Advances in Visual Perception
PSYC 526

Profs. Fred Kingdom & Kathy Mullen

Lecture

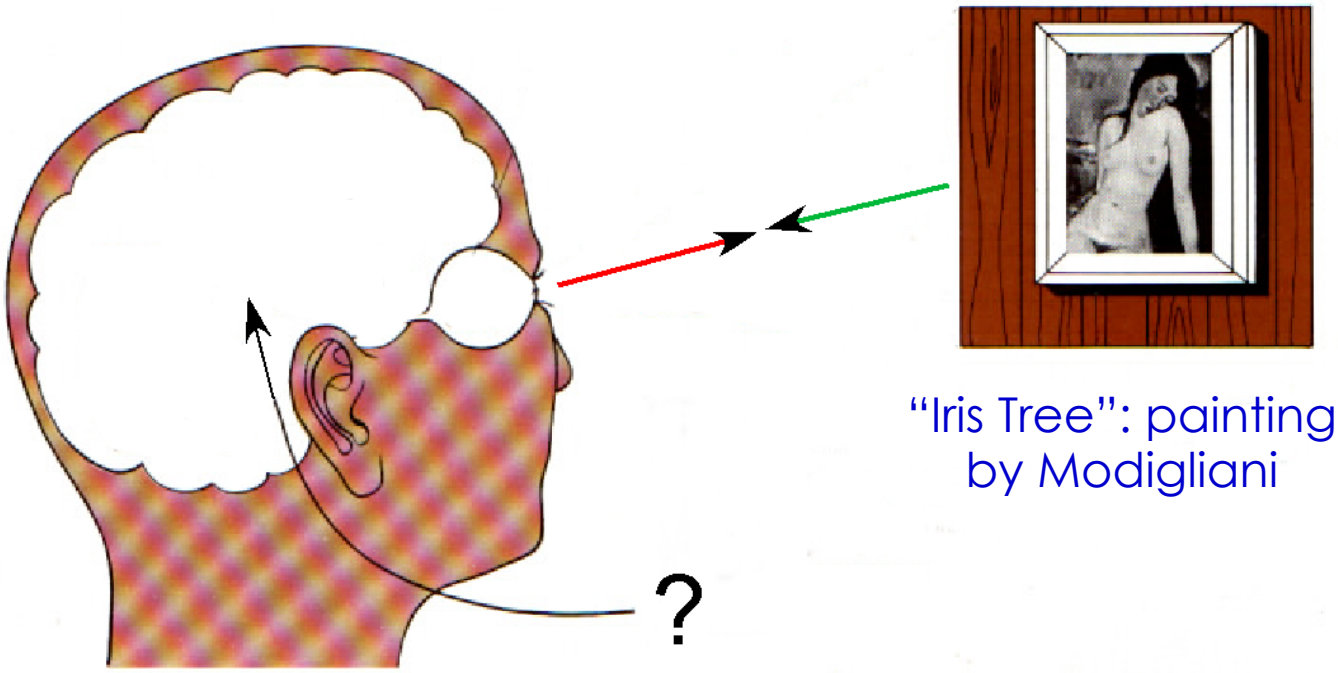
Topic 1
A VERY Brief History of Vision

Readings

Frisby & Stone "Seeing", The Computational Approach to Biological Vision, Chapter 1

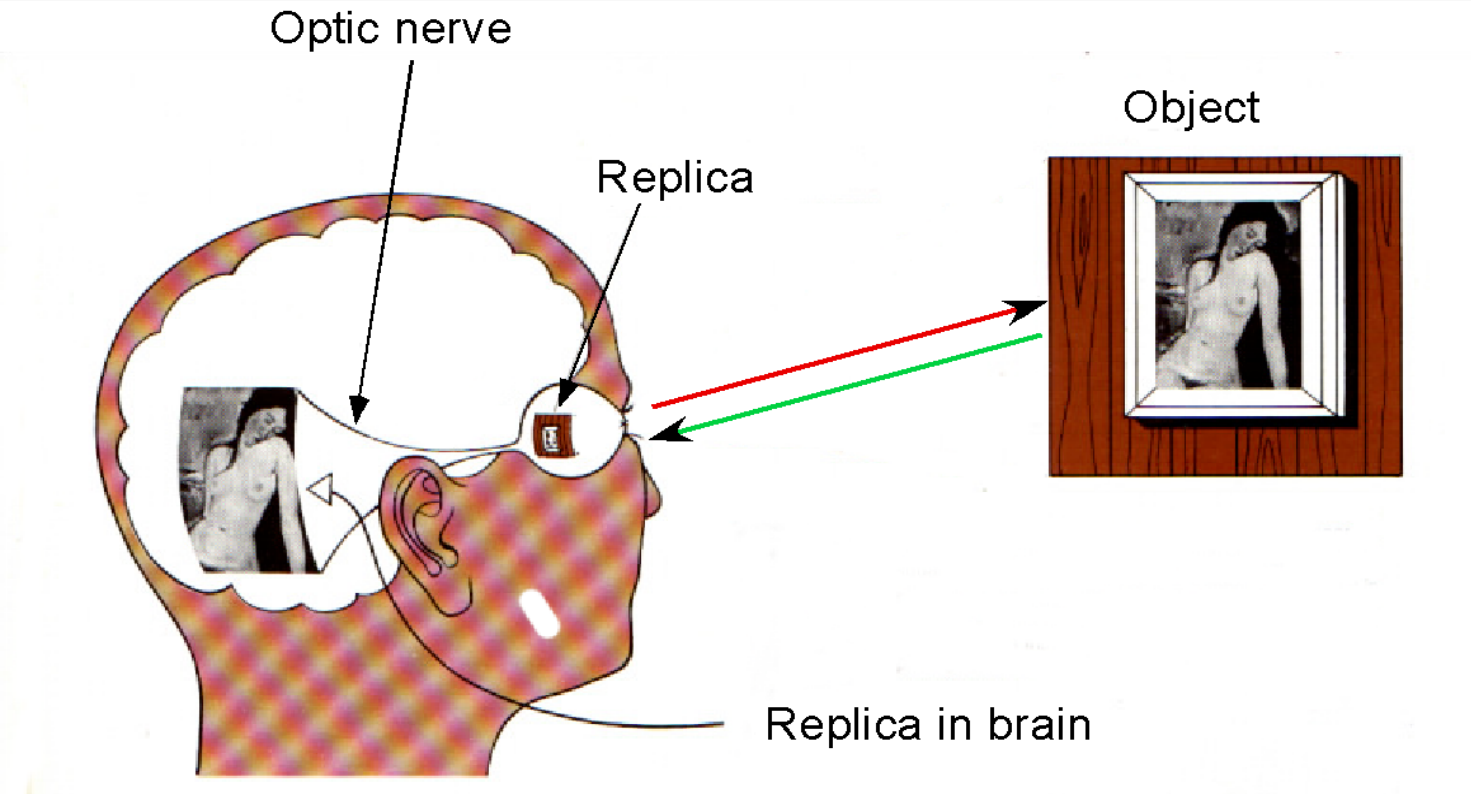
Wade, 1998 "Light and sight since antiquity" Perception, 27(6)

