Divisions of Psychology

Psychology
- the science of the study of the mind (mental processes) and behavior, partly a science, requires objectivity, must be able to define variables, observe or measure (quantify) variables

Psyche
- the totality of the human mind, consciousness, and unconsciousness

Mental processes
- difficult to define, they can't be observed but they can be inferred
- behavior is studied to infer mental processes

Behavior
- driven by motivation
- can be defined, observed, and measured, but its cause is not known as well

Experiments
- there must be a manipulated/changing variable
- may cause another variable to change

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Major Divisions of Psychology
- Experimental Psychology
  - began in mid to late 1800s in Leipzig, Germany by Wilhelm Wundt
  - aim is to describe consciousness
  - structuralism
    - developed by Edward Titchener in US
    - Basic structures of the mind, analogous to the basic elements in chemistry
    - used introspection: self reflection
    - this proved very unreliable and highly subjective
  - Functionalism (pragmatism)
    - developed by William James in US
    - doesn't matter whether the mind is physical or not
    - studied the actual functions of the mind
    - wrote the first textbook

- Clinical Psychology
  - Freud is considered the founder of psychotherapy, though he was not a psychologist, he was a neurologist
  - began in the late 1940s, largely due to war
  - applies knowledge of fundamental experimental psychology
  - social, developmental, educational, and industrial psychology

Schools of Psychology

- cognitive
  - major branch of experimental psychology in the late 1800s, William James
  - studies higher mental functions: consciousness, memory, emotion, motivation etc
  - attempts to infer hypothetical mental states of information processing
  - semantic decision task: defining things as they are remembered/thought of
  - fell into disrepute because it was thought to be unscientific by behaviorists, revived in 1950s
  - cognitive neuroscience
    - use biological methods to study cognitive activity
    - use computers to mimic cognitive processing: cognitive modelling
- biological
  - also called cognitive neuroscience
  - attempt to measure actual mental events by monitoring brain activity
  - manipulate psychological state and observe the effect of this manipulation on brain activity and structure
  - manipulation done with stimulate (electricity), lesion/removal of part, drugs
- behavioral
  - started in the 1920s
  - because psychology is objective, we must be able to directly observe events
  - that is done through behaviour
  - asks the question, Why do we behave the way we do?
    - All behaviour can be explained by consequences of behaviour
  - behaviours are repeated through reinforcement
  - we do not repeat behaviour that has not been reinforced
  - environmental explanation of behaviour, not inner mind
    - all behaviour is learned
  - near its beginning no need to think about genetic influence or inner mind
  - Determinism: all behaviour is determined by consequential events, no control of actions
  - inappropriate behaviour come from poor learning and must be corrected
- social
  - emphasis on social behaviour
  - study on social environment and its effects
  - contains socio-biology
    - most of human behaviour can be explained through genetic principles
    - orbits around the survival of the species/survival of and individuals genes
    - ethology: study of animal behaviour
- psychoanalytical
  - Freudian psychology (late 1800s – early 1900s)
  - describes the role of the unconscious in influencing behaviour
  - much of behaviour and emotions are repressed, and they unconsciously influence personality and behaviour
  - also deterministic, just by the unconscious drives

- psychoanalysts: don't require an MD
  - can not prescribe drugs

- psychiatrists: need and MD, employ a medical model
  - diagnoses illnesses, treats with psychotherapy and drug therapy
- clinical psychologists
  - must have a PhD in research (in Canada)
  - trained in both research and clinical psychology
  - can not prescribe drugs
  - emphasis on abnormal behaviour, not necessarily illness
- Experimental psychologists
  - trained only as a researcher, with a PhD
  - can't provide psychotherapy or counseling

- phenomenological
  - Humanistic theory: emphasis on unique human quality of behaviour
  - everybody is different due to differences in experiences
  - considered unscientific because it focuses on subjective experiences
  - concerned with developing theories of inner life rather than explaining behaviour

Scientific Method

Epistemology: methods of obtaining knowledge

- research issues
  - stability vs change
  - rationality vs irrationality
  - nature vs nurture
- Divine insight
- pure logic and thought (Aristotle)

- Scientific Method/Manipulation
  - Idealism
    - all that exists in not material
    - we have an immaterial form
  - Materialism
    - all that exists is material
  - Scientific method consists of
    - variables
      - what changes and why?
    - theory
      - opinion or speculation

  - statistic abnormality
    - not psychologically abnormal, just on the outer edges of the normal curve

- central tendency
  - there are usually individual differences in the dependent measure, some score high or low
- 3 measures of central tendency
  - Mean
    - average
    - can be distorted by very high or very low values
  - Median
    - half above, half below (middle number)
    - much less distorted by very high or low values
  - Mode
    - occurs most often (tip of the curve)
    - not necessarily the middle

- Correlation studies
  - a change in one variable is also associated with a change in another
  - does not necessarily mean that a change in one variable causes the change in the other
    - they might both be affected by the same thing, causing a change at the same time
    - must be proved through experimentation
  - the correlation allows one to predict the value of one variable if the value of another variable are known
  - correlations vary from -1.0 to +1.0 (a perfect 1/-1 would make a straight line graph)
  - the larger the correlation, the stronger the association/ability to predict
  - 0 is no relationship
  - correlation does not prove causality

- Sources of Variance
  - Explained variance
    - caused by a known change/manipulation of a variable between subjects
  - Unexplained variance
    - individual differences that we don't know of affecting the study

- Logical positivism
  - all theories are false until proven true

- Experimental manipulation
  - manipulate the independent variable
  - this can cause the dependent variable to change

- Social Modeling theory
  - exposure to something causes it to be expressed more by individuals
  - violent media causes violence

