# Chapter 5 - Consciousness

Introduction to Psychology as a Behavioural Science (University of Windsor)

CHAPTER 1 - PSYCHOLOGY AND SCIENTIFIC THINKING

# WHAT IS PSYCHOLOGY? SCIENCE VERSUS INTUITION

William James often regarded as the founder of psychology. He believed psychology was a "nasty little subject". It answered the questions WHY and HOW human behaviours works rather than why you fall in love or get angry.

**Psychology and levels of analysis –** psychology isn't easy to define → scientific study of the mind, brain, and behavior. Another way to make this point would be that it describes psychology as a disciple that spans *multiple levels of analysis*. Thinking of it as rungs on a ladder, the lower rungs being biological influences (the brain) and the higher ones as social influences (the mind). It is crucial to understand that "brain" and "mind" are just different ways of describing the same "stuff"

- We can't understand psychology by only focussing on one aspects of analysis. Each tells us something different, allowing us to see from different perspectives.
    - Biological factors
    - Social factors

**What makes psychology challenging and fascinating? –** There are five major challenges that we find in psychology. These are of the following:

(1) *Multiple determined* human behavior is difficult to predict, in part because almost all our behaviour is produced by many factors
(2) *Psychological influences* are rarely independent of each other, making it difficult to pinpoint which cause or causes are operating.
(3) *Individual differences* people differ from one another in thinking, emotions, personalities, and behavior – these help to explain why people act differently in particular situations
(4) *Reciprocal determinism* people often influence each other – if an extravert you are likely to find people around you who are also outgoing. Their outgoing personality will in turn make you even more extraverted
(5) *Cultural differences* cultures differ in ways they might perceive a situation – studies have been done through **emic** (insider) and **etic** (outsider) approaches

**Why can't we always trust our common sense? –** Common sense tends to be contradictory to each other → absence makes the heart grow fonder vs. out of sight out of mind

**Naïve realism: is seeing believing? –** The belief that we see the world precisely as it is. We trust our common sense largely because of this factor. We trust our intuitive perceptions of the world and ourselves.

- If we are driving down a one lane road and a car is speeding the opposite was, our naïve realism tells us there is no room, get off the road
- The Earth seems flat, the sun seems to revolve around the earth. Yet both these statements drawn from naïve realism are false

**When our common sense is right –** Common sense isn't always wrong. Our snap 5 judgements of bout whether someone we've just watched in a videotape is trustworthy or not tend to be more right than you would think.

- Happy employees, make for more productive work environment. Studies show this to me true.

We must learn when – and when not – to trust our common sense. Doing so will help us become more informed consumers of popular psychology and make better-real world decisions

**Psychology as a science** – science is an *approach to evidence.* It consists of a set of attitudes and skills designed to prevent us from fooling ourselves. Science begins with *empiricism* – the premise that knowledge should initially be acquired through observation. Science refines our initial observations, subjecting them to stringent tests to determine whether they are accurate

**What is a scientific theory?** – Is an explanation for a large number of finding in the natural world, including the psychological world. It offers an account that ties multiple findings together. They generate predictions regarding new data we haven't observed yet. For a theory to be scientific, it must generate novel predictions that researchers can test.

- Misconception 1: a theory explains one specific event
- Misconception 2: a theory is just an educated guess

**Science as a safeguard against bias: protecting us from ourselves –** best scientists are aware of their biases and try to find ways to compensate for them. The scientific method is used to overcome the confirmation bias.

- **Confirmation bias:** the tendency to seek out evidence that supports our beliefs and deny, dismiss those that contradict them
- **Belief perseverance:** confirmation bias predisposes us the belief perseverance, this is the tendency to stick to our initial beliefs, even when the evidence contradicts them.

**Metaphysical claims: the boundaries of science –** it is important to distinguish the difference between scientific claims and metaphysical claims. Metaphysical claims are assertions about the world that we can't test, such as God or the afterlife. They cannot be proven by the scientific method.

**Recognizing that we might be wrong –** Many scientific conclusions prove to be wrong or partially wrong in their first attempt. One researcher found that about 1/3 of findings from published medical studies don't hold up in future studies. Researchers steer away from giving definitive proofs, rather they use "suggest", "appears, or "rises the possibility that".

## PSYCHOLOGICAL PSEUDOSCIENCE: IMPOSTERS OF SCIENCE

**The amazing growth of popular psychology –** The growth of psychology has not only led to an information explosion but also the *misinformation explosion*. This industry has had an enormous growth of treatments and products that claim to cure almost every imaginable psychological ailment.

**What is a pseudoscience? –** As set of claims that seems scientific but isn't. Pseudoscience lacks the safeguard against confirmation bias and belief perseverance that characterize science. We must be careful to distinguish metaphysical claims and pseudoscience claims because metaphysical claims cannot be measured but pseudoscientific claims can be, although not thoroughly.

**Warning signs of pseudoscience –** discuss the three most crucial warning signs

(1) *Overuse of ad hoc immunizing hypotheses:* is an escape hatch or loophole that defenders of a theory use to protect this theory from being disproven.
(2) *Lack of self-correction* – as a scientific claims turn out to be wrong, this may be seen as a weakness when it is in fact a strength. This is because wrong claims tend to be weeded out eventually, even though it often takes a while

(3) *Overreliance on anecdotes*: numerous anecdotes may seem impressive, but it shouldn't persuade us to put much stock in other claims. This is because most anecdotes are based on "I know a person who" claims

**Why we are drawn to pseudoscience? –** Our brains are predisposed to make order out of disorder and find sense in nonsense.

**The search for meaningful connections -** Apophenia: our tendency to perceive meaningful connections among unrelated phenomena, and pareidolia: our tendency to perceive meaningful images in meaningless visual stimuli.

- Apophenia: when we think of a friend that we haven't seen in a while and then the phone rings (it is the friend) we interpret this as ESP
- Pareidolia: looking at a cloud and seeing a shape of an animal

**Finding comfort in our beliefs -** Another reason for pseudoscience is motivation: we believe because we want to believe. We are especially more likely to seek out and find patterns when we feel a loss of control over our surroundings. Jennifer Whitson and Adam Galinsky deprived participants of their sense of control, they found tht the participants were more likely to engage to perceive conspiracies, embrace superstitious beliefs, and detect patterns with meaningless stimuli.

**Terror management theory –** Our awareness of our own inevitable deaths leaves many of us with an underlying sense of terror. We advocate this theory by adopting cultural world views, that there is a greater meaning and purpose to life.

- Researchers manipulate this theory by using *morality salience* (the extent to which thoughts of death are foremost in our minds)

**Thinking clearly: an antidote against pseudoscience –** we must learn to avoid commonplace pitfalls, such as *logical fallacies* these are traps in thinking that can lead to mistaken conclusions:

- *Emotional reasoning fallacies:* the error of using our emotions as guides for evaluating the validity of a claim
- *Bandwagon fallacy:* is the error of assuming that a claim is correct just because many people believe it.
- *Not me fallacy:* is the error of believing that we are immune from errors in thinking that afflict other people
    - Researcher have found a phenomenon called the *bias blind spot* this means that an individual is unaware of their own biases but aware of that of others.

**Danger of pseudoscience –** There are three major reasons why we should all be concerned about pseudoscience

(1) Opportunity cost: when looking at pseudoscientific treatments for mental disorders this may lead someone to forgo the opportunities to seek effective treatments.
(2) Indirect harm: treatments that are themselves harmless can cause harm indirectly by causing people to forfeit the chance to obtain a treatment that works
(3) Direct harm: pseudoscientific treatments can sometimes to dreadful harm to those who receive them, causing psychological or physical damage – occasionally death
    a. Candance Newmaker – rebirthing therapy accident

# SCIENTIFIC THINKING: DISTINGUISHING FACT FROM FICITON

**Scientific skepticism –** An approach of evaluating all claims with an open mid but insisting on persuasive evidence before accepting them. To be a scientific skeptic we must adopt 3 attitudes.

(1) A willingness to keep an open mind
(2) A willingness to accept claims only after researchers have subjected them to careful scientific testing
(3) An unwillingness to accept claims on the basis of authority alone

Skeptics are willing to change their minds when confronted with evidence that challenges their preconceptions, but only if the evidence is persuasive.

**A basic framework for scientific thinking –** the also known as *critical thinking* which is a set of skills for evaluating all claims in an open-minded and careful fashion. There are six principles of scientific thinking:

(1) *Ruling out rival hypothesis*: have important alternative explanations for the findings been excluded?
(2) *Correlation vs. causation*: can we be sure that A causes B?
(3) *Falsifiability*: can the claim be disproven?
(4) *Replicability*: can the results be duplicated in other studies?
(5) *Extraordinary claims*: is the evidence as strong as the claim?
(6) *Occam's razor:* does a simpler explanation fit the data just as well?

# PSYCHOLOGY'S PAST AND PRESENT

**Psychology's early history –** The field of psychology was difficult to distinguish from philosophy. In the late 1800's Wilhem Wundt developed the first full-fledged psychological laboratory in Leipzig, Germany. His students focused on basic questions concerning our mental experiences. Wundt used a combination of experimental methods including reaction time procedures, and a technique called *introspection* (method by which trained observer carefully reflect and report on their mental experiences). The pioneering work of Wundt began psychology as a science. But before this it also need to separate from spiritualism, it did so by creating a new field; the psychology of human error and deception.

**The great theoretical frameworks of psychology –** five major theoretical perspectives were founded:

(1) *Structuralism:* Titchner → uses introspection to identify basic elements or "structures" of experience
    a. Problems: highly trained introspectionists often disagreed on their subjective reports, and German psychologist Oshwald Kulpe showed that subjects asked to solve certain mental problems engage in *imageless thought* (thinking unaccompanied by conscious experience)
    b. Askes: WHAT
(2) *Functionalism:* William James influence by Darwin → to understand the functions or adaptive purposes of our thoughts, feelings, and behaviours
    a. Darwin believed in natural selection: emphasized the physical and behavioral characteristics evolved because they increased that chances of survival
    b. Askes: WHY

(3) *Behaviourism*: John B. Watson & B.F. Skinner → to uncover the general principles of learning that explain all behaviors; focus is largely on observable behavior
    a. Thought proper psychology was *observed* behaviour
    b. *Human mind as a black box* we know what comes in and out, but we needn't worry about what happens between
(4) *Cognitivism*: Jean Piaget & Ulric Neisser → to examine the role of mental processes on behavior
    a. Viewed thinking as merely another form of behavior
    b. Our interpretation of the rewards punishment are a crucial determinant of behaviour
(5) *Psychoanalysis*: Sigmund Freud → to uncover the role of unconscious psychological processes and early life experiences in behavior
    a. Impulse, thoughts, and memories of which we're unaware
    b. He believed that primary influences on behavior aren't forces outside the organism, but rather the unconscious drives

**Types of psychologist -** Clinical, counselling, school, developmental, experimental, biological, forensics, industrial-organizational psychologists

**Evolutionary psychology –** applies Darwin's theory of natural selection to human and animal behavior

- Biologist refers to *fitness* as the extent to which a trait increases the chances that organisms that possess this trait will survive and reproduce at a higher rate than competitors who lack it

**Free will-determinism debate –** to what extent are our behaviors freely selected rather than caused by factors outside of our control

- Major exception is the clause for insanity – legal systems assume that severe mental illness can interfere with people's free will.
- Skinner proposed that free will is nothing but an illusion, that we aren't consciously aware of the thousands of subtle environmental influences impinging on our behavior at any given moment

**How psychology affects our lives –** psychologist often distinguish basic (how the mind works) from applied research (how we can use basic research to solve real world problems)

**Application of psychological research –** If you live in or near a big city, you may have noticed the change in fire engine colors, from red to yellow. This is because psychological research has shown that people have a stronger response to the color yellow rather than red.

Cars previously only have two brake lights but studies have shown that an additional third brake light at the base of the windshield would be beneficial. This is because the addition of visual information would decrease the risk of rear-end accidents.

According to behaviourist people tend to respond more to faces in magazines that are on the left hand side rather than the right. Written text in contrast also better captures their attention.

To get into college or university you may have to take a set of standardized tests

Police officers who asks victims of violent crimes to select a suspect from a lineup. Traditionally using *simultaneous lineups* in which the suspect and decoys were to lineup in a row. NOW we use *sequential lineups* were the suspects take their turn to enter the room then decide whether or not he or she saw the perpetrator is more accurate.

CHAPTER 2 - SCIENTIFIC METHODS

**Facilitated communication -** For infantile autism, sits the child down with a keyboard on front of them. With an adult as a helper (holding the hand) these children are able to perform full sentences. Founded by Douglas Biklen. – Jenny Storch reported sexual abuse about her father.

- Studies eventually showed that in virtually 100% of the trials the typed word corresponded to the picture flashed by the facilitator. It seemed that the facilitated communication originated entirely from the minds of the facilitator. Scientist identified it as *ideomotor effect*.

## THE BEAUTY AND NECESSITY OF GOOD RESEARCH DESIGN

**Why we need research design –** the facilitated communication story tells us why. Without research designs, even intelligent people can be fooled.

For several decades mental health professionals turned to *prefrontal lobotomies* as an effective treatment of schizophrenia and other severe mental illness'.

**Heuristics –** mental short cuts – help us to streamline our thinking and make sense of the world. These may have an evolutionary component. According to cognitive psychologist we are all cognitive misers, that is mentally lazy and try to conserve our mental energies by simplifying the world. Occasionally this method can get us in trouble. In some cases it can lead us to not merely simplify reality, but to *oversimplify* it.

**Representation of heuristics –** Daniel Kahneman and Amos Tversky pioneered the study of heuristics. When we use this term we judge the probability of an event by its superficial similarity to a prototype. "We judge a book by its cover"

**Base rate –** a fancy term for how common a behavior or characteristic is. *Base rate fallacy* when we neglect to consider base rates

**The availability heuristic –** we estimate the likelihood of an occurrence based on the ease with which it comes to our mind

**Cognitive biases –** systematic errors in thinking

- Confirmation bias: tendency to seek out information that is the same as our hypothesis
- Hindsight bias: tendency to overestimate how well we could have successfully forecasted known outcomes → "I knew it all along" effect
    - Overconfidence: tendency to overestimate our ability to make correct predictions

## THE SCIENTIFIC METHOD: TOOLBOX OF SKILLS

It is a tool box designed to counteract our tendency to fool ourselves. The following tools permit us to test *hypothesis*:

**Naturalistic observation –** this means watching behavior in a real world setting, rather than in a laboratory because the lab may cause for false effect, or not get the full effect. By doing so, we can better understand the range of behaviors displayed by individuals in the "real world", as well as the situations in which they occur.

- Study by Robert Provine on laughter, he eased dropped on 1200 instances of laughter, were he evaluated the response. He found that women are more likely to laugh in social environments and

20% of the time the statements made preceding laughter couldn't remotely be described as funny. Speakers laugh considerably more than listeners

- **Major advantage:** high in *external validity* – extent to which we generalize our findings to "real world" settings. Although there is not much research to support this claim.
- **Major disadvantage:** they tend to low in *internal validity* – the extent to which we can draw cause-and-effect inferences. These instances can also be problematic if the people know they are being observed, as this can affect their behaviour.

**Simplest design in psychologist's investigative toolbox** – the case study. This can be helpful in providing *existence proofs* – demonstrate that a psychological phenomenon does in fact occur. They provide a valuable opportunity to study rare or unusual cases that are difficult or impossible to re-create in a la, such as a person with atypical symptoms or rare types of brain damage. They offer useful insights that researchers can test in systematic investigations.

- **Limitation:** cases almost never lend themselves to systematic tests of hypotheses about cases almost never lend themselves to systematic tests of hypotheses about *why* a given phenomenon occurred. ALSO we don't know if the knowledge gained in a single case generalizes beyond that case

**Self-report measures and surveys: asking people about themselves and others –** psychologists often use *self-report measure* aka questionnaires or *surveys* to evaluate characteristic of a person

**Random selection: the key to generalizability –** identify a representative sample of the population and administer our survey to draw people from that sample. It is the procedure that ensures that everyone in a population has an equal chance of being chosen to participate.

- Crucial if we want to generalize our results to a broader population

*Hite report on love* she sent out 100 000 surveys asking women questions about their marital relationships. The results were outstanding. But only 4.5% of the readers responded. She does not know if they responded because they could relate to the abusive questions, or they were unsatisfied with their relationship or not.

**Evaluating measures -** When evaluating a situation we must ask ourselves two particular questions:

- *Reliability:* is the measurement consistent
  - Test hold up over a span of time *test-retest reliability* (baseline test, tested 2 months later)
  - Also applies to interviews and observational data *interrater reliability* – the extent to which different people who conduct an interview, or who make behavioral observations, agree on the characteristics they are measuring.
- *Validity:* the extent to which the test measures what it is supposed to.

Reliability is a necessity for validity, because we need to measure something consistently before we can measure it well. A test can be reliable but invalid. We need to bear in mind that we can obtain different answers depending on how we word the question.

**Advantages and disadvantages of self-report measurements –** there are advantages and disadvantages to self-report questionnaires.

- *Advantages*: easy to administer, and measure things like personality traits and behaviours reasonably well
- *Disadvantages*: assume that respondent possess enough insight into their personality characteristics to report on them accurately. Assume that participants are honest in their responses.

- *Response sets*: tendencies to distort their answers to items, often in a socially desirable direction
  - *Positive impression management:* tendency to make ourselves look better than we are
  - *Malingering:* tendency to make ourselves appear psychologically disturbed with the aim of achieving a clear-cut personal goal → financial compensation for injury or mistreatment

**Rating data: how do they rate? –** Instead of having the individual measure themselves through a questionnaire, they have others rate them. A potential problem with this is that the rater could have a potential "blind spot". Aka the *halo effect* and *horns effect.*

- *Halo effect:* tendency of rating of one positive characteristic to "spill over" to influence the ratings of others characteristics that may not be completely accurate.
- *Horns effect:* tendency of rating of one negative trait, such as arrogance, to "spill over" to influence the ratings of other negative traits.

**Correlational designs –** examine the extent to which two variables are associated.

**Correlational guide –** correlations can be *positive* (one improves to other does too) or *negative* (as one goes up the other goes down). Also there is a *correlation coefficient* with 1.0 being the absolute value (perfect correlation).

- **Scatterplot**: a good method in visual measurement of correlation. It is a grouping of points on a two-dimensional graph in which each dot represents a single person's data.

**Illusionary correlation –** the perception of a statistical association between two variables where none exist.

- Examples: full moon, and strange occurrences, arthritis pain increase with rainy days
- People explain this using confirmation bias, availability heuristics (we tend to remember instances that come most easily to mind)

How to minimize the illusionary correlation effect? Force ourselves to keep track of disconfirming instances

**Correlation vs. causation –** correlation designs can be extremely useful in determining whether two variable are related. As a result is can help us predict behavior. An important *limitation* to the conclusions we can draw from correlation designs: correlation doesn't necessarily mean causation. Although a correlation *sometimes* results from causal relationship, we can't tell from a correlational study alone whether the relationship is causal.

**Experimental designs –** allow for cause and effect inferences. The difference among participants of observational designs is measured, but in experimental designs they are created.

**What makes a study an experiment: two components –** *operational definition* this is when we define out independent and dependent variables for the purpose of the study.

(1) Random assignment – participants are divided up into *controlled* group (doesn't receive treatment) and *experimental* group (receives treatment) *between-subject designs* is in an experiment, researchers assign different groups to the control or experimental condition. *Within-subject designs* experiments where each participant acts as his or her own control

(2) Manipulation of an independent variable - I*ndependent variable* is the variable that the experimenter manipulates, *dependent variable* is what the experimenter measures to see whether this manipulation has had an effect.

**Confounds: a source of false conclusions –** the level of the independent variable must be the *only* difference between the experimental and control groups. *Confounding variables* refer to the difference between the experimental and control groups other than the independent variable.

- Any additional treatment other than the independent variable is known as *confounding variable*

**Pitfalls in experimental design –** the placebo effect, the nocebo effect, the experimenter expectancy effect, and demand characteristics

**Placebo effect** – this is the improvement resulting from the mere expectation of improvement. Participants that receive the drug have gotten better merely because they know they were receiving treatment. Avoid this effect, it is critical that patients not know whether or not they receive treatment. That is, the patients must *remain blind* to the condition to which they have been assigned.

**Nocebo effect –** is harm resulting from the mere expectation of harm. Such as ancient African Voodoo.

**Experimenter expectancy effect/Rosenthal effect –** phenomenon in which researchers hypotheses lead to unintentionally bias the outcome of a study. Avoid this effect by instilling the *double blind effect* this is when neither the experimenter nor the participant know if they are a part of the controlled or experiment group.

- Clever Hans, a horse that seemingly displayed astonishing mathematical abilities. A psychologist found that the owner Osten and the viewer we *unintentionally cueing* the horse, toward the correct answers. Lead by changes in facial expression as he became close to the correct number.

**Demand characteristics –** these are cues that a participant picks up on from a study that allows to generate guesses regarding the researcher's hypothesis. The problem is when the participants think they know how the experimenter wants them to act, they may change their behavior. Avoid this effect using *disguising about the purpose* of the study. This can also be done by using "filler" or "distractor" question, questions that are repeated in different ways, to see for potential inconsistencies.

