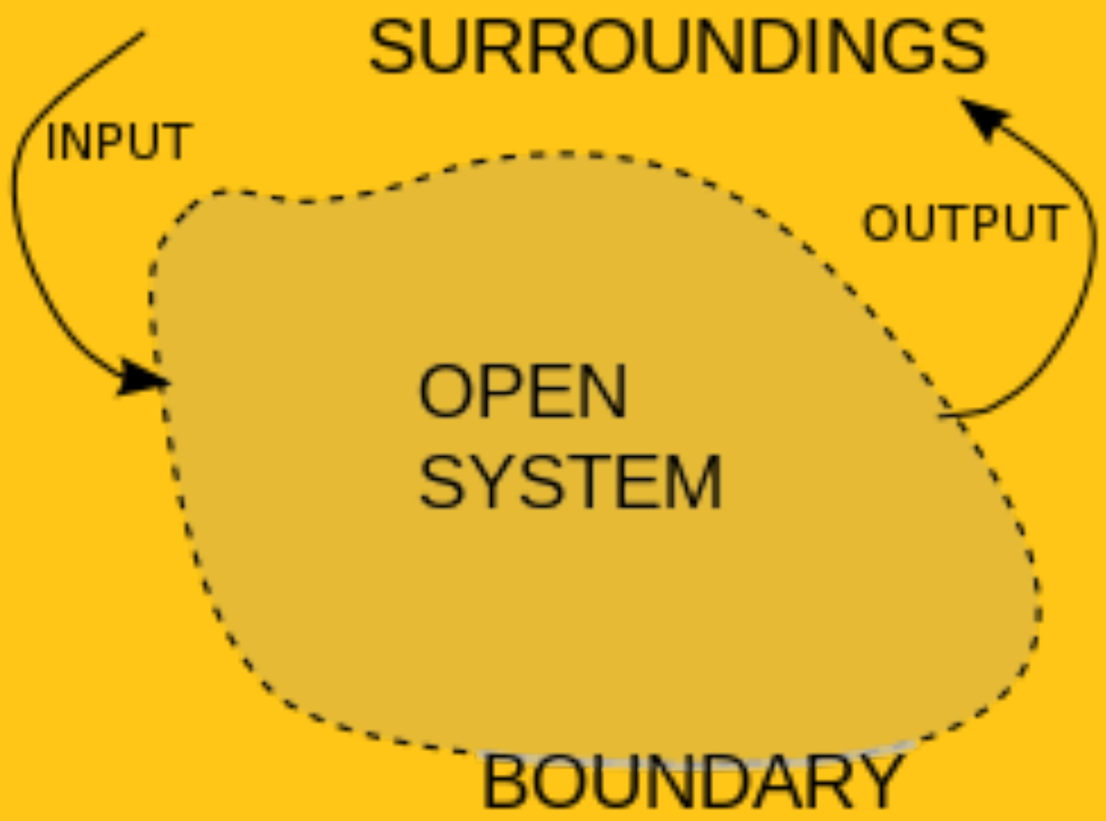
ASPEN HOPKINS

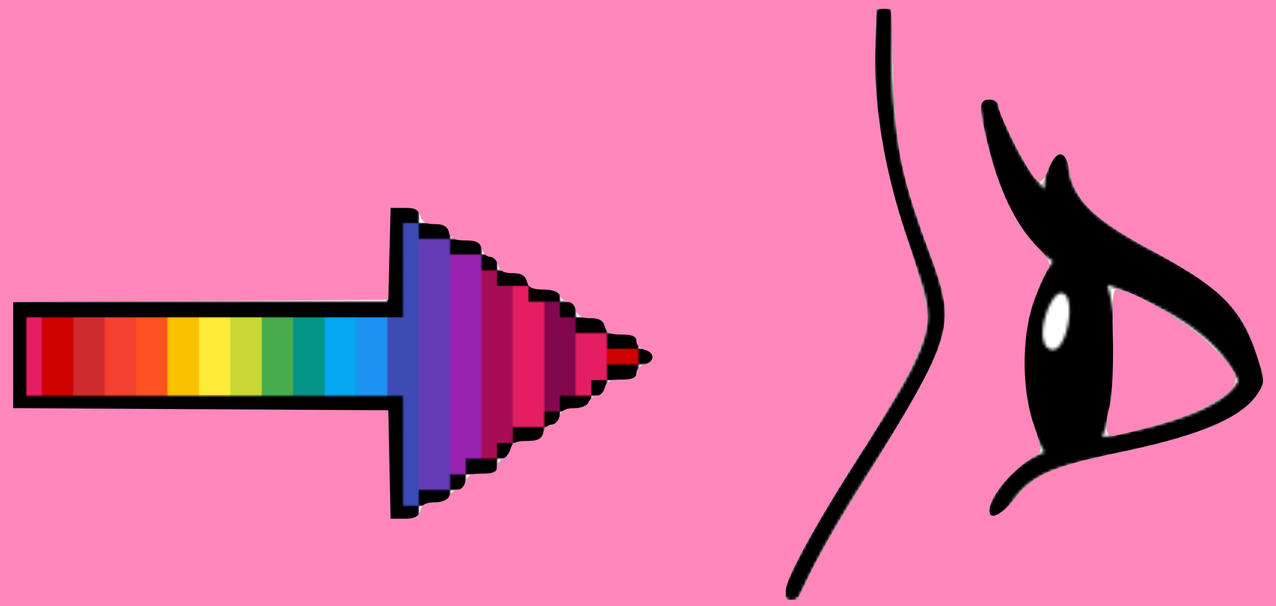
PERCEPTION


SURROUNDINGS
INPUT
OUTPUT
OPEN
SYSTEM
BOUNDARY

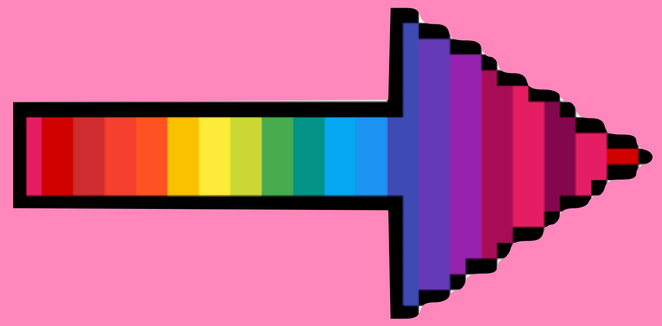
1. WHAT ARE THE INPUTS?
2. WHAT ARE THE OUTPUTS?
3. HOW IS THE OUTPUT COMPUTED?

1. Color
2. Edges
3. Movement
4. Object recognition / Representations


TALKING ABOUT COLOR
(LIKE A THEORIST MIGHT)

