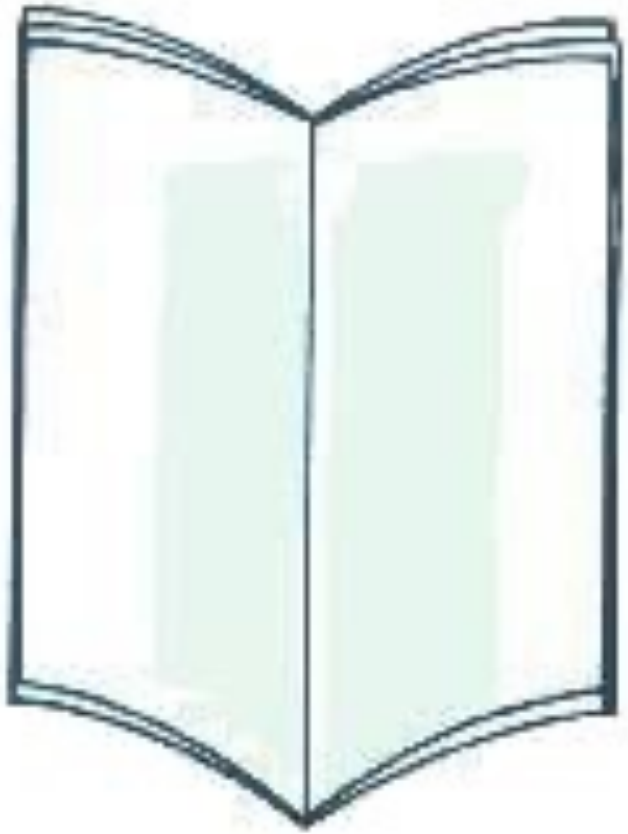


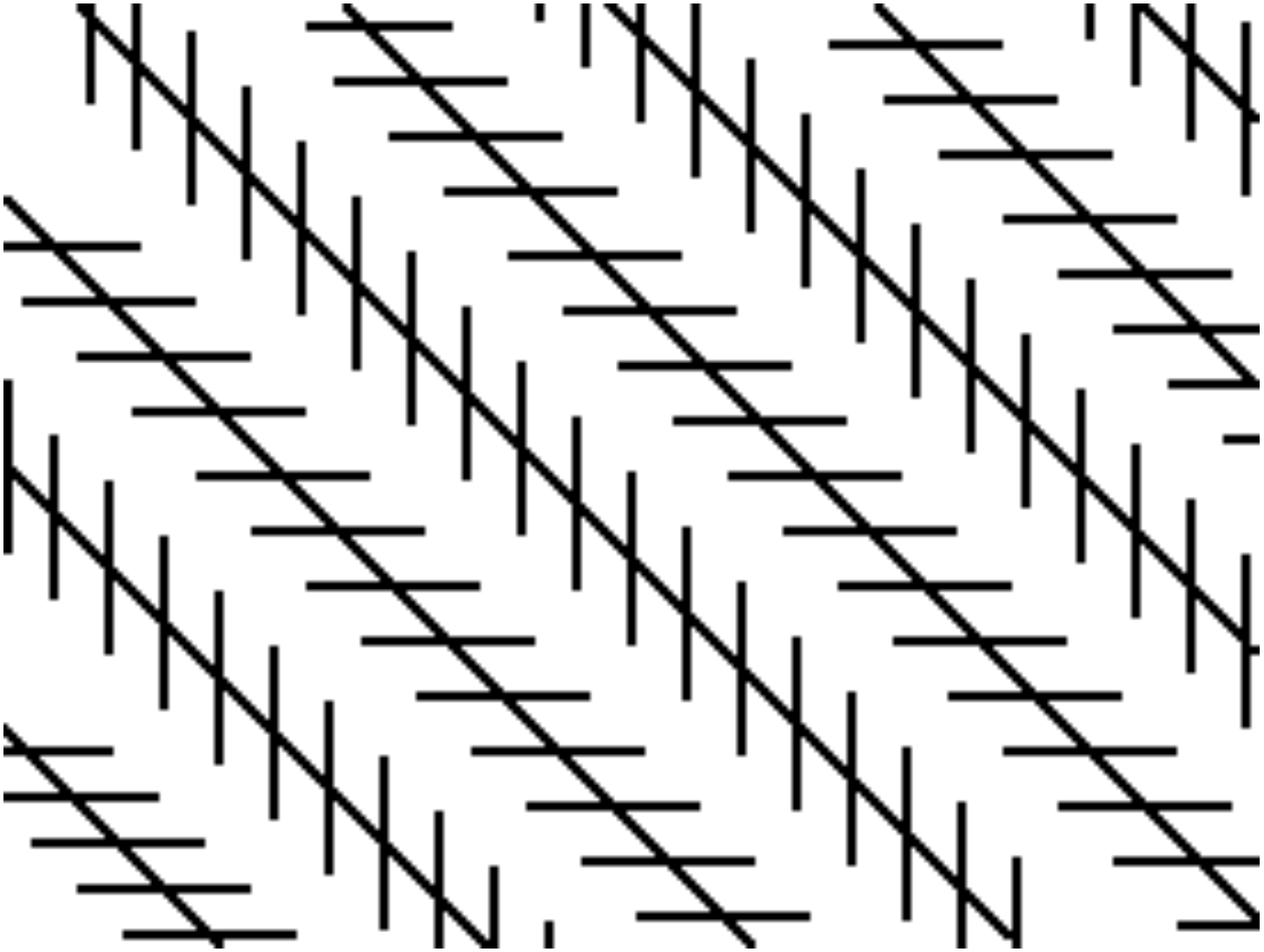


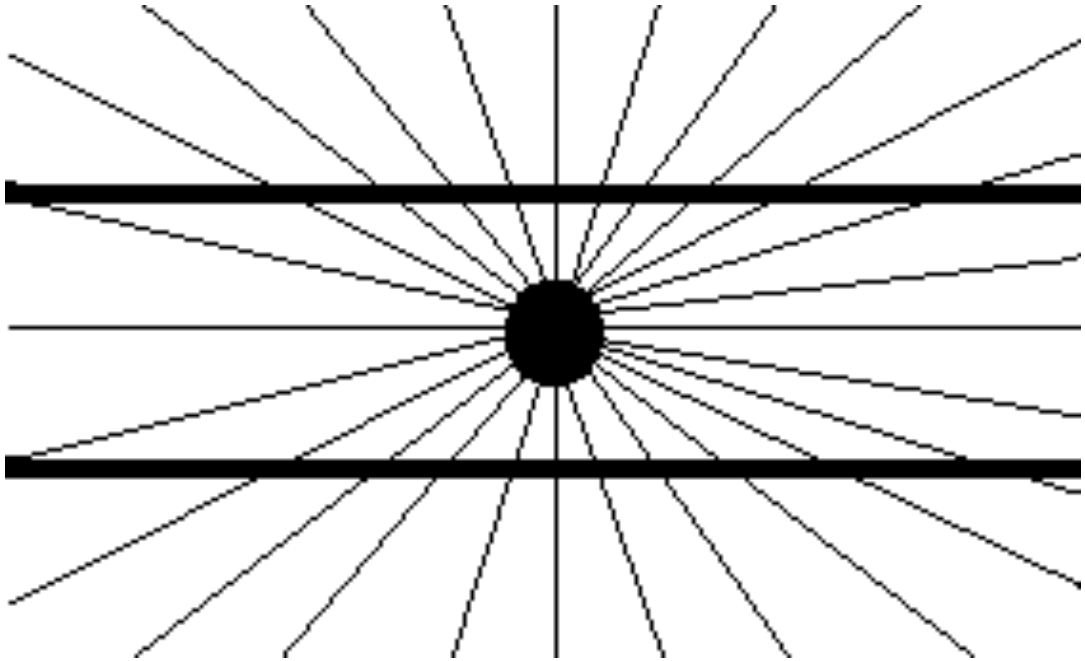


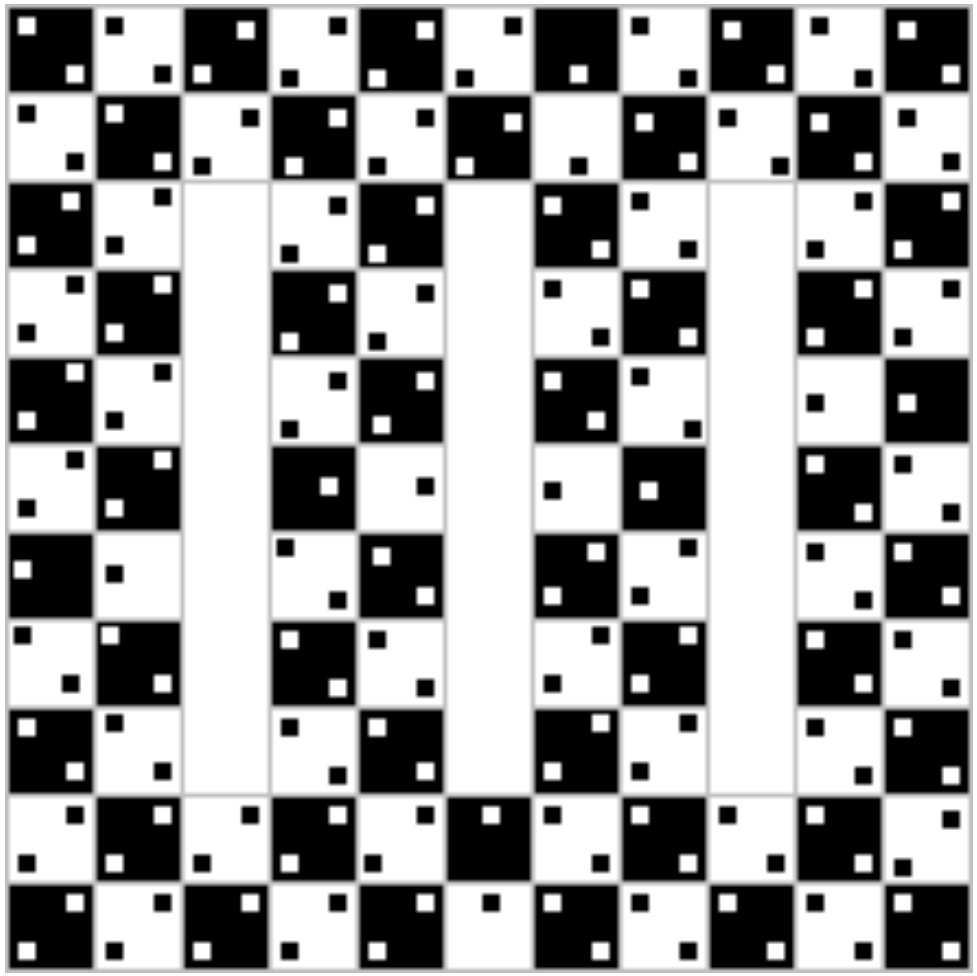


