Module 2: Methods - Notes

Introduction: How Do We Know?:

- "Psychology has a long past but short history." - Hermann Ebbinghaus
    - Signified a revolution in psychology as a science
    - Philosophers had long been asking questions about the mind, thought and reasoning but answered questions on the mind based on a process of **rationalism**
        - Rationalism - "The view that reason and logical argument, but not experience, is most important for how we acquire knowledge."
- Aristotle used rationalism to express that human thoughts, perceptions and emotions were product of the heart, not the brain
    - The heart is at the center of the body, it's connected by blood to all parts of body (Specifically senses) and the beating heart is affected by emotional state
        - Therefore, the heart is the key behind senses and emotion
    - Other organs such as the brain and lungs were considered secondary organs that existed to cool the blood, which helped maintain a tempered and rational state of mind
- Until the middle of the nineteenth century, psychology and the understanding of behaviour depended on rationalism and philosophical reasoning
    - Widely believed that experiments on the mind were impossible
- Flaw in rationalism: What one "thinks" is true about behaviour is frequently different from how one actually behaves
    - Example: Most people would believe that if in a conversation the person one's talking to is replaced, one would notice
        - However, 53% of participants in one study and 67% of participants in a second study failed to notice that the person changed midway through the conversation
    - Differences between how people believe one might act and how one actually behaves highlights the limitations of rationalism to explain behavior
- Ebbinghaus's expression of the "short history" of psychology referred to the fact it has developed past rationalism to using experimental methods to collect **data**, test theories and allowing experience and observation to be the primary sources of knowledge
    - Experimental methods - Researchers gather facts and observations of phenomena to form **scientific theories**
    - Scientific theories: "Rational explanations to describe and predict future behaviour"

Psychology as a Science: The Scientific Method:

- Psychology uses experience-driven approaches to understand behaviour
- **Scientific method**: A common approach in which researchers methodologically answer questions
- Steps:

    - Identify the Problem → Gather information → Hypothesis → Design and Conduct Experiments → Data Analysis and Conclusions → (Restart the process to hypothesis)
- *Identify the problem:* First step is to identify the problem of interest, which could be based on observation, previous research, established theory or intuition
- *Gather information:* Once topic is chosen, review scientific literature and examine existing theories of behaviour
- *Develop a hypothesis:* After evaluating available information, researchers develop a hypothesis about the outcome of the experiment
- *Design and conduct an experiment:* Next step is developing an experiment to test the hypothesis and collect data
- *Analyze the data and draw conclusions:* This steps is essentially determining whether the findings support the experimenter's predictions
- Restart the process: The process starts over again at the point where the researcher reconsiders the original question/problem, potentially choosing to either replicate the same experiment conduct a similar experiment with some modifications (Replication with extension) or move on to a completely new research topic

Descriptive Methods:

- **Descriptive methods**: Any means to capture, report, record or otherwise *describe* a group
- Descriptive research usually identifies "what is" without exactly understanding "why it is"
- There are four popular methods to describe groups:
    - Naturalistic observation
    - **Participant observation**
    - Case studies
    - Surveys

Naturalistic Observation:

- Observational research (Or field research) is a type of non-experimental research of behaviour
- **Naturalistic observation** is described as observation of behaviour as it happens in a natural environment, without manipulation or control of the conditions of the observation
    - Example: Observing the behaviour of animals in a zoo compared to animals in natural habitat
        - Behaviour of animals in zoo reflects controlled observations while the behaviour of animals in their natural habitat is a naturalistic observation
- Lack of manipulation is a key distinction between other approaches in natural settings, such as **field experiments**, where a researcher manipulates and controls the conditions of the behaviour under observation
- Observations can be recorded either qualitatively (Collecting opinions, notes or general observations) or quantitatively (Measuring or counting specific behaviours)
- Benefit of naturalistic observation is that it can frequently help generate new ideas about an observed phenomenon

- Naturalistic observation allows a better understanding of behaviour as it occurs in the real world
    - This description of behaviour is considered *ecologically valid* as the observations are a product of genuine reactions
- During observation of others, it is crucial to remain unobtrusive as possible so that people do not realize they're being watched and the results are authentic
    - Often, animals will reactively change their behaviour upon learning they're being observed
        - This is known as the *Hawthorne effect*
- **Disadvantages of Naturalistic Observation:**
    - Researchers lack control over the environment and the various factors that can affect behaviour
        - Therefore, one cannot be fully certain of *what* is influencing behaviour
        - Can weaken conclusions
        - Can make it difficult for another researcher to repeat an identical experiment
    - Researchers' perspectives and bias may influence interpretation of the behaviours they find relevant
        - It is critical for researchers to be trained on how to count observations, and to compare their results with other raters in order to see if they're making similar observations
        - It is crucial for researchers to share results to ensure validity of the data collected and ensure *interrater reliability*
    - When conducting naturalistic observation, the researcher should be unobtrusive to avoid influencing the findings
        - However, at times, the only way to gain access to an environment or group is by participation