- Catharsis theory (Freudian)

        - exposure to something releases the need to express it
        - violent media decreases violence

- Statistical Significance
    - divide explained variance by unexplained variance
    - if the ratio is large enough, the difference is of statistical significance
        - the higher the ratio, the more likely the difference is significant
    - level of significance is the chance that something occurs/doesn't occur
        - somewhat arbitrary, depends on the situation
    - if unexplained variance is 0, any explained variance is significant
    - if a very large sample is used, very small differences might be statistically significant

- Null hypothesis
    - there is no correlation between the independent variable and the dependent variable

- Research Designs
    - Case Studies
        - one exceptional individual (or a few) are studied in detail
        - problems arise when generalizations are made from case studies
            - the individual could just be an exception
    - Group Studies
        - sample a small number of individuals from a population
            - need to make sure the sample is randomized and that it is representative of the population in study
- Experiments
    - must be carried out in controlled setting (lab)
        - not necessarily ty pical in the real world
    - Quasi-Experiments
        - if an experiment can not be carried out, compare instead of study
            - men vs women, young vs old, control vs patient
            - agression: compare men and women instead of giving women testosterone
    - Pre-Post Experimentation
        - use the same group of participants in repeated experiments
        - one group acts as the control and the subjects
        - eliminates the problem of the differences in groups
        - problem: differences can carry over through the various experiments
    - Placebo
        - double blind: nobody knows if its a placebo
        - no medical treatment that is approved by the ministry of health has not had a placebo test

Neuroscience

- Effects of Drugs
  - stimulate or block receptor on post-synaptic membrane
    - stop transmission, or mimics neurotransmitter (hallucination)
  - may attack enzymes that break down neurotransmitter
  - block re-uptake of neurotransmitter

  - Neurotransmitters
    - acetylcholine
      - excitatory effect on skeletal muscles
      - muscle paralysis: blocking receptors, blocking release
      - muscle convulsions: stimulate release
      - Ach depleted in Alzheimer's
    - norepinephrine
      - plays a role in alertness and mood
      - increases alertness, heart rate (fight or flight)
    - GABA
      - major inhibitory neurotransmitter in the brain
      - sleep and anti-anxiety medications often stimulate GABA receptors
    - dopamine
      - inhibatory
      - movement, attention, and learning
      - insufficient quantity, Parkinson's disease
      - to much dopamine, phsycosis (schizophrenia, cant focus attention on whats relevant or irrelevant)
    - serotonin
      - plays a role in sleep (possibly dreaming, considered a hallucination)
      - also thought to control eating, mood, pain regulation
      - hallucinatory drugs are similar in structure to serotonin (LCD, mushrooms)
      - ecstasy stimulates release of serotonin
    - endorphins
      - natural opiates of the brain
      - structure similar to opiates (heroin, morphine)
      - inhibits sensation of pain, increases mood and pleasure

- Orientation

- anterior – posterior
- medial – lateral
- ventral – dorsal
- superior – inferior

- horizontal: up - down
- coronal: front - back
- sagittal: left – right

- Imaging Techniques
  - Anatomical techniques
    - slicing the brain
    - viewing macrostructures with the naked eye, or microstructures with a microscope
    - appropriate for cadavers

  - MRI
    - provides high resolution images
    - problem: static images, does not show function
    -
      - cannot see single cells
      - expensive

  - Observing the active brain
    - must observe functions lost due to injury of the brain
    - problem: injuries are often widespread, not highly specific

    - can be determined by damaging a specific part of an animal brain
      - done with a heated electrode
    - could also be done with an electrical signal
    - problem: don't know what the animal is experiencing
      - also differences between species

  - Human Stimulation
    - trans-magnetic stimulation
      - a device that sends a somewhat specific signal to the brain
      - done outside the body
    - deep brain stimulation
      - implant electrodes in the brain

- Functional Techniques
  - positron emission tomography (PET), measures radio-activity
    - detects injected radio-transmitters (attached to a molecule, such as glucose)
    - provides image of the function of various structures, shows which areas are active
    - can be specified to be used in neurons that use a specific neurotransmitter
    - disadvantages
      - invasive, requires injection into the blood
      - very slow, needs to wait for blood circulation
      - expensive

  - Functional MRI (fMRI)
    - takes an MRI as well as a map of oxygen, which is required for function
    - high resolution image
    - disadvantages
      - slower than the brain (takes 0.2-0.5 seconds)
      - expensive

  - EEG
    - measures the electrical activity of the brain
      - electrodes attached to the scalp
    - shows rapid changes, up to 30 times per second
    - inexpensive
    - disadvantage
      - doesn't show exactly which area of the brain is stimulated
      - no picture

- Peripheral Nervous System
  - sensory receptors
    - specific, highly specialized to a certain type of stimulus

  - sensory nerves
    - afferent input from the sensory receptors to the CNS

  - motor nerves
    - efferent output from the CNS to the muscles, motor action

  - Autonomic nervous system
    - sympathetic system: readies the body for fight or flight
    - parasympathetic system: returns the body to normal functioning

  - Central Nervous System

        - gray matter
            - small neurons, no myelin sheath
            - form memory and learning, complex decisions
        - white matter
            - transmission to and from brain

- Monosynaptic reflex
    - stimulus
    - activation of affrent neuron
    - information processed by an interneuron
    - actiavtion of effrent neuron
    - reaction

- nuclei: collection of neurons that serve the same function in CNS
- ganglia: collection of neurons in PNS

- Divisions of The Brain
    - Hindbrain: medulla, pons
    - Midbrain: thalamus, hypothalamus, pituitary gland, pineal gland
    - Forebrain

