PSYC 101 (Spring Session 2019)

Chapter 1 - Psychology: Evolution of a Science

Learning Objectives

- To explore the early roots of psychology in *philosophy* and *physiology*
- Some classic 'hot potatoes': nature vs nurture, the mind-body problem
- Main 'schools of thought' in emergence of modern psychology: structuralism vs functionalism, behaviourism

The Scientific Study of Psychology

- **Psychology:** "Psyche" (soul) + "-ology" (study of)
    - The scientific study of mind and behaviour
- **Mind:** the private inner experience of perceptions, thoughts, memories, and feelings, and ever-flowing stream of consciousness
- **Behaviour**: observable actions of human beings and nonhuman animals

Psychology's Ancestors: The Great Philosophers

- **Plato** (428-347 BC)
    - **Nativism:** philosophical view that certain kinds of knowledge are innate or inbornt
- **Aristotle** (384-322 BC)
    - Believed the child's mind was a *tabula rasa* (blank slate) in which experiences were written
    - **Philosophical empiricism**: the view that all knowledge is acquired through experience
- **Galton** (1869)
    - Nature (inherited) vs Nurture (environment) debate, **hot potato #1**

The French Connection

Hot potato #2: the mind-body problem

- Rene Descartes (1596-1650)
    - **Dualism:** Physical body as a container made up of a material substance for the non-physical mind, an immaterial or spiritual substance
        - Linked via **pineal gland**
- Most scientists reject "dualism" and embrace Gilbert Ryle's (1949) "scientific materialism"

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Hot potato #3: Localization of Function

- British philosopher Thomas Hobbes (1588-1679)
  - "Mind is what the brain does"
- Franz Josef Gall (1758-1828)
  - Examined the brains of animals and of children and adults who died of disease → mental ability often increases with larger brain size and decreases with damage to the brain
  - Created **phrenology**: a now discredited theory that specific mental abilities and characteristics, ranging from memory to happiness, are localized in specific regions of the brain
    - Size of bumps or indentation son the skull reflects personality traits like friendliness or ambitious
    - Strong claims based on weak evidence → quickly discredited
- Marie Jean Peirre Flourens (1794-1867)
  - Disagreed with Gall
  - Conducted his own experiments in which he performed lesions on different parts of the brain of dogs, birds and other animals
    - Found that actions and movements differed from normal animals
- Karl Lashley (1929)
  - **Mass action:** learning impairment proportionate to lesion size, regardless of location

French Neurology

- Paul Bronca (1824-1880)
  - French surgeon
  - Worked with patient Mr. Louis Victor Leborgne, who had suffered damage to a small part of the left side of the brain
  - Nicknamed "Tan" because it was the only word he could say (impaired speech production), but had intact comprehension and use gestures
    - Proved that brain and mind are closely linked, thereby debunking Descartes

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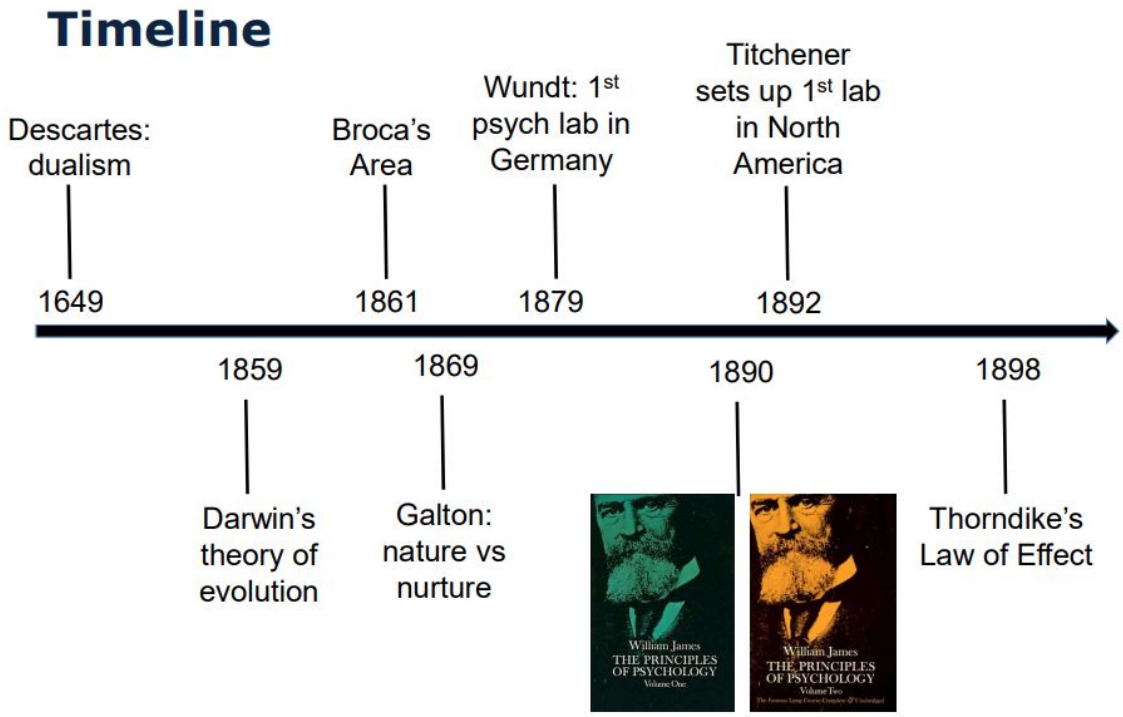

Structuralism

- In Germany**, physiology,** the study of biological processes, especially in the human body, were making discoveries
    - Hermann von Helmholtz (1821-1824)
        - Background in both physics and physiology
        - Developed a method for measuring the speed of nerve impulses in a frog's leg that he then adapted to the study of human beings to estimate the length of nerve impulse
            - **Stimulus:** sensory input from the environment
            - **Reaction time**: amount of time taken to respond to a specific stimulus
            - Difference of rxn time of toe stimulated compared to thigh allowed him to estimate length of nerve impulse of 27m/s
    - Wilhelm Wundt (1832-1920)
        - Opened the first psych lab
        - Believed that scientific psych should focus on:
            - **Consciousness**: a person's subjective experience of the world and the mind

- **Structuralism:** analysis of the basic elements that constitute the mind; involved breaking down consciousness into elemental sensations and feelings
    - Preformed via **introspection:** subjective observation of one's own experience
- Flaws:
    - Non-replicable
    - Difficult experimental method to control due to subjectivity

Functionalism

- William James
    - Disagreed with Wundt; believed consciousness was more like a flowing stream than a bundle of individual components
    - **Functionalism:** the study of how mental processes enable people to adapt to their environments
        - Explain the purpose rather than parts
    - Inspired by Charles Darwin (1809-1882)
        - Darwin created **Natural Selection:** the features of an organism that help it survive and reproduce are more likely than other features to be passed on to subsequent generations
        - James reasoned that mental abilities like consciousness must have evolved since they are adaptive - increased chances of survival, and thus has an important biological function that should be found
    - Didn't conduct lab experiments, so Wundt discredited his work
- G. Stanley Hall (1844-1924)
    - Set up first psych lab in North America at Harvard
    - Focused on development and education and was strongly influenced by evolutionary thinking

Lessons From Work with Patients

- Jean-Martin Charcot (1825-1893)
    - **Hysteria:** temporary loss of cognitive or motor functions, usually as a result of emotionally upsetting experiences
        - Patients become blind, paralyzed, or memory loss w/o physical harm; however, when hypnotized, symptoms disappeared
        - James thought this was crucial to understand normal operation of the mind, and inspired Freud