<u>Participant Observation:</u>

- Participant observation is a research method where a researcher becomes part of the group under investigation
    - Example: To understand doomsday cults, scientists had to pose a new cult members
- Historically, this method of research involved researchers temporarily living in small communities
    - Being part of the group could provide a more enriching experience and afford increased access to the daily lives of the group members
    - However, limitations are prevalent
        - Presence of observer can increase reactivity, changing behaviour
        - Observer's time spent with group members may induce bias and "see" only things that fit the initial hypothesis
- In the late 1960s and early 1970s, David Rosenhan became skeptical of diagnostic abilities of clinicians and questioned accuracy of diagnostic techniques, essentially

doubting that clinicians can accurately distinguish sane from the insane so in turn, he led a three-year investigation
    - Eight healthy researchers (Five men and three women, including Rosenhan) tested the notion that psychiatrists failed to accurately distinguish sanity and insanity
    - Participants tested twelve hospitals in five different states
    - At the intake interview, all the participants (With false identities) reported hearing voices, using words such as “empty”, “hollow” and “thud”
        - These words themselves have little association with danger, or commonly spoken by those with schizophrenia
        - However, these words caused all the researchers to be admitted to psychiatric care facilities
    - Once admitted, participants acted “normally”, making no further indication of hearing voices in their head
    - Participants were in psychiatric ward, taking note of their experiences and perceptions of clinician attitudes
    - Eleven of twelve researchers were diagnosed with schizophrenia, the remaining was diagnosed with manic-depressive psychosis
    - Clinicians could not see that pseudopatients were sane, but other patients in the hospital suspected the researchers were “faking it”
    - Other patients viewed note-taking as a signal of “checking up on the hospital”, while staff viewed is as an aspect of their “illness”
    - Rosenhan proposed that physicians operate with a strong bias toward what statisticians call a “false positive” (The inclination to call a healthy person sick)
    - Participant observation demonstrated that clinicians, at the time, could not reliably differentiate between the sane and the insane
    - Clinical assessment has since developed
- Participation observation brings forward new perspectives and insight that cannot be obtained through naturalistic observation
- Drawbacks:
    - Researcher’s view and bias may affect interpretation of events
        - Potentially, a researcher could become so involved and sympathetic to the group that it causes interference with research objectivity
        - Furthermore, since the observer is a participant, the researcher can, knowingly or not, influence participants’ behaviour, thereby initiating a problem of reactivity and affecting the behaviour being observed
    - Low degree of reliability
        - Can’t be consistent or repeated
    - Observations are dependent on distinctive conditions of participation, what may be true for one person’s experience may not be shared amongst others

<u>Case Studies:</u>

- A **case study** is an in-depth analysis of a specific circumstance or individual

- Clinicians observe an unusual patient, attempting to investigate the patient's condition in greater detail to provide a broader understanding of a phenomenon
- Example: The case study of Henry Molaison (Referred to as "H.M." in scientific literature) demonstrated how a case study can be used to gain insight into behaviour
    - When he was a young boy, Henry started experiencing mild seizures after hitting his head when he fell off his bike
    - The seizures became progressively worse with age, and could not be treated by conventional means
    - When Henry reached his late 20s, the frequency and severity of seizure attacks caused him to lose normalcy of life
    - As a last resort, his neurosurgeon suggested bilateral ablation (Surgical damage) to his ventral medial temporal lobes (Including the **hippocampus** and **entorhinal cortex**), since this brain tissue was believed to be the origin point of his seizures
    - The surgery treated the seizures; however, there was a disturbing side effect, he could not form new memories
    - The following decades, H.M. became the most studied person in psychology
    - Although the case was very specific, this provided an opportunity for researchers to study the role of the hippocampus in the formation of memory
        - This ultimately lead to the identification of different types of memories, like episodic, semantic and **procedural memories** (Memories associated with how something is done)
- Challenges:
    - Generalizing findings from a unique case
    - One cannot be sure that conclusion drawn from a particular case are broadly applicable to other cases
        - One's experience, also known as an *anecdote*, cannot be easily or fairly applied to a broader population of people
- In summary, naturalistic observation, participant observation and case studies all allow researchers to study small groups (Or individuals) to develop rich descriptive data of behaviour
    - While effective, surveys provide much larger representation of patterns of behaviour