Empedocles (492-432 BC)
Emanation Theory



"Iris Tree": painting
by Modigliani

Galen (2nd century AD)

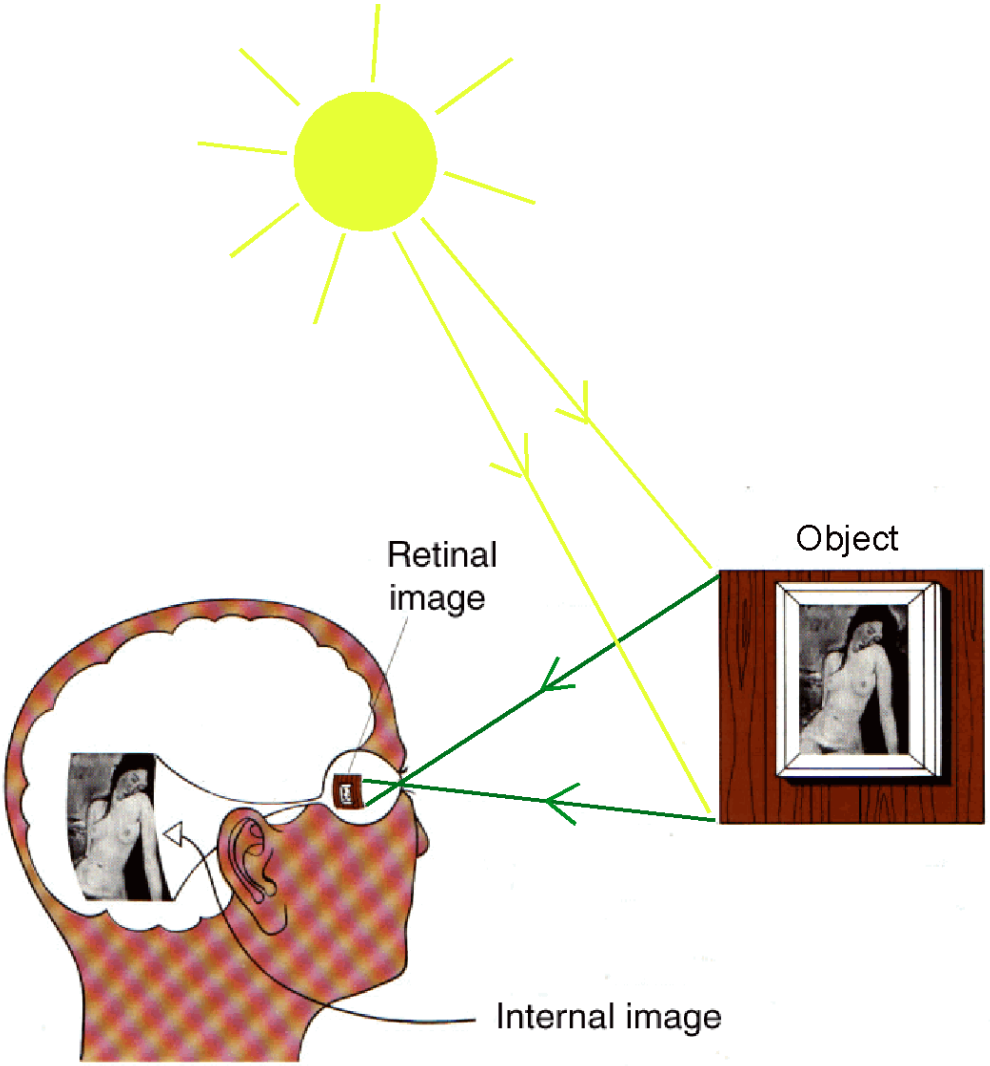


Summary of Greek ideas

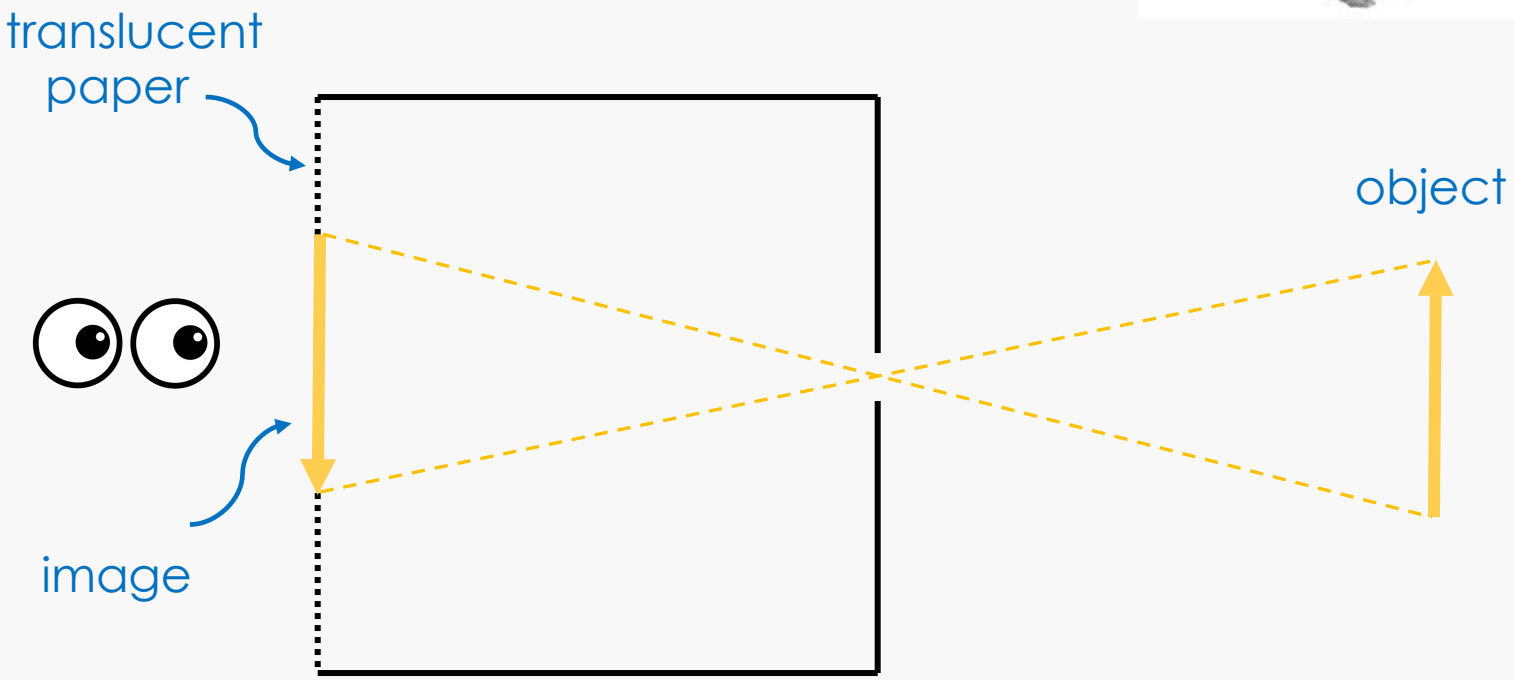
- Eyes emitted rays of light
- Objects were active agents in perception
- Replicas, or images of the outside world are carried to the brain. Galen (2nd century BC) understood that the brain was the seat of all mental images and sensations.