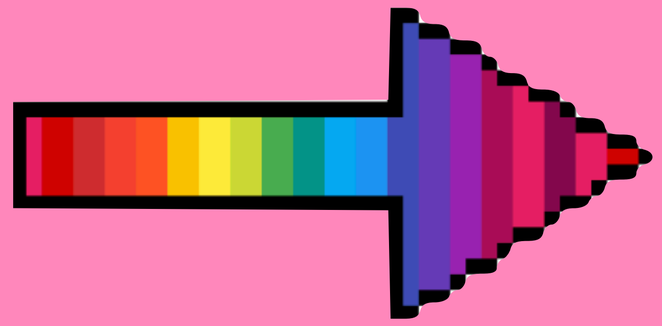


1. WHAT ARE THE OUTPUTS OF OUR SYSTEM?



1. WHAT ARE THE OUTPUTS OF OUR SYSTEM?

2. WHAT ARE WE (THE SYSTEM) COMPUTING WITH COLOR (OUR INPUT)?

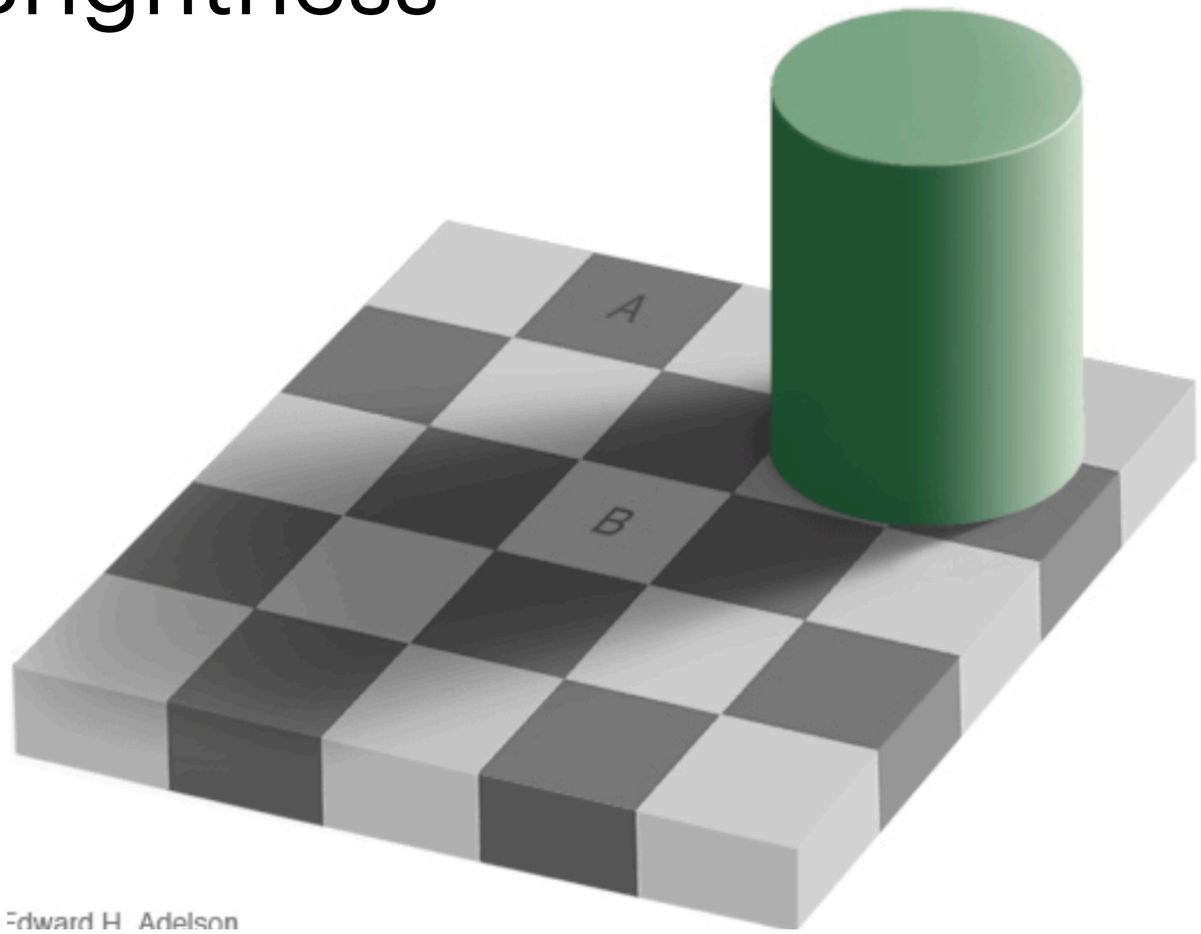


1. WHAT ARE THE OUTPUTS OF OUR SYSTEM?

2. WHAT ARE WE (THE SYSTEM) COMPUTING WITH COLOR (OUR INPUT)?

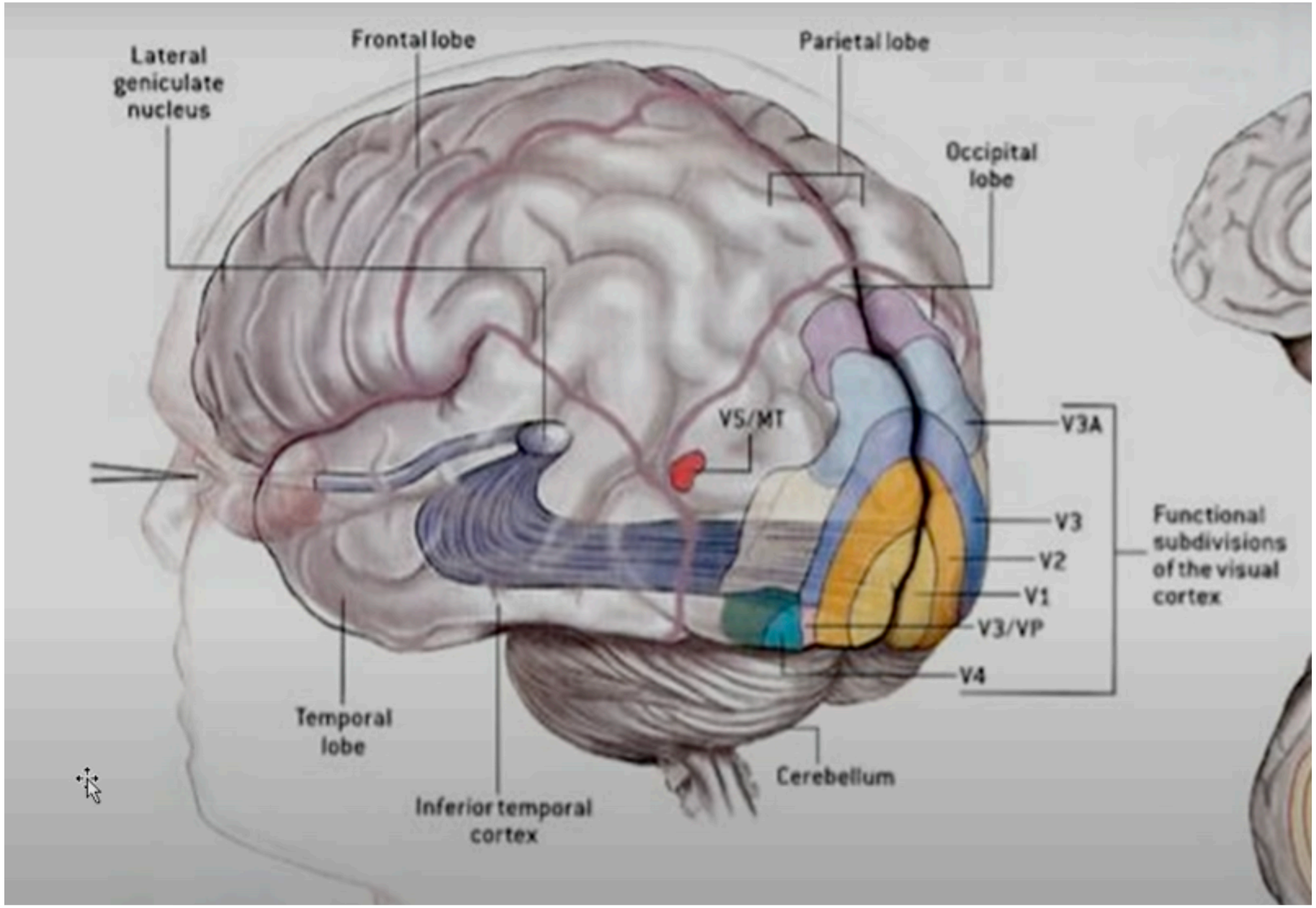
3. WHAT CHALLENGES DO WE FACE WHEN DETERMINING OUTPUTS FROM OUR INPUTS?