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Psychoanalytic Theory

- Sigmund Freud (1856-1939)
  - **Unconscious:** the part of the mind that operates outside of conscious awareness but influences conscious thoughts, feelings, and actions
  - **Psychoanalytic Theory:** emphasizes the importance of unconscious mental processes in shaping feelings, thoughts, and behaviours
  - **Psychoanalysis:** brings unconscious material into conscious awareness to better understand psychological disorders
  - Carl Gustav Jung and Alfred Adler joined the movement but were independent thinkers, which Freud couldn't tolerate; thus, he shaped the theory himself
  - Became controversial since he suggested that understanding a person's thoughts, feelings, and behaviour required a thorough exploration of the person's early sexual experiences and unconscious sexual desires, which were taboo

Humanistic Psychology

- Psychoanalysis failed since he perceived human nature as dark:
  - Saw people as hostages to forgotten childhood and primitive sexual impulses whereas after WWII, positive, invorating, and upbeat
  - Difficult to test in lab
- **Humanistic psychology:** an approach to understanding human nature that emphasizes the positive potential of human beings
  - Humans are free agents who have an inherent need to develop grow, and attain their full potential
  - Saw patients as *clients*

Schools of Thought: Behaviourism

- Introspection is subjective and unreliable
- Psychologists should restrict themselves to the scientific study of objectively observable behaviour
- Dramatic departure from previous schools of thought
- **Behaviourism:** scientific study of objectively observable behavior
- Edward Thorndike: the Law of Effect (1898)
  - Invented the "puzzle box" for cats
  - Rewarded actions are "stamped in"
  - Profitless actions are "stamped out"
- Ivan Pavlov

    - Russian psychologist who pioneered physiology of digestion
    - Created **classical/pavlovian conditioning**
        - Made a tone (**stimulus**) that influenced the salivation of dogs (**response:** an action or physiological change elicited by a stimulus)
- John Broadus Watson (1878-1958)
    - Strongly believed in stimulus-response learning
    - Before: Rat=neutral stimulus (no fear)
    - 5 pairings of the rat w/ loud noise (unconditioned stimulus)
    - After: Rat=conditioned stimulus (elicits fear)
- B.F. Skinner (1904-1990)
    - Created the **Skinner box**
    - Rat placed inside, wander around and accidentally press bar, get lots of food, then press bar repeatedly and eat food until full, then stop pressing bar
        - Principle of **reinforcement:** consequences of a behaviour determine whether it will be more or less likely to occur again
    - The illusion of free will
        - Free will doesn't exist-it's just a history of past reinforcement

Behaviourism: Some problems

- Neisser: "it was supposed that no psychological phenomenon was real unless you could demonstrate it in a rat"
- Chomsky: as young children generate sentences they have never heard before, language learning can't occur by reinforcement
- Garcia (1966): Rats can associate taste w/ sickness, but not a light w/ sickness-evolutionary psychology

Cognitive Psychology

Gestalt psychology

- Max Wertheimer (1880-1943)
    - German psychologist
    - Studied **illusions**: errors of perception, memory, or judgement in which subjective experience differs from objective reality
    - **Gestalt psych**: a psychological approach that emphasizes that we often perceive the **whole rather than the sum of the parts**

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The Cognitive revolution

- **Cognitive psych:** the scientific study of mental processes, including perception, thought, memory and reasoning
- During WWII, the military needed psychologists to help understand how soldiers could learn new tech like radar
    - Donald Broadbent (1926-1993)
        - Found that pilots can't attend to many different instruments at once and must actively move the focus of their attention form one to another
        - Showed that limited capacity to handle incoming info is a fundamental feature of human cognition and that this limit could explain many pilots' errors
    - George Miller (1920-2012)
        - Found consistency in capacity limitations (**6-7** pieces of info)
    - Herbert Simon (1950s)
        - The mind is a computer

Behavioural Neuroscience

- **Behavioural neuroscience:** an approach to psychology that links psychological processes to activities in the nervous system and to other bodily processes
    - Observe animals responses as the animals perform specially constructed tasks, such as running via maze to get food rewards
    - Neuroscientist then can record electrical or chemical responses in the brain as the task is being performed or later lesion to see how performance is affected

Cognitive neuroscience

- **Cognitive neuroscience:** field of study that attempts to understand the links between cognitive processes and brain activity
- Wilder Penfield
    - Poineered surgical removal of brain tissue to relieve seizure disorders
    - Electrically stimulated the cortex during surgery to see how different parts support different mental functions and behaviours

Chapter 2 - Methods in Psychology

Learning Objectives

- To consider how the scientific method (theory, hypothesis) is applied to psychology

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- To consider some of the challenges in designing experiments on human behaviour (demand characteristics, observer bias)
- To understand key ways of testing, displaying and interpreting data from human experiments
- To explore the main ethical principles in psychological research

How to Know Stuff

- **Dogmatism:** people's tendency to cling to their assumptions
- **Empiricism**: belief that accurate knowledge can be acquired via observation
- **Scientific method:** procedure for finding facts by using empirical evidence
- **Theory:** hypothetical explanation of a natural phenomenon
- **Rule of parsimony:** simplest theory that explains all the evidence is the best one
- **Hypothesis:** a falsifiable prediction made by a theory
- **Empirical method:** a set of rules and techniques for observation

Challenges to Empiricism

- Humans are **complex**
- Humans are **variable**
- Humans **react differently** if they are **observed**

Measures in Psychometrics

- Requires defining the property to be measured and finding a way to detect it
- **Operational definition:** a description of a property in concrete, measurable terms
- **Instrument**: anything that can detect the condition to which an operational definition refers
- **Validity**: the extent to which a concrete event defines a property
- **Reliability**: tendency for an instrument to produce the same measurement whenever it is used to measure the same thing
- **Power:** an instrument's ability to detect small magnitudes of the property
    - Define the property: generate an operational definition that has validity
    - Detect the property: Design an instrument that has reliability and power

Expectations and Bias

- **Hawthorne effect:** performance changes under observation
- **Demand characteristics:** aspects of an observational setting that cause people to behave as they think someone else wants or expects. Some ways to avoid them are:

    - **Naturalistic observation:** a technique for gathering info by unobtrusively observing people in their natural environments
    - **Privacy and Control:** participating anonymously
    - **Unawareness:** unaware of the true purpose of the experiment
        - Cover stories
        - Filler items
- **Observer Bias:**
    - Rosenthal and Fode
        - Students who thought they were tested a bright rate recorded faster maze times than those testing a dull rat even though they were all the same breed
    - Happens since:
        - Expectations can influence observations
        - Expectations can influence reality
    - Can be avoided by **double-blind experiment:** a technique whose true purpose is hidden from both the observer and the person being observed

Statistics and psych

- Collection organization and interpretation of data
- Why use statistics?
    - To summarize and examine the sampled data (**descriptive statistics)**
    - To assess whether differences in our sampled data are (likely to be) meaningful (**inferential statistics**)

Descriptive statistics I: Measures of central tendency

- **Mean:** sum/n
- **Median:** Middle value
- **Mode:** most frequent observation
- **Outliers:** Odd/uncharacteristic observation

Descriptive statistics II: Measures of variability

- **Range:** difference between max and min
- **Standard deviation:** measure of the dispersion from the mean

Causation

- **Natural correlations:** the correlations observed in the world around us
- **Third-variable correlation:** 2 variables are correlated only because each is causally related to a third variable. Ways to prevent this are:

- **Matched samples technique:** a technique whereby each participant is identical to one other participant in terms of a third variable
- **Matched pairs technique:** a technique whereby each participant is identical to one other participant in terms of a third variable
- However, third variable problem: a causal relationship between 2 variables cannot be inferred from the naturally occurring correlation between them because of the ever-present possibility of third-variable correlation