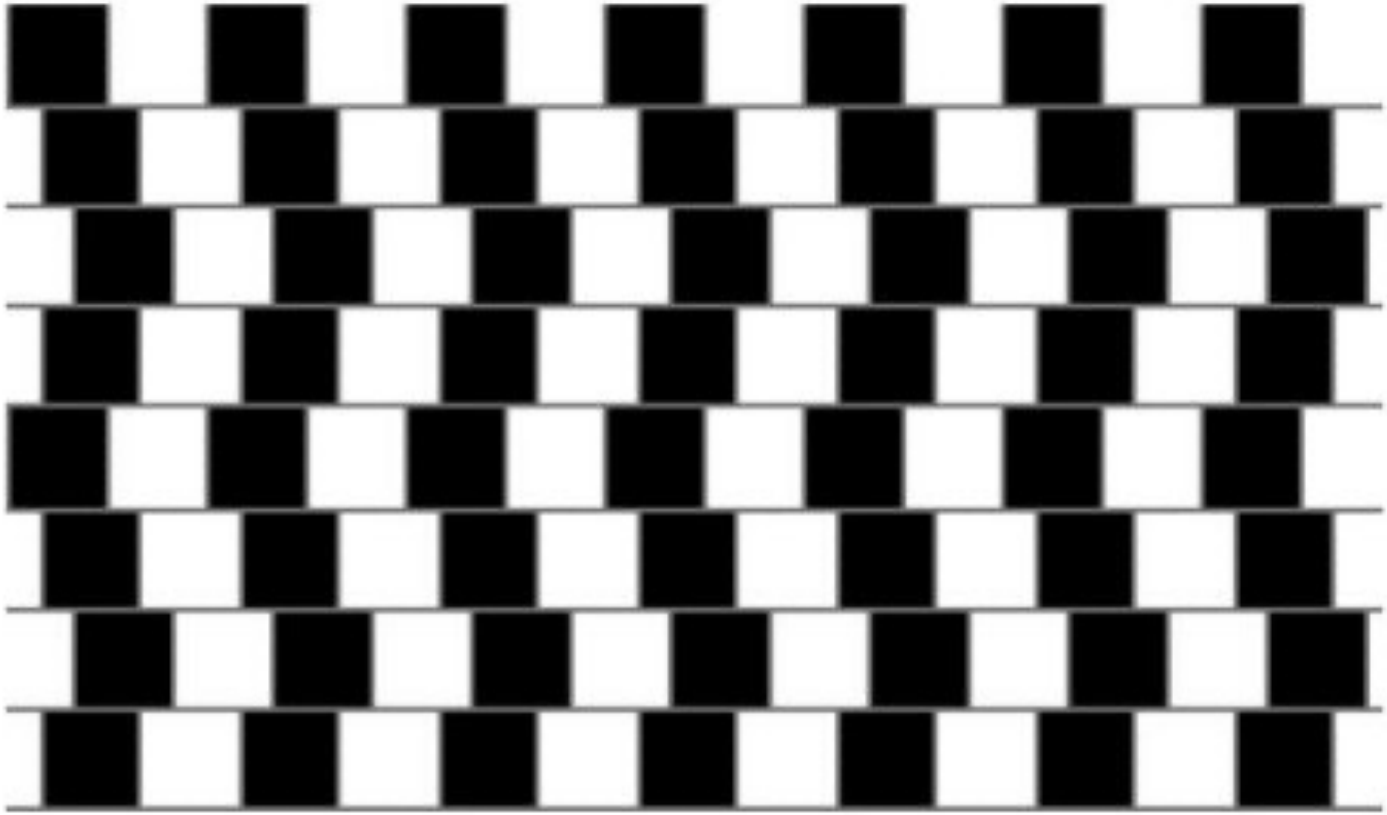


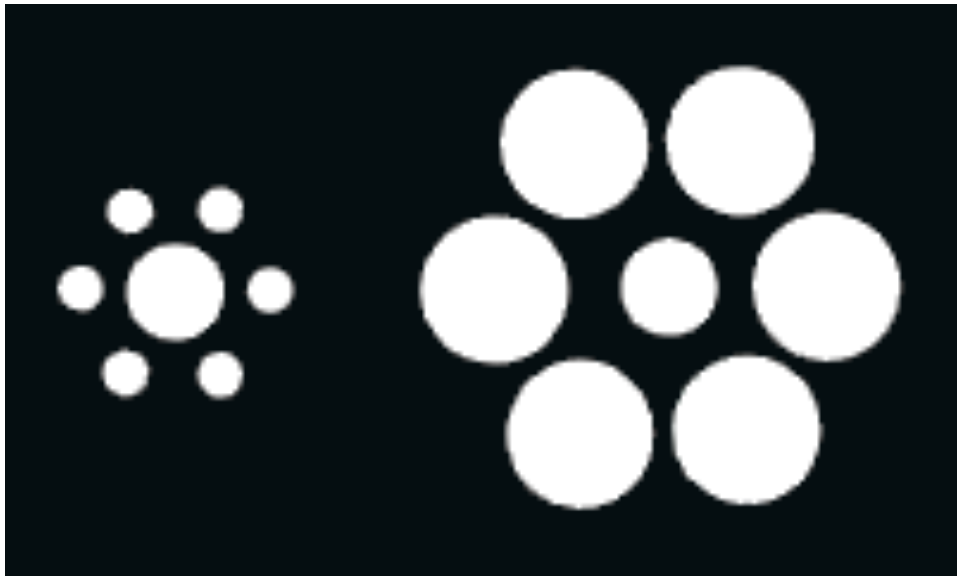


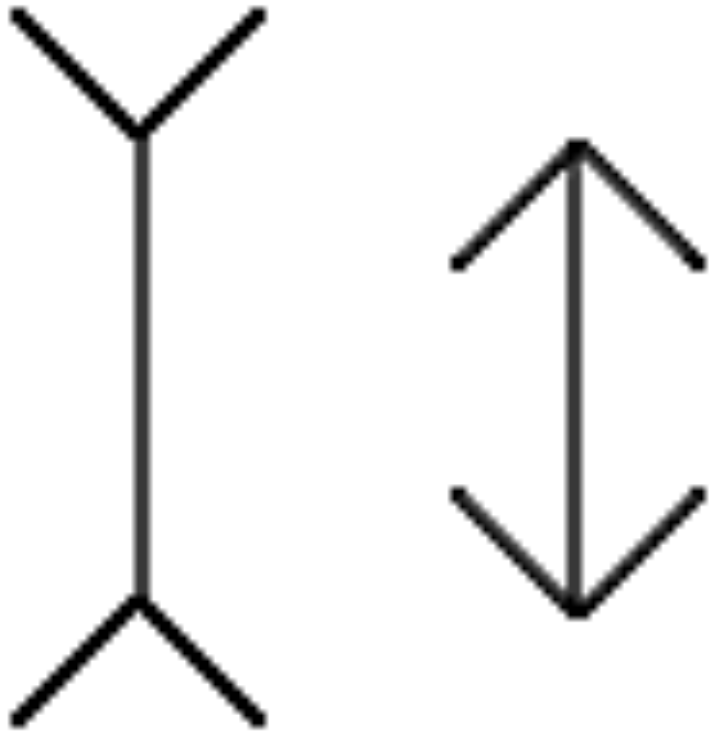


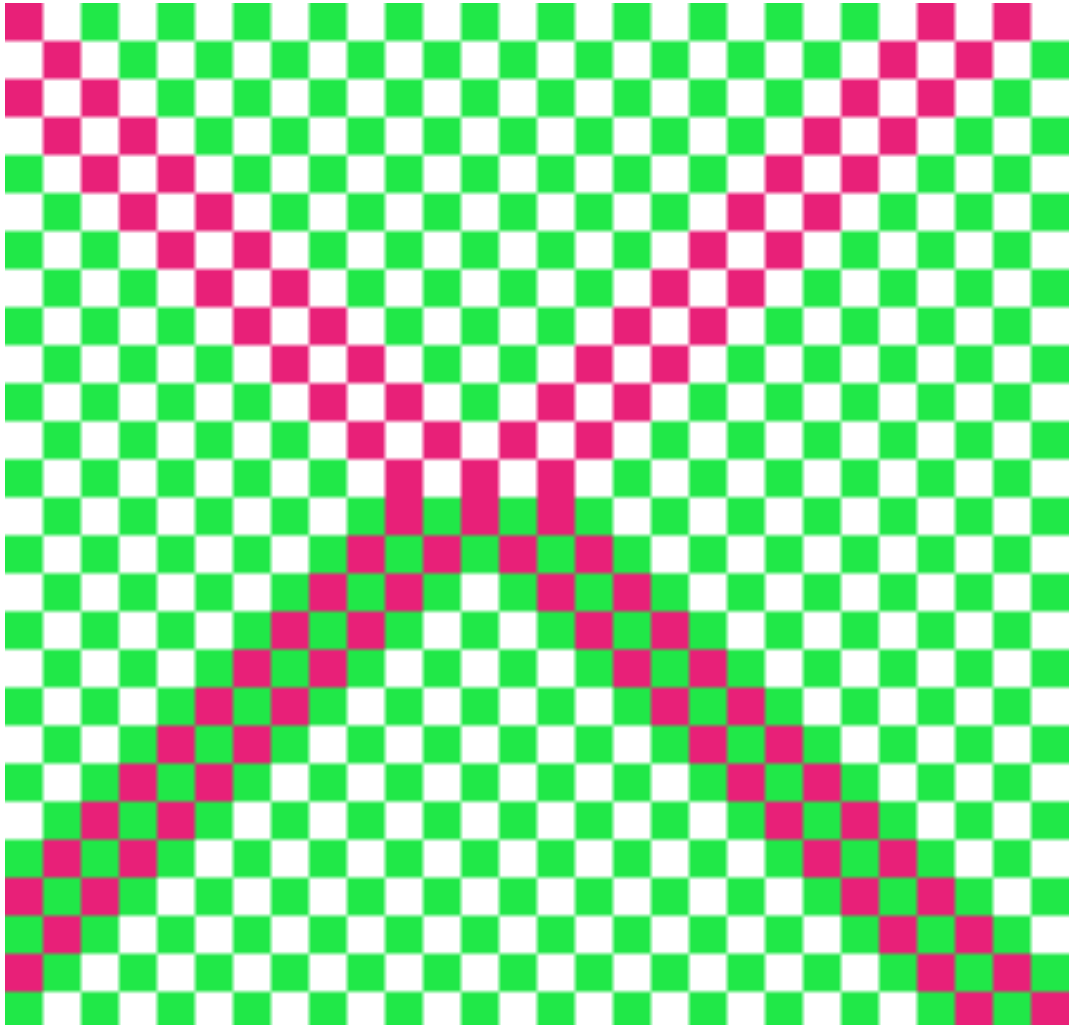