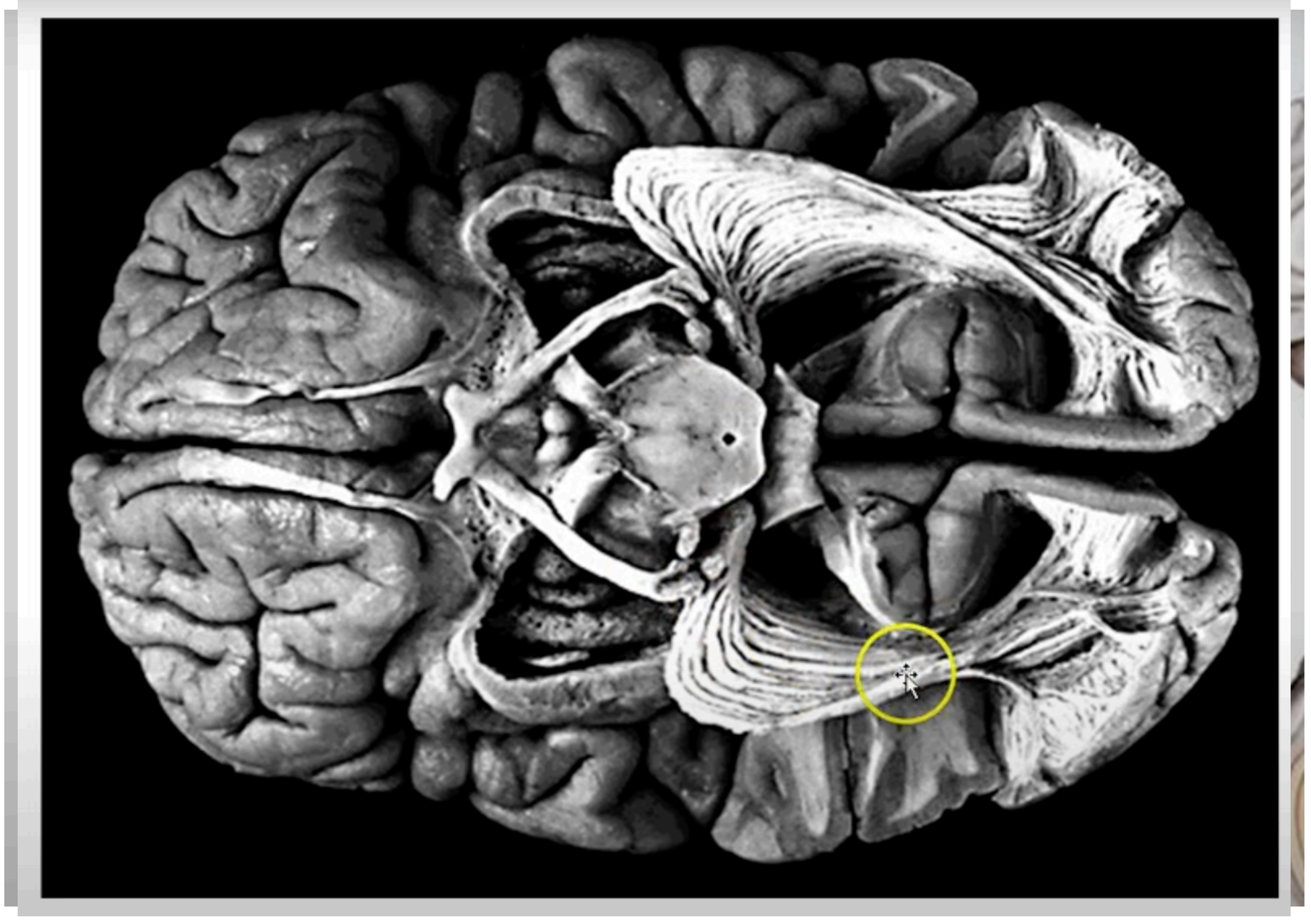
Relative Brightness



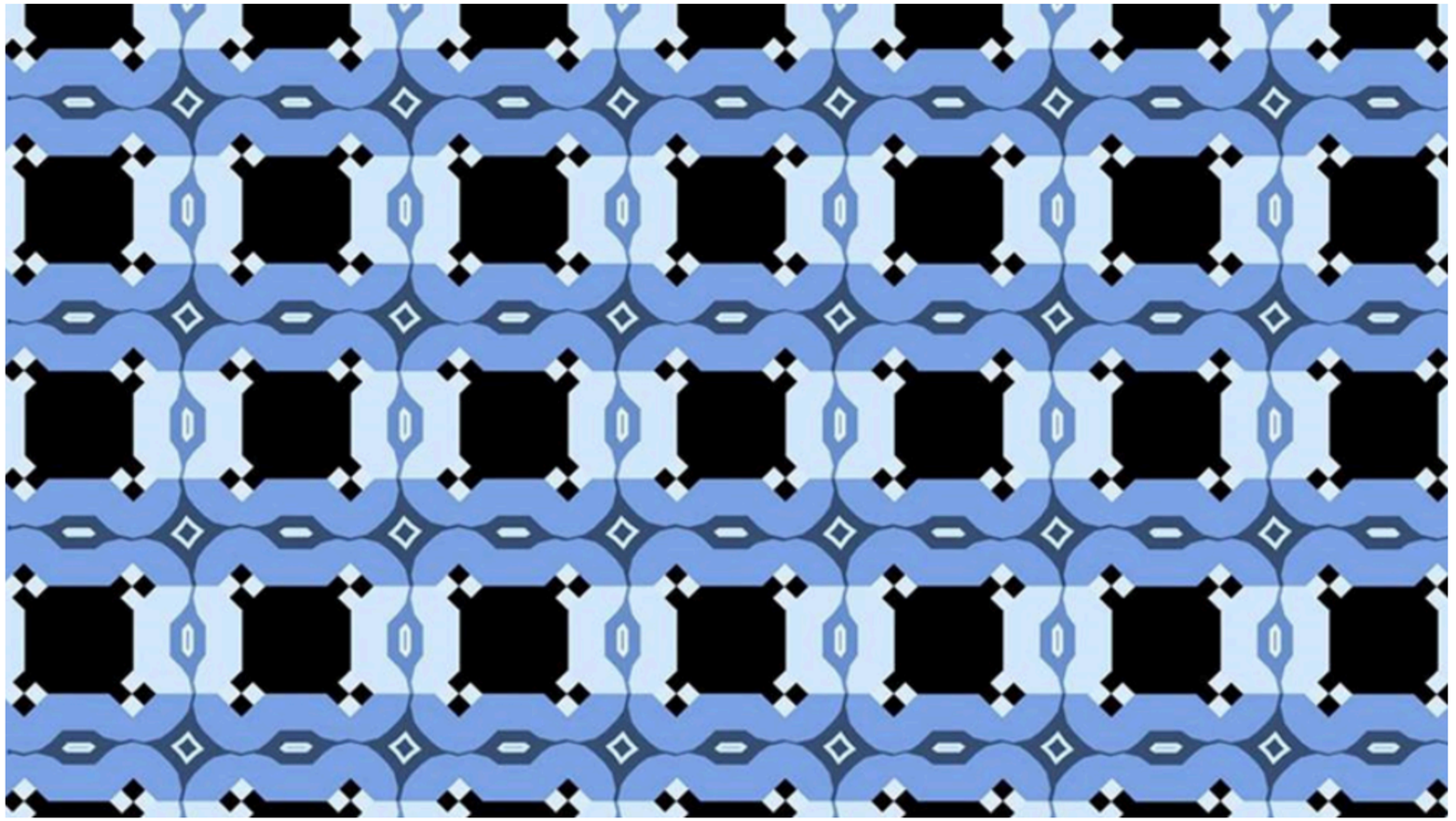
Edward H. Adelson

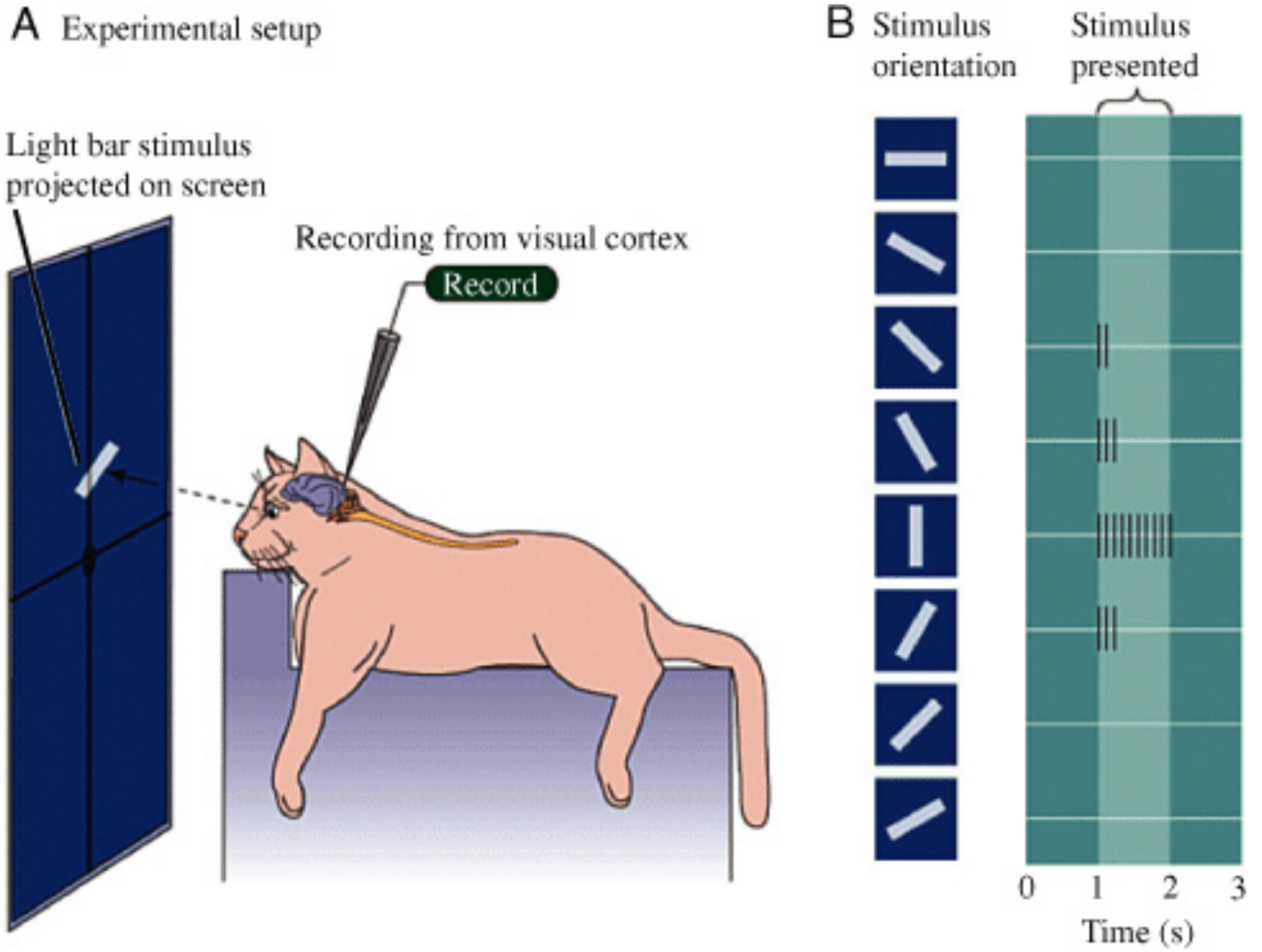

A
B


Lateral geniculate nucleus
Frontal lobe
Parietal lobe
Occipital lobe