Alhazen (965-1040 AD)

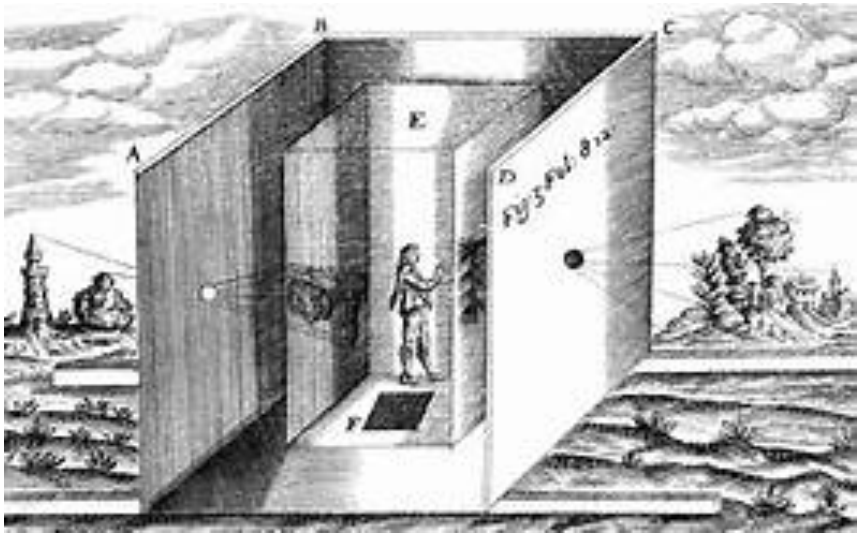
Abū ʿAlī al-Ḥasan ibn al-Ḥasan ibn al-Ḥaytham

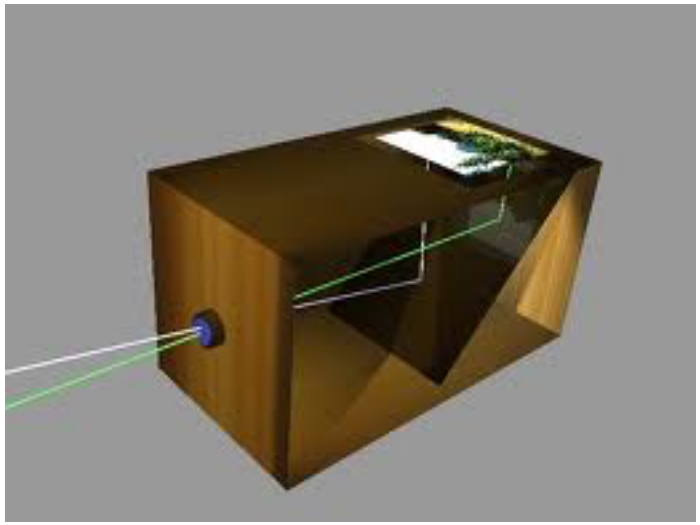


Alhazen invented the pin-hole camera, otherwise called the "camera obscura"

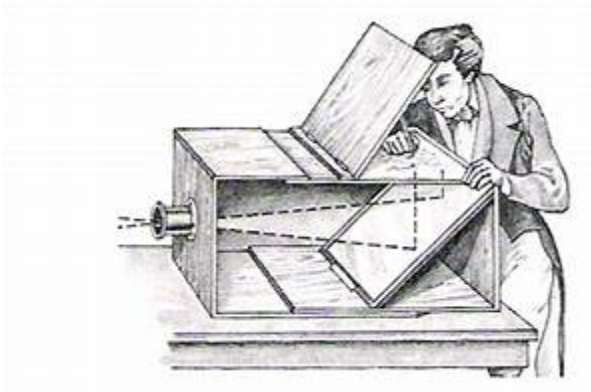


Camera Obscura





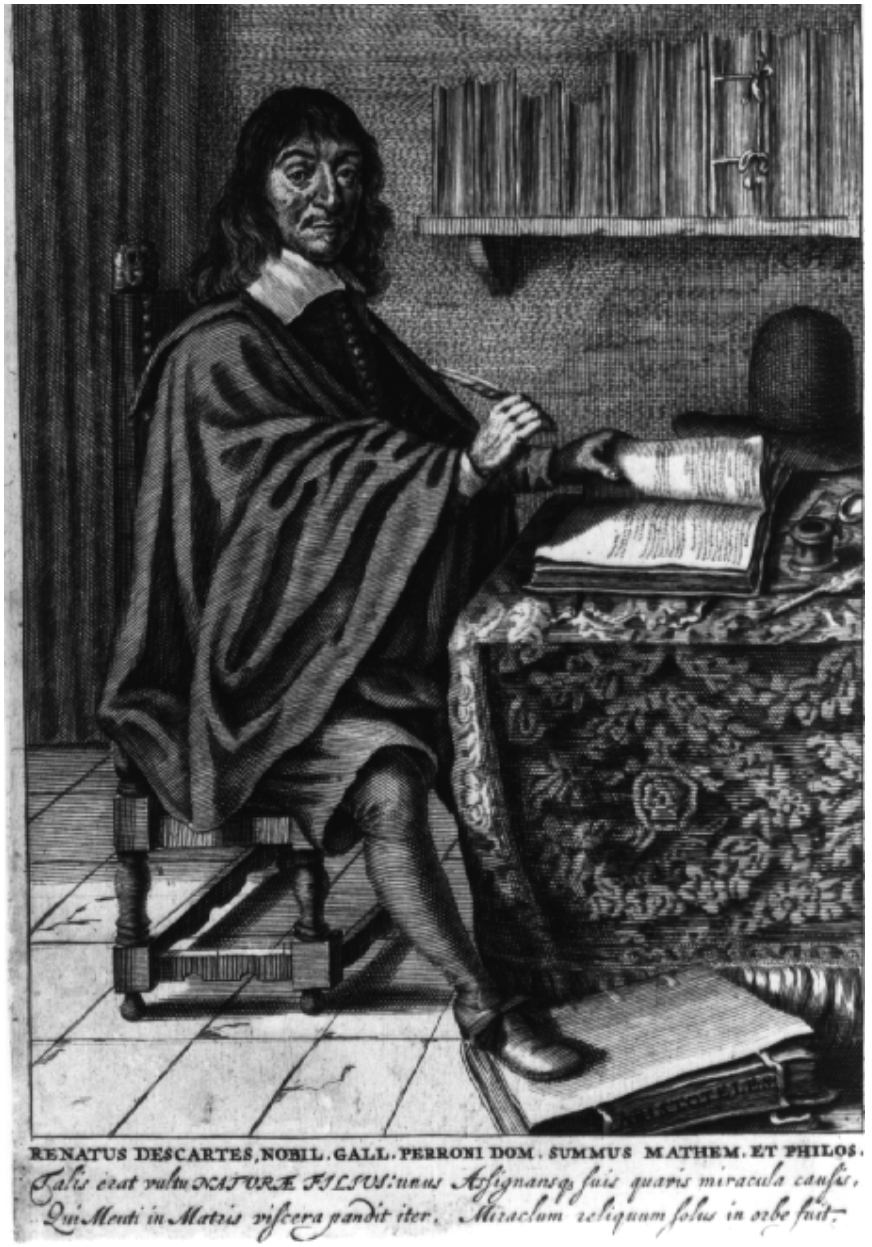
Woodcut from 1671 showing an artist copying an image created by a Camera Obscura



