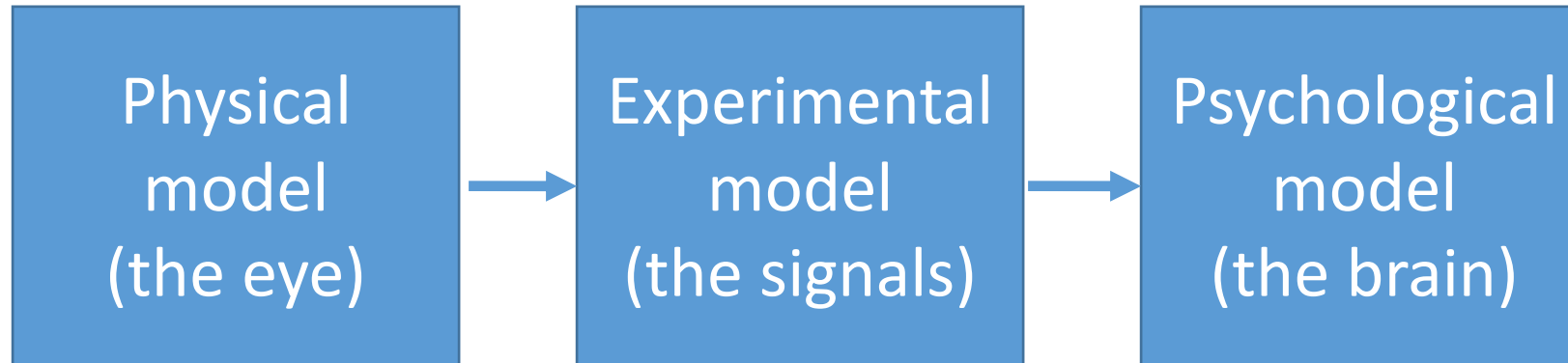


Content

1. Is human vision a good model for computer vision?
2. How does human vision work (and how does it fail)?
3. Software languages & associated literature

Modelling the eye in three parts



Each is not fully understood, especially the brain

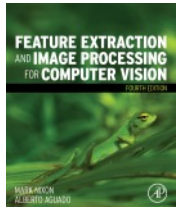
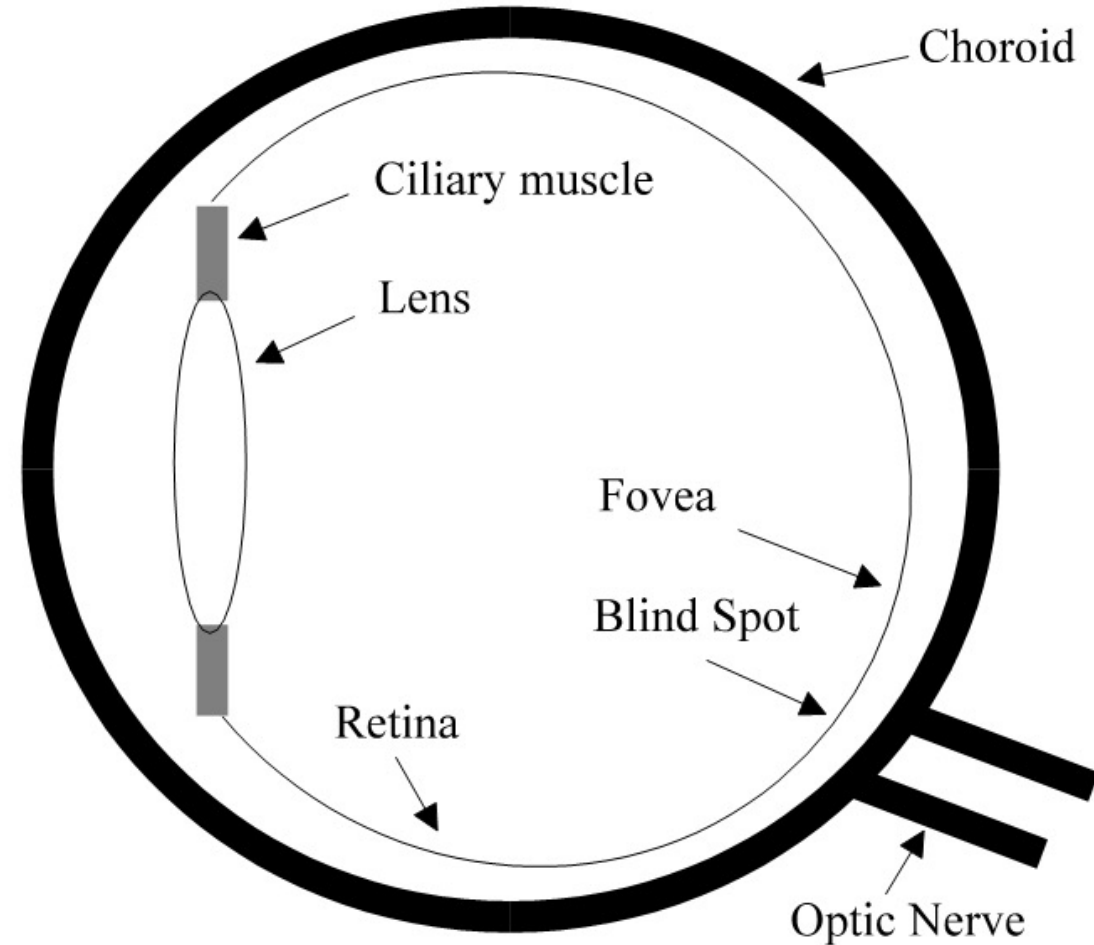
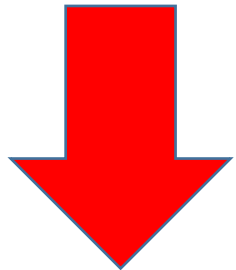
Human eye

Evolved for **survival**

Function of the eye is to form an image on the **retina** (on **fovea**)

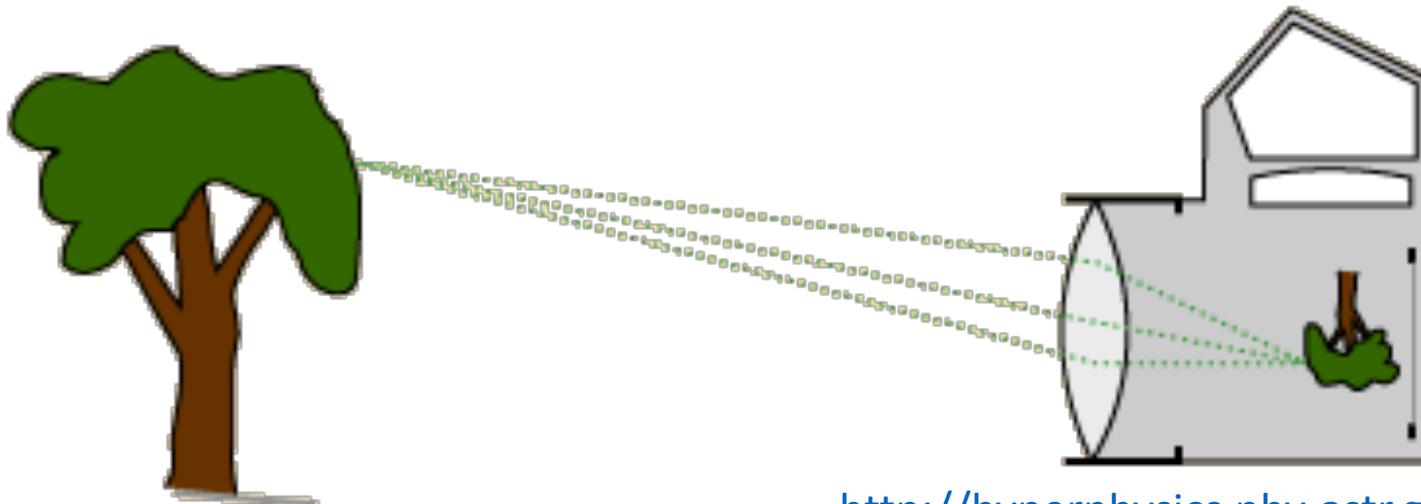
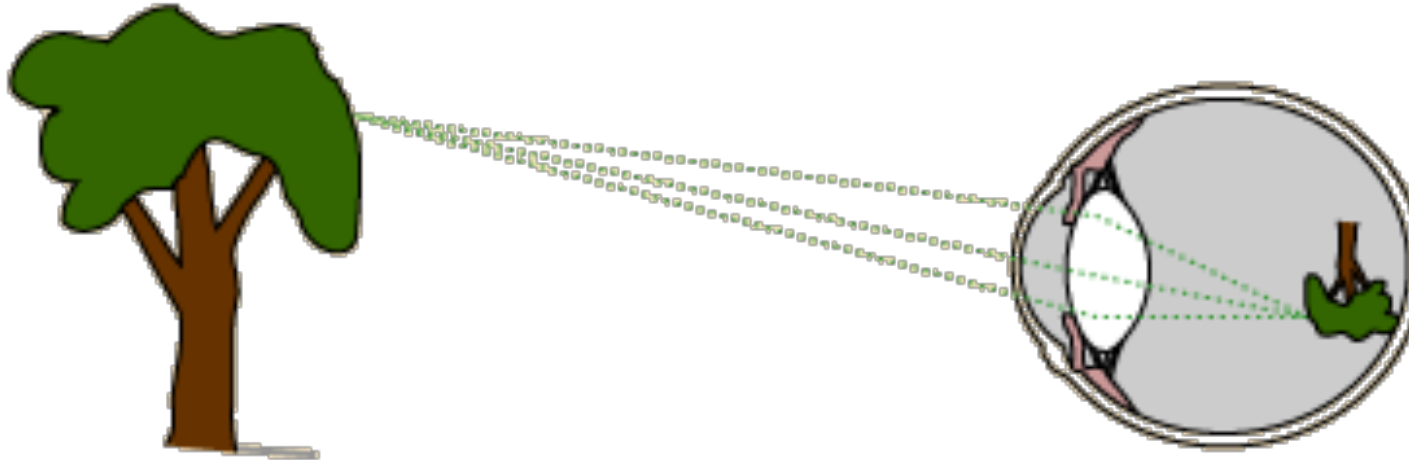
The lens is **shaped**, rather than **moved**

Image is transmitted via **optic nerve**



Optics

Your brain must **invert** the image



Sensors

There must be a lot!