## ETHICAL ISSUES IN RESEARCH DESIGN

Science itself is value neutral, this means that because science is a search for the truth, it's neither inherently good nor bad. This fact, doesn't imply though that scientific research, including psychological research, is value neutral. There are both ethical and unethical ways of searching for the truth.

**Tuskegee tale –** researchers wanted to know the long term effects on syphilis. There were 399 African Americans participants in the study. These participants didn't in fact know they were participating in a study, nor were they told they had syphilis. Even though it was a presently treatable disease. They tracked the subject's progress over time, with holding all information they had known to date.

- 28 died
- 100 died of syphilis related complications
- 40 transmitted the disease to their wives
- 19 children were born with syphilis

**Ethical guidelines for human research –** presently there is a heightened appreciation for protecting the rights of subjects. These studies could never be performed today because of the *Research Ethics Board* (REB**).** This board is in charge of carefully protecting the participants in trials. They adhere to a national set of guidelines found in the *Tri-Council Policy Statement* (TCPS) created by CIHRS, NSERC, and SSHRC. They have created the following guidelines:

(1) *Informed consent* – researchers must tell subject what they are getting into before asking them to participate. During this process participants my ask any questions about the study and learn more about what they are getting involved into.

REB may sometimes allow researchers to forgo at least some elements of informed consent. Such as some psychological studies involved deception. This topic is very controversial due to the study of Stanley Milgram. He invited volunteers to participate in a study of the "effects of punishment and learning" when in reality he was observing the influence of authoritative figures on obedience. The experimenter deceived the participants by leading them to believe that they were administering electrical shocks to other "participant" when they had answered a question incorrectly. Increase the voltage as the answers grew incorrect.

- The only way the TCPS will affirm that deception is justified is
  (a) Researchers couldn't have performed the study without the deception
  (b) Use of deception does not negatively affect the rights of the participant
  (c) Research does not involve a medical or therapeutic intervention

(2) *Debriefing:* REB requests that full debriefing be performed at the conclusion of the study. This is a process whereby researchers inform participants what the study was about. Sometimes they may explain their hypothesis in unethical ways, as to be simpler explained.

**Ethical issues in animal research -** About 7-8% if published research in psychology relies on animals. Studies are mostly conducted on rodents and birds. What most don't know is that the treatment of the animals are regulated by the CCAC. This committee ensure that humane care is provide for the animals while they are in the institution, and their clear goal in research that must greatly outweigh any stress or harm that come to the animal. Animals are used because there are no good alternatives.

## STATISTICS: THE LANGUAGE IF PSYCHOLOGICAL RESEARCH

**Descriptive statistics –** they do exactly as the name entails, *describe*. This type of statistic has two separate subtypes:

(1) Central tendency: give us a sense of the "central" score in our data or where the group tends to cluster
   a. *Mode*: most frequent scores
   b. *Median*: middle value
   c. *Mean*: the average score, this is generally the best statistic to report when our data form a "bell-shaped" or normal distribution

(2) Variability: sometimes called dispersion, gives us a sense of how loosely or tightly bunched the scores are
   a. *Range*: the difference between the highest and lowest scores, this method can be deceptive because two sets of data can have the same range but widely different distributions
   b. *Standard deviation*: depicts the variability, the average amount that an individual data point differs from the mean.

**Inferential statistics –** allows us to determine how much we can generalize findings from our smaple to the full population. In other words when we are asking ourselves whether or not we can draw conclusions regarding whether the differences we've observed in our sampleapply to similar sample.

**Statistical significance –** this is used to figure out whther the difference we've observed in our sample is a believable on. We need to conduct statistical test to determine whether or not we can generalize a statement to a population. We generally use a 0.05 level of confidence. This minimum lelvel 5 in 100 is taken as the probabilty that an occurrence happened by chance. If $p<0.05$ than it is *statistically significant.*

**Practical significance –** that is the "real-world" importance. A finding can be statistically significant yet be of virtually no "real-world" importance.

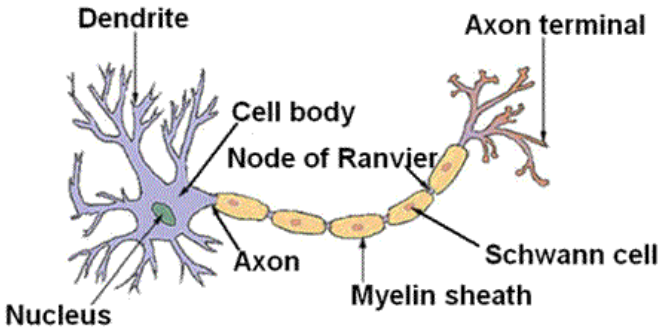
BIOLOGICAL PSYCHOLOGY – CHAPTER 3 – NATURE LECTURE

# NERVE CELLS: COMMUNICATION PORTALS

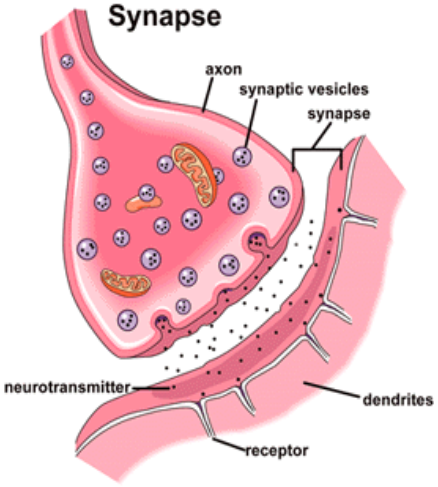
## NEURONS: THE BRAIN'S COMMUNICATORS

**Neurons** – these are specialized nerve cells for communicating with each other. We have 100 billion neurons in our brains, in addition each neuron makes millions of connections with others. In total there are about 160 trillion connections in the brain.

**The cell body –** AKA the soma, is the central region of the neuron. This is where the materials needed by the neuron are made. It manufactures new cell components (large and small molecules). Because this is where the nucleus is located, damage to this region can be fatal. The cell body provides continual renewal of cell components.




**Dendrites –** this is what makes neurons different from any other cell. Their branch-like extensions receive information (signal) from other neurons. The information received from surrounding neurons then makes its way to the cell body.




## AXONS AND AXON TERMINALS

**Axons –** are long tail like extensions protruding the cell body. Theses axons are specialized for sending messages to other neurons. Unlike dendrites axons are usually very thin and near the cell body. The narrowness of the axon creates a *trigger zone* – an area that is easily activated.

**Axon terminal –** these are knob-like structure at the far end of the axon. These contain the *synaptic vesicles* filled with neurotransmitter molecules.

**Synaptic vesicles** – these are tiny spheres that contain *neurotransmitters* – chemical messengers that neurons use to communicate with each other. These vesicles are created in the cell body and travel down the length of the axon. At the end of the axon terminal the vesicles "burst" releasing neurotransmitters.

## SYNAPSE

**Synapse –** It is a miniscule fluid-filled space between neurons through which neurotransmitters travel.

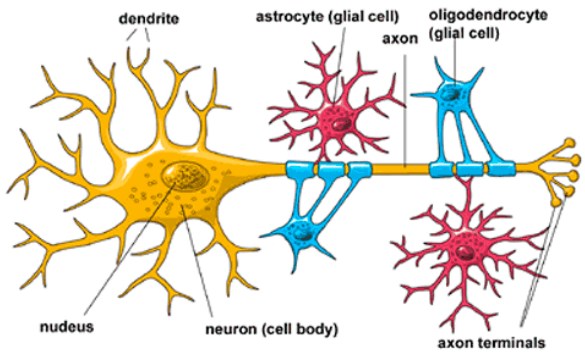
**Synaptic cleft –** is a gap into which neurotransmitters are released from the axon terminal. This gap is surrounded by small patches of membrane on each side, one side sending the neuron information and the other receiving it.

**Neurotransmitters –** once the neurotransmitters are released from the axon terminals into the synaptic cleft, they are quickly picked up by other dendrites of nearby neurons.

Neuroscientist Sir Charles Sherrington was the first to hypothesize the existence of the synapse. He measured how long it took a muscle to become active following nerve stimulation. He believe that neurons communicated with each other and muscles. But what he hypothesized could have been falsified had he been wrong. Santiago y Cajal prove this hypothesis to be right using staining methods techniques to demonstrate the existence of individual neurons.

## GLIAL CELLS

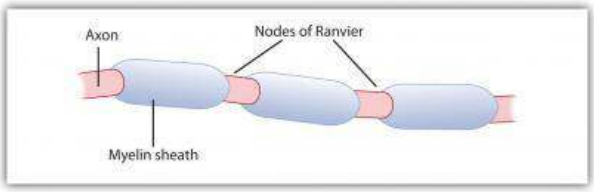
**Glial cells –** (glial means glue) these are cells in the nervous system that play a role in the formation of myelin and the blood-brain-barrier, responds to injury, removes debris, and enhances learning and memory. Treatments that target glial cells may assist in treating a variety of conditions related to the number and activity of cells, including depression and schizophrenia. Glial cells consist of many subcategory cells known as:




- *Astrocytes*: (*astro* meaning star) are the most abundant and star shaped cells. A single astrocyte interacts with as many as 300 000 to 1 million neurons. They communicate with neuron, increase the reliability of neurotransmission, control blood flow to the brain, and play a vital role in the development of the embryo.
  - We find astrocytes in great supply in the BBB (blood-brain-barrier) – a fatty coating that wraps around tiny blood vessels

Side note: the BBB is the brain's way of protecting itself from large molecules, highly charged particle and molecules that dissolve in water not in fat from entering. It protects itself from infection.

- *Oligodendrocytes*: promotes new connections among nerve cells and releases chemicals to aid in healing. These cells produce an insulated "wrapper" around the axon called the *myelin sheath*
  - Myelin sheath is a sheath contains a number of gaps called *nodes* – which help conduct electrical activity more efficiently
  - Node: the messages will jump from node to node making for a quicker transmission.




## ELECTRIFYING THOUGHT

Neurons respond to neurotransmitters by generating electrical activity. This electrical activity can be measured using *electrodes* – small devices made from wire or fine glass tubes. Electrodes allow scientists to measure the *potential difference* in electrical charge inside vs outside the neuron. The basis of travel for the neurotransmitter depends on the uneven distribution of charges in and outside of the cell membrane.

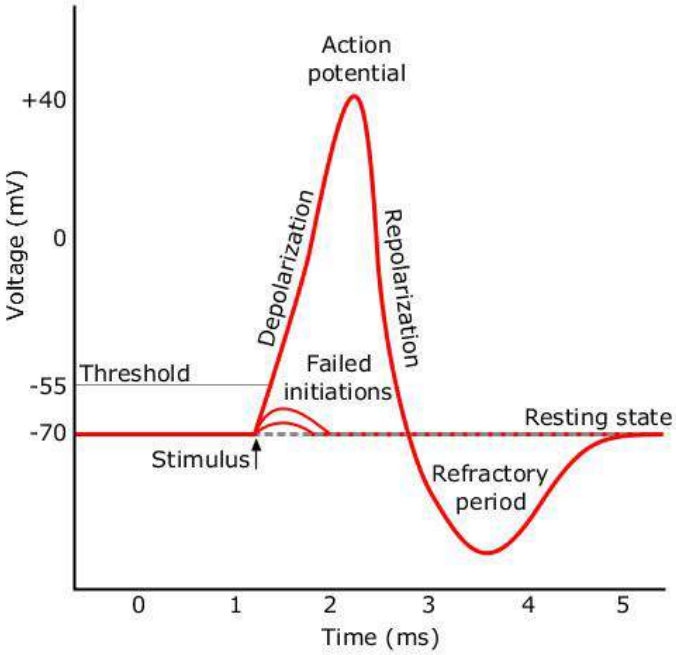
**Resting potential –** this is when there is no neurotransmitters acting on a neuron. In this state there are more NEGATIVE particles on the inside than outside of the neuron (-60 millivolts). While at rest particles of both + and – are flowing inside and out of the membrane

**Threshold –** when the electrical charge INSIDE the neuron reaches a high enough level relative to the outside. An action potential occurs.

**Action potential –** these are abrupt waves if electric discharge triggered by a change in charge inside the axon. When this change occurs it can be referred to as *firing.* Action potentials originate in the *trigger zone* near the cell body and continue all the way down the axon to the axon terminal.

- "all or none" law: either the neuron fires or it doesn't

**Firing –** during this time + charged particles flow rapidly into axons, and then just as rapidly flow out. Causing a spike in positive charge followed by a sudden decrease in charge, with the inside charge ending up at a slightly more – level than its original resting value. The sudden shift in charge produces a release of electricity. When this electrical charge reaches the axon terminal, it triggers the release of neurotransmitters into the synapse




**The absolute refractory period** – this happens shortly after the action potential, it is a brief interval during which another action potential can't occur. This period limit the *maximal firing rate*, the fastest rate at which a neuron can fire.

**Graded potential –** these are the *postsynaptic potentials* that can be excitatory or inhibitory depending on whether positively or negatively charged particles flow across the neuronal membrane and in which direction they flow.

When neurotransmitters bind to its appropriate receptor it causes the opening of the receptor. Since each are specialized to let in a specific charged ion, this can cause an **excitatory postsynaptic potential** (EPSP) IF positive ions are allowed in. this will *depolarize* the neuron. If negative ions move in, it will cause an **inhibitory postsynaptic potential** (IPSP); this hyperpolarizes the neuron.

Graded potentials of the same time are added together, while potential of opposing types (EPSP; IPSP) cancel out. A graded potential can increase or decrease the likelihood that an action potential occur, 'all or nothing' principle.

**Long term potentiation –** this occurs when the graded potential becomes larger than what it was prior to stimulation. This increases the ability of a neuron to communicate and fire action potentials and is the basis of our memories.

**CHEMICAL COMMUNICATION: NEUROTRANSMISSION**

Electrical events are used to transmit information within a neuron, chemical events initiated by neurotransmitters orchestrate communication among neurons.

After the neurotransmitters are release into the synapse, they bind to **receptor sites** along the dendrites of neighbouring neurons. Thinking of a lock and key analogy, neurotransmitters only fit to certain receptor sites.

Neurotransmission can be halted by **reuptake**, this is a process by which the synaptic vesicle reabsorbs the neurotransmitter. Reuptake is one of nature's recycling mechanisms.

**Neurotransmitters –** different neurotransmitters are different messengers. Some *excite* the nervous system, increasing activity; whereas other *inhibit* the nervous system, decreasing activity.

- **Glutamate and GABA -** these are the most common neurotransmitters in the CNS.
  - Glutamate rapidly excites the neuron, increasing the chances of neuronal communication. This release is associated with memory and learning. When overstimulated it may also contribute to schizophrenia or other mental illnesses
  - GABA inhibits neurons, thereby dampening their neural activity. This is why most anti-anxiety medication bind to GABA receptors
- **ACh** this plays a role in arousal, selective attention, sleep, and memory. In diseases like Alzheimer's the neurons containing ACh are progressively destroyed.
- **Monoamines: NE, dopamine, and serotonin** all only contain one amino acid
  - Dopamine plays a specific role in the reward experience that occurs when you accomplish a goa. It also plays a role in decision making and behavioural flexibility
  - NE and Serotonin activate or deactivate various parts of the brain, influencing arousal nad or readiness to respond to stimuli
- **Neuropeptides** are short strings of amino acids in the nervous system. They act as neurotransmitters but with a more specialized goal.
  - Endorphins plays a role in pain reduction, medicine such as morphine or codeine "hijack" the endorphins system by binding to the endorphins receptor sites.
- **Anandamide** plays a role in eating, motivation, memory, and sleep. This is an opiate such as marijuana's THC.

**Neurotransmitters and psychoactive drugs –** scientists have developed specific medications to target the production or inhibition of certain neurotransmitters. Drugs that interact with neurotransmitter system are called *psychoactive*, meaning they affect mood, arousal, or behaviour.

Opiates, like codeine and morphine, function as *agonists*, meaning they increase receptor site activity. More specifically, they reduce our emotional response to painful stimuli by binding with opioid receptors and mimicking endorphins.

Tranquilizers, like Xanax, diminish anxiety by stimulating GABA receptor sites, thereby tamping down neuronal activity

Anti-depressants, like Prozac, inhibit the reuptake of certain neurotransmitters, especially serotonin, from synapse. By allowing the neurotransmitters to remain in the synapse longer these medications enhance these neurotransmitter's effects on receptor sites.

Some drugs work in the opposite way, called *antagonists*, meaning they decrease receptor activity.

**NEURAL PLASTICITY: HOW AND WHEN THE BRAIN CHANGES**

Nature – our genetic makeup – influences what kind of changes are possible and when they will occur. *Plasticity* is used to describe the nervous system's ability to change.

**Neural plasticity over development –** typically our nervous system undergoes the most change during early development, when much of our nervous system has yet to be set in place. The network of neurons in the brain changes over the course of development in four primary ways:

(1) *Growth* of dendrites and axons
(2) *Synaptogenesis*, the formation of synapse
(3) *Pruning*, consistent death of certain neuros ad the retraction of axons to remove connections that aren't used
(4) *Myelination*, the insulation of axons with the myelin sheath

During pruning as much as 70% of neurons die off. This process streamline neural organization, enhancing the communication among brain structures.

**Neural plasticity and learning –** our brain changes as we learn. The synapses perform better by showing a stronger and more prolonged excitatory response, *long term potential*. Enriched environment lead to more elaborate dendrites with more branches.

**Neural plasticity following injury or degeneration –** brain plasticity sharply decreases on adulthood, occurring on a small scale. The human brain and spinal cord exhibit only limited regeneration after an injury or serious illness. But other parts of the brain can take over the function of the lost region. (i.e., Braille, dots in sequences used for the blind to read)

- **Stem cells** a cell, often originating in the embryos, having the capacity to differentiate into more specialized cells, this means that scientists can inject the stem cells into a person's nervous system and stimulate them to grown and replace other broken genes (gene therapy)
- **Neurogenesis** this is another way of getting around neuronal degeneration in the adult brain, this is the creation of new neurons. The odds are high that neurogenesis occurs in adult human brains. But why? One possibility is learning and another may play a role in the recovery of a brain injury.

## THE BRAIN – BEHAVIOUR NETWORK

The connections among neurons provide a physiological bases of our thoughts, emotions, and behaviours. We can think of our nervous system as a highway with two-way flow traffic

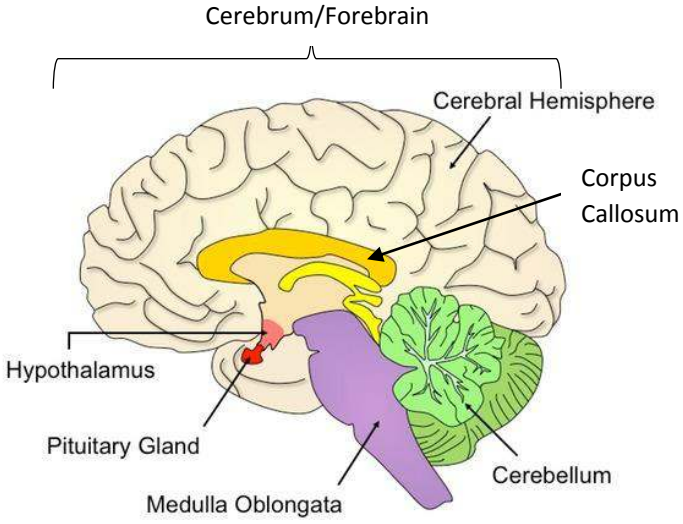
(1) Sensory information comes into the CNS, composed of the brain and spinal cord

All nerves that extend out of the CNS are known as the peripheral nervous system (PNS). The PNS is further divided into the somatic nervous system, which control non-voluntary – that is automatic – functions of the body.

### THE CENTRAL NERVOUS SYSTEM

The CNS is divided into two distinct sections/systems. The brain and the spinal cord are protected by the *meninges*, these are three thin layers of membrane. Further protection is provided by the *cerebral ventricles* – pockets in the brain that contain cerebral spinal fluid (CSF), which provide the brain with nutrients and cushions against injury.

**CEREBRAL CORTEX –** the *cerebrum*, or the forebrain, is the most highly developed area of the human brain. This gives us our advances intellectual abilities.

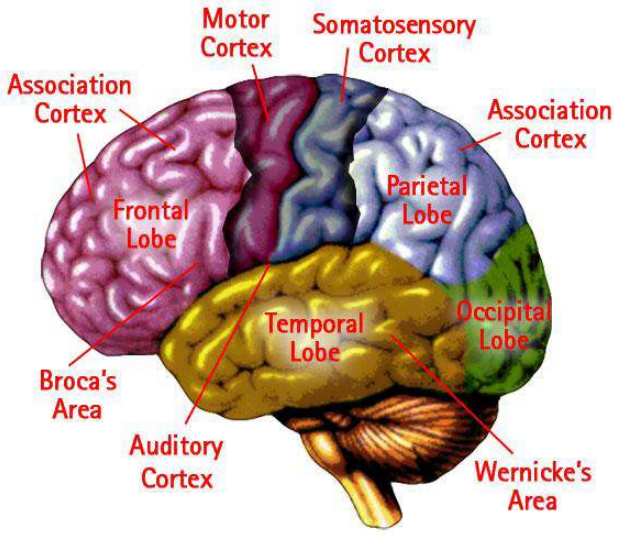


The cerebrum consists of two **cerebral hemispheres** – two halves of the cerebral cortex, each serves distinct yet highly integrated functions (communicate and co-operate continually).