V5/MT
V3A
V3
V2
V1
V3/VP
V4
Functional subdivisions of the visual cortex
Temporal lobe
Inferior temporal cortex
Cerebellum

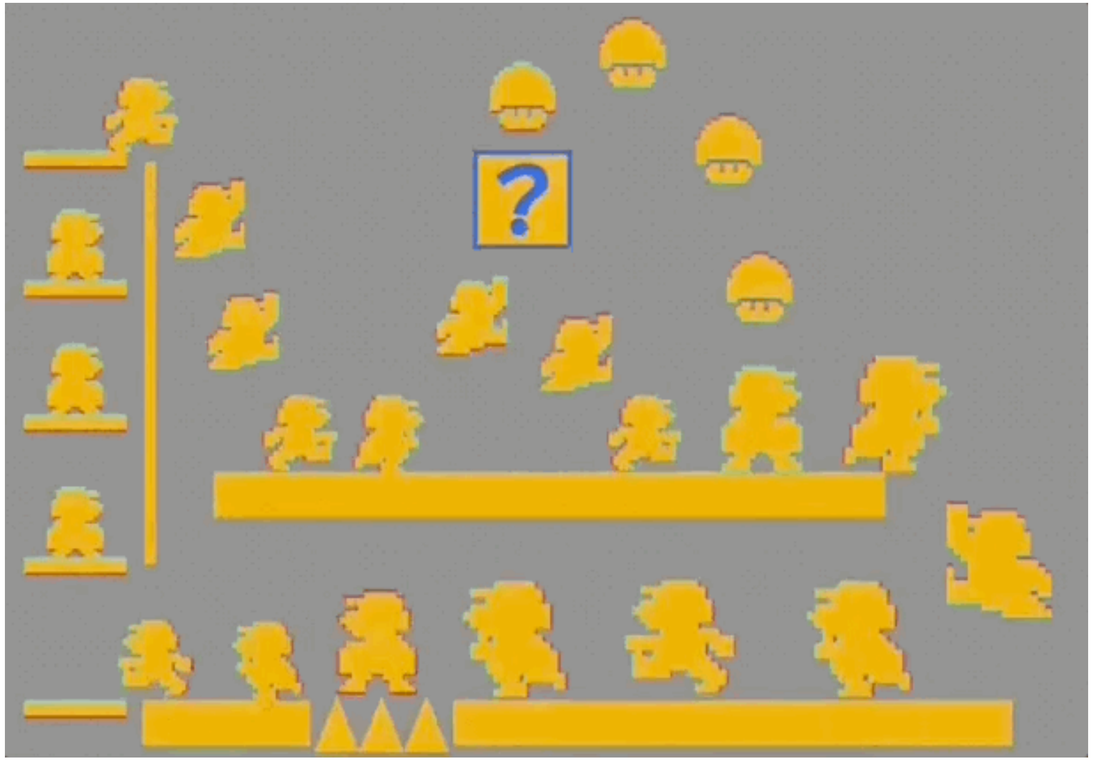


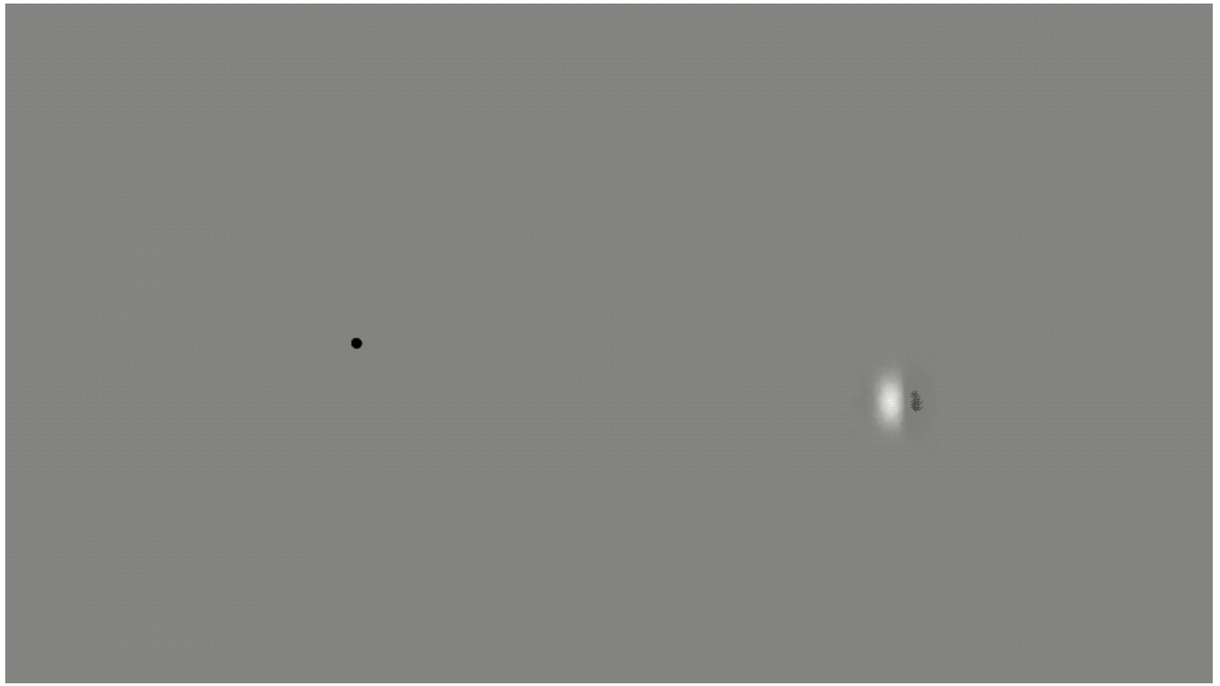

WHAT ABOUT EDGES?