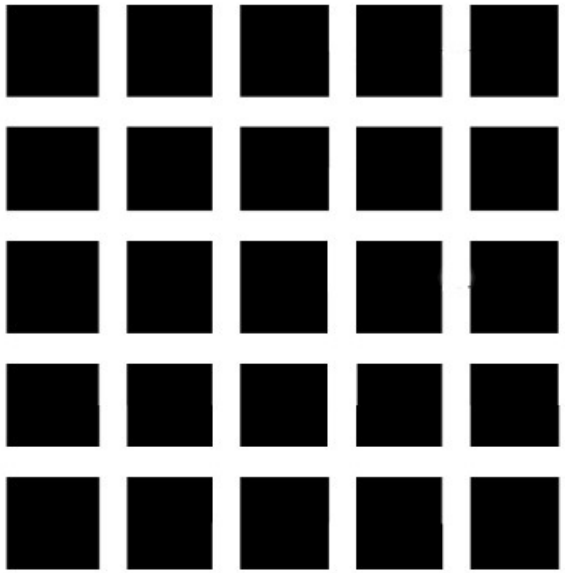


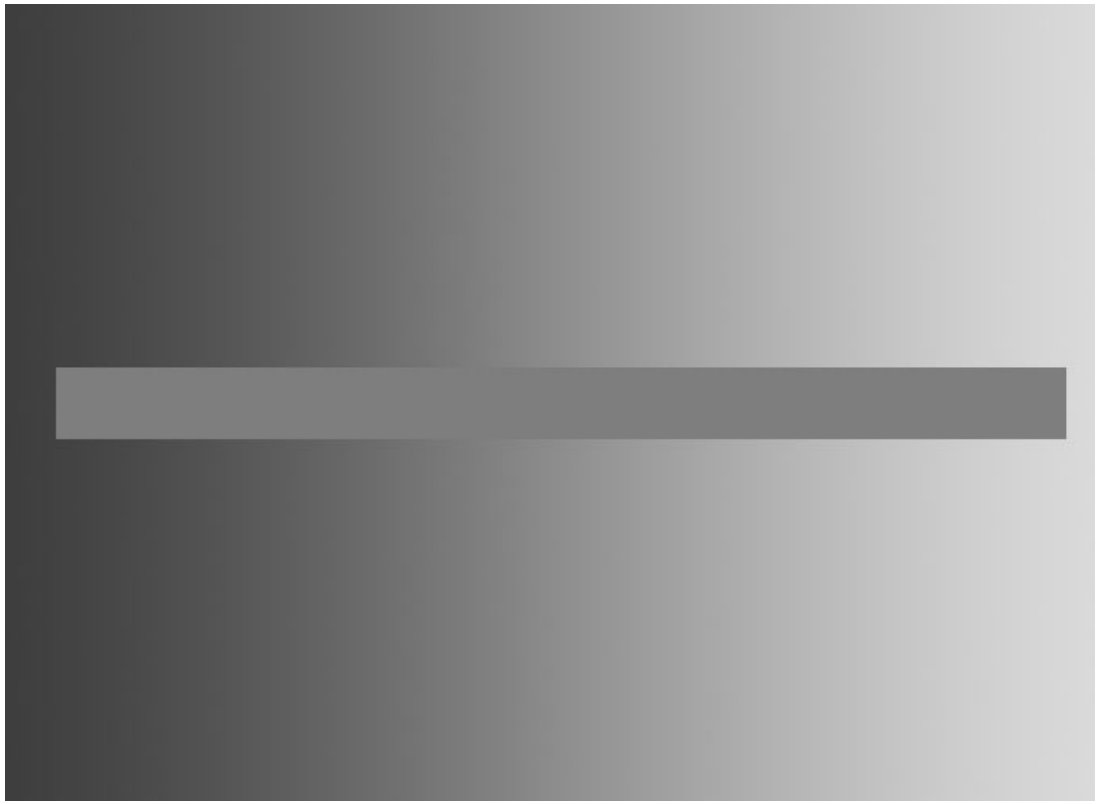


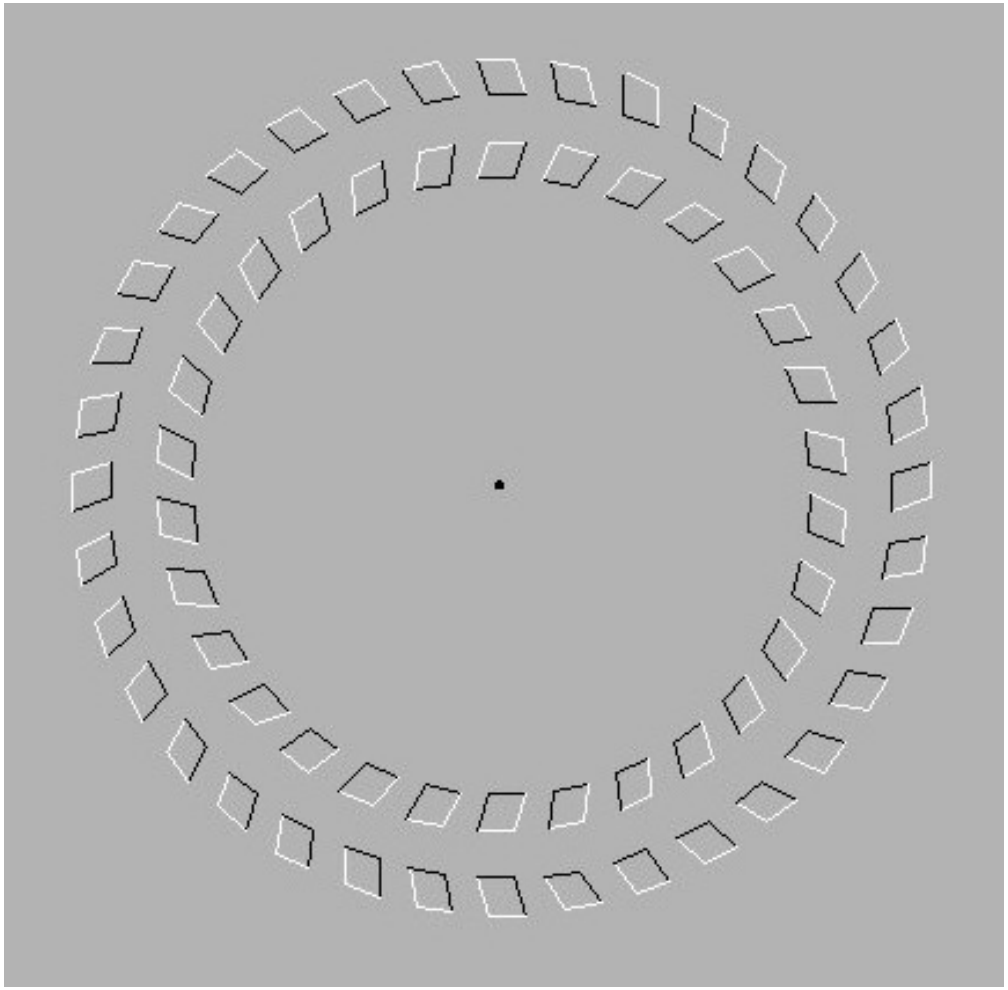