Cones (10^7) and **rods** (10^8)

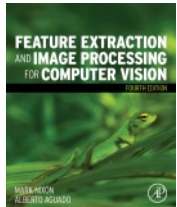
Cones – colour; rods – greylevel

photopic **scotopic**

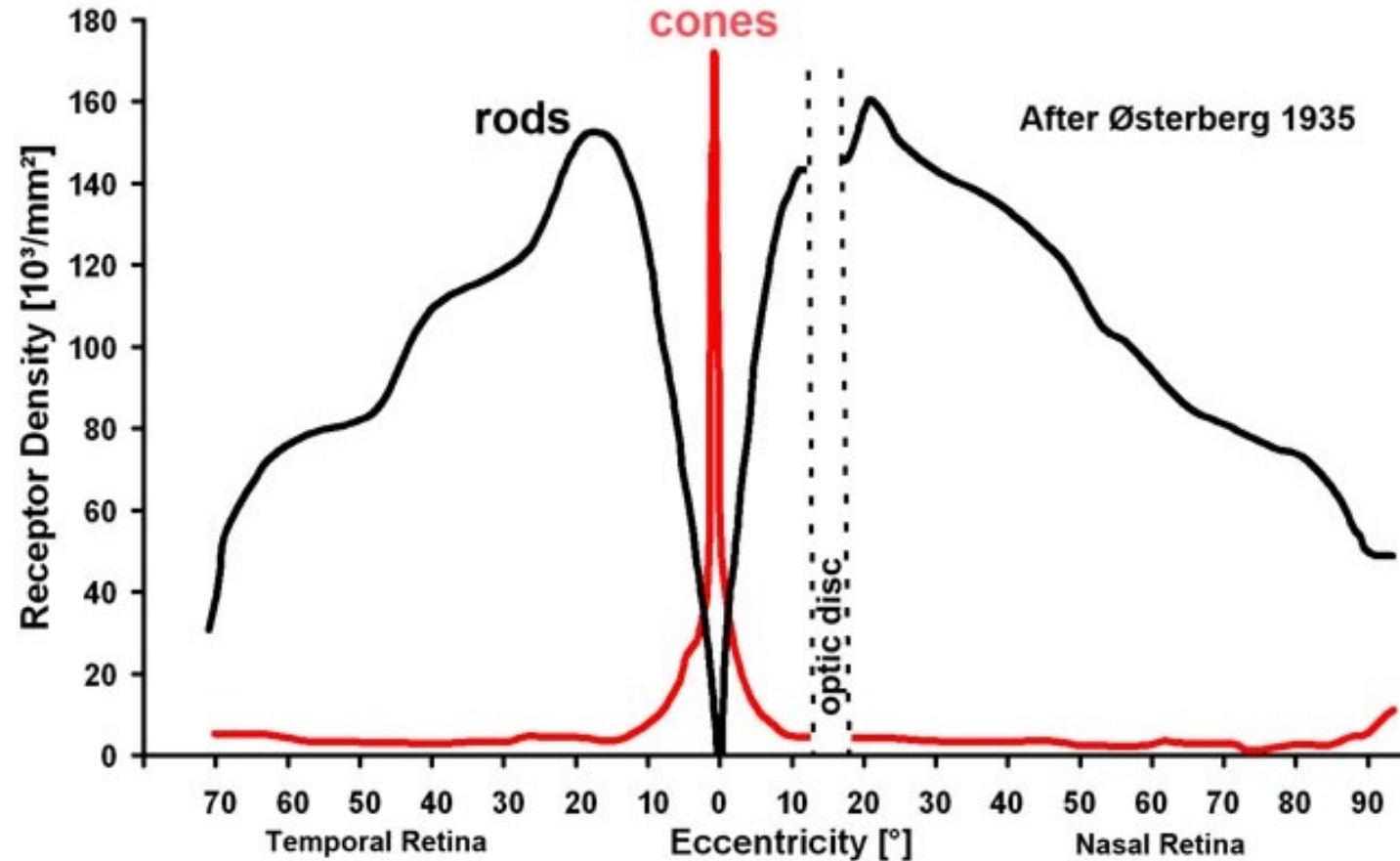
Cones come in three types

1. **S** – short wavelength (blue)
2. **M** – medium wavelength (green)
3. **L** – long wavelength (red)

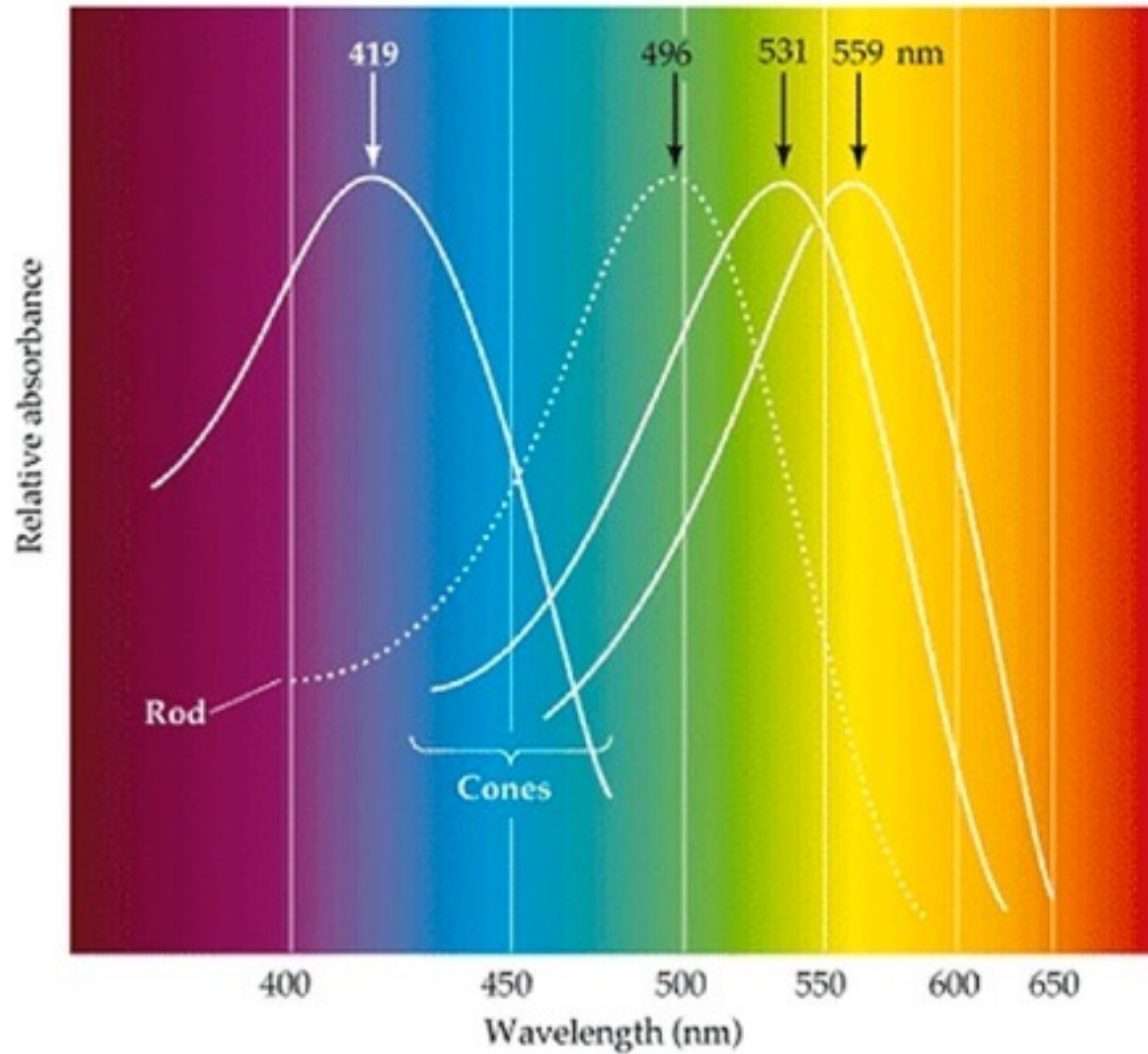
Insufficient bandwidth of **optic nerve**
implies **coding**