    - Brainstem
        - hindbrain and midbrain
            - medulla, pons, midbrain
        - specialized senses of the head (sight, hearing) project here
        - head muscles
        - life support systems, temperature, heart, respiration
        - sleep/wake system
            - reticular activating system (if one fires, all fires/our entire bodies are awake)

    - Cerebellum
        - connected through pons
        - balance, control

    - Diencephalon
        - Thalamus
            - very large, gray matter area
            - receives input from all sensory systems, except olfaction
                - most important in nature, has its own area
            - has specific nuclei for each sense it contains
            - files information to conscious and unconscious
                - prevents distraction
                - has a memory of what is important or not

        - Hypothalamus

- also largely gray matter
    - many subdivisions
- basic life support functions
    - measures levels of nutrients/dissolved particles in the blood supply
        - hunger, thirst
    - basic drives: sexual, behavioral
    - temperature regulation
- controls the Endocrine System via the Pituitary Gland (monitors hormone levels)
    - not really part of the brain because it releases hormones instead of neurotransmitter

- Cerebrum (neocortex)
    - 6 layers of gray matter
    - complex interconnections
    - gyrus: peak, sulcus: valley
        - purpose is to increase surface area
    - frontal lobe, parietal lobe, occipital lobe, temporal lobe
        - longitudinal fissure: split between the hemispheres
        - lateral fissure: between frontal and temporal lobes

    - Primary Sensory Cortices (detects basic features of stimulus input, location/duration)
        - primary visual area
            - back of the occipital lobe
        - primary auditory area (gyrus of Heschl)
            - edge of lateral fissure (temporal)
        - primary somatosensory area (temperature and feeling) and primary motor area
            - top of parietal lobe

    - Speech Areas
        - Broca's area
            - motor aspects of communication
            - left frontal lobe
        - Wernicke's area
            - repetitive sensory aspects
            - auditory and sight (reading)
            - hemisphere can depend on when the memory was made/language learned
        - Non-dominant hemisphere (angular gyrus)
            - tonality, expression of emotion in speech (one side)
            - recognizing emotion in others speech (other side)

    - Association Areas

- no direct contact to the outside world, not sensory or motor
- they receive information after it is processed by the sensory and motor cortices

- Frontal lobe
  - motor functions
    - primary motor cortex in the pre-central gyrus
    - Broca's area and speech
  - performs higher mental functions
    - selective attention, concentration, will, consciousness, self-consciousness

- Temporal Lobe
  - Gyrus of Heschl, primary auditory cortex
  - Wernicke's area, receptive speech
  - short term memory, hippocampus/amygdala
    - if a stored short term memory is found to be important, it is transferred to long term

- Parietal Lobe
  - permanent/long-term memory
  - maintaining attention, switching it to the more important thing

- Hemisphere Differences
  - Dominant Hemisphere (left for most right handed people)
    - language, mathematical operations, logic
    - general, this is overly simplistic
  - Nondominant Hemisphere
    - spatial construction, face recognition, emotional expression
  - Corpus Callosum
    - the major commissure in the brain
      - connects the halves

- Limbic System
  - limbic means circle or loop
    - this loop includes hippocampus, amygdala, hypothalamus
    - plays a role in the maintenance and expression of emotions
      - 4f's: feeding, fighting, fleeing, fucking

- Autonomic Nervous System
  - cortex has limited to no control
  - controlled by hypothalamus
  - sympathetic: increases energy available to the body, done while under stress
  - parasympathetic: conserves energy

Sensation and Perception

- Sensation
  - ability to perceive external energy, transform it to action potentials
  - Sensation is more or less objective, we all have the same/similar receptors
    - perception is subjective

- Transduction
  - receptor translate (transduces) energy to action potential

- Perception
  - must involve memory
  - presumably takes place at a higher level than sensation
    - may or may not involve conscious thought

- Perceived Features
  - frequency
  - intensity
  - location
  - duration

- Threshold
  - minimum amount of energy required to stimulate the receptor to send a signal
  - subliminal: below the threshold

- Absolute Threshold (limen)
  - minimum amount of energy required to detect the stimulus on 50% of trials
  - Signal Detection Theory
    - absolute threshold can vary for reasons that have nothing to do with sensitivity
    - false positive/miss if they are “liberal” or “conservative”
      - when guessing, more likely to say yes or no
    - d': proportion hits/proportion false positive
      - measures sensitivity

- Hit
  - correct detection

- Difference Threshold (just noticeable difference)
  - detection of minimum change in energy
  - Weber's Law
    - delta(I)/I = k
    - +

- Sensory Coding
  - coding of sensory modality
  - how do we determine different qualities from the same modality (stimulus)
    - frequency modulation

- Audition
  - physics of sound
    - frequency (Hz)
      - wavelength
    - intensity (dB)
      - amplitude
      - logarithmic, *10 each increase of 10 (10^{dB} pressure)
      - 0 dB, softest sound that can be heard by a human ear
    - location
    - duration

  - Auditory Threshold
    - humans: 500-5000 Hz are the most audible
    - must increase intensity to hear other sounds better

  - The Ear
    - outer ear
      - pinnae
        - outside the head, captures the sound
      - auditory canal
        - amplifies the sound
    - middle ear
      - ear drum
        - vibrates at the frequency of the sound
      - hammer, anvil, stirrup
        - bones
        - vibration of the ear drum causes them to vibrate
        - can break, causing permanent damage
          - sharp pain is middle ear muscles trying to protect them
    - inner ear
      - cochlea
        - filled with water, stirrup hits it causing a wave
        - wave stimulates hair cells, sends signal

