An Abridged Version: Interactive Introduction to Research Methodology

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For Bachelor of Arts in Social Work, 2nd Year

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Instructions to the Lecturers

- **Use a post class evaluation to know how well the students have understood and accepted the content of the Lecture. It can be just a 5 minutes session at the end of the class and the best method to measure students' active participation during the session.**
- **Remember the overall research should be in the form of straight funnel; the rim of the funnel being a vague topic to the conclusion being the tapering end. Every finding should converge as a conclusion at the end. (RB)**
- **It need to be understood that psychology is all about participation and interaction with the effort applied to learn the various concept concerning the human affair. This is the basis for any assessment.**

Research Methodology in Psychology

With due thanks to the students and colleagues for their participation, interaction, support and feedback.

Introduction to the Scientific Research (Method)

Unit I

Etymology and Definitions

- The word *research* is derived from the Middle French "*recherche*", which means "to go about seeking", the term itself being derived from the Old French term "*recerchier*" a compound word from "re-" + "cerchier", or "sercher", meaning 'search'.[4] The earliest recorded use of the term was in 1577.
- **A systematic careful inquiry or investigation done to discover new information or relationships and to expand and verify the existing knowledge for the same specific purpose. (**N. Rai, BVIC)
- Humanities scholars usually do not search for the ultimate correct answer to a question, but instead explore the issues and details that surround it. Context is always important, and context can be social, historical, political, cultural or ethnic. An example of research in the humanities is historical research, which is embodied in historical method. Historians use primary sources and other evidence to systematically investigate a topic, and then to write histories in the form of accounts of the past.
- In the broadest sense of the word, the definition of **research includes any gathering of data, information and facts for the advancement of knowledge.**
- Another definition of research is given by Creswell who states - **"Research is a process of steps used to collect and analyze information to increase our understanding of a topic or issue". It consists of three steps: Pose a question, collect data to answer the question, and present an answer to the question,**

The Scientific Research

Tentative Layout

- **Organization of knowledge**
- **Sequencing of Knowledge**
- **Application of Knowledge**
- **Academic research- Project**
- **Scientific Research**
- **Applied and Basic Research**
- **Research as scientific discipline**
- **Reliability and validity important constructs in research. reliability is result of statistics and validity is the measuring tool (??).**
- **Reliability: Does the process tool gives the same measurement every time with the same variable**
- **Validity: Does it measure what it was intended to.**

Research Methods

1) **Cross-sectional designs but this don't yield cause effect relations as in cause of survey which show there is relationships between variable but doesn't most of the times show cause to effect relationships between research unless hypothesis set to conduct research (hypothesis testing in case of survey is least frequent)**
2) **Case study and longitudinal/prospective study sometimes- work stress vs. workplace well being**
3) **Diary Study where workers contribute data.**
4) **Experimental and quasi-experimental designs**
5) **Statistically correlation, multiple linear regression (MLR), and analysis of variance used to interpret data.**
6) **Interviews, self reported questionnaire are qualitative tools in accessing data (but the research may be quantitative as the obtained qualitative data are quantified. The objectivity and subjectivity is maintained in both qualitative and quantitative research.**
7) **Logistic regression??**

The Scientific Research- Concept

- We discussed about the digging of grounded wealth, to the taste of Tungba- sour to bitter (millet made Nepali brewery), to the cause behind the loss of UCPN, Maoist in 2nd Constitutional Assembly, 2013 (2070 BS) in Nepal as some researches.
- But extracting the '**wh**' (why, when, what, how, whom or even how much) is the enough criteria for a investigation to be scientific research or not is a question on consideration/ focus.
- **Scales** are parameters that help in measuring a relationships or variables. A scale is reliable when it gives the same measurement/ results under similar set of conditions. For example an **ECONOMIC STATUS SCALE** is reliable only if two persons with apparently same economic status show the same score in the scale. It establishes dependability, stability, consistency, predictability and accuracy.
- A scale is said to be valid when it correctly measure what is expected to measure. (Maybe from these ideas we can infer that **reliability is result of statistics/ process and validity is the dependency of the measuring tool.)**
- **Research helps to know the truth via creating and producing knowledge (data). This knowledge is organized via classification and nomenclature and preserved for future use or use to solve the problem or use to create tool that solves problem.**
- Knowledge can be defined as "a collection of discrete but related facts and information about a particular domain. It is acquired through formal education or training, or accumulated through specific experiences"

Research: Definitions

- Research is defined as the creation of new knowledge and/or the use of existing knowledge in a new and creative way so as to generate new concepts, methodologies and understandings. This could include synthesis and analysis of previous research to the extent that it leads to new and creative outcomes.
- “Research is a systematic inquiry to describe, explain, predict and control the observed phenomenon. Research involves inductive and deductive methods”. (Babbie. 1998).
- Research is the pursuit of truth with the help of study, observation, comparison and experiment; the research for knowledge through objective and systematic method of finding to a problem (Kothari. 2006).
- When these definitions are consolidated, it can be said that research is the systematic activity directed towards objectively investigating specific problem in order to discover the relationships between and among variables. It seeks to answer specific questions.

What makes a research a scientific discipline?

- Humans are inquisitive (intrinsically curious nature of man) about events and phenomenon, they always wants to know the cause and consequences; happening or not happening through “**wh**” queries so that they could generate knowledge of future use and predicting the future of such events.
- There are basically 4 ways to knowing or understanding (knowledge generation or finding truth):
- **Method of Tenacity:** People said so, and more people validated so we believe such knowledge to be true
- **Method of Authority:** When a authorized person, Church, Geeta or a mosque asserts something as true then it must be true.
- **Method of Intuition**: It is also called **Prior method**. This is true because I feel its true. It’s the result of natural inclination for the truth. The information becomes true not because of reason but of experience.
- **Scientific method: T**his method of extracting knowledge or the knowledge extracted is true not because a lot of people said so in the past or some authorized person said so or I feel so. But because the scientific method finds this knowledge true through experiments and tests. **Cause or effect relation is here established and also self correction or objectivity is maintained.**
- Research is meant to organize knowledge or produce knowledge. It is a creative work undertaken on s systematic basis in order to increase the stock of knowledge including the knowledge of a man, culture, society and to apply this knowledge to solve problems or use this knowledge to devise a tool that solves problem.

Scientific Research

- **Scientific research** is a systematic way of gathering data, a harnessing of curiosity. This research provides scientific information and theories for the explanation of the nature and the properties of the world. It makes practical applications possible. Scientific research is funded by public authorities, by charitable organizations and by private groups, including many companies. Scientific research can be subdivided into different classifications according to their academic and application disciplines. Scientific research is a widely used criterion for judging the standing of an academic institution, such as business schools, but some argue that such is an inaccurate assessment of the institution, because the quality of research does not tell about the quality of teaching (these do not necessarily correlate totally).(Armstrong, S. & Sperry, T., 1994)

What makes a research a scientific discipline?

- The characteristics of a scientific research are:
- A**) Verifiability: E**very time a researched knowledge or process should stand up to its mark to give the same value or interpretations. e.g. Every cloudy Wednesday, the suicidal tendencies in Ilam increases. This fact need to be verified every Wednesday either by observation or other methods (interview) for this research to be a valid scientific research. Reliability quotient is an important aspect of verifiability. Inferences drawn from the data should be similar every time.
- **B) Generality:** Laws or knowledge should be universal and these laws shouldn't limit to individual group or object. The tendency to suicide should include the whole population (universe) of Ilam and not bound to caste, creed or any other stratification. Laws in social science are most often not generalizable and are limited to set of conditions. Basic rule of investigation should be common to all type of scientific investigation.
- **C) Predictability:** Another characteristics of a scientific method is that its result can be predicted with sufficient accuracy. E.g. at 100 degree Celsius the water changes to steam; at 0 degree water changes to ice. Conditions apply for predictability. Predictability also applies with less accuracy in social science research. We use different psychometric test to predict and use the work behaviour.
- **Statistically predictability is maintained through the test of hypothesis.**

What makes a research a scientific discipline?

- **D) Objectivity: T**he result obtained through scientific research should be free from researcher internal or external biases or subjectivity or desire or wishes. All person should arrive to the same conclusion for a observation or phenomenon. E.g. Coal is black for all people. Objectivity helps to repeat the experiment.
- **E) System: S**imilar set of conditions or mode of investigation should have been applied to extract the same knowledge. Results through random methods cant be said as scientific
- Scientific research is a systematic process where data are collected by observations or experimentations.

Objectives of Psychological Research

- The expected answers to research queries are the objectives of the study. If the problems have been stated in negative sentences, then their counter statements i.e. positive sentences are the objectives of the study. For example: the problem of a study is – Condition of a clients in psychiatric ward are deteriorating. Then regard to this the objective becomes – Whether clients would be improved through extensive therapy.
- The tentative objectives of a psychological research are: **General Objectives (broad objectives):** Understanding of human behavior and the reasons (as mental processes) that govern such behavior.
- **Specific or operational objectives:**
- To identify and define a psychological problem or question and to describe and explain a psychological phenomenon and obtain a theme.
- To distinguish between different research methods, strategies and tools used by the psychologist to understand human behaviour and mental issues.
- Systematic investigation and quantification of psychological phenomenon and use of statistical method to validate such phenomenon.
- Generalization based on probabilities (Psychology is the subject of probability.)- it is the use of basic concepts of statistical data.
- Be aware of the major functions of ethics codes, and why they play such a crucial role in psychological research;

Types of Research Methods

- The goal of the research process is to produce new knowledge or deepen understanding of a topic or issue. This process takes three main forms (although, as previously discussed, the boundaries between them may be obscure):
- Based on the requirements and the complexity research can be identified on various types:
- 1) Based on use of knowledge- Basic and applied research
- 2) Base on the process- Exploratory (defining the phenomenon) and Constructive research
- 3) Based on experimental conditions- Lab and field research
- In experiments there is manipulation of variables. The independent variables are manipulated and the extraneous variables are controlled. There is an empirical observation of the result.
- Field experiments often use Quasi Experimental Design or Ex-post facto research design.
- 5) Based on Data- Qualitative and Quantitative Research

Types of Experiments: Lab vs. Field

- The main notion or rationale behind the experiments is to know the cause and effect relationships by varying some variables and controlling some.
- Lab experiments aims to find an absolute cause and effect relationship of the phenomenon under study whereas the field experiments aims to find the consequences/ effect of a phenomenon and not the cause.
- Broadly speaking there are two types of experiments. The **Laboratory Experiment** (not the **Lavatory** Experiment, which basically means the Toilet. Ha! Ha!) and the Field Experiments.
- While most of the experiments in physical science are done in laboratories, many of the experiments in social or managerial sciences are performed in the field. If the research problem is such that it is divorced from the real world surrounding it, laboratory experiments are to be carried out. A laboratory can be considered as any setting in which the researcher is able to closely control the conditions under which observations are made.
- The **undoubted** hypothesis (as considered in Veda) that, " energy can neither be created nor can be destroyed but can only be transformed from one form to another" is very applicable in lab experiments because either mass or energy is conserved in lab experiments.

Types of Experiments: Lab vs. Field

- On the other hand where attempts are made to study the problem with the real setting and to minimize the influence of seemingly unconnected variable (we don't actually control variable in real world setting as we can only reduce their effect). With the growth and development of statistics, the need for a special laboratory for the purpose of the experimentation is no longer regarded as necessary for adequately controlled research (but how? **<u>Can randomization or simply replication can replace the controlling of variable part of the lab experimentations?</u>**).
- It is said **<u>that Replication, Randomization and use of certain statistical control</u>** method help the conduction of field experiments with little interference from the extraneous variable and even with several variables being manipulated at once.

Types of Experiments: Field Experiments

- The use of experimental and control group is the most common approach of controlling a field experiment. **<u>An experimental group would consists a group of people subjected to the experimental variables or treatment while the control group would consist of a group sufficiently similar to the experimental group but not subjected to the experiments</u>**. (They are treated with the natural flow or time and let us idea about whether or not by experimenting a variable or subject can actually produce an outcome. Its more about the relationship between the change in mass/ energy with time).
- There are several statistical designs which are used in field experiments. A design is a plan of allocating experimental treatment to experimental units. The designs help in estimating the effects of individual treatment, their interactions and significant difference in their effects, etc.
- There are several **problems in carrying out experimental researches where study elements as human subjects are used.**
- **1)** They often change their response because of their interaction with the environment and along with relationships that are developed and present during experiments (more during field experiments). The subjects give different response than they had planned regardless of experimental manipulation.
- 2) Awareness among the subjects about them being in the process of experiments would make them give different response than when they were not aware of being in the research and experimentation process. They usually want to give ideal answer or fake good or even bad. This is more about being socially desirable or ideal. There is always the impact of social desirability and demand characteristics.

Types of Research Methods: Basic and Applied

- **Basic research-** The primary purposes of basic research (as opposed to applied research) are documentation, discovery, interpretation, or the research and development (R&D) of methods and systems for the advancement of human knowledge.
- **Applied research-** its focus is to use this knowledge to apply, either through solving the problem or using the knowledge to design a tool that solves the problem.
- It is the research process that uses some theories to solve the existing problem and along with finds out the applicability of applied theories. Applied research in addition to solving problems also helps in advancement of tools and techniques used for problem solving. This research is more like mending an engine of the car and also knowing about the car.
- **Applied research** is a form of systematic inquiry involving the practical application of science. It accesses and uses some part of the research communities' (the academia's) accumulated theories, knowledge, methods, and techniques, for a specific, often state-, business-, or client-driven purpose. Applied research is compared to pure research (basic research) in discussion about research ideals, methodologies, programs, and projects.

Types of Research Methods: Basic and Applied

- Applied research deals with solving practical problems and generally employs empirical methodologies.
- **Because applied research resides in the messy real world, strict research protocols may need to be relaxed.** For example, it may be impossible to use a random sample. Thus, transparency in the methodology is crucial. Implications for interpretation of results brought about by relaxing an otherwise strict canon of methodology should also be considered.[*citation needed*]
- The OECD's Frascati Manual[3] describes Applied Research as one of the three forms of research, along with Basic research & Experimental Development.
- Due to its practical focus, applied research information will be found in the literature associated with individual disciplines.
- **Exploratory research,** which helps to identify and define a problem or question. Its more about defining or exploring a phenomenon.
- Remember our term paper cum research report is more of exploratory research because it places more weight on defining the problem. It is also basic research in many sense because it discovers many prospects.
- **Constructive research,** which tests theories and proposes solutions to a problem or question.

Types of research methods

- **Empirical research,** which tests the feasibility of a solution using empirical evidence.
- There are two major types of research design: qualitative research and quantitative research. Researchers choose qualitative or quantitative methods according to the nature of the research topic they want to investigate and the research questions they aim to answer:
- **Qualitative Research:** Understanding of human behavior and the reasons that govern such behavior. **Asking a broad question and collecting data in the form of words, images, video etc that is analyzed searching for themes.** This type of research aims to investigate a question without attempting to quantifiably measure variables or look to potential relationships between variables. It is viewed as more restrictive in testing hypotheses because it can be expensive and time consuming, and typically limited to a single set of research subjects. Qualitative research is often used as a method of exploratory research as a basis for later quantitative research hypotheses. Qualitative research is linked with the philosophical and theoretical stance of social constructionism. This method enables descriptions and explanations rather than absolute value. However these explanation can be quantified for statistical assertion.

Types of research methods

- **Quantitative research**: Systematic empirical investigation of quantitative properties and phenomena and their relationships. Asking a narrow question and collecting numerical data to analyze utilizing statistical methods. **The quantitative research designs are experimental, correlational, and survey (or quantitative survey).** Statistics derived from quantitative research can be used to establish the existence of associative or causal relationships between variables. Quantitative research is linked with the philosophical and theoretical stance of positivism. The Quantitative data collection methods rely on random sampling and structured data. **Quantitative research is concerned with testing hypotheses derived from theory or producing hypothesis to and/or being able to estimate the size of a phenomenon of interest. It can be a experimental research where a experimenter can manipulate variables.**
- **Hypothesis are assumptions and when these assumptions are tested and proved they become theories.**
- In either qualitative or quantitative research, the researcher(s) may collect primary or secondary data. Primary data is data collected specifically for the research, such as through interviews or questionnaires. Secondary data is data that already exists, such as census data, which can be re-used for the research. It is good ethical research practice to use secondary data wherever possible.
- Mixed-method research, i.e. research that includes qualitative and quantitative elements, using both primary and secondary data, is becoming more common.
- Based on context and requirements, there are a lot types of research as experimental and non experimental research; laboratory versus field research, quantitative vs. qualitative research; basic vs. applied research.

Qualitative and Quantitative Research Methodologies

- **Quantitative research methods include:**
- Experiments: random treatment assignments and quasi experiments using nonrandomized treatments.
- Surveys: which are cross-sectional or longitudinal
- **Qualitative research methods include:**
- Ethnographies which are observations of groups
- Grounded theory which uses multi-staged data collection
- Phenomenological studies which studying subjects over a period of time through developing relationships with them and reporting findings based on research "experiences."
- Case studies which use various data to investigate the subject over time and by activity.
- Each research method has it's strengths and weaknesses. When designing a research study it is important to decide what the outcome (data) the study will produce then select the best methodology to produce that desired information.

Ex-post facto research design

- Design of research is overall layout for the conduction of research, **mainly concerned with identification of methods to collect the data, analyzing the data and reporting the data. It is the procedures to be used in data collection and data analysis used for controlling the variances due to different factors.**
- To propagate a research it is not the type of research but the design of research that is important.
- It is the systematic empirical inquiry in which the scientist doesn't have direct control of independent variable (X) because their manifestations have already occurred or because they are inherently not manipulated. E.g. Knowing the psychological stress or anxiety (Y) of people who suffered a natural disaster as the 2072 earthquake (X) as flood or landslides recently. Inferences about such study can be made without the intervention on any independent variables.
- May be we can use a blend of **Ex Post Facto Research** design and **Experimental Design** to study the effect of long working hours in the abroad employed workers. This is not a lab experiment. It is more of the field experiment.
- There are many types of knowledge, and while scientific "truths" may be better than other truths in many respects, there are others which nonetheless are useful: historical facts, literature and "common sense". These types of knowledge are indeed "good enough" truths, which, in our attempts to understand people's reactions to changes in the world of work, should not be dismissed.

Quasi Experimental Design (QED)

- **Quasi Experiments are semi experimental designs where much of the issues, events and conditions are maintained as original events (that already took place) but some conditions are not maintained as it is not possible.** (As in technology can it be considered parallel as Simulation). Its an empirical study used to estimate the causal impact of an intervention on its target population. They share a lot of common features with traditional experimental design or randomized control trial.
- **<u>But a typical feature this design lacks is that it doesn't introduce random variable in the experimental or control group albeit it may or may not have some control of authority over the flow of design</u>**.
- **This design supports the internal validity that means generalisability is not that possible of such quasi experiments**. Here the experimental groups is more like the control group on both observed or unobserved characteristics.
- If there was possibility of randomized trial (randomness always demands probability issues) as like in experimental research, each participants would have the same chances of having participation in the experiment.
- **There are independent (x) and dependent (y) variable over the experiment, but the causal relationship is not established and as there is no random trial and the population is also limited the generalisability norms are not established. Factors such as cost, feasibility, political concerns, convenience may influence the experiments and only internal validity is established**.

Quasi Experimental Design (QED)

- **In QED its not possible to establish a cause and effect relationships between variable. QED may be used in investigations like road traffic accident, homicide and suicide.**
- Placebo effect is a control used in medical or physiological experiments. QED are best for post-experiment testing on to access the affectivity of the experiments. Naturally occurring variables as age, gender and color of the eye, etc are already within the QED and they are not exploitable.
- **QED is actually a model to access the know how of the incident that has already occurred. e.g. The health of foreign employed worker can be accessed when he return back to his native country and a lot of the naturally occurring variable that need to be accessed are already missing as the environmental condition in which the worker was working, the psyche of the worker at that time, etc.**
- QED is generally used in social science, public health and education and even the political analysis as mini referendum done by the media house in the proximity of any Election. A lot of times the experiment we acknowledge are best in the form of QED because absolute **Control of a lot of variable during a social experiment is absolutely not possible**.
- We can conclude QED is an experiment but absolute control over a lot of extraneous or other variable is not possible.

Difference between

Basic research

- Basic research is used to explore the fundamental bases of behaviour without regard to how those bases are manifested in the real world.
- It explains and predict fundamental behaviour and is just for knowing and upgrading knowledge.
- In a popular memory procedure our subjects has to respond to words on computer screen as fast as possible. Like when a word appears in the screen, they have to say that word and press a key. This can tell a researcher about how information in your memory is linked to other information. But whether this technique have a practical implication in real life is a question and if this technique really improves your working memory is a debate.

Applied research

- It aims to address and answer real world problems.
- The research done have a direct implication or application and also solves practical problems.
- Applied research may be like persuasions, eyewitness memory, clinical treatments of psychological disorders, organizational interventions

Experimental and Control Groups

- Designs are tentative layout or the structure of the research process.
- **Control Groups** (where research variable are not manipulated) are those groups who are structured within an experimental framework and research so as to know the validity of research process. The control groups are not experimented with research inputs or their psychological variables are untouched. The main aim of the researcher in framing the control group is to ascertain whether the research process was biased, whether the results ascertained could be brought about without giving a experimental inputs and even without being tested. In knowing the effectiveness of pharmacological drugs, the experimental group is given with the drugs where as for the control no drugs are given or even if given it would be some placebo that doesn't exhibit the drug characters.
- In retrospect the **Experimental Groups** are those where research variable are manipulated. Control groups are also used for correlating the research process.
- **In experimental groups variables are manipulated but in control group variables are not manipulated to see the effect of time on the subjects under the study. But both the groups are under the research framework.**
- **In contrast we can observe and or manipulate both the control and experimental variable within the experimental groups.** Control variable is most of the times a variable which is extraneous and controlled in an experiment. Where as experimental variables are either varied (increased in their strength or decreased in their strength or intensity).

Studies: Case, Longitudinal and Cross Sectional

- **Studies: When we don't need to experiment on variables but if our prime objective is to establish the causal relation between inputs made and output observed or just to know the cause and effect phenomenon then we do study. Studies are very important academic research like as Literature Study, Thesis or Dissertation, Diagnosis, Case Study, etc.**
- **Case Study:** When a single or group of cases/ units are intensively studied or examined for a long time and various facets are measured or observed, it is called case study. It enables us to explore, understand problems, issues and relationships and the findings in one case study may be a theory in other upcoming case study or research. In case studies data are collected through observations, interviews, protocols (Set of rules), tests, examinations of records, and collections of writing samples, etc.
- **Supplementary:** There is a case study survey in case of community psychosocial research which basically is meant to survey a group as a case. Example when all the children in Autism Care Nepal are surveyed it's a example of case study survey. (is it?. Yes it is.)

Studies: Case, Longitudinal and Cross Sectional

- If the study population covers only a segment of population, the study is **Cross Section Study.** A relative study between different groups of sample can be a type of cross sectional study. **E.g. 1**
- **If we desire to know the psychological trauma for adolescence girls (aged 13 to 15) due to the menstruation, we may consider girls age 13 as one group, 14 as the other and 15 as other. We can study these groups at once and for a relatively short period of time**. (can this be considered as multi level cross sectional study)
- **E.g. 2** The study of parental attitude towards their married daughter in Newar community considers only a segment of population.
- **We need to accept the fact that every or some type of research is in fact case study as we sample population and do our research or investigation on that particular part of population.**

Studies: Case, Longitudinal and Cross Sectional

- **<u>Longitudinal Studies</u>** also focus on study of group (that reflects a section of population). but the time frame of these studies is for a longer period. Usually these studies are meant for detecting changes and know the trend in changes. E.g.. The study of changing attitude toward family life among Nepalese youths during a last decade is an example of longitudional study.
- +2 students (batch 2013) at Bright Vision College studied for a time frame of 10 years can show the prospects and changes in the life of these students. Usually longitudinal studies are very important in Development Psychology. The psychosocial stages of Eriksson is the result of longitudinal study.

Difference between independent variable and dependent variable

Independent variable

- Denoted as X.
- It is called experimental variable, as it can be manipulated or acted with experiments.
- When I tell a joke I act or experiment on someone's humour. Humour here is an independent variable.
- It can be controlled (lab research) or cant be controlled (ex-post facto research)
- Basically in laboratory research and experimental research it is very much important to identify which is experimental variable and which is dependent variable.

Dependent variable

- Denoted as Y.
- It is the byproduct variable and is the result of experiments. So it is called dependent variable.
- If someone's laugh at my jokes than it is the dependent variable because laugh is the result of my joke.
- Can dependent variable and independent variable be interchanged?

Steps In Research Methods

- Identification of **research problem**/ Statement of problem
- **Literature review** (or study about past problems and achievements relevant to the present context of study). The sources of literature review can be address of key figures, published journal and scientific papers, seminars and workshops, thesis, governmental reports and newspaper articles.
- In one way literature review helps in generation of insight for defining the research topic while also helps in comparing the past research with the rationale set behind conducting the new research.
- Specifying the purpose of research/ **Objectives** of research (objectives are fulfilled through result of research and are tested through hypothesis)
- Determine specific research questions or **hypotheses**/ setting hypothesis based on inferences drawn in the past. Hypothesis are set in order to work on the problem or carry over the problem. They are like pick up vans, that carry our luggage and belongings. It is used for testing the relationships between various variables. Here the researcher would be seeking data perhaps from a number of different study situation, aimed at proving or disproving the validity of the relationships.
- **Brain Teaser:** As hypothesis are used to test relationships between variable, are hypothesis major issues in only quantitative research or is it also applicable in case of qualitative research? Both, as FGD also sets hypothesis before its conduction. FGD is a qualitative method.

