Sensation & Perception (18Qs)

Psychophysics: the study of how we perceive sensory stimuli based on their physical characteristics

Transduction: process of converting an external energy of substance into neural activity

- **Sense receptor**: specialised cell responsible for converting external stimuli into neural activity for a specific sensory system

Absolute threshold: lowest level of stimulus needed for the nervous system to detect a change 50 percent of the time

Just noticeable difference (JND): the smallest change in the intensity of a stimulus that we can detect

Signal detection theory: psychophysical theory, which described the detection of stimuli under conditions of uncertainty

- **Response biases**: tendencies to make one type of guess over another when we are in doubt

The sensation we experience is determined by the nature of the sense receptor, not the stimulus.

Synaesthesia: A condition in which people experience cross-modal sensations (ex. hearing sounds when the see colours)

Selective attention: process of selecting one sensory channel and ignoring or minimising others.

Change blindness: poor at detecting changes in complex scenes if those changes occur during eye movements, while light are flickering or during frame changes in a video series

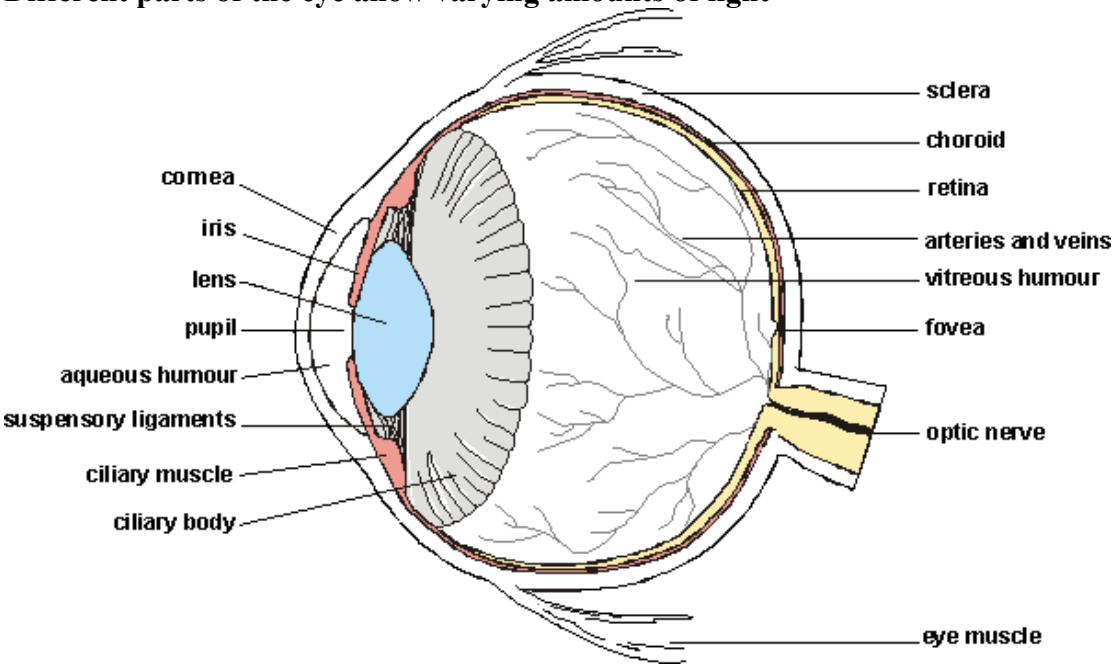
Binding problem: refers to how our brain takes multiple pieces of information and combines them to represent something concrete.

Seeing: The visual System

- Central players in our perception of the world is light
- Light has wavelength in the hundreds of nanometers
- **Brightness**: tintensity of the reflected light that reaches our eyes
- **Hue**: colour of light lens
- Sensitive to three primary colors: Red, Green and Blue
- Mixing varying amount of these are called *additive colour mixing*
- Equal amounts of red, green and blue produces white light

400 to 450nm appears violet
450 to 490nm appears blue
500 to 575nm appears green
575 to 590nm appears yellow
590 to 620nm appears orange
620 to 700nm appears red

Different parts of the eye allow varying amounts of light



The sclera, iris, and pupil: **sclera** is simply the white of the eye; the **iris** is the coloured part of the eye (responsible for eye color are called *pigments*). The **pupil** is a circular hole thorugh which light enters the eye.

- *Pupillary reflex* to decrease the amount of light allowed into them
- Pupils dilate when we are trying process complex information, like difficult maths problems.

The cornea, lens and eye muscles: **Cornea** is curved, transparent layer covering the iris and pupil (curvature is responsible for bending incoming light to focus it on the back of the eye). The **lens** also bends light (the lens changes it curvature)

- **Accomodation**: the lens changes shape to focus light on the back of the eyes, adapting to different lighting conditions.
- **Flat lens → enabling to see distant objects**
- **Fat lens → focus on nearby objects**

The shape of the eye

- **Near-sightedness (myopia)**: results when images are focused in front of the rear of the eye.
- **Far-sightedness (hyeropia)**: results when our cornea is too flat or our eyes too short
- Our vision tends to worsen as we become older. This is because the lens can accommodate and overcome the effects of most mildly misshapen eyeballs until it loses its flexibility due to ageing.