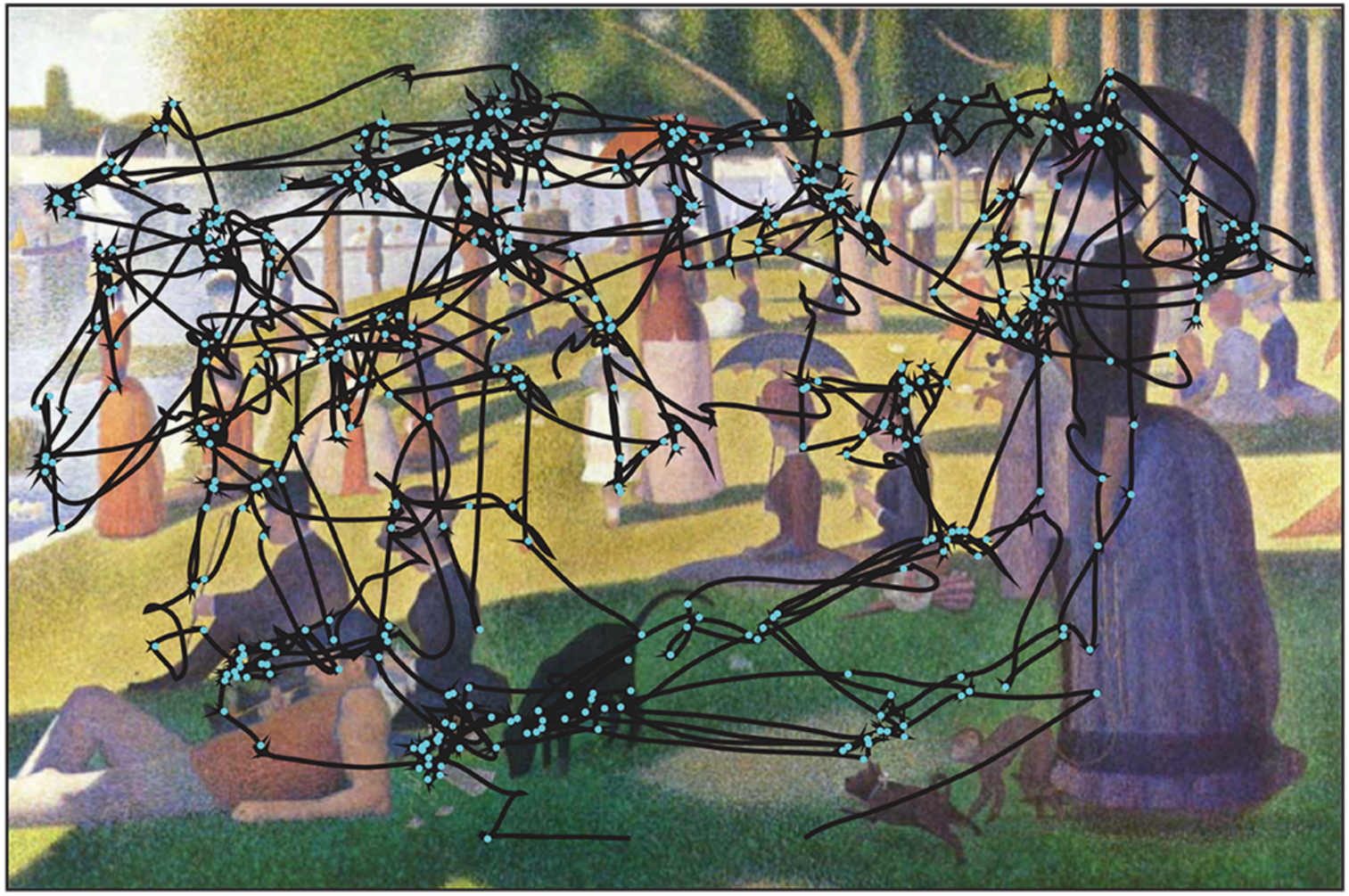


Wiesel TN, Hubel DH. Effects of visual deprivation on morphology and physiology of cells in the cat's lateral geniculate body. J Neurophysiol 26: 978–993, 1963 (http://jn.physiology.org/cgi/reprint/26/6/978).