Rod and cone densities



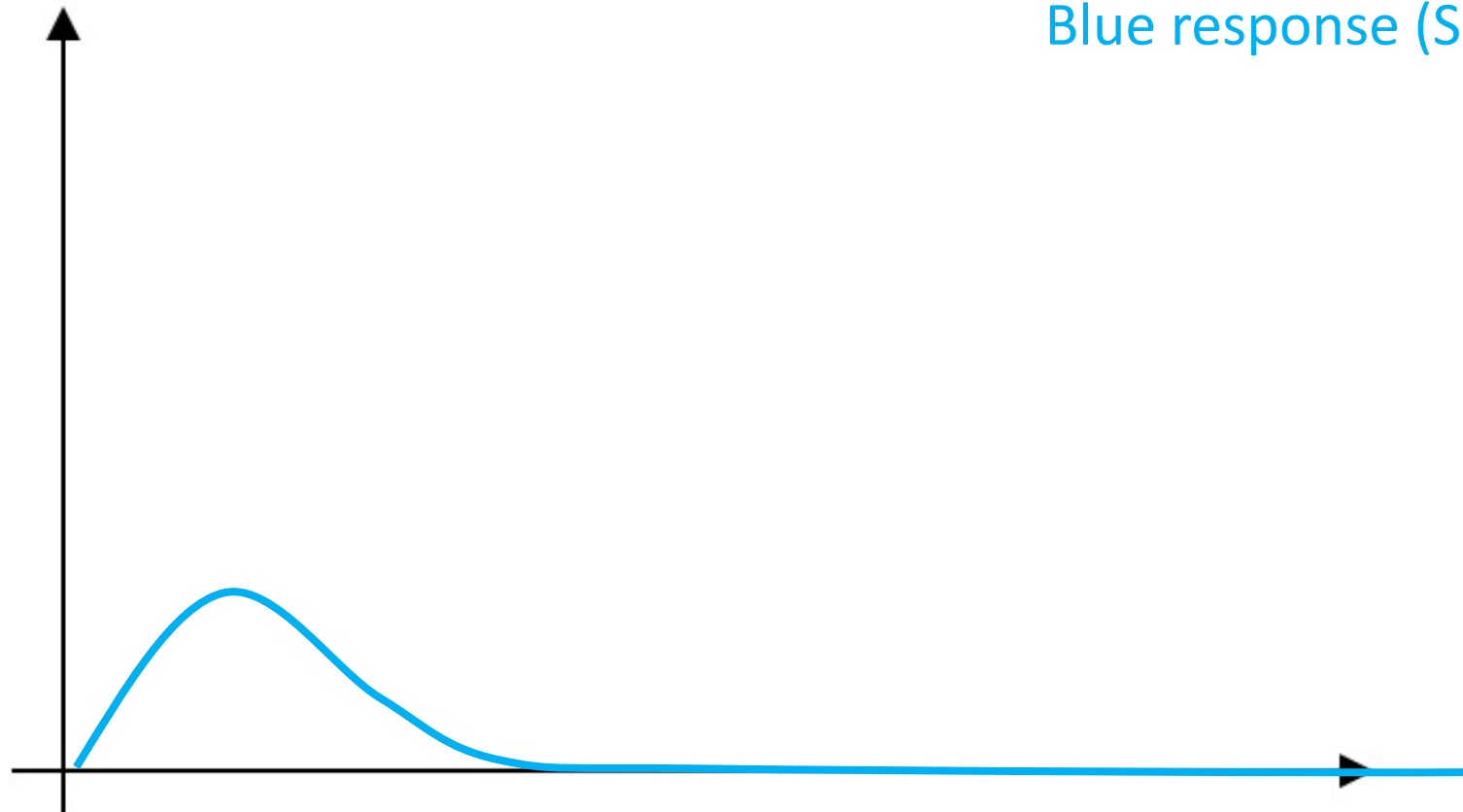
No sensors on blind spot
Most **cones** on fovea
Rods elsewhere



