Perception 1

Tuesday, 7 July 2015
4:46 PM

- Turing test - a test of a machine's ability to exhibit intelligent behaviour equivalent to or indistinguishable from that of a human.
- A machine is said to have passed the test if a person is unable to distinguish between it and a human.
- Why study sensation and perception?
    - Understand the brain
    - Applied cognitive science - cognitive ergonomics
    - Clinical applications - rehabilitation of patients
- Prosopagnosia - inability to recognise faces
- The difference between sensation and perception:
    - Sensation - raw (not meaningful)
        - Bright
        - Sweet
        - Red
        - Dark
    - Perception - meaningful
        - The cookie is sweet
        - The rose is red and smells wonderful
- The brain is lazy when interpreting information which it has seen before in order to focus on more important things - survival tool
- The difference between bottom up and top bottom information:
    - Bottom up
        - Stimulus driven
        - Consistent across people
        - Often meaningless
    - Top down
        - Cognition/memory/knowledge driven
        - Different for different persons
        - Based on existing knowledge, acquired in the past
- Perception is influenced by memory as well as sensory input
- Spreading activation
    - Mainly top down - information stored in your memory gets reactivated upon stimulus
    - Activates existing representations
    - Spreads to neighbouring knowledge

Perception 2

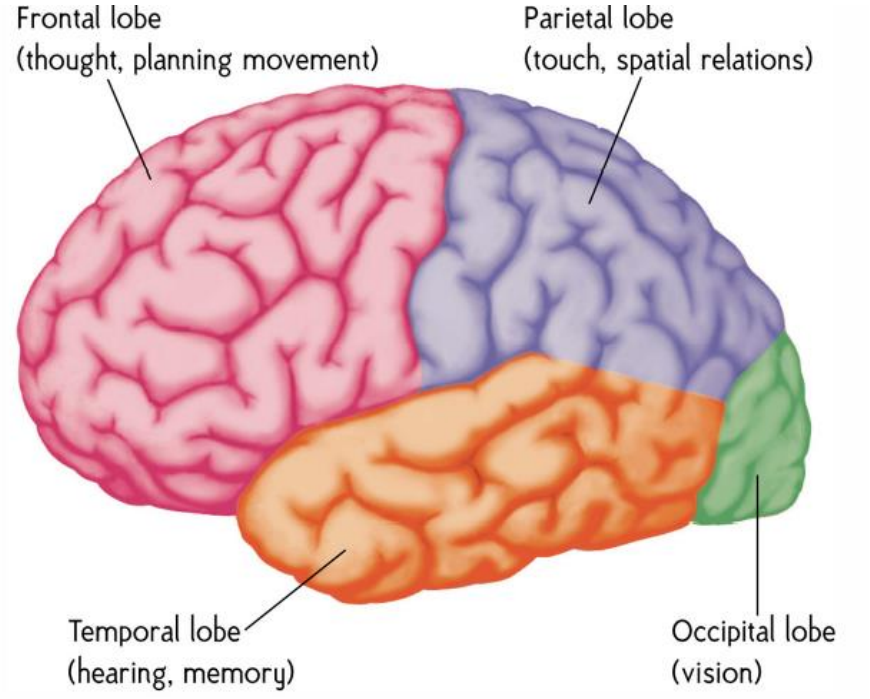
Sunday, 26 July 2015
10:09 PM

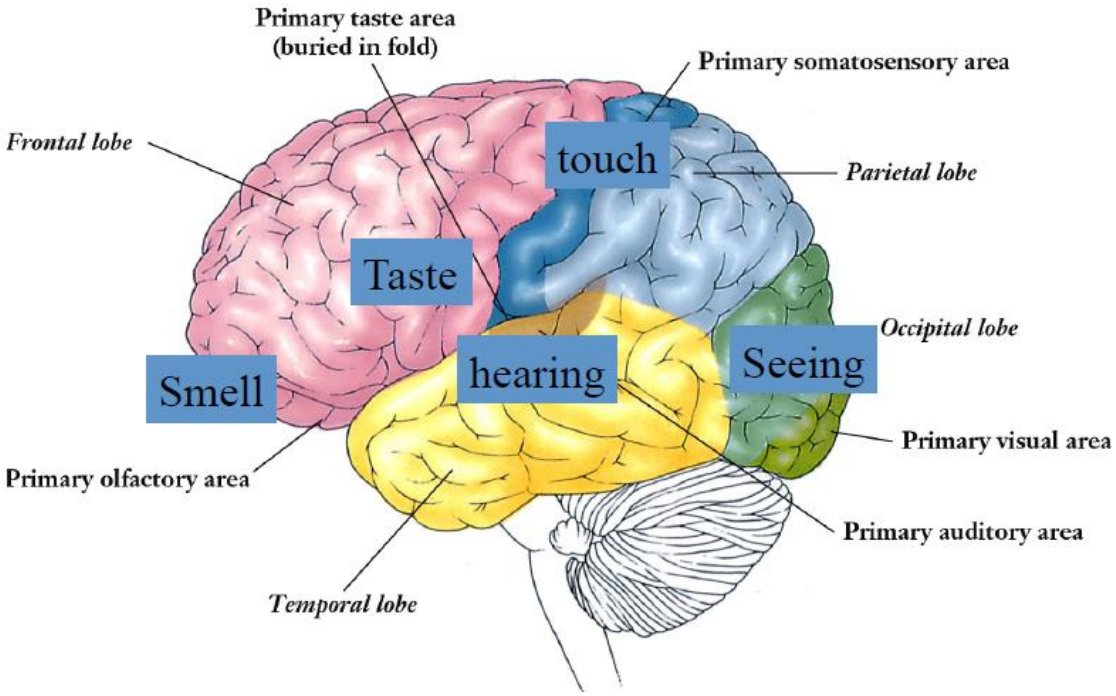
Senses and steps to perception

1. Energy (light, heat, etc.)
2. Sensor (transducer)

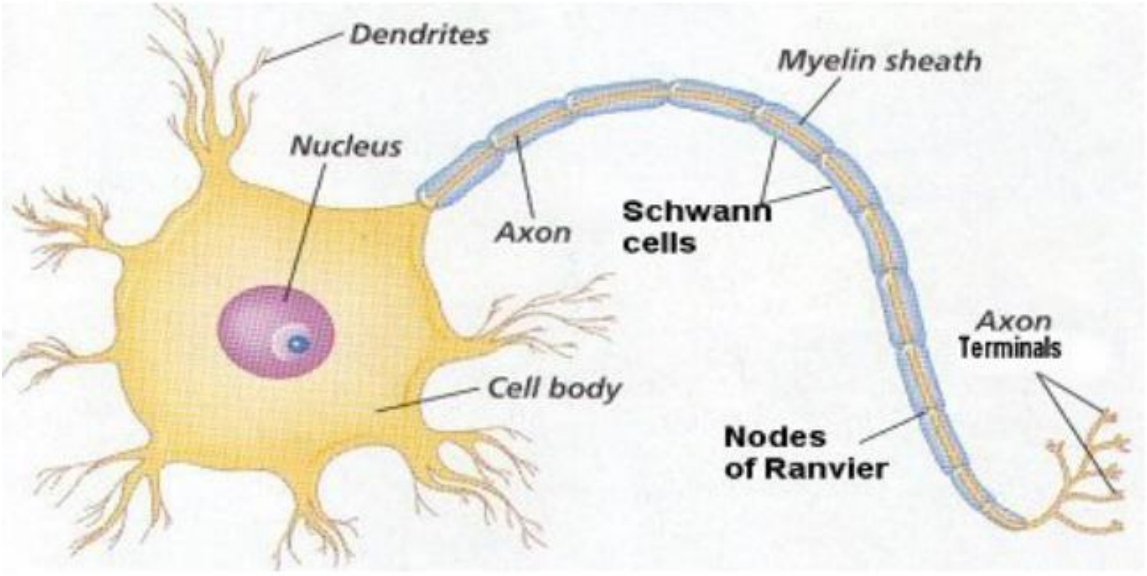
3. Wiring (neurons and neuronal fibres)
4. Relay station (the Thalamus) sends signals to appropriate part of the brain
5. Cortex sensations becomes perception

- Each sense has its own:
    - Specialised receptors (e.g. the eye has photoreceptors)
    - Specialised sensory neurons for transport
    - Specialised brain area where information projects to