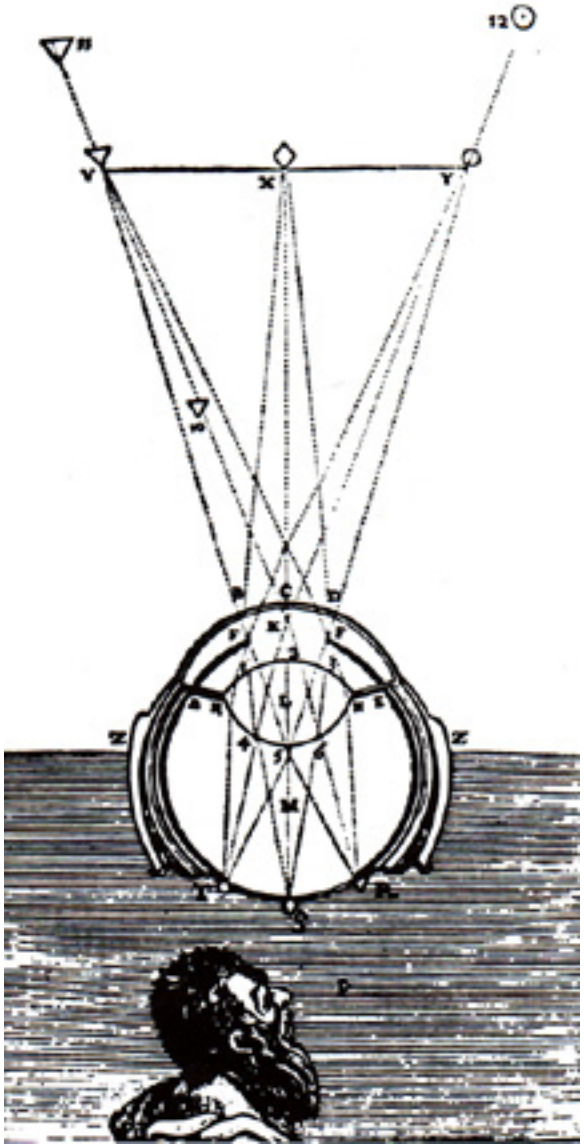
Alhazen (965-1039)

- Rejected emanation theory
- Image formed in the eye optically
- Objects reflected light
- Perceived colour due to colour of object and colour of light

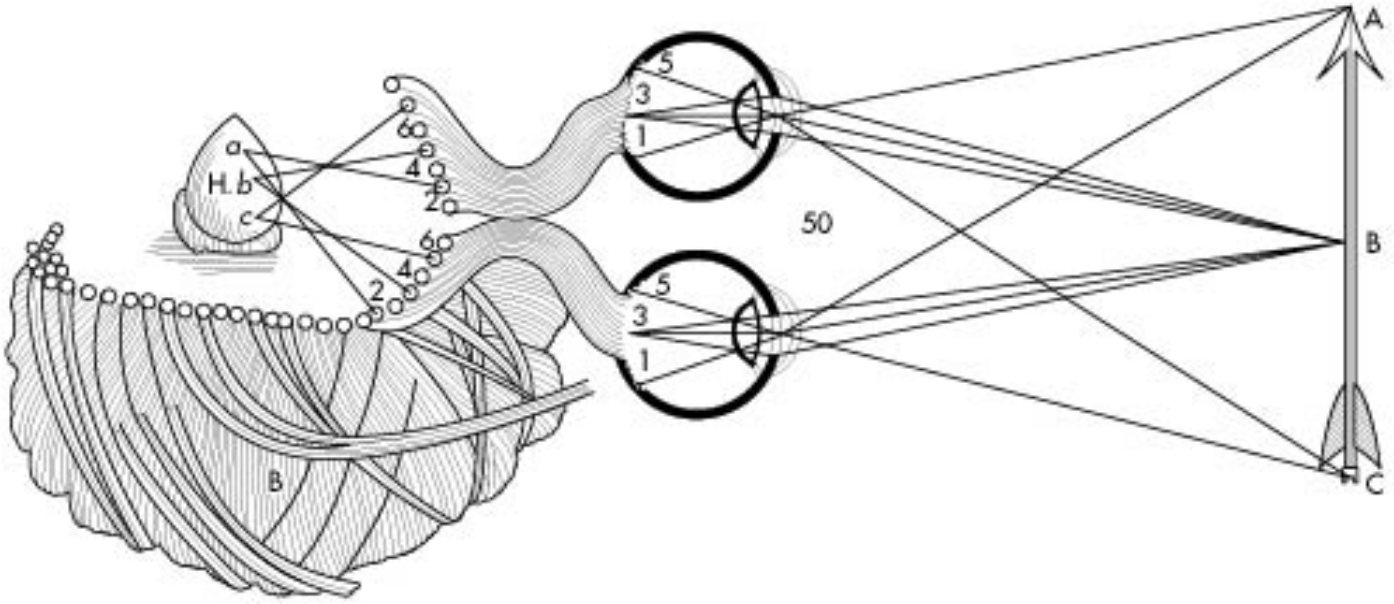
Descartes (1596-1650)



