Psychology

The final exam is cumulative. The midterms are not cumulative. All exams are multiple choice. Highlight important concepts and terms and explanations.

Psych Intro-

1. Roots
2. 2. Some major issues
   - Stability vs. change
   - Rationality vs. irrationality
   - Nature vs. nurture
3. Perspectives
4. Subfields and types of psychologists

Until the 1920s, it was the study of inner mental experience.

Wilhem Wundt- 1879: established the first psychological lab. The focus at this point was introspection as a technique. Father of experimental psychology. Focus on introspection: Self-examination of mental life.

From 1920s to mid 1960s- study of overt behaviour.

John B. Watson: In USA, he thought that psychology should study only public events, measurable and tangible. He didn't think introspective data had a place in psychology. He was the father of behaviourism. Concrete, focused on what could be observed and proven.

Modern definition of psychology: Scientific study of behavior and mental processes.

Additional influences:

By 1920, there were unconscious influences on mind and behavior.

By 1950, neuropsychiology, called neuroscience now.

By 1970, cognitive influences became influences; our capacity to solve problems, reason, etc and how they influenced behavior.

Some major issues (debates)-

Stability vs. change: Does personality change as we grow older?

Rationality vs. irrationality: reliance on?

- cognitive (thought) abilities
- primitive impulses

Nature vs. nurture what guides development?
- Nature (Heredity/genetics)

- Nurture (environmental/experience)

John Locke 17th century:
- Tabula Rasa (blank slate)
- nurture

Charles Darwin:
- theory of evolution

- British biologist
- nature
- principle of natural selection (survival of the fittest)

Behaviorism: (J.B.Watson, B.F. Skinner)

- nurture

Interactionism:

- heredity and environment interact (interaction of nature and nurture)

Perspectives

Neuroscience

- specify neurobiological processes that underlie behavior and mental events

Evolutionary

- how evolutionary mechanisms may function and influence behavior

Behaviour genetics

- influence of variations in genes on behaviour variations

Psychodynamic

- How behavior can stem from unconscious processes. Things that we are largely unaware of. Freud.

Behavioural

- How observable behaviour is learned. Modify different kinds of stimuli and record the behavioural response, ie reward and punishment.

Cognitive

- how the mind processes information
- cognitive (mental) processes; ie perception, memory, problem solving

Social-cultural

- influence of culture and situation on behavior, ie why do Asians study more

Subfields

- Activities of psychologists

Research

Basic vs applied

Basic: describe and explain behavior and mental processes

Applied: assess a real life situation to solve a practical problem

Types of psychologists

Clinical- apply principles to assess, diagnose and treat emotional and behavioural problems and to enhance functioning

Psychiatrists: - MDs, prescription privileges

Developmental: study- human development and factors that shape it from birth to old age

Social study:

- how people perceive and interpret their social world
- how behaviours, beliefs and attitudes are influenced by others
- social relationships and behaviour of groups

School: - work with children to evaluate learning and emotional problems

Industrial/organizational/engineering- work for companies

Industrial: personnel selection/job training

Engineering: help design machines/work tools

Many other specialties ie geriatric, rehabilitation, forensic

2.

Psychological Science (Ch 1)

Agenda-

1. The scientific method
2. Description of behaviour
   - Case study

- Survey
- Sampling
- Naturalistic observation

3. Correlation
4. Experimentation (scientific method)

Science: -uses process/method/logic of inquiry to solve problems and generate a body of knowledge

Scientific knowledge- type acquired via scientific method

Scientific Method- the logic of inquiry

3 characteristics:

1- Control (most important); everything done to control all factors except one of interest. The purpose is to isolate the cause of an effect. Variable- any factor that can take on different values along some dimension
2- Operational definitions- define terms by the steps or operations used to measure them
3- Replication- observations must be reproducible

Scientific theory: an explanation describing a relationship between a phenomena and the factors assumed to influence it.

- Organizes principles
- Predicts behaviours or events

Hypothesis:

- A testable prediction
- Usually arise out of a theory
- Can be tested and rejected; used to modify theory

Description of behaviour

<u>Descriptive research</u>

Approaches/techniques to provide accurate description of:

- Particular situation
- Phenomena
- No cause and effect relationship inquiry
- Simply describe the relationship between variables

- Useful when: initially investigating, testing effectiveness of a solution to a problem

Case study: intensive study of a single subject. The purpose is to determine nature and causes of individual's behaviour. It is also to understand individual and similar future cases. It is usually clinical studies.