<u>Surveys:</u>

- **Surveys** are an efficient way to rapidly collect information and gather an understanding of the current state of people's opinions or attitudes
- Can be administered in various ways such as online surveys, mailed questionnaires, person-to-person interviews and phone interviews
- It is impossible to survey every single member of a group (Called a **population**), therefore surveys can be administered to a smaller subset of the population, called a **sample**
    - Vital that the sample selected is representative of the broader population one wishes to study

- **Sampling error** or **bias** is any pooled selection of people that differs from the entire population in meaningful ways
    - When sampling errors occur, results and conclusion of the experiment cannot be applied back to the whole population
- Disadvantages:
    - Questions asked in surveys must be carefully wired to avoid biasing the outcome in either a positive or negative way
        - This is known as **wording effects**
    - In 1986, a British Gallup poll asked Britons whether their country's nuclear weaponry made them feel *safe*
        - In this poll, 40% agreed
    - In another poll, modified by using the word *safer*, 50% agreed
        - This slight change in wording shifted approximately five-and-a-half million people's votes
- Surveys should consider **response bias** from participants: The tendency for people to answer the question in the way they feel they are expected to answer
- The validity of surveys can be influenced by the **acquiescent response bias**
    - Acquiescence refers to a tendency for participants to indiscriminately "agree" with most if not all items on the survey regardless of their actual opinion
- **Socially desirable bias** is another systematic approach to answering questions
    - Bias is not indiscriminate, however the participants response in specific ways that they believe would be viewed as acceptable by others
- The tendency to describe one's own behaviour is called the *better-than-average effect*, or **illusory superiority**
    - One likely rates their abilities as better than the average, such as the driving example where most people believe they are better drivers than most of the population
    - In a study done in 1977, 94% of professors rated themselves as above average relative to their peers
    - "When more than 90 percent of faculty members rate themselves as above-average teachers, and two-thirds rate themselves among the top quarter, the outlook for improvement in teaching seems less than promising" - Patricia Cross
- Generally speaking, the *response* or *return rate* from surveys varies dramatically depending on the size of survey and motivation of participants
    - On average, the majority of researchers receive responses from 30-50% of people surveyed
    - Not all participants that complete the survey accurately provide responses
- Despite the deficiencies, surveys can be incredibly powerful
    - Example: Alfred Kinsey revolutionized understanding of people's sexual attitudes and behaviours by collection of surveys from more than 18,000 people
        - He compiled the surveys into two publications known as the Kinsey reports: *Sexual Behaviour in the Human Male* (1948) and *Sexual Behaviour in the Human Female* (1953)

        - These publications provided comprehensive insight into sexual attitudes, preferences and orientation; they highlighted differences between social attitudes of sexuality and actual sexual practice
        - Kinsey's contributions helped in sparking the sexual revolution of the 1960s
        - However, statisticians felt his findings may have been subject to a key survey-related bias: Who was willing to participate, and were those who did representative of the rest of the population?
        - During the conservative sexual attitudes of the 1950s, many Americans were reluctant to speak of their sex lives publicly
        - This created the assumption that those who do volunteer to be interviewed may not be representative of the rest of the population
        - This is known as *volunteer bias*, the small group who were willing to talk about their sex lives were likely overrepresented in the survey

Research Ethics for Human Participation:

- **Research ethics:** A set of principles or standards that have been established for psychologists to follow when conducting a research study
- In research, ethics is a set of general principles that outline how people should be educated, treated and respected during participation in a study

The Tuskegee Syphilis Study:

- Mistreatment of participants in the Tuskegee syphilis study (1932-1972) study was a critical reflection point for treatment of research participants in the United States
- The study was created to follow the natural progression of syphilis
    - Over 600 African-American men, including 400 who already acquired syphilis, were recruited to participate in exchange for free meals, medical treatment for "bad blood" (Generic term for a variety of ailments) and burial insurance
    - Researchers' only goal was to follow the time course of the disease, they had no intention of treatment for "bad blood"
    - Over the 40-year span, the participants were misled about the true purpose of the study, denying them medical treatment despite medical advancements for treatment of syphilis
        - Such negligence led to hundreds of deaths that were preventable and needlessly spreading syphilis
    - In 1972, the *New York Times* released the story, the outcry led to the government establishing federal ethical principles for research

General Ethical Principles:

- The American Psychological Association (APA) developed five ethical principles to assist psychologists in developing their research practice
- **Principle A: Beneficence and Non-maleficence:**