The huge band of fibers connecting the two hemispheres is called the **corpus callosum**, meaning "colossal body" in Latin, this is what permits the hemispheres to communicate.

The largest component of the cerebrum is the **cerebral cortex**, this is the outer most part of the cerebrum. Known as the *cortex* meaning bark. The cortex is the place that analyses sensory information, helping us perform complex brain functions, including reasoning and language. The cortex contains regions called *lobes*, each associated with a somewhat different function. Yet each hemisphere contain the same four lobes:

- **Frontal lobe** – assists in motor function and movement, language, and memory. It is also the area that *executive functioning* occurs (oversees and organizes all other lobes functions). A *central sulcus* (deep grove) separates the frontal lobe from all other lobes.
    - **The motor cortex** is a part of the frontal lobe that lies next to the central sulcus. Each part of the motor cortex controls a certain area in the body, with regions requiring more precise control.
    - **Prefrontal cortex** this lies a large expanse of the frontal lobe, responsible for thinking, planning and language.
        - **Broca's area** – play a role in speech production → can understand words, not say

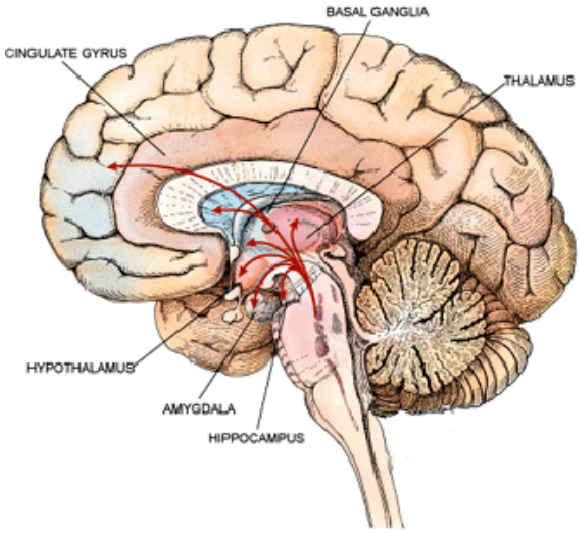



- **Parietal lobe** – the upper middle part of the cortex lying behind the frontal lobe that is specialized for touch and perception. The parietal lobe communicates with the motor cortex every time we touch, grasp, or move and object.
    - **Somatosensory cortex** interprets information coming from touch and perception
- **Temporal lobe** – lower part of the cortex that plays a role in hearing, understanding language, and memory. The lower part of this lobe is critical in storing memories of autobiographical events
    - **Wernicke's area** part of the temporal love involved in the understanding of speech → can speak but not understand
- **Occipital lobe** back part of the cortex, responsible for vision (*visual cortex*)

**Cortical hierarchies** – ***primary sensory cortex*** the regions of the cortex that initially process information from the senses (coming for outside). After information is passed by the eyes, nose, ears through the primary cortex it is then passed through another, which spread throughout all four areas of the brain - ***Association cortex***. This integrates information to perform more complex functions, such as color, shape, size…

**Basal ganglia** – structures in the forebrain that help to control movement. Damage to this area can result in diseases like Parkinson's, a lack in control of your movements and uncontrollable tremors. After the information is transmitted through the *primary and associate cortex* the information is sent through the basal ganglia, which calculates the course of action and transmits it to motor cortex

**THE LIMBIC SYSTEM –** this is the emotional centre of brain that also plays roles on smell, motivation, and memory. In contrast to the cortex' that process information about external stimuli, the limbic system process information about internal states, such as BP, HR, respiration as well as our emotions. It has evolved from a primary *olfactory sense* that controlled various survival behaviours. There are four areas of the limbic system:



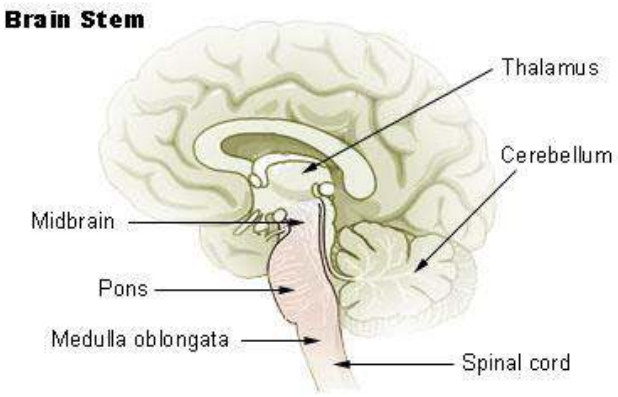

(1) Thalamus – this is a gateway from the sense organs to the primary sensory cortex
(2) Hypothalamus – part of the brain responsible for maintaining a constant internal state (homeostasis)
(3) Amygdala – part of the limbic system that plays a key role in fear, excitement, and arousal.
(4) Hippocampus – part of the brain that plays a key role in spatial memory – the memory of physical layout of things in our environment. Damage to this areas may cause problems forming new memories, but will keep all the old ones

**THE BRAIN STEM –** this is housed inside the cortex and located at the very back of our brains. This contains the *midbrain, pons, and medulla*. The brain stem performs some basic bodily functions that keep us alive. It serves as a relay station between the cortex and the rest of the nervous system.

- Midbrain plays an important role on movement, and controls tracking of visual stimuli and reflexes triggered by sound

The **reticular activating system (RAS)** connects the forebrain and the cerebral cortex; this system plays a key role in arousal. Damage to this area can result in a coma. The pathways emanating from the RAS activate the cortex by increasing the *signal-to-noise ratio* among neurons in the brain

**Hindbrain –** below the midbrain, which consists of the cerebellum, pons and medulla. The last two being a part of the brain stem




- **Cerebellum** plays a predominant role in our sense of balance and enables us to coordinate movement and learn motor skills
- **Pons** plays a crucial role in triggering dreams, connects the cortex to the cerebellum
- **Medulla** regulates breathing, heartbeat, and other vital functions. Damage to this area may cause *brain death*, an irreversible coma.

**THE SPINAL CORD –** this is a thick bundle of nerves that extend from our brain stem and runs down the middle of our backs. It conveys information between the brain and the rest of the body. *Nerves* extend from neurons to the body, travelling in two directions. Sensory information is carried from the body to the brain by way of *sensory nerves*; motor commands are carried from brain to the body by *motor nerve*s. The spinal

cord also contains sensory neurons that contact **interneurons**, neurons that send messages to other neurons nearby.

**Interneurons** – connect sensory nerves to motor nerves to be able to exert bodily movement without passing through the brain, this is a reflex.

### PERIPHERAL NERVOUS SYSTEM

**Somatic nervous system** – part of the nervous system that conveys information between the CNS and the body, controlling and coordinating voluntary movement

**Autonomic nervous system** – the brain, especially the limbic system interacts with the ANS to regulate emotion and internal physical states. It is the part of the nervous system controlling the involuntary actions of our internal organs and glands; along with the limbic system, it participates in emotion regulation. This consists of two division, the sympathetic nervous system (SNS) and the parasympathetic nervous system.

(1) Sympathetic nervous system – engaged during crisis or after actions requiring *fight or flight* response
(2) Parasympathetic nervous system – controls the *rest and digest* response

### CASE STUDY: MILLION DOLLAR MAN

High power lineman Jesse Sullivan. In 2001, he received an electric shock so powerful that it left his arms and legs burnt beyond repair. Needing an double amputation, he require prosthetic limbs, he was chosen to switch his ordinary prosthetic for a "thought-controlled" bionic arm; a limb hardwired to the nervous system

## THE ENDOCRINE SYSTEM

The limbic system co-operates with the endocrine system to regulate emotions. The endocrine system is separate from the nervous system. It consists of glands that release hormones into the bloodstream. Hormones differ from neurotransmitters because they travel in the blood vessels rather than nerves, os they are much slower in action.

### THE PITUITARY GLAND AND HORMONES

The pituitary gland controls the other glands in the body. This gland is under the control of the *hypothalamus*. It releases hormones for various functions. One hormone it *oxytocin* which is responsible for several reproductive functions.

### THE ADRENAL GLANDS AND ADRENALINE

The adrenal glands are located atop the kidneys, they manufacture a hormone called *adrenalin* and *cortisol*. *Adrenalin* boosts energy production in the muscles cells, thrusting them into action, while conserving as much energy as possible. It is nerves in the SNS that signal adrenalin to be released. This triggers:

(1) Contraction and constriction
(2) Opening of bronchiole and pupils
(3) Break down of fat and fatty acids
(4) Breakdown of glycogen

Adrenalin may allow people to perform amazing feats of strength in crisis situations. *Cortisol* regulates BP, cardiovascular function, body's use of proteins, carbohydrates, and fat.

### SEXUAL REPRODUCTIVE GLANDS AND HORMONES

Male → testes → testosterone Female → ovaries → oestrogen

Scientist argue that there is a minimal level of testosterone needed that does not correlate with aggression, but a higher level does correlate with aggression. Some say the testosterone in women regulate their sex drive.

## MAPPING THE MIND: THE BRAIN IN ACTION

### A TOUR OF BRAIN MAPPING METHODS

**Phrenology –** jokingly called "bumpology", was ones first attempt to map the brain. They believes that bumps on the skull as well as enlargements corresponded with personality and intellectual characteristics. Franz Joseph Gall was the founder of this science. What proved to be its undoing was the fact that it was unfalsifiable.

**Brain damage –** methods of studying psychological functioning following damage to specific regions. Scientists created lesions in experimental animals using stereotaxic methods. *Neuropsychologist* rely on sophisticated psychological test, like measuring reasoning, attention, and verbal and spatial ability, to infer the location of brain dysfunction in human patients

**Electrical stimulation and recording of nervous system activity –** researchers soon discovered that stimulating parts of the motor cortex in patients undergoing surgery creates very specific movements. This lead Hans Berger to develop the electroencephalograph (EEG), a device widely used today, measuring the electrical activity generated by the brain. This is a non-invasive process.

**Brain scans –** a virtual revolution in brain research occurred with the advent of brain scans, or *neuroimaging*.

- **CT scans:** computed tomography (CT) – allows us to visualize the brain's structure in a 3D format. It is a reconstruction of multiple X-rays taken through part of a body, which is far more detailed than a regular x-ray
- **MRI:** magnetic resonance imaging (MRI) – shows structural details using a scanner that detect the release of energy from hydrogen atoms in biological tissues following exposure to a magnetic field. This method is superior to the CT for detecting soft tissues
- **PET:** positron emission topography (PET) – this is a method of *functional imaging*, which measure changes in brain's activity in response to stimuli. This method relies on the fact that the brain consumes glucose. They inject a radioactive glucose in a person and track where the radioactive glucose is consumed
- **fMRI:** functional magnetic resonance imaging (fMRI) – this method is based on the *blood oxygenation level dependent*, this is the fact the neural activity quickens, with an increase of blood-oxygen levels in response to heightened demand. Because this method measures blood oxygen levels it has an indirect correlation with neural activity.
- **TMS:** transcranial magnetic stimulation (TMS) – applies strong and quickly changing magnetic fields to the skull to create electric fields in the brain. depending on the level of stimulation, TMS can either enhance or interrupt brain function in a specific region
- **MEG:** magnetoencephalography (MEG) – detects electrical activity in the brain by measuring tiny magnetic fields. MEG reveals patterns of magnetic fields on the skull's surface, thereby revealing

which brain areas are becoming more active in response to stimuli. One of its strength is that it can track brain changes over extremely small time intervals

**Magnetic stimulation and recording –** these methods have helped scientist discover deficits in the brain functioning of people with certain psychiatric disorders. It is extremely easy to misinterpret, largely because many laypersons and even newspaper reporters hold misunderstandings of how they work.

Scans are a product of subtracting brain activity on a "control" task from brain activity on an "experimental" task, which is of primary interest to the researchers. When researchers conduct the calculations that go into brain scans, they're typically comparing the activity of hundreds of brain areas across neural vs experimental tasks.

### HOW MUCH DO WE USE OUR BRAINS

The 10 percent myth – we do not use only 10% of our brains, this myth was created from a misconstrued statement of William James, who stated that we only use minimal amount of our brain. later this was disapproved through Karl Lashley, who created lesions in the brains of rats to see where memory was stored. He found that memory had no one section where is was stored, that is was active in all areas of the brain.

### WHICH PARTS OFOUR BRAINS DO WE USE FOR WHAT?

*Localization of function* is when scientist identify brain areas that are active during specific psychological task over and above a baseline rate of activity. William Uttal warned that researchers are too quick to assign narrowly defined functions to specific brain regions. Individual brain areas contribute to multiple psychological functions.

### WHICH SIDE OF OUR BRAIN DO WE USE FOR WHAT?

Roger Sperry won the Nobel Prize for showing that the two hemispheres serve different functions. His remarkable study was done through a split brained surgery on an individual who had uncontrollable epilepsy. Through his studies he found that the right visual field is the right half of information entering each eye, and the left visual field is the left half of information entering each eye.

He also found that the left hemisphere controls the right hand, and the right hemisphere the left hand.

## NATURE AND NURTURE

Our nervous system, of course, is shaped by both our genes and environment – everything that affects us after fertilization.

### HOW WE COME TO BE WHO WE ARE

**Biological material of heredity -** we know that plants and humans possess chromosomes – slender threads inside the cell's nucleus that carry genes, the genetic material. Genes are composed if deoxyribonucleic acid (DNA), a remarkable substance shaped like a double helix that stores everything cells need to replicate (reproduce) themselves. The genome consists of a full set of chromosomes and the heritable traits associated with them.

**Genotype vs phenotype –** genotype is out genetic makeup, the set of genes transmitted from our parents to us. Our phenotype is a set of observable traits.

- What we see are the dominant genes, meaning they mask the less dominant. In contrast, other genes are recessive which means they are expressed only in the absence of the dominant.

**Behavioural adaptation –** Charles Darwin had a theory of evolution by natural selection. He hypothesized that populations of organisms change over time by selective breeding among individuals within the population who possess an adaptive advantage. They survive and reproduce at higher rates than other organisms. Their successful adaptations have heightened levels of *fitness*, meaning they have better chance of passing on their genes to later generations.

**Human brain evolution –** brain regions with complicated functions have evolved the most. Our behaviours are most complex and flexible than those of other animals, allowing us to respond in many more ways to a given situation. Relative to our body size, we're proportionally the biggest-brained animals.

**BEHAVIOURAL GENETICS: HOW WE SRUDY HERETABILITY**

*Behavioural genetics* to examine the influence of nature and nurture of psychological trait, such as intelligence. This allows us to estimate the **heritability** – the extent to which genes contribute to differences in a trait *among individuals* – of traits and disease. This is typically expressed in percentage.

- If 60% heritability, this means that more than half of the differences *among individuals* in their levels of that trait are due to differences in their genes.

**Three major misconception about heritability**

(1) Heritability applies to a single individual rather than to differences among individuals – heritability tells us the differences among people not within one person
(2) Heritability tells us whether a trait can be changed – many believe that a highly heritable trait cannot be changed. Behavioural geneticist refer to *reaction range* as the extent to which genes set limits on how much a trait can change in response to a new environment
(3) Heritability is a fixed number – heritability can differ dramatically across different time periods and populations

**Behavioural genetic design –** scientist estimate heritability using one of three behavioural genetic designs: *family studies, twin studies,* and *adoption studies*

- Family studies: this research examines the extent to which a characteristic "runs" or goes together in intact families – namely, those in which all family members are raised in the same home. This can be used to estimate the risk of disorder among relatives of people afflicted with that disorder.
- Twin studies: this type of study looks at either identical (monozygotic) or fraternal (dizygotic) twins. Fertility treatments have no effect on the frequency of identical twins because they don't affect whether single egg is split, but those undergoing this treatment have a higher chance of conceiving fraternal twins.
- Adoption studies: studies of intact family members are limited because they cannot disentangle genetic from environmental influences. To address these shortcomings they have studied adoption. I adopted children resemble their biological parents on a psychological characteristics, we can typically assume its genetically influenced. The potential confound being *selective placement.*

SENSATION AND PERCEPTION – CHAPTER 4 – SENSATION & PERCEPTION LECTURE

# TWO SIDES OF A COING: PERCEPTION AND SENSATION

How do signals that reach to our organs get translated into information that our brains can interpret.

**SENSATION: OUR SENSES AS DETECTIVES**

**Transduction –** going from the outside world within, transduction is the process of converting an external energy or substance into electrical activity within our neurons. For all our senses activation is at its greatest when we first detect stimuli. After that our senses decline in strength, this is called *sensory adaptation.* If we didn't engage in sensory adaptation, we'd be attending to just about everything around us, all of the time.

**Psychophysics –** Gustav Fechner published a landmark work on perception. Out of his efforts grew *psychophysics,* the study of how we perceive sensory stimuli based in their physical characteristics.

**Absolute threshold –** psychophysics study this phenomenon, which is the lowest level of stimulus we can detect a change 50% of the time. This demonstrates how sensitive our sensory system is.

**Just noticeable differences (JND) –** this is the smallest change in the intensity of a stimulus that we can detect. This is relevant to our ability to distinguish strong stimuli from the weak.

- **Weber's law –** states that there is a constant proportional relationship between the JND and original stimulus intensity. In others word the bigger the stimulus the stronger the change will need to be to notice a difference in intensity.

**Signal detection theory** – this theory regards how stimuli are detected under different conditions.

- *Response biases* – this is our tendency to make one type of guess over another when we are in doubt about whether a weak signal is present or absent. This was discovered by Green and Swets who implemented a questionnaire which a person would answer yes or no and get the following
    - True positive – hit → hearing a sound that was present
    - False negative – miss → deny to hearing a sound that was present
    - False positive – false alarm → report hearing a sound that wasn't present
    - True negative – correct rejection →deny hearing a sound that wasn't there

**Sensory system to stick to one sense, or do they? –** Johannes Muller proposed that doctrine of *specific nerve energies,* which states that even though there are many distinct stimulus energies – like sound or touch – the sensation we experience is determined by the nature of the sense receptor, not the stimulus.

- *Phosphenes* when you rub your eye these are the little vivid dots of light, caused by pressure in your eye receptors
- Once our visual sense receptors send their signals to the cortex, the brain interprets the input as visual, regardless of how our receptors were stimulated in the first place
- *McGurk effect* we integrate visual and auditory information when processing spoken language, and our brains automatically calculate the most probable sound given the information from the two sources
- *Synesthesia* Galton was the first to describe this. It is a condition in which people experience cross modal sensations (McGurk effect) like hearing sounds when they see color

- *Grapheme-color synesthesia* is the most common form, this is when an individual will see a 6 as red and a 5 as green & *lexical-taste synesthesia* this is when an individual has different tastes for certain words

**PERCEPTION: WHEN OUR SENSES MEET OUR BRAIN**

Our brains piece together:

(a) What's in the sensory field
(b) What was just there a moment ago
(c) What we remember from our past

**Parallel processing** – this is the brains ability to attend many sense modalities simultaneously – multitasking. Two important concepts that go along with parallel processing are:

(1) **Bottom up processing –** which is the processing in which a whole constructed from parts. It start with a raw stimuli we perceive and ends with our synthesizing them into meaningful concepts. This kind of process is done primarily in the visual cortex
(2) **Top down processing –** this is a conceptually driven process influenced by beliefs and expectancies, which we impose on the raw stimuli that we perceive. This starts with the association cortex followed by the primary visual cortex

**Perceptual hypotheses –** a guess will be accompanied by fewer neurons than a concrete answer with a huge number of neurons.

- *Perceptual sets* – this is a set that we formed when expectations influence perceptions
- *Perceptual constancy* – the process by which we perceive stimuli consistently across varied conditions. Because of these different consistencies – size, color – we are able to see things as they are; a door is a door whether open or close.

**Role of attention –** this is our abilities to direct our attention to or from different aspects of our lives.

**Selective attention** – this is the process of selecting one sensory channel and ignoring or minimizing others. The major region that controls this is the reticular activating system (RAS) and the forebrain. Donald Broadbent's *filter theory of attention* views attention as a bottleneck through which information passes. He tested this theory using the *dichotic listening*, where he gave his volunteers messages and then they were asked to ignore them. When asked to ignore the messages, patients seemed to have little to no knowledge as to what the message had said. This study was later replicated using a *shadowing* technique (repeating the messages they paid attention to)

**Intentional blindness** – is the failure to detect stimuli that are in plain sight when our attention is focused elsewhere. Participants were asked to watch a video and keep track of the number of basketball passes the individuals took, but in the middle of the video, a women dressed as monkey hopped across the court, half the subjects failed to notice this change.

**The binding problem –** when we see an apple, many areas of the brain process it, yet we do not know how all this information becomes unified as a whole.

**Subliminal information processing** – scientist have discovered that we process many sensory inputs to which we're exposed unconsciously, and that many of our actions occur with little or no forethought or deliberation.