Steps In Research Methods

- **Data collection** (prior to which **sampling** of population is done where research is being carried)
- Analyzing and interpreting the data/ **Results, discussion and conclusion**
- Reporting (feedback) and **evaluating** research **(if it is applied research use it to solve problem**
- Communicating the research findings and, possibly, recommendations.
- **(Planning or designing is the overall scheme or structure of the research process and conducting all these steps we need to have a proper planning prior to the research, the ethical code of conducts be revised and if necessary new can be formulated. Defining the scope and nature of the problem, specifying the related variables and setting the logical hypothesis are very important)**
- **Cohort**: It is the same group of study elements considered at the beginning of study, which go on experiencing the event changes within a defined time period (children born on particular date, youth of Nepal who experienced the 10-Year-Conflict, students enrolled at a class during a particular academic year.)

Steps In Research Methods

- Wikipedia lists the following steps in scientific research.
- Generally, research is understood to follow a certain structural process. Though step order may vary depending on the subject matter and researcher, the following steps are usually part of most formal research, both basic and applied:
- A) **Observations and Formation of the topic:** Consists of the subject area of ones interest and following that subject area to conduct subject related research. The subject area should not be randomly chosen since it requires reading a vast amount of literature on the topic to determine the gap in the literature the researcher intends to narrow. A keen interest in the chosen subject area is advisable. The research will have to be justified by linking its importance to already existing knowledge about the topic.
- B) **Hypothesis:** A testable prediction which designates the relationship between two or more variables.
- C) **Conceptual definition:** Description of a concept by relating it to other concepts. This steps can be used as the introduction to topic (it is very necessary while doing the literature study or descriptive studies and in cases where we have to analyze the past researches too)
- **Brian Teaser:** Hypothesis can never be wrong? Is it? (Hypothesis can be wrong, but it is a matter of fact that whether it is wrong or right, after it is formulated, we have to test it and **accept it or reject it**). What's your view?

Steps In Research Methods

- D) **Operational definition:** Details in regards to defining the variables and how they will be measured/assessed in the study. Like what could be the operationalized definition for a maltreated child.
- **<u>Operational definition of child maltreatment</u>**: Children under the age of 18 in Nepal who can't respond comprehensively with conscience and give an accurate consent towards various forms of negligence, physical, sexual and psychological mistreatments and other activities conducted against their welfare are said to be children maltreated.
- E) **Gathering of data:** Consists of identifying a population and selecting samples, gathering information from and/or about these samples by using specific research instruments. It more about the collection , description, specification and classification of data. The instruments used for data collection must be valid and reliable.
- F) **Analysis of data:** Involves breaking down the individual pieces of data in order to draw conclusions about it.
- G) **Data Interpretation:** This can be represented through tables, figures and pictures, and then described in words.
- H) Test, revising of hypothesis
- I) **Conclusion, reiteration** (replication- ~~**these are usually for generalization and verification and reliability and validity purpose**~~) if necessary
- Basically in all total research proceeds from choosing a topic problem, to design of the research (sampling, cost estimation and data collection), Analysis (result, interpretation, conclusion) & finally reporting

Rationale behind choosing a topic or identification of good research problem/ topic

- Basically choosing a good research topic lends itself to a <u>**'do-able' project**</u>. It helps to understand the integral role played by the research question (maintain parsimony in the selection and doing of research topic). There is a great role research proposal in having or producing good research question.
- The proposal acts as an exercise in thought, a reference point for supervision, and also as a motivational device.
- Someone in his initial proposal selected a research topics related to tentative of Emotional Intelligence. But he was not able to complete even the proposal or initiate any pilot study regarding this topics. May be it was due to the vastness and sensitivity of topics, the effort to distinguish it from general intelligence and even due to unavailability of tools and backups.
- <u>**The easier or simpler or viable the research topics, the easier to write the proposal.**</u>
- Our ambitions for good grades and for postgraduate places and maybe we want to make a significant contribution to the psychological literature, or you maybe we want to publish work. Often students want to research very broad, all encompassing topics. Such broad topics involve more time and effort than most undergraduate psychology students can afford. However, topics that are too narrow should also be avoided as it is very difficult to generalize such results. You must strike a balance; your topic should be narrow enough to focus your project but not too narrow that the results have no generalizability. Also, your topic should be broad enough to generalize but not to the extent that you cannot manage the area and your project.

Simple strategies for evaluating potential research topics

- **1. Does the topic elicit interest and curiosity in you?** The first decision you should make regards how you actually feel about the topics on your list, and whether you could stick with the topic through to the completion of a research project.
- **2. Is the topic worthwhile?** It is unethical to ask people to participate in your study in your study if it has little or no likelihood, because of poor conceptualization and design, of producing meaningful results or furthering scientific knowledge. Meaningful result and practical implication be there otherwise its unworthy.
- **3. Is the topic do-able?** As recently noted, it is of paramount importance that the topic for your project is feasible. You must make critical decisions regarding whether you will be capable of collecting primary data to answer your potential research question. For example, students are often interested in topics related to psychopathologies, such as schizophrenia or multiple personality disorders, however, at undergraduate level, it is not appropriate or permissible to gather information from such a sample, due to the code of competent caring for example. Same is the case with aptitude and emotional intelligence.
- A topic that Irish students are often interested in is the prison service. Here time , fund and effort is a important consideration before choosing a do able project. Undergraduate students, for example, often do not have the time or resources to invest in participant observation studies, and should settle for some other method of inquiry that suits their research goals. Once you have narrowed down your list of topics, the next step in setting down the foundations for a successful psychology project is to develop your research question.
- Time, cost and effort are the important consideration while selecting a potential do able topic.
- **<u>Selecting potential research topic is to formulate a desire to carry your research.</u>**

Choosing a good research topic

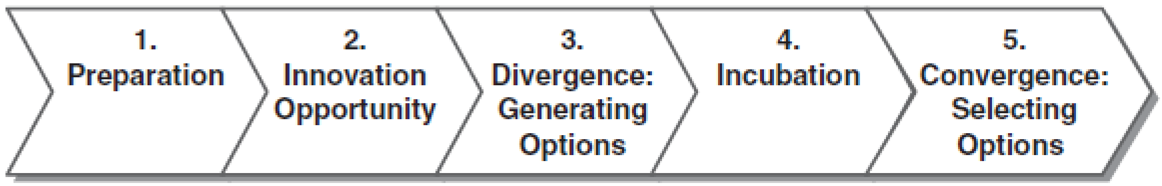


Figure 3.2 The creative process in five steps (Leonard & Swap, 1999)

Table 3.1 Strategies for generating creative ideas (Cryer, 2000)

1.	Talking things over
2.	Keeping an open mind
3.	Brainstorming
4.	Negative brainstorming
5.	Viewing the problem from imaginative perspectives
6.	Concentrating on anomalies
7.	Focusing on byproducts
8.	Viewing the problem from the perspective of another discipline

Basic Concepts in the Scientific Research

Major Concepts or Terms and Terminology Involved with Scientific Research

Unit II

Major Concepts Involved in Scientific Research

- **Major Concepts or Terms and Terminology Involved with Scientific Research: We need to determine the rationale behind adding this chapter in syllabus. So,**
- Some important questions that need to be addressed in this unit II are-
- How do we see a problem? How will we define a topic and set a research topic?
- What are **Variables and its Types**?
- What is **Operational Definition**?
- What is **Literature Review**?
- What are **Ethics, Ethnocentrism And Experimenter’s Bias** in Psychological Research?

Variables and Its type

- We basically deal with-
- Independent Variable
- Dependent Variable
- Experimental Variable- Both the experimental and control variable comes under experiments and can be dealt only in experimental group. It doesn't mean that control variables are only controlled in control groups.
- Control Variable or Extraneous Variable

Variables and Its type

- **There are independent (x) and dependent (y) variable over the experiment, but the causal relationship is not established and as there is no random trial and the population is also limited the generalisability norms are not established. Factors such as cost, feasibility, political concerns, convenience may influence the experiments and only internal validity is established**.
- Control group doesn't control the group member but the variables under the experimentation are untouched and even these control groups helps to control the biasness in the experimentation (without the control variable be manipulated if a desired positive results or effect is if seen in the samples then, we may infer that there is no need of the research and also that the research process is flawed.)
- Population has unit or sector and these sector may wholly represent the sample and give us flawed conclusion (??) - For example, suppose that a sample of 100 American women are measured and are all found to be taller than six feet. It is very clear even without any statistical prove that this would be a highly unrepresentative sample leading to invalid conclusions. This is a very unlikely occurrence because naturally such rare cases are widely distributed among the population. But it can occur. Luckily, this is a very obvious error and can be detected very easily.
-

Operational Definitions

- **Operational definition:** Details in regards to defining the variables and how they will be measured/assessed in the study. What can be the operational definition for a maltreated child?
- **Operational definition of child maltreatment**: Children under the age of 18 in Nepal who can't respond comprehensively with conscience and give an accurate consent towards various forms of negligence, physical, sexual and psychological mistreatments and other activities conducted against their welfare are said to be children maltreated.
- Some well-known behaviorists such as Edward C. Tolman and Clark Hull popularized the idea of operationism, or operational definitions. **Operational definitions are definitions of theoretical constructs that are stated in terms of concrete, observable procedures.** Operational definitions solve the problem of what is not directly observable by connecting unobservable traits or experiences to things that can be observed. Operational definitions make the unobservable observable.
- When a theoretical assumption is taken into function, then a operational definition is formulated. Operational definitions are mostly used during the legal investigations**. When an investigation is to be carried out for an adolescent girl is who is sexually abused, a criteria (here age bar) need to be developed about which age limit is adolescent age and which is adult or consent giving age in terms of marriage/ relationship and sex.**
- **Similarly the operational definition of Psychoanalysis is- Letting The Client Revel Themselves In Free Association (Manner), The Process Would Dig Into Past.**

Literature Review

- **Literature review** (or study about past problems and achievements relevant to the present context of study). The sources of literature review can be address of key figures, published journal and scientific papers, seminars and workshops, thesis, governmental reports and newspaper articles.
- In one way literature review helps in generation of insight for defining the research topic while also helps in comparing the past research with the rationale set behind conducting the new research.

Ethics in Research

- Research ethics can no longer be viewed as a set of rules to be applied, but rather as a way of reasoning about constructing a relationship with participants (York University Task Force on Ethical Issues in Research, 1992).
- The vital role played by ethics in the planning, execution and reporting of quantitative and qualitative research cannot be overstated. Instead of seeing psychological science and ethics as separate, a superior understanding recognizes their essential interdependence. As will become apparent, ethical issues must be addressed at all stages of the research process.
- Codes of ethics promote best practice by providing aspirational principles that encourage reflection and decision-**making within a moral framework**, and also act to regulate professional behaviour, through monitoring and through disciplinary action against those who violate prescriptive and enforceable standards of conduct. Ethics, therefore, lend moral structure to your decision-making throughout the research project: from the planning of your study, your treatment of participants, to the interpretation of your results.
- The code of conduct on ethics are proposed on universal values based on common humanity, respect for the diversity of beliefs, and standards based on differences in culture, religion and political systems..

Ethics in Research

- Gauthier (2003) proposes that psychologists have the right to useful ethical guidance for their professional and research behaviour, and that all individuals have the right to effective protection from the misuse of psychology. This coincides with the International Union of Psychological Science (IUPsyS) who, in 2002, mandated a working group to prepare a Draft Universal Declaration of Ethical Principles for Psychologists (Pettifor, 2004), which was presented in June 2005. This pragmatic (practical or advancing) scheme involved the IUPsyS, the International Association of Applied Psychology (IAAP) and also the International Association of Cross-Cultural Psychology (IACCP). Ethical codes are shared moral principle. There are 3 major areas where ethics can be categorized:
- **1) Planning:** When planning a research project, the codes of ethics mentioned above deal with the researcher's basic problem of balancing the need to discover new principles of behaviour with the need to protect participants.
- **Research ethics can no longer be viewed as a set of rules to be applied, but rather as a way of reasoning about constructing a relationship with participants (York University Task Force on Ethical Issues in Research, 1992).**
- When the research proposals are planned and written they themselves outline the need for research ethics. Planned steps must always be taken to protect and ensure the dignity and welfare of all your participants. Inadequate attention to respect for person, beneficence and justice, can affect the scientific viability and validity or your research. Part of the planning stage also involves determining the degree of risk to be encountered by participants. Under the principle of competent caring, you are required to demonstrate an active concern for the well-being of your participants. This can be achieved by minimizing the invasiveness of your study.

Status and welfare of participants as Research Ethics

- **<u>2) Informed consent and withdrawal:</u>** It is very important to ensure that all the participants that take part in your study are volunteers. As noted by Jonas (1969), only the authenticity of volunteering overcomes the depersonalizing effect of being treated as a token or sample in an experiment. A major ethical consideration concerns the status of your participants, focusing on the issues of informed consent, deception and the right of participants to withdraw from your study at any time. You are required to make it crystal clear to your volunteers that even after they have consented to participate in your study, they can leave the experiment at any time. You are also required to inform your participants of any objectives of your study, which might affect their willingness to participate. Participants should give informed consent formally, after they have been informed of the nature of your study, and are invited to sign a consent form. A lot of times people don't read properly the Terms of Reference in Consent Form.
- Most of the times in qualitative studies informed consent is impossible as the outcomes of the experiments or research can vary. Other criteria for Deception and Loss of Confidentiality are equally important.
- **3) <u>Interpretation of research:</u>** Data falsification can take numerous forms, the most extreme of which is when the researcher fails to collect any data and manufactures it. Another form involves altering or omitting some of the data collected, in order for the results to fit a preconceived biased trend. A final form of data falsification involves guessing or creating missing data, in order to generate a complete data set.

A sample of Consent Form

An Investigation of the Self-Reference Effect

The purpose of this study to determine how accurately people can remember information related to them. If you participate, you will be required to complete a computerised task involving word lists and questions. The task will take approximately 10 minutes to complete. The exact hypothesis that is being investigated will be explained to you at the conclusion of your participation. If you have any questions or concerns about your participation or about the study, you may contact me at ______________________________

I have read the description of the investigation of the Self-Reference Effect, and I voluntarily agree to participate. I understand that I can withdraw from the study at any time, without penalty, and that my participation and the record of my performance will be kept strictly confidential.

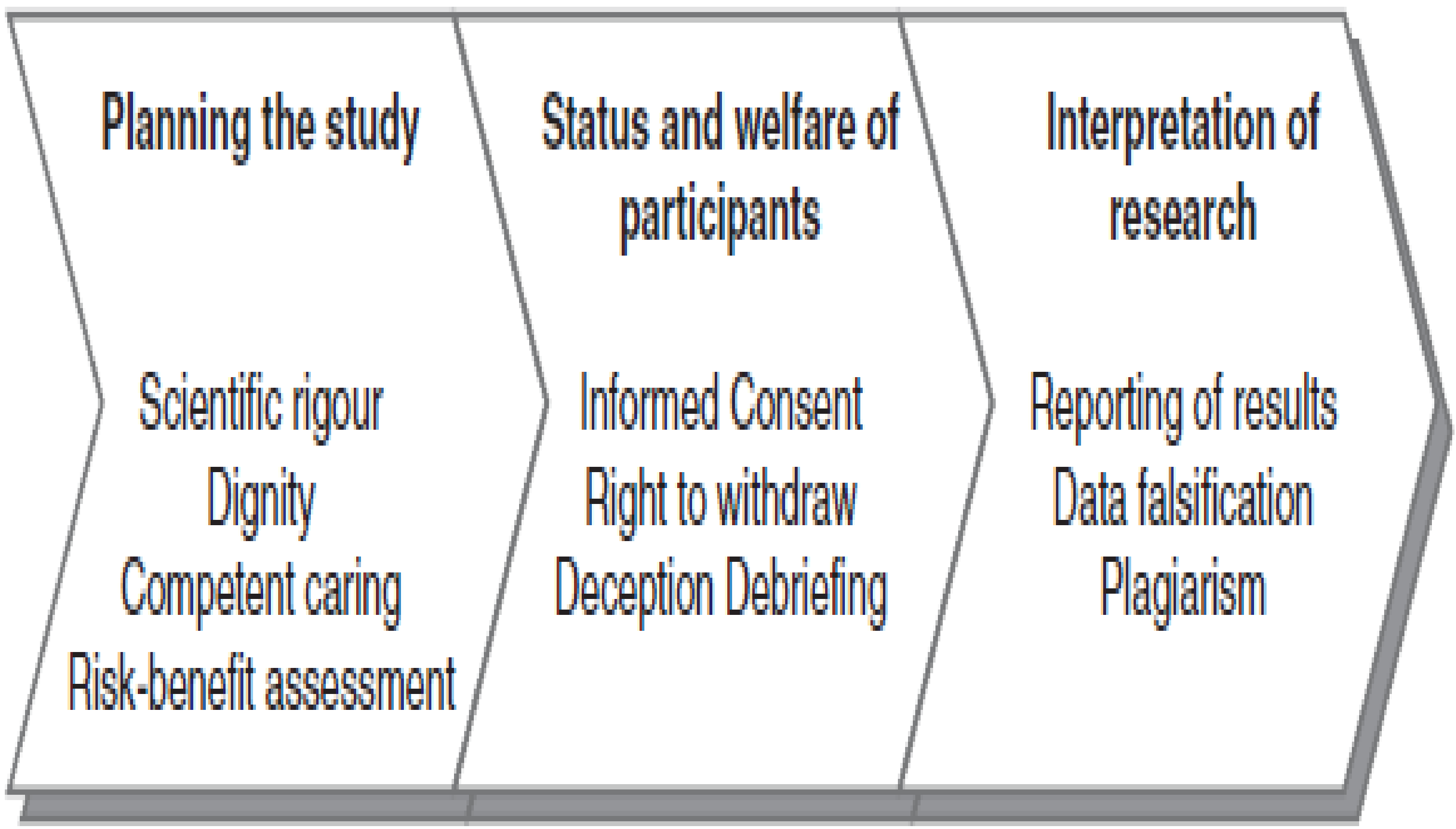
When the entire investigation has been completed (tick the relevant box)

Would ☐ Would not ☐
like a brief summary of the overall results.

Signature of Participant Date

________________________________ ______________________

Research Ethics: Objectives



	European Federation of Psychologists Association (EFPA) Meta-Code of Ethics (1995)
Principle 2.1	Respect for a Person's Rights and Dignity
Principle 2.2	Competence
Principle 2.3	Responsibility
Principle 2.4	Integrity
	Canadian Code of Ethics for Psychologists 3rd ed. (2002)
Principle I	Respect for the Dignity of Persons
Principle II	Responsible Caring
Principle III	Integrity in Relationships
Principle IV	Responsibility to Society
	Code of Ethics: For Psychologists Working in Aotearoa/New Zealand (2002)
Principle 1	Respect for the Dignity of Persons and Peoples
Principle 2	Responsible Caring
Principle 3	Integrity in Relationships
Principle 4	Social Justice and Responsibility to Society
	Ethical Principles of Psychologists and Code of Conduct (APA, 2002)
Principle A	Beneficence and Non-maleficence
Principle B	Fidelity and Responsibility
Principle C	Integrity
Principle D	Justice
Principle E	Respect for People's Rights and Dignity
	Code of Professional Ethics (PSI, 2003)
Principle 1	Respect for the Rights and Dignity of the Person
Principle 2	Competence
Principle 3	Responsibility
Principle 4	Integrity
	Ethical Principles for Conducting Research with Human Participants (BPS, 1978; q.v.)
Principle 1	Introduction
Principle 2	General
Principle 3	Consent
Principle 4	Deception
Principle 5	Debriefing
Principle 6	Withdrawal from the investigation
Principle 7	Confidentiality
Principle 8	Protection of Participants
Principle 9	Observational Research
Principle 10	Giving Advice

Objectives of Psychological Research

- Study of cause (associations) and effect (correlations) to a psychological hazard and to establish association and correlation.
- Test hypothesis, obtain theories and use this theories to devise a diagnostic and therapeutic regulations to solve mental health problems or to obtain psychological advancements.
- Know the biological, physiological, cognitive, developmental, pathological/ abnormality, et al. bases of behaviour.
- To promote scientific curiosity, critical thinking and analytical skills and apply psychological theory to personal, organizational and social issues.
- To identify field and prospects of psychology.
- Analyze the ethical issues in psychological research.
- Discuss the development of psychological as empirical (scientific or experimental or observable field) science .
    - **A brainstorming session with Facilitative Training.**

Example: Objective of the Study

Objectives of the study

1) To gain knowledge and insight about the group therapies, its' different forms and formats and to know in detail over the psychodramatic procedures and technique through descriptive studies.

2) To know about the form of relationship that exists between the clients and the therapist in psychodrama, analyze limitations and evaluate advantages and to give information and suggestion regarding the nature of problem that can be undertaken by this form of therapy.

3) To explore the efficiency of psychodrama for a meaningful human life.

Methodology of the study

This is just a form of descriptive study and there is absence of any statistical primary or secondary data. The study materials are abstracts from many books and their chapters having contents about psychodrama, documentations from various journals and electronic materials including websites.

Hypothesis Testing

- There are two types of hypothesis as seen under the academic prospect. The **Null Hypothesis (H_0)** which tries to predict the topic of research (statement) as relevant or significant and there is no deviations from the objectives of research (the statistical measures for the sample are same as the statistical measure for the population). Usually the null hypothesis is tested at a confidence level of 85 to 99 percent. Here confidence level refer to the accuracy to which proposed hypothesis is correct. When the null hypothesis is rejected an **Alternative Hypothesis (H_1)** comes into action. The alternative hypothesis tries to predict the deviance of result and it is usually based on significance level (assumed accuracy of error result) which may range from 1 to 15 percent. Actually hypothesis is a test of outcome, whether a give phenomenon will occur (predicted in null hypothesis) or whether there would be significant difference in occurrence of outcome (predicted through alternative hypothesis)
- .Brain Teaser: What is hypothesis testing? Is it more of analysis or interpretation?
- ~~Analysis: Break down of data or integration or sum up of the data~~
- ~~Interpretation: Understanding of data; Elucidation~~

Hypothesis Testing

- **A common misconception is that a hypothesis will be proven (see, rather, Null hypothesis). Generally a hypothesis is used to make predictions that can be tested by observing the outcome of an experiment. If the outcome is inconsistent with the hypothesis, then the hypothesis is rejected (see falsifiability). However, if the outcome is consistent with the hypothesis, the experiment is said to support the hypothesis. This careful language is used because researchers recognize that alternative hypotheses may also be consistent with the observations. <u>In this sense, a hypothesis can never be proven, but rather only supported by surviving rounds of scientific testing and, eventually, becoming widely thought of as true.</u>**
- A useful hypothesis allows prediction and within the accuracy of observation of the time, the prediction will be verified. As the accuracy of observation improves with time, the hypothesis may no longer provide an accurate prediction. In this case a new hypothesis will arise to challenge the old, and to the extent that the new hypothesis makes more accurate predictions than the old, the new will supplant it. Researchers can also use a null hypothesis, which state no relationship or difference between the independent or dependent variables. A null hypothesis uses a sample of all possible people to make a conclusion about the population

Ethnocentrism and Experimenter Bias

- Ethnocentrism is a tendency to see one's own group as the center of the world and to rate all other groups according to the norms, values, and characteristics of the observer's group.
- William Sumner is often credited with the first classical definition of ethnocentrism as the point of view where each group considers itself superior while treating all outsiders with contempt. When 19th-century European colonizers described the Africans they encountered as “savages,” they were practicing ethnocentrism. But the practice existed long before the 1800s, probably from the first time one tribe of people encountered another, and it can be observed universally.
- Ethnocentrism discourages interaction between cultures and, at its most extreme, results in discrimination against and conflict with out-groups. **Ethnocentrism is most often manifested as racism and nationalism**. Social scientists can and have been guilty of ethnocentrism when studying other races and cultures. In contrast with ethnocentrism, cultural relativism assumes that each culture's norms have their own intrinsic value and cannot be judged or compared with another. This entry looks at the concept of ethnocentrism, its history in the United States, and its expression in the social sciences.
- Ethnocentrism can be seen as racial prejudice and researcher bias.

Brain Teaser

- How can **<u>Experimenter's Bias or lack of code of ethics</u>** impact from the planning of research to the presentation of the research?
- Experimenter bias such as ethnocentrism can motivate a researcher to design a research in such a way that certain populations of the research are falsely represented. The researcher can present and interpret the results and findings from these research in such a way that he is intently able to predict the aforementioned false or biased claim.
- There may be lack of informed consent from the subjects by the researcher for the experimental trial. This act can be seen as mere superiority feelings towards own culture and ideals.
- Codes of ethics promote best practice by providing aspirational principles that encourage reflection and decision-**<u>making within a moral framework</u>**, and also act to regulate professional behaviour, through monitoring and through disciplinary action against those who violate prescriptive and enforceable standards of conduct. Ethics, therefore, lend moral structure to your decision-making throughout the research project: from the **<u>planning of your study, your treatment of participants, to the interpretation of your results</u>**.