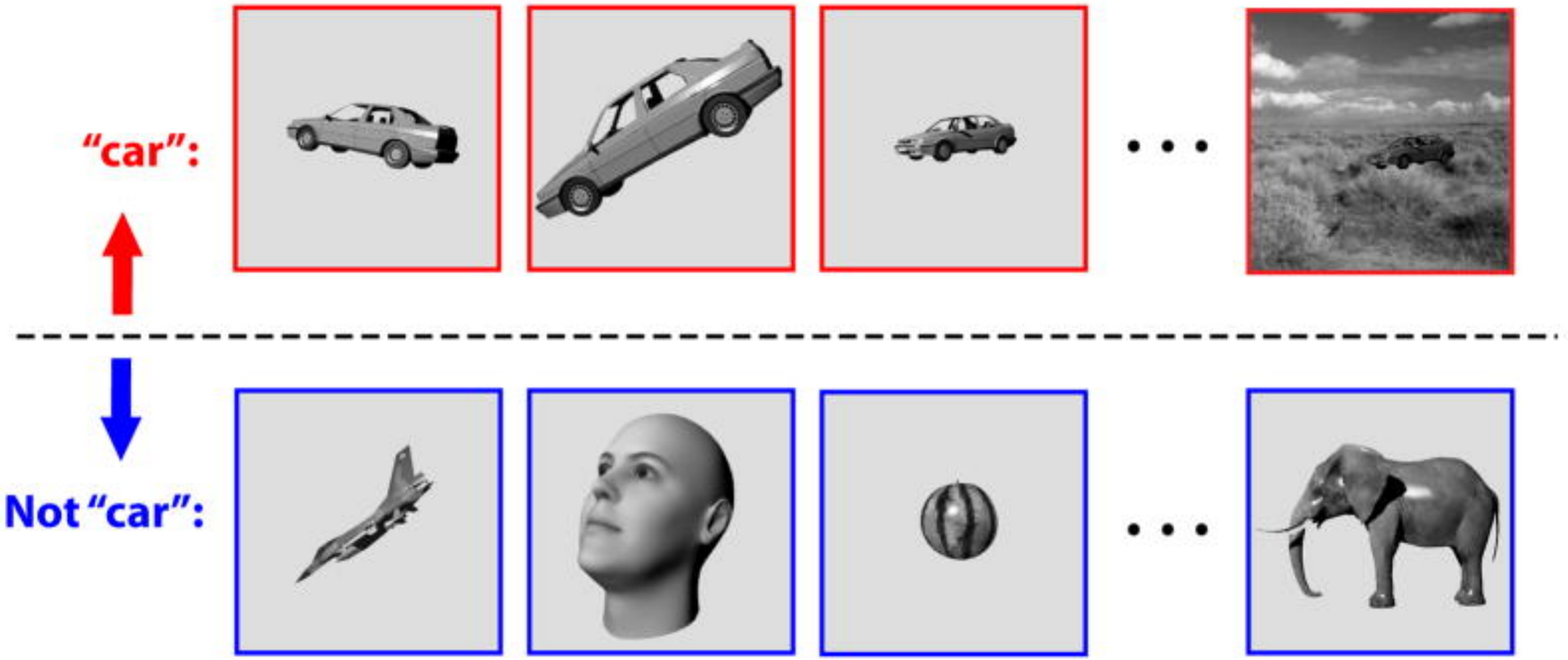
Adelson and Bergen



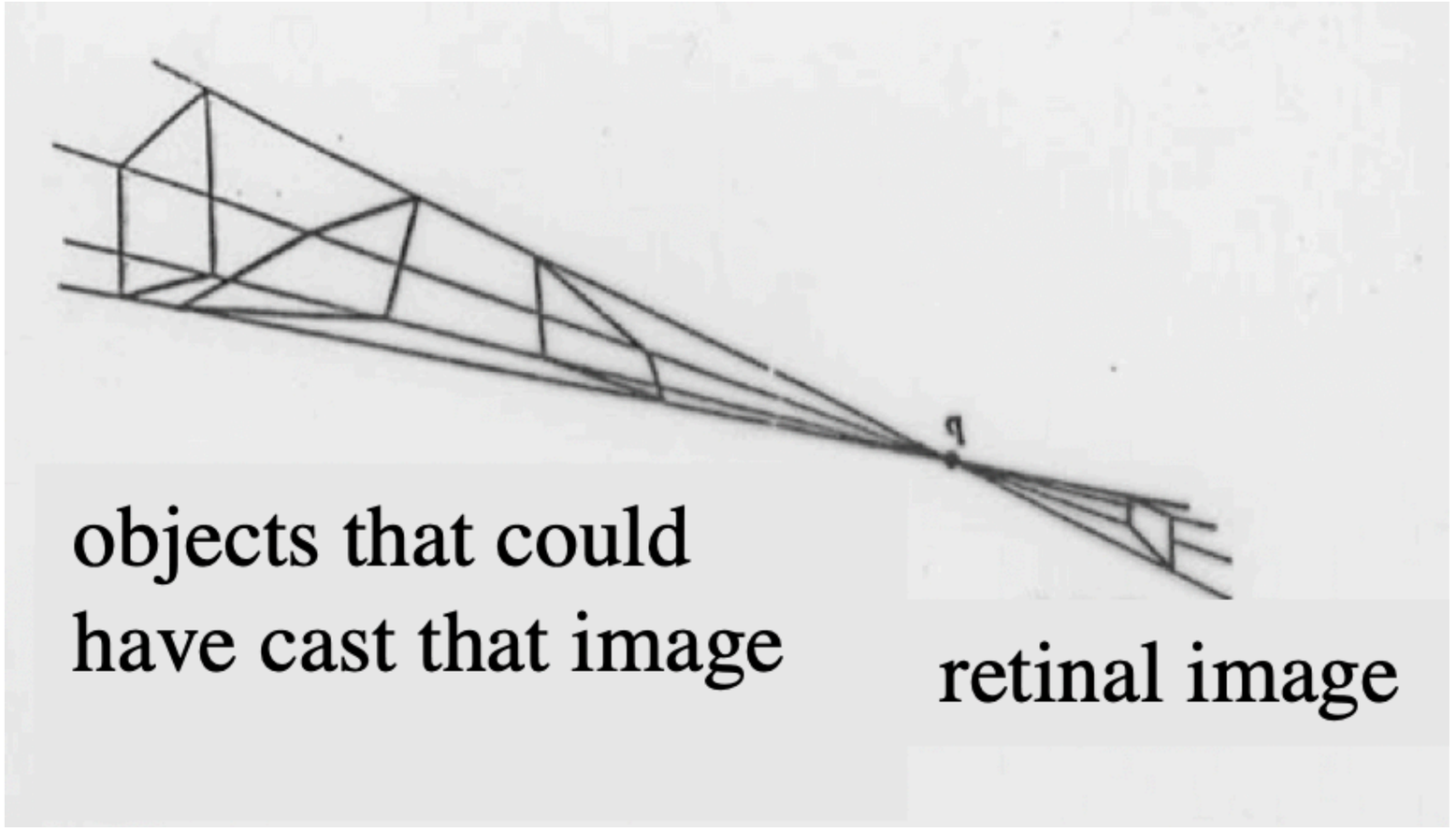
The lines scribbled over this famous Georges Seurat painting come from an experiment that tracked how the human eye jerks around as it takes in the details of the scene. R. Wurtz / Daedalus 2015 / Public Domain

OBJECTS

CORE OBJECT RECOGNITION

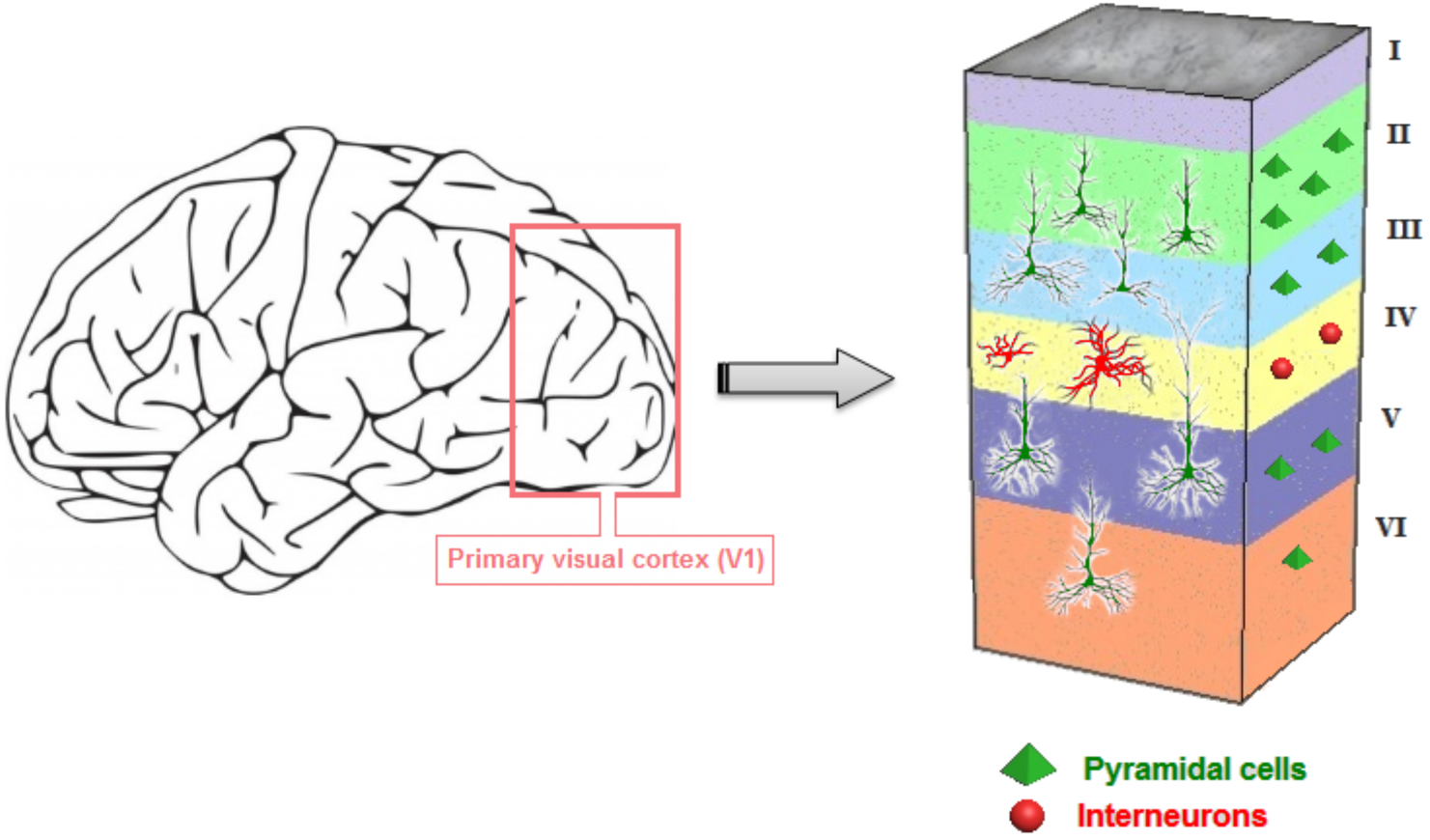


WHAT ARE THE NECESSARY INGREDIENTS FOR OBJECT RECOGNITION?