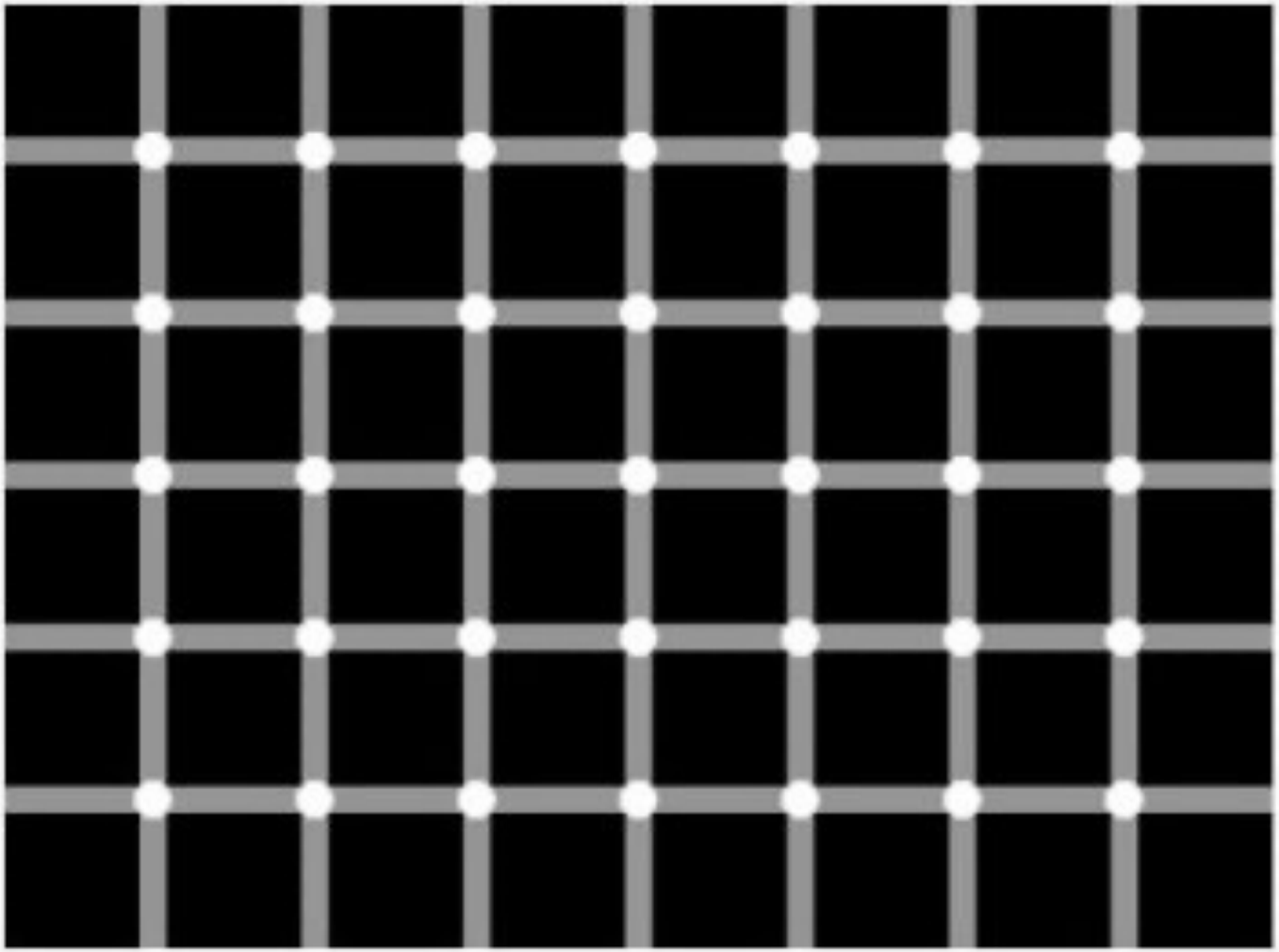


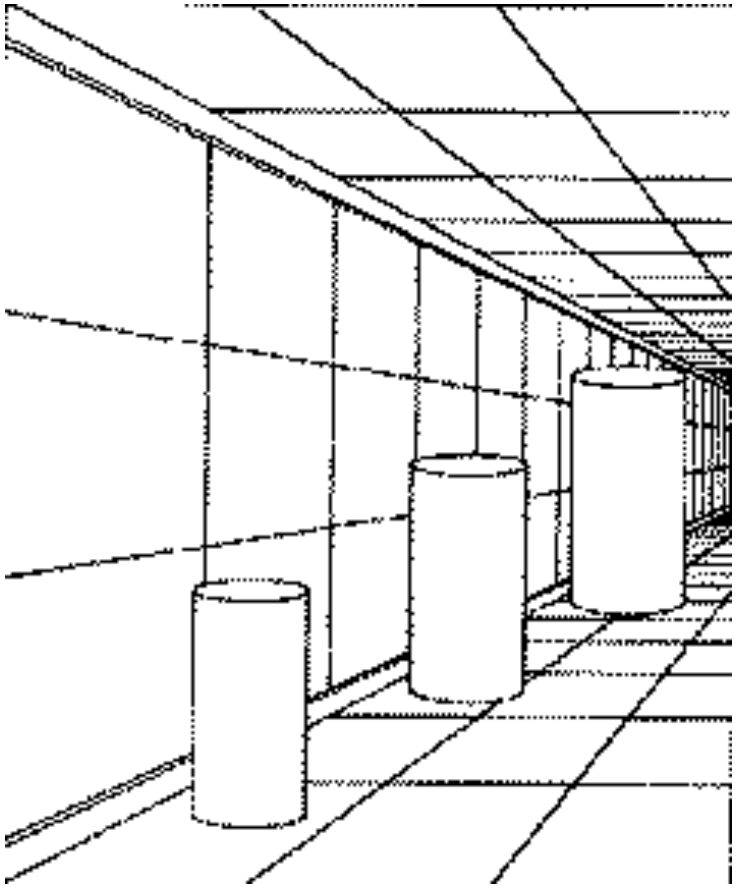










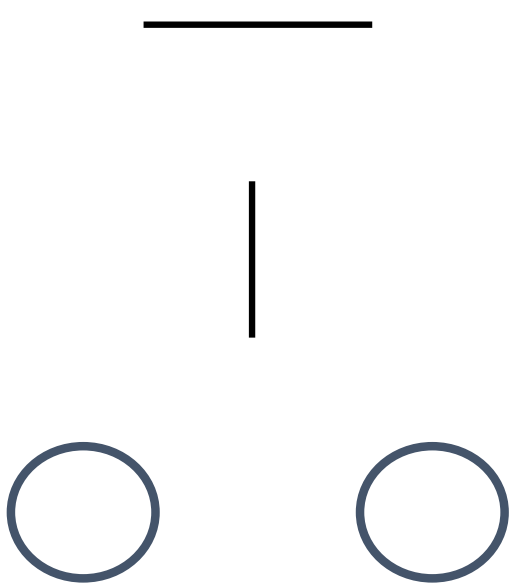


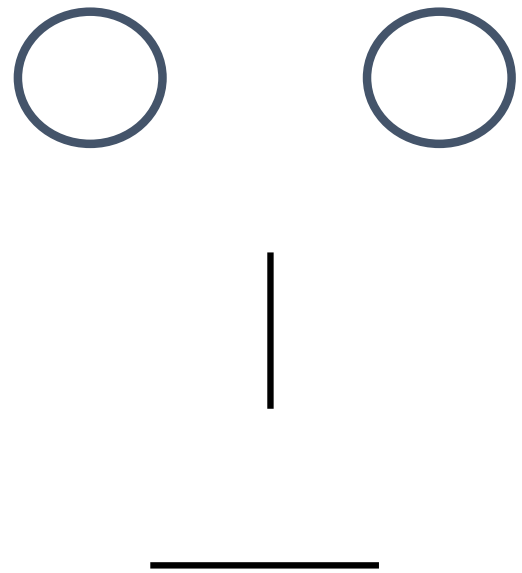