Key elements of an experiment

- **Manipulation:** changing the variable to determine its causal power
  - IV, DV, control,
- **Random assignment**
  - **Self-selection:** a problem that occurs when anything about a participant determines whether he or she will be included in the experimental or control group
  - **Random assignment:** a procedure that lets chance assign participants to the experimental or control group
    - **Convenience samples**: students are WEIRD (Western, Educated, Industrialized, Rich, Democratic)

Drawing Conclusions

- **Internal validity:** an attribute of an experiment that allows it to establish causal relationships
- **External validity:** an attribute of an experiment in which variables have been defined in a normal, typical, or realistic way

Human research has a dark history…

- Nazis and medical research (1940s)
  - Doctors performed barbaric experiments on human subjects
- **The Nuremberg Code** (1947)
  - Informal consent
  - Human research based on animal work
  - benefits>risks
  - Minimize discomfort and avoid injury
- **The Belmont Principles** (1979)
  - Respect for people
  - Show concern for welfare
  - Research should be just
- **Tuskegee Syphilis Study** (1932-1972)

- 399 african americans studied with syphilis w/o treatment
- **Issues:**
  - Lack of informed consent
  - Deception
  - Withholding care and info
  - Exploitation of a vulnerable group

Milgram's Obedience Study (1963)

- **Obedience to authority**
  - Motivated by Nazi Germany's behavior
  - Advertised as a learning experiment
  - Higher shocks when learner makes errors
  - How far would people go to obey authority?
  - **Issues**: deception, unanticipated psychological harm

Zimbardo's Prison Study (1973)

- **Roles and attributions**
  - Students as prisoners or guards
  - Getting into the roles
  - Discontinuation of the study
- **Issues**: harm to subjects, lack of neutrality as a researcher

Research Ethics Boards (REBs)

- Established where research is conducted
- Members and roles
- Levels of risk and approval
  - Expedited and full review
- Renewed annually, updates
- Canadian principles: TCPS2

Canadian Code of Ethics for Psychologists

- **Informed consent:** a written agreement to participate in a study made by an adult
- **Freedom from coercion:** not only physical and psychological coercion but monetary coercion as well
- **Protection from harm:**
- **Risk-benefit analysis**
- **Deception**
- **Debriefing:** verbal explanation of true nature and purpose of study

- **Confidentiality**

Respecting Animals

- **Canadian Council on Animal Care (CCAC)**
  - **Replacement:** no other alternative and use of animals is justified
  - **Reduction:** smallest number of animals possible
  - **Refinement:** procedures must be modified to minimize the discomfort, infection and pain of animals
- Relevant statistics
  - 91% of NIH animal research uses mice and rates
  - Increasing use of zebrafish and drosophila (fruit flies)
  - ~70% studies involve no or minor/short-term discomfort

Thinking Critically of Evidence

- Sir Francis Bacon
  - **Confirmatory bias:** Humans are **biased** towards info that confirms their existing beliefs, and they **ignore** or **disregard contradictory evidence**

Crooks of Science

- Diederik Stapel (2012)
  - Social psychologist who fabricated data from many published experiments
- Andrew Wakefield (1988)
  - Published Lancet paper linking measles vaccine to autism and bowel disease
  - Conflict of interest, fraudulent data
- Jan Hendrik Schon (1988)
  - Falsely claimed that he made a molecular-scale transistor and was later found out
    - Lost his job, doctoral degree revoked

Chapter 3 - Neuroscience and Behaviour

Learning Objectives

- The neuron as the basic unit of the nervous system
- Electrical transmission along the axon → action potential
- Chemical transmission across the synapse → psychopharmacology
- The major divisions of the nervous system: central and peripheral, two branches of the autonomic nervous system, basic functions of the spinal cord

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- Organization of the human brain: hindbrain, midbrain, forebrain. Subcortical structures. The four lobes of human cortex. Topographical representation (the homunculus)

Components of Neuron (edit later)

- Found by Spanish physician Santiago Ramon y Cajal (1852-1934) by using Golgi stain

Neurons specialized by function

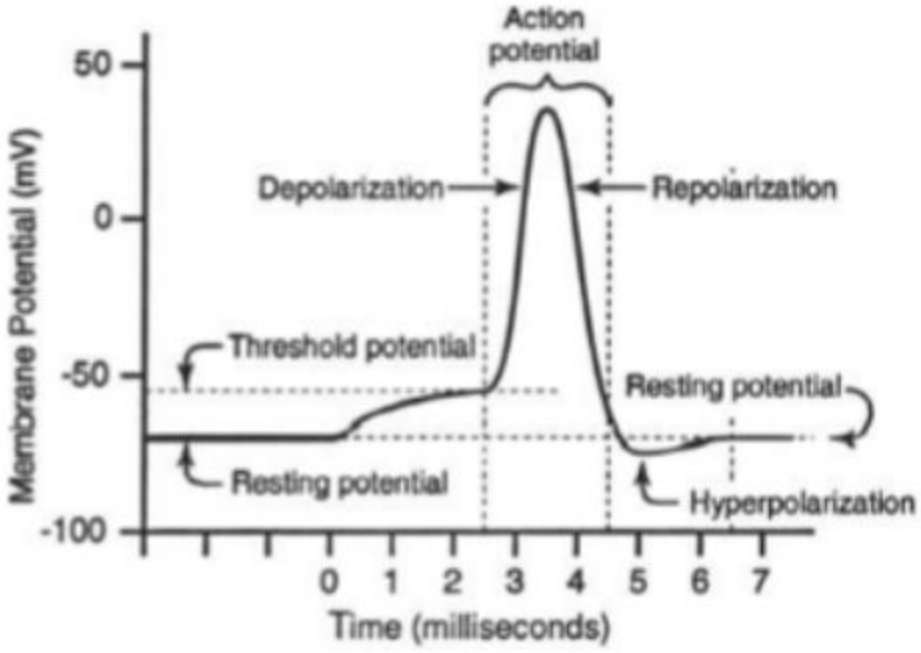
- **Sensory neurons:** receive info from outside to the brain via spinal cord
- **Motor neurons:** carry signals from spinal cord to muscles for movement
- **Interneurons:** connect sensory neurons, motor neurons, or other interneurons

Neurons specialized by location

- **Purkinje cells:** type of interneuron that carries info from cerebellum to the brain and spinal cord
- **Pyramidal cells:** found in the cerebral cortex
- **Bipolar cells:** a type of sensory neuron found in the retina

Action Potential

- **Action potential:** an electric signal that is conducted along the length of a neuron's axon to a synapse



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Propagated via saltatory conduction after Ranvier discovered them

Multiple sclerosis (MS)

- **Demyelinating disease:** progressive damage to the myelin, slowing down the transmission of info from one neuron to another
    - Leads to loss of feeling in the limbs, partial blindness, and difficulties in coordinated movement and cognition, motor fatigue
- Canada has one of the highest rates of MS in the world

Tale of Two Animals

- Hodgin and Huxley (1939)
    - Discovered the resting potential in the (giant) axon of the giant squid: 100x larger than human axon
- Lowei (1921)
    - Fluid released from heart of one frog slowed down heart of a second frog → must be chemical
    - Squirts fluid from Heart A to Heart B→ Heart B slows down
        - Must be a chemical basis - acetylcholine

Synaptic Transmission Steps (khanacademy)