Theories of ethnocentrism

- Scholars like Sumner initially argued that the tendency toward ethnocentrism developed in an environment of scarce resources. Individuals formed groups—tribes, races, nations—whose members cooperated to find these limited resources and competed with other groups for survival. **Thus, simple physical need motivated trust of in-group and distrust of out-group members**. Social identity theory revised this structuralist and functionalist explanation, arguing that the mere act of individuals classifying themselves as members of the same group automatically results in a display of in-group favoritism. The very ordinary desire for **self-esteem prompts individuals to positively** differentiate their in-group in comparison with an out-group on the basis of the particular parameter they select, such as race, language, or religion.
- Ethnocentrism, as an extension of kinship sentiments, is a genetically selected propensity because it is biologically advantageous. **The antithesis of ethnocentrism is orientalism or cultural relativism.**
- Research has also shown that ethnocentrism is a general affective-cognitive system. **Thus, people who hold prejudices against one disadvantaged group tend to hold prejudices against other disadvantaged groups as well, even though these out-groups have nothing in common except their disadvantaged status.**

Theories of ethnocentrism

- Ethnographers and researchers from Europe and America had been studying other cultures and races from a position of Western superiority, all the while assuming that they were being objective. The notion of **Orientalism**, developed by Edward Said to critique how Europeans exoticized and stereotyped the East while retaining a position of superiority over it, is perhaps the best-known example of ethnocentrism.
- **Critics argued that sociological positivism was inherently flawed because the social sciences could never be value-free. The social scientist always makes assumptions about observations based on his or her Socio-cultural background.** There were calls for greater self-reflexivity among social scientists to recognize their prejudices. Standpoint theory argues that all viewpoints are partial and that a strong objectivity can be achieved only by considering different perspectives, especially those of marginalized groups.

Ethnocentrism (Brain Teasers)

For this reason many aspects of our psychology—our mental processes and behaviors—are universal, that is, common to all people of all cultures and backgrounds. For example all humans appear to have some degree of specific fears, such as to snakes, spiders, heights, and darkness because these types of fears have led in our evolutionary history to greater probability of survival (Seligman & Hager, 1972, cited in Buss, 2001). All people have a tendency to perceive their own ingroup as heterogeneous, fully recognizing the individual differences that exist in that group, while they perceive other groups as more homogeneous, assuming less diversity within the group (Linville & Jones, 1980; Triandis, McCusker, & Hui, 1990). People also seem to have a natural proclivity to fears of strangers and outgroup members, which may be a universal basis for ethnocentrism, prejudice, aggression, and even war (Buss, 2001). The differences in how we treat ingroup and outgroup members are likely rooted in our evolutionary history because such distinctions were useful in the past to our reproductive success. Other universal psychological processes, such as incest avoidance, facial expressions of emotion, division of labor by sex, revenge and retaliation, mate selection and sexual jealousy, self-enhancement, and personality can be traced to the core aspect of a universal human nature based on biological imperatives and universal social problems of adaptation and living.

Left outs

- ~~Topics like **Research Design** has been left out maybe because this research methodology is meant for bachelor level students and it is the basic research that we are to teach the student, not comprehensive level of research design.~~
- **Hallow Effect** (as errors in research design): This is the tendency of rating an object in the constant direction of general impression of the object. Believing a person to be intelligent, because he agrees with us; believing a man to be virtuous because we like him are some examples of Hallow effect in our day to day experiences. Often teachers evaluate the children's achievement on the basis of children docility (Obedience; Meekness; Submissiveness). This is another example of hallow effect.
- Actually the tendency to rate one characteristics on the basis of other characteristics of an individual is the Hallow Effect.
- Brain teaser: What is Hawthorne Effect?

Sampling

Unit III

Sampling

- **A sample is a finite part of a <u>statistical population (this notion itself represent that this population is under study)</u> whose properties are studied to gain information about the whole (Webster, 1985).** When dealing with people, it can be defined as a set of respondents(people) selected from a larger population for the purpose of a survey.
- Sampling is the act, process, or technique of selecting a suitable sample, or a representative part of a population for the purpose of determining parameters or characteristics of the whole population.
- A population is a group of individuals persons, objects, or items from which samples are taken for measurement for example a population of presidents or professors, books or students.

Sampling

- It is the first step of the data collection for research. As population consists innumerable unit which cant be considered for study, as is practically not viable, representative of the units of the whole population is considered as the research population. This few selected units of the population is called **sample**.
- Each entity or body within the population is called unit. There are units which have similar elemental properties and they can be grouped as element.
- In statistics, quality assurance, & survey methodology, **sampling** is concerned with the selection of a subset of individuals from within a statistical population to estimate characteristics of the whole population. Acceptance sampling is used to determine if a production lot of material meets the governing specifications. Two advantages of sampling are that the cost is lower and data collection is faster than measuring the entire population.

Sampling

- Each observation measures one or more properties (such as weight, location, color) of observable bodies distinguished as independent objects or individuals. In survey sampling, weights can be applied to the data to adjust for the sample design, particularly stratified sampling (blocking). Results from probability theory and statistical theory are employed to guide practice. In business and medical research, sampling is widely used for gathering information about a population.
- Each and every unit of the population should the probability of being selected as sample otherwise exclusion doesn't give the scientific notion to the sampling technique.
- **In drawing samples, the following three criteria be considered: purpose of the investigation; types of sampling or sampling design to be used; size of the sample at each stage sampling.**

Steps in Sampling

- Expert statistician advice is good before the highly specialized technique of the sampling. the basic features and **STEPS** in sampling are:
- Defining the population to be covered
- Defining the sampling units
- Acquiring the frame/ list of the population elements
- Deciding about the size of the sample
- Deciding about the type of the sample to be used and
- Testing the reliability of the sample

Why is sampling necessary?

- To draw conclusions about populations from samples, we must use inferential statistics which enables us to determine a population`s characteristics by directly observing only a portion (or sample- and sample consisting a unit or element of population) of the population. We obtain a sample rather than a complete enumeration (a census) of the population for many reasons.
- Obviously, it is cheaper to observe a part rather than the whole, but we should prepare ourselves to cope with the dangers of using samples. In this tutorial, we will investigate various kinds of sampling procedures. Some are better than others but all may yield samples that are inaccurate and unreliable. We will learn how to minimize these dangers, but some potential error is the price we must pay for the convenience and savings the samples provide.
- There would be no need for statistical theory if a census rather than a sample was always used to obtain information about populations. But a census may not be practical and is almost never economical. There are six main reasons for sampling instead of doing a census. These are; -Economy and effort -Timeliness -The large size of many populations -Inaccessibility of some of the population -Destructiveness of the observation - accuracy
- **The economic advantage of using a sample in research obviously, taking a sample requires fewer resources than a census.**

The Time Factor & Bias And Error In Sampling

- A sample may provide you with needed information quickly. For example, you are a Doctor and a disease has broken out in a village within your area of jurisdiction (work authority), the disease is contagious and it is killing within hours nobody knows what it is. You are required to conduct quick tests to help save the situation. If you try a census of those affected, they may be long dead when you arrive with your results. In such a case just a few of those already infected could be used to provide the required information. The pathological examination of few of those would lessen tediousness of the process and even quicken the investigation and therapy.
- **Bias And Error In Sampling** A sample is expected to mirror the population from which it comes, however, there is no guarantee that any sample will be precisely representative of the population from which it comes. Chance may dictate that a disproportionate number of untypical observations will be made like for the case of testing fuses, the sample of fuses may consist of more or less faulty fuses than the real population proportion of faulty cases. In practice, it is rarely known when a sample is unrepresentative and should be discarded.
- Sampling error comprises the differences between the sample and the population that are due solely to the particular units that happen to have been selected.
- **Sampling Bias is a tendency to favour the selection of units that have particular characteristics.**

Sampling Bias

Sampling bias is a tendency to favour the selection of units that have paticular characteristics.

Sampling bias is usually the result of a poor sampling plan. The most notable is the bias of non response when for some reason some units have no chance of appearing in the sample. For example, take a hypothetical case where a survey was conducted recently by Cornell Graduate school to find out the level of stress that graduate students were going through. A mail questionnaire was sent to 100 randomly selected graduate students. Only 52 responded and the results were that students were not under strees at that time when the actual case was that it was the highest time of stress for all students except those who were writing their thesis at their own pace. Apparently, this is the group that had the time to respond. The researcher who was conducting the study went back to the questionnaire to find out what the problem was and found that all those who had responded were third and fourth PhD students. Bias can be very costly and has to be gaurded against as much as possible. For this case, $2000.00 had been spent and there were no reliable results in addition, it cost the reseacher his job since his employer thought if he was qualified, he should have known that before hand and planned on how to avoid it. A means of selecting the units of analysis must be designed to avoid the more obvious forms of bias. Another example would be where you would like to know the average income of some community and you decide to use the telephone numbers to select a sample of the total population in a locality where only the rich and middle class households have telephone lines. You will end up with high average income which will lead to the wrong policy decisions.

Non Sampling or Measurement Error

- The other main cause of unrepresentative samples is non sampling error. This type of error can occur whether a census or a sample is being used. Like sampling error, non sampling error may either be produced by participants in the statistical study or be an innocent by product of the sampling plans and procedures.
- A non sampling error is an error that results solely from the manner in which the observations are made. The simplest example of non sampling error is inaccurate measurements due to malfunctioning instruments or poor procedures. For example, lets consider the observation of human weights. If persons are asked to state their own weights themselves, no two answers will be of equal reliability.
- Non-sampling errors are other errors which can impact the final survey estimates, caused by problems in data collection, processing, or sample design. They include:
- **Overcoverage**: Inclusion of data from outside of the population.
- **Undercoverage**: Sampling frame or frame list does not include elements in the population.
- **Measurement error**: e.g. when respondents misunderstand a question, or find it difficult to answer.
- **Processing error**: Mistakes in data coding when the sample is too large.
- **Non-response**: Failure to obtain complete data from all selected individuals.
- Biased observations due to inaccurate measurement can be innocent but very devastating. A story is told of a French astronomer who once proposed a new theory based on spectroscopic measurements of light emitted by a particular star. When his collogues discovered that the measuring instrument had been contaminated by cigarette smoke, they rejected his findings.

* Non Sampling or Measurement Error

Errors in sample surveys [edit]

Survey results are typically subject to some error. Total errors can be classified into sampling errors and non-sampling errors. The term "error" here includes systematic biases as well as random errors.

Sampling errors and biases [edit]

Sampling errors and biases are induced by the sample design. They include:

1. Selection bias: When the true selection probabilities differ from those assumed in calculating the results.
2. Random sampling error: Random variation in the results due to the elements in the sample being selected at random.

Non-sampling error [edit]

Non-sampling errors are other errors which can impact the final survey estimates, caused by problems in data collection, processing, or sample design. They include:

1. **Overcoverage**: Inclusion of data from outside of the population.
2. **Undercoverage**: Sampling frame does not include elements in the population.
3. **Measurement error**: e.g. when respondents misunderstand a question, or find it difficult to answer.
4. **Processing error**: Mistakes in data coding.
5. **Non-response**: Failure to obtain complete data from all selected individuals.

After sampling, a review should be held of the exact process followed in sampling, rather than that intended, in order to study any effects that any divergences might have on subsequent analysis. A particular problem is that of *non-response*.

Two major types of nonresponse exist: unit nonresponse (referring to lack of completion of any part of the survey) and item nonresponse (submission or participation in survey but failing to complete one or more components/questions of the survey).[10][11] In survey sampling, many of the individuals identified as part of the sample may be unwilling to participate, not have the time to participate (opportunity cost),[12] or survey administrators may not have been able to contact them. In this case, there is a risk of differences, between respondents and nonrespondents, leading to biased estimates of population parameters. This is often addressed by improving survey design, offering incentives, and conducting follow-up studies which make a repeated attempt to contact the unresponsive and to characterize their similarities and differences with the rest of the frame.[13] The effects can also be mitigated by weighting the data when population benchmarks are available or by imputing data based on answers to other questions.

Nonresponse is particularly a problem in internet sampling. Reasons for this problem include improperly designed surveys,[11] over-surveying (or survey fatigue),[8][14] and the fact that potential participants hold multiple e-mail addresses, which they don't use anymore or don't check regularly.

Other Biasness

- No two interviewers are alike and the same person may provide different answers to different interviewers. The manner in which a question is formulated can also result in inaccurate responses. Individuals tend to provide false answers to particular questions.
- Respondents might also give incorrect answers to impress the interviewer. This type of error is the most difficult to prevent because it results from out right deceit on the part of the respondent.
- Knowing why a study is being conducted may create incorrect responses. A classic example is the question: What is your income? If a government agency is asking, a different figure may be provided than the respondent would give on an application for a home mortgage.
- Finally, it should be noted that the personal prejudices of either the designer of the study or the data collector may tend to induce bias. In designing a questionnaire, questions may be slanted in such a way that a particular response will be obtained even though it is inaccurate.

* Survey weights and Method of producing random samples

- **Survey weights:** In many situations the sample fraction may be varied by stratum and data will have to be weighted to correctly represent the population. Thus for example, a simple random sample of individuals in the United Kingdom might include some in remote Scottish islands who would be inordinately expensive to sample. A cheaper method would be to use a stratified sample with urban and rural strata. The rural sample could be under-represented in the sample, but weighted up appropriately in the analysis to compensate.
- More generally, data should usually be weighted if the sample design does not give each individual an equal chance of being selected. For instance, when households have equal selection probabilities but one person is interviewed from within each household, this gives people from large households a smaller chance of being interviewed. This can be accounted for using survey weights. Similarly, households with more than one telephone line have a greater chance of being selected in a random digit dialing sample, and weights can adjust for this.
- Weights can also serve other purposes, such as helping to correct for non-response.
- **Methods of producing random samples:** Random number table
- Mathematical algorithms for pseudo-random number generators
- Physical randomization devices such as coins, playing cards or sophisticated devices such as ERNIE

Frame List and Sampling Size

- **Frame list: I**t is the list of population units from which the sample units are selected. This list is sometimes called frame. If a list is not available it should be prepared before conducting main survey. It should be inclusive of all population, should include the latest additions to the population as birth and death, migration (in or out). The list in the name should not be repeated more than one time. Frame list helps to helps us making proper and inclusive sample size.
- **Sample Size:** Before deciding how large a sample should be, you have to define your study population. The question of how large a sample should be is a difficult one. Sample size can be determined by various constraints. **For example, the available funding may pre-specify the sample size. When research costs are fixed, a useful rule of thumb is to spent about one half of the total amount for data collection and the other half for data analysis.** This constraint influences the sample size as well as sample design and data collection procedures. An optimum sample size is one which fulfills the requirements of efficiency, representativeness, reliability and flexibility.

Sampling Size

- In general, sample size depends on the nature of the analysis to be performed, the desired precision of the estimates one wishes to achieve, the kind and number of comparisons that will be made, the number of variables that have to be examined simultaneously and **how heterogeneous a universe is sampled. For example, if the key analysis of a randomized experiment consists of computing averages for experimental and controls in a project and comparing differences, then a sample under 100 might be adequate, assuming that other statistical assumptions hold.** Sample size is a function of the precision of the estimates one wishes to achieve, the variability or variance, one expects to find in the population and the statistical level of confidence one wishes to use.
- **For example, to estimate mean earnings in a population <u>with an accuracy of $100 per year,</u> using a 95% confidence interval and assuming that the standard deviation of earnings in the population is $1600.0, the required sample size is 983:$[(1.96)(1600 (s.d)/100)]^2$ (squared).** (May be this approach is for deciding sample size for a phenomenon whose confidence level is 95%) **<u>Here 100 must be the variance. (Is it?)</u>**
- It is said chi square helps to determine sample size. [for sure this formula is for chi square (~ sample size approximately equals to value of chi square). The formula for sample size goes $\mathbf{ns^{2/}\ \sigma^{2}}$

Sampling Size

- **<u>Deciding on a sample size for qualitative inquiry can be even more difficult than quantitative because there are no definite rules to be followed</u>**. It will depend on what you want to know, the purpose of the inquiry, what is at stake, what will be useful, what will have credibility and what can be done with available time and resources. **With fixed resources which is always the case, you can choose to study one specific phenomenon in depth with a smaller sample size or a bigger sample size when seeking breadth.**
- In purposeful sampling, the sample should be judged on the basis of the purpose and rationale for each study and the sampling strategy used to achieve the studies purpose. The validity, meaningfulness, and insights generated from qualitative inquiry have more to do with the information-richness of the cases selected and the observational/analytical capabilities of the researcher than with sample size.
- In conclusion, it can be said that using a sample in research saves mainly on money and time, if a suitable sampling strategy is used, appropriate sample size selected and necessary precautions taken to reduce on sampling and measurement errors, then a sample should yield valid and reliable information.
- **The positive square root of variance (represented as sigma$^{2)}$ is called standard deviation (represented as sigma) i.e. square root 1/n summation f (x- X)^{2} where f is frequency, x is sample mean and X is population mean and n is the cumulative <u>frequency (population frequency). Here n is sample size.</u>**

Type of Sampling

- There are three primary kinds of samples: the **Convenience**, the **Judgment Sampling**, and the **Random Sample (or Probability Sampling**). The 4th kind is **Non Random Sampling or Non Probability Sampling.** They differ in the manner in which the element or units are chosen. Here we deal only on the basis of two criteria i.e. non random sampling (non-probability sampling) and random sampling (probability sampling)
- **Non Random Sampling:** a) **Purposive Sampling** b) **Quota Sampling** c) **Convenience Sampling** d) Self Selected Sampling (accidental Sampling)
- **Random Sampling:** a) **Simple Random Sampling** b) **Random Number Table**s c) Restricted Random Sampling d) **Stratified Sampling** e) **Cluster or Multistage Sampling** f) **Systemic Sampling**
- Proper probability sampling is a technical business, Thus, it is always advisable to get expert advice from a statistician at an early stage or else you risk wasting your valuable time.
- In using key informant one chooses them strategically, considering the structure of the society and the content of the inquiry. When we use key informants, we are not randomly sampling from the universe of characteristics under study. Rather, we are selectively sampling specialized knowledge of the characteristics.
- Actually under the scope of Purposive sampling comes the Quota, Snowball, Judgment and even the Convenience samplings.

Type of Sampling

- There is one fundamental thing that we need to keep in mind before initiating some researches or designing psychometrics or bringing changes in an organization. **Organizations are changing faster than ever before. Such changes are influenced by the effects of globalization, changing nature of workforces, developments in Information Technology, increasing diversity in workplaces and workforces, decentralization of work (through contingent working paradigm, outsourcing, etc.) and so forth.** Such changes create both opportunity and threats to the individual, group and organizational lives. In order to minimize this dysfunctional nature of changing work and workers and to take full advantage of such changes, there is need for new order of thinking together with classic perspective on organizational behaviour i.e. **Know the Old Rules, Before Making New Ones.**
- Organizations are **heliotropic** (when presented with the options, organizations will move toward light, that is, affirmative imagery or opportunity towards growth) in character in the sense that organizational actions have an observable and largely automatic tendency to evolve in the direction of positive imagery.
- It is usually said that non random sampling is used for representing every type of unit present in a small population.

1) Non Random Sampling

- **Nonprobability sampling** is any sampling method where some elements of the population have no chance of selection (these are sometimes referred to as 'out of coverage'/ undercovered), or where the probability of selection can't be accurately determined. It involves the selection of elements based on assumptions regarding the population of interest, purpose, convenience which forms the criteria for selection. **Hence, because the selection of elements is nonrandom, nonprobability sampling does not allow the estimation of sampling errors.** These conditions give rise to exclusion bias, placing limits on how much information a sample can provide about the population. Information about the relationship between sample and population is limited, making it difficult to extrapolate from the sample to the population.
- Example: We visit every household in a given street, and interview (we can't ask for the test hay way because it is very critical phenomenon, needs time and effort and the subject need to be assured of anonymity and accuracy) the first person to answer the door. In any household with more than one occupant, this is a nonprobability sample, because some people are more likely to answer the door (e.g. an unemployed person who spends most of their time at home is more likely to answer than an employed housemate who might be at work when the interviewer calls) and it's not practical to calculate these probabilities.

1) Non Random Sampling

- **<u>a) Purposive sampling: </u>This is also non random sampling method; here the** investigator selected the sample arbitrarily (subjectively or randomly) which he considers important for the research and believes it as typical and representative of the population. **Say, an investigator wants to forecast the chance of coming into the power of a political party in general election; for that purpose he selected some reporters, some teachers and some elite people of the territory and collect their opinions. He considers those are the leading persons and their view are relevant for the chance of coming in to the power of them party. As it is a purposive method it has big sampling errors (even bias) and carry misleading conclusion.**
- **If I want to study Stress in Uterine Cancer Women I go for a hospital where such women are treated and rehabilitated. May be I take whole cluster of women for study if I think they are important in my research.**

1) Non Random Sampling

- The defects of this sampling is that the knowledge about the large population **(frame list which is the list of units of the population where research need to be done must be available)** must be available which is not possible and selection bias is extreme. But even though it is cheap method and helpful when some elements are necessarily be selected. Around 16 types of purposeful sampling has been identified as:
- **Types of Purposive Sampling**
- **i) Stratified purposeful sampling :** This illustrates characteristics of particular subgroups of interest and facilitates comparisons between the different groups.
- **ii) Double sampling: In this method sampling is drawn twice. For the first time a** large size of sample is selected and send the mailed questionnaire to the respondents (say 500) after receiving back the answered questionnaire (say 300, as all mailed questionnaire do not come back,) the investigator again randomly draws the required number of sample (say100) and send the modified questionnaire to the respondents. This method is time consuming and expensive.

1) Non Random Sampling

- **<u>iii) Snowball or chain sampling :</u> This particular one identifies, cases of interest from people who know people who know what cases are information rich, that is good examples for study, good interview subjects.** This is commonly used in studies that may be looking at issues like the homeless households. What you do is to get hold of one and he/she will tell you where the others are or can be found. When you find those others they will tell you where you can get more others and the chain continues**. This is information relied or reference based inclusion of units for sampling.**
- If I have to study some strange and unique phenomenon then I may rely my sampling in Snowball Sampling Method. This is a **<u>Sociometric Sampling Technique</u>** generally used to study the small group. **All the persons in a group identify their friends who in turn know their friends and colleagues, until the informal relationships converge into some type of a definite social pattern.** It is just like the snow ball go on increasing its size when rolling in a ice-field.
- In case of drug addict people it is difficult to find out who are the drug user but when one person is identified he can tell the names of his partner then each of his partner can tell another 2 or 3 whom he knows uses drug . This way the required number of element/person is identified and collects data. This method is suitable for diffusion of innovation, network analysis, decision making.
- A population in which the samples are scattered, this method helps as in form of pilot research or survey.

1) Non Random Sampling

- **b) Quota Sampling: This method of sampling is almost same with that of stratified** random sampling, the only difference is that **here in selecting the elements randomization is not done instead quota is taken into consideration. Actually randomization of proportional representation is not done.**
- In the above example the Gram Panchyat consists of 60% Hindu voters; for a sample size 150 the proportion is 90 individual, this number of individual is selected from the voter list of Hindu voters not observing the rule of randomization but as quota, so 90 number voters are selected as per convenience of the investigator. As quota sampling is not random so sampling method is biased and lead to large sampling errors.
- We can also stratify a population and take proportional quota from each strata of the population and this is basically non random quota sampling.
- **c) Convenience Sampling:** In this method, a **sample is selected according to the convenience of the sample.** The convenience may be in respect of availability of the units or source list. It is useful in getting general ideas about the phenomenon of interest. For example you decide you will interview the first ten people you meet tomorrow morning. It saves time, money and effort. It is the poorest way of getting samples, has the lowest credibility and yields information-poor cases. A complete source list is not available. The selection of names from the telephone directory will come under this sampling.
- **A convenience sample results when the more convenient elementary units are chosen from a population for observation.**
- **D) Judgment Sampling: A** judgment sample is obtained according to the discretion of someone who is familiar with the relevant characteristics of the population.

1) Non Random Sampling

- **<u>e) Self Selected and accidental sampling: </u>**Accidental sampling (sometimes known as **grab**, **convenience** or **opportunity sampling**) is a type of non-probability sampling which involves the sample being drawn from that part of the population which is close to hand. That is, a population is selected because it is readily available and convenient. **It may be through meeting the person or including a person in the sample when one meets them or chosen by finding them through technological means such as the internet or through phone**. **The researcher using such a sample cannot scientifically make generalizations about the total population from this sample because it would not be representative enough. For example, if the interviewer were to conduct such a survey at a shopping center early in the morning on a given day, the people that he/she could interview would be limited to those given there at that given time, which would not represent the views of other members of society in such an area, if the survey were to be conducted at different times of day and several times per week. This type of sampling is most useful for pilot testing.** Several important considerations for researchers using convenience samples include: **whether samples act as a control, what is the reliability of these sampling.**
- **These accidental sampling when done through the media or social networking sites, when samples themselves want to be included for TV program, or respond to BBC Nepal questions, etc. are not fixed and represented as Self Selected Samples. But a researcher can later stratify these samples and make them random sample.**

2) Random Sampling

- **A probability sampling is one in which every unit in the population has a chance (greater than zero, should it be non negative?? I feel probabilities are always non negative) of being selected in the sample, and this probability can be accurately determined. The combination of these traits makes it possible to produce unbiased estimates of population totals, by weighting sampled units according to their probability of selection.**
- Probability in proportion is considered from zero to 1 where as in percentage from 0 to 100%.
- What makes it a probability sample is the fact that each person's probability is known. When every element in the population *does* have the same probability of selection, this is known as an **'Equal Probability Of Selection' (EPS)** design. Such designs are also referred to as 'self-weighting' because all sampled units are given the same weight.
- Probability sampling includes: **Simple Random Sampling, Systematic Sampling, Stratified Sampling, Probability Proportional to Size Sampling, and Cluster or Multistage Sampling.** These various ways of probability sampling have two things in common: Every element has a known nonzero equal probability of being sampled and involves random selection at some point.
- This is the type of sampling that is used in lotteries and raffles. For example, if you want to select 10 players randomly from a population of 100, you can write their names, fold them up, mix them thoroughly then pick ten. In this case, every name has equal chance of being picked. Random numbers can also be used.