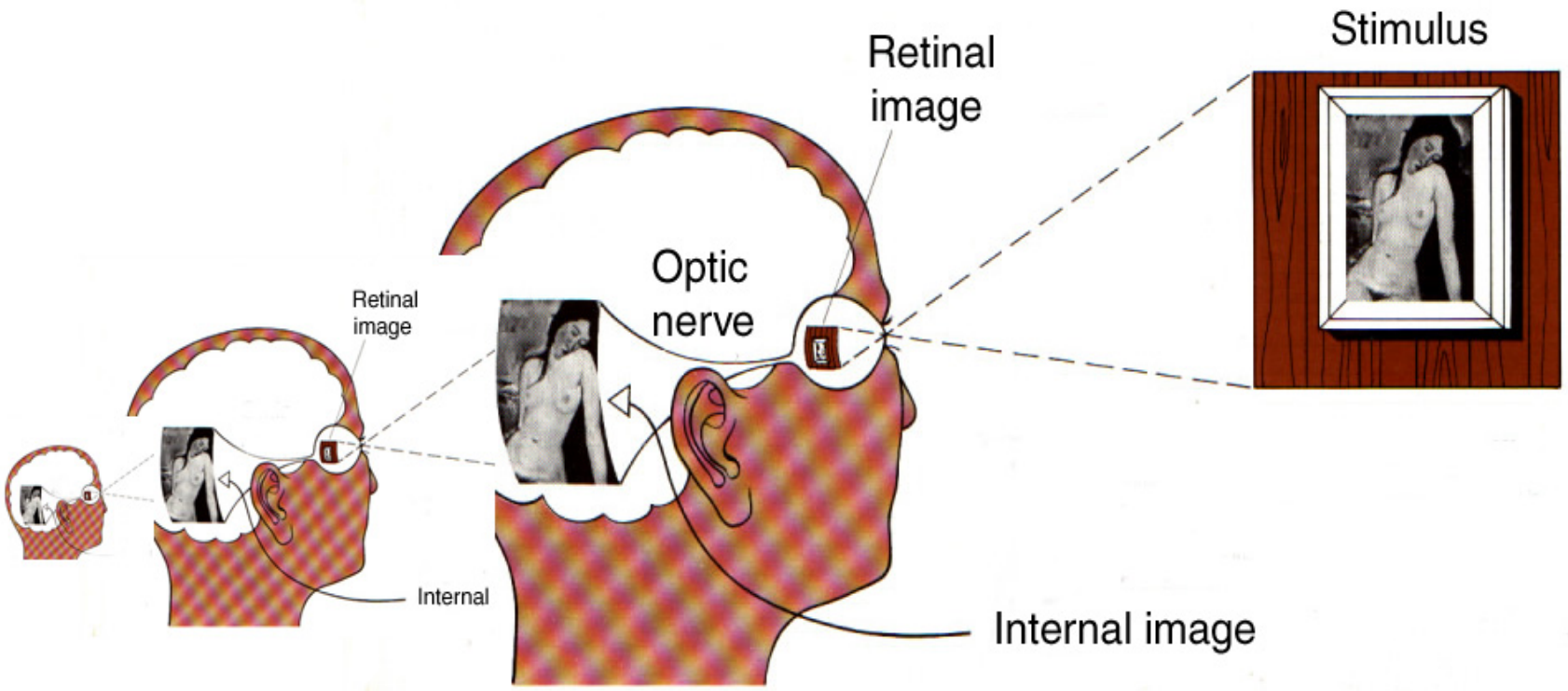
Viewing the retinal image (Descartes)



René Descartes' conception of brain and mind



The ‘homunculus fallacy’

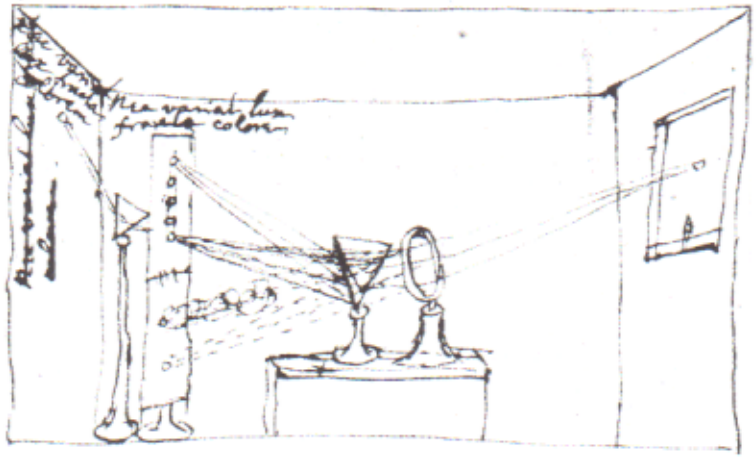


Summary of Renaissance ideas

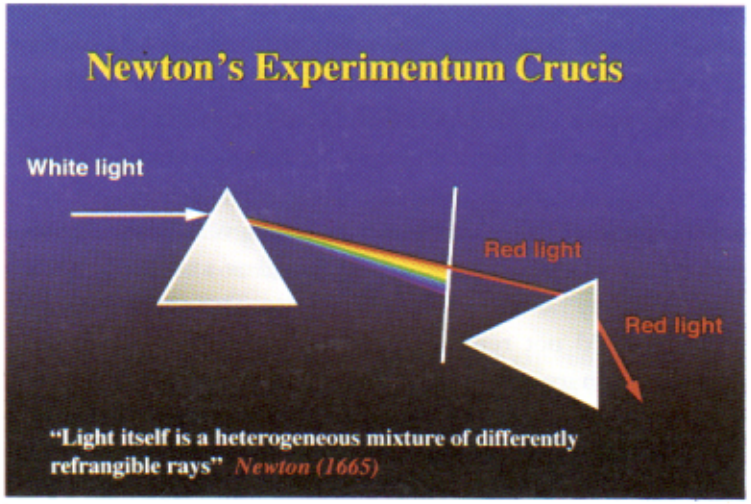
- Recognized the problem of a "sensorium" or "homunculus"
- Believed that the optic nerve carries images
- Recognized that two images had to be fused binocularly to produce a single view of the world

Isaac Newton (1642-1727)