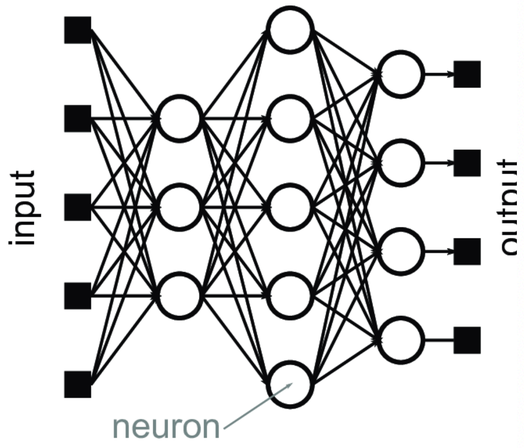

objects that could
have cast that image
retinal image

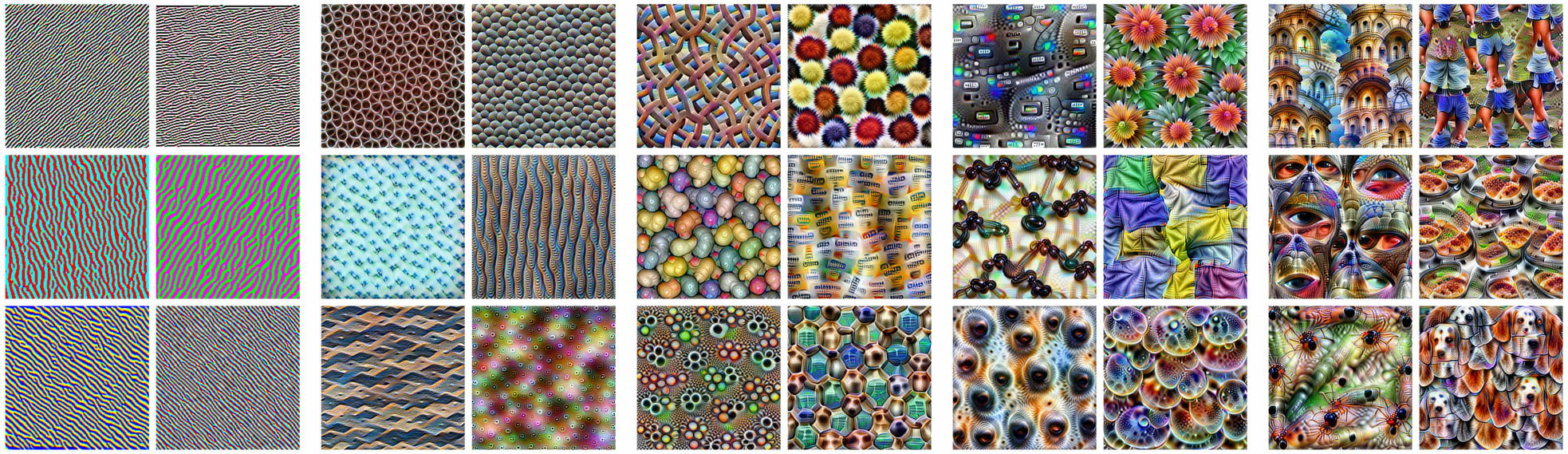
WHAT ARE THE NECESSARY INGREDIENTS FOR OBJECT RECOGNITION?

Selectivity & Invariance


Primary visual cortex (V1)
I
II
III
IV
V
VI
Pyramidal cells
Interneurons

CONCEPTS ACROSS LAYERS



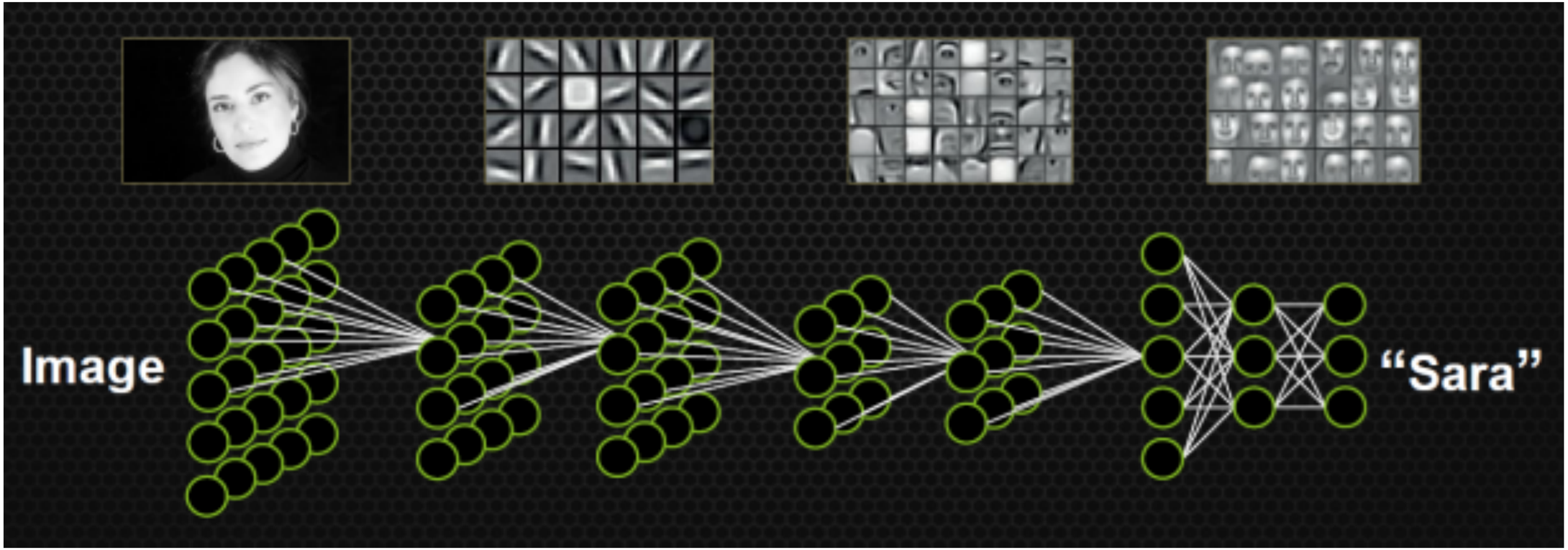


Edges (layer conv2d0) **Textures** (layer mixed3a) **Patterns** (layer mixed4a) **Parts** (layers mixed4b & mixed4c) **Objects** (layers mixed4d & mixed4e