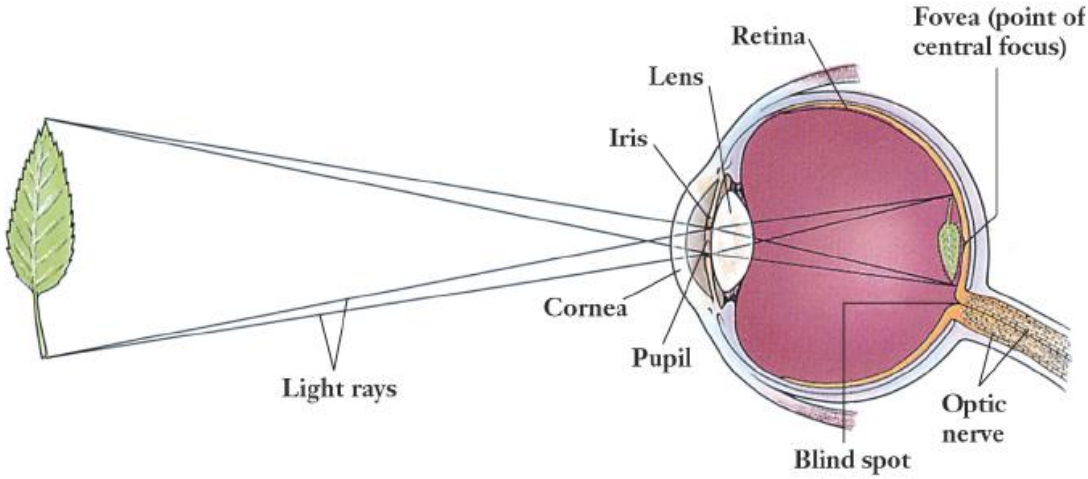




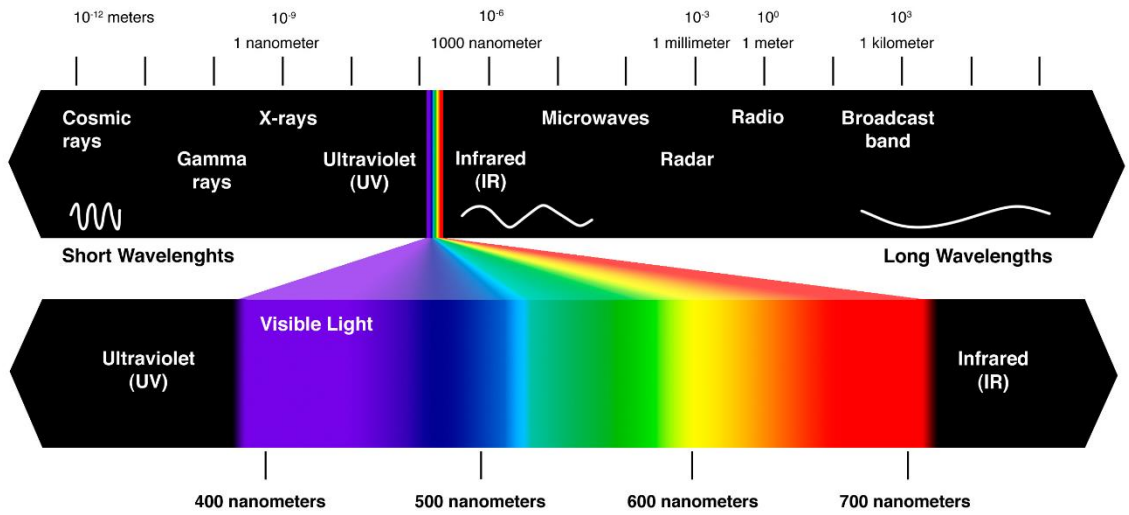
- Grey matter - outer layer is where the action happens - thinking and processing signals
- White matter - acts as a connection cable