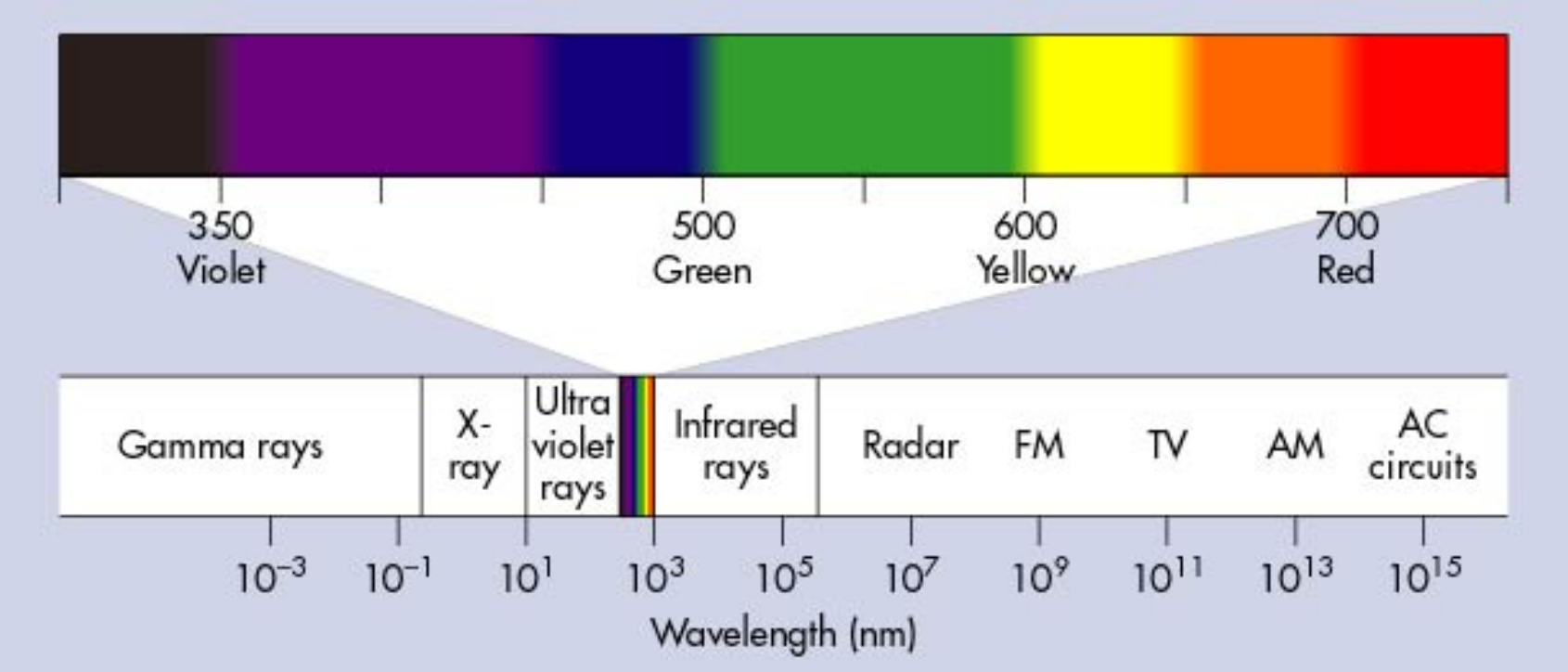
(a)



(b)



A beam of light separated into its wavelengths



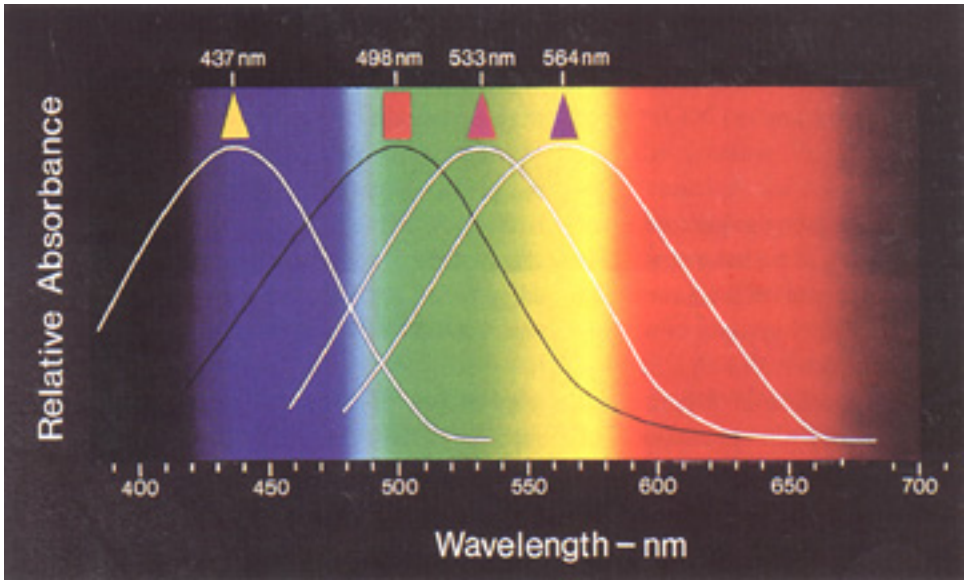
Summary of Post Renaissance ideas

- Spectrum of colours continuous
- The colour of an object is a result of the ability of that object to reflect the various colours in the spectrum
- Light waves are not themselves coloured, but elicit a coloured sensation
- Belief that the results of colour mixing were due to the physical properties of light, rather than visual processes

..also by the end of the renaissance

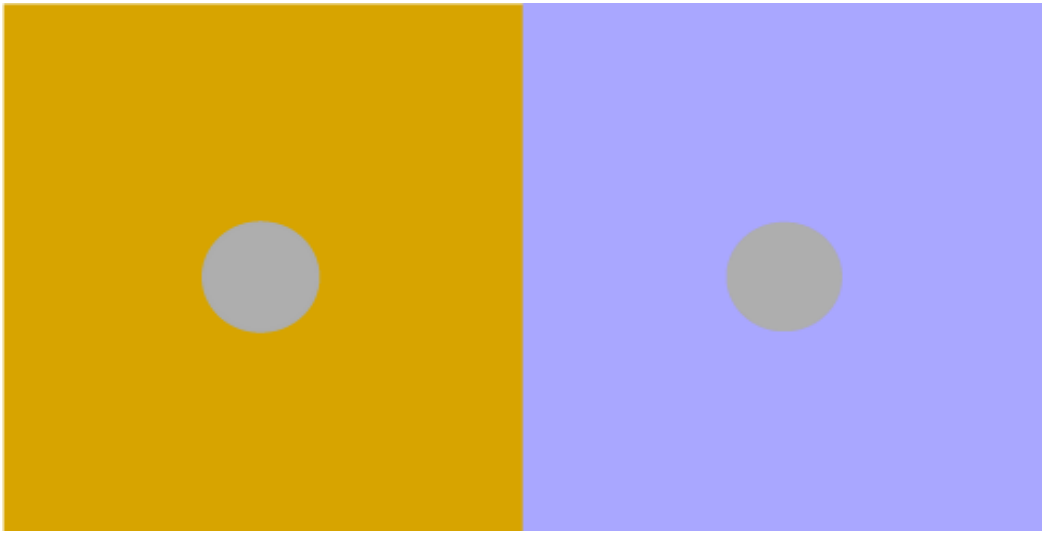
- The lens in the eye produced the retinal image
- A "sensorium" (or 'homunculus') in the head was able to "see" the contents of the image
- The world we perceive is not a simple copy of physical reality