<http://webvision.med.utah.edu/wp-content/uploads/2011/03/Spectrum.jpeg>

Spectral responses

Spectral response



Blue response (S sensors) is poor

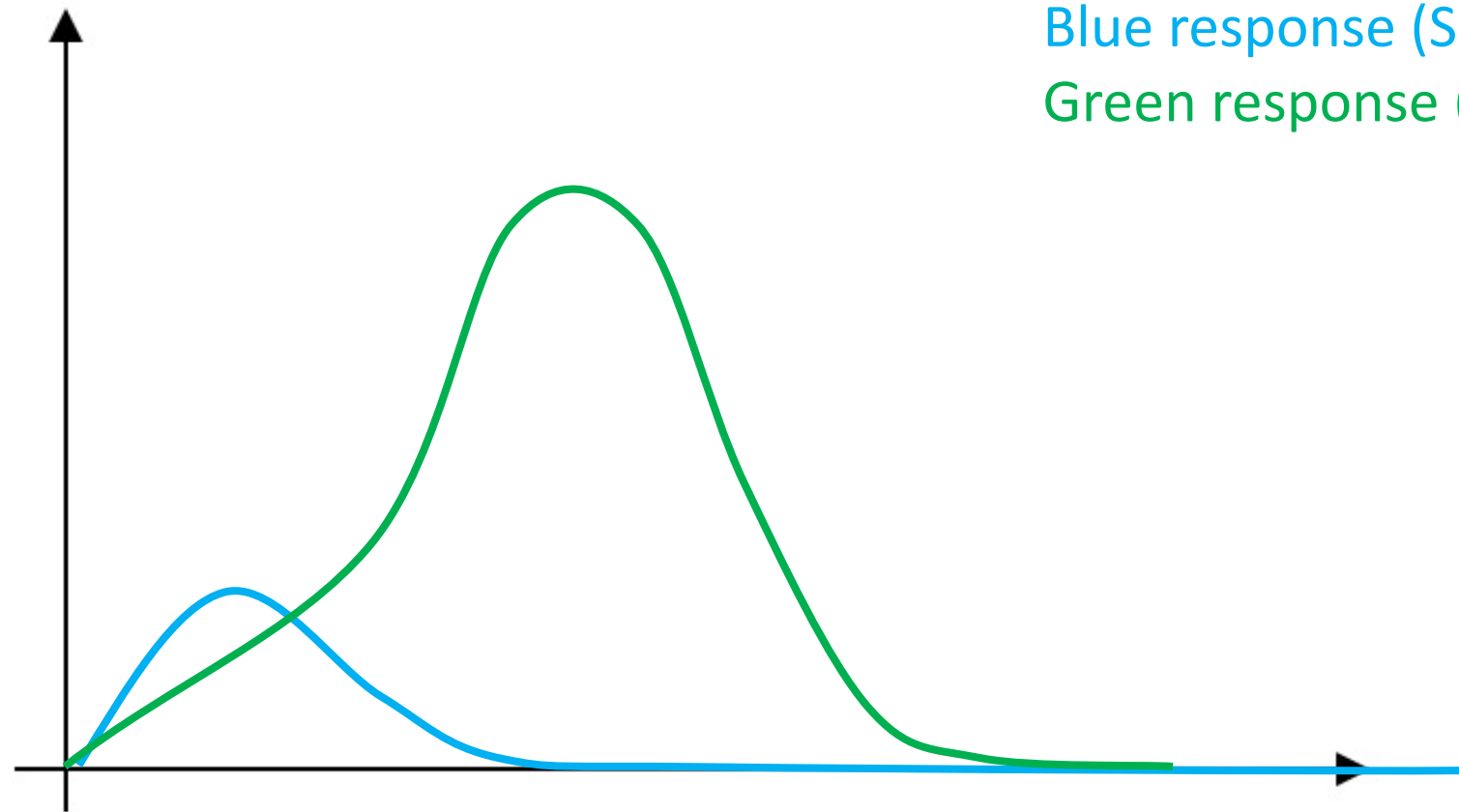
Blue

Red



Spectral responses

Spectral response



Blue response (S sensors) is poor
Green response (M sensors) dominates

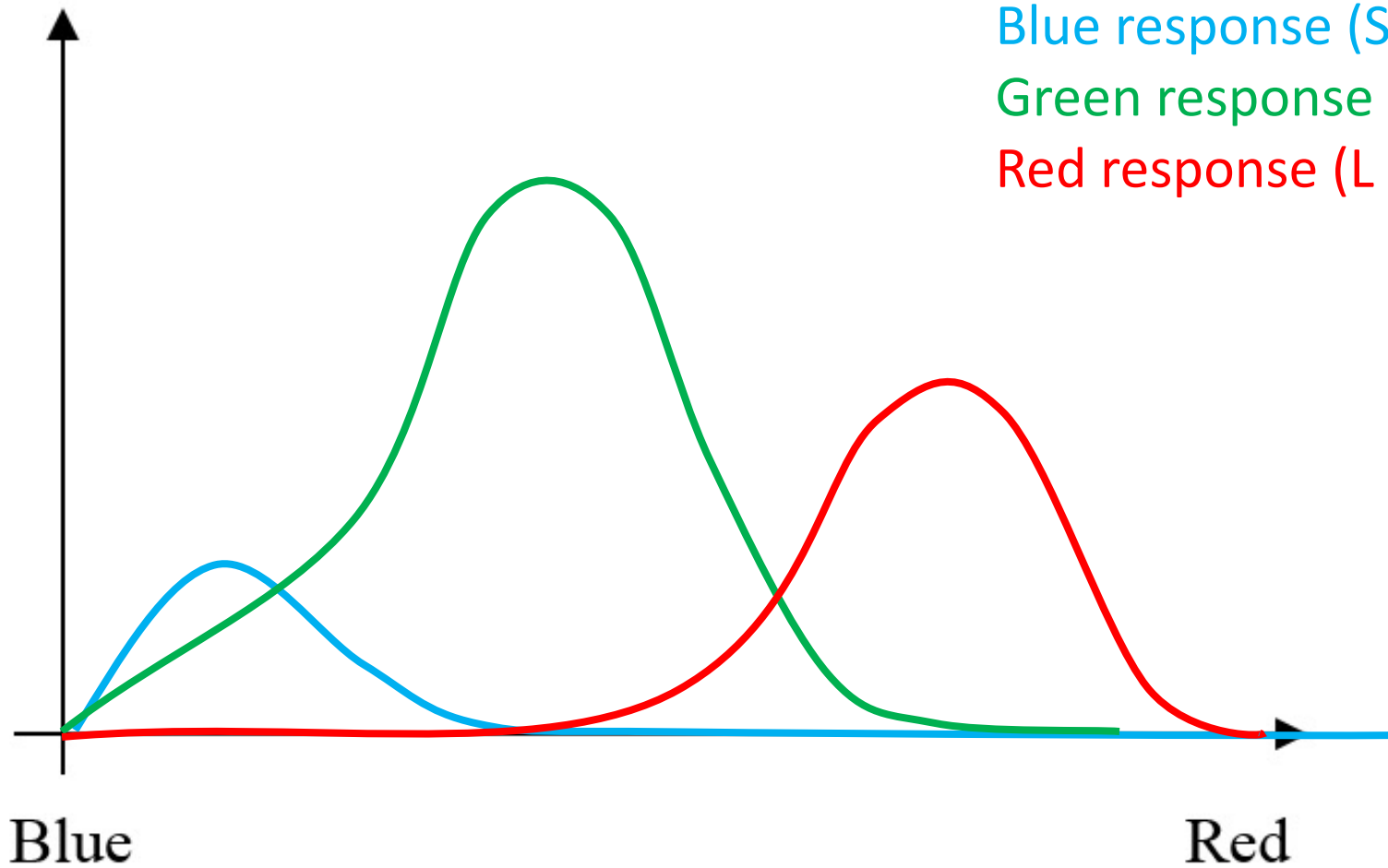


Blue

Red

Spectral responses

Spectral response

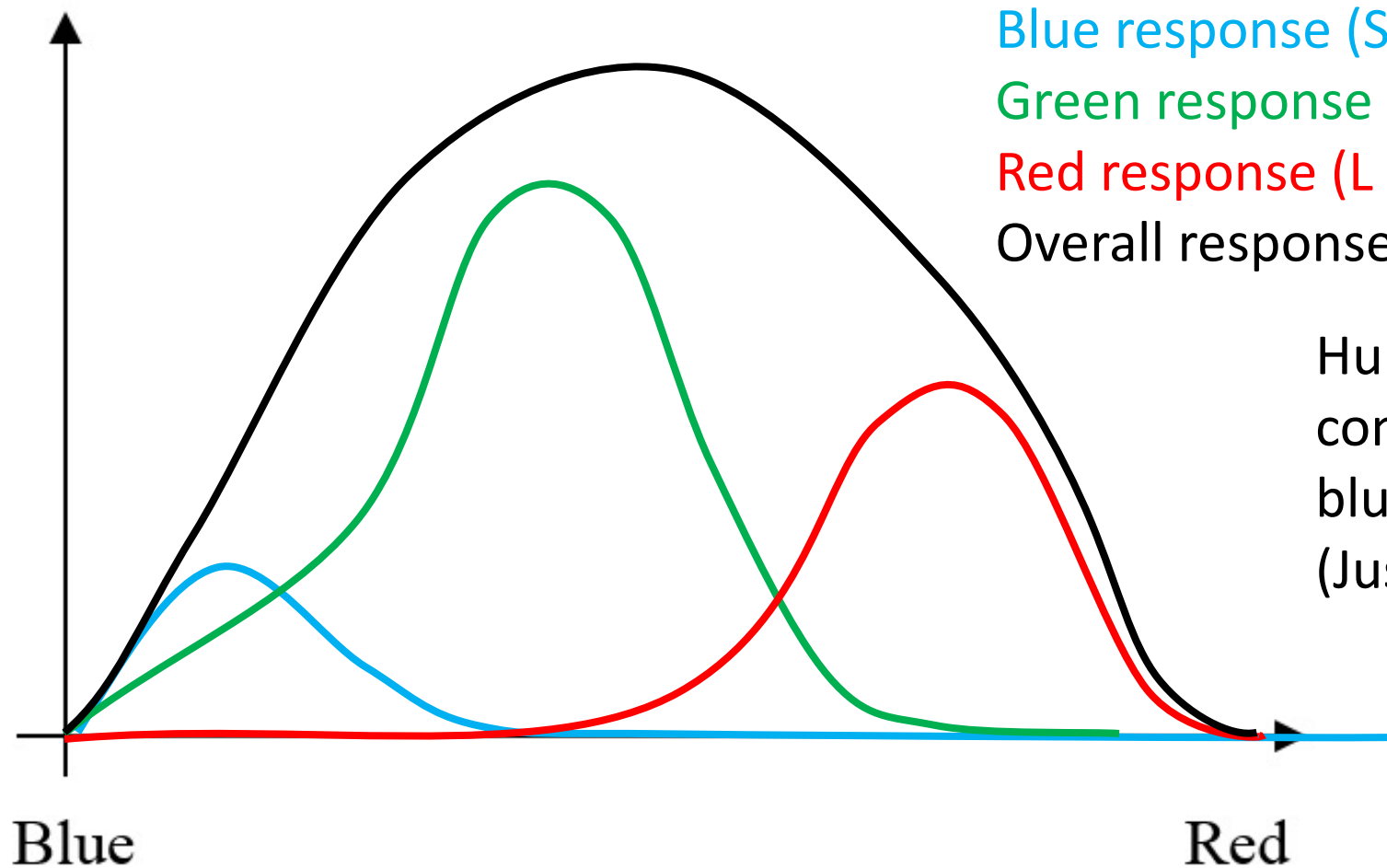


Blue response (S sensors) is poor
Green response (M sensors) dominates
Red response (L sensors) close to heat



Spectral responses

Spectral response

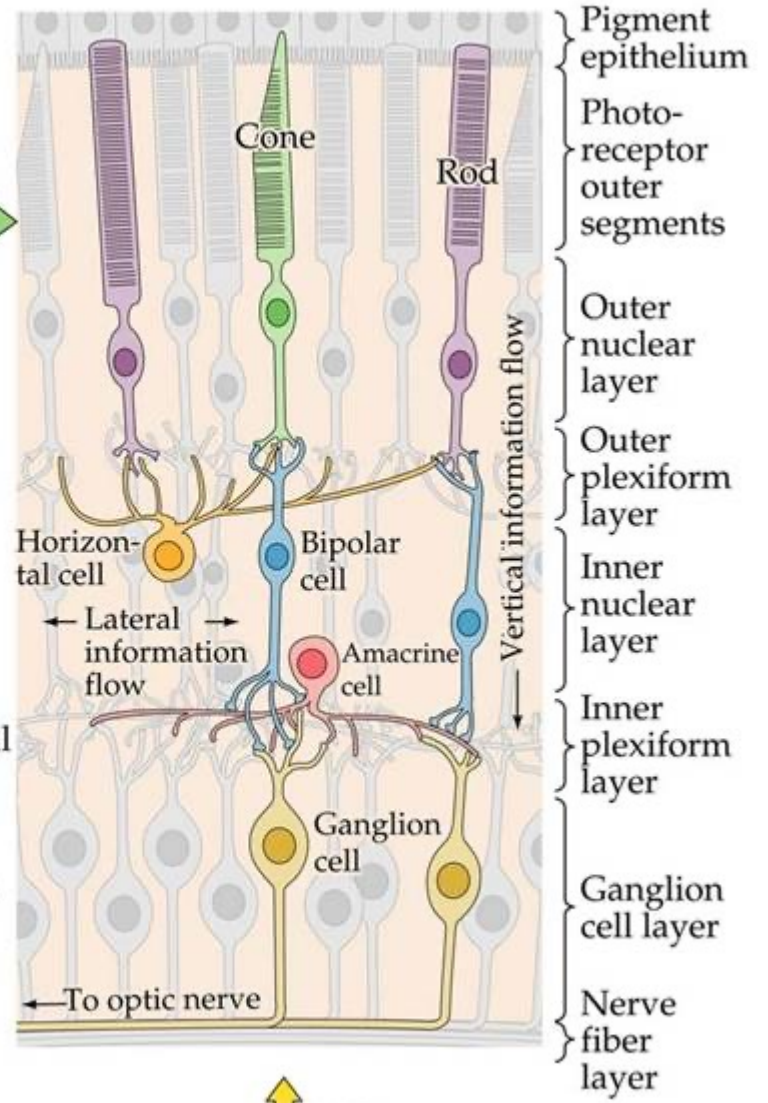
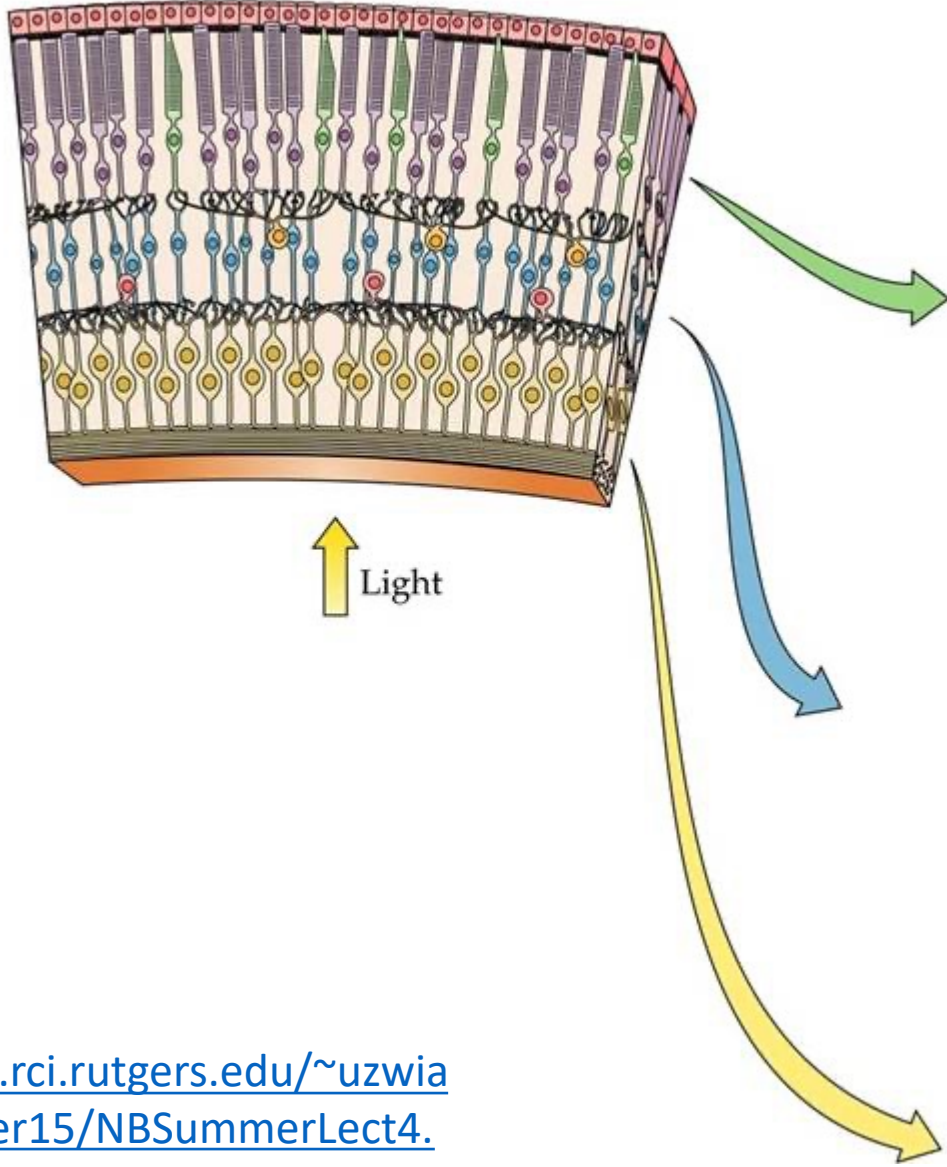