1. The action potential travels down the axon. When the action potential enters the presynaptic terminal button, it becomes **depolarized.**
2. The depolarization **opens voltage-gated channels of Ca^{2+}**. The [Ca^{2+}] is greater **outside** than **inside** and causes it to rush inside the cell by exocytosis.
3. The Ca^{2+} influx causes the synaptic vesicles to fuse with the presynaptic terminal and thus the NTs are released
4. The NTs are released and diffuse across the synaptic cleft and bind to receptor sites/proteins on a dendrite of a postsynaptic neuron, initiating a new action potential
5. Activation of postsynaptic receptors leads to the opening or closing of ion channels in the cell membrane directly or indirectly.
6. The effects of the localized change in the membrane potential of the receiving cell is due to **EPSPs** and **IPSPs:**
    a. **Excitatory Postsynaptic Cleft (EPSP)** is **depolarizing:** it makes the inside of the cell more **positive**, bringing the membrane potential closer to its threshold for firing an action potential. Therefore, the change in membrane potential makes the target cell **more likely to fire its own action potential**

   b. **Inhibitory Postsynaptic Cleft (ISPS)** have the opposite effect-they tend to keep the membrane potential of the postsynaptic neuron **below threshold** for firing an action potential. Thus **IPSPs** cause **hyperpolarization,** making the inside of the cell more **negative.** They are important as they counteract, or cancel out, the excitatory effect of EPSPs.
      i. The binding of the NTs to th receptor leads to spreading of IPSs or EPSPs via neuron to the axon hillock where the inputs are **summated** - a **graded response** - in order to pass the threshold and thus create an action potential
7. NTs leave the synapse by
   a. **Reuptake:** where NTs are reabsorbed by the terminal buttons of the presynaptic neuron's axon via **transporters**
   b. **Enzymatic activity:** enzymes break down specific NTs
   c. Binding to certain receptor sites called **autoreceptors** on the presynaptic neuron. They detect how much NT has been released into a synapse and signal the neuron to stop releasing if excess present.

Chapter 4 - Sensation and Perception

Learning Objectives

- To distinguish between sensation and perception
- Understand the concept of transduction as underlying our basic senses
  - Vision, hearing, taste, smell, touch
- Principles of psychophysics s enabling the psychological study of sensation:
  - Detection thresholds
  - Weber's law
  - Signal detection theory

From environment to brain

- **Sensation:** Stimulation of a sense organ - "detecting the elementary properties of a stimulus"
- **Transduction:** The mechanism for sensation' converting physical signal into neural signals
- **Perception:** Organizing and interpreting those inputs to ultimately became aware of the sensation

Psychophysics

- German scientist Gustav Fechner (1801-1887) developed a new approach to measuring sensation and perception
    - **Psychophysics:** methods that measure the strength of a stimulus and the observer's sensitivity to that stimulus
        - ex) see a flash of light and related brightness to observer's yes/no response

Top-down effects on vision

- Sensory input is ambiguous- we see an interpretation
- Our knowledge (or what we *think* we know) can influence what we see

Measuring Thresholds

- **Absolute Threshold:** the minimal intensity needed to just barely detect a stimulus in 50% of trials
    - Useful for assessing how sensitive we are to faint stimuli, but human perceptual system is better at detecting changes in stimulation that on/off
- **Just Noticeable Difference (JND):** the minimal change in a stimulus that can just barely be detected
    - Not a fixed quantity; depends on how intense the stimulus is and the associated sense organ
- **Weber's Law:** The just noticeable difference of a stimulus is a **constant proportion**
    - JND of a stimulus increases in proportion to the background intensity

Sensory Misgivings

- Abs difference thresholds requires a critical assumption - a threshold exists
- However, transition from not sensing to sensing is gradual; 50% goes undetected
- Sensory signals experience competition (noise), other stimuli coming from the internal and external environment
    - Memories, moods, and motives intertwine w/ what you see, hear and smell at any given time as well as other sights, sounds, and smells

Signal Detection Theory

- **Signal detection theory:** the response to a stimulus depends both on a person's sensitivity to the stimulus in the presence of noise and on a person's decision criterion
- Proposes a way to measure **perceptual sensitivity:** how effectively the perceptual system represents sensory events separately from the observer's decision-making strategy

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Sensory Adaptation

- **Sensory adaptation:** A change in the sensitivity of sensory receptors over time
    - Often a decline in sensitivity with prolonged stimulation (neural fatigue): smells, tastes, loud noises…
    - In some cases, we can become more sensitive: dark adaptation (actually due to recovery of photopigment bleaching under bright light)

Vision Intro

- Hermann Snellen **(1834-1908)**
    - Dutch ophthalmologist who developed 20/20 vision system
    - **Visual acuity:** the ability to see fine detail

The Eye Detects and Focuses Light

- **Cornea:** clear, smooth outer tissue that bends light wave and sends it to pupil
- **Pupil:** hole in iris
- **Iris:** translucent, doughnut-shaped muscle that controls the size of the pupil and hence that amount of light that enters the eye
- **Lens**: muscle that is behind the iris and bends light
- **Retina**: a layer of light-sensitive tissue lining the back of the eyeball
- Muscles change the shape of the lens to focus objects at different distances, making the lens flatter for objects that are far away or rounder for nearby objects
    - → **accomodation:** the process by which the eye maintains a clear image on the retina

Light is Converted into Neural Impulses in the Retina

- 2 types of photoreceptors in the retina contain light-sensitive pigments that transduce light into neural impulses
    - **Cones:** detect colour, operate under normal daylight conditions and allows focus on fine details
    - **Rods:** active under low-light conditions
- **Fovea:** an area of the retina where vision is the clearest and there are no rods at all
- Rods and cones form innermost layer, under layer of transparent neurons made up of **bipolar** and **retinal ganglion cells**
    - **Bipolar cells:** collect neural signals from rod and cones and transmits them to the outermost layer of the retina
    - **Retinal ganglion cells:** organize the signals and send them to the brain
- Axon of RGCs form **optic nerve:** creates blind spot

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Receptive Fields

- Only 1 million retinal ganglion cells
- Bipolar and retinal ganglion cells summarize info from a patch of photoreceptors (a "receptive field")
- Fewer cones are summated by a single retinal ganglion cell → superior acuity i.e. spatial resolution)

The Optic Nerve Carries Neural Impulses to the Brain

- Half of the axons in the optic nerve that leave each eye come from RGCs that code info in the right visual field and the other half code in the left visual field
- Objects in the right visual field stimulate the left half of each reina, and vise versa
- **Optic chiasm: "**nasal" fields cross here
- The left half of each optic nerve (representing the right visual field) runs via the thalamus' relay station called the **Lateral geniculate nucleus (LGN)** in the thalamus
- Visual signal travels to the back of the brain, to the part of the occipital lobe called the **primary visual cortex, or area VI**

Colour Vision

- **Trichromatic theory:** 3 types of cone cells
  - **S**-cone **(blue)**
  - **M**-cone **(green)**
  - **L**-cone **(red)**
- Balance of firing across 3 cones yields the colour (pattern codes)
- **Colour opponent system:** pairs of visual neurons work in opposition
  - Red vs green, blue vs yellow

Neural Systems for Perceiving Shape

- **Area VI (Primary Visual cortex)** contains neurons that respond to edges oriented at each position in the visual field
  - Some vertical, horizontal, 45º, etc

Pathways for What, Where, and How

- 2 functionally distinct pathways (visual streams) project from occipital cortex to visual areas in other parts of the brain
  - **Ventral (below) stream:** travels across the occipital lobe into the lower levels of the **temporal lobes**; includes brain areas that represents an object's shape and identity identifies "what"

- **Dorsal (above) stream:** travels from occipital to **parietal lobes** (including some of the middle and upper levels of the temporal lobes) connecting w/ brain areas that identify the location and motion of an object; allows us to perceive spatial relations (where) vs. crucial for guiding movements, such as aiming, reaching, or tracking w/ the eyes; "where" or currently considered as "how"