Retina: membrane at the back of the eye responsible for converting light into neural activity

Fovea: central portion of the retina

Acuity: Sharpness of vision

Rods: receptor cells in the retina allowing us to see in low levels of light

Cones: receptor cells in the retina allowing us to see in color
- The less numerous cones (small cones) give us our colour vision, cones require more light than rods do
- Different types of receptor cells contain photopigments (chemicals that change following exposure to light)
- Photopigment in rods is Rhodopsin (Vitamin A)

Ganglion cells: last cells in the retinal circuit; contain axons (bundles all the axon and depart the eye to reach the brain)

The optic nerve
- Contains axons of ganglion cells, travels from the retina to the rest of the brain.
- After the optic nerves leave both eyes, they come to a fork in the road called the *optic chiasm*.
- Optic nerves enter the brain, turning into *optic tracts* (OT).
- OT sends most of their axons to the visual thalamus and then to primary visual cortex (V1) for visual perception.
- These axons play key role in reflexes, like turning heads to follow something interesting we have seen.

How we Perceive Shape and Contour

Feature detection
Neurons that fire to specific features of a stimulus
Pathway away from retina shows neurons that fire to more complex stimuli
Cells that are feature detectors:
- Simple cortical cell (display distinctive responses to slits of light of a specific orientation, but need to be in specific location)
- Complex cortical cell (orientation specific, reponses are less restricted to one location)
- End-stopped cortical cell

Opponenet process theory

Opponent-process mechanism proposed by Hering
Three mechanisms
- red/green, blue/yellow, and white/black
- The pairs respond in an opposing fashion to the absorbance of light, such as positively to red and negatively to green

- These responses were believed to be the result of chemical reactions in the retina.

Researchers performing single-cell recordings found opponent neurons (1950s)
- Opponent neurons are located in the retina and LGN
- Respond in an excitatory manner to one end of the spectrum and an inhibitory manner to the other

Trichromatic theory
- Each theory describes physiological mechanisms in the visual system
- Trichromatic theory explains the responses of the cones in the retina
- Opponent-process theory explains neural response for cells connected to the cones further in the brain

When We Cannot See or Perceive Visually

Blindness: inability to see or more specifically the presence of vision is less than or equal to 20/200 on the Snellen eye test.

Colour blindness: the loss of perception for one or more colours, is most often due to the absence or reduces number of one or more types of cones stemming from genetic abnormalities
- **Monochromats**—only one type of cone and thereby lose all colour vision (extremely rare)
- **Dichromats**— have two cones and are missing only one. Red-green dichromats see considerable colour but cannot distinguish reds.

Motion blindness: serious disorder in which patients cannot seamlessly string all images processed by their brain into the perception of ongoing motion

Visual Agnosia: deficit in perceiving objects. Can tell us the shape and colour of an object, but cannot recognise it.

Blindsight: people with cortical blindness resulting from damage in V1 can make correct guesses about things in their environment, even though they cannot see them.

Hearing: The Auditory Sytem

Audition: our sense of hearing

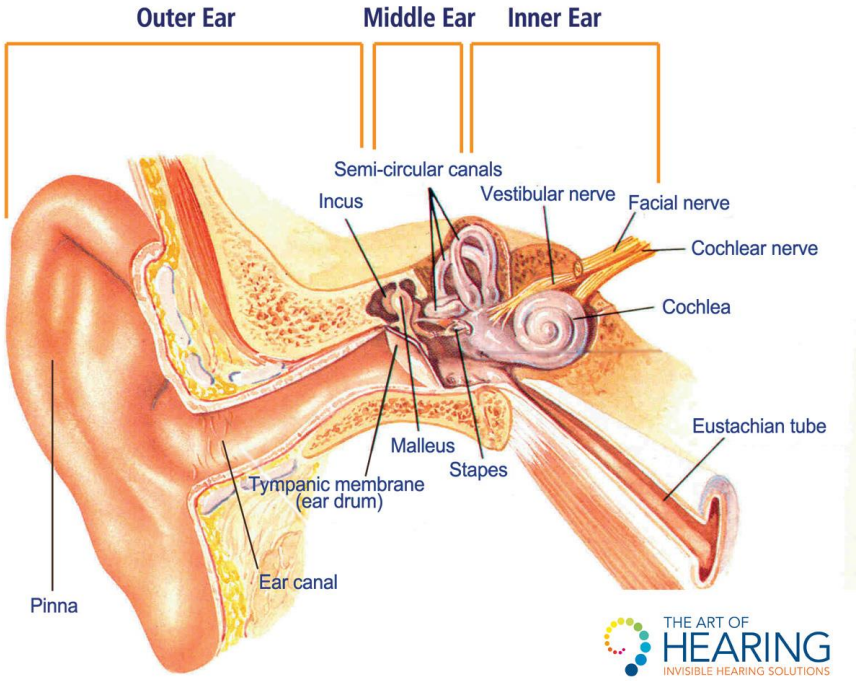
Pitch: corresponds to the frequency of the wave. HF (high frequency) corresponds to HP (high pitch), vice versa.

Human ear is sensitive to **frequencies** ranging from **20 to 20 000 Hz**

Loudness: the amplitude or height of the sound wave corresponds to loudness. Measured in decibles (dB)

Timbre: complexity or quality of sound that makes musical instrumers, human voices or other sources sound unique

Structures and Function of the Ear



Pinna: flexible outer flap of the ear, which channels sound waves into the ear canal

Ossicles: three tiniest bones in the body, hammer, anvil stirrup

Eardrum: Membrane that vibrates in response to sound waves

Ear canal: conducts soundwaves to the eardrum

Cochlea: bony, spiral shaped sense organ used for hearing

Organ of Corti: tissue containing the hair cells necessary for hearing