Blue response (S sensors) is poor
Green response (M sensors) dominates
Red response (L sensors) closer to heat
Overall response from S, M and L

Human vision must
compensate for the poor
blue sensors
(Just like a camera)

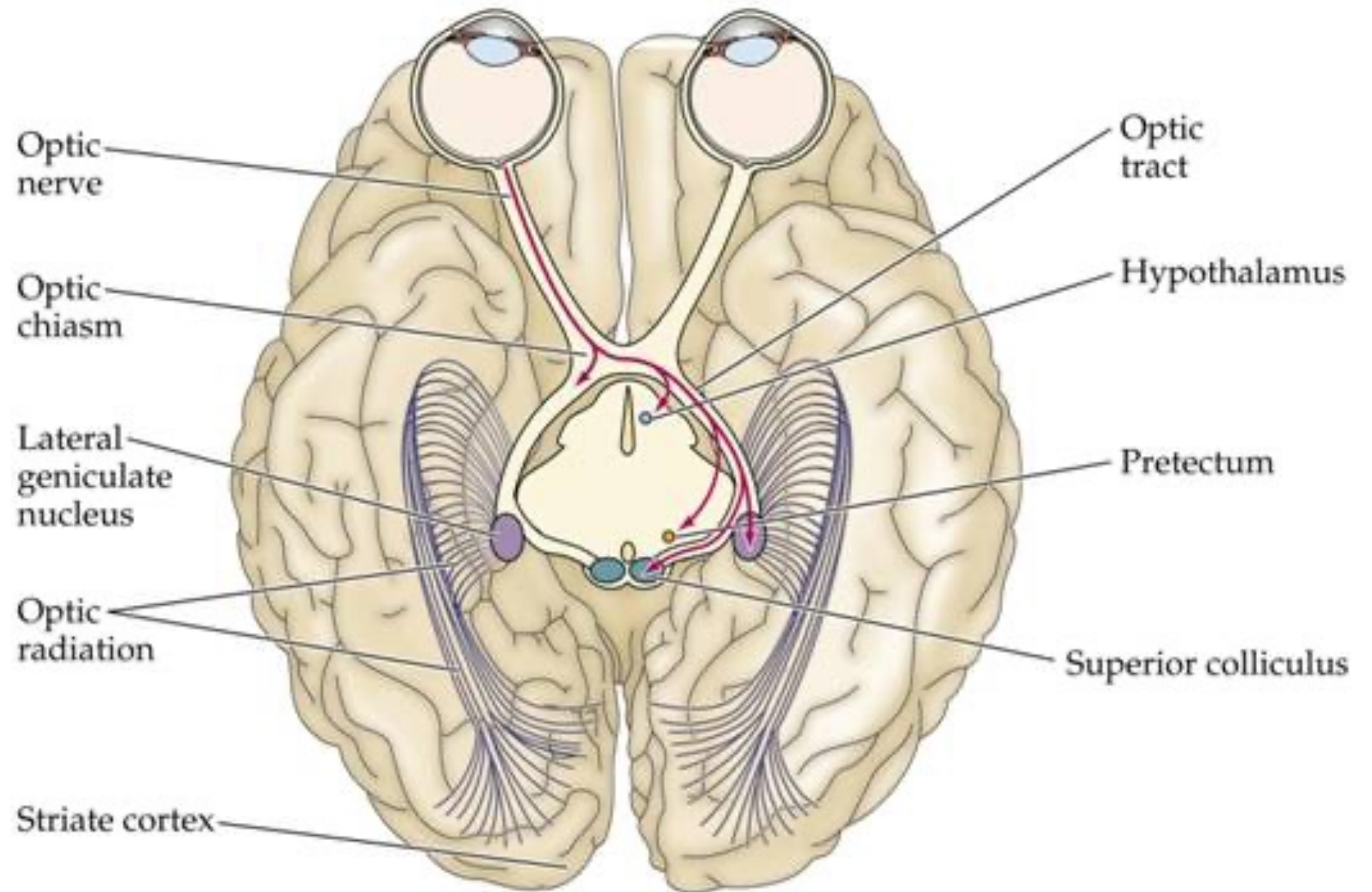


Section of retina



<http://www.rci.rutgers.edu/~uzwialk/NBSummer15/NBSummerLect4.html>

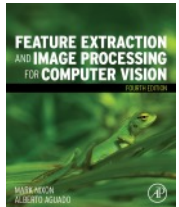
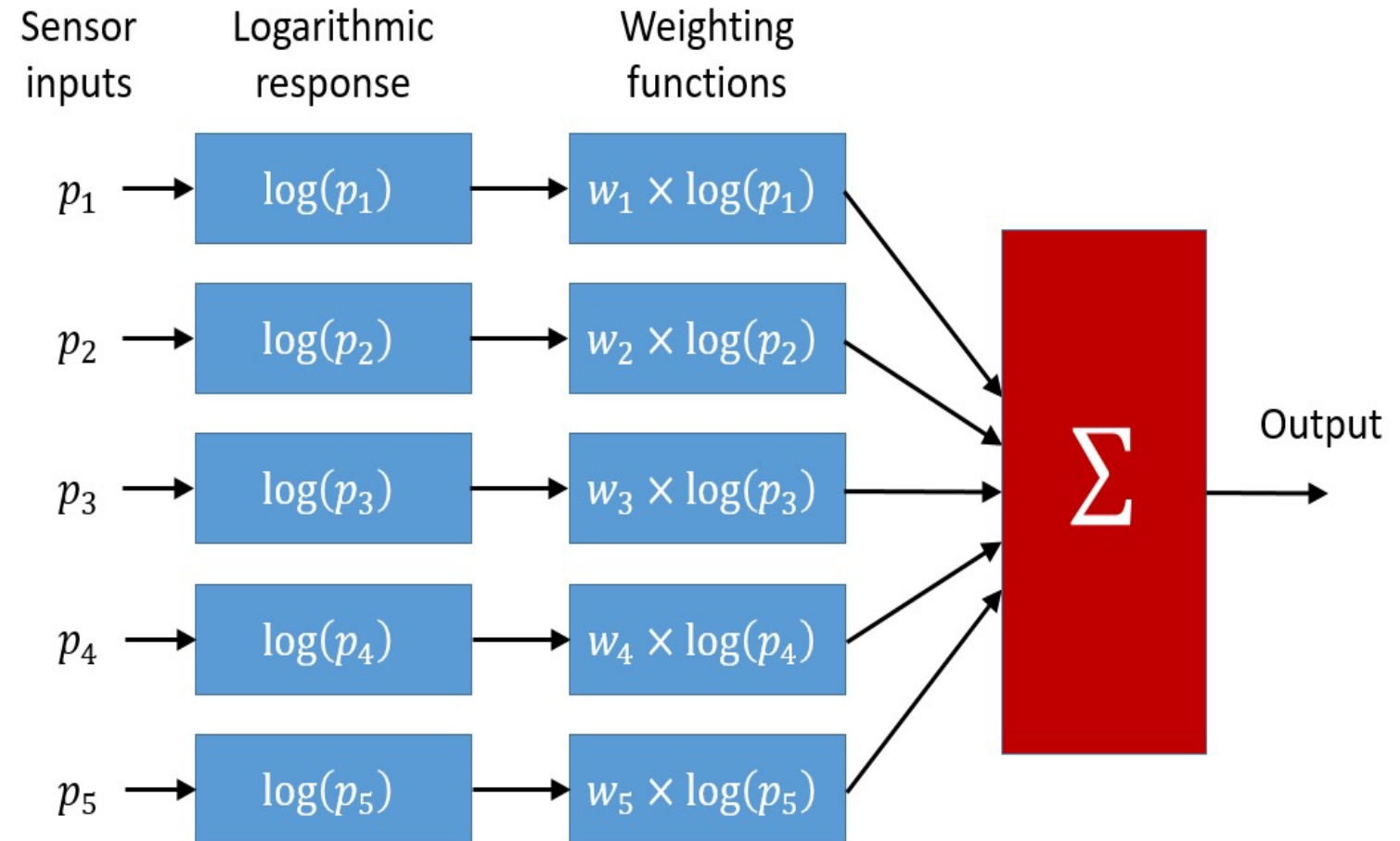
Cortices