2) Random Sampling ????

Example: We want to estimate the total income of adults living in a given street. We visit each household in that street, identify all adults living there, and randomly select one adult from each household. (For example, we can allocate each person a random number, generated from a uniform distribution between 0 and 1, and select the person with the highest number in each household). We then interview the selected person and find their income.

People living on their own are certain to be selected, so we simply add their income to our estimate of the total. But a person living in a household of two adults has only a one-in-two chance of selection. To reflect this, when we come to such a household, we would count the selected person's income twice towards the total. (The person who is selected from that household can be loosely viewed as also representing the person who isn't selected.)

2) The Criteria for Random or Non Random Sampling Design

- **Factors commonly influencing the choice between these designs include:**
- **Nature and quality of the frame and also the availability of the sampling frame**
- **Availability of auxiliary information about units on the frame**
- Accuracy requirements, and the need to measure accuracy
- Whether detailed analysis of the sample is expected
- **Cost/operational concerns**
- **A frame is an identified population out of a heterogeneous population. It is literally the population identified for the research. (??)**
- **GQ: Why are there a lot of different sampling types? It is because necessity and situation demands a lot of different types of sampling especially for their convenience and purpose.**

a) Simple Random Sampling

- **In a simple random sample (SRS) of a given size, all such subsets of the frame are given an equal probability. Furthermore, any given pair of elements has the same chance of selection as any other such pair (and similarly for triples, and so on).** Here an element cannot come twice as sample. This minimizes bias (even though there is the presence of error) and simplifies analysis of results. **In particular, the variance between individual results within the sample is a good indicator of variance in the overall population, which makes it relatively easy to estimate the accuracy of results. Variance in attributes is a most important quality of the sampling because they provide variable information for a good and representative data.**
- **Maximum variance in two sample units results rich and diverse information and representation of the whole sampling frame. Sampling frame is a population selected for research, otherwise a large population could result inappropriateness (may be we are not able to manage the chunk of data) and errors in data collection.**
- However, SRS can be vulnerable to sampling error because the randomness of the selection may result in a sample that doesn't reflect the makeup of the population. **For instance, a simple random sample of ten people from a given country will on average produce five men and five women, but any given trial is likely to overrepresent one sex and underrepresent the other. (Systematic and stratified techniques), attempt to overcome this problem by "using information about the population" to choose a more "representative" sample.**
- **EPS itself removes the sampling bias.**

a) Simple Random Sampling

- There are two approaches of this method, the units of population selected for the sample are observed and replaced so that in successive selection they can again be selected as a fresh unit. This method is called **Simple Random Sampling with replacement or unrestricted sampling.** This type of sampling may be used while organizing army parade.
- In the second case the units selected once are not replaced as for new selection. This method is called **Simple Random Sampling without replacement or simply Simple Random Sampling.**
- It seems that sampling is not that absolute measure and can be flexible as according to the time and demands of the situation.
- **Replacement of selected units:** Sampling schemes may be *without replacement* ('WOR' - no element can be selected more than once in the same sample) or *with replacement* ('WR' - an element may appear multiple times in the one sample). For example, if we catch fish, measure them, and immediately return them to the water before continuing with the sample, this is a WR design, because we might end up catching and measuring the same fish more than once. However, if we do not return the fish to the water (e.g. if we eat the fish), this becomes a WOR design.

a) Simple Random Sampling

- **SRS may also be cumbersome and tedious when sampling from an unusually large target population. In some cases, investigators are interested in "research questions specific" to subgroups of the population. For example, researchers might be interested in examining whether cognitive ability as a predictor of job performance is equally applicable across racial groups. SRS cannot accommodate the needs of researchers in this situation because it does not provide subsamples of the population. "Stratified sampling" addresses this weakness of SRS.**
- A simple random sample is obtained by choosing elementary units in such a way that each unit in the population has an equal chance of being selected. **A simple random sample is free from sampling bias as due to EPS but sampling errors cant be denied.** However, using a **Random Number Table** to choose the elementary units can be cumbersome or tedious. If the sample is to be collected by a person untrained in statistics, then instructions may be misinterpreted and selections may be made improperly.
- **Instead of using a least of random numbers, data collection can be simplified by selecting say every 10th or 100th unit after the first unit has been chosen randomly as discussed below. Such a procedure is called systematic random sampling. But h**ere also the sampling error due to periodicity exists.

b) Systematic Random Sampling

- **Systematic sampling relies on arranging the study population according to some ordering scheme and then selecting elements at regular intervals through that ordered list.** Systematic sampling involves a random start and then proceeds with the selection of every *k*th element from then onwards. In this case, ***k* = (population size N /sample size n).** It is important that the starting point is not automatically the first in the list, but is instead randomly chosen from within the first to the *k*th element in the list.
- **If the initial number randomly chosen is (i) then the successive sample unit numbers are (i + k) th order number, (i +2 k) th order number, etc.**
- **It is usually difficult when the order or k^{th} value is not an integer. In large population sampling this non integer or fractional value may impact the sampling size, usually differences in sampling size.**
- As long as the starting point is randomized, systematic sampling is a type of probability sampling. It is easy to implement and the stratification induced can make it efficient, *if* the variable by which the list is ordered is correlated with the variable of interest. **'Every 10th' sampling is especially useful for efficient sampling from databases.**
- A systematic random sample is obtained by selecting one unit on a random basis and choosing additional elementary units at evenly spaced intervals until the desired number of units is obtained. For example, there are 100 students in your class.

b) Systematic Random Sampling

- **You want a sample of 20 from these 100 and you have their names listed on a piece of paper may be in an <u>alphabetical order.</u> This list is the sampling frame or frame list. If you choose to use systematic random sampling, divide 100 by 20, you will get 5 (as order or periodicity). Randomly select any number between 1 and 5 through raffles or lottery scheme. Suppose the number you have picked is 4, that will be your starting number. So student number 4 has been selected. From there you will select every 5th name (4, 9, 14, 19…) until you reach the last one, number one hundred. You will end up with 20 selected students.**
- <u>6 students (with frame list in Alphabetical Order and with tag number), 2 samples needed to be taken or two scholorships for these students are available. When 6 is divided by 2 the answer is 3 (k^{th} order). So lets write 1, 2 , 3 on raffle paper. The number which is chosen becomes the order. So if 2 is chosen then the next sample is unit tag no 5.</u>
- **(But it would have been better if we make 20 groups of 5 units or students each, each student in the group is designated 1 to 5. We can pick up or the students themselves can pick up a raffle from each group to get a sample of 20 students). Other process of selection could be-** A simple example would be to select every 10th name from the telephone directory (an 'every 10th' sample, also referred to as 'sampling with a skip of 10').

b) Systematic Random Sampling- Vulnerabilities

- **However, systematic sampling is especially vulnerable to periodicities in the list. If periodicity is present and the period is a multiple or factor of the interval used, the sample is especially likely to be *un*representative of the overall population, making the scheme less accurate than simple random sampling.**
- **Periodicity is a problem as well as convenience. It creates preferential bias.**
- Another drawback of systematic sampling is that even in scenarios where it is more accurate than SRS, its theoretical properties make it difficult to *quantify* that accuracy. (In the two examples of systematic sampling that are given above, much of the potential sampling error is due to variation between neighbouring houses - but because this method never selects two neighbouring houses, the sample will not give us any information on that variation.)
- As described above, systematic sampling is an EPS method, because all elements have the same probability of selection (in the example given, one in ten). **It is *not* 'simple random sampling' because different subsets of the same size have different selection probabilities - e.g. the set {4,14,24,...,994} has a one-in-ten probability of selection, but the set {4,13,24,34,...} has zero probability of selection.**
- Systematic sampling can also be adapted to a non-EPS approach; for an example, see discussion of PPS samples below.

b) Draw backs of Systematic Random Sampling

However, systematic sampling is especially vulnerable to periodicities in the list. If periodicity is present and the period is a multiple or factor of the interval used, the sample is especially likely to be *un*representative of the overall population, making the scheme less accurate than simple random sampling.

For example, consider a street where the odd-numbered houses are all on the north (expensive) side of the road, and the even-numbered houses are all on the south (cheap) side. Under the sampling scheme given above, it is impossible to get a representative sample; either the houses sampled will *all* be from the odd-numbered, expensive side, or they will *all* be from the even-numbered, cheap side.

Another drawback of systematic sampling is that even in scenarios where it is more accurate than SRS, its theoretical properties make it difficult to *quantify* that accuracy. (In the two examples of systematic sampling that are given above, much of the potential sampling error is due to variation between neighbouring houses - but because this method never selects two neighbouring houses, the sample will not give us any information on that variation.)

Random Number Table (RNT)- As method of selecting/ producing random samples

- **Random number tables** have been used in statistics for tasks such as selected random samples. This was much more effective than manually selecting the random samples (with dice, cards, etc.). Nowadays, tables of random numbers have been replaced by computational random number generators.
- There are different methods of drawing samples form a populations. However the most convenient method is to use the random number tables. The tables are series of two or four digit figures collected from different sources. **Tippet selected at random numbers from census reports 40,000 digits and combined them by groups of four digits in 10,000 numbers.** Fisher and Yates constructed this table at random from 15^{th}, 16^{th}, 17^{th}, 18^{th} and 19^{th} place digits in Thomson's twenty figures logarithm table. The original list of 15,000 digits was arranged into 7500 pairs of digits.
- On the other hand Kendall and Smith used the special machine to construct 100 groups of 1000 digits each. They discarded 5 of these groups because they are found to be unsatisfactory.

Random Number Table (RNT)- As method of selecting/ producing random samples

- Examples of RNT
- Tippet's Random Numbers:
- 2952 6641 3992 9792 7979 5911 3170 5024
- 4067 9524 1545 1396 7203 5356 1300 4693
- Similarly there are Kendall and Smith's Random Numbers: as 23, 15, 75…
- **If the digits given in a random number table are really random, each digit from 0 to 9 is expected to occur in equal number of times i.e. in 80 digits (may be for digits placed in RNT in successive order and not for individual number counting), any digits (0 to 9) is expected to occur 8 times.**

Random Number Table (RNT)

- Selection procedure: Suppose 20 students from a group of 350 students are to be selected by using random numbers. Since the students population size is there digit figure, first of all the students are numbered serially (to make a frame list) in order of three digits numbers from 001, 002…..350. Then a page of random number tables is turned over and the successive three digits numbers are observed and recorded by starting from any number of three digits. Any number greater than 350 is ignored. The observation and recording continues until desired sample size of 20 are achieved.
- Suppose the random number table chosen is Tippet's random number as shown (but this RNT is 4 digit number table, so how we can choose 3 digit number). Then if the first number chosen is 292, then the subsequent random numbers will be observed as 295, 256,…561,, 269, 323 a total of 20 numbers. These random numbers are considered as the serial numbers of students to be chosen. Thus from these 20 number any 10 can be chosen as 295, 269 and 323.
- **In above selection of random numbers, any three digit figures greater than 350 are discarded. In this way, lots of such number are deleted. However the minimization of such discarding may be done by dividing the greatest 3 digit figure 999 by 350 so that the quotient is an integer. In this way random numbers can be grouped into equal intervals like 001-350, 351-700 and 701-1050. third interval has its upper limit greater than the greatest digit figure 999, therefore the third interval is discarded.**
- **Therefore the only first and second intervals are used for selection of numbers. Any random number found in the interval 001-350 is taken as sample unit. Also found in the interval 351-700 is also taken into consideration. The difference of the random number observed in this interval and upper limit of the preceding interval is considered the chosen random number. Thus if the random number is 623, then 623-350 = 273 is taken as one of chosen random numbers.**

Demonstration To Produce Random Samples

- Lets assume that there are 350 students in BSW faculty in BVIC studying Psychology. We are going to select 10 students as a representative out of this population of 350 students for a upcoming conference in **“ Mental Health and Student’s Academic Performance”.**
- We make a sampling frame (list) of those 350 students in ascending alphabetical order and give them symbol numbers from 001 to 350 **[or it can be 01-50 (as in Kendell and Smith’s Random Number which consists of 2 digit numbers)]** as:
- 001. Aevon
- 002. Bidiyolke
- 003. Christina ….
- 350. Rohit.
- ~~We have already created our own version of 1000- 3 digit Random Numbers in a table and named it as **Fig. Psychology Students at BVIC-Random Number Table** - [if it were Kendell and Smith’s Random Number table it would have been less than 100]~~
- Now we turn on this RNT **[or Kendell and Smith’s]** and locate 10 symbol numbers in consecutive order. We accept numbers less than 350 but reject numbers above 350.

Psychology Students at BVIC- RNT(1000 numbers)

001	243	036	999	723	889	442	666	012	010
356	002	123	071	521	689	474	093	009	044
991	183	003	029	106	147	396	008	887	212
056	349	077	004	521	006	007	029	388	181
222	345	019	556	005	049	141	488	176	351
...	...	...	...	...	...	...	...	...	...

Fig. Psychology Students at BVIC-Random Number (1000) Table

Demonstration To Produce Random Samples

- In above selection of random numbers, any three digit figures greater than 350 are discarded. In this way, lots of such number are deleted. However the minimization of such discarding may be done by dividing the greatest 3 digit figure 999 by 350 so that the quotient is an integer. In this way random numbers can be grouped into equal intervals like 001-350, 351-700 and 701-1050. As the third interval has its upper limit greater than the greatest digit figure 999, therefore the third interval is discarded.
- Therefore the only first and second intervals are used for selection of numbers. Any random number found in the interval 001-350 is taken as sample unit. Also found in the interval 351-700 is also taken into consideration. The difference of the random number observed in this interval and upper limit of the preceding interval is considered the chosen random number. Thus if the random number is 623, then 623-350 = 273 is taken as one of chosen random numbers.
- **Proper probability sampling is a technical business. Thus, it is always advisable to get expert advice from a statistician at an early stage or else we may risk wasting our valuable time, effort and resources. It is not advisable to construct our own RNT as even computer generated RNT have been seen with a lot of errors.**

Important Facts about Random Number Table

- ~~For these numbers in RNT be really random numbers, the frequency of repetition of digit 1 (digit one) in 1000*3 (3000 total) digits should be 300. If it were 10 digits RNT, digit 1 should be only one time in the RNT.~~
- The numbers here in the RNT corresponds to the symbol number in the Sampling frame list (details of population under study)
- Nowadays, tables of random numbers have been replaced by computational random number generators.
- In the 1950s, a hardware random number generator named ERNIE was used to draw British premium bond numbers. So in share markets where people apply for millions of unit share but as the company have limited no of unit share, RNT can be used to distribute the shares.
- Random numbers in RNT are susceptible to computational errors and biasness (if the producer use it). So it advised that we don't make RNT but use standardized RNT.
- **If carefully prepared, the filtering and testing processes remove any noticeable bias or asymmetry from the hardware-generated original numbers so that such tables provide the most "reliable" random numbers available to the casual user.**
- **Note that any published (or otherwise accessible) random data table is unsuitable for cryptographic purposes since the accessibility of the numbers makes them effectively predictable, and hence their effect on a cryptosystem is also predictable. By way of contrast, genuinely random numbers that are only accessible to the intended encoder and decoder allow literally unbreakable encryption of a similar or lesser amount of meaningful data (using a simple exclusive OR operation).**
- **Published tables still have niche uses, particularly in the performance of experimental music pieces that call for them, such as *Vision* (1959) and *Poem* (1960) by La Monte Young.[1]**

c) Stratified Sampling

- **A stratified sample is obtained by independently selecting a separate simple random sample from each population stratum.** A population can be divided into different groups may be based on some characteristic or variable like income of education.
- Separating the strata as distinct subpopulation, we can randomize this subpopulation by simple random sampling and takes out sample based on quota allotted or proportional representations. Again if we wish to decrease the sample size we can mix the samples from the subpopulation and take for re randomization.
- Like any body with ten years of education will be in group A, between 10 and 20 group B and between 20 and 30 group C. These groups are referred to as strata. You can then randomly select from each stratum a given number of units which may be based on proportion like if group A has 100 persons while group B has 50, and C has 30 you may decide you will take 10% of each. So you end up with 10 from group A, 5 from group B and 3 from group C. **Each stratum is then sampled as an independent subpopulation, out of which individual elements can be randomly selected.**
- There are several potential benefits to stratified sampling. **(The proportional representation from each group can be itself make up the sample size and may we need not further sampling or randomization and this is usually done in quota sampling.)**

c) Stratified Sampling

- The percentage of ethnic population in Nepal is 35% Janjatis, 28% Aryan, 15% Dalits, Newar 5% and other representative groups has a proportion of 17%. So lets select 35 Janaatis, 28 Aryans, 15 Dalits, 5 Newars and 17 other representative groups. From these strata we can choose 10 sample (sample size) units by randomization based on EPS (may be by using systematic sampling among this 100 units of population). Even while selecting Aryans from the Aryan frame list there can be stratification of the different groups in Aryans.
- In Stratified Random Sampling **the population is first divided into different homogeneous group or strata which may be based upon a single criterion such as male or female. Or upon combination of more criteria like sex, caste, level of education and so on** .This method is generally applied when different category of individuals constitutes the population like general. O.B.C, S.C, S.T or upper caste, middle caste, backward caste or small farmers, big farmers, marginal farmers landless farmers etc. To have an actual picture of a particular population about the standard of living, in case of India it is advisable to categorized the population on the basis of caste, religion or land holding otherwise some section may be under-represented or not represented at all.
- Stratified random sampling may be of two types: a) Proportionate stratified random sampling and b) Disproportionate stratified random sampling.
- **Is cognitive ability predictor of job performance across all the ethnic groups? To work on this problem we need the stratified random sampling.**

Proportionate Stratified Random Sampling

- In case of Proportionate Stratified Random Sampling (the samples are drawn form the population based on the proportional representation in the overall population) method, the researcher stratifies the population according to known characteristics and subsequently, randomly draws the sample in a similar proportion from each stratum of the population according to its proportion. **That is, the population is divided into several sub-populations depending upon some known characteristics, this sub population is called strata and they are homogeneous**.
- Suppose, a VDC consists of 1000 voters among which 60% is Aryans, 30% is Janjatis and 10% is Dalits. Now the investigator wants to draw a sample of 150 voters from the population as per their proportion. That can be done by multiplying the sample number with their proportion; as per this method the sample size of each strata becomes:
- The representation of Aryan voter will be 150 x 60% = 90, Janjatis will be 150 x 30% = 45 and Dalit will be 150 x 10% = 15. So the investigator has to collect the complete voter list of the VDC and *randomly select the sample from each category as calculated above. In this method the* sampling error is minimized and the sample possesses all the required characteristics of the population.
- **It s more like proportional representation in the Constitution Assembly. (Is it?). Actually proportional representation of each strata of research population is the motto behind any stratified random sampling or representation.**
- **The proportion of the population belonging to a strata are represented in stratified random sampling.** That can be done by multiplying the sample number with their proportion.

Disproportionate Stratified Random Sampling

- In this method the sampling unit in each stratum is not necessarily be as per their population. Suppose for the election researcher or investigator wants to the know the voting pattern of male and female of Aryan, Janajatis and Dalit voters; in that case he must take equal no. of male and female voter from each category. Here the investigator has to give equal weightage to each stratum. This is a biased type of sampling and in this case some stratum is **over-represented and some are less-represented; these are not truly representative sampling, still this to be used in some special cases.**

c) Stratified Sampling: Pros and Cons

- First, dividing the population into distinct, independent strata can enable researchers to draw inferences (~~**biasness**~~) about specific subgroups that may be lost in a more generalized random sample.
- Second, utilizing a stratified sampling method can lead to more efficient statistical estimates (provided that strata are selected based upon relevance to the criterion in question, instead of availability of the samples). Even if a stratified sampling approach does not lead to increased statistical efficiency, such a tactic will not result in less efficiency than would simple random sampling, provided that each stratum is proportional to the group's size in the population.
- Third, it is sometimes the case that data are more readily available for individual, pre-existing strata within a population than for the overall population; in such cases, using a stratified sampling approach may be more convenient than aggregating data across groups (though this may potentially be at odds with the previously noted importance of utilizing criterion-relevant strata).
- **Finally, since each stratum is treated as an independent population, different sampling approaches can be applied to different strata, potentially enabling researchers to use the approach best suited (or most cost-effective) for each identified subgroup within the population.**
- **Can it be possible we can randomize within the strata and just take out number of proportional representation? We can use the simple random sampling from the Janajatis and just take out 35 units from this group or we can systematically randomize the population of Aryans and take out 28 units.**

c) Stratified Sampling

- **There are, however, some potential drawbacks to using stratified sampling. First, identifying strata and implementing such an approach can increase the cost and complexity of sample selection, as well as leading to increased complexity of population estimates.** Second, **when examining multiple criteria, stratifying variables may be related to some, but not to others, further complicating the design, and potentially reducing the utility of the strata. Finally, in some cases (such as designs with a large number of strata, or those with a specified minimum sample size per group), stratified sampling can potentially require a larger sample than would other methods (although in most cases, the required sample size would be no larger than would be required for simple random sampling.)**
- **A stratified sampling approach is most effective when three conditions are met** : Variability within strata are minimized, Variability between strata are maximized, The variables upon which the population is stratified are strongly correlated with the desired dependent variable.

c) Stratified Sampling

- **Advantages over other sampling methods:** Focuses on important subpopulations and ignores irrelevant ones.
- Similarities between the intragroup members/ unit and variances between the intergroup units are thoroughly represented.
- Allows use of different sampling techniques for different subpopulations.
- Improves the accuracy/efficiency of estimation.
- Permits greater balancing of statistical power of tests of differences between strata by sampling equal numbers from strata varying widely in size.
- **Disadvantages:** Requires selection of relevant stratification variables which can be difficult.
- A lot of variables which could have important impact on the research result are lost during the sampling, so only focused variables are measured which means the research may be inconclusive.
- **Is not useful when there are no homogeneous subgroups.**
- Can be expensive to implement.

c) Stratified Sampling

- **Poststratification**: Stratification is sometimes introduced after the sampling phase in a process called "poststratification". This approach is typically implemented due to a lack of prior knowledge of an appropriate stratifying variable or when the experimenter lacks the necessary information to create a stratifying variable during the sampling phase. Although the method is susceptible to the pitfalls of post hoc approaches, it can provide several benefits in the right situation. Implementation usually follows a simple random sample. In addition to allowing for stratification on an ancillary variable, poststratification can be used to implement weighting, which can improve the precision of a sample's estimates.[1]
- **Oversampling**: Choice-based sampling is one of the stratified sampling strategies. In choice-based sampling,[5] the data are stratified on the target and a sample is taken from each stratum so that the rare target class will be more represented in the sample. The model is then built on this biased sample. The effects of the input variables on the target are often estimated with more precision with the choice-based sample even when a smaller overall sample size is taken, compared to a random sample. The results usually must be adjusted to correct for the oversampling.
- Proportional representation from each strata is itself biased notion.

d) Clustered Sampling

- This is another type of probability sampling method, in which the sampling units are not individual elements of the population, but group of elements or group of individuals are selected as sample. **In cluster sampling the total population is divided into a number of relatively small sub-divisions or groups which are themselves clusters and then some of these cluster are randomly selected for inclusion in the sample. Actually the purpose of clustered sampling is to find a cluster of samples where we can work on the variable intended for study or research.**
- **Cluster basically refers that they are aggregated as sector or segments within a population.**
- **A)** Suppose an investigator wants to study the functioning of mid day meal service in a district in that case he can use some schools clustering in a block or two without selecting the schools scattering all over the district. Cluster sampling reduces the cost and labour of collecting the data of the investigator but less precise than random sampling.
- (In Kaski District if a Clinical Psychologist wants to research about the cases of mass hysteria, he can find a group of units or cluster within a school. He can thoroughly research all the students over the school or some classes in that school. Which class or which school to select is obviously based on selection based on simple random or systematic random sampling)

d) Clustered Sampling

- B) A cluster sample is obtained by selecting clusters from the population on the basis of simple random sampling. The sample comprises a census of each random cluster selected. For example, a cluster may be some thing like a village or a school, a state. So you decide all the elementary schools in New York State are clusters. You want 20 schools selected. You can use simple or systematic random sampling to select the schools, then every school selected becomes a cluster. If you interest is to interview teachers on their opinion of some new program which has been introduced, then all the teachers in a cluster must be interviewed. **Though very economical cluster sampling is very susceptible to sampling bias. <u>Like for the above case, we are likely to get similar responses from teachers in one school due to the fact that they interact with one another.</u>**
- **E.g.. Some researcher willing to research suicide rate among college students, he may identify your college as a population, individual classes as the clusters or units, apply simple or systematic random sampling to choose few classes; he may then use suicide inventory as the method of data collection using the whole of the class. Or may be he can derive sample unit from each classes and then administer questionnaire or inventory over them.**
- **He may also consider, out of hundreds, few schools like yours as sample cluster through simple random sampling and again derive class cluster out of all the classes in your school or college.**

d) Clustered Sampling

- Sometimes it is more cost-effective to select respondents in groups ('clusters'). Sampling is often clustered by geography, or by time periods. **(Nearly all samples are in some sense 'clustered' in time - although this is rarely taken into account in the analysis.)** For instance, if surveying households within a city, we might choose to select 100 city blocks and then interview every household within the selected blocks.
- **Clustering can reduce travel and administrative costs.** In the example above, an interviewer can make a single trip to visit several households in one block, rather than having to drive to a different block for each household.
- **It also means that one does not need a sampling frame listing all elements in the target population. Instead, clusters can be chosen from A Cluster-Level Frame, with an element-level frame created only for the selected clusters. In the example above, the sample only requires a block-level city map for initial selections, and then a household-level map of the 100 selected blocks, rather than a household-level map of the whole city.**
- Cluster sampling generally increases the variability of sample estimates above that of simple random sampling, depending on how the clusters differ between themselves, as compared with the within-cluster variation. For this reason, cluster sampling requires a larger sample than SRS to achieve the same level of accuracy - but cost savings from clustering might still make this a cheaper option.

d) Clustered Sampling

- Cluster sampling is commonly implemented as **Multistage Sampling**. This is a complex form of cluster sampling in which two or more levels of units are embedded one in the other. The **first stage** consists of constructing the clusters that will be used to sample form (in the first stage we choose sample clusters). In the **second stage**, **a sample of primary units is randomly selected from each cluster (rather than using all units contained in all selected clusters).** In following stages, in each of those selected clusters, additional samples of units are selected, and so on. **All ultimate units (individuals, for instance) selected at the last step of this procedure are then surveyed.** This technique, thus, is essentially the process of taking random subsamples of preceding random samples.
- Multistage sampling uses the notion that after clusters are derived for research, further few selected samples from each cluster can be randomly selected and they can be surveyed or researched.
- **Multistage Sampling** can substantially reduce sampling costs, where the complete population list would need to be constructed (before other sampling methods could be applied). By eliminating the work involved in describing clusters that are not selected, multistage sampling can reduce the large costs associated with traditional cluster sampling.
- A large chunk of variables of the research population are missed and not included which obviously raises the question of reliability and validity of the information accessed and results obtained.