Cortical processing of the visual field

- Tiny areas of damage to **primary visual cortex (V1**) can lead to partial blindness
- ('scotoma') a cortical 'blind' spot'
- 'Retinotopic' organization of visual cortex (another) example of topographic representation,
- as in homunculus)
- **Visual form agnosia:** inability to recognize objects by sight

Hubel & Wiesel: Electrophysiology

- Single-neuron feature detectors
  - **Area VI** contains neurons that respond to specific orientations of edges
    - Neuron fires continuously when the bar is pointing to the right at 45º, les often vertical, and nothing at left at 45º

Colour and Motion

- As you move from VI up to the visual cortex, there are many specialized regions that analyze specific visual properties
- Property: **Colour**
  - Lesion syndrome: **Cerebral achromatopsia**
  - Area of damage: **V4**
- Property: **Visual Motion**
  - Lesion syndrome: **Akinetopsia**
  - Area of damage: **V5**

Two Visual Streams: Lesion Data

- Lesion to "what" pathway
- **Agnosia**: inability to recognise objects
- **Prosopagnosia**: inability to recognise familiar faces
  - ex) Goodale and Milner: DF unable to recognise simple shapes, discriminate slot orientations, but can post a letter into the slot

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Illusory Conjunctions (Treisman)

- **Parallel processing:** brain's capacity to perform many activities at the same time
- **The binding problem**: How are features linked together, so that we are unified objects in our visual world rather than free-floating or miss combined features
- **Illusory conjunction:** a perceptual mistake whereby the brain incorrectly combines features from multiple objects
    - Explained by **feature-integration theory:** focused attention is not required to detect the individual features that make up a stimulus, such as the colour, shape, size, and location of letters, but is required to bind those individual features together
        - **Attention** is the glue that binds individual features into a whole percept
- Binding process uses both ventral and dorsal pathways

Recognizing objects by Sight

- **Modular view:** specialized brain parts or modules detect and represent faces or houses or even body parts in the temporal lobe
- **Perceptual constancy:** even as aspects of sensory signals change, perception remains consistent

Visual Perception and Organization of Objects

- The brain imposes order on incoming sensations: the **Gestalt Laws** of Perceptual Organisation/ Grouping Rules
    - **Simplicity:** visual system tends to select simplest or most likely interpretation
    - **Closure:** we fill in missing elements where these creates edges
    - **Similarity:** elements that look similar are perceived together
    - **Continuity:** easier to perceive smooth continuation than abrupt shift
    - **Proximity:** objects that are close are grouped together
    - **Common fate:** elements of an image that move together are perceived as parts of a single moving object

Monocular Depth Cues

- **Monocular depth cues:** aspects of a scene that yield info about depth when viewed w/ only one eye
    - **Relative size**
    - **Familiar size**

- **Linear perspective**: parallel lines converge
- **Texture gradient**
- **Interposition:**

Change Blindness

- Only 7/15 people noticed the switch!
- Effects amplified by attentional load e.g. cell phone use → implication for driving!!

Varieties of Attention

- **Overt** attention
  - Where you are directly looking
- **Covert** attention
  - Look at something but your attention is somewhere else
- **Selective attention** (e.g. to one ear, or one region of visual space)
  - Spotlight
- **Divided attention**
  - Dichotic listening: perform two tasks, which is difficult
- **Cocktail party effect**

Spatial Attention: Parietal Neglect

- Following right parietal damage, many patients ignore the left visual field
  - Copy right side of drawing
  - Eat food of right side of plate
  - Shave right side of face
  - Collide w/ objects on left side
  - NB: not blind in formal testing

Neglect

- Right parietal lobe holds a map of both sides of space
- Left parietal lobe only represents right visual field
  - When left parietal is damaged, there is a back-up on the right
  - When right parietal is damaged, there is no back-up on the left field

Chapter 7 Learning

Forms of Learning

- **Learning:** the acquisition from experience, of new knowledge, skills, or responses that results in a relatively permanent change in the state of the learner.

    - Learning is based on experience
    - Learning produces changes in the organism
    - These changes are relatively permanent
- **Habituation:** a general process in which repeated or prolonged exposure to a stimulus results in a gradual reduction in responding
- **Sensitization:** presentation of a stimulus leads to an increased response to a later stimulus

Classical Conditioning

- **Classical conditioning:** neutral stimulus produces a response after being paired with a stimulus that naturally produces a response
- **Extinction:** gradual elimination of a learned response that occurs when the CS is repeatedly presented without the Unconditioned stimulus
- **Spontaneous recovery:** tendency of a learned behaviour to recover from extinction after a rest period

Second-order Conditioning

- **So far: Tone(CS) → Food (US)**
- What if now: Light → tone → food?
- Is there a CR to the light? YES
- Real-world example: MONEY

Little Albert

- Demonstration of Pavlov's effects in humans
- Demonstration of an emotional response
- Demonstrated generalization to other with objects
- Ethically dubious and Albert was not "neurotypical"

Phobias and Preparedness

- Spider, dog, snake phobias predominate but knife, gun, electrical socket phobias rare
- Garcia and Koelling (1966)
    - Quinine taste (CS) could be associated with nausea (US) but not shock (US)
    - Light and tone (CS) could be associated with shock (US) but not nausea (US)

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Drug Overdose

- **Drug paraphernalia** (needles, ashtrays, **environments)** become CSs that precede drug effects
- Siegel
  - For heroin users, CR is opposite to the UR
  - Heroin: slows heart rate/ breathing (UR)
  - **Drug paraphernalia**: increases heart rate/breathing (CR)
- Risk of overdose if drug administered in novel environment (few CSs) where the preparatory and compensatory CR does not occur

Operant Conditioning

- **Operant conditioning:** a type of learning in which the consequences of an organism's behaviour determine whether it will repeat that behaviour in the future
- **Law of Effect Thorndike :**
  - Behaviors that are followed by a "satisfying state of affairs" tend to be repeated, and those that produce an "unpleasant state of affairs" are less likely to be repeated

B.F. Skinner - The role of reinforcement and punishment

- Founded operant conditioning based upon reinforcement
  - **Operant behaviour:** behaviour that an organism performs that has some impact on the environment
- **Shaping**: method of successive approximation
- **Superstitious conditioning:** we attribute reward to wrong response!
- B.F. Skinner **- The Skinner Box**

Delay to Reinforcement

- NB. same principle applies to Classical Conditioning although there is a notable exception:
- Conditioned taste aversion: powerful (1 trial) learning with sickness occurring hours later

Schedules of Reinforcement

- Two factors to consider:
  - **Fixed-interval schedule (FI)** reinforcers are presented at fixed time periods, provided that the appropriate response is made
  - **Variable-interval (VI)**: a behaviour is reinforced on the basis of an average time that has expired since the last reinforcement

- **Fixed-ratio**: reinforcement is delivered after a specific number of responses have been made
- **variable -ratio schedule (VR**): delivery of reinforcement is based on a particular average number of responses
- **Intermittent reinforcement:** only some responses are reinforced
  - Ratio schedules yield higher overall responding than interval schedules

Shaping through successive approximations

- **Shaping:** learning that results from the reinforcement of successive steps to a final desired behaviour
- Superstition
- **Latent learning:** something is learned, but not manifested as a behavioural change until sometime in the future

Brain Mechanisms of Reinforcement

- Olds and Milner (1954)
  - "Intra-cranial self stimulation" of dopamine axons (**medial forebrain bundle**) from midbrain via **hypothalamus** to **nucleus accumbens** (part of ventral striatum, in basal ganglia) **operant procedure**

Dopamine and Classical Conditioning

- Dopamine neurons (in the midbrain) signal reward expectancy
- Once the pairing has been learned, the neuron only fires to the CS, *not the reward itself*
- So dopamine is involved in **prediction and information** rather than "pleasure"

Observational Learning

- Classical and operant conditioning assume first-hand experience
- But we can learn associations from **watching others** (also called vicarious conditioning)
- Susan Mineka
  - Experiments on lab-reared rhesus monkeys
  - Had never encountered snakes before

Observational Learning in Children

- Albert Bandura (1925-present)
  - **Diffusion chain:** learn behaviour by observing another person, and then become models from which other individuals learn the behaviour

- Social learning theory
- Ubiquitous type of learning - more common than learning first-hand

Observational Learning in Monkeys

- Mineka et al (1984)
  - Young rhesus monkeys watch video of parent behaving fearfully, splice with either a snake (prepared CS) or a flower (unprepared CS)
  - After videos, monkeys displayed fear to snake but not flower
  - Fear has been conditioned

Mirror Neurons: neural basis for observational learning?