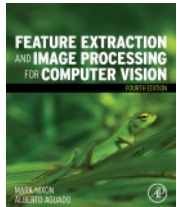
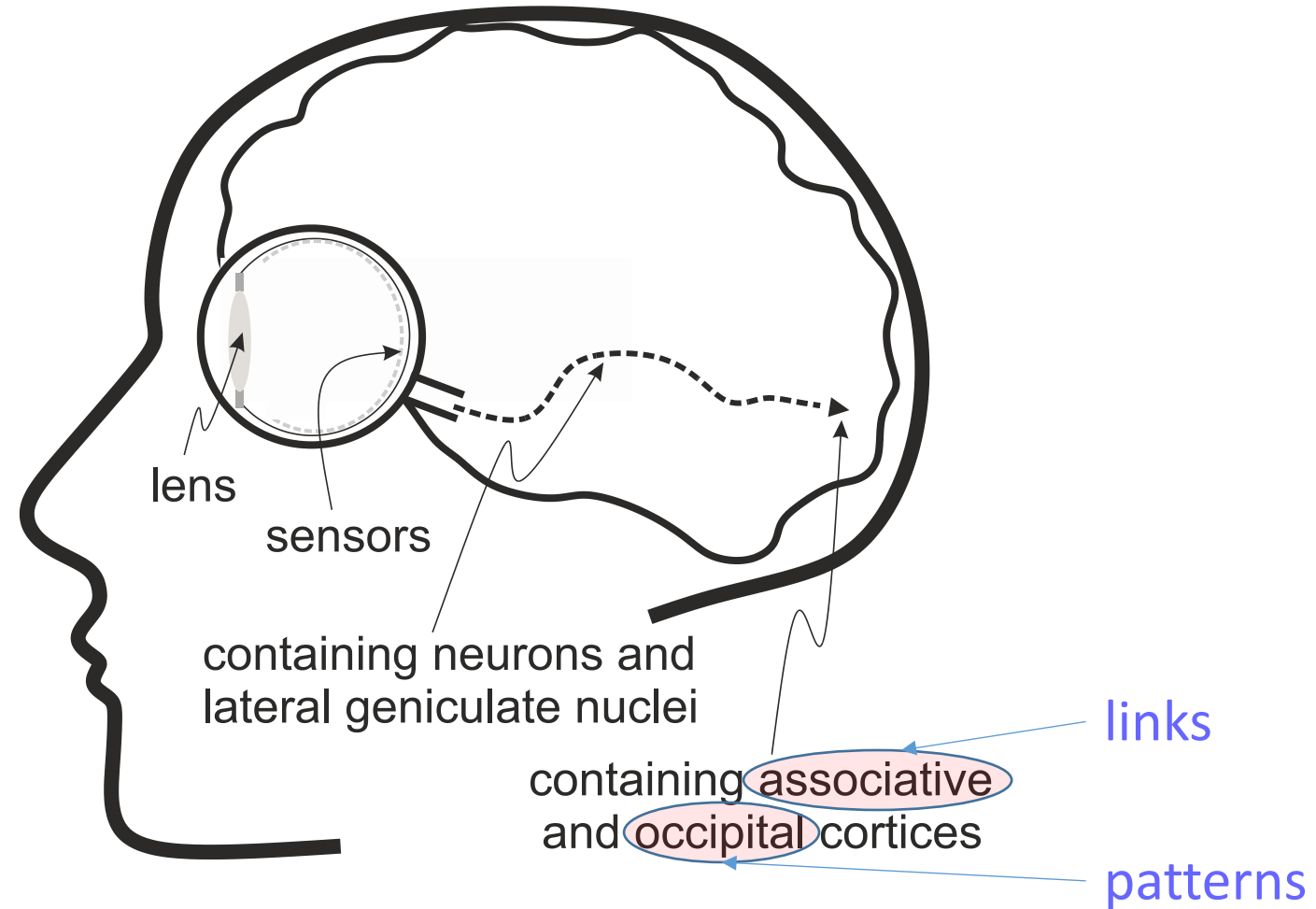
Neural processing

Sensor information must be **combined**

Note **Weber's law**



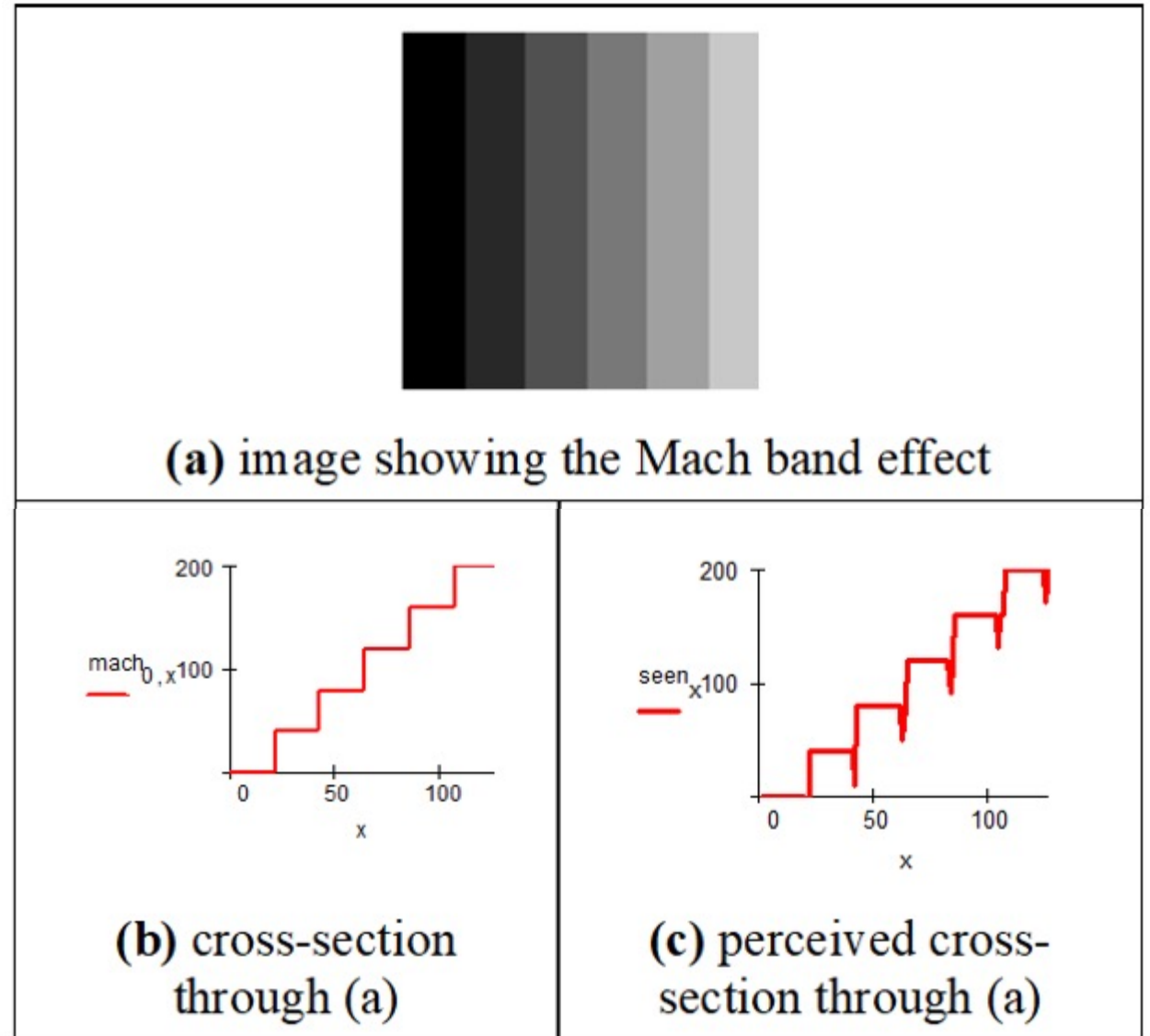
Where are we?



Mach bands

Mach bands are **not** in the image:
your vision introduces them

Result of **brightness adaption**

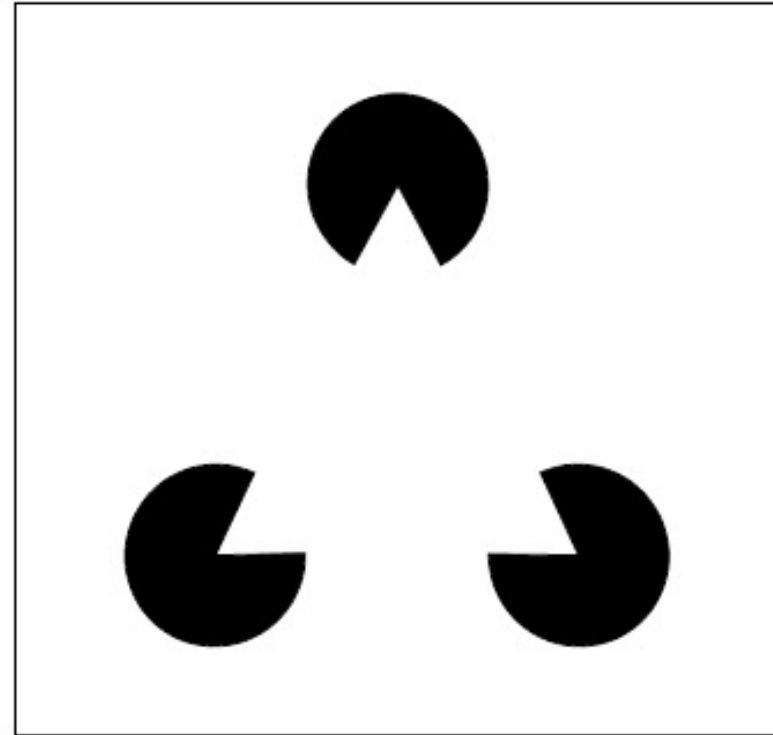


How human vision uses edges

The human eye needs **training** and can be **deceived**



(a) word?

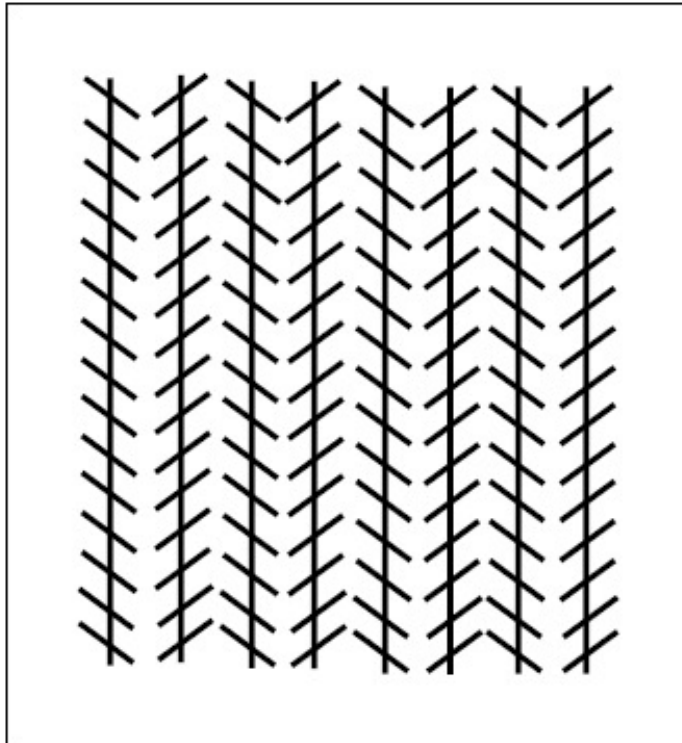


(b) Pacmen?

