

**PSYC3318 Perception and Sensory Neuropsychology**  
**Textbook Notes**

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## TOPIC 1 & 3 (Chapter 1): Foundations

**Sensation:** the initial steps in the perceptual process, whereby physical features of the environment are converted into electrochemical signals that are sent to the brain for processing

- **Senses:** physiological functions for converting particular environmental features into electrochemical signals

**Perception:** the later steps in the perceptual process, whereby the initial sensory signals are used to represent objects and events so that they can be identified, stored in memory, and used in thought and action

- **Representations:** information in the mind and brain used to identify objects and events, to store them in memory, and to support thought and action
- **Stimuli:** the objects and events that are perceived (distal stimuli) and the physical phenomena they produce (proximal stimuli)
- **Neurons:** cells of the nervous system that produce and transmit information-carrying signals
- **Neural signals:** information-carrying electrochemical signals produced and transmitted by neurons
- **Sensory receptors:** specialised neurons that convert proximal stimuli into neural signals
  - **Photoreceptors:** neurons in the eye that convert light into neural signals
  - **Mechanoreceptors:** neurons in the fingertips that convert pressure on the skin into neural signals

**The process of perception:** distal stimuli produce physical phenomena called proximal stimuli that specialized cells called sensory receptors convert into neural signals that are sent to the brain → the speed and accuracy of perception can be enhanced by expectations and other types of information

- 1) **Distal stimuli:** a perceived object or event in the world
  - 2) **Proximal stimuli:** a physical phenomenon evoked by a distal stimulus that impinges on the specialized cells of a sense (e.g. light entering the eyes, sound entering the ears, pressure against the skin)
  - 3) **Proximal stimuli converted to neural signals, which are sent to the brain**
  - 4) **Signal processing in the brain** → neural signals represent visual, auditory and tactile perceptions → give rise to conscious awareness and provide a basis for a variety of cognitive activities (e.g. thought, planning, memory storage, action guidance)
- **Top-down information:** an observer's knowledge, expectations, and goals, which can affect perception
  - **Bottom-up information:** the information contained in neural signals from receptors

### Three main questions

- 1) **Transduction:** the transformation of a physical stimulus into neural signals
- 2) **Neural code:** a pattern of neural signals that carries information about a stimulus and can serve as a representation of that stimulus
- 3) **Psychophysics:** a field of study concerned with relating psychological experience to physical stimuli → measures perceptual experience on the basis of simple behavioural responses (e.g. reporting whether a stimulus was detected or whether two stimuli appeared to be the same or different)
  - **Cognitive neuroscience:** measures neural activity both at the level of the individual neurons and at the level of groups of neurons and neural circuits in the brain

### Number of senses

- **Traditional senses** → vision, audition, touch, smell and taste
- Senses evolve in response to the physical properties of objects and events in the world that organisms need to sense in order to survive
- **Body senses** also include other dimensions not in the table e.g. hunger (blood glucose level), thirst (body fluid levels), internal body temperature, muscle fatigue
- Some animals have evolved the ability to sense other physical properties in their environment (e.g. some fish can sense changes in electric fields emitted by their own bodies and by other fish, some birds can sense the earth's magnetic field, bees can sense a property of light called polarization)

Primary senses		Receptors	What is sensed
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	<b>Physical stimuli transduced</b>		<b>Physical dimensions</b>	<b>Perceptual dimensions</b>
<i><b>Vision (sight)</b></i>	Light	Photoreceptors in eye	Intensity Wavelength Spatial distribution Temporal distribution	Brightness Colour Shape, texture, location in 3D space Motion
<i><b>Audition (hearing)</b></i>	Sound	Hair cells in inner ear (in cochlea)	Amplitude Frequency Waveform Interaural differences	Loudness Pitch Timbre Location of sound source in 3D space
<i><b>Tactile perception (touch)</b></i>	Mechanical forces	Mechanoreceptors in skin	Skin indentation Skin stretch Skin motion, low-frequency vibration of skin High-frequency vibration of skin	Spatial pattern, texture, shape Hand conformation Slip, grip control Fine texture, transmitted vibration
<i><b>Proprioception (body perception)</b></i>	Mechanical forces	Nerve fibres in muscles, tendons and joints	Muscle tension	Limb position and movement
<i><b>Pain perception</b></i>	Mechanical forces, molecules, extreme temperatures	Nociceptors in skin	Tissue damage	Pain quality (e.g. sharp or throbbing) and location on or in the body
<i><b>Thermoreception (temperature perception)</b></i>	Heat	Thermoreceptors in skin	Skin temperature	Heat, cold
<i><b>Balance</b></i>	Gravitational force	Hair cells in inner ear (in semicircular canals)	Head orientation (tilt)	Balance
<i><b>Body movement</b></i>	Acceleration	Hair cells in inner ear (in semicircular canals)	Head acceleration (including rotation)	Body movement
<i><b>Olfaction (smell)</b></i>	Molecules	Olfactory receptor neurons in nose	Molecular structure and concentration	Odour
<i><b>Gustation (taste)</b></i>	Molecules	Taste receptor cells in mouth	Molecular structure and concentration	Sweetness, saltiness, bitterness, sourness, and other dimensions of taste and flavour

**Natural selection:** the basic mechanism of biological evolution, whereby advantageous traits are more likely to be passed on to offspring through genetic inheritance and to become increasingly prevalent in a population

- **Three core ideas:**

- 1) Organisms have observable characteristics, or traits, called **phenotypes** (e.g. structures like eyes and ears and functions like respiration and digestion). Phenotypes result from a genetic code called a **genotype**, carried in DNA, that uses the machinery of the cell to produce the organism's phenotypical structures and function

The genetic code is transmitted in DNA from one generation to the next via **reproduction**. DNA can undergo **random mutations**, resulting in new genetic sequences that might produce new phenotypes. Occasionally a mutation yields a new trait that is