    - States that research should strive to do good (**Beneficence**) and avoid designing experiments that can intentionally harm (**Maleficence**) the participants
    - Psychologists need to weigh the benefits of the research against the costs of the participants' well-being
- **Principle B: Fidelity and Responsibility:**
    - When people agree to participate in experiments, they put trust in the researcher
        - In turn, this principle inspires researchers to maintain that trust
    - **Fidelity**: Often associated with the meaning of "loyal" or "faithful"
    - Researchers should remain honest and reliable with participants, data and when reporting their findings
    - Example: If study could make participants feel embarrassed or upset, participants should be notified ahead of time
    - Psychologists hold the responsibility to protect the well-being of participants and taking action when needed
- **Principle C: Integrity:**
    - States that psychologists should engage in accurate, honest and non-biased practices in the science, teaching and practice of psychology
        - Example: Psychologists should strive to communicate results to colleagues and the public accurately, without making up data (Fabrication) or manipulating data (Falsification)
- **Principle D: Justice:**
    - The concept of **justice** strives to establish "equality" in the research process
        - Specifically, those participating in research should also be the same people who stand to benefit from the research outcomes
    - Justice is explicitly stated as historically, researchers have included or excluded population from participation
        - Example: Women and children were treated as vulnerable populations, thereby excluding them from participation
        - As a result, research on the effects of medical treatments were based on male-only populations and then applied generally to women and children
        - Due to fundamental differences between sexes and age groups, the efficacy and safety of treatments were skewed
    - At times, there are practical reasons for limiting participation in a research activity
        - Example: A study on child development may only include children within a small range of ages because it captures how children perceive, react or behave at a particular time
        - In this example, age is an inclusion criterion
    - **Inclusion criterion**: A participant attribute that is essential to answering the research question
    - **Exclusion criteria**: Any attributes that would prevent participation because they cannot address the research question
        - Example: Adults would not take part in a child development study

    - Combination of inclusion and exclusion criteria form a study's **eligibility criteria**, which is a set of characteristics shared by all participants that ensure they will help address the research question
- **Principle E: Respect for People's Rights and Dignity:**
    - States that each person is value in the research process and that researchers must take measures to respect and protect the participants' rights, privacy and welfare
    - Researchers must communicate openly about details of the study before asking for participants' consent to taking part in the research process
        - Including a requirement for respect of privacy and confidentiality
        - Must ensure that data is kept private and that identifying information cannot be traced back to an individual
    - Respect for people's dignity includes understanding vulnerabilities of participant populations (Such as socioeconomic status, religion, race, disability) and taking measures to ensure that participation is not coerced
        - Example: Compensating participants with money or course credit is a common practice in psychology research but the amount should not be excessive enough that it would motivate participation in activities that participants would otherwise feel comfortable with doing

<u>The Practice of Ethical Research:</u>

- Federally funded institutions are required to have safeguards in place to ensure ethical principles are being upheld during the practice of research
- Research projects conducted in the United States must be viewed by a research ethics board, called an **Institutional Review Board** (IRB), before they may begin
- IRB is a committee of independent people who assess if a research project will be conducted in accordance to the general ethical principles
- They ensure the following:
    - The proposed study will use sound research design
    - Risks associated with participation are minimized and reasonable
    - The benefits of the research outweigh any potential risks
    - All participants can make an informed decision to participate, and that decision may be withdrawn at any time without consequence to the participant
    - Safeguards are in place to protect the well-being of participants
    - All data collected will be kept private and confidential
- Once approval is granted, participants can be recruited
    - Not just a simple "yes"
- Potential participants must have complete understanding of their involvement
- Researchers must obtain informed consent from every participant
- **Informed consent** is the process whereby researchers work with the participants to describe essential details of the study
    - Details include experimental procedures, risks and benefits of participation, how personal information will be protected and the rights of the participants
- **The Facebook Emotional Contagion Experiment: A Question of Informed Consent:**

    - Research in controlled laboratory settings has examined how emotional states can be affected and transferred from person to person through the process of “emotional contagion”
- In January 2012, for one week, researchers changed the amount of positive or negative information in 689,000 users’ news feeds
    - Some saw more posts with positive emotional words while some saw more negative emotional content
        - People who saw more positive events were more likely to create a more positive posts of their own, whereas those who saw more negative posts were more likely to create more negative posts
        - Like in the lab, emotion contagiousness applies to social media
    - Not received well by public, mainly due to lack of informed consent
        - Essentially, 689,000 users *unknowingly* participated in a study
        - Editors of the journal argued that data collection via Facebook did not require the same level of consent as research conducted in federally funded institutions
        - The study remained a source of ethical debate for years and it highlights a case in which research was conducted in an ethical gray area