Coca-Cola


REMBRANDT
Talens


CA


MAKE POVERTY HISTORY
JULIAN BEEVER



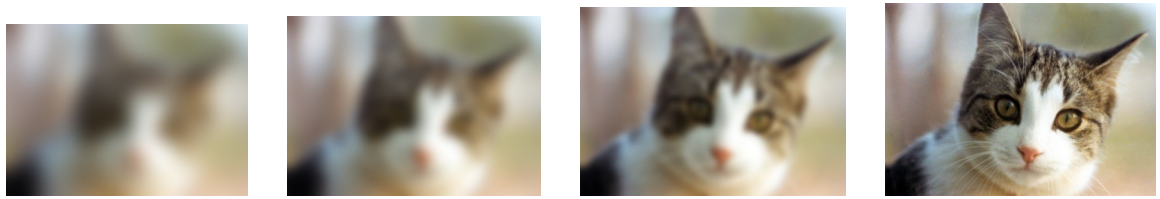


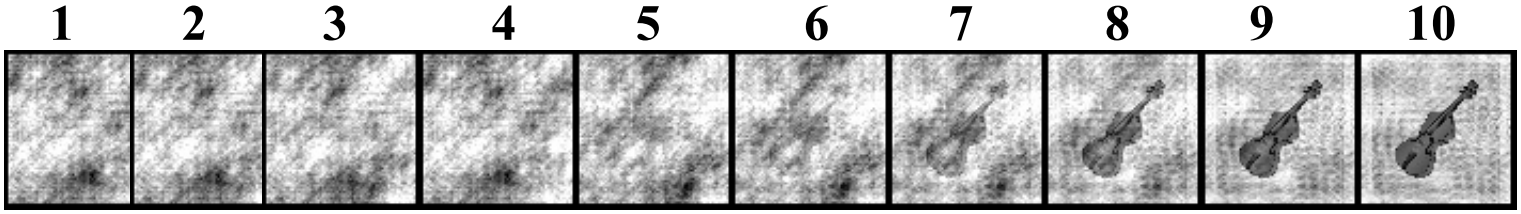
The perception of an object:

Instantaneous and effortless

e.g. Thorpe, Fize and Marlot (1996); Grill-Spector and Kanwisher (2005)

How do we recognize objects?