- 

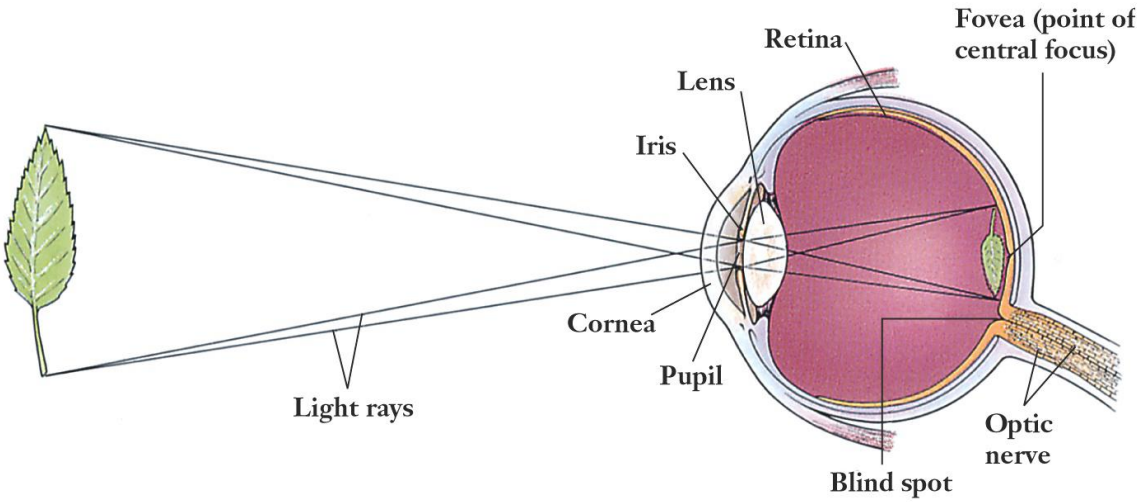
- The grey matter contains the nuclei of the neurons
- The white matter is made of the Myelin sheath

- 

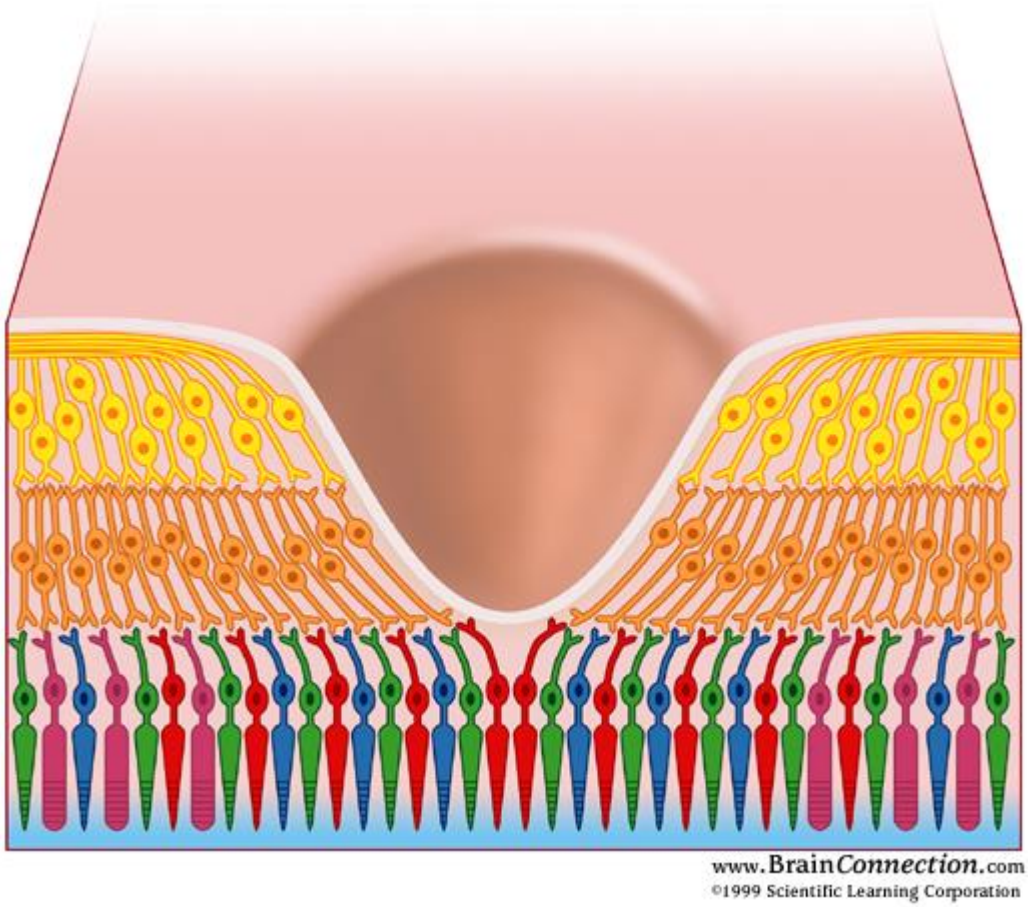
- Eye dominance test - the eye you can't see with when it is closed is the dominant eye
- Sunset - short wavelength light disappears first