- Theory of Pitch and Intensity
  - frequency theory
    - different number of action potentials depending on frequency of stimulus
    - intensity is determined by the number of different neurons
    - can't explain above 1000Hz, neurons cant fire that fast
  - place theory
    - different areas of the cochlea create different pitches
    - beginning codes for high frequencies, the end low frequencies
    - intensity coded by frequency of firing
    - difficult to only stimulate one region
    - damage to basilar membrane will result in loss of predictable frequencies
      - aging causes damage to the hair cells
      - low frequency loss is very rare

- Adaptation
  - if a stimulus intensity remains constant, our sensory receptors adapt to it
  - causes after images

- The Eye
  - Cornea: protective layer on the outside
  - Lens: attached to muscles, allowing for you to focus the image
  - Iris: blocks light
  - Pupil: where the light comes through

  - Retina
    - fovea: area of the best sensory capabilities
    - blind spot: optic nerve
    - cones
      - packed in the center of the retina, near the fovea
      - three colours of cones, RGB
      - have graded potentials depending on intensity
        - high levels required to trigger an action potential
    - rods
      - found in the periphery
      - many more than cones, but each signal is weaker
      - they are spaced relatively far apart compared to cones
      - used to detect movement in the periphery
      - also detect dim light (night vision)
      - not sensitive to colour
      - several rods project to a single bipolar cell

- Colour Theory
  - Young-Helmholtz 3 colour theory
    - three types of cones
    - all colours are made by mixing the three, done in the brain
    - problem: colour blindness
      - always red-green or blue-yellow colour blind, not just one colour
  - Hering 2 colour theory
    - opponent colour theory
    - red and green cones project to a common bipolar cell
    - ganglion cell determines colour based on how often the bipolar cell fires

- Pathway to the cortex
  - retina – optic nerve – optic tract – thalamus – visual cortex (relevant information)
  - information from the left visual field goes to the right side of the brain

  - feature detection
    - single neuron in the primary visual cortex is highly specialized for detection of specific features
    - they recognize horizontal/vertical lines, lines at very specific angles, specific lengths
    - specific regions for specific objects (faces, houses, chairs)

- Pain
  - common to all senses
  - receptors are called nociceptors
  - phasic pain: acute, short duration, carried by a myelinated neuron
  - tonic pain: long duration, non myelinated neuron

  - natural pain killers: endorphins
  -

  - perception: great deal of individual differences
    - highly psychological (easily modulated)
    - changed by drugs, inattention, willpower (strong placebo effects)

  - Gate Control Theory of Pain
    - bottom up processing
      - pain never reaches the brain
    - top down processing
      - consciously use will to ignore pain
      - learning from previous experiences

- Perception
  - entirely high level processing
  - Visual Capture
    - vision dominates other senses, we pay more attention to it
    - if vision says something and another sense says different, we ignore the other one

  - perceptual organization
    - gestalt psychology
      - given a cluster of sensations, the perceiver organizes them into a whole or a gestalt
      - to bring order to sensations, we group them
    - figure-ground
      - in order to perceive, we need to perceive a figure as being distinct from its surroundings, the ground
      - requires edge detection (Hubel and Weisel)

  - depth perception
    - binocular cues
      - multiple eyes sense different things, which are encorporated and signal depth
        - retinal disparity
    - stereograms
      - contain two views of the same image
      - if we can force the eyes to see independently, we will see vivid depth
      - the brain must do the integration of the images

    - monocular cues
      - relative size: we know nearer objects are larger
      - relative height: far objects are higher in the visual field
      - linear perspective: parallel lines converge at a distance
      - texture gradient: near objects are more clear, have distinct texture
      - interposition: near objects will block far objects
      - relative brightness: near objects reflect more light than far objects

  - motion perception
    - as light sequentially stimulates one retinal cell after another, our cortex may experience this as movement
      - higher levels of the brain need to determine whether something is moving, or you are moving

    - stroboscopic motion
      - still pictures varied slightly in position, repeatedly flashed
      - frames

    - apparent movement
      - error in distinguishing between object moving and eyes moving

- Perceptual Constancies
  - allows us to perceive an object as unchanging even though the stimuli that fall onto our receptors have changed

  - shape constancy: at different angles, we still see a door as a door
  - size constancy: see far people as farther away

  - perceptual context
    - colours appear differently depending on the background

Consciousness and Drugs

Consciousness as a State (sleep)

- circadian rhythms (every 24 hours)
  - sleep is a circadian rhythm in human adults

- suprachiasmatic nucleus
  - located above the optic chiasm
  - initiates sleep based on availability of light

- pineal gland
  - releases melatonin, under the control of the suprachiasmatic nucleus
    - released during the night, in the absence of light
    - melatonin decreases motor activity, induces fatigue, lowers body temperature

- effects of constant light/dark
  - without cue for sleep, humans sleep about 1 hour later ever day
    - effectively creates a 25 hour day
    - each day, you would fall asleep 1 hour later
    - this would occur in a person who was blind due to ocular damage, and not a person who was blind due to brain damage (occurring after the optic nerve, where the suprachiasmatic nucleus gets its info)

- definition of sleep
  - state of unconsciousness required
  - processing of stimulus input to cortex must be inhibited
    - inhibited by the thalamus

  - measurement of consciousnesss
    - overt behaviour
    - physiology
      - EEG
        - beta: 15+ Hz, alert
        - alpha: 8-12 Hz, relaxed

        - theta: 4-7 Hz, drowsy/light sleep
        - delta: 1-Hz, deep sleep/coma
    - brain's response to stimuli (evoked potentials)
- stages of sleep
    - N1: between awake and entirely asleep, theta > alpha
    - NREM (non rapid eye movement)
        - N2: fully asleep, theta with some delta
            - hypnogogic reverie: slow eye movement
            - spindles: inhibit consciousness, show up on EEGs
            - K-complex: spike in EEG in response to external stimulus
                - meant to detect danger?
            - occupies about half of total sleep
        - N3: slow wave sleep, almost entirely delta activity
            - has spindles and k-complexes too
            - night terrors and sleep walking