1
2
3
4
5
6
7
8
9
10

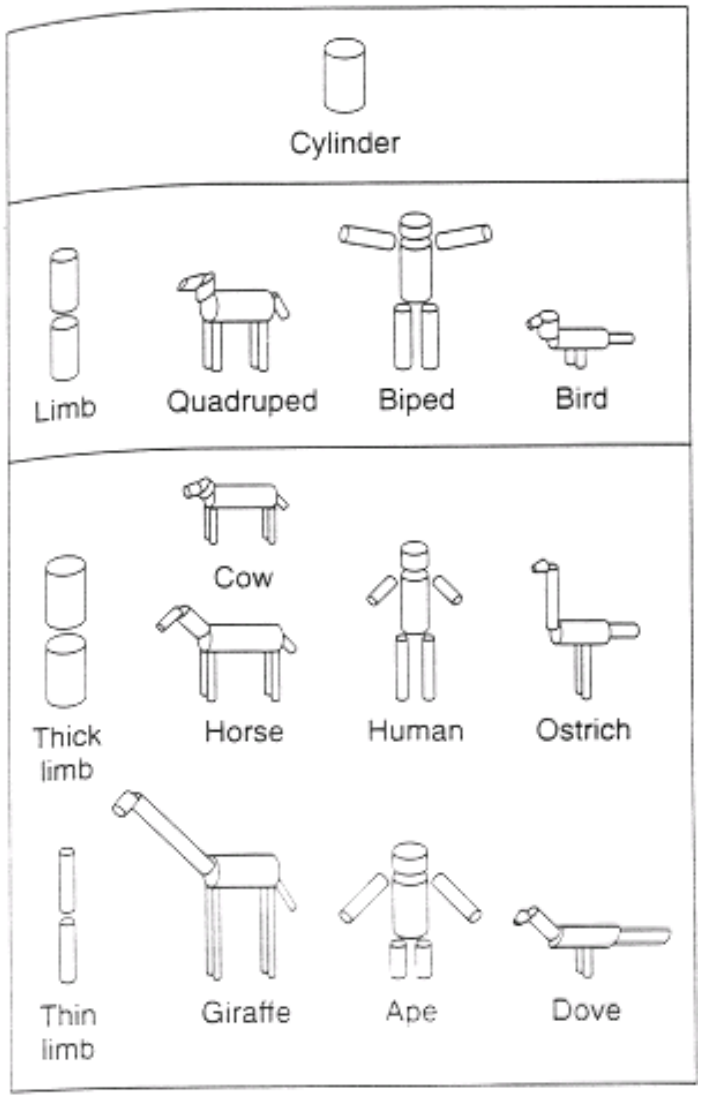
Pattern Recognition

Top-Down Processing

Template Matching

Top Down Processing

Geon Model



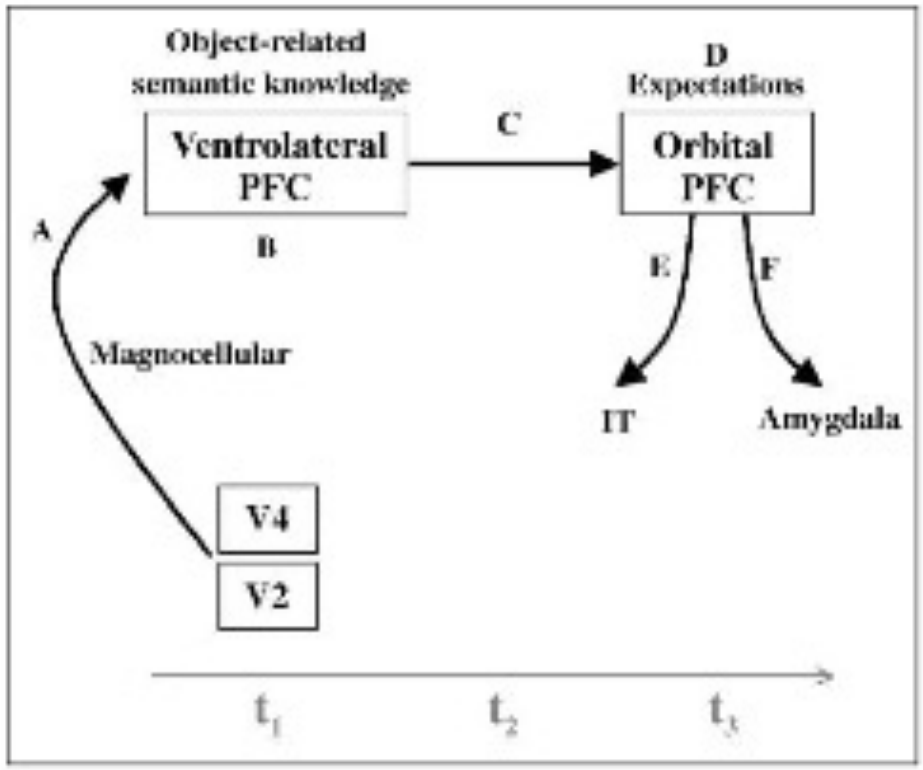
A Cortical Mechanism for Triggering Top-Down Facilitation in Visual Object Recognition