<u>Special Ethical Considerations:</u>

- There may be research participants that may not be able to provide free and informed consent, therefore it is critical to consider these ethical situations
- **Vulnerable populations:**
    - Any individual or group of individuals with either of the following two criteria:
        - 1. **Decisional impairment**: Any instance when a potential participant has diminished capacity to provide informed consent (Example: Children and the mentally disabled)
        - 2. **Situation vulnerability**: Instances when the freedom of “choice” to participate in research is compromised as a result of undue influence from another source (Examples: Military personnel and prisoners that may feel obligated to participate out of fear of being punished if they do not; people in economically disadvantaged situations who may be inclined to participate as they will receive benefits that they would otherwise not have)
    - One can simply say that these populations should not participate in research, however, the principle of justice advocates that no person should be denied of the possible benefits of participating in a study
    - In such instances, the researcher must construct experiments with additional safeguards to ensure protection of these populations
    - Specifically, researchers should consider the following:
        - No study should ever be conducted on vulnerable populations if the research question could be reasonably carried out using participants without these vulnerabilities

        - When research is carried out, researchers should be responsive to the needs, conditions and priorities of the individuals; IRB committees should include members with expertise on these populations
        - In instances of decisional impairment, consent to participate requires that two types of consent are acquired: Parents and guardians must provided informed consent on behalf of the individual *and* the participant must provide **assent** (Affirmative permission)
        - In cases of situational vulnerability, additional safeguards should be put in place to prevent exploitation (Example: Including an impartial third party to advocate on behalf of individuals)
- **Deception:**
    - Researchers could possibly feel informing participants of the real intent of the study can change how the participants react, thus affecting the outcome
    - Therefore, some research experiments might seek IRB approval to engage in participant **deception**, the act of withholding information about the purpose and procedures of the study during the informed consent process
    - For approval, IRBs must meet four criteria:
        - 1. The research poses no more than a minimal risk to participants, meaning it is unlikely to cause emotional or physical discomfort
        - 2. The deception does not affect the well-being and rights of participants
        - 3. Researchers must provide justification that using deception is the only way to conduct the study
        - 4. Once the participant's role is finished, they should be *debriefed* by researchers and provided with information about the investigating and how they contributed to addressing the research question and in rare cases, participants must be informed about deception and they should be given the opportunity to asks questions (The goal of this process is not only providing information but also to help them leave in a similar mental state as they entered)
- **Milgram's Conformity Experiment: An Example of Research Deception:**
    - In 1961, Stanley Milgram created an experiment to test the length people would go to obey an instruction by an authority figure
        - Based on the World War II Numerberg war criminal trials
    - Prior to the experiment, experts estimated that less than 1% of a population would willingly participate in the death of others
    - He recruited 40 male participants by means of a local newspaper advertisement for a study of memory
    - During the experiment, participants were misled into believing that they would help teach a list of word-pairings to another participant, who was actually a **confederate** (A researcher acting as a participant)
    - Learner studied a list of word pairs, followed by a memory test in which the "teacher" (Real participant) would name a word and ask the learner to recall its match from the four choices

- The teacher-participant was instructed to administer an electric shock for each mistake, increasing magnitude each time
- Milgram created a mock-shock generator with 30 switches that included voltages from 15 volts to 450 volts
    - Were labeled with terms such as “slight shock”, “moderate shock” and “danger: severe shock”
- During the experiment, the confederate, who was hooked up to the mock-shock generator, purposefully made wrong answers and for each the teacher-participant believed that were delivering increasingly painful electric shocks (None were ever applied)
    - The confederate made complaints of pain, even yelling that he had a heart condition at a point
    - At the 300 volt shock, the confederate would bang on the walls, demanding for release
- Many teacher-participants began to object the experimenter and in response, the experimenter would deliver the following commands:
    - Prompt 1: “Please continue.”
    - Prompt 2: “The experiment requires you to continue.”
    - Prompt 3: “It is absolutely necessary that you continue.”
    - Prompt 4: “You have no other choice but to continue.”
- Beyond 300 volts (Still 10 more levels of shocks), the confederate ceased responding, implying death
- The study revealed that 100% of participants delivered shocks up to 300 volts, and 65% continued up to 450 volts
- Milgram noted most participants strongly objected to delivering shocks, showing significant distress, but continued to follow orders to the end
- His research gave support to the “obedience” defense, which demonstrates that most people are more likely to follow order by an authority figure, even to the extent of killing someone
- Deception was a necessary to generate an authentic measure of obedience, with the results directly contradicting how most people would “think” they would respond in such a situation
    - However, it also brought forward an unsettling example of the potential harm research participation may have on mental well-being of its participants
- Answering the research question came at a cost to all participants
    - Participants experienced emotional discomfort, guilt and psychological trauma (Maleficence) because they were led to believe they were severely harming someone
- When participants protested delivering shocks, the experimenter’s “prompts” failed to respect an individual’s freedom to participate (Principle E: Respect for People’s Rights and Dignity)
    - IRBs are not likely to approve such studies without major modifications for protection

Correlation:

- There are various approaches to analyzing data, dependent on study design and research question
- Often in research, one is looking to identify relationships that exist between two or more variables
- One way to quantify this relationship is through **correlation**, a measure (Denoted as r) that captures the direction and strength of a relationship between variables
    - In other words, as one variable can changes, so does another
- Scatterplot is one way to represent the relationship between two variables
- **Scatterplot**: Is a type of graph that has one variable on the x-axis and the other on the y-axis, and provides a visual representation of relationships between variables
    - If the relationship is strong, the points cluster tightly in a linear relationship
        - This relationship can be described using a simple statistic called a correlation (Denoted as *r*) to capture the direction and strength of a relationship

Direction of Correlation:

- Correlations can have positive, negative or zero directionality
- When two variables are **positively correlated**, the variables change in the same direction; as one variable increases, the other variable also increases
- When variables are **negatively correlated**, an increase in one variable leads to a decrease in the other
- A **zero correlation** indicates that there is no apparent relationship between the variables
- Scatterplot is a good way to show directionality
    - Each data point on a scatterplot represents the intersection of scores on two variables
- **Line of best fit**: A straight line on a scatterplot showing the general relationship of data points

Strength of Correlation:

- Positive and negative values convey the direction of the correlation, but not how closely the two variables are related
- The *strength* of a correlation is determined by a second metric
- The closer the data points are to the line of best fit, the stronger the correlation is
- **Correlation coefficient**: A numerical representation of the strength of the relationship between variables (Denoted as r)
    - The value of a correlation coefficient ranges from -1 to +1
    - Positive and negative signs indicate the *direction* of the relationship, whereas the absolute value of the correlation is the magnitude or *strength* of the correlation
    - In a perfect positive (r = +1.0) and negative (r = -1.0) correlation, all points fall on a straight line
    - Thus, as the correlation gets stronger, the coefficient gets closer to +1 or -1
    - When there is no relationship (r = 0 or numbers close to zero), no relationship between variables exists

Correlations Can Be Misleading:

- Correlation leads people to believe there is a cause-and-effect relationship between the variables, but simply because two variables are related, does not mean one knows why
- *Correlations are not causation*
- Correlation is just a relationship between two variables
    - Example: When ice cream sales rise, so do homicides
        - Does not mean eating ice cream causes people to kill others or that killing others causes ice cream cravings
        - Confounding variable: Hot weather - Ice cream is an appealing way to cool down and people are more likely to be outside, in greater contact with each other
- **Confounding variable**: Another variable that may influence one or both variables that are being measured, thereby influencing the correlation coefficient
- Just knowing there *is* a relationship between two variables doesn't reveal *why* that relationship exists
- When a relationship between two variables is appealing, one tends to attribute *causality*, the notion that one variable directly affect another variable
- Correlations are great clues to exploring relationships and making predictions about behaviour
    - Knowing a correlation exists may lead to more systematic approaches to determine what the causal relationships between the factors are
- Most effective method of determining causation is through a controlled experiment

Experimental Methods:

The Hypothesis:

- A hypothesis is a prediction about what will happen in the research
- Aim of conducting experimental research is to explain cause-and-effect relationships
    - Using the scientific method, one can find support for or modify an existing theory
        - Can also accumulate evidence through replication to develop new theories
- Experiment is used directly to link ideas within a *cause-and-effect relationship*
- Simplest form can be framed:
    - **If _[I do this]_, then _[this]_ will happen**
- **Hypothesis**: An educated prediction about the outcome of an experiment
- A hypothesis should have the following characteristics:
    - *It should be consistent with prior observations or an existing theory*
        - Hypothesis is an education prediction based on existing material learned from descriptive methods
        - Descriptive methods is the "what is" and a hypothesis addresses "why it is"
    - *It should be as simple as possible*
    - *It should be specific*

        - Good hypothesis provides all the details about who is being measured, what changes will be made during the experiment and what effect one predicts those changes will have on the outcome
    - *It should be testable*
    - *The hypothesis should be falsifiable*
        - Falsifiability is necessary in order to distinguish fact from fiction
- *Operational definition*: Is how a researcher decides to measure a variable
- *Experimental hypothesis*: What one expects to find if an idea is correct

Experimental Variables:

- *Independent variable (IV)*: The variable that the experimenter will manipulate, and it must contain at least two levels
    - Always comes first, before any measurement is taken, and is what one believes will cause a change in the experiment
- *Dependent variable (DV)*: The variable(s) the experimenter counts or measures (It is the outcome measure)
    - The effect *depends* on the cause, therefore what is measured is always called the dependent variable
- *Extraneous variables* (Also known as *confounding variables*): Any variables that are not the focus of the study, but may influence the outcome of research if not controlled
    - It is key to control as many extraneous variables as possible in order to produce the most accurate conclusions