- Giacomo Rizzolatti (1937-present)
  - Discovered neurons in monkey that fire to performing an action, an watching others perform same action
  - "Monkey see, monkey do"

Cognitive Aspects of Conditioning

- Is conditioning really the mindless learning of associations?
  - Expectation, prediction, information…(Rescorla-Wagner model)
  - Edward Tolman (1886-1959) first described higher-level influences on human learning

Implicit Learning

- Changes little across the lifespan
- Resistant to some disorders that affect explicit learning

Chapter 6 - Memory

- **Encoding:** process of transforming what we perceive, think, or feel into an enduring memory
- **Storage:** the process of maintaining info in memory over time
- **Retrieval:** the process of bringing to mind info that has been previously encoded and stored
-

Encoding

- **Semantic encoding (lower left frontal lobe)**
  - process of relating new info in a meaningful way to knowledge that is already stored in memory
- **Visual imagery encoding (occipital lobe)**

    - Storing new info by converting it into mental pictures
- **Organizational encoding (upper left frontal lobe)**
    - Categorizing info according to the relationships among a series of items

Storage

- **Sensory memory:** holds sensory info for a few seconds or less
    - **Iconic memory:** fast-decaying store of visual info
    - **Echoic memory:** fast-decaying store of auditory info
- **Short-term memory (STM) or working memory**
    - Holds about 7 items
        - **Rehearsal:** process of keeping info in STM by mentally repeating it
        - **Chunking:** combining small pieces of info into larger clusters or chunks that are more easily held in short-term memory
    - **Serial position effect:** first few and last few items are more likely to be recalled than the middle items
- **Long-term memory**: holds info for hours, days, weeks, years

HM (1926-2008)

- Removal of his medial temporal lobes (MTL) bilaterally and hippocampus
- Suffered from **Anterograde amnesia:** inability to transfer new info from short-term to long-term memory
    - Short-term memory and IQ intact
    - HM had profound anterograde amnesia but partial retrograde amnesia
- **Retrograde amnesia:** inability to retrieve info that was acquired before a particular date, usually the data of an injury or surgery
- **Consolidation:** process by which memories become stable in the brain
    - The cortical trace is laid down by the hippocampus, but eventually becomes free
- **Reconsolidation:** memories can become vulnerable to disruption when they are recalled, thus requiring them to be consolidated again
    - Disrupting it can eliminate fear memory in amygdala
- **Long-term potentiation (LTP):** communication across the synapse between neurons strengthens the connection, making further communication easier

Retrieval

- **Encoding-specificity principle:** a retrieval cue can serve as an effective reminder when it helps recreate the specific way in which info was initially encoded

- **State-dependent retrieval:** the process whereby info tends to be better recalled when the person is in the same state during encoding and retrieval
- **Transfer appropriate processing:** ex) divers who learned in underwater did better if tested underwater

Retrieval: Neural Basis

- PET responses to recalling previously learned lists (Schacter et al., 1996)
  - **Successful** recall (i.e. high % lists) **hippocampus**
  - **Failed** recall (i.e. low % lists) **left frontal lobe**

The Case of Clive Wearing

- Arguably the most severe memory patient in recorded history
- Damage caused by Herpes Simplex Encephalitis (virus)
- Profound **anterograde amnesia**

Types of Long term memory

- **Implicit:** past experiences influence later behaviour and performance, even w/o an effort to remember them or an awareness of the recollection
- **Explicit:** people consciously or intentionally retrieve past experiences

Implicit Memory

- **Procedural memory:** gradual acquisition of skills as a result of practice “knowing how” to do things
- **Priming:** an enhanced ability to think of a stimulus, such as a word or object, as a result of a recent exposure to the stimulus
  - HM can prime → doesn’t require hippocampus

Explicit Memory

- **Semantic memory:** network of associated facts and concepts that make up our general knowledge of the world
  - Hippocampus not involved
- **Episodic memory:** collection of past personal experiences that occurred at a particular time and place
  - Hippocampus and medial temporal lobe
  - Helps us envision future

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Chapter 9 Language and Thought

Language: The Basics

- **Grammar:** the rules of the language, including morphology (word rules) and syntax (sentence rules)
- **Phonemes:** smallest unit of sound recognizable as speech
- **Phonological rules:** how phonemes can be combined to produce speech sounds
- **Morphemes:** the smallest meaningful units of language
- **Morphological rules:** how morphemes can be combined to form words
- **Syntactical rules:** indicate how words can be combined to form phrases and sentences
- **Semantics:** meaning
- **Deep structure**: meaning of a sentence
- **Surface structure:** how a sentence is worded
- About 4,000 human languages exist (w/ basic structure and sound and rules)

Do other species have language?

- **Rhesus monkeys**
  - alarm calls for snake, eagle, leopard
- Alex, the African Grey Parrot
  - Large vocabulary
  - Counts to 6
  - Asks questions
- Chimps
  - No vocal chords (use lexigram)
  - Large vocabulary (160)
  - Simple sentences

Distinguishing Speech Sounds

- In japanese, no distinction between l and r phonemes
- Dishabituation paradigm: pacifier study in infants aged 1-4 months (elmas et al 1971)
- La la la switched to ra ra ra → japanese infants increase sucking

Behaviourist Approach of Learning

Thru reinforcement, shaping, extinction, and other principles of operant conditioning

- When infants mature, the vocalize; the sounds that are not reinforced diminish, and the ones used stay

- Criticism (chomsky)
    - Parents spend little time teaching (reinforcing) language
    - Children generate unique sentences
    - Errors are characteristic e overgeneralization “I runned” (and not superstitious conditioning)

Nativist Approach to Learning

- Language development is best explained as an innate, biological capacity
- The brain has a **language acquisition device (LAD):** a collection of processes that facilitate language learning
- **Genetic dysphasia**
    - Syndrome characterized by an inability to learn grammar despite reasonable intelligence

The Language Areas

- Nb. left hemisphere
- Aphasia: difficulty in producing or comprehending language

Broca's Aphasia

- **Location:** Left frontal cortex
- **Function:**
    - Production of sequential patterns in vocal and sign languages
    - Motor programs for articulation
    - Syntactic rules
- French physician Paul Broca's patient, Mr. Leborne was nicknamed “Tan” because it was the only word he could say
- Intact comprehension - e.g. object pointing
  → impaired speech production

Wernicke’s Aphasia

- **Location:** Left temporal cortex
- **Function**: language comprehension (spoken and signed)
- Patients can produce grammatical speech, but is meaningless, and have considerable difficulty comprehending language
- **Pure word deafness**
    - Highly localized wernicke’s damage
    - “I can hear you talking, I just can’t understand what it means”
    - Own speech is excellent
    - Can recognize non-speech sounds (barking dogs, door bells)

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Thinking: Concepts and Categories