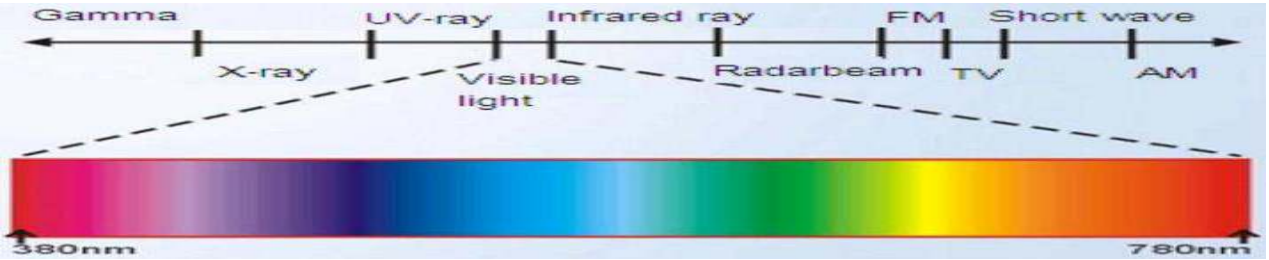
**Subliminal perception** – this is the processing of sensory information below the limen or threshold of conscious awareness. To study this participants are shown a word or photograph very quickly. They frequently follow this stimulation by another, which is the mask, to block the mental processing of the subliminal stimulus. For unclear reasons, the effects of subliminal information often vanish when subjects becomes aware of or even suspect attempts to influence them subliminally.

**Subliminal persuasion** – this is subthreshold influences over our votes in elections, product choices, and life decisions. *Illusionary placebo effect* this is caused by participants who had claimed to have improved after listening to self-help tapes, when in fact they had not improved at all.

## SEEING: THE VISUAL SYSTEM

**Light: the energy of life –** this is a form of electromagnetic energy composed of fluctuating electric and magnetic waves. Visible light has *wavelengths* of hundreds of nanometers. We as humans response to a narrow range of wavelengths of light; this range is called human visual spectrum. This spectrum increases with the amount of Vitamin A in our diets can increase our ability to see infrared light, which has a longer wavelength than red. The experience of color depends primarily on three dimensions: *brightness*, *hue*, and *saturation.* When light reaches an object, part of the light is reflected off and part is absorbed.

(a) *Brightness:* this is directly influenced by the intensity (amount) of the reflected light that reaches our eyes
(b) *Hue:* this is what we refer to as the color of an object
(c) *Saturation:* this is the level of purity of a color, a highly saturated colors appears as more vivid




### THE EYES: HOW WE REPRESENT THE VISUAL REALM

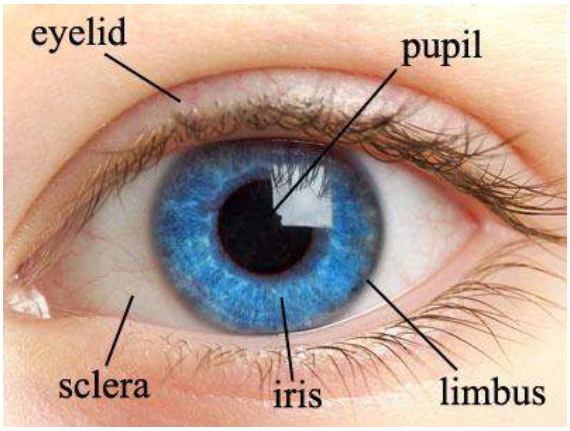
**How light enters the eye –** different parts of our eye allow in varying amounts of light, permitting us to see either in bright sunshine or a dark theater. Structures toward the front of the eyeball influence *how much light* enters our eyes, they focus the incoming light to form images at the back of the eye.

**Sclera –** this is simply the white of the eye

**Iris –** this is the colored portion to which we see. It is composed of two *pigments* (chemicals responsible for color):

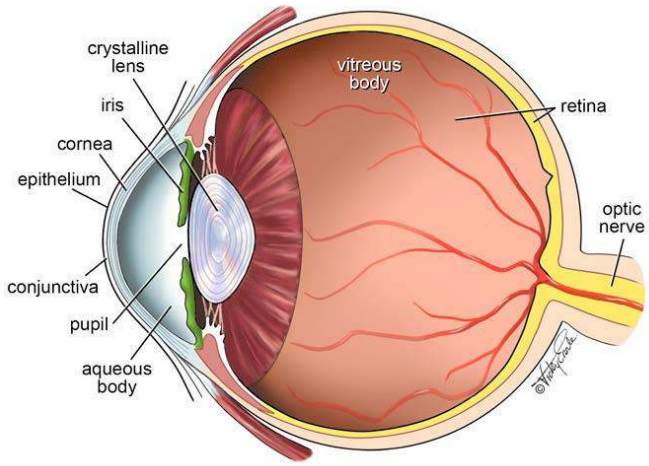
- Melanin → brown
- Lipochrome → yellow-brown

Those who have blue eyes have lipochrome pigments but they appear blue because blue light is scattered more by the iris containing less pigments



**Pupil –** this is the circular hole to which light enters the eyes. Closing of the pupil is a reflex response to light or object coming toward us. The pupal dilation (expansion) or constriction (shrinking) is what enables us to controls the amounts of light entering our eyes.

**Cornea –** this is a curved, transparent layer covering the iris and pupil. Its shape bends incoming light to focus the incoming visual image at the back of the eye.




**Lens –** also bends light, but unlike the cornea, the lens changes its curvature, allowing for fine-tune visual image. Consists of some of the most unusual cells: they are completely transparent, allowing light to pass through.

**Process of accommodation –** the lens changes its shape to focus on the back of the eye, in this way they adapt to different perceived distances of objects. These are "internal" corrective lenses. → More FLAT, means more distance; more FAT, means more close

**Shape of the eye –** the shape determines whether we are nearsighted (aka *myopia*) which results when images are focused in front of the rear of the eye, due to the cornea being too steep or our eyes being too long. OR farsighted (aka *hyperopia*) which results when our cornea is too flat or our eyes are too short. The loos of flexibility in the lens sue to aging is called *presbyopia*.

**The retina: changing light into neural activity –** according to scholars is a part of the brain, is a thin membrane at the back of the eye.

- **Fovea** this is the central part of the retina responsible for visual acuity, or sharpness of vision.

When light passes through the retina to sense receptor cells located on the outermost layer:

- **Rods** – this is the most plentiful, they are along and narrow. Enable us to see basic shapes and forms. We rely on rods to see in *low level light* – dark adaptation – time in the dark before rods regain maximum light sensitivity.
- **Cones** – shaped like cones, re responsible for seeing color. We put our cones to work when reading because it is sensitive to details. Cone require more light than rods do.

Different types of receptor cells contain *photopigments* – chemicals that change following exposure to light. Photopigments in rods are called *rhodopsin*.

**Optic nerve –** contains axons of *ganglion cells* – cells in the retinal circuit that contain axons, bundled together. This is the nerve hat travels from the retina to the brain. After the nerves leave their respectful eye they come to a fork called *optic chiasm.* Most of the axons are sent to the visual cortex in the thalamus and then the primary visual cortex, other are send to structures in the midbrain called *superior colliculus.* The place where the optic nerve connects to the retina is called the *blind spot.*

**VISUAL PERCEPTION**

Even though different parts of our brain process different aspects of a visual perception, we perceive whole objects and unified scenes, not isolated components

**How we perceive shape and contour –** while studying the visual perception in cats Hubel and Weisel accidentally discovered that many cells in V1 respond to bars of light that are presented at a specific orientation. For example, some cells will only respond to vertical bars, while others will only respond to horizontal bars, and yet other only oblique bars of light.

A complex cell that responds to a vertical line will still respond even if the oriented bar is shifted slightly to the right or left. What these responses suggest is that the cells in V1 are set up to respond to very simple features of our visual environment. These features can then be used as "building blocks" for our brain to reconstruct our visual environment.

**Featured detection –** this is our ability to use certain minimal patterns to identify objects. The cells allowing us to detect simple or complex shaped are called *feature detection cells* in that they detect lines and edges, there are more complex cells at higher levels of processing. The many visual processing areas of the cortex allow us to progress from perceiving basic shapes to the enormously complex objects we see in our wolds.

**Gestalt principle –** our brains often provide missing information about outlines, a phenomenon called *subjective contours*. Gaetano Kanizsa illustrates that with a mere hint of 3 or 4 corners we can come to the conclusion of its shape. These principles are rules governing how we perceive objects as wholes within their overall context. The main Gestalt principles are of the following:

(1) *Proximity* – objects that are close to each other tend to be perceived as a whole
(2) *Similarity* – we see similar objects as compromising a whole much more so than dissimilar objects.
(3) *Continuity* – we still perceive objects as wholes, even if another objects blocks one of them
(4) *Closure* – when partial visual information is presented, our brains fill in what's missing
(5) *Symmetry* – perceive objects in symmetrical arrangements as a whole more than those that aren't
(6) *Figure*-ground – we make an instantaneous decision as to what may be the center figure and ignore all that is in the back ground

**Rubin's vase illusion** – *bistable* image

**Face recognition –** our ability to recognize familiar faces, including our own. Scientist found that the lower part of the temporal lobes is responds to faces. Researchers have discovered that certain neurons in the hippocampus fire in response to celebrities faces. At the present, the most parsimonious hypothesis is that sprawling networks of neurons, rather than single cells, are responsible for face recognition.

**How we perceive motion –** motion is so important that there is a region in the brain that possess neurons solely devoted to processing motion information. This region is located along the pathway that leads to the parietal lobe and referred to as region V5. Neurons in this region respond to both direction and speed. The amount of motion needed for a single neuron to respond to a moving stimulus is the same as the amount of motion that is needed for an organism to see motion.

*Phi phenomenon* this is the illusory perception of movement produced by the successive flashing of images.

**How we perceive color –** scientist have discovered that we use the lower visual pathways leading to the temporal lobe to process color. There are many theories to explain the way we perceive color, such as the following:

- **Trichromatic theory –** proposes the idea that colour vision is based in our sensitivity to three primary colours – blue, green, and red. Young suggested that our vision is sensitive to three primary colors of light, and that other colors were combinations of the primaries
    - **Color blindness –** a person who is color blind cannot see all these colors, this is most often due to the absence or reduced number of one or more types of cones (3 color sensitive cones) stemming from genetic abnormalities
- **Opponent process theory –** is the theory that was perceive colors in terms of three pairs of opponent colors: either red or green, blue or yellow, or black or white. The *trichromatic theory* cannot explain after images. Ganglion cells of the retina and cells in the visual area of the thalamus that respond to red spots are inhibited by green spots

**How we perceive depth –** depth perception is our ability to see spatial relations in three dimensions. We can use two kinds of cues to gauge depth:

(1) Monocular depth cues – stimuli that enables us to judge depth using only one eye – this is done by the use of *pictorial cues* in which gives us a sense of what is located where in a stationary position:
   a. Relative size
   b. Texture gradient
   c. Interposition
   d. Linear perspective
   e. Height in plane
   f. Light and shadow

(2) Binocular depth cues – stimuli that enables is to judge depth using both eyes – because half of the nerves from the eyes are separated before meeting at the *optic chiasm*, this allows us to compare visual information incoming from both eyes – *binocular cues:*
   a. Binocular disparity – both eyes seeing different things
   b. Binocular convergence – when looking at a nearby object, we focus on them reflexively by using our eye muscles to turn our eyes inward – our brain is aware of how much our eyes are converging and it uses this information to estimate distance

**Depth perception appears in infancy –** Gibson and the *visual cliff*, infants between 6-14 months of age hesitate to crawl over glass elevated several feet above the floor, even when their mothers beckon.

**When perception deceives us –** this is done through several types of illusions

- **Moon illusions –** is the illusion that the moon appears larger when it is near the horizon, rather than high in the sky
    - **Misconceptions:**
        - This is due to errors in distance
        - When high is the sky there is nothing else to compare it too
- **Ames room illusion -** this is a distorted room that is in fact trapezoidal. Making someone appear to be very small on one side and large on another. Used in the Charlie and the Chocolate Factory and Lord of the Rings
- **Muller-Lyer illusion –** a line of identical length appears to be longer when it ends in a set of arrow pointing inward than outward
- **Ponzo illusion –** aka rail road track illusion, converging lines enclose two objects of identical size, leading us to perceive the object closer to the converging line are larger
- **Horizontal-vertical illusion** – causes us to perceive the vertical part of an inverted T to be longer than that of the horizontal part.
- **Ebbinghaus-Titchener illusion** – leads us to perceive a circle as larger when surrounded by smaller circles and smaller when surrounded by larger circles

### WHEN WE CAN'T SEE OR PERCEIVE VISUALLY

**Blindness –** this is the dramatic reduction in the ability to see, or, more specifically the presence of vision less than or equal to 20/200 on the Snellen eye chart. Objects at 20ft appear as though they are at 200ft in a normal sighted person. 20/20 is perfect vision.

The blind cope by emphasizing other senses, such as touch. Recent studies suggest that tactile sensitivity is indeed heightened in blind adults, giving them the same sensitivity as someone younger.

**Motor blindness –** serious disorder in which patients can't seamlessly string still images processed by their brain into the perception of ongoing motion.

**Visual agnosia –** this is a deficit in perceiving objects. A person with this condition can tell us the shape and colour of an object, but cannot recognize it or name it.

**Blindsight –** this is the phenomenon in which blind people who've experienced damage to a specific area of cortex can still make correct guesses about the visual appearance of things around them. People with blindsight have suffered damage to the V1, the primary visual cortex, so that route of information flow to visual association areas is blocked. Coarser visual information still reaches the visual association cortex through alternative pathways and bypass the V1.

## HEARING: THE AUDITORY SYSTEM

### SOUND: MECHANICAL VIBRATION

In a perfectly empty space there can be no sounds, this is because there are no molecules to vibrate.

**Pitch –** sounds have a pitch. Pitch corresponds with frequencies, if high frequency than it is high pitch; low frequency is low pitch. The human ear can pick up frequencies ranging from about 20 to 20 000Hz. When it comes to sensitivity of pitch age matters, hearing deteriorates as one gets older

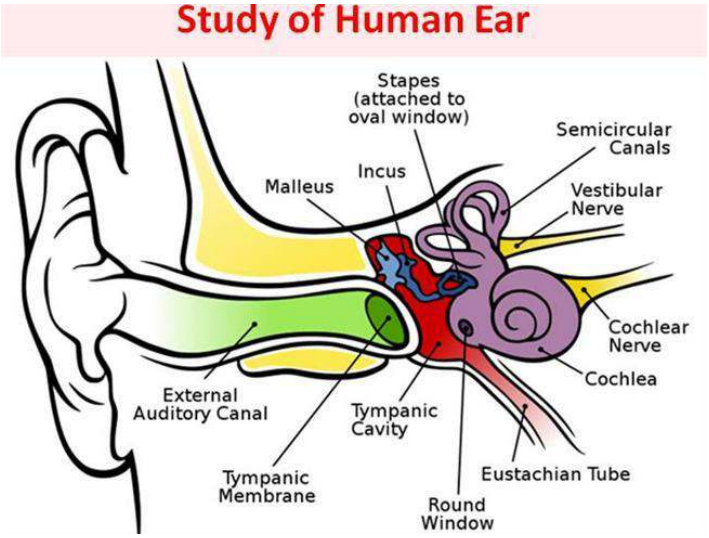
**Loudness –** the amplitude –or height- of the sound wave corresponds to loudness. It is measured in decibels (dB). Loud noises are of higher amplitude, and lesser noises are of lesser amplitude.

**Timbre –** this refers to the quality or complexity of the sound that makes musical instruments, human voices, or other sounds unique.

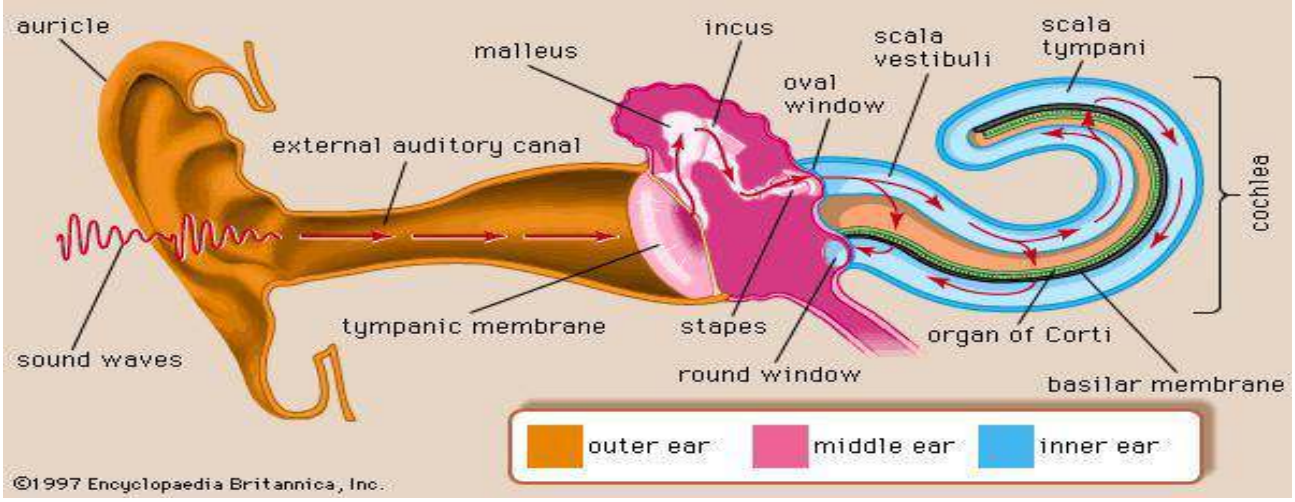
### STRUCTURE AND FUNCTION OF THE EAR

There are three parts to the ear: *outer*, *middle*, and *inner* each performing a different job.

- **Outer ear**: consists of the *pinna* (what we see, cartilage and skin) and the *ear canal* (funnels sound waves to the ear drum)
- **Middle ear**: *ear drum* containing the *ossicles* (smallest 3 bones in the body) – these are the *malleus, incus* and *stapes* – the ossicles vibrate at the frequency of the sound wave, transmitting it from the ear drum to the inner ear



- **Inner ear**: this is where the *cochlea* – converts vibration into neural activity – spiral shaped, on the outer parts of the cochlea it is body but on the inside it is filled with a thick fluid, in which the sound waves disturb and travel to the base of the cochlea, where pressure is released and transduction occurs
    - **Within the cochlea** – the *organ of Corti* and *basilar membrane* (supporting membrane of organ of Corti), these are critical parts because the organ of Corti contains hair cells imbedded within them, where the transduction of the auditory system takes place → that information feeds into the *auditory nerve*, which travels to the brain through the thalamus.




## AUDITORY PERCEPTIONS

Once the auditory nerve enters the brain, it makes contacts with the brain stem which sends auditory information to higher systems – the cortex.

**Pitch perception –** this is the primary auditory cortex processes different tones in different places

- At the BASE of the basilar membrane → most excited by high pitched tones
- At the TOP of the basilar membrane → most excited by low pitched tones

Scientist call this the *place theory* – a specific place along the basilar membrane matches a tone with a specific pitch. There are two routes to perceiving low-pitched tones:

(1) **Frequency theory –** the rate at which neurons fire action potentials faithfully reproduces the pitch. This method works well up to 1000Hz
(2) **Volley theory –** sets of neurons fire at their highest rate. This method is good for 1000 and 5000Hz.

**Localization of sound –** when the auditory nerve enters the brain stem, some of its axons connect with cells on the same side of the brain, but the rest cross over to the other side of the brain. This arrangement enables information from both ears to reach the structures of the brain stem.

- *Binaural cues* – two sources of information take a different route, they arrive at the brain stem slightly out of sync with each other, our brain compares the difference
- *Monoaural cues* – heard by one ear only

**Echolocation –** certain animals, such as bats, whales and dolphins emits sounds and listen to their echoes to determine the distance of an objects from themselves. Researchers have found that blind people have a strong sense of echolocation by using their mouth, clicking sound and listening to the echo.

### WHEN WE CAN'T HEAR

1 in 1000 people are deaf: they suffer from a profound loss or hearing, or those who have hearing deficits are "hard of hearing". Causes for being deaf are due to the following:

- **Conductive deafness –** this is due to malfunctions in the ear, especially a failure of the eardrum or ossicles of the inner ear
- **Nerve deafness –** this is due to damage of the auditory nerve
- **Noise-induced hearing loss –** loud sounds, especially those that last a long time or are repeated, can damage our hair cells on the basilar membrane

### CASE STUDY – THE STUDY OF MUSIC

Levintin studies music's effect on the brain. He had Sting listen to music while undergoing an fMRI scan. While different types of music showed different levels of brain activity, there was on type Muzak (elevator music), that did not show any change in brain activity. His response suggest s that he may be somewhat synthetic – seeing music.

## SMELL AND TASTE: THE SENSUAL SENSES

Smells is also known as olfactory and taste as gustation, these are chemical sense because we derive the sensory experiences from chemical substances. The most critical function of our chemical senses is to sample our food before swallowing it.

### WHAT ARE ODOURS AND FLAVOURS?

Odours are airborne chemicals that interact with receptors in the lining of the nasal passage. We are also sensitive to five basic tastes – sweet, salty, sour, bitter, and umami/meaty; there is believed to be a possible sixth taste, that of fatty foods.

### SENSE RECEPTORS FOR SMELL AND TASTE

Human have over olfactory genes. Each olfactory neurons contains a single type of olfactory receptor which "recognize" an odorant on the basis of its shape.