Sample Selection:

- In an experiment, researchers must select experimental and control groups
    - Groups must be fair and representative of a larger population
        - This helps one be sure that any differences seen between the groups is caused by the independent variable
- *A simple random sample*: Type of sampling where every individual in the population has an equal chance of participating
    - Advantage is that, if large enough, it should approximate the larger population
- *A stratified random sample*: A stratification divides the population first by subgroups, then randomly takes samples in proportion to the population of interest
    - Particularly is useful when there are two or more identifiable subgroups
- *Non-random sample*: Generally follows the rule that not all individuals are equally likely to participate
    - Researchers might decide to create a *convenience sample* - A group of individuals that are only selected because of a pre-existing condition, convenience or easy access to participation

Experimental and Control Groups:

- Once participants are selected, a basis by which one will measure changes and compare behaviour must be established
- Example: Study of testing a memory-enhancing drug

    - The group that receives the treatment of interest is called the *experimental group*
    - The other group, called the *control group*, is treated nearly identical but does not receive the drug
    - One must also consider the power of the mind and how it can influence feelings and behaviour
        - The throughout of taking a drug that enhances memory can lead to subtle psychological effect that lead one to being more aware in preparation for performing better on the memory test
        - This is called the *placebo effect*
- To account for the placebo effect, sometimes researchers will create a *placebo group*

Internal Validity/External Validity:

- When studying causal relationships, one must take measures to control any unrelated factors that may affect the outcome
- By controlling for factors that might bias the outcome of the experiment, one is addressing *internal validity*, the degree to which results may be attributable to the independent variable rather than some other effect
- The *external validity* of a finding speaks to the degree to which a result can be applied beyond the scope of the experiment
- *Generalization* is the external validity of how the results from an experiment can apply to other settings, other people and other time periods
    - In other words, how it applies to the real world
- Replication not only serves to establish internal validity but can also be key in establishing external validity

An Example Experiment:

- Cognitive psychologists theorize that the act of recalling or recognizing material in a test actually leads to better retention of information than if a piece of information was not recalled
    - Reason why there are so many questions in the text
    - Called the “testing effect”
- In 2006, Roediger and Karpicke conducted an experiment on the effect that tests (Independent variable) had on memory recall (Dependent variable)
    - They hypothesized that repeated testing should lead to greater recall of information than simply studying
    - Recruited a random sample of undergraduate participants and asked them to read a passage of text
    - Participants were assisted to two random different groups
    - First group, the experimental group, was asked to call the information while the second was not
    - If the “testing effect” hypothesis was real, improvement in recall would be seen in later testing
    - If the hypothesis was false, no differences would be seen or even a decrease in recall compared to the control group

    - In conclusion, performance in the long term is better after testing than after studying
    - In this case, the researchers manipulated two experiences that led to a change in behavior, allowing them to conclude that testing caused better memory retention in the long term

Making Sense of the Data:

- After data collection, one must make sense of the findings
- Need to know whether the experimental and control condition differed with regard to the outcome measure (DV)

Describing Data: Central Tendency:

- *Descriptive statistics*: Information like the mean, median and mode and the frequency of certain demographics
- Inferential statistics: Determining whether there are real differences between the independent variable condition so that one can make inferences about the causal relationship between the IV and DV
- *Descriptive statistics* are a collection of ways to describe the data in the simple form, involving the use of quantitative values
- Average (Mean): Relevant and frequently used measure of the *central tendency* of the data
- Three types of central tendency: The *mean* (Average score), *median* (Middle score in an ordered set of data) and *mode* (The most frequently occurring number in a data set)
    - Main disadvantage of the mean: It can be significantly affected by extreme values (Outliers)

Describing Data: Spread of Data:

- The difference between groups is in the *variability*
- The most commonly used measure of variability is the *standard deviation (SD)*
- Simple deviation scores are problematic because simply subtracting the score from the mean, the positive and negative values cancel each other
- If one summed the deviation scores, the total would be zero, so the deviation scores are squared because a negative number squared is a positive number
- The average of the squared deviation scores is called the *variance*
- The square root of the variance is the standard deviation
- In order to account for some of error in measurement, the denominator becomes n - 1, where n is the total number of scores

A Brief Introduction to Inferential Statistics:

- The idea of statistical significance is based on simple rules of probability
- In statistics, one uses intuitive sense to help reach decisions about what events are “unlikely” to happen by chance alone
- If the probability *(p*) of an event is less than 5% (Represented as $p < 0.05$), it is typically called a *statistically significant* event that is unlikely to happen by chance alone

