Visual Perception

Top-Down Processes
Sensory input is ambiguous. Information is lost converting image to 2D. The visual system has to make several **assumptions.**

Generic View Assumption Unusual or unique viewpoints are unlikely (e.g. Ames room).

Perception is guesswork and work through inductive assumptions.

Gestalt Principles of Grouping
These illustrate some of the ways the visual system pieces together fragmentary information

Similarity: Group Similar Items

Proximity: Group nearby items

Continuity: Prefer smooth contours

Common Fate: Elements with same moving direction are grouped together.

Global Processing

Ventral Stream (occiptical lobe V4 down to temporal lobe): Responsible for **object recognition** (e.g. faces). Damage causes visual prosopagnosia (inability to recognise faces).

Dorsal Stream (occipital lobe V5 up to parietal lobe): Responsible for control of movement (e.g. reaching). Damage causes **faliure** in letter-posting task.

Local Processing

Local Processing: Neurons in the visual cortex perform **local processing** of the image. They indicate the orientation at different points along an edge. But they don't communicate with each others.

Local Processing Beyond the V1 are many more visual areas, **hierarchically aranged** in the parietal cortex and inferotemporal cortex (e.g. face selective cells). There are also different streams for different functions, **horizontally arranged** (e.g. V4 global form, V5 global motion)

Area V5: Global Motion: Large receptive fields respond to global motion: more motion coherence (e.g. flocks of birds) elicits higher levels of activation.

Area V4: Global Form: Large receptive fields respond to global pattern organisation: more pattern coherence (concentric patterns) elicits higher levels of activation.

Johansson showed participants groups of dots clustered in the shape of walking people. From that, people were able to interpret sex, actions, emotions and identity. Evidence of **biological motion.**

Motion Blindness: Patient LM: Suffered a cortical lesion to area V5. Moving objects appeared as sequence of static images = Impaired lip reading.

The Motion After Effect: Evidence that the two functions are separate. More activity in the cells that detect rightwards motion causes people to adapt to rightwards motion. When static image is presented, the image appears to rotate.

Object Recognition

Geons (Biederman) This suggests that the mind has internal, shape representations. They are structural descriptions based on an alphabet of elementary shapes (geons).

View-Based Representation Store a limited set of views in memory. Interpolate between views to match current view. Support for this comes from Shepard and Metzler (1971) shape rotation tasks. Faces are harder to perceive if in negatives or inverted faces (Thatcher Illusion).

All visual information is perceived largely the same by all people. However, top-down processes control how and what is perceived.

The Eye

Light arriving at the eye provides information about what is there. There are two **primary dimensions of light: Intensity** (brightness) and **Wavelength** (contrast). Contrast defines the shape of the boundary and as the shape of the object.

Light arrives at the **cornea,** which focuses the light on to a single point on the retina. The 3D world becomes a 2D image.

The retina **transduces** light in to neural activity. It is back to front, which means that light starts at the **rods and cones** (both types of photoreceptors), which are farthest from the cornea. These **photoreceptors transduce** light in to electrical signals. These signals are then transmitted via **bipolar cells** to **ganglion cells.**

Cone photoreceptors are responsible for colour vision and rod photoreceptors are responsible for night vision.

The ganglion cell gathers signals from several photoreceptors. Their axon projects to brain via the **optic nerve**.

Ganglion cells have a circular shape. They detect differences in **edges and contrasts** in the visual field. The effect of the light depends on where it falls on the **receptive field.** Some regions are **excitatory** (increase in activation) some are **inhibitory** (decrease in activation).

On-center ganglion cells are excitatory in the centre and inhibitory on the surround. **Off-center cells** are the opposite. There is an equal amount of each.

The optic nerve projects via the **lateral geniculate nucleus** to the visual cortex (area V1). Optic nerves cross at the **optic chiasm.** The left visual cortex sees the right visual field and vice versa.

Hubel & Wiesel (1959) studied the cortices of domestic cats (felis catus) and identified three types of cortical cell. **Simple cells** (identify straight lines, edges and slits) **Complex cells** (respond to lines of a particular orientation) and **Hypercomplex cells** (take length in to account).

Damage to an area of the visual cortex (V1) is causes a **scotoma,** which is a blind region in a connected part of the visual field.