We detect taste with taste buds – sense receptor on the tongue responding to certain flavours. Bumps on our tongue are called *papillae* they contain numerous taste buds. It is a myth that there are certain areas of the tongue responsible for certain tastes. There is only weak tendency for individuals taste receptors to concentrate at certain locations on the tongue, and any location on the tongue is at least slightly sensitive to all tastes. The reason scientist believe this myth is because receptors that detect sweet tastes are often located on the tip of the tongue and receptors that detect salt are often on the sides, but there's a good mix of receptors everywhere on the tongue.

### OLFACTORY AND GUSTATION PERCEPTION

Our perceptions of smell and taste are often remarkably sensitive and more informative that we consciously realize. For example, babies can identify their mother odours and siblings can recognize each other on basis of odour.

After odours interact with the sense receptors in the nasal passages, the resulting information enters the brain, reaching the olfactory cortex and parts of the limbic system.

After taste information interacts with taste bud, it enters the brain, reaching a taste-related area called gustatory cortex, somatosensory cortex, and parts of the limbic system.

We analyze the intensity of both to determine whether it is pleasant. Parts of the limbic system, such as the amygdala, help us distinguish pleasant from disgusting.

*Pheromones* – odourless chemicals that serve as social signals to members of one's species – that alter sexual behaviour. Mammal detect this using their *vomeronasal organ*. Humans do not have this, instead it is said that a nerve called "nerve zero", may step in to enable pheromones to trigger responses in the brain.

## OUR BODY SENSES: TOUCH, BODY POSITION, AND BALANCE

The system we use for touch and pain is the *somatosensory system*. For body position we use *proprioception* and *kinesthetic sense*, and for balance we use the *vestibular sense*.

### SOMATOSENSORY SYSTEM: TOUCH AND PAIN

**Pressure, temperature, and injury –** this system responds to stimuli applied to the skin. The stimuli can either be very specific, or generalized to a larger area of the body. Damage to internal organs can cause referred pain.

**Specialized and free nerve endings in the skin –** we sense light touch and deep pressure through *mechanoreceptors*, specialized nerve endings located on the ends of sensory nerves in the skin. We sense touch, temperature, and especially pain with *free nerve endings*, which are far more plentiful than specialized nerve endings. Nerve endings of all types are evenly distributed across our body surface. Most of them in the finger tips and the fewest in the middle back.

**How we perceive touch and pain –** touch travels more quickly than pain. Often touch and pain trigger spinal reflexes. Most often with pain is the *withdrawal reflex*. After activating these spinal reflexes, touch and pain information travels upward through parts of the brain stem and thalamus to reach the somatosensory cortex. We cannot localize pain like we can touch, pain has a large emotional component.

According to the *gate control model* the idea that pain is blocked or gated from consciousness by neural mechanisms in the spinal cord – neural mechanisms function as a "gate", controlling the flow os sensory input to the CNS.

**Phantom limb illusion** – persons with amputated limbs often experience discomfort or pain in the missing limb. About 50-80% of amputees experience phantom limb sensation. Vilayanur Ramachandran and colleagues developed a treatment called *the mirror box*. This is where when the patient is experiencing sensations in the limb, they look in the mirror and realize it is not actually there.

**Pain insensitivity –** this is the impaired ability to sense pain, an extremely rare condition that is sometimes inherited. Others may show an indifference to painful stimuli: they can identify pain, but have no significant discomfort.

### PROPRIOCEPTION AND VESTIBULAR SENSE: BODY POSITION AND BALANCE

Proprioception is our sense of body position, our vestibular sense is our sense of equilibrium or balance.

**Proprioceptors –** we use this to sense muscle stretch and force. From these two sources of information we can tell want our body is doing. There are two kinds of proprioceptors:

- *Stretch receptors* imbedded in the muscle
- *Force detectors* imbedded in the tendons

This information enter the spinal cord and travels upward through the brain stem and thalamus to reach the somatosensory and motor cortexes.

**The vestibular sense -** in addition to the cochlea, the inner ear contains **3 semicircular canals**. These canals, are filled with fluid, help us with our sense of equilibrium and to maintain balance.

This information reaches parts of the brain stem that control eye muscles and trigger reflexes that coordinate eye and head movement. It also travels through the cerebellum, which controls bodily responses that enable us to catch out balance when we are falling.

**ERGONOMICS: HUMAN ENGINEERING**

A field in psychology called *human factors* optimizes technology to better suit our sensory and perceptual capabilities. Donald Norman stated that there are many everyday objects that are designed without the perceptual experiences of users in mind. These psychologist have applied their extensive knowledge of sensation and perception to improve the design of many everyday devices. For example, new designs for computer screen, keyboard, or mouse that can enable workers to better reach for their computer or see their screens can increase their efficiency.

# CHAPTER 5 – CONSCIOUSNESS

Susan Clancy believed that she was abducted by aliens while she was sleeping, and that she was starting to recall the horrific memories of the event.

**Sleep paralysis –** strange experience of being unable to move just after falling asleep or right before waking up. This is caused by the disruption in the sleeping cycle and is often associated with anxiety or even night terror, feelings of vibration, humming noises, and the eerie sense that a menacing figures close to or on top of the immobile person. This is believed to be the latest explanation for "alien abductions".

**Consciousness –** our subjective experience of the world, out bodies, and our mental perspectives.

## THE BIOLOGY OF SLEEP

Some theories suggest that sleep plays a crucial role in memory consolidation, others believe it is critical to the immune system, neural development, and contributes to our survival by conserving our energy.

**The circadian rhythm** – this terms means the changes that occur on a 24 hours basis in many biological processes. *Jet lag* is a disruption in our body's circadian rhythm.

**Biological clock –** term for the *suprachiasmatic nucleus* (SCN) in the hypothalamus that's responsible for controlling our levels of alertness.

Most of us need 7-10 hours of sleep, about 1% of the population with a gene mutation called DEC2 can sleep for 6 or less hours and be well rested.

After more than 4 days of sleep deprivation, we may even experience brief hallucinations. Sleep deprivation is also associated with a variety of health outcomes: weight gain, increase risk of high BP, diabetes, heart problems, less of an immune response to viral infections.

**Stages of sleep –** Nathaniel Kleitman and Eugene Aserinsky monitored his sons Armond's eye movement, and brain waves while sleeping. Whenever eye movement occurred, Armond's brain pulsed with electrical activity, as measured by an EEG. Aserinsky further suspected that his eye movement may be due to episodes of dreaming. The researchers were able to confirm this by awakening subjects experiencing REM, almost all reported having vivid dreams. Later research showed that in the stage of NREM dreams may still occur. Sleep consists of five stages:

(1) This is a light stage of sleep, where our brain activity powers down to about 50% or more. It then produces *Theta waves* which occur 4-7 times per second. In this stage we may experience *hypnagogic imagery* – scrambled, bizarre, dream-like images that flit in and out of consciousness. We may also experience sudden jerks of our limbs.
(2) Our brain waves are slowed even more. Sudden intense bursts of electrical activity called *sleep spindles* of about 12 to 14 cycles per second. Occasionally there are sharply rising and falling waves known as *k-complexes.* This set of waves ONLY occurs when you are asleep. *We spend more than 65% of our sleep in this stage.*
(3) After about 10-30 minutes light sleep gives away to much deeper slow wave sleep, in which we can observe *delta waves*. These waves are as slow as 2-3 cycles per second. In stage 3 delta waves only appear 20-30% of the time.
(4) In this stage *delta waves* occur more than 0.5 of the time. In order to feel fully rested in the morning, we need to experience these deeper stages of sleep throughout the night.

(5) After 15-30 minutes we return to stage 2 before our brain shifts dramatically into high gear. With high frequency, low amplitude waves resembling wakefulness. Stage 5 is more commonly known as REM sleep. This is the stage at which our brains are the most active. With each cycle REM sleep increases in time.

We don't only dream in REM sleep, although we dream more. 82% of REM sleep is associated with dreams compared to the 43% of NREM sleep. When humans are deprived from REM sleep we tend to experience the *REM rebound* the amount and intensity of REM sleep increases, suggesting that REM serves as a critical biological function.

**Paradoxical sleep –** the brain is active at the same time the body is inactive. But if our sleep didn't paralyze us we could potentially act out our dreams.

**Lucid dreaming –** this challenges the idea that we're either totally awake or totally asleep. Dreamed and known you were dreaming

- 72% of people who have had a lucid dream claimed they could control it, compared to 34% of non-lucid dreams.

**Disorders of sleep –** list of sleep disorders:

**Insomnia** – having trouble falling asleep and staying asleep.

**Narcolepsy –** disorder characterized by the rapid and often unexpected onset of sleep.

**Sleep apnea –** disorder cause by a blockage of the airway during sleep, resulting in daytime fatigue

**Night terrors –** sudden waking episodes characterized by screaming, perspiring, and confusion followed by a return to a deep sleep.

**Sleep walking -** walking while fully asleep.

## DREAMS

Scientist don't know we why dreams, but evidence from a variety of sources suggest that dreams are involved in:

(a) Processing emotional memories
(b) Integrating new experiences with already established memories to make sense of and create a virtual reality model of the world
(c) Learning new strategies and ways of doing things
(d) Simulating threatening events so we can better cope with them
(e) Reorganizing and consolidation memories

**Freud's dream protection theory –** Freud believes that during sleep the ego, which acts as a sort of mental censor, is less able than when awake it keep sexual and aggressive instincts at bay by repressing them. He distinguished between the *details of the dreams itself* (manifest content) and *the true meaning behind it* (latent content). But sexual themes account for as little as 10% of dreams we remember.

**Activation-synthesis theory –** developed by Alan Hobson and Robert McCarley which proposed that dreams reflect the brains activation in sleep, rather than repressed unconscious wish, as Freud claimed. They believed dreams were the brains attempt to makes sense of random and internally generated signals during REM sleep.

**Dreaming and the forebrain –** this demonstrates the emphasis on the forebrain and dreaming. Mark Solms surveyed 332 cases of patients with brain damage. With this he determined that with damage to the deep frontal white matter or the parietal lobes can lead to the complete loss of dreaming.

**Neurocognitive perspectives on dreaming –** those who believe this theory believe that explaining dreams only in terms of neurotransmitters and random neural impulses doesn't tell the full story. They contend that dreams are a meaningful product of cognitive capacities, which shape what we dream about.

- Studies reveal that dreams are associated with everyday activities, emotional concerns, and preoccupations

OTHER ALTERATIONS OF CONSCIOUSNESS AND UNUSUAL EXPERIENCES

**Hallucination** – a realistic perceptual experiences in the absence of any external stimuli. Brain scans reveal that the visual cortex becomes active, just as it does when we see real objects. A frequent misconception is that hallucinations only occur in individuals who are psychologically disturbed, although they may occur more often in these situations, they are not unique to the case. They can also be brought on by oxygen and sensory deprivation.

**Out of body experiences –** sense of our conscious leaving our body.

- 25% of students, and 10% general population have report this experience

**Near death experiences -** out-of-body experiences reported by people who've nearly died or thought they were going to die.

- Scientist have offered an alternative to this based in the chemical reactions within the brain as this experience occurs – may result from a massive release of *endorphins*

This experience can be caused by the following things:

(a) Electrical stimulation tot the temporal lobes
(b) Lack of oxygen to the brain
(c) Psychedelic and anesthetic

**Déjà vu experiences –** feeling of revealing an experience that is new. The frequency of déjà vu experience tend to decrease with age. What may cause this:

(a) Excess of neurotransmitter dopamine in temporal lobes
(b) Small seizures in right temporal lobe, largely responsible for the feeling of familiarity, might experience the feeling right before a seizure.

**Mystical experiences –** feeling on unity or oneness with the world, often strong spiritual overtones. Ways to measure this experience:

(a) fMRI
(b) brain scanning techniques

**Hypnosis –** a set of techniques that provided people with suggestions for alternations in theur perception, thoughts, feelings, and behaviors.

- Myths:

- hypnosis produces a trance-like state in which "amazing" things happen
- hypnotic phenomenon are unique
- hypnosis is a sleep like state
- hypnotized people are unaware of their surroundings
- they forget what happened during hypnosis
- enhances memory

**Theories of hypnosis -** Researchers have attempted to explain hypnosis through a variety of factors

(a) unconscious drives and motivations
(b) willingness to overlook logical inconsistencies
(c) receptivity to suggestion
(d) inhibition of the brains frontal lobe

**Sociocognitive theory –** reject the idea that hypnosis is a trance state or unique state of consciousness. They believe that people's attitudes, beliefs, motivations, and expectations about hypnosis, as well as their ability to respond to waking imaginative suggestions, shape their responses to hypnosis.

Participants told that hypnotized people can resist suggestions find themselves able to resist, whereas those told that hypnotized people can't resists suggestions often failed to resist

**Dissociation theory -** An influential alternative to sociocognitive theory. It is an approach to explaining hypnosis based on a separation between personality functions that are normally integrated.

**DRUGS AND CONSCIOUSNESS**

**Psychoactive drugs –** substances that contain chemicals similar to those found naturally in our brains that alter consciousness by changing chemical processes in neurons.

**Abuse vs dependence –** there is a fine line between the two, what starts out as a social factor between friends to get "high" can turn in to a dependence.

- *Substance abuse:* when they experience recurrent problems associated with drugs
- *Substance dependence:* more serious pattern of use, leading to clinically significant impairment, distress, or both
- *Tolerance:* a key feature to dependence this is the reduction in effect of the drug as a result of repeated use, requiring users to consume greater quantities to achieve the same effect
- *Withdrawal:* an unpleasant effect if reducing or stopping consumption of a drug that users consumed habitually
- *Physical dependence:* dependence on a drug that occurs when people continue to take it to avoid withdrawal symptoms
- *Psychological dependence:* dependence on a drug that occurs when continued use if the drug is motivated by intense cravings

**Explanation for drug abuse –** people often use drugs when they become available.

**Sociocultural influences –** cultures and groups in which drinking and drugs are strictly prohibited, exhibit lower rates of alcoholism

**Learning and expectancies –** people consume alcohol and other drugs to relieve anxiety, only when they believe that they will have this effect

**Genetic influences –** alcoholism tends to run in families.

**Depressants -** drugs that depress the effects of the central nervous system – alcohol and sedative drugs

- Sedative: drugs that exert a calming effect
- Hypnotic: drugs that induce a sleep-inducing effect

77% of Canadians consumed alcohol in 2010, alcohol acts as an emotional and physiological stimulant only at relatively low doses because it depresses areas of the brain that inhibit emotion and behavior. Compared with men, women have more body fat (alcohol isn't fat soluble) and less water in which to dilute alcohol.

**Balanced placebo effect –** the user expectancy, this is a four group design in which researchers tell participants they either are or aren't receiving an active drug and, in fact, either do or don't receive it. This allows researchers to tease apart the relative influence of expectancies and the physiological effects of alcohol and other drugs. In males expectancies may override pharmaceutical effects of alcohol on enhancing humour, anxiety reduction, and sexual responsivity.

**The sedative hypnotics –** when people have problems falling or have excessively high rates of anxiety, a doctor may prescribe them this. They are dangerous at high dosages and can produce unconsciousness, coma, and even death.

**Stimulants** – drugs that increase activity in the central nervous system, including heart rate, respiration, and BP.

**Nicotine –** has *adjustive values* meaning it can enhance positive emotional reactions and minimize negative ones.

**Cocaine -** increases the activity of the neurotransmitters dopamine and perhaps serotonin, which contribute to its reinforcing effects.

**Amphetamines –** three situations apply:

(1) Occasional use of small doses of oral amphetamines to postpone fatigue, elevate mood, and cram for test. In this case the intake doesn't become a routine part of the users lifestyle
(2) Users obtain drug from doctor, but ingest them on a regular basis for euphoria-producing effects rather that their prescribed purpose.
(3) Speed freaks – who inject large doses intravenously to achieve the "rush". The user is likely to have an inability to sleep and loss of appetite, be restless, talkative, and excited.

Meth can destroy tissues and BV and cause acne; it can also case weight loss, tremors, and dental problems.

**Narcotics –** heroin, morphine, and codeine are derived from opium plant. Opiates are often called narcotics because they relieve pain and induce sleep. 1-2% of adults have tried heroin. Heroin addiction is inevitable.

**Psychedelics -** LSD, mescaline, PCP, and ecstasy as hallucinogenic because they produce dramatic alterations in perception, mood, and thought.

**Marijuana -** most frequently used drug in Canada 42% of Canadians over the age of 15 have reported using it at least once. Scientist haven't found consistent evidence for serious physical health or fertility consequences of marijuana use.

**LSD and hallucinogens -** Approximately 11% of Canadians have tried LSD, the effect of psychedelics may stem from its interference with the action of neurotransmitter serotonin at the synapse.

CHAPTER 6 – LEARNING

**Learning –** a change in an organism's behaviour or thoughts as a result of experience.

**Habituation –** process of responding less strongly over time to repeated stimuli. This is the simplest and probably the earliest form of learning. This makes good *adaptive sense.*

- Neuropsychologist Eric Kandel uncovered the biological mechanism of habituation of *Aplysia* a 12cm slug. When pricked they will retract as a defence mechanism. But when touch repeatedly they begin to "get used to" it and stop responding to the stimuli.

## CLASSICAL CONDITIONING

The process of connecting one stimuli to another. Such as the appearance of an apple, to its taste.

**Pavlov's discoveries –** his primary research was the digestion in dogs, his discoveries in this domain and NOT classical conditioning won him the Nobel prize. He harnessed the dogs and inserted a salivary tube, to measure the amount of salivation, in response to meat powder. Yet he observed that the dogs not only salivation to the presence of meat powder but also the previously neutral stimuli, such as the researchers footsteps as they approach with food. The dogs seemed to anticipate the meat powder, salivating before the food had arrived.

This process of association is called **classical conditioning** – a form of learning in which animals come to respond to a previously neutral stimulus that had been paired with another stimulus that elicits an automated response.

**Unconditioned stimulus (UCS) –** stimulus that elicits an automatic response without prior conditioning.

- Pavlov – the meat powder

**Unconditioned response (UCR) –** automatic response to an unconditioned stimulus

- Pavlov – salivation

To get to the next point Pavlov paired the meat powder with the sound of a metronome. When the dogs hear the metronome, food was coming.

**Conditioned stimulus (CS) –** initially neutral stimulus which, after conditioning, elicits a CR

- Pavlov – metronome

**Conditioned response (CR) –** response elicited by a previously neutral stimulus as a result of conditioning

- Pavlov – when metronome is heard, dog salivates

**Principles of classical conditioning –** classical conditioning comes in three distinct phases:

(1) *Acquisition* – gradually learn – or acquire the CR. The more often CS and UCS are paired the higher the CR strength is. For optimal results pairing must be done within a half a second delay.
(2) *Extinction* – the CR (salivation) decreases in magnitude and eventually disappears when the CS (metronome) is repeatedly presented alone, without the UCS (meat powder). Extinction is an active process. During this time new response, which in this case the dogs *absence* of salivation, gradually "writes over" or inhibits the CR (salivation)

(3) *Spontaneous recovery* – a seemingly extinct CR reappears in a weaker form, if the CS is presented once again with the UCS.

**The renewal effect** – which occurs when we extinguish a response in a setting different from the one in which the animal acquired it (dog leaving the room). This explains phobias because when we are in the same room as what we are afraid of it will elicits the CR. But as soon as we leave the room there is no longer that association.

**Stimulus generalization –** the process by which stimuli that are similar, but not identical, to the original CS elicit a response. *Generalization gradient* the more similar the stimulus to the original the strong the CR.

- When I was younger I was bit by a German Sheppard, now I'm afraid of ALL dogs.

This process allows us to transfer what we've learned to new things.

**Stimulus discrimination –** it occurs when we exhibit a less pronounced CR to CSs that differ from the original CS. We are able to tell the difference between both stimuli.

- When I was younger I was bit by a German Sheppard, I am only afraid of German Sheppard (or big dogs) not ALL dogs.

**Higher order of conditioning** – developing a conditioned response to a conditioned stimulus by virtue of its association with another conditioned stimulus.

- If Pavlov's original CS (metronome) was paired with a circle, the dog will eventually salivation to the circle and the tone. As we add stimuli (1) tone-circle, (2) circle-voice, and so on, the association becomes weaker

This allows us to extend classical conditioning to a host of new stimuli. This also helps us explain *occasion setters* this is when someone might crave a cigarette while at a party (CS), because they have previously smoke one with their friends in the same setting (CS).

**Applications of classical conditioning to daily life –** without this we couldn't develop physiological associations to stimuli that signal biologically important events. Such as salivation, this helps us digest food.

**Classical conditioning and advertisement –** the repeated pairing of sights and sounds pf products. Marketing people use this to try to establish classically conditioned connections between their brand and positive emotions.

- McDonald's theme song, or Ronal McDonald.

*Latent inhibition:* refers to the fact that once we've experienced a stimulus alone to many times, it's difficult to classically condition it to another stimuli. In other words a *familiar* stimulus is more difficult to condition than an *unfamiliar* stimulus.

- McDonald's theme song used for men's footwear jingle

**The acquisition of fears and phobias –** Watson and Rayner performed a study on Little Albert, wanting to falsify Freud's belief that phobias stem from deep seated conflicts buried in our unconscious. Little Albert enjoys little furry animals. But as the experiment require, after a few seconds of him playing with the rat, the experimenters would strike a gong (UCS), scaring him. Little Albert began to associate the rat with fear.