Helmholtz (1821-1894)

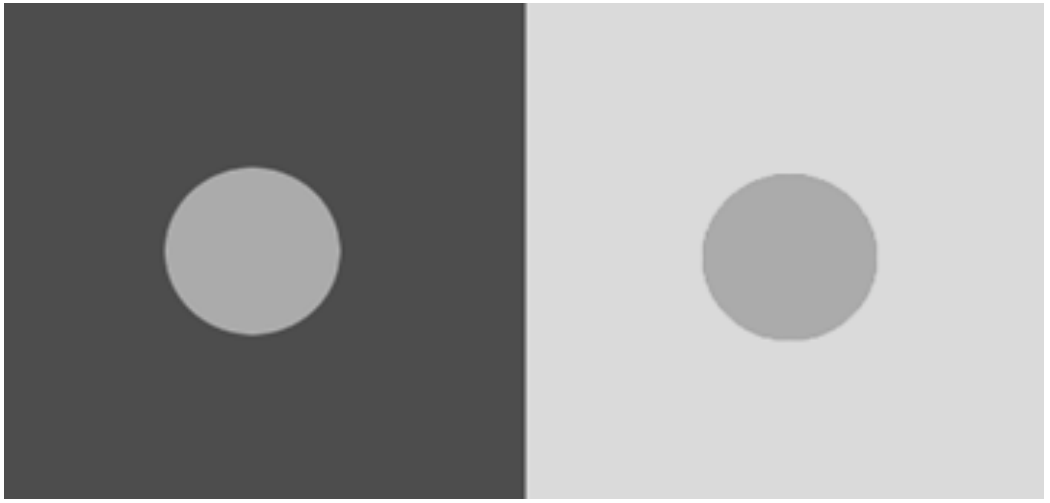


Helmholtz believed that visual illusions were caused by “unconscious inference”