Four main problems with case study:

1. Lack of generalizability
   - Small sample size
2. Non-standardization of data collection
   - Comparisons difficult
3. Retrospective data (by recollection)
   - Accuracy?
4. Bias
   - In observation and interpretation

The survey- to describe behaviour or opinions of people by taking a self-report (questionnaire or interview) on a sample

Sampling:

Representative sample- random selection of a sample from a population (whole group)

- Each person in the population has an equal probability of being included

Naturalistic observation: observe and record behaviour in natural settings

- No intervention or manipulation of situation
- Can provide accurate description
- Time consuming
- Cannot determine cause and effect

Correlation: expresses the relationship between measures (variables)

In terms of direction and strength.

Scatterplot- graph plotting, two variables.

The correlation coefficient

- Statistic expressing relationship
- Symbolized: r
- Range
- -1 to +1
- Sign indicates direction of relationship
- When both increase or decrease together
- When the variables move in opposite directions the sign will be negative

Lecture #2 (continued)

Higher value means a stronger relationship.

Correlation coefficient r=+.37 The plus indicates the direction of the relationship. The .37 indicates the strength of relationship. The r is the correlation coefficient.

For example, exam scores and frequency of absences are a negative correlation. High school GPA and college GPA are a positive correlation.

- How it's used: No manipulation or treatment involved (simply measures variables)
- Can enable prediction
- Correlation alone cannot determine causality.

  Two problems:
  1. Reverse causation. Does variable A cause variable B or does B cause A?
  2. Third variable: One third variable could cause both A and B

For example, low self-esteem could cause depression or depression could cause low self-esteem or distressing events/ biological predisposition could cause low self-esteem and depression

Why use correlational design?
When we cannot ethically manipulate certain variables or it's not possible to manipulate certain variables.

<u>Experiment</u>
One definition: Objective observation of phenomena which are made to occur in a strictly controlled situation in which one or more factors are varied and the others are kept constant

Experimentation- researcher makes systematic changes to one variable and looks for effects of these changes on a second variable

- Can investigate cause and effect relationships.
  Three main advantages of experiments:
  1. Control
  2. Ability to manipulate variables precisely
  3. Able to determine cause and effect relationships

Three main

disadvantages of experiments:
1. Artificiality. 2- Design difficulties. 3- Time consuming

Independent variable- the one manipulated

Dependent variable- the one measured. Dependent depends on independent.

Experimental condition:

- Treatment condition
- Exposure to independent variable

Control condition:

- No exposure to independent variable

Random Assignment:

- To assign subjects to conditions
- People can't select which study group they want to be in because this causes bias.

True experimental study:

- Experimenter assigns subjects to conditions
- After experimental condition applied scores on the dependent variable assessed for all conditions

Experimental control:

- All factors controlled (kept equivalent for all groups) except independent variables; ie random assignment

Placebo:

- Inert substance or treatment

Placebo effect:

- Any effect on behaviour as a result of receiving a placebo

Placebo control group:

- Group who receives a placebo for comparison purposes

Blind procedure for subjects:

- Kept blind (unaware) of whether receiving treatment or not
- Controls for subject bias, which is the tendency to respond to cues and try to figure out the hypothesis and try to 'help'

Double-blind procedure:

- Both subjects and research staff are blind
- Controls for experimenter bias, which is an influencing outcome of the experiment because of their own motives which contaminate the results
- Experimenter bias could be if they communicate cues to subjects
- Data recording bias

Neuroscience and Behaviour (Ch 2)

Neural Communications

- Neurons
- Neural structure
- Neural functioning
- How neurons communicate

The nervous system

- Subdivisions

The Brain

- Neuroimaging techniques
- Lower level brain structures
- Cerebral cortex
- Functions of the cortex-: motor, sensory, association, language

Biological Psychology (Psych): (Also: neuro-or physiological psych or behavioural neuroscience)

- Establish connections between biology and behaviour

Neural communications:

Neurons are

- Nerve cells
- Basic unit of nervous system

Neuronal Structure: Cell Body contains

- Nucleus
- Cell life support structures

Dendrites:

- A number of short branches
- Project from cell body
- Message receivers
- Send messages to cell body

Axon:

- Fibre extending from neuron
- Message transmitter
- Sends messages from cell body down axon to terminal branches
- Message passed to other neurons/muscles/glands

Myelin Sheath:

- Layer of fatty tissue (insulates some axons)

Neuronal Functioning

Action Potential:

- Neural impulse as result of receiving signal or chemical message
- Brief electrical charge travelling down axon
- Electrochemical process

Ions:

- Electrically charged molecules

Resting Potential:

- A polarization
- Resting axon: inferior excess of negatively charged ions
- Outside axon: excess of positively charged ions
- Axon has closed gates to positive ions.