Uses and Limitations of Probability and Non Probability Sampling

- **Randomness of the sampling is for maintaining unpredictability otherwise EPS would not be maintained. But this randomness in a lot of sense becomes unrepresentativeness.**
- **1) Simple Random Sampling** may also be cumbersome and tedious when sampling from an unusually large target population. In some cases, investigators are interested in "research questions specific" to subgroups of the population. **For large population it is advisable to use either systematic or stratified random sampling.**
- **However, SRS can be vulnerable to sampling error because the randomness of the selection may result in a sample that doesn't reflect the makeup of the population**. For instance, a simple random sample of ten people from a given country will on average produce five men and five women, but any given trial is likely to overrepresent one sex and underrepresent the other. (Systematic and stratified techniques), attempt to overcome this problem by "using information about the population" to choose a more "representative" sample.
- **The positive point about the simple random sampling is that the subset of the sampling frame list also get EPS so is good.**

Uses and Limitations of Probability and Non Probability Sampling

- Using a **Random Number Table** to choose the elementary units can be cumbersome. **If the sample is to be collected by a person untrained in statistics, then instructions may be misinterpreted and selections may be made improperly.**
- **Instead of using a least of random numbers, data collection can be simplified by selecting say every 10th or 100th unit after the first unit has been chosen randomly as discussed below. such a procedure is called systematic random sampling.**
- **Uses:** High level of randomization is possible from this type of sampling. It is usually advisable for smaller population where there is purpose and convenience and smaller sample size even can represent the population
- **Its best to use that sampling method that minimizes errors and biasness. The best sampling design would be that fits the context, lessens the cost , time and effort.**
- **If sampling and data collection methods don’t go hand to hand with objective of the research then there is always errors and biasness.**

Uses and <u>Limitations</u> of Probability and Non Probability Sampling

- 2) **<u>Pros:</u> As long as the starting point is randomized, <u>Systematic Sampling</u> is a type of probability sampling.** It is easy to implement and the stratification induced can make it efficient, *if* the variable by which the list is ordered is correlated with the variable of interest. 'Every 10th' sampling is especially useful for efficient sampling from databases.
- **<u>Cons:</u>** However, systematic sampling is especially vulnerable to periodicities in the list. If the first sample chosen in not random, then periodicity becomes predictability and it is certain to be biased analysis and interpretation. If periodicity is present and the period is a multiple or factor of the interval used, the sample is especially likely to be *un*representative of the overall population, making the scheme less accurate than simple random sampling.
- Periodicities are vulnerable to predictability.
- Another drawback of systematic sampling is that even in scenarios where it is more accurate than SRS, its theoretical properties make it difficult to *quantify* that accuracy. (In the two examples of systematic sampling that are given above, much of the potential sampling error is due to variation between neighbouring houses - but because this method never selects two neighbouring houses, the sample will not give us any information on that variation.)
- ~~**This type of sampling can be used in allotting scholarships and vacancy or army personnel recruitment.**~~

Uses and Limitations of Probability and Non Probability Sampling

- **3) Disadvantages of Stratified Sampling:** Requires selection of relevant stratification variables which can be difficult and is **not useful when there are no homogeneous subgroups.** It can also be expensive to implement. Here in this sampling some strata are over-represented and some are less-represented; these are not truly representative sampling, still this to be used in some special cases.
- A lot of variables are lost while reducing the population to samples. The reliability of result is obviously questioned.
- **This type of sampling is good in census study.**
- **4) Clustered Sample:** Though very economical cluster sampling is very susceptible to sampling bias. **Like we may be likely to get similar responses from teachers in one school due to the fact that they interact with one another and belong to the same cluster represented as a school in a district. Sample selected from the same cluster may not represent variability. Clustered sampling and multistage sampling when used successively always reduces the representativeness of the sample.**
- A large chunk of variables of the research population are missed and not included which obviously raises the question of reliability and validity of the information accessed and results obtained. The absence of sampling frame is a difficulty for a researcher who wants to reinvestigate the study or use the data from the samples as the secondary data.
- **This type of sampling is useful in pilot surveys while launching new goods in market.**

Uses and Limitations of Probability and Non Probability Sampling

5) **Purposive sampling and quota sampling** have errors, bias and even misleading conclusion. There may be a lot of hallow effect as we take those sample units into the consideration of research which agrees with our intent of study. Maybe this way we plot misleading conclusions.

Random Number Table can't be used by a person who is not used to simple statistics.

- When purpose are clear as in case of studying the stress level of uterine cancerous women it is vey helpful.
- **Snowball Sampling: I**t is also called sociometric sampling technique. In case of drug addict people it is difficult to find out who are the drug user but when one person is identified he can tell the names of his partner then each of his partner can tell another 2 or 3 whom he knows uses drug . This way the required number of element/person is identified and collects data. This method is suitable for diffusion of innovation, **network analysis,** decision making.
- A population in which the samples are scattered, this method helps as in form of pilot research or survey. But **Snowball sampling and double sampling** is expensive and time consuming. **Judgmental sampling** is based on preference of someone and already biased where as **convenience sampling** is the poorest of all sampling as it lacks any randomization, information accessed are inadequate.

Uses and <u>Limitations</u> of Probability and Non Probability Sampling

- 6) In case of **<u>Self Selected or Accidental Sampling</u>** the people that he/she could interview would be limited to those present there at that given time, which would not represent the views of other members of society in such an area, if the survey were to be conducted at different times of day and several times per week.
- Self selected or accidental samples always have over enthusiasm but not proper representation of the units and the reliability of the data accessed is always in question.
- **They are frequently used in electronic media for conducting Public Poll for public opinion.**

Demonstration To Understand Various Types of Random and Non Random Sampling

- Lets assume that the students of BVIC in BSW 2nd Year studying Research Psychology represents (~~consists of~~) 3 clusters of units. They are to be taken into sampling so that they can be researched or enquired or investigated for the death (due to suicide in the month of January 2014) of R. Raut a student studying in class 12.
- Lets assume that this research is to be headed by **Dr. Shishir Subba of the Central Department of Psychology** who through this research will try to outline the psychological cause regarding suicide and give recommendations to the management and teaching faculty of the college.
- A sample size of 10 unit from the selected cluster of population of 50 would go into the research procedure. These selected units are also entitled to scholarships in the Masters Degree.
- For sure every cluster would try to win the chances to be in the research of Dr. Shishir Subba and each unit of the cluster would have the same intentions to be in the list.
- The effectiveness of the leader in presenting the rationale behind their inclusion in the team, the advantages of given sampling methods over other sampling methods and a descriptive layout of the sampling method would give them headway to the research team. All the units of the cluster or team need to participate in the proposal presenting regarding the sampling method they are entitled to describe. Dr. Subba would judge the process.

Demonstration To Understand Various Types of Random and Non Random Sampling

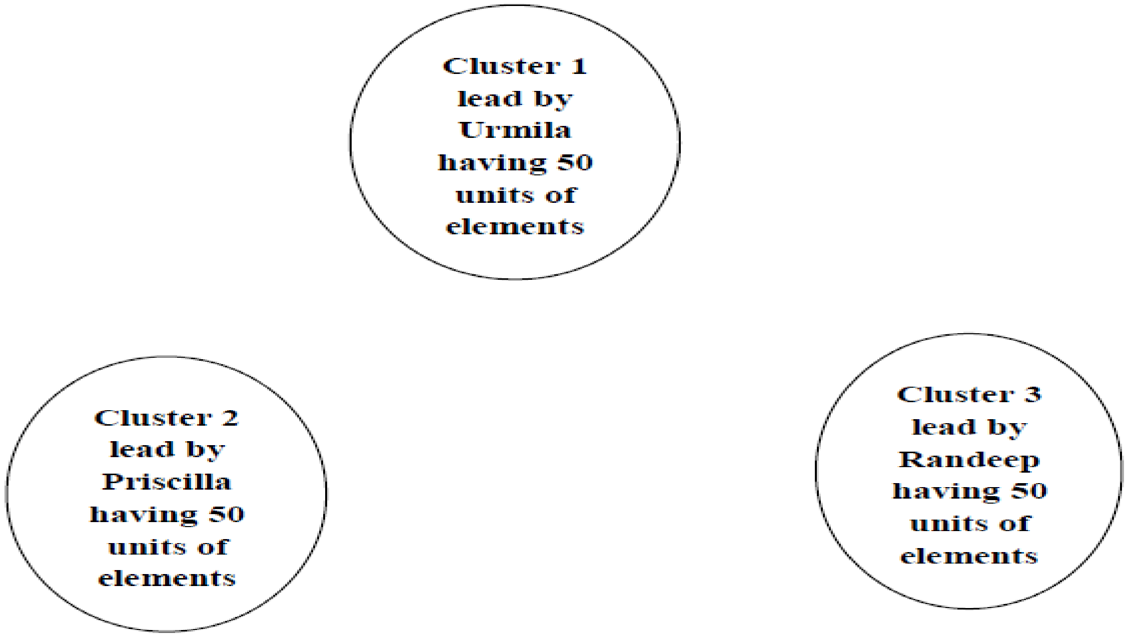
- We start with making a clustered level frame (list) of those 3 clusters lead by their own **leader**.
- 001. **Urmila**, Aevon, Chirstina and a total of 50 units including teachers, non teaching staffs and administrators representing **Cluster 1**
- 002. **Priscilla**, Tulasi, Bidiyolke and a total of 50 units including teachers, non teaching staffs and administrators representing **Cluster 2**
- 003. **Randeep**, Nazma, Dipu and a total of 50 units including teachers, non teaching staffs and administrators representing **Cluster 3**

Demonstration To Understand Various Types of Random and Non Random Sampling

- Now the role of each leader is to use the below mentioned sampling methods to make their own cluster into research or investigation (as they can benefit by getting scholarships to study MA Psychology). The leaders (participating equally into sharing information, strategies and making his team members into the process too) should elaborate how his cluster going to be into the research and also give details about the sampling method as given to the team.
- **Cluster/Team 1- Urmila/ Aevon- Stratified Random Sampling**
- **Cluster/Team 2- Priscilla- Clustered Random sampling**
- **Cluster/Team 3- Randeep- Any of the Non Random Sampling**
- In this way the students may understand about the purposive and convenience sampling (as this strategy inclines towards that objective)
- How are they going to use random number table and systematic random sampling methods in this procedure?
- What could be the likely limitations and benefits of using their methods of sampling?
- An opposing team can criticize over the presentations of the Presenting Team. The Presenting Team have the equal right to defend their assertions in the presentations.
- Lets start!

Demonstration To Understand Various Types of Random and Non Random Sampling

- 3 clusters within BVIC represented by students studying Research in BSW 2nd Year.
- BVIC could have been selected as a cluster in itself from hundreds of colleges in Lalitpur through Clustered Sampling.



<u>**Graphical Representations of the Clusters**</u>

- Now your task is to use different clusters and make a sample that atleast includes your cluster.

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Data Collection Techniques

Unit IV

Data Collection Techniques

Data- Concept

Types- Primary and Secondary Data, Qualitative and Quantitative Data

Differences between Qualitative and Quantitative Data

Data- Concept

- **Data collection** is the process of gathering and measuring information on variables of interest, in an established systematic fashion or norms or regulations that enables one to **answer stated research questions**, test hypotheses, and evaluate outcomes. The data collection component of research is common to all fields of study including physical and social sciences, humanities, business, etc. While methods vary by discipline, the emphasis on ensuring accurate and honest collection remains the same.
- In research the following steps may be taken for data collection:
- a) **Gathering of data:** Consists of identifying a population and selecting samples, gathering information from and/or about these samples by using specific research instruments. The instruments used for data collection must be valid and reliable.
- b) **Analysis of data:** Involves **breaking down** the individual pieces of data in order to draw **conclusion**s about it.
- c) **Data Interpretation:** This can be represented through tables, figures and pictures, and then described in words.

Data- Concept

- Regardless of the field of study or preference for defining data (quantitative, qualitative), accurate data collection is essential to maintaining the integrity of research. Both the selection of appropriate data collection instruments (existing, modified, or newly developed) and clearly outlined instructions for their correct use reduce the likelihood of errors occurring.
- A formal data collection process is necessary as it ensures that data gathered are both defined and accurate and that subsequent decisions based on arguments embodied in the findings are valid.[1] The process provides both a baseline from which to measure and in certain cases a target on what to improve.
- **Consequences from improperly collected data include: Inability to answer research questions accurately; Inability to repeat/ replicate and validate the study.**
- **Distorted findings result in wasted resources and can further mislead other researchers to pursue fruitless avenues of investigation. This compromises decisions for public policy, and causes harm to human participants and animal subjects.**
- While the degree of impact from faulty data collection may vary by discipline and the nature of investigation, there is the potential to cause disproportionate harm when these research results are used to support public policy recommendations.

Overview of Data Collection Methods: Qualitative and Quantitative Methods and Data

- **Primary Data** is data collected on firsthand specifically for the research, such as through interviews or questionnaires. When the data is collected from the source it is primary data.
- When we analyze and interpret and classify and organize, the primary data secondary data comes into existence. **Secondary Data** is data that already exists, such as census data, which can be re-used for the research. It is good ethical research practice to use secondary data wherever possible.
- ~~**When the primary data is organized or tabulated and used for a research it could be secondary data.**~~
- ~~**But primary and secondary data can be the interchangeable notions, and we have to comprehend such notions as according to the demands and context.**~~
- It needs to be understood from where these primary and secondary data comes. Basically qualitative and quantitative data collection methods yield primary data and later when these primary data analyzed, secondary data comes into existence.
- **It is usually found that quantitative methods yields data that can be measured, has numerical values. On the other hand qualitative methods gives us data that can be explained or described but not measured for numerical values.**
- There are also qualitative and quantitative research methods.
- **Tips: The relevance of qualitative research methods or data collection is very much important in social science as it enables a description and elaboration of phenomenon. To establish the psychological phenomenon, we need description and not solely absolutely measurable values.**

Qualitative Methods of Data Collection

- **Qualitative Research**: Understanding of human behavior and the reasons that govern such behavior. Asking a **broad question and collecting data in the form of words, images, video etc that is analyzed searching for themes.**
- This type of research aims to **investigate a question without attempting to quantifiably measure variables (the variable could have numerical values but the relationships between the variables are not established in case of qualitative research) or look to potential relationships between variables.** It is viewed as more restrictive in testing hypotheses because it can be expensive and time consuming, and typically limited to a single set of research subjects. It is also inductive as it tries to include a broad question and its multiple faces within a single frame.
- **Qualitative research is often used as a method of exploratory research as a basis for later quantitative research hypotheses. Qualitative research is linked with the philosophical and theoretical stance of social constructionism.**
- In general, there are three approaches or methods in collecting data : **Quantitative , Qualitative And Mixed Methods.**

Qualitative Methods of Data Collection

- **Qualitative Methods** used in qualitative research **does not rely on numerical measurements alone;** it focuses on small number of cases (sampling size is small), uses intensive interviews, a comprehensive account of some event or unit or phenomenon, issue etc.
- **Qualitative data doesn’t have numerical value but qualitative research can use the quantitative data. May be because of these reasons the triangulation methods are used. (RB)**
- Some of the tools for collecting qualitative information are: Interviews (by the use of questionnaire or without the use of questionnaire), Survey, Focus Group Discussion-participation in the setting (FGD), Observation, Follow Up Interview.
- **Normally, checklists/ schedules are prepared to elicit such information.**
- **Brain teaser: Whether graphs are qualitative data or as the figure can interpret numerical forms/ values they can be tagged as the quantitative data?**
- **Does quantitative data rely highly on psychophysics? Quantitative data are more about the experimental outcome.**
- **Brain teaser**: Can we interpret and produce a diagrammatic representation of qualitative data (or the inferences drawn from that qualitative data)?
- We are actually not able to represent the qualitative data in diagrammatic representation but if we can count the number of similar phenomenon or variable (though pattern identification or thematic analysis) occurring in an research, we are able to represent them in diagrams.
- **Qualitative research doesn’t mean only qualitative data but also numerical data. These numerical data can be interpreted in the diagrammatic representation.**
- **But what about data in the form of words? The words can be tabulated, described, and insight be generated. All the insights generate you inference or result of the study at the end. (can tabulation be considered as schematic representation?)**

Quantitative Methods of Data Collection

- Quantitative research: Systematic empirical investigation of quantitative properties and phenomena and their relationships. **Asking a narrow question and collecting data that have numerical value and to analyze and interpret utilizing statistical methods. The quantitative research designs are experimental, correlational, and survey (or descriptive).**
- Quantitative research yields data that can be numerically measured and statistically linked. **Statistics derived from quantitative research can be used to establish the existence of associative or causal relationships between variables.**
- The Quantitative data collection methods rely on random sampling and structured data collection instruments that fit diverse experiences into predetermined response categories. These methods produce results that are easy to summarize, compare, and generalize. (need of calibration)
- **Quantitative research is concerned with testing hypotheses derived from theory and/or being able to estimate the size of a phenomenon of interest.** Depending on the research question, participants may be randomly assigned to different treatments (this is the only way that a quantitative study can be considered a true experiment). If this is not feasible, the researcher may collect data on participant and situational characteristics in order to statistically control for their influence on the dependent, or outcome, variable.
- If the intent is to generalize from the research participants to a larger population, the researcher will employ probability sampling to select participants.

Quantitative Methods of Data Collection

- Quantitative Methods uses and find numerical values in information (data) accessed or measurement done and applies tools and techniques to analyze that numerical measurements of the specific phenomena. It uses either the census or the sample approach for collecting data.
- **Quantitative research is seen as concerned with observable and measurable and the numbers. It is focused, objective, generalizable and by implication value free. It is based on the philosophy that reality is observable and that human beings are rational beings.**
- **<u>However, for all practical purposes most research contain some aspects of both research types.</u>**
- **<u>Questionnaire (structured, semi structures or unstructured) is prepared to elicit information.</u> Questionnaire can be prepared to elicit information for both the qualitative and quantitative methods of data collection.**
- **The focus of quantitative research methods is defining the relationships between the phenomenon or variables where as the focus of qualitative research method is more about the description or elaboration of phenomenon.**

Quantitative Methods of Data Collection

- Usually in **<u>Mixed Methods that</u>** combines both the quantitative and qualitative research tools for collecting information. Analysis of the report is based on the findings of both methods.
- A very important **<u>shortcomings/ limitations</u>** that need to be eliminated in during data collection is that when research problem is not properly linked to the objectives of research and with the data collection procedures (or even sampling procedure and tools) there always comes errors in accessing and measuring data . So it need to be understood that a good research proposal is that where each objective is properly linked with the data collection tools.
- Quantitative research is linked with the philosophical and theoretical stance of <u>positivism</u>
- **What are the rationales behind qualitative or quantitative research methods?**
- **Answering the research questions.**
- **Exploring the phenomenon or finding the relationships between the variables.**
- **Qualitative research are explorative where as quantitative research are explanatory.**
- **<u>Brain Teaser</u>**: Nature has its own mathematics, how?

Differences Between Qualitative and Quantitative Methods

Qualitative methods	**Quantitative methods**
Qualitative data	*Quantitative data*
Natural settings	*Experiential settings*
Search for meaning	*Identification of behavior*
"Rejection" of natural science	*Adoption of natural science*
Inductive approaches	*Deductive approaches*
Identification of cultural patterns	*Pursuance of scientific laws*
Focus attention on individual	*Focus attention on aggregates*

Differences Between Qualitative and Quantitative Methods

- **Qualitative method is the exploration of phenomenon where as the quantitative methods are the explanations of phenomenon.**
- Quantitative methods always approves the law of nature or progression of nature. e.g. 400 eggs that are in the ovum of a women are matured and liberated during the 30-35 years of their reproductive life cycle. (does qualitative methods actually rejects the law of nature or is it that it doesn't use the law of nature in identifying or interpreting data?)
- Quantitative approaches use those statistical parameter that deduces a large chunk of data into easily interpretable and identifiable forms. In contrast, in the case of qualitative data collection methods when a data is found, it helps further exploring of relevant data. So qualitative methods are very much used in pattern analysis where as the quantitative methods in formulating the scientific laws.
- Qualitative methods of research generally have small sample size for research where as the sample size is generally large (aggregate) in quantitative research.
- **<u>Brain Teaser</u>**: Are all experimental research quantitative research?

Comparisons Between Qualitative and Quantitative Methods

- **The qualitative and quantitative approaches are never substitutes for one another. This is so because; necessarily they observe different realities or different aspects of reality (McCracken 1989:18).**
- Statistical procedures or Quantitative Methods/ Researches use tools of mathematics to establish relationships and linkages among constructs/ variables across settings and groups. **They always demand y is a result of manipulation in x.** By contrast qualitative researchers use tool of logic to establish the same relationships within a given setting (Borman, LeCompte and Goetz 1986:55).
- Qualitative analysis – in fact, all analysis - is the search for patterns in data and for ideas that help explain the existence of those patterns (Bernard (1995:360). Content analysis and pattern analysis is always the specialty of qualitative methods.
- **Important consideration while choosing the appropriate methods for data collection: a) Nature of the research, design of research, the environment, time, individual as enumerators and subjects and many other factors guide the selection of method/s b) Acceptability and validity of conclusion depends on the proper choice of method c) Discipline, supervisor, resource persons, literature are helpful. Researcher is the ultimate decision maker**
- **Tips- Calibration: I**n Kathmandu valley 200 grams is recorded as one **"Pau/ Quarter"** where as in other cities as Pokhara 250 grams is recorded as one **"Pau/ Quarter" . Calibration of instruments is an important process in measurement. So psychological tests and tools are already calibrated and are used in specific context.**

Data Collection Techniques
Unit IV

Chapter b

Data Collection Methods- Concept

Types- Qualitative

i) Observational Methods- naturalistic, structured and unstructured -

ii) Focus Group Discussion

iii) Survey- questionnaire and interview

iv) Case study

v) Experimental Method – Quantitative

Data Collection Methods- Concept

- Qualitative researchers typically rely on four methods for gathering information: (a) participating in the setting, as the focus group discussion ~~**or participants observation**~~ (b) observing directly, (c) interviewing in depth, and (d) analyzing documents and material culture. But it need to be understood that several secondary and specialized methods of data collection supplement them.
- We will be dealing with a lot of data collection methods in qualitative research but how the data will inform the research questions and how the researcher plans to use these methods, however, depends on several considerations.
- Assumptions made in these seven categories for qualitative inquiry as outlined by **Brantlinger's (1997)** shape how the specific research methods are conceived and implemented throughout a study. They form the bases for how we choose a specific methods over other in our inquiry. (It seems that these categories also help in choosing a specific research method. Is it?)
- **1) Nature Of The Research:** Is the inquiry technical and neutral, intending to conform to traditional research within the inquiry, **or is it controversial and critical,** with an explicit (clearly seen) political agenda?

Brantlinger's (1997) Assumptions

- 2) **Positioning relative to the participants:** Is the inquiry distant and objective or intimately involved in our lives? One researcher may be sending inquiry questions through emails to a distant respondent/ participants or subject. Though it could be very objective, it may not be very involved in our lives.
- 3) **Direction of gaze:** Is it outward, toward others—externalizing the research problem—or does it include other intentions?
- 4) **Purpose of the research**: **Whether the primary purpose of the study is professional and essentially private (e.g., promoting career), or is it intended to be useful and informative to the participants or the site?** (Most of the times in case of Appreciative Inquiry, researcher tries to establish that the study or inquiry is being done for the welfare of the participants. May be in case of research intended towards academic goal such as achieving PhD. the research is only beneficial for one who does it.)
- 5) **The intended audience of the study:** Whether it is the scholarly community or the participants themselves?
- 6) **Political positioning:** Is the research as neutral or has it got some politically explicit agenda?
- 7) **Exercise Of Agency:** Does she see herself and the participants as essentially passive or as "engaged in local praxis"?