    - REM (rapid eye movement)
        - EEG looks like you are wide awake, fast brain waves
        - very difficult to awaken
        - dreaming occurs here
            - Freudian theory, dreams are a manifestation of repressed desires
        - absence of frontal lobe functions
            - why dreams don't seem weird at the time

    - first 4 hours of sleep are largely NREM, with occasional short REM sleep
        - largely N3
    - rest of sleep is largely REM sleep, with occasional short NREM (mostly N2)

- Nightmares
    - strong emotional REM dream
    - occurs more often in younger people
        - occurs much more in those with PTSD
    - may reduce anxiety experienced later/during the day

- Purpose of NREM and REM sleep
    - REM is a luxury, it occurs after NREM
    - many memories are stored during REM sleep

    - REM sleep is dangerous, autonomic nervous system can fail
    - infants have a lot of REM sleep because in the womb, they don't rely on their ANS

- Recapitulation Theory
    - change in one species should be similar to change across species through evolution

    - Reptiles exhibit REM sleep, but they don't have eye movement

        - difficult to compare across species
    - they are less conscious while resting

- Sleep for energy conservation
    - smallest animals have the highest metabolic rate
        - they sleep the most
    - predators sleep more, don't need to worry about death
        - prey has little REM, large animals have little NREM

- Mammals
    - need to maintain near constant temperature
    - also need to breath
    - have muscle atonia during REM
    - sea mammals
        - have muscle atonia but must be in motion
        - sleep on land or be half awake
        - dolphins/whales keep one hemisphere awake, can only move half their body
            - take turns

- Manipulate Sleep
    - sleep deprivation
        - humans can tolerate days without sleep, more than 2 weeks even
        - sleep deprivation effects emotion, rational thinking, selective attention (frontal lobe)
        - animals
            - develop sores, matting of fur
            - die after a few weeks
            - appears that the immune system is active in NREM sleep (N3), need it to fight disease
        - after sleep deprivation, you sleep more than normal, but not all of the sleep missed is made up
            - this sleep is more N3 by quantity

- NREM
    - recovery from day's activities
    - growth hormone is released during NREM, largely during N3
    - luteinizing hormone is also released during N3
    - waste from metabolism is washed out, especially from the brain, during sleep

- REM
    - memories are solidified with sleep
        - brain areas that were active during the initial learning reactivate during REM (some during NREM)
        - why young children sleep more

Consciousness as a Process

- sensory receptors are constantly bombarded with input
  - we are only conscious of a small portion of this input
  - the brain has a limited capacity to process information
  - basic features (location, intensity, duration, pitch/colour) are extracted before consciousness
  - only relevant information is made conscious (psychological/personal relevance and biological relevance)

Active Attention (selective)

- psychological/personal relevance
- active attention requires considerable effort and focusing in order to chose to become aware of it
  - contains a measure of free willingness because the individual must chose
  - deciding is actually a very complex task
- modulated by a central executive (probably frontal lobe), it decides what is relevant (Capacity Theory)
- memories are only formed (short term stored in hippocampus) on relevant things
  - storage and maintenance of memory also requires effort
- features of the incoming sensory messages are compared with existing messages in memory to determine if they are relevant
- because effort must be maintained, disturbance will interrupt making a memory (distraction)
  - also because it takes effort, cortical fatigue will occur (mental tiredness)
- failure of selective attention results in information overload

Passive Attention

- biological relevance
- passive attention requires little to no effort, certain stimuli will force the observer to switch attention because it is deemed more relevant
  - automatically switches
- not necessarily more relevant, just has the potential to be (don't know until you pay attention to it)
- intrudes into consciousness (a distraction)
- argued whether it is only biologically relevant input (loud sound), or whether it can be subjective (your name being called)

Controlled Processing

- requires effort, uses processing resources
- processing of one task affects the performance of another
  - resources devoted to one task, not available for another
- serial processing: processing of a secondary task cannot begin until the first is completed

Automatic Processing

- no effort because no resources need to be used, several tasks can be carried out simultaneously (parallel processing)
- tasks that initially required effort can become, with practice, effortless/automatic

Multitasking

- more than one task can be carried out in parallel at no detriment to any of the other tasks
  - if sufficient resources/brain power are available
- also called divided attention
- if resources are not available, individual must decide which tasks to process (serial processing)
- listening to music and working is not always multitasking, usually attention switches between the two

Hallucinogens

- Cannabis (marijuana, hash)
  - makes up the majority of illicit drug use
  - research shows that there are cannabinoid receptors in the brain
    - cannabidiol (CBD) and tetrahydrocannabinol (THC)
    - only THC is psychoactive
  - two or three different sub species, have different effects due to levels of THC vs CBD
  - causes relaxation, mild euphoria, disinhibition
  - is a mild hallucinogen
  - has long lasting effects, opposite of tolerance
  - no evidence that it is physically addictive, but it is shown to be psychologically addictive (reinforcer)
  - increases performance and cognitive tasks
  - may have long term effects on learning and memory
- LSD (lysergic acid diethylamide)
  - potency of LSD has decreased dramatically from 1960 to today
  - minutes dosage has very large and long lasting effect
    - no way to counter it
  - unpredictable
- Psilocin
  - magic mushrooms

- many are similar in chemical structure to serotonin (dreams/sleep halucinations)
- little evidence of addiction
- phychological experience varies widely among individuals
- hallucinations can be large or small
  - can cause synaesthesia (hearing colours)
  - vivid colours