- **Concept:** mental representation that groups or categorizes shard features of related objects, events or other stimuli
- **Family resemblance theory (Rosch et al., 1973)**
  - Focuses on features that appear to characteristic of category members but may not be possessed by every member
- **Prototype theory**
  - Based on the "best" or "most typical" member of a category
  - Prototype possess most (or all) of the most characteristic features of a category
- **Exemplar theory**
  - We make category judgements by comparing a new instance with stored memories for other instances of the category
- **Category-specific deficit**
  - An inability to recognize objects that belong to a particular category, although the ability to recognize objects outside the category is undisturbed

Brain Parts & Function

- **Frontal lobe:** forward from the central sulcus
- **Primary motor cortex and premotor areas**
- **Prefrontal cortex**
  - **dorsal/lateral** → "cold" executive functions
  - **ventral/medial** → "hot" emotional functions

The Executive Functions

- **Executive functions:** a collection of processes that involve the control and monitoring of behavior **(controlled and top-down)**
- 2 (related) distinctions:
  - **Automatic vs Controlled** processes
  - **Bottom-up vs Top-down** processing
    - Bottom-up: Driven by sensory input
    - Top-down: supervised by knowledge or strategy
- **Executive process #1:** Planning the Tower of Hanoi test
- **Executive process #2:** Flexibility - The Wisconsin Card Sort Test
  - Sometimes called the 'gold standard' task of frontal lobe integrity
  - Test of cognitive flexibility
  - Sticking w/ an unsuccessful strategy is called 'perseveration'

    - Test also requires: rule formation, feedback processing, inhibition of previous rule
- **Executive process #3:** Inhibition (or lack of = impulsivity)
    - Utilization Behaviour (L'hermitte 1986): in extreme cases, these patients are compelled to utilize objects placed in front of them; entirely "bottom-up' behaviour
    - In healthy people, the stroop Test: "name the colour of the stimulus"

Problem solving

- **The Tower of Hanoi**
    - General characteristics of psychological problems:
        - A 'given state' and a goal state'
        - # of rules that constrain solution
        - Viable number of moves that create a problem space
    - How do we solve the problem? **Means - ends analysis**:
        - Note difference between current state and goal state
        - Form a sub-goal that reduces that difference
        - Select mental operator that permits attainment of sub-goal

Psychological Factors that Affect Problem Solving

- Constraint relaxation (e.g. matchsticks and 9-dot problem)
- Addition of new information (e.g. a hint)
- Goal-subgoal conflict
- "Functional fixedness": tendency to perceive functions of objects as fixed (a failure to 'restructure' the problem)

Analogical Problem Solving

- **Analogical problem solving:** finding a similar problem w/ a known solution and applying that solution to the current problem
    - **Ex)** the fortress and radiation problems - isomorphic problems (structurally equivalent)
- Humans are poor at spontaneous use of analogy - many subjects also need its relevance to be highlighted
- Analogy requires mapping structure from aa unknown problem to new problem - but hard to know which past problem is relevant

Sudden insight

- The "aha!" moment: the solution appears suddenly

- Gestaltists were reacting against trial-and-error learning in Thorndike's cats: gradual, incremental problem solving (also called "hill climbing" in humans, like many math problems)
- Increased activity deep in the **frontal lobes** in the **anterior cingulate**, which controls cognitive processes

Functional Fixedness

- **Functional fixedness:** tendency to perceive the functions of objects as unchanging
- Ex) Dunckers (1945) candle problem
    - Performance improved if matches and box are separated)

Thinking and Judgement Strategies

- **Reasoning**: mental activity that consists of organizing info or beliefs into series of steps in order to reach conclusions
    - **Practical reasoning:** figuring out what to do, or reasoning directed towards action
    - **Theoretical/Discursive reasoning**: reasoning directed towards arriving at a belief
        - Both prone to **Belief Bias**: statements conflict w/ their beliefs about the world; evident in **syllogistic reasoning,** where a conclusion follows from two statements that are assumed to be true and can involve operators "all," "some" or "no"
- **Rational choice theory:** we make decisions by determining how likely something is to happen, judging the value of the outcome, and then multiplying the two
- **Availability bias**: items that are more readily available in memory are judged as having occurred more frequently
    - ex) third letter as k is more frequent than first letter k, but most people think the opposite is true
- **Heuristics:** fast and efficient strategies that may facilitate decision-making but do not guarantee that a solution will be reached
    - Shortcut or rule of thumb that avoids the algorithm: a well-defined sequence of procedures or rules that guarantees a solution to a problem
    - "If...then" statements but can sometimes give rise to ridiculous responses - albeit in contrived, laboratory conditions
- **Conjunction Fallacy:** People think that two events are more likely to occur together than either individual events
    - ex) feminist bank/clerk problem

- **Representativeness heuristic:** making a probability judgement by comparing an object or event w/ a prototype of the object or event
    - ex) engineers and lawyers problem
- **Optimism bias:** people believe that, compared to others, they are more likely to experience positive events and less likely to experience negative events in the future

Framing effects

- **Framing effects:** people give different answers to the same problem depending on how the problem is phrased (or framed), which can influence expected utility
    - **ex)** tropical flu problem: gains version, most subjects are risk averse (A>B) and in losses version, most subjects are risk preferent (D>C)
- **Sunk cost effect:** continued investment in poor decisions to justify/recover the initial payout

Prospect Theory

- **Prospect theory:** people chose to take on risk when evaluating potential losses and avoid risks when evaluating potential gains

Gambling

- **Gambling:** individual behaviour where a monetary wager is placed on the prospect of an uncertain monetary outcome
- Problem of Gambling: “Difficulty limiting money or time spent on gambling, with adverse consequences for the gambler or others’”, and “inability to resist urges to gamble, w/ negative consequences”

Forms of Gambling

- **Games of chance:** lottery, slot machines, bingo
- **Games of (some) skill:** poker, blackjack
- both: horse-racing, sports betting
- “House edge”: commercial gambling games have a **negative EV** so the more you play, the more likely you are to lose

Who is most at risk of developing a gambling problem?

- Problem gamblers more likely to be
    - Male
    - Youth
    - Low socioeconomic status (e.eg. household income)
    - Ethnic minority (e.g. first nations)

- Experience other mental health problems

Behaviourist account of gambling

- Skinner (2953): gambling as operant conditioning w/ reinforcement (money) delivered on an unpredictable (variable ratio) basis
- VR schedules are:
  - Difficult to establish
  - Very difficult to extinguish

Gambling and Dopamine

- Dopamine agonist medications can trigger excessive gambling
- These drugs can also trigger other impulse control problems (hypersexuality, shopping)
- NB. in Parkinson's Disease, the dopamine system is degenerating

A Cognitive Approach: Decision-Making Biases in Gambling

- Features of gambling games cause the gambler to overestimate his/her chances of winning
  - Gamblers develop an **illusion of control** where they confuse a game of chance w/ a game of skill
  - Gamblers detect patterns in sequences of events
    - **Gambler's fallacy:** (heads, heads, heads → "tails")
    - **Hot hand fallacy** (win, win, win → "I'll win")

Chapter 5 - Consciousness

What is consciousness?

- The most difficult and controversial topic in cognitive psych
- Easy problem: e.g. what are the brain correlates of colour perception?
- Hard problem: e.g. why do we need to be aware of colour in the first place? How do we explain the subjective experience of greenness (Pinker 2007)? I smy green the same as your green?
- Is consciousness by itself adaptive? (functionalism)
- Is consciousness an artifact of mental processing (a "side effect" that is not by itself useful or important); in which case, are computers conscious to some extent?