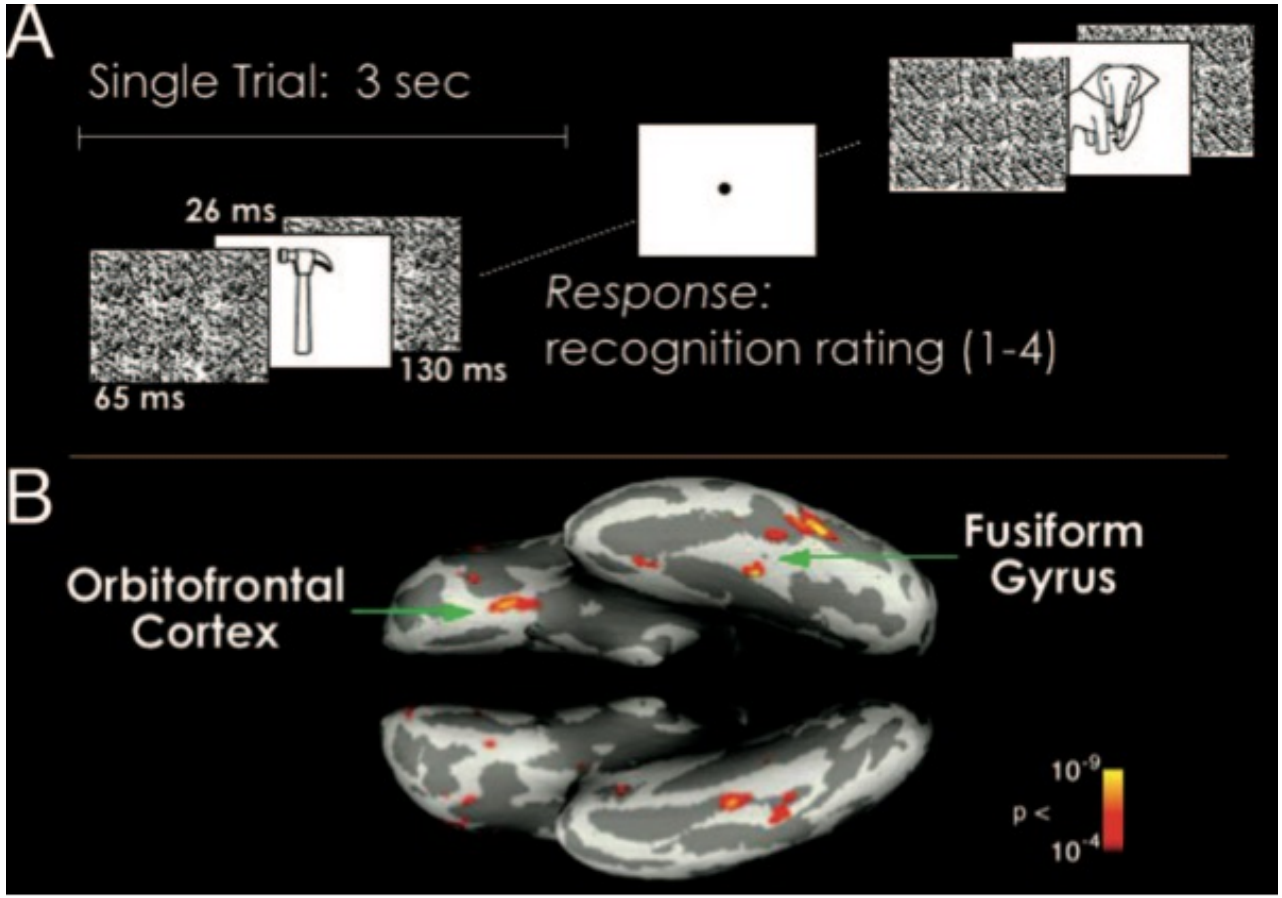
Moshe Bar

The Idea…

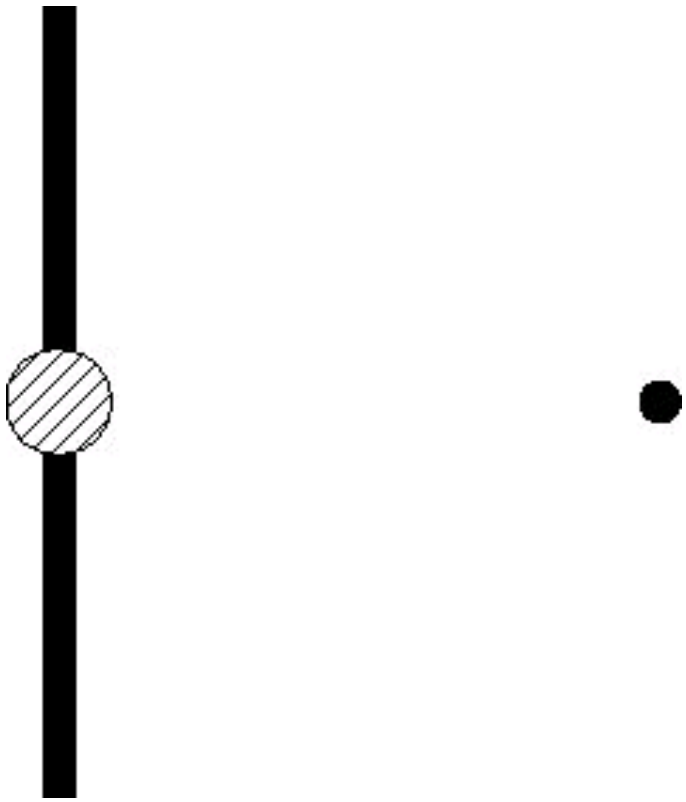
- A “blurred” image (low frequency information) is sent from early visual areas directly to PFC

- PFC generates an “expectation” which is sent back to temporal cortex




A
Single Trial: 3 sec
26 ms
65 ms
130 ms
Response:
recognition rating (1-4)
B
Orbitofrontal Cortex
Fusiform Gyrus
p <
10-9
10-4

‘Filling In’



Charles Bonnet Syndrome

Top-down facilitation of visual recognition

M. Bar*†, K. S. Kassam*‡§, A. S. Ghuman*§¶, J. Boshyan*, A. M. Schmid*, A. M. Dale*, M. S. Hämäläinen*, K. Marinkovic*, D. L. Schacter‡, B. R. Rosen*, and E. Halgren*

*Martinos Center at Massachusetts General Hospital, Harvard Medical School, Charlestown, MA 02129; and ¶Program in Biophysics and ‡Department of Psychology, Harvard University, Cambridge, MA 02138

Edited by Riitta Hari, Helsinki University of Technology, Espoo, Finland, and approved November 23, 2005 (received for review August 17, 2005)

Cortical analysis related to visual object recognition is traditionally thought to propagate serially along a bottom-up hierarchy of ventral areas. Recent proposals gradually promote the role of top-down processing in recognition, but how such facilitation is triggered remains a puzzle. We tested a specific model, proposing that low spatial frequencies facilitate visual object recognition by initiating top-down processes projected from orbitofrontal to visual cortex. The present study combined magnetoencephalography, which has superior temporal resolution, functional magnetic resonance imaging, and a behavioral task that yields successful recognition with stimulus repetitions. Object recognition elicited differential activity that developed in the left orbitofrontal cortex 50 ms earlier than it did in recognition-related areas in the temporal cortex. This early orbitofrontal activity was directly modulated by the presence of low spatial frequencies in the image. Taken together, the dynamics we revealed provide strong support for the proposal of how top-down facilitation of object recognition is initiated, and our observations are used to derive predictions for

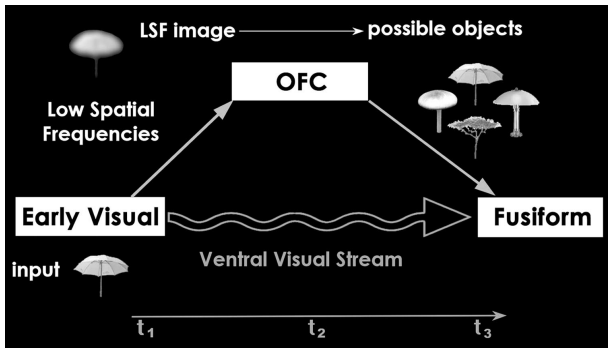


Fig. 1. An illustration of the proposed model. A LSF representation of the input image is projected rapidly, possibly via the dorsal magnocellular pathway, from early visual cortex to the OFC, in parallel to the systematic and relatively slower propagation of information along the ventral visual pathway. This coarse representation is sufficient for activating a minimal set of the most probable interpretations of the input, which are then integrated with the bottom-up stream of analysis to facilitate recognition.