Depressants

- alcohol
  - most commonly used drug
  - always depresses neural activity (may depress a center that controls social inhibition)
    - depresses frontal lobe control (and perhaps limbic system), logic, consequences
  - effect on transfer of short term to permanent memory, may inhibit REM sleep
- barbiturates (tranquilizers)
  - prescribed to induce relaxation and sleep
  - impairs memory and judgment in large doses
  - can kill in large doses or in combination with alcohol
- opiates
  - chemicals such as morphine and heroin, made from the opium poppy
  - similar chemical structure to endorphins (natural pain killers of the brain)
  - depresses sympathetic nervous system
  - reduces pain and depression, but can be addictive
  - causes the brain to produce less endorphins, increasing tolerance and lowers quality of life when not using
  - has the most painful withdrawal (still not as bad as implied by media)

Stimulants

- excite sympathetic nervous system, cause cortical arousal
- help stay awake, lose weight, boost mood, athletic performance
- cause a crash (agitation/depression) after a rush
  - especially seen in cocaine and MDMA because of depletion of neurotransmitters

- cocaine/crack
  - snorted, injected, or smoked
  - increases focus, mental alertness, eliminates fatigue and decreases appetite
  - taken in large amounts prolonged use can cause depression, anxiety, irritability, sleep problems, paranoia, convulsions, death
  - associated with high energy jobs because it boosts energy and productivity (also may only be affordable to these people (bankers, lawyers))

- MDMA (ecstasy)
  - a derivative of amphetamine, used largely at clubs/raves
  - does not cause overt hallucinations, but may cause distortion of time perception
  - causes the release of serotonin and blocks its reabsorption
    - serotonin regulates mood, aggression, sexual activity, pain, sleep
  - depletion of serotonin causes depression
  - high dosages cause overstimulation of sympathetic nervous system, dehydration, overheating, death
  - may affect sleep cycle and immune system
  - exposure linked to long term damage to neurons involved in mood, thinking, and judgment
    - serotonin nerve terminals are also damaged

Drug Tolerance

- from repeated use, larger does is required to produce the same effect
- physical dependence/addiction
  - physical pain, craving for the drug
- psychological dependence/addiction
  - drug acts as a positive or negative reinforcer and thus is repeatedly used
  - pleasure or relief from negative emotions respectively
- tolerance is not even throughout the body
  - pleasure center of brain may need more of the drug for the same effect, but another part, such as cardiovascular control will not be able to tolerate an increased dose
- some drugs (usually hallucinogens) can have negative tolerance, less is required each time
  - could be because the drugs linger in the body for a very long time

Addiction

- some psychoactive drugs do not cause addiction (LSD)
- even in highly addictive drugs (cocaine, heroin), only 10% will show addiction
  - medical drug use results in a lower rate of addiction
- no causation in gateway drugs, only correlation
- recovery rate in medical treatment for addiction vs none are similar
- addictions do not occur in pleasant, non drug related activities, these are compulsions

Drugs and Crime

- many cultural, ethnic, religious, and racial differences
- punish severely = lower usage
  - hasn't worked so far
  - Cannabis usage is lower in the Netherlands than in the US

- in portugal, all drugs were decriminalized in 2001
  - lowered usage of heroin and marjiuana, deaths from herion, crime rate

Health and Drugs

- problems defining health related problems
- difficult to monitor problems with illegal drugs, because they aren't willing to contact authorities

- rating of drug harm
  - governments and WHO classify drugs based on how much harm they cause
  - degree of risk determines criminal penalties

  - physical harm: acute , chronic, risk from injecting
  - dependence related: intensity of pleasure, psychological dependence
  - social: intoxication, cost of treatment

Learning and Conditioning

- Habituation
  - the response to a repeated constant stimulus becomes smaller and eventually ceases
  - this can be a result of adaptation (receptor ignores, chemical supplies exhausted) or habituation (brain ignores)
  - occurs when two pieces of information match

  - habituation involves forming new memories, we learn not to respond
    - formation of memory involves a change in the nervous system

- Classical Conditioning
  - Ivan Pavlov (early 1920s)
    - salivary reflex in dogs
  - association is formed between two previously unrelated stimuli

  - acquisition (learning curve)
    - with increased trials, learning decreases slowly

  - generalization
    - respond to generalized condition from specific situation
    - similar stimuli will elicit condition stimulus

  - extinction
    - present bell but no food, kills the CR (contingent reinforcement)
      - CR is the idea that both appropriate and inappropriate responses have consequences

  - spontaneous recovery
    - a time after extinction, spontaneous recovery of the response

  - Thorndike's Law of Effect
    - responses that produce a satisfying effect become more likely to occur again
    - cause and effect

  - Watson and Skinner
    - Watson
      - laid out the basic tenets of the science of behaviour
      - psychology should study what is directly observable

    - Skinner
      - stimulation gives a response, which gives a consequence of response
      - association is formed between stimulus and response
      - operant conditioning
        - behaviour is controlled by its consequences
        - rate of response increases following learning

        - Skinner box: a highly controlled environment, all aspects of behaviour are controlled
            - in a box
    - reinforcer
        - anything that increases the rate of response
        - positive reinforcement
            - appropriate actions are given positive things
        - negative reinforcement
            - appropriate actions make negative things stop

        - primary reinforcer
            - gives us base needs (food, water, sex)
        - secondary reinforcer

        - schedules of reinforcement
            - fixed schedule
                - reinforcement occurs at predictable times
            - variable schedule
                - occurs at unpredictable times
                - much more strong, increases the number of responses

            - ratio schedule
                - occurs after a certain number of appropriate responses
                - increases number of responses
            - interval schedule
                - occurs after a certain amount of time