- It is possible to calculate probabilities of any data set using measure of century tendency: The mean, standard deviation and a tendency for data to follow a consistent pattern
- *Normal distribution*: Measures plots on a graph that create a bell-shaped curve
    - Normally distributed data are described as symmetrical, with a single central peak in the middle (Average of the data) and where the spread of data (The standard deviation) gets smaller and smaller as one moves away from the mean
    - In normal distribution, the mean, median and mode are the same number
    - Since the normal distribution is so predictable, one can reliably estimate probabilities at any point under the normally distributed curve
        - As one moves further from the mean, less of the population is likely to achieve that score
        - One can measure the spread away from the mean using standard deviation
        - Ronald Fisher determined that around 1.64 standard deviations away from the mean represent the most extreme 5% of the population on one side of the distribution

Drawing Conclusions from Data: A Demonstration:

- A statistical test has its benefits and drawbacks
    - Using data, one can create predictions based on what is known
    - This information allows one to establish criteria to use to make decisions, but there is a chance that the decision could be the wrong one
- Advantages of this statistical procedure: One can is making decisions using a rational process, and is removing some of the subjective elements of the decision-making process

Summary (Copied directly from textbook):

- The steps of the scientific method are (1) identifying the problem, (2) gathering information, (3) generating a hypothesis, (4) designing and conducting experiments, (5) analyzing data and formulating conclusions, and (6) restarting the process at step 3 by taking what you've learned into consideration
- The difference between naturalistic and participant observation is whether the researcher is a part of the environment while making their observations about it
- Bias can appear in observational research in many ways, including when participants change their behavior in response to being observed (known as *reactivity* or the *Hawthorne effect*) and when multiple observers disagree about what they've observed
- Case studies are an in-depth way to gather a large amount of detailed information about a single person or a handful of individuals; however, case studies may not be generalizable to larger populations
- Populations need to be sampled effectively, preferably using random sampling techniques; sampling error/bias can occur when the people who participate in a study are not representative of the intended population

- The way people respond to questions in research studies is influenced by multiple factors, including but not limited to the wording of questions, the desire to answer in socially desirable ways, a general tendency to agree or say yes to questions, and a tendency to think of ourselves as better than average
- Five ethical principles have been developed by the American Psychological Association (APA) to guide research with human subjects: (1) beneficence and nonmaleficence, (2) fidelity and responsibility, (3) integrity, (4) justice, and (5) respect for people's rights and dignity
- Ethical research in psychology should strive to have the most potential benefits to society with the fewest potential harms, not take advantage of participants, and be truthful with both participants in the study and the wider scientific community
- Vulnerable populations (including those with impaired decision-making skills and those who are vulnerable by virtue of their circumstances) must be treated with particular care; informed consent is especially important in these groups
- Deception in psychological research is only warranted in special circumstances, and participants must be fully debriefed about any deception that occurred after they finish participating in the study
- A correlation describes the relationship between two or more variables and can be positive, negative, or zero (unrelated)
- Correlations have both strength and direction; strength describes how closely two variables are related, while direction describes whether the variables increase and decrease together (a positive relationship) or are inversely related, meaning that if one increases the other variable decreases (a negative relationship)
- Correlation coefficients are calculated to describe the strength and direction of a correlation
- Correlation is not the same as causation: At times, correlation coefficients are misleading or confounding variables can make two variables appear causally related when they, in fact, are not
- Experiments are conducted to determine whether manipulating an independent variable causes changes in a measured dependent variable
- Independent variables are manipulated by researchers (resulting in "experimental" and "control" groups), while changes in a dependent variable or "outcome measure" represent the effect of the researchers' manipulation
- Placebo effects can occur if a person believes in a cause-and-effect relationship; these effects represent the power of participants' expectations in an experimental setting and can be mitigated by the use of placebo groups
- Internal validity exists in an experiment when a cause-and-effect relationship can be established; extraneous (confounding) variables threaten our ability to claim that an independent variable causes a change in a dependent variable
- External validity describes the extent to which the results of an experiment are generalizable to other people, other settings, other time periods, or other contexts
- Descriptive statistics are used when we want to report on our results descriptively: Measures of central tendency (e.g., mean, median, and mode) attempt to find a number

that best represents the data, while measures of variability (e.g., standard deviation and variance) help describe the distribution or “spread” of the data

- The mean is the average score in a data sample, the median is the “middle” score if the scores were rank-ordered from lowest to highest, and the mode is the most common score
- Standard deviation describes the average distance from the mean score in a data set; this helps us understand whether scores are all very close to the mean or more spread out
- Inferential statistics allow us to make inferences about whether differences exist between two (or more) sets of data; for example, whether or not a true difference is likely to exist between experimental and control groups. Such differences could be statistically significant depending on the results of the analyses used on the data