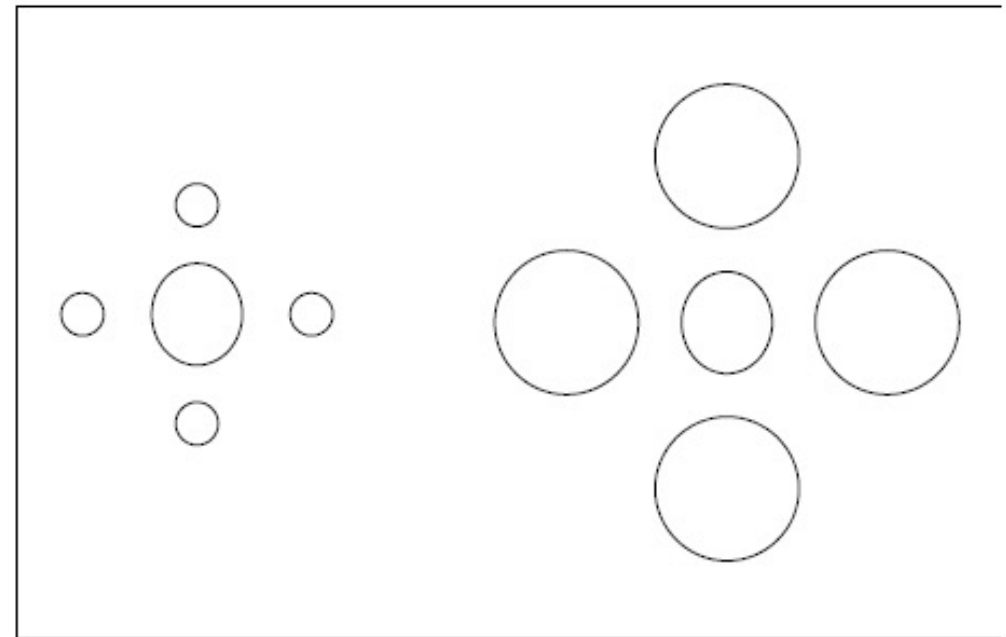


Static illusions

Measurement needs comparison

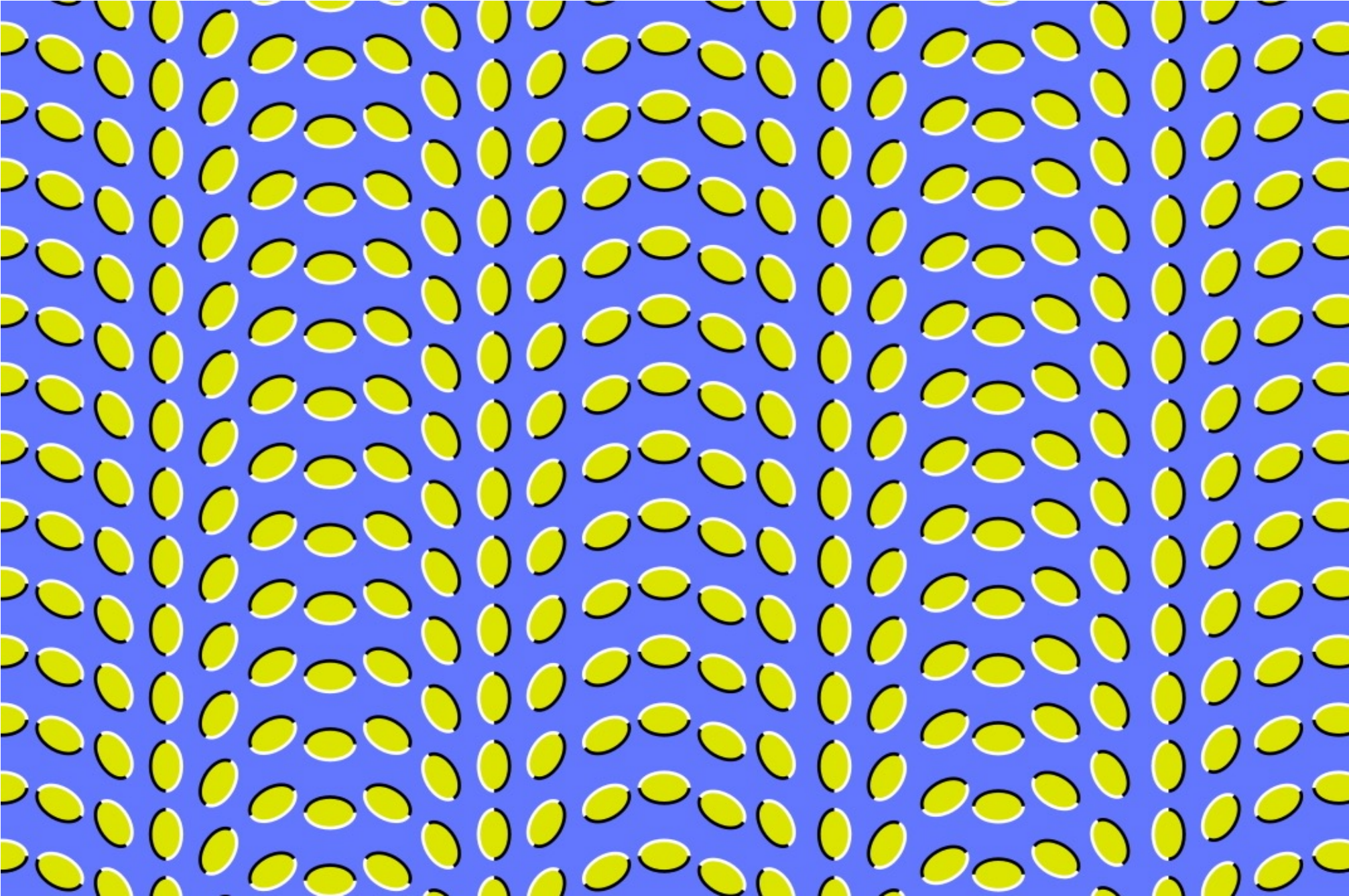


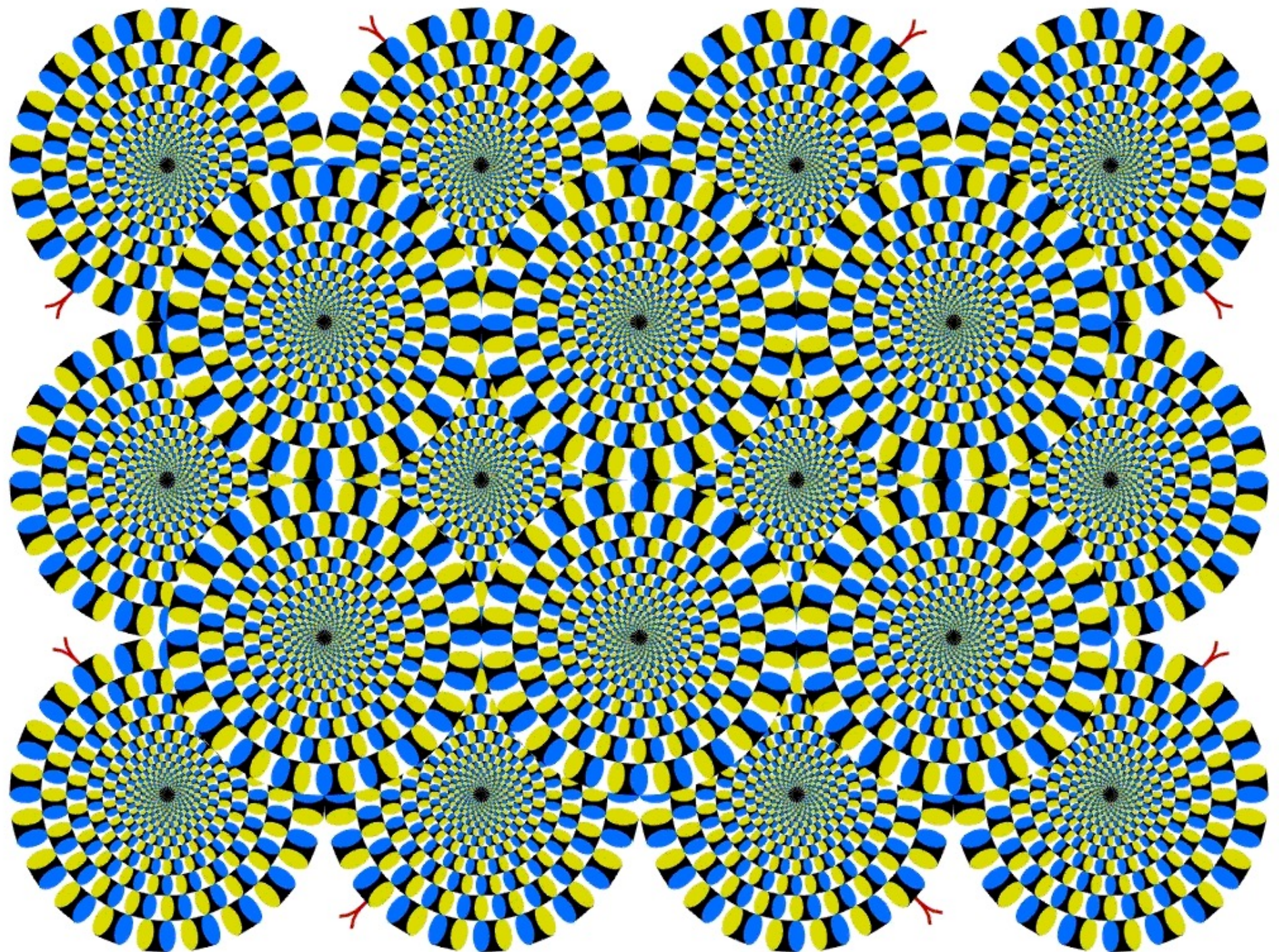
(a) Zollner

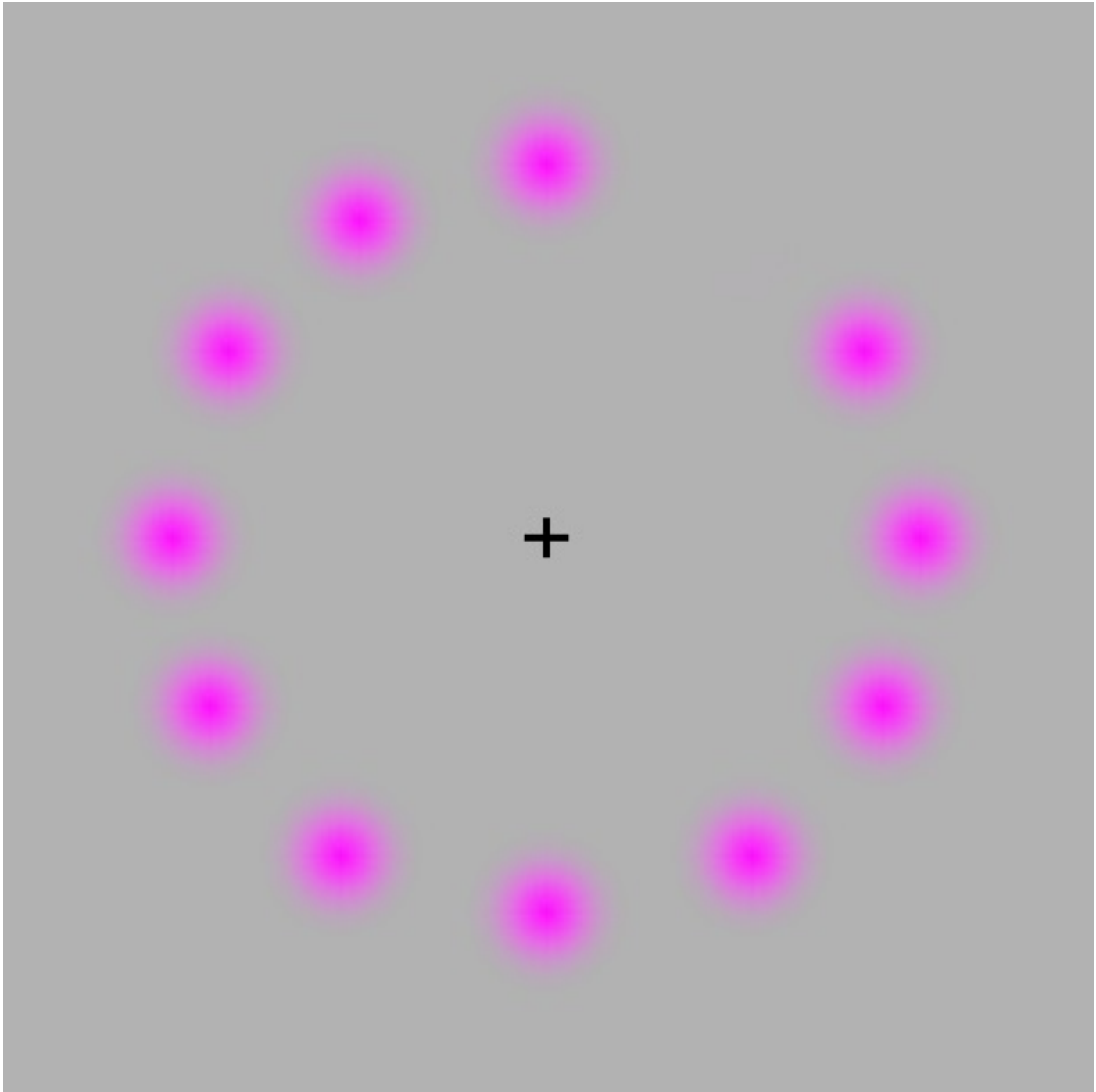


(b) Ebbinghaus



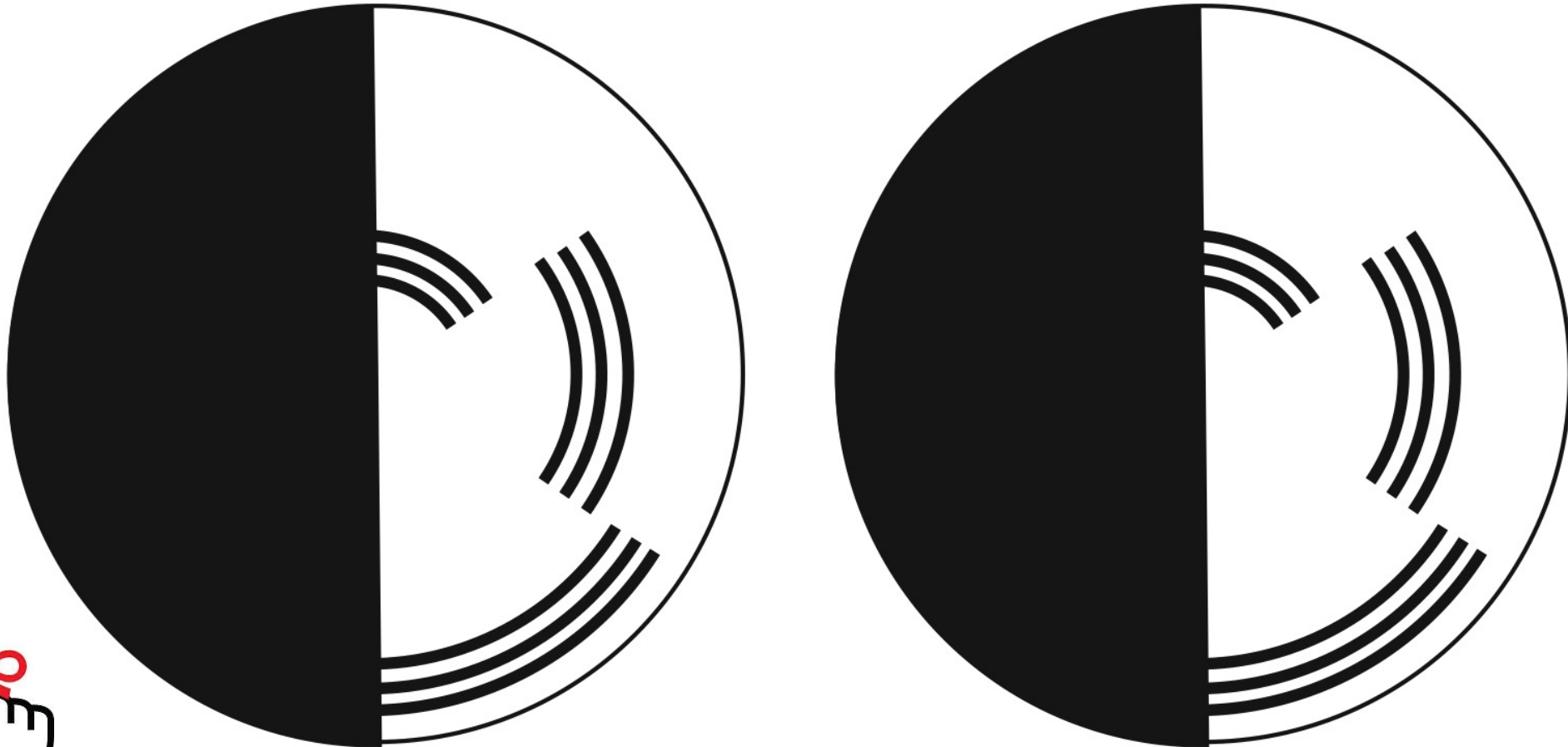






Benham's disk

Illusions are a consequence of **complex function**



Main points so far

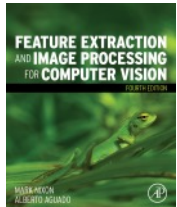
1 – human eye can be modelled in **three** sections

2 – it **works** very well

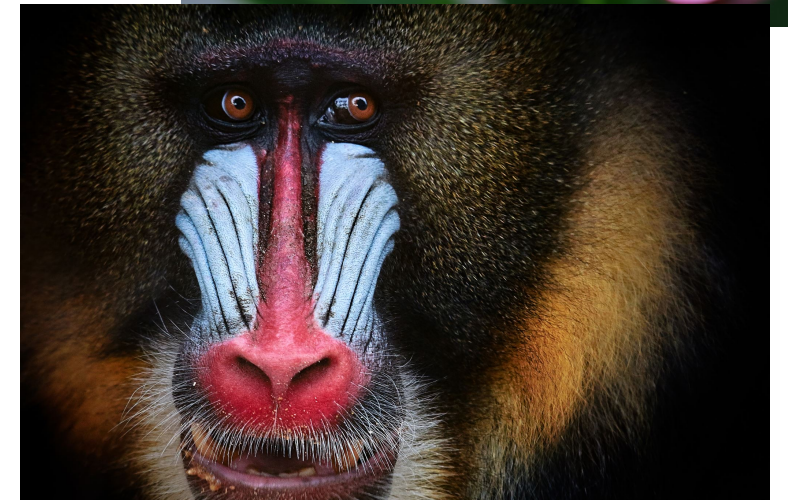
3 – but it can be **deceived**

4 – is it a **good** model for computer vision?

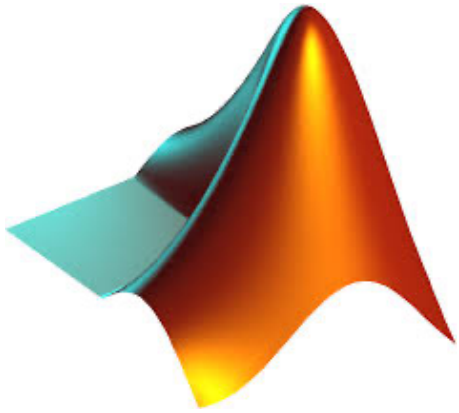
Next up, how images are formed



Human to Computer Vision



Software languages



Matlab



Python



Associated literatures



References of each Chapter



Other books:

- ❖ CVOnline: homepages.inf.ed.ac.uk/rbf/CVonline/books.htm
- ❖ Digital Signal Processing: dspguide.com

Journals, magazines and conferences:

- ❖ IEEE, SIAM, Springer, Elsevier, IET
- ❖ CVPR, ICCV, ECCV, etc.

Computer Vision News:

<https://www.rsipvision.com/computer-vision-news/>