Crying (CR) whenever he was introduced to a rat or an animal similar to it (stimulus generalization). Although these findings were not always replicated, it is a significant example of classical conditioning. If we are able to induce fear in children we can reduce this as well. Little Peter afraid of rabbits, was given his favourite candy when introduced to a rabbit. He began to associate the rabbit with joy.

**Classical conditioning and drug tolerance –** Shepard Seigel found that people who used drugs in a particular setting, such as always being in the same room when administering a drug, develop enhanced tolerance to the drug in that setting. This is why people tend to overdose at a friend's house, or in unfamiliar setting. The body does not see the cues, and cannot prepare itself for the drugs. This *cue-dependent tolerance* to a drug is therefore due to a type of CR known as *conditioned compensatory response* that helps us counter act the effects of the drug.

**Fetishes –** sexual attraction to nonliving things. This was proven by Michael Domjan who performed a study on male quail. In this study he introduced the male quail to a cylindrical object made of terry cloth, then shortly after a female quail in which he would mate. After about 30 pairings, about half the male quail would attempt to mate with the cylindrical object when presented alone.

**Disgust reactions –** Paul Rozin found that we acquire disgust reactions with surprised ease, these are tied to stimuli that are biologically important to us. He performed a study with two bottle of water & sugar. One was labelled "sucrose water" and the other "sodium cyanide, poison". He found that participants were more reluctant to drink out of the "poison" labelled water, even though they were informed they both only contained sucrose and water.

## OPERANT CONDITIONING

Operant conditioning is the learning controlled by the consequences of the organism's behavior. Also known as *instrumental conditioning*, because the organism's response serves an instrumental function.

**Distinguishing *operant conditioning* from *classical conditioning* –**

| | Classical Conditioning | Operant conditioning |
|---|---|---|
| Response is … | Automatic | Voluntary |
| Behavior is a function of … | Preceding stimuli | Following consequence |
| Behavior depends on … | Autonomic nervous system | Skeletal muscles |

**Law of effect –** E.L Thorndike, forms the basis of much of operant conditioning: if a response, in the presence of a stimulus, is followed by a satisfying state of affairs, the bond between stimulus and response will be strengthened. Early forms of behaviorism referred to as S-R psychology. Thorndike discovered this law in the classic study of the cat and the puzzle boxes:

He place a hungry cat inside and box and put a tantalizing piece of fish just outside. In order for the cat to get out, it needed to hit upon the right solution, which was pressing on a lever or pulling on a string inside the box. Then by sheer accident the cat hit the correct solution. He found that the cat's time to escape from the puzzle box decreased gradually over 60 trials. But at no point did the cat realize what he needed to do to escape. Thorndike concluded that the cats were learning by trial and error NOT by *insight* (grasping the underlying nature of the problem).

**B.F. Skinner and reinforcement –** he had developed what we know as the *Skinner box*. A box which electronically records an animal's responses and prints out a *cumulative record*, or graph of the animal's activity. These boxes typically contained a bar that delivers food when pressed, a food dispenser, and often

a light to signal when food is coming. Because this box did not require any human observation, Skinner ran the risk of missing some important behaviours that the box wasn't designed to record. On the other hand this allowed him to carefully control the types of stimuli presented and precisely measure the animal's responses to those stimuli.

**Terminology of operant conditioning –** there are three key concepts in Skinnerian psychology: *reinforcement, punishment* and *discriminative stimulus*.

**Reinforcement -** Skinner preferred this term because it tell us the organism's behavior changes in response to the reward. The meaning is any outcome that strengthens the probability of a response.

- **Positive reinforcement –** where the consequence consists of *adding* something pleasant
- **Negative reinforcement –** where the consequence consists of *removing* something pleasant

**Punishment –** which is any outcomes that weakens the probability of a response.

- **Positive punishment –** *adding* a stimulus the organisms wishes to avoid
- **Negative punishment –** *removing* a stimulus that the organism wishes to experience

Disadvantages of punishment:

(1) Tells an organisms only what NOT to do, not what to do
(2) Creates anxiety
(3) May encourage subversive behavior, prompting people to be more sneaky
(4) May provide a model for children's aggressive behavior

**Discriminative stimulus –** typically abbreviated to $S^d$. A stimulus associated with the presence of reinforcement. Snapping our fingers ($S^d$) to render the attention of a dog, and the dog comes to us in hope to receive much-appreciated petting. It is a signal that if you come near us we will reward you.

**Same principles of classical conditioning -** *Acquisition, extinction, spontaneous recovery, stimulus generalization,* and *stimulus discrimination*

**Schedules for reinforcement –** Skinner found that animal's behaviour's differ depending on the schedule of reinforcement – the pattern if delivering reinforcement.

- Continuous reinforcement – reinforce behaviour EVERY time → animal learn quicker
- Partial reinforcement (*intermittent*) – reinforce behavior SOMETIMES → greater resistance to extinction

Humphrey's paradox – shows that our intuitions about reinforcement are only partially correct.

(1) The consistency of administering reinforcement
    a. Fixed – consistent basis
    b. Variable – irregular basis
(2) The basis of administering reinforcement
    a. Ratio – reinforce based on certain number of responses
    b. Interval – reinforce based on amount of time

**Four major reinforcement schedules:**

(1) Fixed ratio (FR) schedule – pattern in which we provide reinforcement following a regular number of responses.

(2) Fixed interval (FI) schedule – pattern in which we provide reinforcement for the first response following a specific time interval.
(3) Variable ratio (VR) schedule – pattern in which we provide reinforcement after a variable number of responses, with the number varying randomly around some average.
(4) Variable interval (VI) schedule – pattern in which we provide reinforcement for the first response following a variable time interval, with the actual intervals varying randomly around some average.

Variable schedules tend to yield more consistent rates if responding than do fixed. Fixed schedules tend to produce a pause after each reinforcement. VR schedules usually yield the highest rates of responding of all.

The extreme unpredictability of the VR schedule is precisely what keeps gamblers hooked, because a huge reinforcement can come at any time.

**Application of operant conditioning –** parenting practices, animal training, and weight loss

**Animal training –** *shaping by successive approximations* **-** conditioning a target behavior by progressively reinforcing behaviors that come closer and closer to the target.

**Overcoming procrastination –** David Premack found that we cab positively reinforce a less frewuent behaviour with a more frequently performed behaviour.

- Study (less frequent behavior) for 30 minutes, means you get 10 minutes on Facebook (more frequent behavior)

**Superstitious behavior –** found in athletes because they may have performed a behavior directly preceding an astonishing performance. Now they have directly associated this behavior with a positive outcome. Making them more likely to perform the behavior in order to get the desired outcome.

**Therapeutic uses for operant conditioning –** the best way this is used is by instilling a *token system*. This system is called *token economy*. These are often set up in psychiatric hospitals, for reinforcing appropriate behavior and extinguishing inappropriate ones. It begins by *identifying target behaviors*.

- Secondary reinforcers – are neutral objects that becomes associated with primary reinforcers
- Primary reinforcers – items or outcome that naturally increase the target behavior.

They are also used in situation such as autism. This system improves their language deficits. *Applied behavior analysis* for autism makes extensive use of shaping techniques; mental health professionals offer food and other primary reinforcers to the individuals with autism as they reach progressively closer approximations to certain words and, eventually complete sentences.

The disadvantage of this is that the new found behavior is not always transferable to the outside world

**Two process theory –** this is that we need both classical and operant conditioning to explain the persistence of anxiety disorders. Let say:

People acquire phobias by means of classical conditioning. Once they are afraid, they start to avoid their feared stimulus. By avoiding the feared stimulus they don't allow sufficient opportunity for their fear response to extinguish. When avoiding it they experience immediate reduction in anxiety – which *negatively reinforces* (taking away unpleasant stimuli) their tendency to avoid dogs, which is operant conditioning.

# COGNITIVE MODELS OF LEARNING

Skinner did not believe that *thinking* and *learning* were associated

**S-O-R psychology -** This is an evolved version of the S-R theory. The S-O-R theory is more complex, the *stimulus-organism-response*. The organism is the link between s and r. This theory believes that your behaviors are NOT mindless and automatic. An organism's response to a situation depends on its *interpretation*. To explain differing behavior Skinner would look at the learning histories, how people have been trained to react. Whereas the S-O-R theory would look at the interpretation of the criticism, whether it may be constructive or a personal attack.

This phenomenon is called *cognitive conditioning* whereby our interpretation of the situation affects conditioning, suggest that conditioning is more than an automatic, mindless process. These theorist also emphasize the role of expectations in learning.

**Latent learning –** learning that isn't directly observable. We learn many things without showing them. This is the crucial difference between *competence* – what we know – and *performance* showing what we know. Edward Tolman proved this by experimenting on rats:

He had three randomly assigned groups on rats. The first was rewarded why they got to the end of the maze. The second was not rewarded and then the third was only rewarded on their 11$^{th}$ time making it to the end. The first group made far lesser errors. The third group showed a large and abrupt drop in the number of errors after the 11$^{th}$ day. The findings show that those rats in the third group were learning all along, they just hadn't bothered to show it because they had nothing to gain.

In another studies one set of rats ran repeatedly through a maze to receive reinforcement. The put another set of rats on "trolley cars", in which the rats could observe the maze but not run through it. When the second group pf rats had the chance to run through the maze they did just as good as the first group. Proving that those rats had created *cognitive maps* of the maze.

**Observational learning –** believed to be a variant of latent learning because it is done without reinforcement.

**Observational learning of aggression –** Bandura performed a study on preschool aged children. Where they were split into groups, one watching a tv show of Bobo the doll and a man quietly ignoring it; the other consisted of the make hitting the doll with a rubber mallet. The children were then placed into a room with Bobo the doll, those who watched to violent video were more likely to imitate the violent behavior.

- Cause and effect real world application: children who watch violent tv might be more prone to violent behavior, OR the violent behavior could cause an attraction to violent tv shows.

**Mirror neurons and observational learning –** You learn as you watch. Neuroscientist have recently begun to pinpoint a potential physiological basis for this type of learning. When a monkey watches another perform an action a group of neurons located in the prefrontal cortex are activated. These are the same neurons that would be active if they were performing the action themselves. These neurons are extremely selective and do not become active when a monkey is stationary or sees pieces of food that another monkey grabbed.

**Insight learning –** Wolfgang Kolher a German psychologist interest in an ape named Sultan, a particularly intelligent ape. Kohler performed a test of insight on this ape, by placing a bowl of bananas outside his cage, well out of his reach. He then gave Sultan 2 bamboo sticks neither long enough to reach the banana.

Sultan did some thinking and found a solution: if he stuck one bamboo stick into the other it would be long enough. The solution to this problem did NOT occur through trial and errors, as with Thorndike's cats. But rather by *insight* the sudden understanding of the solution to a problem.

## BIOLOGICAL INFLUENCES ON LEARNING

Our biology influences the speeds and nature of our learning in complex and fascinating ways. Here are three examples:

**Conditioned taste aversion –** someone who will drink so much whisky one night that they become violently ill, they can no longer drink this alcohol without feeling sick. This refers to the fact that classical conditioning can lead us to develop avoidance reactions to the taste of food. This story contradict that of the other examples of classical conditioning in the following ways:

(1) Classical conditioning requires repeated pairing.
(2) The delay between Cs and UCS in *conditioned taste aversion* can be 6-8 hours
(3) Conditioned taste aversion tends to be more specific with little stimulus generalization

**Preparedness and phobias –** preparedness is evolutionary predisposition to learn some pairings of feared stimuli over others owing to their survival value. This is the second challenge to *equipotentiality* – the claim that we can classically condition all CSs equally well to all UCSs. According to Seligman we fear certain stimuli because it posed a threat to our ancestors. Preparedness may render us likely to develop *illusory correlation* between fear-provoking stimuli and negative consequences.

**Instinctive drift –** the tendency for animals to return to innate behaviors following repeated reinforcement. Using the operant conditioning theory Brelands attempted to train a racoon to drop coins into a piggy bank. They successfully trained the racoon to pick up the coin using food reinforcements. But despite the repeated reinforcements the racoons began rubbing the coins together, dropping them, and continuing to rub them together as they do with food.

## LEARNING FADS: DO THEY WORK?

**Sleep assisted learning –** learning new material while asleep. A study was done by exposing sailors to Morse code while they were asleep. These candidates were able to learn Morse code 3 weeks faster than those unexposed.

**Accelerated learning –** this supposedly allows people to pick up new information at anywhere from 25 to several hundred times their normal learning speeds. This is done through several techniques such as:

- Generating expectations
- Visualization of information
- Paying classical music
- Breathing in regular rhythm

**Discovery learning –** learning how to rule out explanations for findings is a key ingredient to the scientific method. This is giving students the experimental materials and asking them to figure out the scientific principles on their own.

*Direct instructions* have been proven to be more effective and efficient than discovery learning

**Learning styles –** their preferred means of acquiring information. Whether they are *analytical* – break problems down into separate components, *holistic* – excel at viewing problems as a whole. *Verbal* – who prefer to talk through problems, and *spatial* – who prefer to visualize problems in their heads.

MEMORY – CHAPTER 7 – MEMORY LECTURE

**True story –** A.J. has a very rare condition called *hyperthymestic syndrome*, this means that she and an incredible memory and is able to recall events some 24 years ago without a problem

**True story –** Nadean Cool won a malpractice settlement against her psychotherapist, who had claimed she had multiple personalities many others, such as being a part of a satanic cult.

# HOW MEMORY OPERATES

**Memory –** this is the retention of information over time. We have many different levels of memory, they may range from a 16 year old birthday, or what you learning yesterday.

## THE PARADOX OF MEMORY

This is the thought that the same memory mechanisms that serve us well in most circumstances can sometimes cause us problems in others.

**When our memories serve us well –** research shows that our memories are astonishingly accurate.one study showed 2560 photographs to a group of college students for only a few seconds each. Three day later they paired these images with new photographs and the participants were asked which is correct, they were right 93% of the time.

*Infantile autism* – those with autism lack specialized memory skills, but there are impressive exceptions. This is so in the case of Kim Peek who had an intelligent quotient of 87, below the norm of 100. Yet Peek memorized about 12 000 books word for word, the zip codes to all areas in the US, every number of highway connecting every city in the US, as well as a *calendar calculator.*

Rajan Mahadevan memorized the numbers of pi to 38 811 digits, this too him three hours to recite. Despite having this particular knowledge he could not remember where the washrooms were at the University of Minnesota's psychology department although he had been down that hall repeatedly.

**When our memories fail us –** most or perhaps all of us are prone to false memories under the right circumstances. *Memory illusion* this is a false but subjectively compelling memory, most are by-products of the brain's general tendency to go beyond the information available to us. This helps us make sense of the world. *Representative heuristic* is that we simplify things to make them easier to remember.

## THE RECONSTRUTIVE NATURE OF MEMORY

When we try to *recall an event, this is known as actively reconstructing* our memories using cues and information available to us *passively reproducing* our memories is much like downloading something off the web.

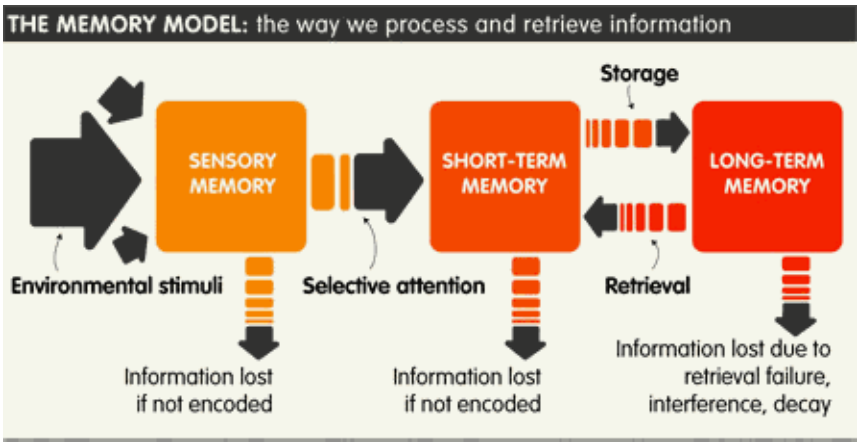
**Observer memory –** this means a memory in which we see ourselves as ab outside observer would

- These memories provide and existence that at least some of our memories are reconstructive others wise we would observe memories as though reliving them (through our own eyes)

**Field memory –** this is seeing the world through your visual field – own eyes.

- Asians are more likely than European Americans to be subject to *observer memory*
- European Americans are more likely than Asians to be subject to *field memory*

## THE THREE SYSTEMS OF MEMORY




There are three major systems:

(1) Sensory memory
(2) Short term memory
(3) Long term memory

These system serve different purposes and vary along at least two important dimensions to which it can hold information:

- *Spans* – how much
- *Duration* – how long

**The sensory memory** – this is tied closely to the raw materials of our experiences, our perceptions of the world; it holds these perceptions for just a few seconds or *less* before passing them on to the next system.

This system is helpful because it buys our brains a bit of extra time to process incoming sensations. It allows us to "fill in the blanks" in our perceptions. Psychologists believe there to be a specific memory for the different senses:

**Iconic memory** – this is the *visual* sensory memory. Goerge Sperling, was able to prove this memory to be true by flashing participants a display of 12 letters with four letters arranged in three rows. When participants weren't cued they were able to remember 4 or 5 letters, different participants remembering different letters. This suggested Sperling that participants had the capacity to remember any letters, but no one person could recall them all. He then decided to use a *cues*, these were different tone that corresponded with a certain section of the 12 letters, to which the participant had to recall. This was called *method of partial report*. Virtually all participants were able to get these right. Determining that we have access to the 12 letters, but only for a very short period of time before they disappear.

**Echoic memory** – this is the memory associated with hearing, this lasted 5 to 10 seconds, conveniently assisting us in the process of note taking during lectures.

**The short-term memory** – this is the second system, it works actively with the information handed to it, transforming it into more meaningful material before passing *some* of it on to the third system. It hold on to information longer than the *sensory memory*, but not much longer.

Psychologist often refer to this as the *working memory*, which is our ability to hold onto information we're currently thinking about, attending to, or processing actively.

**Duration** – Margaret Peterson's participants were presented with a list of three letters (MKP, ASN), then they were asked to recall this information either three seconds after or up to 18, while counting backwards by three. After 10-15 seconds participants did not better than chance at recalling the three letters. This suggests that short term memory is no longer than 20 seconds

**Memory loss: decay vs interference** – *decay* is the fading of information from memory over time. Research suggests that the birth of new neurons in the hippocampus lead to decaying of the previous/older neurons. As we create new memories our older ones fade away. *Interference* is the loss of information from memory because of competition from additional information. There is evidence that both decay and interference exist. There are two different kinds of interference:

(1) *Retroactive interference* – interference with the retention of old information due to the acquisition of new information
(2) *Proactive interference* – interference with acquisition of new information due to previous learning of information

**Capacity –** this is the amount of information we can hold. *The magic number* is the span of short term memory, according to George Miller; seven plus or minus two pieces of information.

**Chunking** – this is organizing information into meaningful groupings, allowing us to extend the span of our STM.

**Rehearsal** - this is repeating information to extend to duration of retention in STM and promote the likelihood of transfer to long term memory. There are two major types of rehearsal:

a. *Maintenance rehearsal* – this is repeating stimuli in their original form to retain them in STM
b. *Elaborative rehearsal* – this is liking stimuli to each other in a meaningful way to improve retention of information in STM

**Depth of processing –** this finding is consistent with a *level of processing* – the depth of transforming information, which influences how well we remember it. There are three levels of visual processing:

(1) Visual – most shallow
(2) Phonological (sound related)
(3) Semantic (meaning related) – deepest level

**The long-term memory –** this permits us to retain important information for minutes, days, weeks, months, or even years; in some cases a lifetime.

This is the third step, our relatively enduring store of information. It includes facts, experiences, and skills we've acquired over our lifetime.

**Difference between STM and LTM –** the *capacity* for LTM is huge. Some scientist estimated it to be as much information as 500 complete sets of Encyclopaedia Britannica. This *duration* is that information often endures for years, even decades. Barrick did a study on those who studied languages in school, he found that memory declines rapidly two to three years after taking the course, but after this the decrease tend to level out, not experiencing significant differences until 50 years later. He referred to this as *permafrost*. *Errors* in LTM tend to be due to *semantics* – rather than acoustic – this is our interpretation (poodle or terrier)

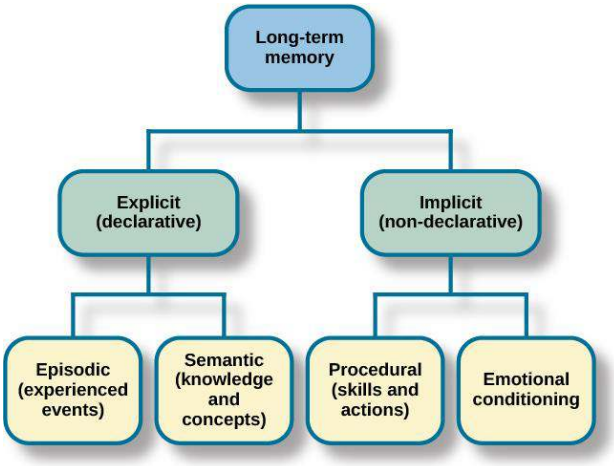
**Primacy effect –** is the tendency to remember words at the beginning of a list especially well

**Recency effect –** is the tendency to remember words at the end of a list especially well. This is only occurs when you recall the words at the end of the list first, as it is fresh in STM.