- The image is projected on the retina upside down and then the brain processes it by flipping it around.
- The fovea is the point of central focus - the image projected on the fovea is manipulated by muscles which contract and relax the lens -



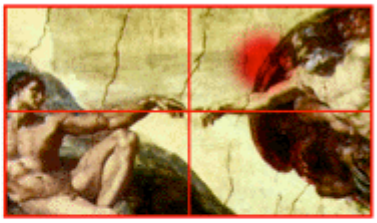
- Low vs high spatial frequency - determines detail of an image - high frequency = high detail
- The eyes are part of the brain and the spatial frequency of the iris is like a finger print
- A baby sees low spatial frequencies before they develop a good eye for detail at around 6 to 7 months - high spatial frequency
- Myopia - Nearsighted - image projected before the retina - can't see far away
- Hyperopia - Farsighted - image is projected after the retina - can't see up close



- Ganglion cells are located near the inner surface of the retina (in front of the cones/rods and bipolar cells) - cables connecting to the brain - they receive information from the bipolar cells
- Bipolar cell layer cover divide the cones/rods and the ganglion cells - receive signals from photoreceptors and transmit them to the ganglion cells
- The cone photoreceptors are relied on for colour vision - the rods are used for low visibility
- Cerebral achromatopsia - inability to see colour - different to cortical colour-blindness
- Cones are highly concentrated in the fovea while rods are found more around the fovea but still in the retina - unknown reason
- Cones
    - Photopic vision
    - Daylight
    - Colour vision
- Rods
    - Scotopic vision
    - Important at night
    - Colour-blind
- It takes time to adapt to darkness because there aren't many photons received (relatively) so the eye needs to be able to amplify the signal by increasing the sensitivity of rod photoreceptors
- The blind spot occurs near the fovea where the axons exit the eye and go to the brain - the brain constructs what it thinks it sees there so that there isn't a blank spot
- People with severe epilepsy need to have half of their brain removed - they can still operate with half a brain but spasticity can occur according to the side that is removed - some recovery is possible if occurs ate young age - low vocabulary at young age

- Nasal connection from the eye cross over so that the left eye goes to the right side of the brain but the temporal connection remains on its respective side - optic chiasma - allows visual cortex to receive the same hemispheric visual field from both eyes

- Scotoma



- Quadrantanopia

- Hemianopia

Perception 3

Wednesday, 29 July 2015
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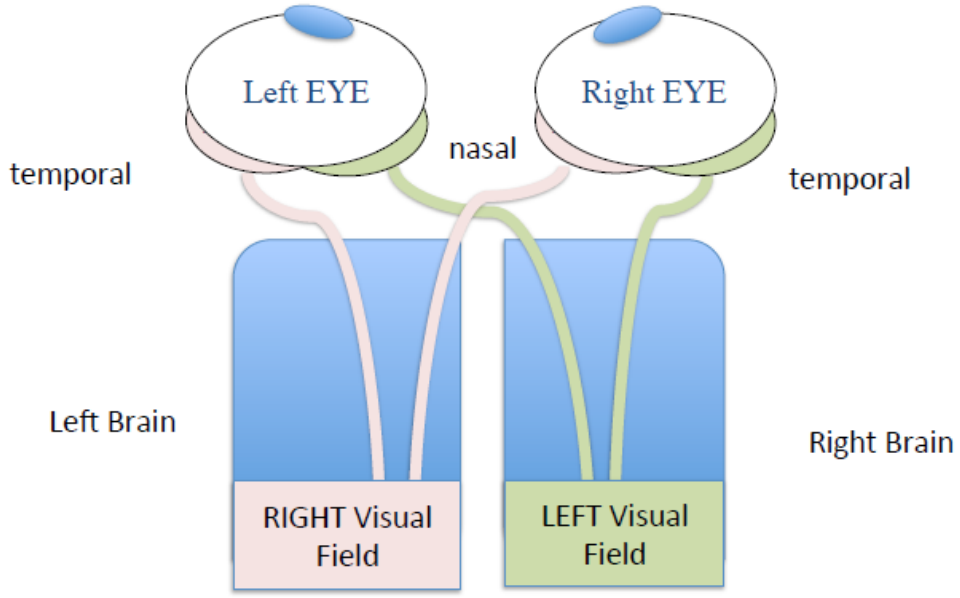
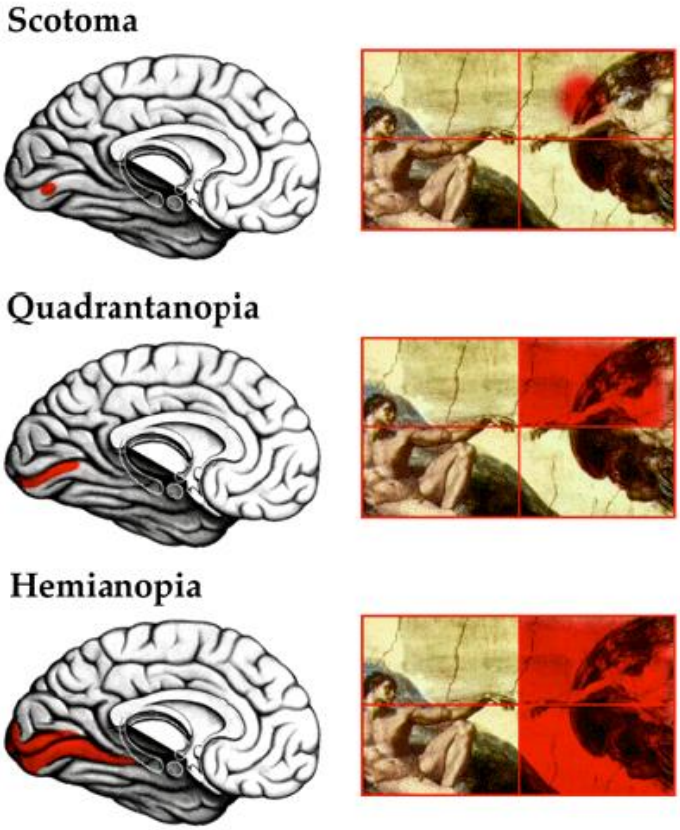
<u>Visual Fields and Representations in the Brain</u>