Depolarization:

- When the neuron fires: gates open and positive ions flood in
- Membrane depolarizes along its length

Refractory Period:

- Resting period after depolarization
- Neuron pumps positive ions out (ion pump) and then there is resting potential again

Threshold:

- Minimum level of excitation/stimulation required to trigger firing (all or nothing principle)
- Signals to dendrites and cell body can be inhibitory or excitatory and they combine

How neurons communicate:

- Terminal branches of axon of sending neuron are close to receiving neuron

Synapse:

- Junction between end of axon of a neuron and dendrite or cell body of the next

Synaptic Gap:

- Tiny gap at junction
- Neural impulse reaches terminals at end of axon
- Impulse triggers release of chemical messengers (from sacs at end of axon)

Neurotransmitters:

- Chemical messengers
- Cross synaptic gap
- Bind to receptor sites on receiving neuron
- Excite or inhibit an action potential in receiving neuron

Synaptic vesicles:

- Knoblike sacs that discharge neurotransmitters

Reuptake:

- Process by which excess discharged neurotransmitters are reabsorbed by the sending neuron
- Drugs can block reuptake, ie ssri inhibitors (Prozac)

Degradation

- Enzymes in receiving neuron inactivate neural transmitter
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How neurotransmitters influence us

- Over 70 different neurotransmitters

Dopamine: movement, attention, emotion

Dopamine hypothesis of schizophrenia

*too much

*antipsychotics block DA receptor sites

Parkinson's disease has too little

Serotonin- mood, hunger, sleep, arousal

- Levels raised by SSRI's (anti-depressants)
- LSD mimics it

Acetylcholine (Ach)

- Learning, memory, triggers muscle contraction
- - role in Alzheimer's disease
- Nerve gases: causes paralysis by destroying degrading enzyme

Endorphins

- Natural opiate-like neurotransmitters
- Released when in pain and during vigorous exercise
- Opiate drugs (analgeisics) resemble endorphins in molecular shape
- Norepinephrine (NE)

How psychoactive drugs alter neurotransmission

Psychoactive drugs

- Influence mental functioning and mood

Molecular Psychology

- Studies mental processes and their aberrations in terms of molecular interplay between neurons

Different drugs can act in various ways at the same synapse:

- Mimic effect
- Cause or block release
- Occupy receptor site and block out normal neurotransmitter
- Block or increase reuptake
- Block or increase degradation
- Block storage in pre-synaptic membrane

Agonist

- A drug that excites neuronal firing
- By mimicking or by blocking reuptake

Antagonist

- Drug that inhibits
- By blocking or by blocking release

Two subdivisions

1. Central nervous system, brain and spinal chord
2. Peripheral nervous system, nerves connecting central nervous system to other parts of the body (sense receptors, muscles and glands); autonomic and somatic. Autonomic is made of sympathetic and parasympathetic subdivisions

Nerves

- Sensory and motor axons bundled together in peripheral nervous system that connect to central nervous system

Sensory neurons (In PNS)

- Send information from sensory receptors (skin, muscles and joints) to CNS

Motor neurons (In CNS)

- Send instructions to muscles and glands

Interneurons

- In central nervous system
- Internal communication

The Brain

Neuroimaging techniques

- Seeing the brain

CAT (or CT) scan (computerized axial tomography)

- X-rays through head and measure amount of radiation getting through
- Can construct cross sectional picture and reveal brain damage

PET Scan (position emission tomography)

- Radioactive glucose injected

- Most active neurons will use and be most radioactive
- Can draw cross sectional pictures and identify epilepsy, blood clots, brain tumours

MRI (Magnetic resonance imaging)

- Use strong magnetic field, radio-frequency pulses and computers
- It can detect tumour and abnormalities of spinal cord
- Reveal information about mental functions

Brain Structures

- Three concentric layers

1- Brainstem (central core)
- Regulates primitive behaviours and survival functions
- Oldest and most innermost