**Von Restorff effect –** this is the tendency to remember words or stimuli that are distinctive or that stick out from other stimuli

**Serial position curve –** this is a graph depicting both primacy and recency effects on people's ability to recall items on a list

**Types of LTM**




- Explicit memory – memories we recall intentionally and of which we have conscious awareness (both semantic and episodic – writing a test)
    - *Semantic memory* – our knowledge of facts about the world
    - *Episodic memory* – recollections of events in our lives
- Implicit memory – memories we don't deliberately remember or reflect consciously (unlocking a door) also includes, habituation, classical condition and other forms of learning.
    - *Procedural memory* – memories for how to do things, including motor skills and habits
    - *Priming* – our ability to identify a stimulus more easily or more quickly after we've encountered similar stimuli (*stem completion task*, having seen a word such as Queen an hour later you complete the task of filling in the black K____. Having seen the word queen, you are more apt to writing King as opposed to Know or Knock.)

## THE THREE PROCESSES OF MEMORY

There are three major processes of memory: *encoding*, *storage*, and *retrieval*. This can be compared to the analogy of a librarian:

**ENCODING** – *using a computer, a librarian enters the cataloguing information for a book into the librarian's database. In the process, the librarian finds out where the book needs to be shelved. The computer prints out a label (what we might think of as an encoding label) that the librarian affixes to the book's spine so that everyone will know where the book should be stored.*

This refers to the process of getting information into our memory

**Role of attention –** to encode something, we must first attend to it. *Next in line effect* – this is when and individual is so preoccupied with what they are going to say, that they forget (don't encode) what the person before them has said. That principle helps us explain why the popular belief that our brains record every event we've encountered as a myth.

**Mnemonics –** this is a learning aid, strategy, or device that enhances recall. This method relies on internal mental strategies – namely, strategies used during encoding that help us later retrieve the information. There are two major features:

a. We can apply them to a wide variety of material
b. Most depend on having stored knowledge to begins with

**Pegword –** the words associated with a number is a "pegword" – one is a "bun". First you must associate each number in the list with a word that rhymes with each number. Suppose that you want to remember the word chunking. You may use "one is a bun" and view the *pegword* (bun) as broken into chunks.

**Method of Loci –** this method relies on imagery. It is that association of memories with objects. If you have 5 things to remember, picture yourself walking down the hall to your bedroom, and associated 5 things you see with the things you need to remember.

**Key word method –** this strategy depends on our ability to think of an English word (the keyword) that reminds you of the word or thing you are trying to remember.

**STORAGE –** *the librarian puts the book in the proper section of the library, according to how they've been catalogued*

This refers to the process of keeping information in memory. Where we choose to store information or perceive things depends on our *interpretation and expectations* regarding its content.

**The value of schema –** a schema is an organized knowledge structure or mental model that we've stored in memory, this may depend on the *script*- set order of events. Schemas are a valuable function – they equip us with frames of reference for interpreting new situations – helps us interpret information.

**Schemas and memory mistakes –** schemas can sometimes cause problems for us, because they can lead us to remember things that had never happened. Schemas simplify, sometimes they may over simplify which can produce memory illusions

Mark Snyder and Seymour Uranowitz gave participants in a study a biography of a fictional character – Betty K. – life, following their readings they were either told that she lived a heterosexual, or a homosexual lifestyle. They found that participants distorted their memories of the original information, such as her relationship with her father and friends, to be in line with their schema.

**RETRIEVAL –** *when the librarian wants to access the book, he looks up the cataloguing information and then goes to the appropriate shelf with his computer printout showing the catalogue location of the book to retrieve it*

This is the third and final step. Many types of forgetting results from failures of retrieval: our memories are still present but we cannot access them.

**Retrieval cues –** these are hints that make it easier for us to recall information. Your LTM contains the missing words but you need the *retrieval cues* to remember them

**Measuring memory –** there are three major ways of measuring memory: *recall*, *recognition* and *relearning*.

**Recall and recognition –** *recall* is generating previously remembered information on our own (Short Answer)– tends to be more difficult than *recognition* which is selecting previously remembered information from an array of options (Multiple Choice). This is because recalling items requires two steps (a) generating an answer, (b) determining whether it is correct.

**Relearning –** this is how much more quickly we learn information when we study something we've studied previously. Herman Ebbinghaus tested himself, to do so he used hundreds of "nonsense syllables" to test his own recollection across differing time intervals. He found that most of our forgetting occurs almost immediately after learning new material. When he attempted to relearn the material, he learned it much more quickly the second time around.

Relearning is a more sensitive measure of memory than recall and recognition, this is because it allows us to assess memory using a relative amount rather than a simple "right" or "wrong" answer.

**The law of disturbed versus massed practice –** this proposes the idea that we tend to remember things in the long run when we spread out our learning over long intervals rather than try to learn the same amount in short intervals.

**Tip of the tongue phenomenon –** this is the phenomenon in which we're sure we know the answer to a question but cannot come up with it. This phenomenon tells us that there is a difference between something we've forgotten because it didn't get stored in memory and something that's in there that we can't quite retrieve.

**Encoding specificity –** this is the fact that we are more likely to remember something when the conditions present at the time we encoded it are also present at the time of retrieval. There are two different ways to explain this principle:

**Context-dependent learning –** this refers to the superior retrieval when external context of the original memories matches the retrieval context. Godden and Baddeley examined this by presenting 40 unrelated words to scuba divers either on land or in the water. Then these individuals were asked to recall the words. The study found that memory was best when the original context matched that of the retrieval.

**State-dependent learning –** this refers to the superior retrieval of memories when the organism us in the same physiological or psychological state as it was during encoding. There is anecdotal evidence of this phenomenon among alcoholics – who believe they need to get drunk to find objects that they misplaced while in the same state. This thought also extends to moods, in which case is called, *mood-dependent learning*. Studies show that most people find it easier to recall unpleasant events (sad, depressed, pain) rather than pleasant events (happy, relieved). Although this can create difficulties for researchers. *Retrospective bias* – this is our current psychological states can distort memories of our past. Those who were depressed, had the tendency to state unpleasant childhood – causality.

# THE BIOLOGY OF MEMORY

## NEURAL BASIS OF MEMORY STORAGE

**Elusive engram –** this is the physical trace if each memory in the brain. This theory was studied by Karl Lashley he taught rats to run through a mazes, and the lesioned their brains in hopes that they would lose their ability to run through the maze. What he found was the opposite of what he expected. There is no one region that controls memories. He learned two important things: the more brain he removed, the worse the rats performed, and no matter where he removed brain tissue, the rats still kept some recollection of the maze.

**Long term potentiation (LTP) –** this refers to a gradual strengthening of the connections among neurons by repetitive stimulation over time. Terje Lomo first observed this in the hippocampus of rabbits, he found that neurons that "fire together wire together".

Today researchers believe that our ability to stored memories depends on strengthening the connections among neurons arranged in sprawling networks that extend to the far and deep recesses of our brains. The question becomes whether LTP is directly or indirectly influential over memory. Still most agree that the hippocampus plays a key role in forming memories.

**LTP and the hippocampus –** researchers used thin slices of the hippocampus of various animals to tell what cells are responsible for LTP. They found that hippocampus neurons responded at an enhanced level

to ordinary neurons when stimulated. Like the hippocampus, the amygdala and parts of the association cortex exhibit LTP-like activity, following a fear stimulus – formation of fear memories.

**LTP and glumate –** LTP tends to occur at the synapses where the sending neuron releases the NR glumate into the synaptic cleft. The glumate then interact with the receptor for NDMA and another substance (AMPA). LTP enhances the release of glumate into the synaptic cleft, resulting in enhanced learning.

## WHERE IS MEMORY STORED?

**Amnesia – biological bases of explicit and implicit memory –** research demonstrates that two forms of memory are governed largely by different brain systems. The best evidence comes from individuals with severe amnesia. The two most common types of amnesia are:

- *Retrograde amnesia* – we lost memories of our past
- *Anterograde amnesia* – we cannot form new memories

Myths about amnesia:

- Memory recovery is abrupt
- We forget everything about ourselves – this is *generalized amnesia* and is exceedingly rare

**Emotional memory –** memories can bring us distress, such as in the cases of remembering a traumatic events.

**The role of the amygdala –** this is where the emotional components of memories are, especially those governing fear, are stored here. Research has uncovered the specific roles of the amygdala and the hippocampus.

- If the *amygdala is damaged* one can remember the facts about the fear-producing experience, but not the fear
- If the *hippocampus is damaged* one can remember the fear but not the events causing the fear

**Erasing painful memories –** emotional memories can persist, even if they become distorted over time. The hormones adrenalin and NE are released in the face of stress and stimulate protein receptors on nerve cells, which solidify memories.

Two sets of students were shown the same 12 slides, one with an emotionally neutral background, and the other with an emotionally disturbing story. When they returned 24 hrs later to test their memories, those who hears the emotionally arousing story displayed the best recall for the part of the story about the boy's trauma. Those with the neutral story recalled the same amount of detail for all parts of the story.

This experiment was repeated but this time half were given the drug *propranolol*, which blocks the effects of adrenalin and beta-adrenergic receptors. Those participants didn't display especially good recall for the emotionally arousing part of the story. *This was not replicated.* Psychiatrist Pitman prescribed his patients that witnesses a severe car accident the same drug and he found that it only dampened the effects of traumatic memories; it didn't erase them.

### BIOLOGY OF MEMORY DETERIORATION

At the age of 65, we usually begin to experience memory problems and some degeneration in the brain. Many people equate senility with one cause: Alzheimer's disease. This is the most frequent cause of senility, accounting for 50-60% of cases of dementia. Those over the age of 62 are 13% at risk compared to those

above 85 who have a 42% change of acquiring the disease. Memories are lost starting with the most recent eventually making it to the more engrain (older) memories.

Those with Alzheimer's disease contain senile plaques and neurofibrillary tangles in their brains. These cause for loss of synapses and death of cells. They can also contribute to memory loss and intellectual decline. → Being physically active has shown to reduce ones chances of getting this disease

## THE DEVELOPMENT OF MEMORY

Fetuses display *habituation* this is a form of implicit memory that is described as decreases in attention to familiar stimuli.

### MEMORY OVER TIME

Memory changes as we age. On average infants have a worse memory than children, children worse than teens, teens worse than adults and so on, so forth. There are two main arguments as to why children's memories becomes increasingly sophisticated:

- Children's memory spans increase with age, the result of the better use of strategies
- Our conceptual understanding increases with age
- Children develop enhanced meta-memory skills – knowledge about our own memory abilities and limitations

### INFANTILE IMPLICIT MEMORY

Carolyn Rovee-Collier developed an innovative technique to study infant's implicit memories. She did to by place a child in a crib to witness a mobile spinning, after recording a baseline, she attached a ribbon around the ankle of the baby that was attached to the mobile. Infants found the motion of the mobile inherently reinforcing. Because the movement is dependent on the infants' behaviors, they quickly becomes conditioned to kick their legs to get the mobile moving

After a predetermine period of time she exposed the infants once again to the same situation, with no reinforcement (ribbon). The found that children as young as 2 months retained a memory of this experience, although they forgot it after just a few days

### INFANTILE AMNESIA

This is our inability to recall events which had happened prior to a certain age. Recent research suggests that culture may shape the age and content of our first memories.

European N Americans earlier than Taiwan, but more self-centered compared to those in Taiwan

**Infantile amnesia and popular psychology –** many advocated for *hypnotic regression* claim to be able to retrieve memories from well before the age of 2, possibly even within the womb

**Explanations for infantile amnesia –** possibly due to the lack in development of the hippocampus, or that they possess no self-concept.

## FALSE MEMORIES: WHEN GOOD MEMORIES GO BAD

We are far more confident in our recollection of events than we should be.

## FALSE MEMORIES

**Flashbulb memories –** these are emotional memories that are extraordinarily vivid and detailed. They don't decay over time. A study was done on students about their recollection of the space shuttle Challenger explosion. They have students write down how they felt, and then again two years later. They found that participants had opposite reactions, claiming they had never written the prior statements – this is known as *phantom lightbulb memory* – this captures the idea that many seeming flashbulb memories are false.

**Source monitoring** – this is the lack of clarity about the origin of a memory, whether it be yours friends, or a famous authors. We try to identify the origins of our memories by seeking cues about how we encoded them. Works well be helping us avoid confusing our memories with our fantasies. Yet because the cues regarding vividness and detail of memories are far from perfect, source monitoring isn't perfect.

**Cryptomnesia –** this is the failure to recognize that our ideas originated with someone else.

## IMPLANTING FLASE MEMORIES

Elizabeth Loftus found the dramatic effect of misleading suggestions on both memories and eyewitness reports. She found **suggestive memory technique –** this is a procedure that encourages patients to recall memories that may or may not have taken place.

**Misinformation –** this is the creation of fictitious memories by providing misleading information about an event after it takes place. The likelihood that someone recalls a false memory depends on the type of information that is presented in the scenario. University of Windsor researcher, gave students 4 scenarios, 3 of which were reality and one being fictitious. They found that when adding personal/relatable evidence to the fictitious scenario people were more prone to choose this one as something that truly happened.

**Event plausibility –** there are limits to how far we can go in implanting false memories. Much of what we recall hinges on our beliefs, hunches, and "best guesses" about what we have experienced. Researchers found that:

- It is easier to implant a memory of something that's plausible than something that is implausible
- It is easier to implant a memory of an event from the distant past for which we have hazy to no recall than an event from the recent past that we remember well

**Memories of impossible events –** one major criticism: perhaps participants actually experiences the suggested event, such as being lost in a mall, but they did not remember until the suggestion reminded them of it. *Existence proof* demonstrates that it is possible to create elaborate memories of events that never happened.

## GENERALIZING FROM LAB TO THE REAL WORLD

Due to some ethical issues upon the implementation of thought in to the heads of patients, this has not been done in a real world setting ethically. Due to the laboratories *lack of external validity* these methods are not plausible.

**Eyewitness testimony –** Gene Bibbons was incorrectly incarcerated for 16 years for a crime he didn't not commit, due to the misidentification of the perpetrator by the witness. Her testimonies or thoughts could have been altered due to suggestibility. Eyewitnesses sometimes provide invalid evidence, especially when they have ample time to observe the perpetrator under good lighting conditions, when the criminal isn't disguised, and when little time elapses between the crime and identification of the guilty party. Studies suggest that *sequential lineups* are more effective than *simultaneous lineups*.

## SUGGESTIBILITY AND CHILD TESTIMONY

Children are especially vulnerable to suggestibility to recall events that didn't occur. Children's memories are also effected by their schema, especially their expectations about how others will act

**The false memory controversy –** this is the possibility that memories of child abuse and other traumatic events can be shaped by suggestive techniques in psychotherapy, for example Nadean Cool.

Memory recovery therapist believe that patients *repress* their memories of traumatic events, and then *recover* them years, or decades later. They believe that repressed memories are the root cause of current life problems and must be addressed to make progress in psychotherapy. But:

- There is slim evidence that people repress traumatic memories
- Reason to doubt that many memories can be repressed and then recovered year or decades later

Researchers voiced concern about whether suggestive procedures can lead patients to conclude erroneously that family members abused them in childhood

## THE SEVEN SINS OF MEMORY

1. Suggestibility – misleading information following events, leading questions, and explicit information and suggestions can increase the chances of our believing that fictitious events occurred.
2. Misattribution – mistaking what we've imagines for a real memory
3. Bias – our schemas can bias our memories – stereotypes
4. Transience – many of our memories will fade with time
5. Persistence – events can linger in our minds for days or weeks and intrude into our thoughts, even disrupting our ability to sleep
6. Blocking – a temporary inability to access information – tip of the tongue (TOT) phenomenon
7. Absentmindedness – stem from the failure either to encode memories because we're not paying attention or to retrieve memories we've already stored.

EMOTIONS AND MOTIVATION – CHAPTER 11 – EMOTIONS AND MOTIVATION LECTURE

**Emotions –** this is a motivated state marked by physiological arousal, expressive behaviors, and mental experiences

## DISCRETE EMOTIONS THEORY: EMOTIONS AS EVOLVED EXPRESSIONS

THEORIES OF EMOTIONS: WHAT CAUSES FEELINGS?

**Discrete emotions theory** – this is the idea that humans experience a small number of distinct emotions, even if they combine in complex ways. Advocates of this theory propose that emotions have distinct biological roots and serve evolutionary functions. Each emotions has its own distinct "motor program" – set of physiological responses. It is believe that due to the fact that the cortex evolved later than the limbic system, emotions precede our thoughts about them.

**Support for an evolutionary basis of emotions –** the fact that some emotional expressions emerge without direct reinforcement suggests that they may be by-products of innate motor programs.

- Newborns smile spontaneously during REM sleep, 6 weeks will smile at their favorite faces, and 3 months will smile when they are learning something new and no one is around.

Charles Darwin was among the first to point out the similarities between the emotional expressions of humans and many nonhuman animals. Eugene Morton found a deep-seated similarity in communication among humans and mammals/birds, this suggests that we may share some genetic heritage.

**Culture and emotions –** another way to evaluate the claim of discrete emotions are products of evolution is to examine the *universality* of emotion expression. This is the thought that if emotions do come from evolution than we would expect expression to communicate the same meaning across cultures.

**Recognition of emotions across cultures –** research showing that people recognize and generate the same emotional expressions across cultures. But this may be due to a shared experience rather than shared evolutionary heritage.

Paul Ekman study a group pf people isolated from the Western World. He presented them with a brief story, followed by a few photographs. They were then asked to match the photographs to the story. Ekman concluded that a small number of **primary emotions** (7) are cross culturally universal.

- Happiness (easiest to detect)
- Disgust
- Fear
- Sadness
- Surprise
- Contempt
- Anger

There has also been recent research suggesting a possible 8th – pride. Primary emotions do not tell the whole story of our emotions. **Secondary emotions** are those that help describe what an individual may be feeling.

- "alarm" – fear & surprise
- "hatred" disgust & anger

**Cultural differences in emotion expression –** this can be described at the *display rule* – cross culture guidelines for how and when to express emotions. The finding that certain emotions exist across most or all cultures doesn't mean that cultures are identical in their emotional expressions.

Wallace Friesen studied videotaped Japanese study secretly will they watch two video clips. One was of a neutral seen where all students showed neutral emotions. The second was a gory seen of ritual genital mutilation. When there was no authoritative figure present, the Japanese expressed emotions of disgust and fear; when presented with an older authoritative figure they expressed a faint smile to hide their true emotions.

**Accompaniments of emotional expression** – John Gottman found that contempt, and facial expressions that go along with it, is among the best predictors of divorce.

**Emotions and physiology –** we can differentiate at least some of the primary emotions by their patterns of physiological responding. Brain imaging data also shows al lest some evidence for discrete emotions. Fear, disgust, and anger tend to show different patterns of brain activity. Fear in the amygdala, disgust in the insula – limbic system, and anger in the frontal cortex

**Real vs. fake emotions –** genuine happiness ca be distinguished due to the fact that it involved an upward turning of the corner of the mouth, drooping eyelids and crinkling if the corner of the eyes. Whereas fake happiness is only meet with mouth movement not eye.

- *Duchenne smile* – genuine
- *Pan am smile* – fake

**COGNITICVE THEORIES OF EMOTION**

These kind of theories disagree with Gottman, they believe that emotions are a product of thinking – how we interpret things.

**James-Lange theory of emotion –** this is perhaps the oldest theory, developed partially by William James. This theory explains emotions as a result of our interpretations of our bodily reaction to stimuli.

Researchers examine 5 groups of patients with injuries in different regions of the spinal cord. James and Lange would have predicted that those with higher cord injuries report less emotions – fear, anger – than those with lower spinal cord injuries. Some have not been able to replicate these findings.

**Somatic marker theory –** Antonio Damasio the found has proposed that we unconsciously and instantaneously use our "gut reactions" to gauge how we act. Researchers studies participants with *pure autonomic failure* (PAF), which is marked with the deterioration of the ANS in middle age. These patients don't experience any increase in the autonomic nervous system in response to stimuli.

**Cannon-Bard theory –** this model proposes for the correlation between emotions and bodily reactions. They believe it to be an emotion-provoking event leads simultaneously to both emotion and bodily reactions. They had estimated, although now proven unlikely due to the involvement of other systems, such as the limbic system, that the thalamus triggers both an emotion and bodily reaction.

**Two-factor theory of emotion** – this theory by Schachter and Singer proposes there to be two psychological events that are required to produce emotions:

- After encountering an emotion-provoking event, we experience an undifferentiated state of arousal
- We seek to explain the source of this autonomic arousal. Once we attribute the arousal to an occurrence, we label that arousal with an emotion.

Both founders proposed that this typically occurs when one is not aware of it. Emotion, Schachter and Singer concluded, requires both physiological arousal and an attribution of that arousal to an emotion-inducing event. Yet not all researchers have been able to replicate this result.

*There is no one single theory that cannot replace the others without losing a crucial piece of the puzzle.*

**UNCONSCIOUS INFLUENCES ON EMOTIONS**

**Automatic generation of emotion –** research suggest that a good deal of our behaviour is produces automatically – without conscious awareness. Investigators presented subjects visually with a set of words describing either positive or negative stimuli. These images appeared so fast that they were *subliminal*. Those who were exposed to positive stimuli reported being in a better mood more than those presented with a negative stimulus

**Facial feedback hypothesis –** this proposes that you are more likely to feels emotions that correspond to your facial features. This hypothesis originated with Charles Darwin, but was later elaborated by Robert Zajonc who proposed that changes in the BV of the face "feedback" temperature information to the brain, altering our emotions in predictable ways. He also argued that emotions typically arise from our behaviour and physiological reactions, he viewed this process as purely biomechanical and cognitive.