- extinction
    - response, whether appropriate or inappropriate, occurs because it has been reinforced
    - to remove a response, the reinforce must be removed

- punishment
    - inappropriate response is followed by punishment
        - in theory should result in extinction, but it doesn't always
    - positive punishment
        - a negative stimulus is added
    - negative punishment
        - a valued stimulus is removed
    - problems
        - consequences are not predictable, punishment may be seen as reinforcer (yelling at/being payed attention to)
        - individual may avoid situation
        - individual may stop responding altogether
        - a different, non-punishment stimulus may be added (give someone something when they ask nicely)

- Avoidance
  - animal learns to avoid an aversive situation
  - dentist = pain, leaving dentist = no more pain
    - learn to avoid the pain
  - difficult to remove, because the individual must meet the thing that they are trying to avoid

  - according to skinner, all learning requires the appropriate response to be reinforced
    - some learning may have no reinforcer

- modeling
  - learning which takes place by observation and imitation has no reinforcement
  - especially prevalent in children

- latent learning
  - rats explore a maze without any reinforcement
  - rats who have not been reinforced find food in maze at the same speed as those who have
  - must have learned a type of cognitive map (memory), learned without reinforcer

Motivation

Homeostasis
- maintenance of internal balance
- largely regulated by the hypothalamus

Social Biology
- much of behaviour is due to evolutionary principles (survival of the species/my genes)
- much of our behaviour has evolved from other animals
- many animal and human behaviours are inherited, used to be called instincts
  - common to all members of a species
  - term was dropped because this is not necessarily true

Value of Actions
- pleasure is a basic psychological motivator
  - mesolimbic dopamine system
    - this system can be activated by this system (pleasant things, electric shocks)

Maslow's Hierarchy of Needs
- triangle/pyramid of human needs (some are common to animals)
  - base has physiological needs (hunger, thirst, sleep)
  - next is safety and security (last step comes first, will give this up for food)
  - next is belongingness and love (socialization)
    - socializing increases likelihood of survival
    - explains depression, abusive relationships
  - next is self esteem needs

- next is self actualization needs
- last is self transendence (fulfilled, help out other people)

Sexual Motivation

- can be studied by surveys, but they may not be representative due to the type of people who are okay with answering the questions

- initiation
  - non primates, females determine sexual activity, dependent on the hormone estrogen
    - receptive (in heat) when estrogen levels peaks during ovulation period
    - testosterone levels are more constant, males are always ready (in all species)
      - associated with competition among males
      - castration results in no interest in sexual behaviour

  - primates (also dolphins and whales), males determine activity
    - sex hormones are less important
    - a good deal of activity is not associated with furthering the species, but survival of the species is still assured by constant sex
    - reinforced by pleasure

- sexual drives
  - men
    - males continue to engage in sexual activity into their 70s
    - middle aged men engage in extra marital affairs more often than females
  - women
    - aged 30-45 more sexually active than those around 20
      - more partners, casual sex (biologically their last chance)
    - sexual drive usually drops significantly around 40 or 50

- sexual orientation
  - non heterosexuals are minorities for obvious reasons
  - most heterosexual males have had homosexual fantasies
  - very difficult to change orientation, neither willpower or psychotherapy are effective

  - psychological causes
    - having opposite sex friends as a child, attracted to those who are different from your childhood friends (maybe)

    - genetics
      - if one identical twin is gay, 50% chance the other will be
      - if one fraternal twin is gay, 20% chance the other will be

    - environment
      - environment of the womb (exposure to androgens looked at)
  - women score higher at some things, and men at other, when tested
    - gay men score towards the women, gay women score towards the men

- brain differences
  - hypothalamus
    - many cadavers studied had AIDS, science wasn't great
  - posterior corpus callosum is larger in homosexual men

Hunger

- Cannon's study
  - put a balloon in a stomach, still felt hungry
  - drive comes from the brain, not from hearing our stomachs growl (peripheral signal)
    - cholecystokinin (CCK) signals food intake, lowers hunger drive
    - pectin YY (PYY) also lower hunger drive
    - ghrelin increases hunger drive

- central signals (hypothalamic)
  - levels of blood glucose and other nutrients measured by hypothalamus

  - lateral hypothalamus
    - controls lower set point, releases orexin, which increases hunger drive
    - stimulation with an electrode causes massive overeating (dont eat till stomach bursts)
    - lesions result in an animal refusing to eat (eat a minimal amount)
  - ventromedial hypothalamus
    - upper set point, lower hunger drive
    - stimulation results in starvation
    - lesions cause overeating

  - peripheral sites can signal emptiness or fullness
    - why stimulation of areas doesn't lead to death

- psychological factors
  - taste
    - some genetic (sweet and salty) while some are conditioned
  - ecology of eating
    - social factors: we eat more with others
    - unit bias: we will eat more when presented with larger portions (also utensils)

- disorders
  - anorexia
    - weight at least 15% less than normal
    - 1% of adult females, occurs much less in men
    - predominantly young, white, high socio-economic status
      - seen more in families which emphasize perfection and achievement
      - almost entirely psychological, not genetic
    - hard to treat, most deny that there is a problem

    - perceived ideal body weight
      - in a study, men found ideal women 5kg heavier than what women said men looked

for

- obesity
  - in the last 40 years, doubled (quadrupled in children)
  - negative attitudes towards obesity
    - less likely to be hired, socially ostracized
  - more likely to be depressed, causes more eating

  - causes
    - largely genetic
      - identical twins have the same weight, even if raised apart
    - social factors
      - women want to lose weight more than men
      - cheaper foods are generally worse for you