2. Limbic system
- controls emotions

3. Cerebrum
- regulates higher intellectual processes

Lower level brain structures

The brainstem
- Extension of spinal cord

Medulla

- As spinal cord enters skull
- Controls heartbeat and breathing

Reticular Formation

- Neuronal network from spinal cord to thalamus
- Relay centre for sensory inputs
- Filter for sensory messages
- Control of arousal level (sleep/wakefulness)

Other lower level brain structures

Thalamus

- Top of brainstem
- Relay station directing incoming sensory information to higher brain regions

Cerebellum

- Convoluted and at rear

- Coordination movements

Limbic system

- Doughnut shaped structure
- Role in basic motives
- Four F's: fighting, (anger) fleeing, (fear), feeding (eating) mating (sex)
- Includes hippocampus, amygdala, hypothalamus

Hippocampus

- Critical role: storing new memories

Amygdala:

- Two clusters
- Role in rage and fear
- Can produce placidity with lesions
- Aggression with electrical stimulation

Hypothalamus

- Just below thalamus
- Centres regulate: eating, drinking, body temperature, sexual behaviour
- Critical role in regulating endocrine system (regulating hormones) by controlling pituitary gland
- Important role in stress response
- Has reward centres

Cerebral cortex

- Higher control centre
- Outer thin surface layer of cerebrum

Grey matter:

- cell bodies
- unmyelinated fibres

White Matter:

- beneath cortex
- myelinated and appears white

Cortical tissue:

- $1/8^{th}$ inch thick,
- 30 billion nerve cells
- Convolutions increase surface area

Glial cells

- Hold neurons in place
- Provide nutrients
- Remove waste, dead neurons and foreign substances
- Outnumber neurons by 9 to 1

Two cerebral hemispheres

right and left

- Joined by corpus callosum
- Each divided into four lobes

1. Frontal lobe
   - Problem solving, planning and judgement
   - Speaking and muscle movements
2. Parietal
   - Includes sensory cortex
3. Occipital
   - Visual areas
4. Temporal
   - Auditory areas

Functions of the cortex

Motor cortex

- Controls voluntary movement
- Body represented upside down
- Sides of body governed by opposite hemisphere cortex
- More motor cortex devoted to precise control functions

Sensory cortex

- Registers incoming body sensations
- Body represented upside down and body sensation goes to opposite hemisphere
- More sensory cortex devoted to sensitive areas

Visual Cortex

- Receives visual information
- Right hemisphere receives from left sides of each retina (i.e. left visual field to right hemisphere)
- Left hemisphere receives from left sides of each retina (i.e. right visual field to left hemisphere)

Auditory cortex

- Receives auditory information
- Both ears send to right hemisphere and left hemisphere but stronger connections to opposite side hemisphere

Association functions

- ¾ of cortex:
- Associating sensory inputs with stored memories
- Higher mental functions

Frontal association areas

- In frontal lobes
- Major roles:
- Problem solving
- Judging
- Planning
- Processing new memories

Damage:

- Inability to plan
- Lack moral inhibitions

Language

Aphasia

- Language deficits caused by brain damage
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Broca's area

- Left frontal lobe
- Controls speech via motor cortex
- Damage: Expressive Aphasia
- Can understand spoken and written language
- Problems enunciating
- Only key words used
- Speak in slow laboured way

Wernicke's area

- Left temporal lobe
- Controls word comprehension and expression (interprets and understands auditory code)
- Damage:
- Cannot understand meanings of words
- Produce articulate but meaningless speech

Angular Gyrus

- Behind wernicke's area
- Matches written (visual) words with auditory code
- & transmits code to wernicke's area (which interprets it)

Damage

- Inability to read
- Can speak and understand

Spoken word stimulus ---→

Auditory area ----→

Wernicke's area (word matched with auditory code and activates meaning)

Written word stimulus --→

Angular gyrus (matches visual word with auditory code) ---→ wernicke's area

- Majority of people have language functions in left hemisphere

General specializations

Left hemisphere

- Language expression/ verbal tasks
- Logic and mathematics

Right hemisphere

- Very limited language comprehension
- Spatial skills/spatial tasks
- Facial identification
- Facial expression of emotion

Two hemispheres

- Do not work independently
- Activities integrated

Vision

- Left hemisphere translates letters into sounds
- Right recognizes faces

Hearing

- Left- language sounds… Right- non-language sounds; music

Memory – left- verbal memory… right- visual memory

Language- left- grammar… right-humor, emotional content

Mathematics- left- arithmetic…. Right- geometry

Problem solving- left- problems to be solved, analytically… right- problems to be solved, holistically