Brantlinger's (1997) Assumptions

- Assumptions made in these seven categories shape how the specific research methods are conceived and implemented throughout a study. Explicit discussion of assumptions strengthens the overall logic and integrity of the proposal.
- **It is very clear that the assumptions of Brantlinger focus whether there is beneficiary of the research to other than the researcher himself and whether if there are clearly political agenda mixed within the inquiry. These assumptions show us path regarding how to sow the seed for the research and collect data. Furthermore these assumptions would take us to take the process of research as according the objectives of researches.**
- **A political agenda mixed up inquiry or research may be costly, time demanding, not going well with the objectives and hypothesis and due to political intentions inserted could lead us to now where. There may be no any results of conclusion from such inquiries. Its best those intentions are avoided.**
- **When research process are just meant to completion of a academic course for the researcher, then there are chances that there are high dropout rate in case of questionnaire, respondent may not give valuable information while on the interview spot because he is not totally interested on the process. Its best that field workers are emotive and can elicit answers for research questions.**

Design Of Lessons

- **The nearer the respondent/ clients/ subjects to the lead researcher the better the volume and richness of data. Such data obtained are reliable for the lead researcher to have a trust on for the better outcome.**
- The investigation of Royal Massacre in Narayanhiti Palace of Nepal 2001 was inconclusive and yield no believable conclusion because of the political agenda (may not have been seen or shown overtly at that time).
- **We will be first dealing with methods of data collection in qualitative research as observational methods, focus group discussion and survey as a qualitative methods. <u>Then we will proceeds towards the quantitative methods as experimental and outline the need of case studies for in-depth studies in both the qualitative and quantitative methods. In addition we will try to know about the use of tools that elicits the information required.</u>**
- **For example, some speak of “doing case studies” as a way of collecting data, but, more often, an entire report, even a book, is a case study.**
- Qualitative methods are always the pre requisite of any research. It is assumed that in ancient times when no statistical methods have been invented this method of data collection should have been extensively used. Probably while designing the approach to warfare, qualitative or observational method of study should have been done to know the strengths and weakness of the opponent and thereby outlining their own need and strength in the war.

A book by Dr. Shishir Subba, Tribhuvan University, " Sociocultural Construction of Illness" highlight the relevance of qualitative research in the following paragraphs.

The oral recitals and other information written here were collected while interacting with several groups of people of Jājarkot. Within the span of three years, the investigator, stayed for more than six month in different villages of the district, collected data from local people, traditional healers including the *Kādī* healer, patients and household heads and generated information on different types of healing practices. A household survey, observation and case study method was applied to different groups of informants. Semi-structured interview, Focused Group Discussion, in-depth qualitative interview was conducted to draw the information. The data collected was primarily qualitative supported by quantitative data thus a triangulation approach was applied. *Kādī* was one of the healing practices collected for examination of modern and traditional healing practices. Here brief introduction of traditional healing practices and details of selected transcribed *Kādī* recitals are presented.

The Principles of Qualitative Methods of Data Collection

- People differ in their experiences and understandings of reality; how one participants define a situation may not reflect assumptions made or objectives intended by the researcher.
- A social phenomenon cannot be understood outside its own context. **Research is itself a socially constructed phenomenon.**
- Theory both guides qualitative research and is the result of it. Qualitative research through the **exploration (induction)** of phenomenon help us pioneer a theory.
- Exceptional cases may yield insight into a problem or new leads for further inquiry.
- **<u>Understanding of human behavior emerges slowly and non- linearly.</u>**
- **Researchers and the informants are considered as collaborators.**
- **The idea behind qualitative methodology is "to get people to open up and let them express themselves in their own terms and at their own pace (Bernard 1995:209).“**
- **It is easy for people to express things and let us the relevant data at the moment than out of the context. Even questionnaires can’t elicit as much as information as we feel adequate.**

Observational Method- Naturalistic, Structured and Unstructured

- Ethnography: ethno = culture; graphy = writing or an inscription.
- Nisa: The Life and Words of a !Kung Woman (Shostak, 1983) is a book that is a life history of one African woman, and the data collection method is called life history, consisting of long-term participant observation and in-depth and ethnographic interviewing. Ethnography is itself an in-depth observation.
- **Observation entails the systematic noting and recording of events, behaviors, and artifacts (objects) in the social setting chosen for study.** The observational record is frequently referred to as **field notes—detailed**, nonjudgmental, concrete descriptions of what has been observed. **Observation may be invasive as Participant observation and or non invasive as in case of classroom studies or activities in Sambidhan Shabha for journalism purpose.**
- **For studies relying exclusively on observation, the researcher makes no special effort to have a particular role in the setting; to be tolerated as an unobtrusive or non invasive observer is enough.**
- Classroom studies are one example of observation, often found in education, in which the researcher documents and describes actions and interactions that are complex: what they mean can only be inferred without other sources of information.
- **This method assumes that behavior is purposeful and expressive of deeper values and beliefs and other mental processes.**

Observational Method- Field Notes

- **Observation can range from a highly structured, detailed notation of behavior structured by checklists to a more holistic description of events and behavior.**
- We can also insert the issue of **Observational Research** which is basically qualitative inquiry and it is used **for studying nonverbal behaviors (gestures, activities, social groupings, etc.).**
- **Field notes are not scribbles. The proposal writer should have clear note-organizing and note-management strategies.** Figure 4.1 provides an example of edited and "cleaned-up" field notes for a study of kindergarten teachers. O'Hearn-Curran (1997) has formatted **DESCRIPTIVE notes in a column on the left while reserving a second column on the right for her COMMENTS OR INSIGHTS. These include her emerging analytic insights about the behavior. Observers' comments are often a quite fruitful source of analytic insights and clues that focus data collection more tightly.** They may also provide important questions for subsequent interviews.
- **Its clear that observation helps in analyzing the situation and makes the observer insightful of events.**
- **In play therapy with children extensively use of observational studies are done.**
- **Field notes can also be used prior interviewing to set and define the circumstances in which the interview took place.**
- **Scribbles: Just something written after listening. It's more like field notes but not the field note..**

Observational Method- Field Notes

Figure 4.1 Sample Field Notes

Tuesday, November 13, 1997 12:40 p.m. Observation	*Observer's comments*
There are 17 children in the room. There are 3 adults: 1 teacher, 1 classroom assistant, and 1 student teacher (the student teacher is an older woman).	
The room is in the basement of the school. The school is a brick building approximately 90 to 100 years old. The room is about 40 feet by 30 feet. The room is carpeted and is sectioned off by furniture. There is an area with big books and a chart in the left-hand back corner of the room. Next to that is a shelf with a mixture of small books, tapes, and big books in baskets. Next to that is a small area with toy kitchen furniture and dolls. There is an area with several tables in front of the kitchen area. There are many small chairs pulled up to the table. In the front of the room is an area with a sand table. There is a semicircle table in the left-hand front corner of the room. The walls are colorful with papers that have been made by the children. One wall has papers with apples on them. Another wall has pictures of children with their names on the front of the papers. There are several small windows in the room and the florescent lighting seems to be the major source of light.	*The teacher seems to have done a great job of making the room seem very inviting. The space itself is not optimal*
The children have just come into the room. They have put their coats and backpacks onto their hooks in the hall outside.	*Most of the children appear to know the routine*

Observational Method- Naturalistic, Structured and Unstructured

- In the early stages of qualitative inquiry (it is often compared as to having lack of goal and defined interest and is meant to identify similar pattern in a setting), the researcher typically enters the setting with broad areas of interest but without predetermined categories or strict observational checklists. In this way, the researcher is able to discover the recurring patterns of behavior and relationships. **After these patterns are identified and described through early analysis of field notes, checklists become more appropriate and context-sensitive. Focused observation then is used at later stages of the study, usually to see, for example, if analytic themes explain behavior and relationships over a long time or in a variety of settings. This focused observation could itself be a scribble for Case Studies.**
- ***Observation is a fundamental and highly important method in all qualitative inquiry. It is used to discover complex interactions in natural*** **social settings.** Even in studies using in-depth interviews, observation plays an important role **as the researcher notes the interviewee's body language and affect in addition to her words**. It is, however, a method that requires a great deal passion and equal effort from the researcher. **Discomfort, uncomfortable ethical dilemmas and even danger, the difficulty of managing a relatively unobtrusive role, and the challenge of identifying the big picture while finely observing huge amounts of fast-moving and complex behavior are just a few of the challenges.**

Observational Method- Naturalistic, Structured and Unstructured

- Whether a researcher is simply observing from afar or finding a participant-observer role in the setting, some contexts may present dangers. *Street ethnography (cultural writing) is a term that describes research settings which* can be dangerous, either physically or emotionally, such as working with the police (as journalist during People's Movement II 2062-2063), drug users, cults, and situations in which political or social tensions may erupt into violence (Weppner, 1977).
- Observations involve more than just "hanging out or just jotting down things." Planful and self-aware observers use observation systematically (DeWalt & DeWalt, 2001)**. At the proposal stage, the researcher should describe the** purpose of the observing, the phase of the study in which it is likely to be most fruitful, and the use of field notes to respond to the research questions.
- **Observation is the method of qualitative data collection and field note is the tool used to collect data.**
- **<u>We need to accept the fact that every or some type of research is in fact case study as we sample population and do our research or investigation on that particular part of population.</u>**

Observational Method- Types

- **Observation entails the systematic noting and recording of events, behaviors, and artifacts (objects) in the social setting chosen for study.** Observation is the oldest method of data collection used by mankind for the scientific observation.
- **We have a lot of different methods of observation as interpretive, ethnographic, participant observer and even case studies however we precisely use the following types which can be discussed within the qualitative research in psychology.**
- <u>1) Naturalistic</u>
- <u>2) Structured</u>
- <u>3) Unstructured</u>

Observational Method- Naturalistic Observations

- **<u>Naturalistic</u>:** When the observation is carried out to observe natural behaviour and when the circumstances is also natural and not lab controlled then it is referred as naturalistic observation. Not only the observer also naturalizes himself to the group norms and conformities.
- Naturalistic observation differs from structured observation in that it involves looking at a behavior as it occurs in its natural setting with no attempts at intervention on the part of the researcher.
- **Similarly like the naturalistic observation there is <u>CONTROLLED OBSERVATION</u> which is more of structured and non participatory. Lab experiments are more of controlled observations. In fact Controlled Observations like the scientific experiments, are always the matter of manipulation and observations where some variables are even controlled.**
- Observations in natural settings is a very good way of doing Pilot Survey.

Naturalistic Observation

- Naturalistic observation is a research method commonly used by psychologists and other social scientists. This technique involves observing subjects and phenomenon in their natural environment and for the natural behaviour (unconsciously expressed). This type of research is often utilized in situations where conducting lab research is unrealistic, cost prohibitive or would unduly affect the subject's behavior.
- Basically when the observer participates with the activities of the group he is observing or under study then it gives the data of natural of behaviour. Here the observer becomes the member of the group, and watches over the behaviour of the group of close proximity but he may or may not participate in group activities. For sure he is the part of the group but not the part of the activity. For this reason it also the **<u>Participatory Observation</u>**. But it is equally important that it can also be non participating observation when the observer doesn't become as the group members but watches from the distance.
- Naturalistic observation differs from structured observation in that it involves looking at a behavior as it occurs in its natural setting with no attempts at intervention on the part of the researcher.
- In structured observation we usually frame up time, person and place to observe. May be we take a consent from the people that we are willing to observe.
- **As outlined by Dr. Shishir Subba in his research when he stayed in the village with the villagers for around 6 months.**

Naturalistic Observation

The oral recitals and other information written here were collected while interacting with several groups of people of Jājarkot. Within the span of three years, the investigator, stayed for more than six month in different villages of the district, collected data from local people, traditional healers including the *Kādī* healer, patients and household heads and generated information on different types of healing practices. A household survey, observation and case study method was applied to different groups of informants. Semi-structured interview, Focused Group Discussion, in-depth qualitative interview was conducted to draw the information. The data collected was primarily qualitative supported by quantitative data thus a triangulation approach was applied. *Kādī* was one of the healing practices collected for examination of modern and traditional healing practices. Here brief introduction of traditional healing practices and details of selected transcribed *Kādī* recitals are presented.

Naturalistic Observation

- Naturalistic observation could be **unstructured (having no definite rules and with just the field notes) in a lot of senses** in its process of data collection or could be controlled (in terms of observation process through definite plans and schedules and not the subjects or phenomenon) and structured with proper observation plan, schedules, sociometric or psychometric scales, etc.
- **The Advantages Of Naturalistic Observation** is that group member are unconscious of the fact that they are being observed so carry out their behaviour in natural fashion. The observer can see the process in a close distance. He develops greater appreciation for various activities for the group; **a person actually living in a prison and undergoing the hardship can fully realize the feeling and reactions of the prisoner**
- **For example by actually participating in a marriage ceremony of a tribe one can not only learn about the ceremony but relate with the significance of the ceremony too.** People are more willing to share information about the particular events at that right time than in other time. Also people may not share information to those who are just trying to fulfill their academic interest.
- So questionnaire method may not be particularly helpful to elicit information on such particular ceremonies. If data are anyhow accessed, then there are chances that the data could be insufficient or inadequate. So its recommended that we use the observation method by using the observation schedules.

Naturalistic Observation: Advantages

- One of the advantages of this type of research is that it allows the researcher to directly observe the subject in a natural setting.
- It allows researchers to study things that cannot be manipulated in a lab due to ethical concerns. For example, while it would be unethical to study the effects of imprisonment by actually confining subjects, researchers can gather information by using naturalistic observation in real prison settings. Also it can help support the external validity of research. It is one thing to say that the findings of a lab study will generalize to a larger population, but quite another to actually *observe* those findings actually occurring in a natural setting.
- **Brain teaser:** In statistics a **meta analysis** refers to methods that focus on contrasting and **combining results form different studies in hope of finding or identifying similar patterns among study results**, source of disagreement among those results or other interesting relationships that may come to light in the context of multiple studies. It's more like the digging of study results. **(Is content analysis that is used in Rosarch's Test a type of meta analysis?).** **~~Defining or calculating the average value of effect size different studies can be a meta analysis~~. In meta analysis we quantitatively analyze and summarize the result of a lot of studies to at least find the similar pattern in such studies.**

Naturalistic Observation: Disadvantages

- 1) One of the **Disadvantages** of naturalistic observation include the fact that it can be difficult to determine the exact cause of a behavior and the experimenter cannot control for outside variables.
- 2) People may behave differently when they know they are being watched. People may try to behave in a certain way in order to conform with what they think the researchers expects to see.
- 3) Different observers may draw different conclusions from the same witnessed behavior.
- Some other disadvantages of naturalistic observation: **The Disadvantages** of this method is that as the observer is **linked to the group emotionally, he kills the objectivity (but when it is non participating observation, emotional killing objectivity seldom occurs)** of the process and becomes biased and partial. For the research point of view this could be particularly not helpful. May be due to over familiarity he may neglect a lot of different micro events that could held much importance to the research process.
- Here the observer feeling as the member collects data that are only ideal to the particular tribe. His range of experienced and he takes a particular position in collecting data.
- A stranger without participatory observation is better equipped and in position to observe things because he can pay attention to minute details.

Data Collection Methods Used in Naturalistic Observation

- Researchers may utilize a number of different techniques to collect data from naturalistic observation. **This might involve writing down the number of times a certain behavior occurred in a specific period of time, or making an actual video-recording of the subjects of interest.**
- **Tally counts:** The observer writes down when and how many times certain behaviors occurred.
- **Observer narratives:** The observer may take notes during the session and then go back later to try to collect data and discern behavior patterns from these notes. Field notes are extensively used.
- **Audio or video recordings:** Depending upon the type of behavior being observed, the researchers might also decide to make actual audio or video-taped recordings of each observation session.
- **How Often Is Data Collected?** Because it is rarely practical or even possible to observe *every* moment of a subject's life, researchers often use sampling to gather information through naturalistic observation. The goal is to make sure that this sample of data is representative of the subject's overall behavior. Obtaining a representative sample can occur in a few different ways:
- **Time sampling:** Involves taking samples as different intervals of time, which may be random or systematic.
- **Situation sampling:** Involves observing a behavior in a variety of different situations and settings.

Naturalistic Observations: Examples

- Let's imagine that you want to study differences in risk taking behavior between teenage boys and girls. You might choose to observe behavior in a few different settings, such as on a sledding hill, a rock-climbing wall, an ice-skating rink and a bumper car ride. After you operationally define "risk-taking behavior," you would then observe teens in these settings and record every incidence of what you define as a risky behavior. The frequency of behaviour observation here is **<u>Situational Timing</u>**.
- **<u>Some famous examples of naturalistic observations include Charles Darwin's journey aboard the *HMS Beagle*, which served as the basis for his theory of natural selection, and Jane Goodall's work studying the behavior of chimpanzees.</u>**
- Naturalistic observations rarely becomes controlled observations, as we doesn’t control variables or manipulate them. But it can be participatory or non participatory or structured or unstructured.
- **<u>In naturalistic observation we are able to control the structure of observation (regarding what to observe and what to observe not) but we can’t manipulate the phenomenon, nor we can change the environment but change occurs perpetually in a natural environment and in this changed environment behaviour is observed.</u>**
- **We will be dealing with the structured and unstructured (which both can be non participatory observation) standing on the frame of Naturalistic observation.**
- It needs to be understood that neither of any observational method of data collection are absolute in their process and procedure.

Structured and Unstructured as Non Participating Observations

- As has been inferred time and again, **observation is a technique that involves directly observing behaviour with the purpose of describing it. To observe means to examine an object, or an individual, or group of people, or an event with all of the senses. Recording of observations may take many forms, from simple and casual to exact and sophisticated.** For example, an observer may observe an event and then complete a checklist on whether or not key behaviours occurred. Or the observer may write notes on everything that happens in his or her presence. More sophisticated recording may involve audio-visual devices.
- The technique can be classified into participant and non-participant observations. **Participant observation takes place when an observer participates with the people and in the events he or she is observing. Non-participant observation occurs when an observer observes events without interacting with the person(s) being observed**.
- **Non-participant observation may further be classified as structured or unstructured.**
- **The aim of unstructured observation is to observe and record behaviour in a holistic way without the use of a pre-determined guide. Naturalistic observations in many of the cases are unstructured but participatory.**
- **Structured observation, on the other hand, refers to a technique in which an observer observes events using a guide that has been planned in advance.** (controlled observations can be in a lot of ways structured observations but all structured observations are necessarily not controlled observation. Absolutely controlled observation goes to the line of quantitative methods and they are more used in lab conditions).

Structured Observations

- It need to be understood that the naturalistic observation can be both the structured and unstructured observation. If we use coding system, schedules and checklist to observe and tabulate then it becomes a structured observation otherwise if a predefined measurement is not used then it becomes unstructured. (??).
- What are the criteria for structured and unstructured observation? Is it just the coding/ measuring system or are there other than that to be a observation structured or unstructured? **One of the first considerations when using observations is the issue of how the observations will be interpreted. As such structured observations are descriptive, inferential and evaluative observational techniques.** It can be said structuring the observations more clear way is to denote the structuring of observation and not that of environment or variable.
- Does structuring means what to observe what next or does it mean controlling the observation (as in case of experimental design ~~as ex-post facto research design~~?? Usually controlling observation means controlling the variables or situations which rarely occurs in structured observations.)
- **Structured observations are very much controlled with regards to the control over the observation (what to observe and what not to observe?) than variables as because structured observations are focused, look selectively at the social phenomena, and can be used to test hypothesis.**

Structured Observations

- When conducting a structured observation, the focus of the observations has been determined beforehand. This type of observation follows the principles and assumptions of quantitative research: the focus of the observation is fragmented into predetermined, smaller, more manageable pieces of information (behaviours, events etc.) that can be aggregated into variables. It can be fragmented into following part (so as to give the resemblance of controlled observation or quantitative research) –
- i) use of detailed observation plan
- ii) use of schedules and checklist
- iii) use of sociometric scales (and field notes?)
- iv) use of hypothesis
- v) use of team observation
- vi) use of control groups
- Events in structured observation are recorded according to an observation guide. The observer is not involved in the activities being observed, but records them as inconspicuously as possible. However, it must be pointed out that the presence of even a "neutral" and non-interacting observer may influence the behaviors of the person(s) or events being observed.
- **Use of hypothesis and control groups may be exclusive for the experimentally observed observation.**

Structured Observations

- Of course, there are different levels of "structure" that structured observations take. **For example, in a highly structured observation the researcher has decided in a rather precise and mutually exclusive way the observation categories in advance.**
- **In a semi- structured observation, the researcher starts with an agenda of what will be observed and how, but collecting the data with observations is done in a less systematic or predetermined way.**
- **Collection of data by observations can be conducted on facts (e.g., the number of students in a classroom), events (e.g., the amount of collaborative work taking place between students in the classroom) or behaviours (e.g., the number of incidents of antisocial behaviour in a classroom). Observations can look at verbal or non-verbal behaviour.** A distinction can be drawn between **observations conducted in natural versus artificial settings.**
- Much observation is conducted in real world contexts or, in other words, natural settings. **However, observation is a legitimate method of data collection within the experimental research tradition.**

Structured Observations

- In experimental research, the relevant conditions (independent variables) are manipulated or contrived (fixed) in systematic ways and the effect of these conditions on specified behaviours (dependent variables) is measured. In some sense at least, since a change is being introduced into the contextual conditions, the setting for this kind of intervention research can be described as artificial. The extent to which artificiality is introduced into the setting represents a challenge to the authenticity or validity of the research. Observation like all research methods can be seen as always involving some kind of balance or compromise between the interests of validity, reliability and feasibility.
- Although structured observation may seem simple, obtaining useful data requires reliable observers, an informative observational guide, and the cooperation of those being observed. Structured Observation is potentially one of the most useful field methods in drug use studies.
- **The primary disadvantages of this process is the issue of bias in the observation process in both the observer and the person being observed.** The observer's bias includes his or her subjective judgment regarding events being observed. **For example, if the observer has a positive attitude towards the person being observed, he or she may record positive observations and ignore negative behaviours. To overcome this bias, an observer must be trained to be neutral and non-judgmental towards persons being observed. (but I suppose use of schedules and primarily checklist restricts the observer biasness as there is clear line of control.)**

Structured Observations: Key Steps

- From the perspective of the person being observed, bias occurs when the person being observed alters his or her usual performance of an activity in order to impress the observer. ~~In a diarrhoea study in one country for example, when prescribers were informed that the observation concerned diarrhea, they examined infants who had diarrhea longer than they did other patients. The examination took about 5-7 minutes for diarrhea cases, whereas the examination for other patients took only 1-2 minutes.~~
- **Structured observation can take the aid of focus group discussion to understand a pattern of behaviour.**
- In general, the goal for using the observational method one or more of the following: 1) To generate **research hypotheses** through pilot studies (until when very little is known about the problem.) 2) To collect **information not available in any other way,** such as communication patterns during a provider-patient encounter. 3) To **supplement other data** as part of a multiple assessment approach where observation may aid in the interpretation of data.
- **Key Steps in Conducting Structured Observations**
- **Step 1. Decide if a resource person is needed.**
- Step 2. **<u>Determine what is to be observed</u>**. (observational plan including selecting criteria) : this also includes time sampling and situational sampling
- **Step 3. Choose the observers.**

Structured Observations: Key Steps

- **<u>Step 4. Develop observation guides.</u>** (use of schedules or checklist or sociometric scales): The basis for structured observations is the observation guide. A preliminary list of issues to be observed, and the categories in which to record them, must be prepared in advance based on the objectives of the study. Since it is difficult to predict observable behavior in advance, a draft protocol can initially be partially structured maybe through the pilot unstructured observation. More attention should be paid to specific aspects that appear central to the problem as the study proceeds, and a final observation guide prepared.
- The guide should be prepared to suit local situations; the input of the field team is particularly useful. You may also find it useful to begin with the instruments and protocols presented in the annex, and adapt them to the local environment and problem of interest. Its better that we use the unstructured pilot observations to develop guide.

Structured Observations: Key Steps

- **<u>Step 5. Select the setting for the observations</u>** (and even the hypothesis if it is lab conditioned process).
- I think this should be the first step as unless we determine the arena and population of the research, we are not able to take further steps.
- **<u>Step 6. Train observers and pre test observations</u>**. Structured observation may not appear as complicated as other applied qualitative methods such as FGD and in-depth interview. However, observable behavior may be so complex and rapid that observers may fail to detect interesting and important aspects if they are not properly trained. Observers need to be well trained to enable them take note of interesting unforeseen events which may not be indicated in their guides.
- **<u>Step 7. Conduct the observations and with team also as a team observations.</u> Remain reasonably detached yet attentive.** Observers must record observations as systematically and accurately as possible. The use of observational guides or forms should enable them to record events easily. It is also important to write notes about events that are not included in the guides or forms. These qualitative data will add flavor to the interpretation of the more structured items and could provide unexpected, but relevant information. **For example, the fact that female patients are not touched by male health workers may not have been captured by the observation protocol, but could be a key finding for developing an intervention.**

Structured Observations: Key Steps

- **Step 8. Analyze and interpret the observational findings.** Categorization and summarization of data is done during the analysis. The analysis of structured observational data, by the use of computer or manually, begins the moment the data collection begins.
- The exercise involves a number of activities which include; **Routine Debriefing Sessions** involving observers and investigators. This aspect of data management can improve the quality of the final results.; **Comparing notes** of observers from daily field trips. This makes it possible to compare the performance of different observers, and to spot and remove irrelevant parts of their field notes. It also provides an opportunity to add new themes or topics which are found useful while the data collection lasts.