The mind

- **Problem of other minds**: the fundamental difficulty we have in perceiving the consciousness of others
- **Mind-body problem:** the issue of how the mind is related to the brain and body

Measuring Consciousness: Libet's clock and "free will"

- In Libet's experiments, the participant was asked to move their finger at will, while watching a dot move around the face of a clock
- They were asked to note the moment at which the action was consciously willed
- EEG sensors measured brain activation while EMG sensors timed muscle movement
- **Results:** brain started to show electrical activity **before** the person's conscious decision to move

The Nature of Consciousness

- 4 basic properties:
  - **Intentionality:** directed toward an object
  - **Unity:** seamless integration of senses
  - **Selectivity:** capacity to include some objects but not others
    - **Dichotic listening:** people wearing headphones hear different messages in each ear show filtering of info
    - **Cocktail-party phenomenon:** people tune in one message even while they filter out others nearby
  - **Transience:** tendency to change

Levels of Consciousness

- **Minimal consciousness:** low-level kind of sensory awareness and responsiveness that occurs when the mind inputs sensations and may output behaviour advice
- **Full consciousness:** you know and are able to report mental state
- **Self-consciousness:** distinct level of consciousness in which the person's attention is drawn to the self as an object
- **Mental control:** the attempt to change conscious states of mind
- **Thought suppression**: conscious avoidance of a thought
  - **Rebound effect of thought suppression:** the tendency of a thought to return to consciousness with greater frequency following suppression

Freudian Unconsciousness

- **Dynamic unconscious:** an active system encompassing a lifetime of hidden memories, the person's deepest instincts and desires, and the person's inner struggle to control these forces
- **Repression:** a mental process that removes unacceptable thoughts and memories from consciousness and keeps them in the unconscious
- **Freudian slips:** unconscious mind in speech errors and lapses of consciousness

Cognitive unconsciousness

- **Cognitive unconscious:** all the mental processes that give rise to a person's thoughts choices, emotions, and behaviour even though they are not experienced
- **Dual-process theories: subliminal perception**: thought or behaviour is influenced by stimuli that a person cannot consciously report perceiving

Sleep

- **Sleep:** a natural bodily sate where consciousness is absent or significantly reduced, sensory input is dulled and voluntary motor movement is suspended
- **Altered state of consciousness:** a form of experience that departs significantly from the normal subjective experience of the world and the mind
- **Hypnagogic state:** pre-sleep consciousness
- **Hypnic jerk:** sudden quiver or sensation of dropping
- **Circadian rhythm**: a naturally occuring 24h cycle

Sleep Stages

- **Awake: high frequency activity** (**beta waves)** and **low-frequency** activity (**alpha waves**) when **drowsy,** relaxed
- **First Stage: Theta waves**
- **Second Stage:** short bursts of activity **sleep spindles, K complexes**
- **Third/Fourth Stage (slow sleep):** delta activity
- **Fifth Sleep: REM sleep**
    - Rapid eye movements and high level of brain activity
    - EEG patterns become high freq waves sawtooth waves like beta
    - Quickened pulse, blood pressure rises, sexual arousal
- Cycle from initial stage 1 to stage 4 and then backwards through the stages to emergent stage 1
- Each cycle lasts about 90 minutes
- As the night progresses, more and more time is spent in emergent stage 1

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Why do we sleep?

2 general theories

- **Recuperative theory**
  - Sleep repairs the wear and tear done to our bodies while awake
  - No change in performance on physical task and intellectual ability
  - Decreased performance on task that require alertness and vigilance (attention)
  - Impaired concentration and irritability
  - Sleep improved brain waste clearing
  - Waste clearing is facilitated by neuron shrinking during sleep
- **Circadian theories**
  - Sleep evolved to encourage inactivity during unproductive and dangerous parts of the day
  - Is roughly a day (~25h)
  - 24 hour cycle regulated by the **suprachiasmatic nucleus** (your biological clock) in the **hypothalamus** (just 20,00 neurons)
    - Without natural light, we adjust to 25h cycle (based on Kleitman and Richards in the Mammoth Cave Study)
  - Prediction: the daily sleep time of each species should be related to how vulnerable it is when it sleeps and how much time that it must spend feeding itself:
  -

Stage Specific Sleep Deprivation

- **REM deprivation**
  - Ultimately fatal
  - REM rebound
- **Slow-wave sleep deprivation**
  - Also rebounds
  - **Physical tiredness**
- Effects:
  - Memory
  - Reaction time, coordination
  - Mood, irritability

Sleep Disorders

- **Insomnia:** difficulty in falling asleep or staying asleep
- **Sleep apnea:** person stops breathing for brief periods while asleep
- **somnambulism/sleepwalking**
- **Narcolepsy**: sudden sleep attacks occur in the middle of waking activities

- **Sleep paralysis:** the experience of waking up unable to move
- **Night terrors/sleep terrors:** abrupt awakenings with panic and intense emotional arousal

Dreams

- **Manifest content:** a dreams' apparent topic or superficial meaning
- **Latent content:** a dream's true underlying meaning
- **Activation-synthesis model:** theory that states that dreams are produced when the brain attempts to make sense of random neural activity that occurs during sleep
- **REM Activation:** amygdala, visual associations areas, motor cortex, brain stem
- **REM Deactivation:** prefrontal cortex

Drugs

- **Psychoactive drugs:** chemicals that influence consciousness or behaviour by altering the brain's chemical message system
    - **Stimulants:** Drugs that excite neural activity
        - Cocaine, amphetamine (dopamine), nicotine (acetylcholine), caffeine
    - **Depressants:** drugs that reduce neural activity
        - Benzodiazepines e.g. valium → increase GABA
    - **Narcotics** - opioid system → euphoria, pain (heroin, morphine)
    - **Hallucinogens** (LSD, ketamine)

Why do people use drugs?

- **To feel good/euphoria**
    - Positive reinforcement: response increases when pleasant stimulus occurs
- **To escape low mood, adversity or trauma, OR alleviate unpleasant withdrawal symptoms**
    - Negative reinforcement: response increases when an aversive stimulus is removed

Dangers of Addiction

- **Drug tolerance:**
- **Physical dependence:** pain, convulsions, hallucinations
- **Psychological dependence:** strong desire to return

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Depressants

- **Examples: alcohol, barbiturates, benzodiazepines, toxic inhalants (glue, gasoline)**
- Sedative or calming effect, tend to induce sleep in high doses, and arrest breathing
- **Alcohol:** initial effects, euphoria and reduced anxiety → positive feeling
    - Slowed speech, coordination, judgement
    - **Expectancy theory**: alcohol effects can be produced by people's expectations of how alcohol will influence them in particular situations
    - **Alcohol myopia**: alcohol hampers attention, leading people to respond in simple ways to complex situations

Stimulants

- **Ex) caffeine**, **amphetamines, nicotine, cocaine, modafinil, and ecstasy**
- Increase the levels of **dopamine** and **norepinephrine** in the brain → inducing higher levels of activity in the brain pathways that rely on them → increase alertness and energy, euphoric sense of confidence, agitated motivation
- Ecstasy: empathic and closeness with others
- Cocaine: exhilaration and euphoria
    - Side effects: insomnia, depression, aggression and paranoia, heart attack, hyperthermia
- Nicotine: relaxation and improved concentration

Narcotics

- **Narcotics:** highly addictive drugs derived from opium that relieve pain

Hallucinogens

- **Hallucinogens:** drugs that alter sensation and perception → visual and auditory hallucinations
- **Ex) LSD**, mescaline, psilocybin, PCP and ketamine

Marijuana

- **Marijuana/cannabis:** plants whose leaves and buds contain a psychoactive drug called THC
- Euphoric, heightened senses of sight and sound, rush of ideas
- Affects judgement and short-term memory, and impairs motor skills and coordination, depression and anxiety later on
-