Two hemispheres

- Do not work independently
- Activities integrated
- Behaviour depends on integrated functioning at biological levels
- However biological and psychological events are simultaneous

Reductionism:

- To reduce psychological notions to biological ones

Sensation ch5

- Basic principles: thresholds and sensory adaptation
- Vision: light energy, the eye, visual information processing, colour vision
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Sensation

- Detecting and encoding by sensory receptors of stimuli energies in environment
- (ie light energy, sound waves)
- Encoded as neural signals

Perception

- Selecting, organizing and interpreting sensations (higher level)

Basic principles

- Thresholds

Absolute threshold

- Minimum stimulus magnitude that can be discriminated from no stimulus at all
- Correct detection 50 % of the time defines absolute threshold

Psychophysics

- Study of relationships between stimulus energies and our psychological experience

Signal detection theory

- Proposes no one absolute threshold but detection depends on expectations, motivation, experience and level of fatigue
- Used to predict when we will detect faint stimulus

Difference threshold (just noticeable difference: JND)

- Minimum difference in stimulus magnitude between two stimuli necessary to detect a difference

Weber's law

- JND is a constant minimum percentage not a constant amount
- In general: larger the size of original stimulus, then sensory system less sensitive to intensity change

Sensory adaptation

- Sensitivity to an unchanging stimulus diminishes (sensory receptor sensitivity relies upon change)

Vision

- Depends upon:
- Physical light stimulus
- Ability to transform light energy into sights

Transduction-

- Process by which sensory systems transform stimulus energy into neural impulses

Light energy

- Electromagnetic
- Travels in waves with varying wavelengths

Eyes sensitive to:

- Small portion of wavelengths: 400 to 700 nanometers

Wavelength:

- Determines hue (colour)

Wave intensity:

Determines brightness

The eye:

- Cornea: transparent surface membrane
- Pupil: opening controlled by iris (muscle adjusts to light level)
- Lens: focuses incoming light rays by accommodating (changing shape)
- Retina: thin multilayered tissue on back surface, contains receptor cells that convert energy into neural impulses, sends impulses to brain

Two types of retinal receptors

1. Rods
   - More light sensitive than cones
   - Detect black white and grey
   - Mostly in periphery

2. Cones
   - Sensitive to detail and colour
   - Concentrated near fovea (focal point of retina containing no rods)
     need more light than rods

   Photopigments:
   - chemicals in rods and cones

   - Absorb light and a neural impulse sent to bipolar cells (in retina) and then to ganglion cells
   - Axons from all ganglion cells converge to form optic nerve (carries information to brain)

   Visual information processing

   - Optic nerves converge at optic chiasm
   - Messages transmitted to thalamus and on to visual cortex

Feature detectors:

- Neurons in visual cortex
- Respond to specific features of a visual stimulus, ie edges, lines, angles, movements
- Hubel & Weisel (Nobel:1981)
- Single-cell recording

- Monitor activity of a single neuron in response to a stimulus with micro-electrode implant in cortex

Neuronal systems interact and even higher level cells (temporal and parietal cortex) can respond to ‘a face’ and have recognition functions

Brain ‘Constructs perceptions’

Depends on:

- Assumptions
- Interests
- Expectations

Top-down processing

- Processes driven by knowledge and expectations

Bottom-up processing

- Processes driven solely by input

Parallel Processing

- Brain constructs perceptions by processing neural networks simultaneously (not a step-by-step serial process)

Young-Helmholtz trichromatic (three-colour) theory

- Noted: if you combine light waves of three primary colours (red, green and blue) you can create any colour
- Proposed: eye has a receptor for each primary colour (ie cones for red, green, blue)
- Each cone will absorb some wavelengths better than others
- Theory confirmed: retina has three types of colour receptors
- Cannot explain Eg: why we cannot see a greenish-red

Opponent process theory (Hering)

- Proposed two types of colour sensitive units each having opponent pairs
  1. Red OR green response
  2. Blue OR yellow response

Some neurons:

+ red - Green

- Red + green

+ yellow - blue

- yellow + blue

- Cannot simultaneously perceive colours in an opponent pair
- Activating one unit with red for eg: deactivates green

Two Stage theory (Hurvich and Jameson 1974)

- Trichromatic theory for receptor cells in retina
- Higher in visual processing (thalamus): colour opponent neurons (discovered: 1984) (confirmed by research: trichromatic cells feed into opponent colour ones in thalamus)