  - dieting (most dont work in the long term)
    - eliminate food as a reinforcer
      - changes upper set point
    - change metabolic rate

- bulemia
  - binge eating followed by elimination of food (vomiting or laxatives)
  - incidence not specific, therefore it is thought to be genetic
    - linked to depression, perhaps neurotransmitter deficiency

Memory

Stages of Information Processing
- encoding (acquisition)
  - much is encoded automatically, with no effort (feature extraction)
  - depth of encoding
    - little extracted with just visual, more so with addition of sound, even more so with semantic processing (defining a word)
- storage (retention)
- retrieval

Sensory Memory
- basic features of a stimulus are automatically extracted and encoded
- these are stored in a brief lasting sensory memory
- iconic (visual) and echoic (auditory)
- limited contents

Short Term Memory
- limited contents (7 +- 2)

    - chunking: mnemonic to aid memory (remember words, not letters)
- depends on rehearsal to maintain memory
    - rehearsal requires effort (active attention)
    - spacing effect: retention is higher when rehearsal is distributed
- serial position effect
    - primacy effect: remember the first things in a list better
    - recency effect: remember the last things in a list better

Long Term Memory
- permanent and essentially limitless
- consolidation: transfer from short term to long term
    - requires the hippocampus
    - loss of consciousness during this period results in memory not being stored

Memory Storage
- must be a permanent change to the nervous system
    - most likely at the level of the synapse

Types of Permanent Memories
- explicit (declarative)
    - memory for facts and experiences that one can consciously recall
- implicit memory (nondeclarative)
    - memories that exist but cannot be consciously recalled (motor skills)
    - implicit motor memories may be stored in the cerebellum
        - do not require consolidation via the hippocampus
    - priming
        - automatic thoughts from input (hear black, think white)

Amnesia
- loss of explicit memory, implicit is well preserved
- may not know they have some knowledge, but they can demonstrate that they do
    - knowledge without memory

Flashbulb Memory
- very vivid, precise, and long lasting memory, caused by a highly personal and emotional event
- stored on one occasion, retained for a lifetime

Retrieval
- recall
    - the ability to retrieve information from memory (fill in the blank)
- recognition
    - similar to priming, ability to identify items in memory (multiple choice)

Forgetting
- poor encoding: information was never stored

- poor storage: information fades over time
  - drops significantly in the first few years after, then levels out
- poor retrieval: information encoded and stored, but can't be retrieved
  - fading of physical memory trace or competition from newly formed memories
  - proactive interference: early storage interferes with new storage (password)
  - retroactive interference: old memories interfere with new ones

False Memory
- recalling past memories results in constructed memories to fill in missing information
- misinformation effect: receiving new information can alter previously stored information
  - more significant in memory that is fading

- childhood trauma
  - very poor memories of young years
    - may be repressed (goes against flashbulb memories)
  - can't measure levels easily because many cases might be misinformation

Emotions

Recognition of Emotions
- innate ability to recognize emotions
- James-Lange Theory of Emotion
  - perception of stimulus > physiological change > perception of physiological change > emotion
  - we do not feel fear because of a bear, we feel fear because our hearts are beating fast (cause of the bear)
  - problem: many emotions would be the same/similar
    - perhaps very subtle differences between physiological changes

- mimicking an emotion can lead to actually experiencing it
- empathy: observing someone express an emotion causes you to experience the emotion
  - mirror neurons

- Cannon-Bard Theory
  - physiological changes are slow, onset of emotions is rapid
  - emotion and physiological change occur simultaneously

  - to experience emotion, one must be physically aroused and cognitively label the arousal
    - arousal can intensify emotions
    - spillover effect: arousal from one even affects our response to other events
      - more likely to ask someone out after a period of fear, interpreted as sexual arousal

Arousal and Performance
- high arousal decreases performance similarly to low arousal

- easy tasks are best done at higher arousal than more difficult tasks
    - harder tasks need more attention

Expression of Emotions

- simple emotions generally universal
- more complex may change based on society, culture

- facial muscles express each emotion differently
    - anger most visible to us, has significance for survival
- tonality of voice and body movement also express emotions
- different emotions activate different brain regions
    - watching fearful or angry faces activate the amygdala
    - negative emotions may activate the right frontal lobe, positive the left frontal lobe

- Anterior Cingulate Cortex (ACC)
    - inhibition of inappropriate behavior
    - involved in deception

- Nucleus Accumbens
    - rich in dopamine receptors, deals with pleasure
- cultures that stress individuality have longer and more profound expression of emotions (Europe)
- cultures that stress communality, negative or self promoting emotions rarely displayed (Asian)

- facial feedback effect
    - facial expressions amplify our emotions by activating muscles associated with specific states
    - people who are told to smile fell happier than those told to frown, even if they felt the same way before
- behaviour feedback effect
    - same except behaviour

Fear

- adaptive emotion, prepares us for fight or flight
- innate (cliffs, snakes, spiders seen in primates) or learned
- genes can affect temperament (emotional activity)

- amygdala
    - associated with many emotions, particularly fear and anger
    - sensory modalities go to thalamus, then straight to the amygdala before rest of brain
        - so we recognize danger before we know what it is, for speed
        - olfaction skips the thalamus, straight to amygdala

Anger

- best recognized emotion
- catharsis (freud): emotion expression provides emotional release or catharsis

    - anger is released by expressing it
    - can lead to more anger (Schacter and Singer 2-factor theory)

Happiness

- feeling happiness causes us to do good things
- adaptation level hypothesis
    - we adapt to our present level based on past experience
    - rich people can be just as miserable as poor people, happiness is relative

- relative deprivation
    - we experience our personal level of happiness relative to others
    - feel better when comparing to shittier tier people