Unstructured Observations

- The observation is unstructured in sense that we don't use true methodology to record data and data recording can simply be done through the use of field notes or simply narrative in descriptive forms. Four types of unstructured observation will be considered: **ethnography and participant observation, naturalistic observation; narrative methods; and critical incidents. What these approaches share is that they are relatively informal and do not rely on pre-specified coding systems.**
- ~~It need to be understood that the naturalistic observation can be both the **structured** (?? May be in terms of using of tools) and unstructured observation and usually non controlled and even participatory or non participatory.~~ If we use coding system, schedules and checklist to observe and tabulate then it becomes a structured observation otherwise if a predefined measurement is not used then it becomes unstructured (except field notes or checklist??).
- If we use techniques and tools as – **i) use of detailed observation plan ii) use of schedules iii) use of sociometric scales iv) use of hypothesis v) use of team observation vi) use of control groups -** then it becomes **Experimentally Controlled Observation And Very Structured** otherwise if there is just the use of some schedules and field notes without any hypothesis it becomes unstructured in sense.
- 10 people do research using the same observation techniques but with a sort of blended form and with their own style. So any type of observation or qualitative research is not absolutely structured.

Unstructured Observations: Types

- **<u>1) Ethnography And Participant Observation</u>:** The terms 'participant observation' and 'ethnography' are often used interchangeably. **Both imply that the researcher immerses him- or herself in a social setting for a lengthy period of time and gather information through observation and asking questions. Sometimes, 'ethnography' is seen as the more comprehensive methodological approach: besides participant observation it typically includes other forms of data collection, such as interviews and documents.**
- Also note that the term **<u>'ethnography'</u>** refers to both the methodological approach and the finished product. Advocates of participant observation and ethnography argue that the researcher can best gain knowledge by being involved in a social setting or group and experiencing a situation first hand (Mason, 2002).
- **<u>2) Naturalistic Observation</u>** is observation carried out in real-world settings: it is an attempt to observe things 'as they are', without any intervention or manipulation of the situation itself by the researcher.
- **<u>We need to accept the fact that naturalistic observation can be participatory or non participatory or structured or unstructured. (RB)</u>**
- This has been described as a 'pure' or 'direct' observation (Punch, 2009, p.154), which can be contrasted with observation carried out as part of experimental research in which the researcher actively intervenes and contrives (planned or schemed) the conditions of the context being investigated.

Unstructured Naturalistic Observations

- Miles and Huberman (1994) give a very full account of the features of 'naturalistic research'. It involves 'intense' study of a real-life situation; the researcher attempts to create a 'systemic, encompassing, integrated' overview of the context; and the researcher tries to acquire an 'empathetic understanding' of the situation as perceived by 'local actors' as if 'from the inside'
- Naturalistic observation is a broad category of methods which can take a range of forms of recording, which in one way or another involve the use of words to construct some kind of record of events observed. **For example, an observer may attempt to keep a simple 'running record' of as much detail of what is happening in a particular situation over the duration of the observation, or a researcher may try to maintain a diary of events or behaviours observed over a more prolonged period of observation.**
- In diary methods the researcher relies to some extent on their memory of events and clearly this means that diaries, to some degree at least, provide a selective account of what has been observed. Diary method is peculiarly a way of unstructured naturalistic observation.

Unstructured Observations: Types

- **3) Narrative methods:** Narrative methods represent a category of approaches by which naturalistic observation can be pursued, which in essence are an attempt to **'tell the story' of what is happening in a given situation.**
- However, it is important to note that the idea of a narrative account can be applied to different stages in the research process, not simply the data gathering stage. **For example, Robson (2002) points out that a narrative account can be constructed as means by which to collate and represent a synthesis of quantitative data derived from more structured observation schedules. In such situations a narrative is constructed by the researcher which conveys the interpreted meaning of the data available in the form of a story which communicates that meaning effectively to users of the research. Narrative methods is simply seen as unstructured unless blended or diffused with other approaches.**
- **4) Critical incidents: Critical Incidents offer an approach to observation which provides a means by which to select what is significant in a given situation and to provide a degree of focus for observation.** Critical incidents can thus be seen as a variant of, or supplement to, the diary method. In identifying critical incidents the observer selects key events seen in some way as particularly salient or significant in the situation to be recorded and subsequently analyzed. **A critical incidents approach is potentially useful in professional contexts. For example Tripp (1993) advocates a critical incidents approach as a means of developing teachers' professional judgment through focused enquiry. Situational sampling is very much important in situational sampling.**

Procedural Outlay for Observations

- Observational research is used for studying nonverbal behaviors (gestures, activities, social groupings, etc.). Sommer & Sommer (1986) developed the list shown below to assist in observation research.
- 1) Specify the question(s) of interest (reason for doing the study). 2) Are the observational categories clearly described? What is being observed and why?
- 3) Design the measurement instruments (schedules, checklists, categories, coding systems, etc.). 4) Is the study designed so that it will be 'Valid (i.e., does it measure what it is supposed to measure, and does it have some generalizability)?
- 5) Train observers in the use of the instruments and how to conduct observational research.
- 6) Do a pilot test to (a) test the actual observation procedure and (b) check the reliability of the categories of observation using at least two independent observers. 7) Revise the procedure and instruments in light of the pilot test results. If substantial changes are made to the instrument, run another pilot test to make sure changes will work under the field conditions.
- 8) Collect, compile, and analyze the data and interpret results.
- Casual observation is normally done like unstructured interviews. During the early stages of a research project, casual observation allows the researcher(s) to observe subjects prior to designing questionnaires and/or interview formats.

The Pros and Cons of Observational Methods

- Pros: i) Excellent approach to discover behaviors
- ii) **Provides indicators of the impact of programs that might be more reliable than data gained by asking people.** Good technique when there are observable products and outcomes.
- iii) As a supplementary method, structured observation can also be made during focus group discussions (FGDs), in-depth interviews, or interviews using a structured questionnaire. **It can also be used to supplement quantitative methods of data collection, such as prescribing surveys.**
- Cons: i) Requires staff and time to observe and record observations.
- **ii) Cannot ask questions of participants during observation.**
- **iii) Might want to use follow-up interviews to verify observations.**

Focus Group Discussion Method of Data Collection

- During recent years, the importance of qualitative approaches in understanding social realities has been increasingly recognized by social scientists as well as by programme managers. **Many researchers have started questioning the adequacy of an exclusively quantitative approach in explaining changes in the social and demographic situation**.
- Among the various qualitative methods, "**Focus Group Discussion**" has become very popular and is being extensively used in social and behavioural research. While focus group is an established method in market research, its use in social science, demography or other related disciplines is rather new.
- In particularly in focus group discussion we can afford to interact with a large chunk of respondent however if it is focus groups as a data collection method we just do a group interview of approximately six to twelve people who share similar characteristics or common interests. So focus group discussion can be a sort of group interview.

Focus Group Discussion Method of Data Collection

- A **facilitator** guides the group based on a predetermined set of topics. The facilitator creates an environment that encourages participants to share their perceptions and points of view. **Focus groups are a qualitative data collection method, meaning that the data is descriptive and cannot be measured numerically**. (Is it?)
- **BBC Sajha Sawal** can be a peculiar example of FGD based qualitative data collection methods. But the number of respondent here is more than 12 and here the questioning pattern is always two way.
- A focus group discussion was conducted for the students at TIC and BVIC regarding the structure of organization, leadership and communication flow in the Public Service Commission.

Focus Group Discussion Method of Data Collection

- It is basically a qualitative method in which the moderator, with the help of predetermined guidelines, stimulates free discussion among the participants on the subject of inquiry. **The order in which the topics are covered is flexible, but generally the discussion starts with more general issues and slowly flows into more specific ones.** At the end, a few probing questions are sometimes asked to reveal more in-depth information or to clarify earlier statements or responses.
- **Generally the participants are chosen purposively and it is recommended that they should be homogeneous with respect to characteristics which might otherwise impede the free flow of discussion. It is also considered desirable that the participants should not know each other or the subject of the discussion in advance**.
- The focus-group session should be held in a natural setting and be conducted in a relaxed manner. The full discussion is tape-recorded. **Apart from the participants and moderator, a note taker also sits in the session but does not participate in the discussion. The note taker knows about the objectives and subject of inquiry, and is expected to be well trained in observing and noting nonverbal group feedback, such as facial expressions. Later the note taker also transcribes the complete discussion based on notes and tapes. These transcripts then serve as basic data for analysis.**

Focus Group Discussion (FGD) Method of Data Collection: Rationale

- Qualitative research methods always demands smaller sample size as it is the exploration of phenomenon. We need to go in depth about the research purpose so smaller the sample size the better the result of exploration. (is it?)
- **Rationale behind FGD:** Excellent approach to gather in-depth attitudes, beliefs, and anecdotal data from a large group of patrons at one time. **The idea behind FGD is that group dynamics or interactions might generate more ideas than individual interviews. It can give validity and authorization to already used method of data collection because we directly interact with the informant of the research. Hence it helps to generate supplementary and complementary information. On the other hand it also helps to generate new ideas**
- **It can be effectively used to focus on details regarding issues found through surveys or other data collection methods regarding the reliability of information.** Drawing of conclusion regarding the reliability of information collected in various observations, survey or depth interview can be done through the FGD method.
- **Participants are not required to read or write. Technique relies on oral communication. So we can also involve illiterate people to gather information (if their senses are intact).** But there are equally some **Limitations** regarding the use of this method as the method of data collection.

Focus Group Discussion (FGD) Method of Data Collection: Rationale

- **Requires staff and time to set up and facilitate focus group and also to identify and schedule participants for focus group**. There is always the need of up to **dated and strong facilitator to guide discussion and ensure participation by all members and elicit rich information. There is also the requirement of special equipment to record and transcribe focus group discussion.**

Focus Group Discussion Method of Data Collection: Use

- **Use:** FGD are **mainly used** when **researcher want more in-depth information on perceptions, insights, attitudes, experiences, or beliefs. Focus groups are useful for gathering subjective perspectives from key stakeholders.**
- For example, the ministry of social affairs if funds a program for the mid day meal among all school level students and wants to evaluate affectivity of the process than sample students would be called from all the country who would participated in the program. **Most probably the interaction would be highlighted on the effect of mid-day-meal. Data would be collected on the students' perceptions about how well they were feed mid day meal and how is their school performance.**
- To gather additional information as an adjunct to quantitative data collection methods. Focus groups, like other qualitative methods, are useful in providing interpretations or evaluations of data collected through quantitative methods (quantitative data is numeric and measureable).

Focus Group Discussion Method of Data Collection: Use

- **For example, a program may use a log to track the number and type of teachers trained in an HIV-prevention curriculum and use a post-training questionnaire to measure knowledge gained immediately after the event.** A focus group conducted several months later could provide additional information about how the teachers are using the new knowledge in their work, what they believe are the benefits of the training, and what insights they have about how the training could be improved.
- **As part of a mixed method evaluation approach. Mixed methods approaches are used to <u>increase validity of evaluation findings</u> by using a variety of data collection techniques. Because focus groups are one of the few methods in which data is gathered from a group, it is useful as part of a mixed method approach.**

Focus Group Discussion: Planning and Development of Process

- Two key components of planning your focus groups include developing the focus group guide and deciding the number and type of participants.
- **Develop the focus group guide.** The focus group guide is a series a questions and prompts for the facilitator to use. Typically, the facilitator will ask questions of the group and allow time for participants to respond to each other's comments. **The focus group guide serves as a "road map" and memory aid for the facilitator. When developing the focus group guide, identify from who you want to obtain information, what type of information you want to obtain, and what use you have for the information.** The same focus group guide will be used for each focus group.
- **Select the number and type of participants for each focus group.** Once decided from whom we want to obtain information, we can decide what types of participants is desired for each focus group. **Each individual focus group should be made up of similar individuals, so the number of focus groups will depend on how many different types of groups from which you want to gather information. Stratified Random Sampling can be very good.**
- **Homogeneity in sampling is a major aspect of FGD.**
- **Even during the Stratified Random Sampling we can facilitate the sampling process through FGD.**
- **Brain Teaser:** How do you develop **Focus Group Discussion Guide**?

Focus Group Discussion: People Involved

- The people involved in the FGD method of data collection:
- **The facilitator** guides the group through the discussion and keeps the group focused on the topics for discussion. He can't control the discussion so let the discussion go spontaneously.
- **The note taker is an observer and does not interact with the group.** The notes should include a sense of what each person said; identify how comments were said; and record when transitions occurred from one topic to the next. He can also note down body languages and other non verbal behaviours. He can describe the situation and create insight about those situations as on his own. He is a sort of non participatory natural observer.
- **The technician is responsible for recording the focus group.** The recording will be used to create a transcript of the event. The recording can be video or audio or narrative unstructured written documents or even the field notes and particularly in organizational process memo.
- Focus groups can be conducted in person or via teleconference. While it is ideal to conduct a focus group in person, it is possible to conduct a focus group by phone or teleconference or web technology as Skype or even facebook.
- **Focus groups typically last about 60 to 90 minutes.**
- The focus group needs to be appropriate for the type of participants in the group. The questions and the manner in which the focus group is facilitated will vary based on the type of participants.
- **Planning for a focus group for third graders will be different than planning one for their parents or teachers and may require a facilitator skilled at working with children.**

Focus Group Discussion: People Involved

- It is expected that the **informal homogeneous group setting, and the open-ended nature of questions,** will encourage the participants to feel free from various constraints to which they are subject during individual interviews. Thus it is believed that they express their views openly and spontaneously. The moderator helps the participants to interact and this interaction stimulates memories and feelings and thus leads to a full in-depth discussion of the topic at hand. These group dynamics distinguish focus group sessions from individual in-depth interviews typical of ethnographic research.'
- How **can focus groups be used?** Available literature shows that the focus-group approach, like some other qualitative methods, could effectively be used as follows.
- l ***As an idea-generation tool:*** Focus-group discussions could, for example, be used by a health programme to find out what motivates people to use a specific health product or health service facility, or to adopt better health-related practices.
- ***In conjunction with a quantitative study*** Focus-group discussions are often used as a complement to a quantitative study, helping to answer such questions as "why?" or "how?", rather than "how many?". They can also be used as a preliminary step, providing background information, and to generate hypotheses for field-testing. They can also be used to refine a questionnaire, and to ensure that the words and concepts correspond to those commonly used by the target group. It can also be used as follow ups in quantitative study.

Focus Group Discussion: Analyzing the FGD for qualitative data

- **<u>Analysis of focus-group discussions:</u>** Focus-group discussions provide a great deal of data, including interview notes and often transcripts of the session. This information needs to be analyzed and organized in an understandable fashion.
- Content coding is often mentioned as the method of choice. This consists of listening or watching the tapes and reading the transcripts (if available) to generate a list of key ideas for each topic under discussion. Quotations and ideas are then placed under the appropriate categories, which can be divided into subcategories or combined into larger themes.
- If transcripts are used for analysis, and content analysis is done properly (i.e. care is taken to note which views are expressed how many times and by how many participants), the answers or the conclusions drawn are fairly stable. Videotapes or observations of note takers add further stability to the interpretations.

Focus Group Discussion: Acquaintances?

Should focus-group members know one another beforehand? It is usually recommended that focus groups consist of individuals who are not acquainted with one another. It is believed that this increases the likelihood that group members express themselves frankly. However, this is not a practical option in many rural villages or urban slums where it is generally very difficult to find people who are not acquainted with one another. Based on experience in carrying out focus-group discussions in India, we feel that for topics which are not sensitive, the type of informant does not make much difference, and the usual rule of anonymity can be relaxed. However, in the case of sensitive issues, participants who do not know one another provide better information than acquainted ones.

How **can focus groups be used?**

- ***As a primary data-collection method in studying the sexual behaviour or abortions.*** In fact, the former study in Indonesia found that participants were much more willing to discuss abortion in the focus-group discussion than they were in survey interviews. **However, care must be taken to treat the results of focus-group interviews with some caution, since they can only suggest plausible answers, and cannot be indicative of the distribution of attitudes or beliefs in the population.**
- It can be used as pilot study just like any kinds of observational methods.

The Role of the Moderator

The role of the moderator. The moderator is crucial in focus-group research. It is the job of the moderator to keep the group focused on the topic at hand, to encourage group members to speak freely, to ensure that no group member dominates the conversation and that all opinions are heard, to create a supportive atmosphere, to probe when necessary, and to listen well. However, not much is known about the effect of the moderator's style on the results of interviews. For example, does an active moderator get more and better information than a quiet, laid-back moderator?; does a challenging argumentative moderator evoke more or better responses than a polite friendly moderator? More experimentation is required with moderator style, in order to be able to make informed choices on this important issue.

Focus Group Discussion: Advantages and Disadvantages

- **What are the advantages focus groups?**
- Quick and relatively easy to set up. **The group dynamic can provide useful information that individual data collection does not provide.**
- **It is useful in gaining insight into a topic that may be more difficult to gather through other data collection methods.**
- **What are the disadvantages of focus groups?**
- Susceptible to facilitator bias. In a company if facilitation has been done through FGD the facilitator may be in the side of the establishments and so no proper questioning relating to the problem of the workers be done. The discussion can be dominated or sidetracked by a few individuals.
- Data analysis is time consuming and needs to be well planned in advance and the data may not provide valid information at the individual level. **FGD is not a stand alone process and it cant be done for rapid assessment of the data.**
- **The information is not representative of other groups if the sampling or particularly stratification of the stakeholders not done properly.**
- **There is objection regarding the data collection through recording instruments. May be people don’t want to be taped.**

Problems In Conducting Focus-group Interviews With Women

- **Focus-group discussions usually last for one or two hours.** Group members are expected to concentrate on the topics being discussed. Experience suggests that this is difficult for women in the South Asian context (and perhaps in other societies where free movement of women is socially restricted) to be represented in discussion regarding abortion, sexual health, violence against women, etc.
- Often, the women selected for the session feel it necessary to bring someone with them, especially the younger women who are frequently accompanied by their mother-in-law or younger sister-in-law. **It is always a reason that women don't want to revel their private matter in front of their in laws.**
- In addition, mothers are often required to leave the room to attend to some urgent work (e.g. to take care of crying children) and subsequently come back. This interrupts the discussion, and makes it harder for respondents to follow. **Availability of space where a focus group could be privately conducted is a serious problem in some rural areas and urban slums (unless the respondents are ready to come to a community centre such as a school or Panchayat hall).** If the sessions are conducted in a private home, getting enough space and privacy might be problematic.

Survey: Overview

- The word survey has been derived from word **Sur** or **Sor** and **Veeir** or **Veoir** which me **Over** and **Seeing (look)** respectively. Therefore the literal meaning of a survey is **To Take A Look Over Something Or Overlook Something From A High Place.** However in scientific investigations, the word survey is used as a technique of investigation by direct observation of a phenomenon or collection of information through interviews.
- **Brain Teaser:** So can observational method of data collection be called as Survey?
- At present, the meaning of survey has been used in broader sense to include the observations of published documents also. The survey is used for two quite different purpose.
- The first is to **describe current practices and events**. As such it may be termed as **Polls**. A polling survey is concerned mainly with the distribution of responses or answers to any particular item. It may be used to know the trend and practices and identify changes in an organization. It can be used to make data banks.

Survey: Overview

- The second use of the **survey is to analyze the facts**. Analytical survey go beyond the simple description of the current state of practice. A polling survey of one organization may show us that all its managers exercise authoritarian style of management but it enables us to say little else that might of importance. For instance, do all managers exercise such a style and to what extent does that style influences the performances? Analytical survey may help us to answer such questions. Analytical surveys are more in-depth and helps to correlate.
- While analytical surveys may enable us to establish relationship between the variables involved, **they don't demonstrate how they are related means they don't establish cause and effect relationship. This is one of the weaknesses of survey method.**
- The basic objective of survey is to fulfill immediate needs and use the knowledge available at a given time. It is practical in nature.
- **Survey may form basis of some hypothesis but while designing survey we need not to formulate hypothesis. Surveys doesn't intent to formulate theories or new techniques because it is gross overview.**

Survey: Questionnaire and Interview Based

- **<u>Overview: </u>It is the best method for gathering brief written responses on attitudes, beliefs** regarding library programs. It can include both close-ended and open-ended questions that can be administered online or in face to face interview. Can be administered in written form or online. Personal contact with the participants is not required when administered through mails or online. Personal contact is more required in more person to person face interview.
- Staff and facilities requirements are minimal, since one employee can easily manage the distribution and collection of surveys, and issues such **as privacy, quiet areas, etc. are typically not concerns.**
- **A survey involves interviews with a large number of respondents using a predesigned questionnaire. The survey team formulate special questionnaire, based on which interview is done.**
- A lot of times survey have been referred as Quantitative Method. However different research purpose can make it either quantitative of qualitative research.
- **<u>A) Four basic survey methods based on how we take survey among respondents</u>**:
  - **Person-administered surveys: It is more about face to face interview.**
  - **Computer-assisted surveys: It is more of mailed or online questionnaire based.**
  - **Self-administered surveys: It is more like biographical data/ tests.**
  - **Mixed-mode (hybrid) surveys**

Types of Survey Methods

- **1) Person-administered:** In this method an interviewer reads questions, either face-to-face or over the telephone, to the respondent and records his or her answers. It's more like interview. It was the **Primary method for data collection for many years until development of communications systems and advancement in computer technology. Manufacturing industries carry out pilot survey before launching their products in the market using this methodology as it also enable them interact with possible buyers and sellers of their products.**
- But this method of data collection can be inappropriate with sensitive topics such as hygiene, finances, political opinions, reproductive and sexual health, etc.
- The prime advantages of this method is: Feedback (right at the place), Rapport, Quality control, Adaptability. **There are equal disadvantages which are as the probability of humans making errors, the speed of administration and accessing of data is in low speed.** The cost in administration of survey is high in comparison to the computer administered survey. Time, paper, field workers increases cost.

Types of Survey Methods

- **2) Computer-administered:** Here in this method computer technology plays an essential role in the interview work. The questions are simply emailed or kept in online forum. As a self selected sampling people would be themselves willing to fill the questionnaire or if notification to a probable respondent is frequented about the survey and questions then he/ she fills the questionnaire. There is significant drop out rate in case of computer administered survey.
- Advantages:
  - Speed
  - Error-free interviews
  - Use of pictures, videos, and graphics
  - Real-time capture of data
  - Reduction of "interview evaluation" concern in respondents
- Disadvantages:
  - Technical skills required
  - High set-up costs

Types of Survey Methods

- **<u>3) Self-administered</u>**: The respondent completes the survey on his or her own. **Some peculiar examples of this method is Traditional “paper & pencil” survey. Filling the forms and biographical data that is used in personnel selection procedure are a lot of times self administered survey to a large extent.**
- **<u>Advantages</u>**:
  - Reduced cost
  - Respondents control pace at which they answer
  - No interview-evaluation apprehension
  - **In case of psychological research it can lead to cognitive assessments because people think, evaluate and give judgments or answers.**
- **<u>Disadvantages</u>**:
  - Respondent controls the survey; do not send in on time. There is high drop out rate if the questionnaire is mailed.
  - Lack of monitoring: no one to explain or encourage respondents
  - High questionnaire requirements and the questionnaire should be self comprehensible and must be perfect!

Types of Survey Methods

- **Mixed Mode**: A combination of two or more methods. Basically the combination can be of computer assisted and person administered or computer and self administered. This method has increasingly become popular to use mixed-mode surveys in recent years.
- **Advantages:**
  - Multiple advantages to achieve data collection goal.
  - Example: May use online surveys to quickly reach portion of population with Internet access and may use telephone calling to reach those without Internet access. The speed is quite high if online medium is used.
- **Disadvantages:**
  - Mode affects response and a lot of times people are unwilling to fill the survey even if it is in social networking sites or in the inbox of personal email.
  - Additional complexity.
  - *** I think computer assisted and person administered mixed up mode would be very expensive.**

Types of Survey Methods

- Also the following are the types of survey base on-
- **B) Survey methods based on coverage of population are:**
- Social Survey
- Market Research Survey
- Opinion Survey
- Census
- **Social Indicators:** Per Capita GDP, Standard of Living, Physical Quality of Life Index, etc.
- **C) Survey methods based on subject matter, techniques of data collection and regularity of their conductions are:**
- General And Specific Survey
- Census And Sample Surveys
- Regular And Ad Hoc Survey
- Preliminary And Final Surveys
- Multipurpose Survey
- Base Line And Evaluations Survey
- Vertical And Integrate Surveys

Social Surveys: Overview

- Social Survey, as according to **Well (1935)** defined as a fact finding study dealing chiefly with working class's poverty, its nature and problem. But the scope of social survey is much wider than that covered by this definition. **Narrowing the definition of survey to a particular case is to defeat the very purpose of the survey, because the methods associated with it are applied to extraordinary wide variety of investigation, ranging form classical poverty surveys to Gallup Polls, Market research, etc. Survey of this kind of surveys are funded by government, organizations and universities.**
- Social survey supply information regarding public life and also throw fresh light on some aspect of sociological theory.
- The subject of survey may be written opinions and attitude regarding social change and factors and opinions regarding leadership, motives and expectations of people and employee, etc.
- **Opinions Polls, Labour Force Survey, Klub Psychology Psychosocial Survey, etc are the example of social survey.**

Social Surveys: Objectives

- The surveys are motivated by the following objectives:
- **Supply information on any problems** such as how people spend of entertainment
- **Description of phenomenon** such as relationship between mental problems and underlying stress (as in Klub's Psychosocial Survey). This description can be in detail at least in case of surface information. Survey doesn't intend to disprove or reject any principles or theories.
- **Explanation of phenomenon: W**hen relationships are established we can explain the phenomenon through statistical measures. So its better that we formulate hypothesis along the design of survey or while conduction survey.
- A survey may be general or specific. It may be purely of utilitarian in nature or may have academic importance aimed at verification of some established theory or any of its corollaries.
- There is a **Case Study Survey** in case of community psychosocial research which basically is meant to survey a group as a case. Example when all the children in Autism Care Nepal are surveyed it's a example of case study survey. (is it? Yes)
- **Psychosocial** is a word derived from two words namely **Psycho** which means psychology or scientific study of mental process and human behaviour; and the word **Social** meaning society. This term was coined by **Erick Erickson**.