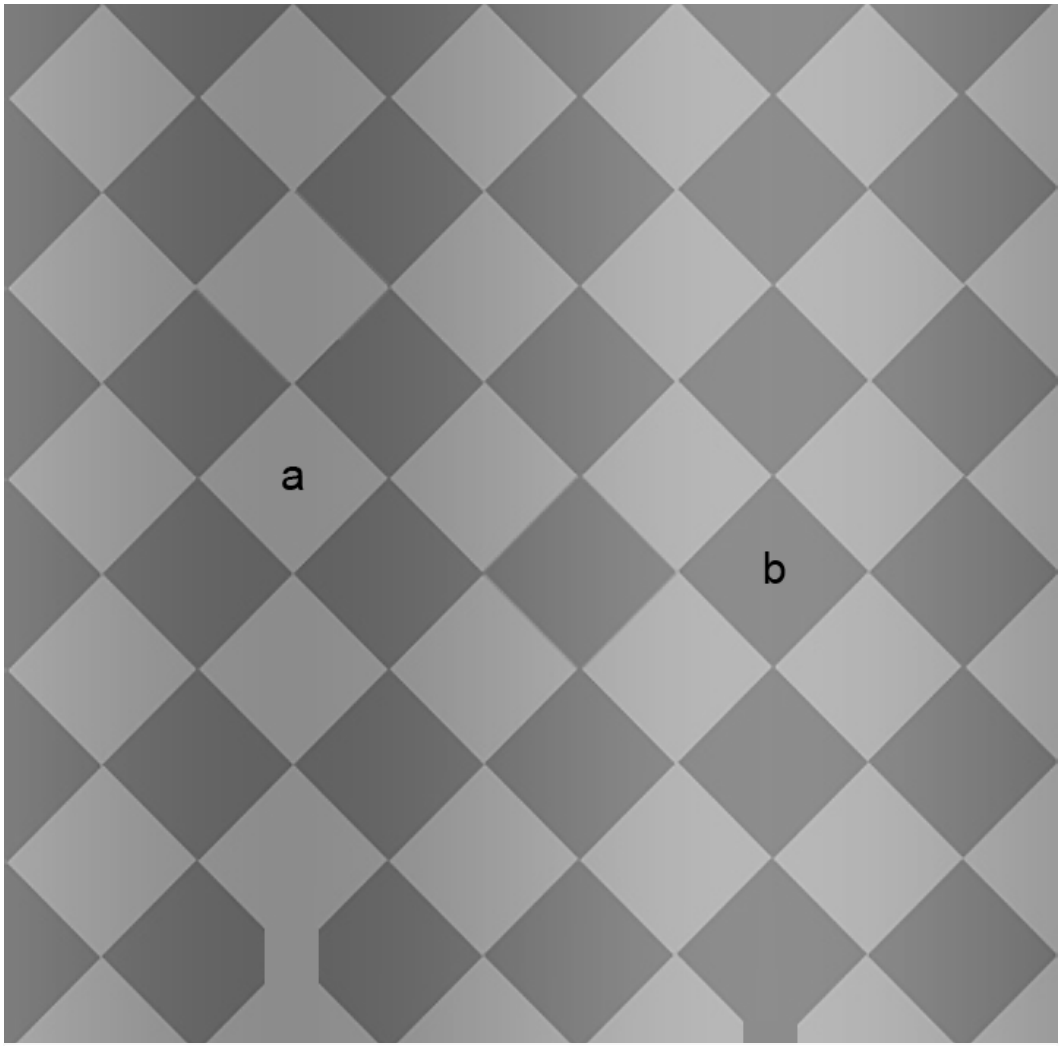
Simultaneous colour contrast



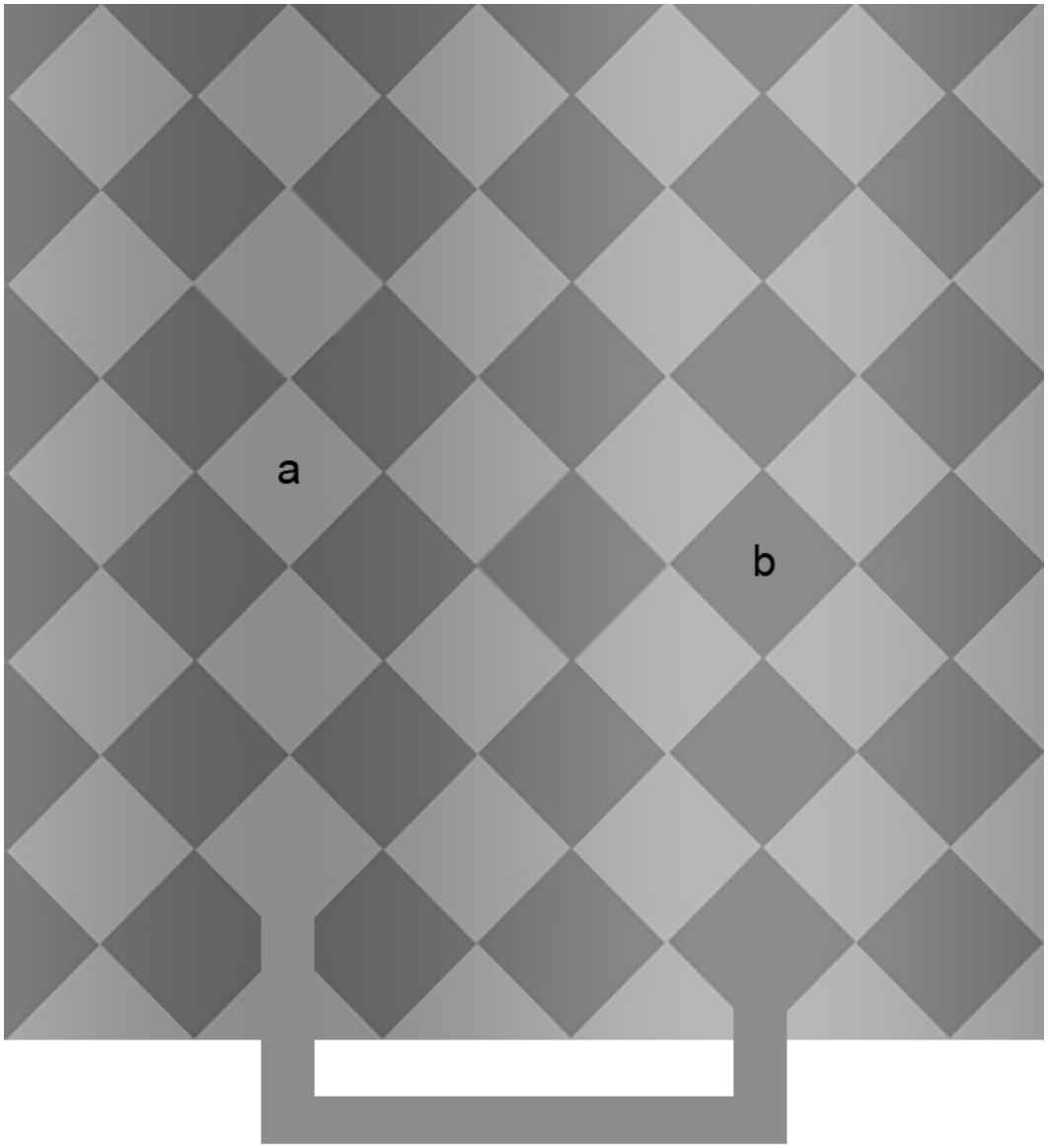
Simultaneous brightness contrast



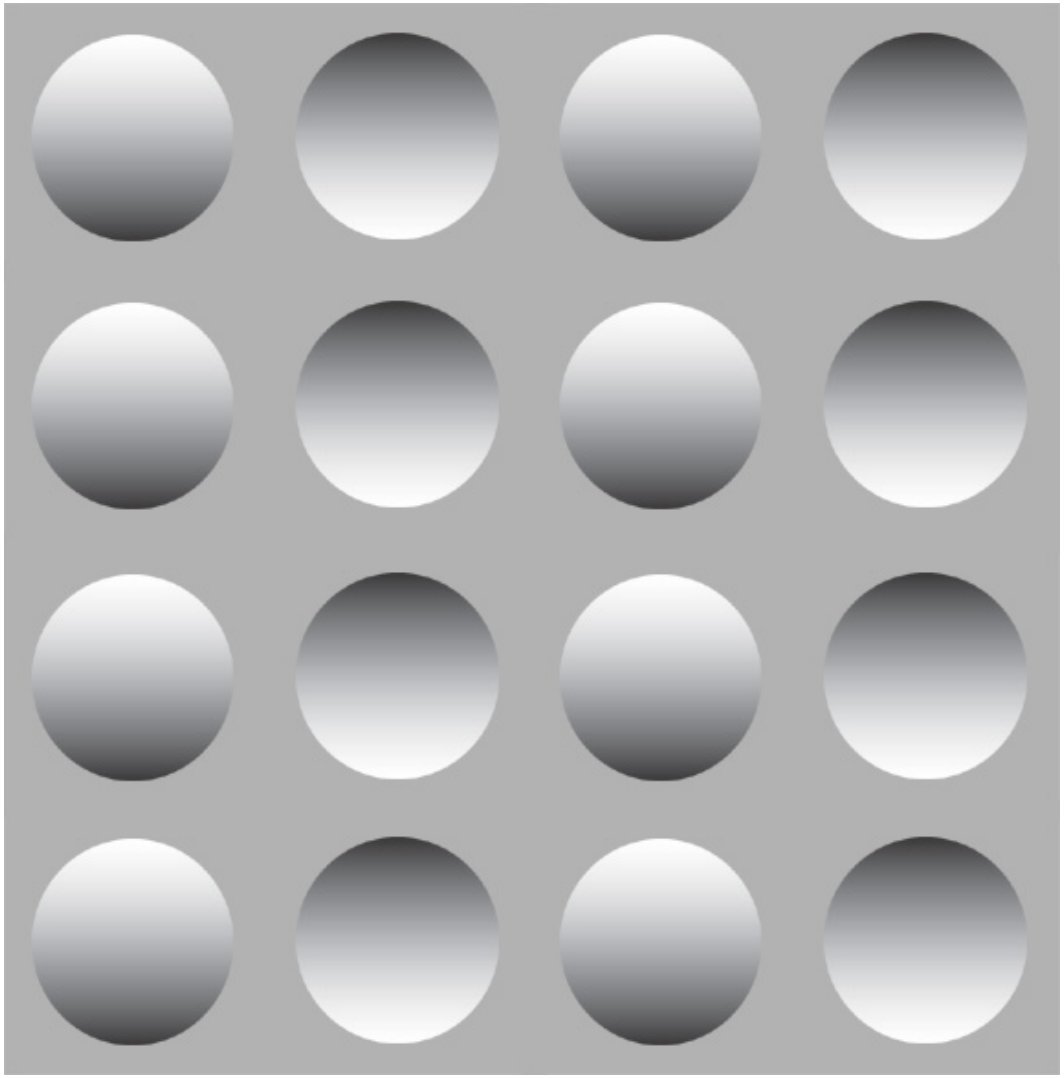
“a” and “b” have the same luminance!



….as you can see if you join them up



What is the perceptual hypothesis here?



By the end of the 19th century…..

- Different sensations (pain, touch, smell, sight, hearing) are mediated by different physiological structures in the nervous system

- The origin of sensory qualities lay in the structure of the nervous system and not the nature of the outside world

- Within a modality (e.g. sight) different nerve fibres respond selectively to different stimuli (e.g. different ranges of wavelength)

- Perception is affected by in-built knowledge of the world, i.e. is not a simple transformation of the raw sensory input

Thank you!