- Temporal connection stays on one side
- Nasal connection crosses over to the other side
- Connections cross over so that an image from a particular hemispherical visual field is transmitted to the same part of the brain



- Upper and lower Calcarine Sulcus - upper visual field to lower calcarine and vice versa

Red shade represents are of blindness and part of the brain affected



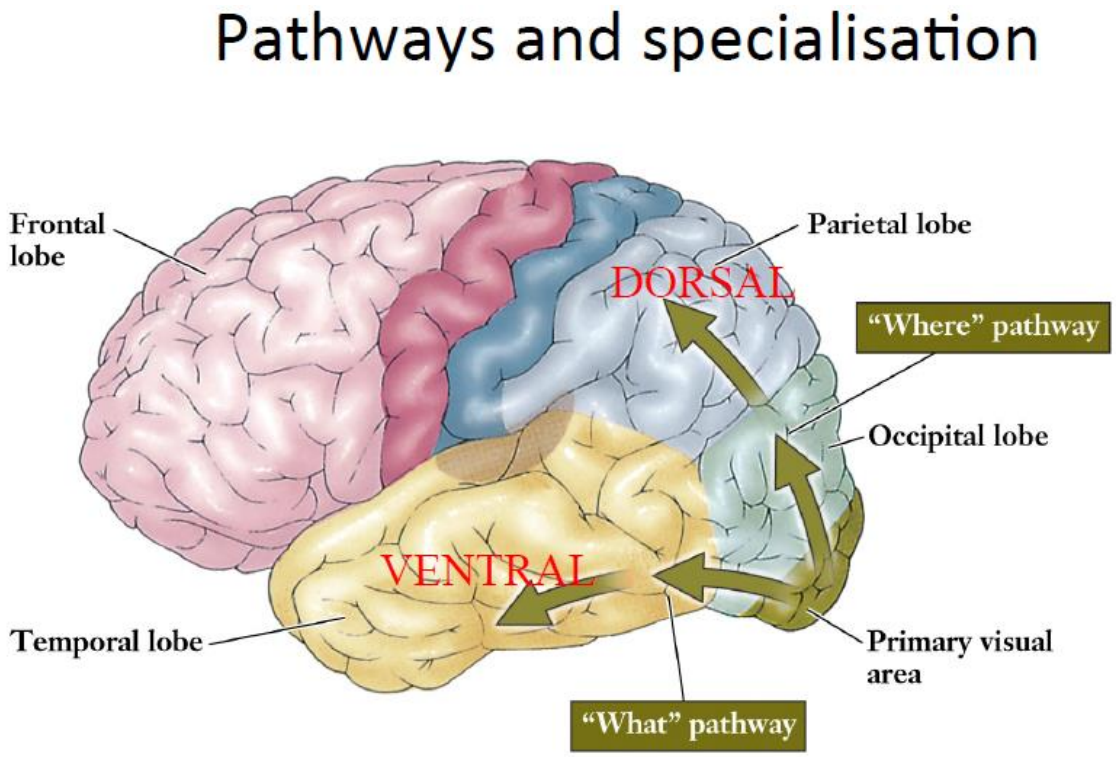
- Corpus Callosum - the central connection within the bran connecting the two brain halves together
- fMRI measures changes in magnetic field due to blood pressure or water in the eyes