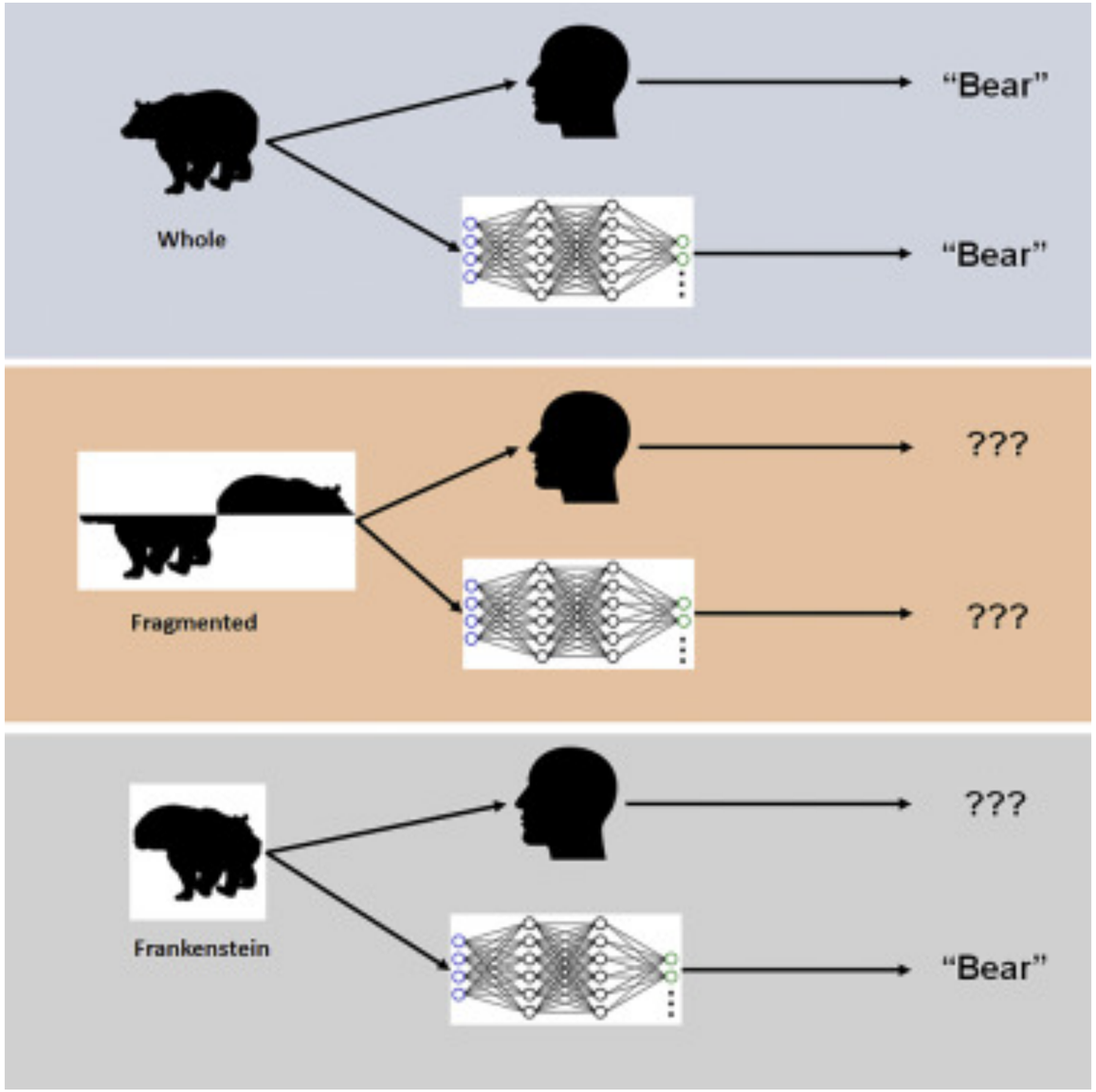
Olah, 2017

https://distill.pub/2017/feature-visualization/

REPRESENTATIONS

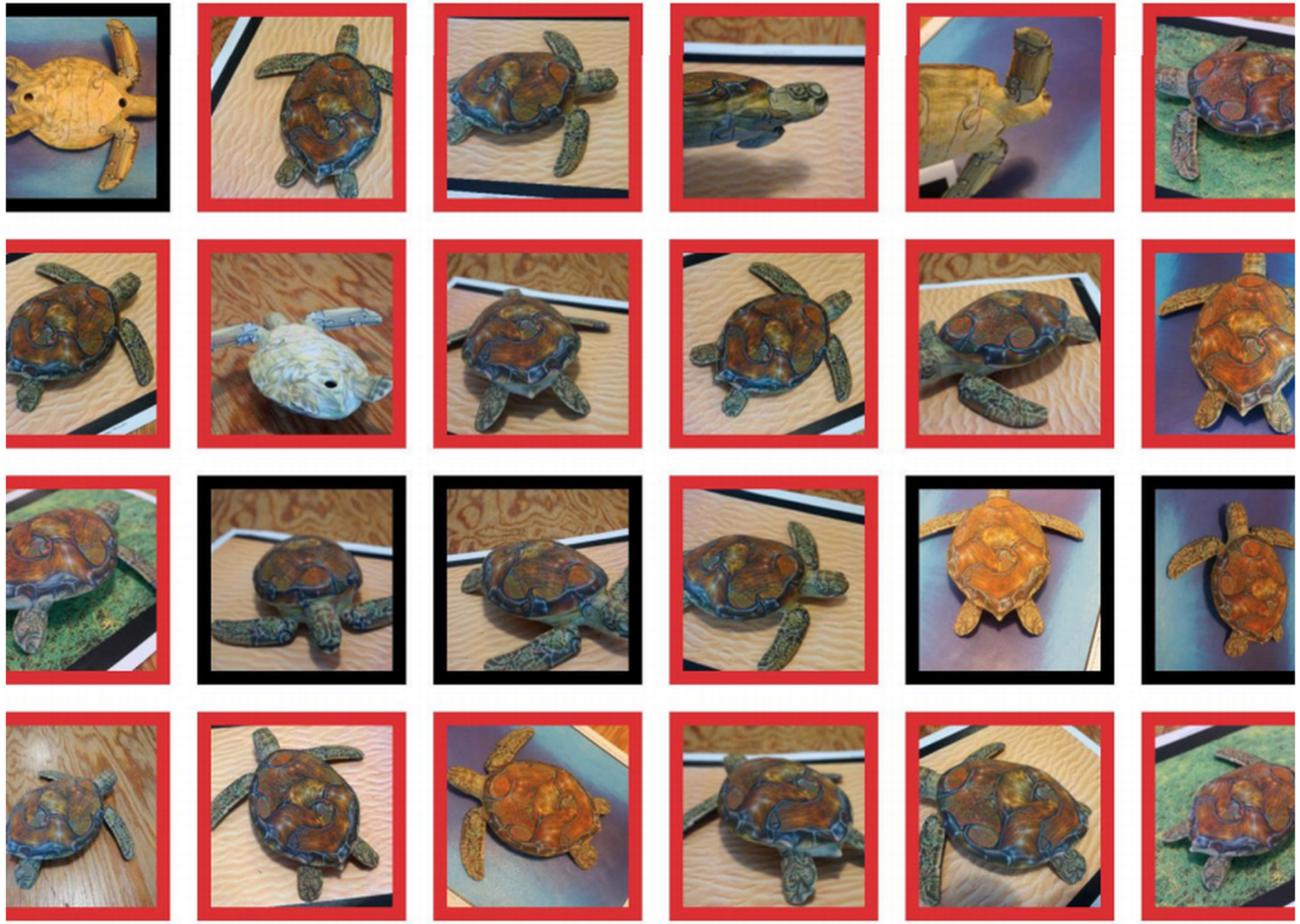


LOCAL VS CONFIGURAL SHAPE PROPERTIES

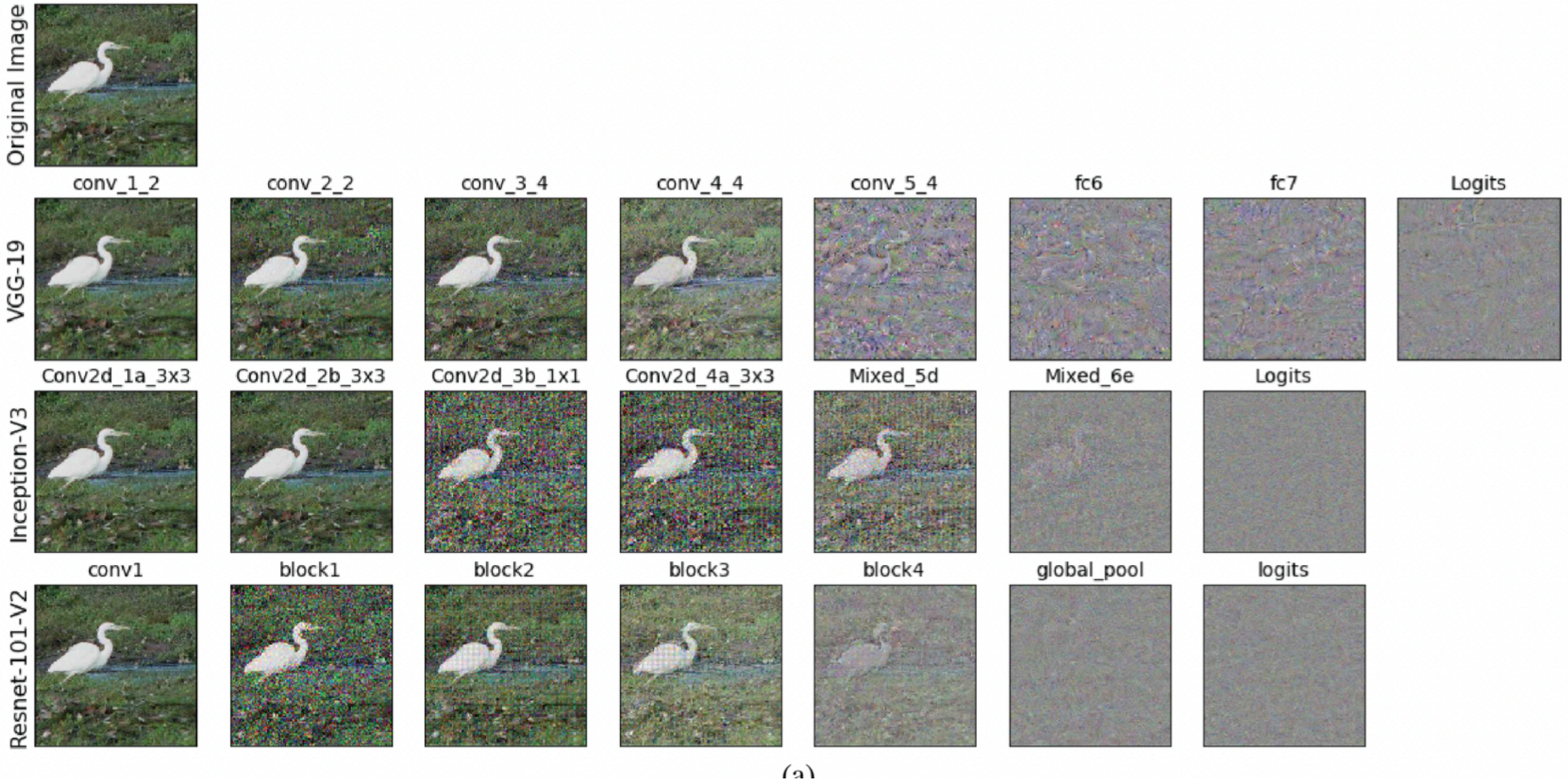


https://www.sciencedirect.com/science/article/pii/S2589004222011853

METAMERS



METAMERS



https://proceedings.neurips.cc/paper/2019/file/ac27b77292582bc293a51055bfc994ee-Paper.pdf

Singer et al. From photos to sketches - how humans and deep neural networks process objects across different levels of visual abstraction. 2022. Journal of Vision.

https://andreasrefsgaard.dk/projects/is-it-funky/