## NON VERBAL EXPRESSION OF EMOTION

**Nonverbal leakage –** this is an unconscious spillover of emotions into nonverbal behavior. This is a powerful cues that we are trying to hide emotions. *Curse of knowledge* this refers to when we know something, in this case what we intend to say, we often make the mistake of assuming that others know it too.

**Body language and gestures –** our body language can convey a lot about our emotional states, our body language can convey a lot about our emotional states. Slumped posture could convey sadness, upright could convey happiness or anger. *Gestures* come in seemingly endless forms:

- *Illustrators* – gestures that highlight or accentuate speech, such as when we forcefully move our hands forward to make an important point.
- *Manipulators* – gestures in which one body part strokes, presses, bites, or otherwise touches another – mostly done when we are stressed
- *Emblems* – gestures that convey conventional meanings recognized by members of a culture, such as a hand wave, and nodding of the head

Psychologist often overlook the fact that in different cultures, they may have the same gestures, but they may convey two different messages.

**Personal space –** this is known **proxemics** – the study of personal space. Edward Hall was the founder of this notion. He observed that personal distance is correlated positively with emotional distance. He proposed that there are levels of personal space, although the distance may differ among cultures:

1. Public distance: used when publicly speaking
2. Social distance: used when speaking among strangers or causal acquaintances
3. Personal distance: used among close friends or romantic partners
4. Intimated distance: used for kissing, hugging, whispering, and affectionate touching

## LYING AND LIE DETECTION

**Humans as lie detectors –** although many of us are confident of our abilities to detect lies, research suggest that given 50-50 chance of being right, most of us achieve only about 55% accuracy and few exceed 70%. Studies using mothers and teachers to assess the rate of lying among their children have shown, that mothers state their children lie more than teachers do, and both showed a preference to more boys lying than girls. Another sobering fact is that there is little to no correlation between people's confidence in their ability to detect lies and their accuracy.

**Polygraph tests –** measuring physiological changes within an individual when being asked though-provoking or accusatory questions.

**The modern polygraph –** polygraph examiners believe this method to be 98% accurate. Like most other techniques the polygraph rests on the assumption of the *Pinocchio response* – a perfect physiological or behavioural indicator of lying. The most widely administered version is the controlled question test (CQT). This measures individuals on three types of questions:

1. **Relevant questions** – or "Did you do it" questions, those bearing on the crime in question
2. **Irrelevant questions** – those not bearing on the crime in questions or on suspects lies
3. **Control question** – those reflecting on probable lies. Typically inquiring about trivial flaws

**Evaluating the Polygraph tests –** they yield a high rate of *false positives* – that is, the innocent we presumed to be guilty. The polygraphs may confuse arousal with evidence of guilty, due to their similar physiological responses.

***Voice stress analysis*** – to detect lies on the basis of findings that people's voice increases in pitch when they lie

Many properly trained subjects can "beat" the test by using *countermeasures* – methods designed to alter their response to control questions.

### Other methods of lie detection

**Guilty knowledge tests –** these rely on the premises that criminals harbour concealed knowledge about the crime that innocent people don't**.** The GKT doesn't hinge on the assumption of a Pinocchio response, rather individuals are given a series of multiple choice questions, some containing information about the crime. They would be measured on their physiological responses. This methods shows *low levels of false positives,* but has a fairly high rate of false negatives because many criminals may either not have noticed or forgotten important details of the crime scene.

**Testing using brain scanning techniques –** this method uses the traditional GKT by measuring the suspect's brain waves following each item, a technique called *brain fingerprinting*. One problem is that most evidence from this technique comes from laboratory studies in which participants are forces to rehearse details of a simulated crime, rendering it with *low external validity*.

Other companies use fMRIs to determine falsehoods from truths. The brain activation is associated with lying may be similar or identical to those associated with merely *thinking* about lying.

**Integrity test -** these are paper-pencil questionnaire that presumably assess worker's tendency to steal or cheat. Integrity test questions fall into several categories, including potential employees:

1. *History of stealing* – have you ever stolen before?

2. *Attitudes toward stealing* – do you think people who steal should be fired?
3. *Perceptions of others honesty* – do you believe that most people steal from their companies every now and then?

## POSITIVE PSYCHOLOGY: PSYCHOLOGY'S FUTURE OR PSYCHOLOGY'S FAD?

Contemporary psychology has focused on minimizing severe distress and on returning disturbed people to adequate levels of functioning. Popular psychology has underestimated people's resilience in the face of stressful life events. From this emerged the discipline of **positive psychology –** this is the discipline that has sought to emphasize human strengths. It focuses on helping people to find ways to enhance positive emotions, as well as building psychologically healthy communities. Yet some psychologist have condemned this as a fad whose claims have out stripped the scientific evidence.



**Defensive pessimism** is a strategy of anticipating failure and compensating for this expectation by mentally over preparing for negative outcomes. Optimists has the tendency to gloss over mistakes, this may sometimes prevent them from seeing reality clearly. They tend to recall feedback about their social skills as better than it was, this may prevent them from learning from their interpersonal errors.

## WHAT IS HAPINESS FOR?

Happiness is generally defined as people's subjective sense of how satisfied they are with life – may produce enduring psychological and physical benefits. The **broad and build theory** proposes that happiness predisposes us to think more openly, to avoid overlooking thing that we might have if unhappy.

## WHAT MAKES US HAPPY: MYTHS AND REALITES

- **Misconception 1 –** the prime determinant of happiness is what happens to us
- **Misconception 2 –** money makes us happy
- **Misconception 3 –** happiness declines in old age
    - **Positivity effect:** there is an increase in happiness with age, because they have a tendency to remember more positive than negative information
- **Misconception 4** – people on the west coast are happier

Here are some common facts that *make us happy:*

- Marriage
- Friendship
- College or university
- Religion
- Exercise
- Political affiliation
- Gratitude
- Giving
- Flow – a mental state in which we're completely immersed in what we are doing

When thinking of these statements we must bear two cautions:

- The association between these variable and happiness are typically modest in magnitude and there are many exceptions to trends
- Many of these findings derive from correlational research, so the direction of the causal arrow is often unclear

**FORECASTING HAPINESS**

As humans we are remarkably poor at **affective forecasting –** our ability to predict our own and others happiness. We often overestimated the long-term impact of events on our moods.

**Durability bias –** the belief that both our good and our bad moods will last longer than they do.

**Hedonic treadmill –** the tendency for our moods to adapt to external circumstances. This hypothesis proposes that we begin life with a genetically influenced happiness "set point" from which we bounce up and down in response to short-term life events

**SELF-ESTEEM**

Self-esteem is typically defined as people's evaluation of worth

**Great myths of self-esteem –** there is no evidence that low self-esteem is the root of all unhappiness – *single variable explanation.* People with higher self-esteem aren't much more likely than people with low self-esteem to have good social skills or to do well in school. They are also just as likely to abuse alcohol and other drugs. Popular psychology literature links aggression to low self-esteem. There may be some truth. Yet most evidence suggest that subset of high self-esteem people is especially prone to aggression.

**Realities of self-esteem –** high self-esteem is associated with greater initiative and persistence – that is, a willingness to attempt new challenges and stick with them even when the going gets rough- and with resilience in the face of stress

It is also related to **positive illusions** – the tendency to perceive ourselves as more favourable than others do. Most high self-esteem individuals see themselves as more intelligent, attractive, and likeable than do low self-esteem individuals.

The association between positive illusions and psychology adjustment in controversial. Some believe that unrealistically favourable views of ourselves are healthy because they imbue us with self-confidence; but on the other hand positive illusions make it difficult for us to see reality clearly.

MOTIVATION: OUR WANTS AND NEEDS

**Motivation –** this refers to the psychological drives that propel us in a specific direction.

**MOTIVATION**

**Drive reduction theory –** this is one of the most influential theories. It was formulated by Clark Hull who proposed that certain drives, like hunger, thirst, and sexual frustration, motivate us to act in ways that minimize aversive states. From an evolutionary stand point drives are geared to ensure our survival and reproduction. Most drive reduction theories propose that we're motivated to maintain a given level of psychological *homeostasis.*

**Drive and arousal –** according to the **Yerkes-Dodson theory** there's an *inverted U-shaped* relationship between arousal on the one hand and mood and performance on the other hand. At the middle point of the cure this is the optimal level of arousal. Once a person veers more leftward, this is what creates the drives, in order to reach that optimal state. This theory is popular among sport psychologist.

Daniel Berlyne noted that under arousal can heighten our sense of curiosity, motivating us to explore stimuli that are complex and novel.

**When our drives clash –** certain drives generate the *approach-approach* this is having to make the choice between 2 attractive stimuli. Others generate an *avoidance-avoidance* these are having to choose between 2 unattractive stimuli. And lastly the *approach-avoidance* this is the stimuli that has aspects that are attractive and ones you would like to avoid. Example: wanting to get a college degree (approach), but not wanting the uncertainty of the future ahead (avoidance).

**Incentive theories –** the drive reduction theory does explain WHY we often engage in behaviours even when our drives are satisfied. These incentive theories propose that we're often motivated by positive goals. These goals are either *internally* or *externally* motivated. Certain rewards that we might expect to be reinforcers may *undermine* intrinsic motivation.

Researchers identified children in preschool who liked to draw. They then split them up into three groups and found:

(1) Children drew pictures knowing they were going to receive an award → they found that this group lost their intrinsic motivation to draw and not did it for external reasons
(2) Children drew pictures and were rewarded without prior knowledge
(3) Children drew with no incentive

These findings imply that when we see ourselves performing a behaviour to obtain external goals, we conclude that we weren't interested in that behaviour in the first place.

*Rival explanation* are the *contrast effect* this is that once we have received reinforcement for performing a behaviour, we anticipate reinforcement again.

**Our needs: physical and psychological urges –** theorist have distinguished *primary needs* – biological necessities, and *secondary needs* – psychological desires. According to Maslow's we have a hierarchy of needs. We must satisfy our primary needs in order to move on to the secondary more complex needs.

**HUNGER, EATING, AND EATING DISORDERS**

**Hunger and eating: regulatory processes –** it was suggested by Walter Cannon and Alfred Washburn that the stomach contracts, when it is empty, this causes hunger. To test this they had student's swallowed balloons to simulate a full stomach. They found that there were still reports of muscle contraction. Later it was found that those with surgically removed stomachs still experienced hunger pins. These findings falsify the stomach contraction hypothesis.

It was found that when researchers stimulate the *ventromedial* or middle lower part of rats' hypothalamus, they will eat very little or stop eating all together. This area seems to let rats know when to stop eating.

**Glucostatic theory –** this theory suggests that when our blood glucose levels drop, hunger creates a drive to eat to restore the proper level of glucose.

**Chemical messengers and eating –** when we eat a candy bar, some of the glucose may be converted to fat, which stores energy for the long term. The more energy in fat cells, the more they produce hormones called *leptin*. This hormone signals the hypothalamus and brain stem to reduce appetite and increase the amount of energy used.

**The set point –** some believe there to be a genetically programmed *set point* – a value that establishes a range of body and muscle mass we tend to maintain. When we eat too little, regulatory mechanisms kick in to increase our appetite or decrease our metabolism. According to this hypothesis, an

obese individual has a biological predisposition toward greater weight than does a thin person. What is clear is that we are not fated to remain at a fixed weight: there's a range of weights we can "settle into".

**The role of genes in obesity –** genes probably exert a substantial influence on out weight. In about 6% of the cases of severe obesity, a mutation in a major *melanocortin-4 receptor gene*. Twin studies found a correlation for fat mass in the range of 0.7-0.9 for identical twins, and 0.35-0.45 for fraternal twins.

**Sensitivity to cues and expectations –** the supersizing of portions is called *portion distortion*, this has probably contributed to the obese population of Americans today. Portions sized have gone up 25% in restaurants dinner plates. Because we think in terms of "units" of things as the optimal amount – a heuristic called *unit bias* – controlling portions if food consumed us a good way to control our weight.

Stanley Schachter proposed the **internal-external theory** – this theory holds that relative to other people, people with obesity are motivated to eat more by external cues than internal cues.

**Eating disorders: bulimia and anorexia –** people who try to lose weight in a short amount of time are especially prone to binge eating's

**Bulimia nervosa** – this is an eating disorders associated with a pattern of bingeing and purging in an effort to lose or maintain weight. Bulimia means "ox hunger". It is the most common eating disorder afflicting 1-3% of the populations – 95% of them are female, and 8-16% being young females. Those with this disease report high levels of body dissatisfaction and often see themselves as obese when in fact they are normal weight.

Twin studies suggest there to be a genetic factor, but it is also trigger by sociocultural expectations.

**Anorexia nervosa** – this is a less common disease with rates from 0.5-1% of the population. Those with this disease display a refusal to maintain body weight at or above minimally normal weight for age and height. This disease is present in not only present in Western cultures but also other cultures that have had minimal exposure to western media.

## SEXUAL MOTIVATION

This is your **libido** – a wish or craving for sexual activity and sexual pleasures. These desires are deeply rooted in our genes and biology, but are also influences by the environment

**Sexual desire and its cause –** the sex hormone testosterone can sometimes enhance sexual interest in short term, but other biological influences are also at play. Neurotransmitter serotonin is that key to explaining an intriguing link between migraines headaches and increased libido. Low sexual desires are associated with high levels of serotonin. Migraines are associated with low levels of serotonin, so it is hypothesized that people with migraines would report high levels of sexual desires.

Researchers have discovered that variations in a gene that produces DRD4, a protein related to dopamine transmission, are correlated with student's reports of sexual desire and arousal. Women tend to experience greater variability than men in sex drive. Women with high sex drives tend to attracted to both men and women, whereas men with high sex drives tend to only be attracted to one sex, depending on their sexual orientation. In contrast from men, women's appetite for sex – but not their romantic needs – appears to decline after they form a secure relationship.

**The physiology of the human sexual response –** Masters and Johnson reported that basic sexual arousal cycle was the same for men and women. Based on their research and other information scientists define the *sexual response cycle* in terms of four phases:

(1) *Excitement*: this phase in human sexual response in which people experience sexual pleasure and notice physiological changes associated with it
(2) *Plateau*: this is the phase in human sexual response in which sexual tension builds
(3) *Orgasms* (climax): this is the phase in human sexual response marked by involuntary rhythmic contractions in the muscles of the genitals in both men and women
(4) *Resolution*: this is the phase in human sexual response that follows orgasms, in which poepl report relaxation and a sense of well-being.

**The frequency of sexual activities in aging –** the frequency of people's sexual activities decrease but their sexual satisfaction doesn't decrease with age. In the early stages of marriage, couples have sex at least two times a week.

- 56% are sexual active over the age of 60
- 30% of women 80-102
- 63% of men 80-102

There are at least three problems with much of the research on sex and aging

- Many surveys haven't disentangled age from length of time people are in a relationship (frequency tends to decrease the long the relationship)
- Scientist have not examined the effects of poor health on sexual activity in the elderly
- Many studies on seniors aren't based on random samples, so it is not clear how representative they are of the elderly

**Sexuality and culture –** people's expression of sexual desires is shaped by social norms and culture. David Buss found that residents of non-Western societies, including India, Iran, and China, place much greater value on chastity in a potential partner than do individuals in Western European countries, including Sweden, Holland, and France.

- 59% approved pre-marital sex, 41% disagree

**Sexual orientation –** homosexual behaviour is among 450 species

**Prevalence of different sexual orientations –** research suggest that about 2.8% of males and 1.4% of females aged 18 or older identify themselves as gay, lesbian, or bisexual. Contrary to stereotype that one person in a gay relationship adopts a masculine role, and the other a more feminine one, there is less that ¼ of gay men and lesbians that can fit into this category.

**Can sexual orientation be changed –** Masters and Johnson performed and study and found that 11% of the men and 37% of the women reported a complete change in orientation. It is not clear whether these apparently successful individuals we exclusively homosexual before therapy, and whether their sexual orientation changed beyond their self-reports.

Spritzer's sample was far from random: 76% of mend and 47% of the women were married, and less than 0.5 were openly gay at some point prior to the study.

**Genetic and environmental influences on sexual orientation –** most scientist are skeptical about the ability of gay individuals to change their sexual orientation, because there are indications of in born differences between homosexuals and heterosexuals.

**Sexual orientation: Twin studies –** a correlation rate of 52% in identical twins and 22% in fraternal. A second study done used a strict standard for defining sexual orientation and found a concordance rate of 20% of homosexuality among identical twins and 16% among fraternal.

**Exotic becomes erotic –** gay reported that they were often feminine boys and lesbians that they were often masculine girls, suggesting a potential genetic influence on childhood gender nonconformity.

According to BEM's theory called *exotic becomes erotic*, nonconforming children feel different and estranged from their peers and perceive their same sex peers as unfamiliar and exotic.

**Sex hormones, prenatal influences, and sexual orientation –** when the fetus develops, sex hormones called androgens influence whether the brain sets the child on a path toward masculinity or femininity. According to this theory a girl who is exposed to excessive amount of testosterone in the womb develop masculine traits, and boys exposed to too little develop feminine brains.

Having older brothers increases the odds of male homosexuality by 33% - 3-5% per brother. On average individuals who are homosexual have more fingerprint ridges on their left hand than to hetero sexual. Lesbian women have more masculine ratio of index to ring finger. Male homosexuals are nearly half times more likely to be left-handed. Lesbian women are more than twice as likely to be left-handed.

**Sexual orientation: brain differences –** small clusters of neurons in the hypothalamus, was less than half the size in gay men compared to heterosexual men. Researchers have looked beyond the hypothalamus to find biological indicators. They have found that the corpus callosum is larger in gays and lesbians, because the size of the callosum is genetic it is believe that homosexuality is too.

## ATTRACTION, LOVE, AND HATE

### SOCIAL INFLUENCES ON INTERPOSONAL ATTRACTION

**Proximity –** this is the physical nearness, being a predictor of attraction

**Similarity –** the extent to which we have things in common. Online dating use this as a tool for matching couples – birds of a feather flock together.

- When people interests and attitudes overlap, the foundation is paved for mutual understanding
- We assume that we'll be readily accepted and liked by others who see eye-to-eye with us
- People who share our likes and dislikes provide validation for our views and help us feel good about ourselves

**Reciprocity –** this is the rule of give and take, a predictor of attraction. We tend to feel obligated to give when we get to maintain in a relationship. When we believe that our partner finds us attractive or likeable, we generally act this way in response to this ego-boosting information

**Physical attraction –** scientific discoveries arise from *serendipity* – that is sheer luck. People level od attractiveness as rated by their partners, were found that the only variable that significantly predicted attraction was one the researchers had included only as an afterthought.

**Sex differences –** attractiveness is especially important to men. It was found that the importance people attach to physical attractiveness varies across cultures. Men consistently put more weight on looks in women. Men prefer women to be somewhat younger than they are. Women tend to place more emphasis on having a partner with high financial resources. Women prefer partners that are somewhat older than they are. But they both put a premium on having a partner who's intelligent, dependable, and kind.

**Evolutionary models of attraction –** because men produce mass amounts of sperm they typically pursue a mating strategy that maximizes the chances that at least one of these sperm will find a receptive egg. Men are on the lookout for cues of potential health and fertility (hip ratio). Women are much pickier than men because they only produce one egg a month. Speed dating studies found that men further contact 0.5 the women and women contact 1/3 of the men.

**Social role theory –** proposes that biological variable play a role in men's and women's preferences, but not in the way that evolutionary psychologists see it. Men tend to be bigger and stronger than women, they more often end up in roles of the providers, increasing their chances of achieve higher status positions. Whereas because women bear children, they are more those of the care taker, decreasing their chances of attaining higher status positions.

**Beauty is in the eye of the beholder –** people tend to agree at considerably higher rates about who is and isn't attractive. This is the case not only within race but across races. Men and women tend to agree on whom they find physically attractive. Further more women tend to prefer certain body shapes in men. And men preferring certain shapes in women (child bearing hips)

There are differences in physical preferences within and across cultures. African and Caribbean find women with a large body to be more attractive than thin women.

**When being "just average" is just fine -** by using computers to digitize the faces of students, and then combine them progressively, they found that people generally prefer faces that are the most average. People prefer average faces 96% of the time. Average faces are also more symmetrical, leading us to believe that we see beauty in symmetry. But averageness also reflects the absence of abnormalities and genetic mutation.

**LOVE: SCIENCE CONFRONTS MYSTERY**

Hartfield and Rapson believe there to be two major types of love:

(1) *Passionate love:* love marked by powerful, even overwhelming, longing for one's partner
(2) *Compassionate love:* love marked by a sense of deep friendship ad fondness for one's partner

Robert Sternberg did not believe this was enough so he developed the triatic model to explain why people fall in love:

(1) Intimacy
(2) Passion
(3) Commitment

**Hate: a neglected topic –** Sternberg's model can also help explain why we develop hatred

(1) Negation of intimacy
(2) Passion
(3) Commitment

Differing forms of hate from combinations of these three elements, "burning hate" being the more severe – reflecting high scores of all three.