- Split brain patients - corpus callosum lesion to avoid signals passing from one part of the brain to the other - epilepsy treatment - avoid complete body spasm
- The speech centre is on the left side of the brain so if the corpus callosum is cut, and someone sees something in their left visual field, they cannot identify it via speech because the information is sent to the right side of the brain. The person can pick up the spoon and see it in their right visual field and then identify it via speech.
- Colour-after effect - brain adapts to the colour it sees and the after image is coloured when in reality it is black and white
- The most important pathway in the brain - the visual pathway from the retina to the visual area of the thalamus

Pathways

- Midget - Parvocellular
  - Small
  - Object, colour
  - Temporal (connects to temporal cortex)
  - Ventral (down)
- Parasol - Magnocellular
  - Large
  - Spatial, motion
  - Parietal (connects to parietal cortex)
  - Dorsal (up)

- The humpty dumpty problem - different visual signals travel through different pathways and then they are pieced together again by the brain



- Agnosia - problem with ventral pathway
  - Form agnosia - some description of object seen but unable to draw the object
  - Object agnosia - can draw from an example of object but cannot recognise it via speech
  - Unable to draw what they see but they can draw it from memory

- Bilateral lesion patient - can't see motion

Perception 4

Sunday, 2 August 2015
6:48 PM

Sound

- Brodmann Areas - classification based on cyto-architectonics - weren't completely accurate - areas are actually larger than what he thought
- V1 is the primary visual cortex - information is initially processed here
- When you have no visual area V1 - technically blind
- Extension cable problem - lesion to a neuron at one end may not affect information been sent to the other end
- Blindsight occurs when part or all of the primary visual cortex (V1) is destroyed
    - Subjects report not being able to see anything in the blind hemifield, they are above chance on many tasks
    - Visual awareness - information still enters the brain but cannot be processed entirely
    - Separation of two aspects of visual perception - functional VS conscious

- Phonemic restoration effect - previous knowledge is integrated with sensation (what you hear) - e.g. hearing part of a word but understanding what it is because you hear it in the context of a sentence - top down perception
- McGurk effect - intermodal effect - multisensory integration
    - Hear "ba"
    - See "ga'
    - Perceive "da"
    - The brain integrates sound and sight and constructs a sound
- Multisensory integration - the ventriloquist effect - another example

The auditory system

- Hearing purpose:
    - Communication
    - Language acquisition
    - Music - for therapy etc.
    - Localisation - sound enters one ear before the other
- The human ear can hear between 20 and 20 000 Hz
- Fluid inside semicircular canals us responsible for balance sensation
- Hammer to anvil to stirrup to Cochlea
- Low frequency hit the cochlea in the back, so the higher the frequency the quicker the representation in the brain as these hit the front of cochlea
- The basilar membrane aids in translating sound vibrations into electrical signals and is found within the cochlea - hair cells lie on this membrane
- Primary auditory cortex is surrounded by secondary auditory cortex

Deafness

- Conduction deafness - anvil or other connector is too stiff - sound is amplified
- Sensory-neural deafness - cochlea's hair cells problematic - cochlear implant can solve this - if acoustic nerve to the brain is damaged there is no solution

Perception 5

Tuesday, 4 August 2015
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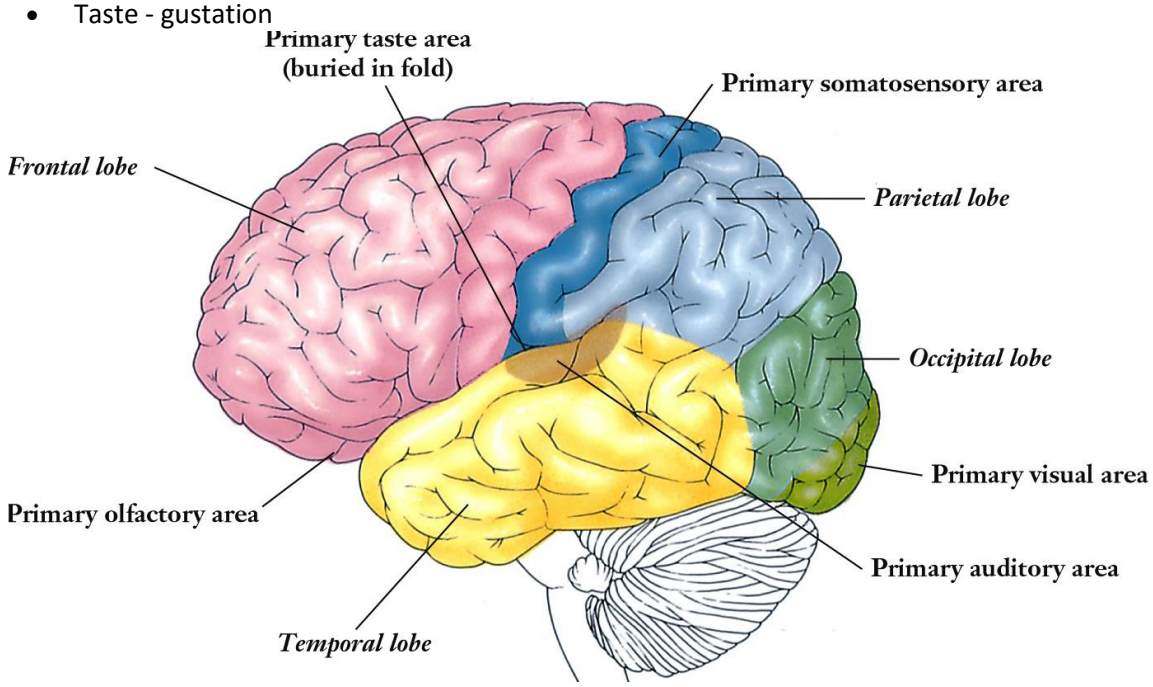
Chemical Senses

- Smell - olfaction
- Taste - gustation



- Humans can distinguish up to 10 000 smells - this is important for recognition
- Other animals use leave scent trails to mark territory or communicate willingness to mate - humans do not use this anymore but we still have this function
- Information enters the nose and the mouth - sensors on tongue and nose combine to make the psychological experience of flavour.
- Colour can contribute to our perception of flavour
- Chemicals are collected by olfactory sensors in nasal cavity and then transferred to the brain via neurons which pass through the skull.
- People with amnesia - inability to remember things - can still remember things through smelling them - the olfactory bulb is close to the limbic system
- Orbitofrontal cortex - responsible for high differentiation of smell - passes from the thalamus to this spot
- Synchronisation of menstrual cycles via smelling human musk - evidence for communication via smell - sweat and pheromones

Taste

- Large buds on tongue are the taste buds - inside these are the taste receptors
- Large concentration of taste buds - genetic - supertasters
- Different taste receptors are distributed around the outside of the tongue but the psychological experience makes us feel otherwise:
- Actual:

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- Psychological
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Vision

- By 6 months of age, vision of details, colours and contrast is pretty good.
- Meltzoff - baby imitates facial expressions
- Techniques with infants - contrast perception - baby will prefer looking at high contrast image - preferential looking paradigm - can be used to understand how good a baby's vision is - the moment where the bay has no differential interest in two high contrast images anymore is how we know the limits of the baby's vision.

Attention to objects

- Shared attention is the ability to notice where others are attending and doing the same
- Experiment - face shown, looks to one side, two shapes shown after - baby looks first at the side which the face looked at
- Spotlight attention - sorting through stimuli of similar visual appearance
- Serial
  - Takes time, often one by one
- Parallel
  - Object of interest pops out regardless of the number of items
- The STROOP task
  - Read text, then read text with different colour, then name colour with different text
  - Reaction time is slowest for naming colour with different text
  - Used to identify international spies - if slow reaction then they understand the language
- CR Stockard - the physical basis of personality