Steps in conducting Surveys

- **Step 1:** Formulation of the problems: it is the identification of research topic or problem intended for surveys. The problem topic should be very relevant to the deep interest of the researcher. It should have utility and practically feasible in terms of cost, time, effort and be able to be gripped by the researcher area of academic and research expertise.
- Problems are formulated in terms of **broad/ general** or specific objectives. E.g..
- **Objectives of the study**
- **General objectives:**
- To know the about learning disabilities and mental retardation.
- To know about degenerative diseases associated with Down's syndrome.
- To explore the emotional and behavioural problems of the children with Downs's syndrome.
- **Specific objective:**
- To know about medical conditions associated with Down's syndrome

Steps in conducting Surveys

- **Step 2:** Preparation of time schedules: Detailing and designing different phases of survey is very important and this should be done according to the elaborative time schedule. The time schedule can be in form of chart or table.
- **Step 3:** Staffing- A competent statistician with the skill of operating software for statistical analysis is very necessary in the team.
- **Step 4:** Cost of Survey- the cost may be administrative and salary cost, consultant fee, field cost, travelling expenses, secretariat and report preparation cost, miscellaneous. A 10 to 15 percent of risk or price hike cost can be added in the estimated cost.
- **Step 5:** Preparation of questionnaire that directly addresses the objectivity of the research.

Advantages And Disadvantages Of Survey

- **The Advantages Of Survey Methods** of data collection is that it is a standard method and there is ease in administration. Survey have the Ability to tap the "unseen" and latent (hidden) phenomenon (if the respondent wishes to revel those phenomenon, otherwise unseen phenomenon are only reveled at the experimental method of data collection). It is accessible to tabulation and statistical analysis and so it is more of quantitative approach. Sensitivity to subgroup differences (how?)
- **The peculiar Disadvantages Or Weakness Of Survey method of data collections are:** Responses are limited to the questions included in the survey and even participants need to be able to read and write to respond. Takes time to pre-test a written survey (validity and reliability of questions) to make sure that your questions are clearly stated.
- **Answer responded always relies on participants' perceptions. We need to be very aware of potential gaps between participants' responses and reality.**
- Surveys work better after we have determined the range of outcomes that the survey can target. Therefore, surveys may not be the best initial data collection tool. (Then what is the purpose or rationale of the pilot survey; is it the conglomeration of method along with observation and focus group discussion). Both the survey and focus group discussion in lot of sense is a cross sectional study between data collected and data expected.
- **Questions on surveys can be misunderstood, especially if they are self-administered and/or if participants do not understand the context for the survey questions.**
- Survey questions (especially closed-ended questions) can be limited to what the provider thinks may be the range of responses. **There is inconsistency in response which may raise issues of non reliability and non validity.**

Advantages and Disadvantages of Survey

- Most of the time **Survey Questionnaire** are **Cross Sectional Study** as we apply it once to **Mine Data** from the probable subjects of a **Sample Unit** or group and as such there is cross inference between data of each unit. But in **Longitudinal Study** we carry **Test Or Retest Or Survey** time and again to establish a trend and get a genuine and authentic data which may be helpful **to predict the reliability or validity of the research process**.
- Some research show that the **Drop Out Rate (not filling or responding to the survey or interview)** in survey is 3% if the questionnaire consists of 10 question and if it is 20 questions then the drop out rate is 6%. But if questions exceed 20, then the trend is normally flat and the drop out rate estimates around 6%. So the brevity or shortness of the questionnaire is a must. **The questionnaire should be engaging and not indulging, terminologies should be clearly introduced to the subjects in simplest understandable way.**
- The interviewer or the surveyor should introduce himself, his organization and his purpose before he starts to deal with the questionnaire. A sense that the particular survey is beneficial to everyone at large and they are not there for sales purpose be maintained by the surveyor (in alignment with the rapport building process before the process of questioning takes place).

Advantages And Disadvantages Of Alternative Method Of Data Collection Through Survey

TABLE 9.3 Major Advantages and Disadvantages of Alternative Data-Collection Methods

Method	Major Advantages	Major Disadvantages	Comment
In-home interview	Conducted in privacy of the home, which facilitates interviewer–respondent rapport	Cost per interview can be high; interviewers must travel to respondent's home	Often much information per interview is gathered
Mall-intercept interview	Fast and convenient	Only mall patrons are interviewed; respondents may feel uncomfortable answering questions in the mall	Mall-intercept company often has exclusive interview rights for that mall
In-office interview	Useful for interviewing busy executives	Relatively high cost per interview; gaining access is sometimes difficult	Useful when respondents must examine prototypes or samples of products
Central location telephone interview	Fast turnaround; good quality control; reasonable cost	Restricted to telephone communication	Long-distance calling is not a problem
CATI	Computer eliminates human interviewer error; simultaneous data input to computer file; good quality control	Setup costs can be high	Losing ground to online surveys and panels
Fully computerized interview	Respondent responds at his or her own pace; computer data file results	Respondent must have access to a computer and be computer literate	Many variations and an emerging method with exciting prospects
Online questionnaire	Ease of creating and posting; fast turnaround; computer data file results	Respondent must have access to the Internet	Fastest-growing method; very flexible; online analysis available
Group self-administered survey	Cost of interviewer eliminated; economical for assembled groups of respondents	Must find groups and secure permission to conduct the survey	Prone to errors of self-administered surveys; good for pretests or pilot tests
Drop-off survey	Cost of interviewer eliminated; appropriate for local market surveys	Generally not appropriate for large-scale national surveys	Many variations exist with respect to logistics and applications
Mail survey	Economical; good listing companies exist	Low response rates; self-selection bias; slow	Many strategies to increase response rate exist

Qualities of Good Field Workers

- Administration of questionnaire and schedules is often done by field workers called **ENUMERATORS**. They **may be hired as temporary staff (most often contingent workers) of the survey project and there is equal chances that in academic researches the lead researcher/s are themselves the enumerators.** The reliability and high turn of the respondents are much depending on these workers. Utter care should be taken to hire them. The qualities of a good field worker are – **Honesty-** neither be fabricating the data (cheating) nor be bending the process (dishonesty) or going aboard it. **Tactfulness- M**ine necessary information by tactfulness. Use the cultural and contextual social capital when necessary. **Personality-** neither be aggressive and not be too social, not be too friendly and be involved in their personal issues. **Interest in work-** may be bored after long period of repeated administration of the same questionnaire and schedules. **Adaptability-** to different situations and circumstances, localities. **Training-** the fieldworker while going with the supervisor watches his process like his first few interviews and based on this he modulates his training skills)- What are the traits of a good enumerators?

Types of Questions

- The types are based how we give answers to the questions. There are the following types of questions.
- **A) Structured Questions**: When the answers to the questions are already conceived and classified into different possible groups, the questions are known as structured questions. Answers given are usually in one word and doesn't differ. e.g. What is your age? Are your married.
- **1) Dichotomous Questions:** when the answer is only in two alternative, either positive or negative. **2) MCQ or Cafeteria Questions:** in this type of question answers are already pre defined with multiple choice (usually 4 in academic MCQ) as in cafeteria's menu. The answers should be mutually exclusive – means only one answer is possible, to each other. The serial arrangements of answer in a question set creates biasness so order is changed.
- **B) Open End Questions:** Here possible answers cant be made or expected. Basically opinions, suggestions. attitude and belief when asked are open end questions e.g. What do you think is the main cause of suicide among teenagers?

Types of Questions

- **C) Leading Questions:** Leading questions which should be avoided as far as possible compels us to give answers in a certain directions. e.g. Should not something be done?
- But when special emphasis has to be done this type of questioning format need to be included.
- **D) Ranking Item Questions:** Like the multiple choice question, it also contains a number of alternative answers but the respondent instead of answering only one alternative has to rank all the alternatives in order of his her preferences or dislikes. For this purpose after every alternative a space is given or bracket ( )
- e.g. What is you preference of the following profession?
- Administration ( )
- University Teacher ( )
- Doctor ( )
- Other Specify ( )
- Like Ranking Item Questions; we have **Rating scale** where we rate (based on some specific weight- like out of 10, how much do you rate the following items). In case of **Likert Rating scale** we have a scale and each point on the scale has some specific answers or we can say each point on the scale is graduated with some reason. This type of questioning format belong to both the form of ranking and rating scale.

Types of Questions

- **<u>E) Ambiguous Questions:</u>** When the language of the question is such that it may be interpreted in more than one way it is called ambiguous question. Ambiguity occurs due to defective language and when phrases and words used have double meaning.
- E.g.. What type of schooling did you have?
- Here the schooling may mean " Type of school attended" or "type of education received". Leading questions or double barrel questions also cause a lot of ambiguity. Usually when such types of questions arise, it is better to give answers in rating scale format. Vagueness occurs in **<u>why</u>** questions.
- **<u>F) Presuming Questions: I</u>**n this type of questioning some presumption about reply of the respondent is already made. This question can be asked only after a filter question that the respondent does have that presumptions;
- E.g. How many cigarettes a day do you smoke.
- Presumptions made in these question are that the respondent does smoke.

Types of Questions

- **<u>G) Hypothetical Questions:</u>** To know the presumptions or belief or assumptions, hypothetical questions are asked. Also to know the reflection of respondent if something or certain things happened and predict future behaviour these types of questions are asked.
- E.g. Would you vote in the election, if you feel they are going to make the constitution?
- The phrase "**<u>would you</u>**" means there is some sort of conditions applied in answering these type of questions.
- **<u>H) Personalized Question: W</u>**hen questions relate to personal matters and personal choices then it may be called personalized question.
- E.g. Have you ever had blood tested?
- This type of question itself be ambiguous in sense that the answer expected could be about HIV test or simple blood test? Personalized questions if not formatted properly could bring about embarrassment.

Types of Questions

- **I) Embarrassing Question**: Embarrassing question may arise in sensitive topics. Like when a survey being done in among rural women about their reproductive or sexual health, we need to ask personalized questions, which may be embarrassing for them to answer. So we need to format questions in such a way that they don't wonder about answering such questions. So we can take the lead by the presumptive questions and the follow with the embarrassing questions.
- E.g.. It should have been very difficult to raise 4 children on you own, didn't it?
- Your sexual life must have been great, isn't it?
- **Or** I wish mine sexual life been as great as yours?
- Since most of the respondents hesitate to report their private affairs directly, a statistical technique was developed to estimate the proportion of respondents having particular private activity without disclosing them. This techniques is called Random Response Techniques and developed by Warner (1955) and improved by Abul-Ela and others (1967). In this technique, respondents choose to answer one of the two statements of which one is sensitive and related to the scope of the study and other is non sensitive question and not related to the fact under study. The choice of the statement to answer is made by means of random device provided by the investigator who knows the probability of selection of each statement. While answering the question the respondent also maintains the privacy of his personal matter.

Types of Questions

- **J) Behaviour Questions:** some time information about regular behaviour of the respondent such as their Newspaper reading, Radio listening or television watching activities are needed for social researches.
- E.g. How often do you go to cinema?
- Behaviour questions may be related to personnel and embarrassing matters as
- How often do you have sex in a week?
- **Bad question need to be avoided**. Too long, complex, personal, ambiguous, leading, not relevant, embarrassing. If answers can be gained through other means there is no need to include these types of questions.
- Also technical terms, medical terms, jargons, native words, subjective or qualitative words and double meaning **words be avoided** as far as possible.

The Qualities of Good Questions

- NO hard and fast rules can be given for the nature of questions because it all depends upon the individual nature of the study, types of the respondent, quality of field workers, etc. However better qualities of question be maintained we follow the following guideline.
- The questions should be few, short, clearly worded and simple and easy to reply.
- They should be within the information scope of the respondent, that is the respondent be in a position to reply.
- Questions should be in direct relationship with the objective of the research. Technical terms and jargons should be avoided as far as possible.
- Questions be in sequential order and inter related with each other.
- Before taking it for survey or interview, the questions be cross checked.
- Questions demanding minimum writing work be included and bad questions be avoided.
- **Wh** questions can be included instead of presuming/ hypothetical questions having **" I wish or Would".**
- **A tabulation plan must be kept in mind while framing questions. Code numbers for each questions and their expected answers are highly appreciated because they facilitate the classification and tabulation of data.**

Conducting Interview

- Stages in in-depth interview: a) Creating natural environment e.g., informal chat, linking with common experience.
- b) Encouraging conversational competence e.g., letting the informant feel that their experiences and opinions are meaningful, use common words and limit (?) words
- c) Showing understanding e.g., express a sense of shared feeling on pains and pleasures in the expressed items.
- d) Getting facts and basic description e.g., focus on descriptive things, wait for emotional items.
- e) Asking difficult questions: be careful find out if the informant is relaxed & trusting, difficult questions can be repeated later.
- f) Toning down the emotional level i.e., restore the feeling of privacy a feeling of uncomfortably exposed.
- g) Closing while maintaining contact i.e., express thanks, reiterate confidentiality.
- We all bring personal histories and perspectives to research but they should be tactically reduced or minimized but it all depends on the field worker or enumerator. In academic research the candidates themselves are the ultimate decision maker. So enough home-work before is needed before anyone begins research. Make an original contribution to the discipline.

Conducting Interview And The Role Of Enumerators

- Administration of questionnaire and schedules is often done by field workers called **ENUMERATORS**. They **may be hired as temporary staff (most often contingent workers) of the survey project and there is equal chances that in academic researches the lead researcher/s are themselves the enumerators.** The reliability and high turn of the respondents are much depending on these workers. Utter care should be taken to hire them. The qualities of a good field worker are – **Honesty-** neither be fabricating the data (cheating) nor be bending the process (dishonesty) or going aboard it. **Tactfulness- M**ine necessary information by tactfulness. Use the cultural and contextual social capital when necessary. **Personality-** neither be aggressive and not be too social, not be too friendly and be involved in their personal issues. **Interest in work-** may be bored after long period of repeated administration of the same questionnaire and schedules. **Adaptability-** to different situations and circumstances, localities. **Training-** the fieldworker while going with the supervisor watches his process like his first few interviews and based on this he modulates his training skills)- What are the traits of a good enumerators?
- **Tips:** Probing an important aspect of interview: Probing is stimulating informants to produce more information.

Case Study: Overview

- **It is the objectivity or purpose that defines how we choose a research method. These methods are equally used in qualitative or quantitative research. The methods of research may be Conventional Method, Historical Research, Case Study, Experimental Method and the Survey.**
- Leadership is one of the important topic or psychological attribute for historical research.
- Study of a lot of different group or variable at **a point of time is Cross Sectional Study**.
- Study of a single group in depth for **a longer period of time is Longitudinal Study**. **This can be synonymous to a Case study of group**.
- Historical research can be, the approach by which Hitler or Churchill lead their countries during the 2nd world war.
- The film making style of Charlie Chaplin or Raj Kapoor can be cross sectionally and historically studied. Both used the notion of arousing empathy (**Daya Ko Patra**) through their main protagonist and that made their film sellable.
- **Cause and effect relationship is not only interpreted through statistical means in quantitative research but through Content Analysis in qualitative research too.**

Case Study: Overview

- A conventional method, which is basically the scientific method of research we carry out, may consists of the following steps:
- a) Defining a research topic
- b) Hypothesis setting based on the purpose of research
- c) Developing a method or tool to carry out research (along with sampling techniques or may be without proper sampling)
- d) Gathering data
- e) drawing of conclusion via result, interpretation and analysis
- Hypothesis not only establish relationships between variable but also helps us to predict result or outcome of a research.

- **Ontology:** Who are you, who are you studying? Are they your equals or your subjects? What rights do you consider them to have?

- **Epistemology:** What do you consider to be knowledge and how does this affect your data collection and analysis?

- **Validity, reliability:** Have you found out what you say you found out? Can you convince others that you have done so? Can you generalise the results to another situation?

Case Study: Overview

- The term " Case Study" usually refers to a fairly intensive examination or exploration and description of single unit or (variable or character, is it?). A unit may be a person or a small group of people or single company. Case studies involve measuring, looking what is there and how it got there (more in sense of historical method).
- In the social sciences and life sciences, a **case study** (or **case report**) is a descriptive, exploratory or explanatory analysis of a person, group or event. An explanatory case study is used to explore causation in order to find underlying principles. So to it can be said case studies enables us to explore, unravel and understand problems, issues and relationships in a particular situation. It cant however allow us to generalize our research that is to argue from one case study , the results findings or theories developed apply to other similar case studies. It is because the data produced by one case study is different for the data produced by other case study involving the same single unit (at least in case of psycho-diagnosis).
- Case studies can be used to check the reliability of findings that has already taken place, taking a single unit for cross check. Case studies also helps to describe a phenomenon and formulate hypothesis along with checking reliabilities of theories through a single cross check of the population that has been researched.
- As case studies produce a **single unit survey** and an analytical frame, the findings of a case study be used to produce the design of experimental studies.

Case Study: Overview

- Case study investigates a contemporary phenomenon within its real-life context, especially when the boundaries between phenomenon and context are not clearly evident or when we wish to clarify the phenomenon. Case studies focus on understanding the dynamics present within a single setting (Eisenhardt, 1989).

Case Study: Overview

- Thomas[3] offers the following definition of case study: **"Case studies are analyses of persons, events, decisions, periods, projects, policies, institutions, or other systems that are studied holistically by one or more methods. The case that is the *subject* of the inquiry will be an instance of a class of phenomena that provides an analytical frame — an *object* — within which the study is conducted and which the case illuminates and explicates." According to J. Creswell, data collection in a case study occurs over a "sustained period of time."[4]**
- **Another suggestion is that case study should be defined as a research strategy, an empirical inquiry that investigates a phenomenon within its real-life context.** Case study research can mean single and multiple case studies, can include quantitative evidence, relies on multiple sources of evidence, and benefits from the prior development of theoretical propositions. Case studies should not be confused with qualitative research and they can be based on any mix of quantitative and qualitative evidence. Single-subject research provides the statistical framework for making inferences from quantitative case-study data.[2][5] This is also supported and well-formulated in (Lamnek, 2005): **"The case study is a research approach, situated between concrete data taking techniques and methodologic paradigms."**
- **Cases are not representative but insight oriented and that too unique insight.** A case selection that is based on representativeness will seldom be able to produce these kinds of insights. **When selecting a subject for a case study, researchers will therefore use information-oriented sampling, as opposed to random sampling.** Outlier cases (that is, those which are extreme, deviant or atypical) reveal more information than the potentially representative case. Alternatively, a case may be selected as a key case, chosen because of the inherent interest of the case or the circumstances surrounding it.

Case Study: Examples

- Let take three peculiar example of case study:
- 1) A man wants to wed a woman. He proposes to his father about his idea. The father in trying to know about the behaviour, academics, family of the prospective groom sends a man to his house. This man investigates et al of the boy including income and family background, etc and give back the descriptive frame regarding the boy to the prospective bride father. If the father presumes that the boy has a stronghold and can take the responsibility of his daughter, he agrees for the marriage of his daughter. This is a type of local case study and undocumented in a lot of senses. The person who bridges all these activities and works as a field worker is called **'LAMI'** in Nepali.
- **Can't such case studies be considered as Naturalistic observations?**
- 2) The case study that is involved in case of mentally ill patient is more structured and well documented. The ICD based case study format used by Institute of Medicine, Kathmandu, Nepal enable a in-depth, but brief analytical case study. Here a psychiatrist or psychologist with the use of structured questions takes details of socio demographic features, history of the patient, current affairs, his Mental State Examination, etc. Based on these qualitative and quantitative findings/ information, the expert gives a provisional diagnosis. Based on this provisional diagnosis the treatment of the mentally ill patient starts. This case study is of more practical value.
- 3) Case studies done in manufacturing plants which may be primarily evaluation and reevaluation of the possible product to be launched in the market.
- Different case studies have different purposes and different strategies and format to carry out the case study.

Case Study: Types of studies under

- In case study, two types of studies are carried out and studies carried out fulfills the same objective:
- **Exploratory Studies:** It seeks to discover significant variable and the relations between them. The relationships between variables are predicated from these type of study. Here a lot of variables of single unit may be studied or overviewed and described so as to formulate hypothesis.
- **Hypothesis Testing**: It is used for testing the relationships between various variable. Here the researcher would be seeking data perhaps from a number of different case study situations or from a single unit and used it to test hypothesis. **Setting up hypothesis and testing them through statistical parameters allows us to predict the probable outcome.**
- Predicting the probable outcome and defining the relationship between various variables is the purpose of the Hypothesis Testing.
- In case studies while intensive investigation of a single person or group of persons or organization may be carried out for the sole purpose of increasing our knowledge about the phenomenon, more often it is carried out in order to practical improvement.

Case studies can be: Exploratory; Explanatory & Descriptive (Yin, 1994)

Case studies can be used to: Provide description, Test theory and Generate theory (Eisenhardt, 1989).

Case Study: Comparison

- When the study is historical choice would be obviously be case studies. It is also preferred in examining contemporary events.
- Experiments are done when the investigator can manipulate behavior directly, precisely and systematically.
- **Supplementary**: PSC visit was more of a case study based and a Mini Research because it used focus group discussion, induction training and single unit survey interview as the method of data collection.

Steps in Case Studies

- 1) The investigator determine the present situation.
- 2) Then he collects background information regarding that case. It helps researcher to compile a list of possible causes of current problem.
- 3) The background information collected is analyzed for possible hypothesis. The hypotheses that cant stand up to the evidence collected are discarded. Only those who stand up are considered important hypotheses of the research study.
- 4) The hypothesis developed are tested. (Underpin your case with theory and derive theory from the case itself.)
- 5) The aim is to check that the hypotheses tested actually work in practice.
- 6) Some actions or improvement are made based on this tested hypothesis.
- **The design of case studies can be as follows:**
- **i) Plan and chart techniques to use ii) Identify site(s) for access & convenience**
- **iii) Schedule data collection (we can use in-depth interview; semi-structured interview and participatory observation as method of data collection within the Case Studies) iv) Regular review**

Limitations And Advantages

- The **<u>limitation</u>** of Case Study is that its findings cant be generalized and not representative. So they don't help to reach conclusion and show the exact relationships of the variables. Case study just help to explore. Although the data produced are rich the case study is meaningless in researching situations which are already structured that is where important variables have already been identified.
- The data bank for case studies may be observations, documents, interviews, conferences, conversations, experimental studies, etc.
- Case study can be of deductive nature when a theory formulated is tested in parts and parcel. We can use this deductive approach for falsification and discarding theory.
- There is no any hard and fast rule in case study research. The case studies are generalizable to theoretical propositions and not to populations or universes. Case studies are conditional in their model in terms of generalization.
- Case Studies take too long and when all the steps/ strategies and tools are to be maintained with a single case then the study becomes costly.
- If questions are properly formatted in case studies then that keeps the researcher or fieldworker in track.
- **<u>Prospects:</u>** Even though case studies are very fine tool if we want an enormous data and that too rich in its content.
- Do not necessarily have to be long, as one could do a case study without ever having to leave the library or telephone.

Comparison of Two Cases

- Compared Hay on Wye “Town of Books” with Stavanger “Town of Culture”
- Objective: to contrast the factors underlying (a) successful and (b) unsuccessful tourism entrepreneurship
- Methods:
  - Interviews with key entrepreneurs
  - Interviews with other stakeholders
  - Relevant news items and other literature

Border Tourism in Israel: Conflict, Peace, Fear and Hope

The main aim of this research is to describe and analyse cultural elements that express the symbolic landscape of Israel's border-tourism attractions. **The methodology selected is based on the naturalistic approach of landscape interpretation**. A descriptive analysis is provided of the symbolism of elements in two case studies of border tourism in Israel.

These places have grown into unique tourist attractions, and they illustrate the conflict or the co-operation between Israel and its neighbouring countries. Visits to Israeli border sites usua**ll**y entail observation and hold a special meaning for tourists, either because they can sense the danger and fear of battles conducted in the past near the border, or because they have a close and clear look at the neighbouring country. On the other hand, these sites are also places of hope for a better future - one of peace and co-operation between the two sides. In many cases the observation points have

Experimental Method of Data Collection

- **Experimental psychology** refers to work done by those who apply experimental methods to the study of behavior and the mental processes that underlie it. Experimental psychologists employ human participants and animal subjects to study a great many topics, including, among others sensation & perception, memory, cognition, learning, motivation, emotion; developmental processes, social psychology, and the neural substrates of all of these.
- **Operational definitions:** Some well-known behaviorists such as Edward C. Tolman and Clark Hull popularized the idea of operationism, or operational definitions. **Operational definitions are definitions of theoretical constructs that are stated in terms of concrete, observable procedures.** Operational definitions solve the problem of what is not directly observable by connecting unobservable traits or experiences to things that can be observed. Operational definitions make the unobservable observable.
- When a theoretical assumptions be taken into function, then a operational definition is formulated. Operational definitions are mostly used during the legal investigations**. When an investigation is to be carried out for an adolescent girl is who is sexually abused, a criteria (here age bar) need to be developed about which age limit is adolescent age and which is adult or consent giving age in terms of marriage/ relationship and sex.**
- **Similarly the operational definition of Psychoanalysis is- Letting The Client Revel Themselves In Free Association (Manner), The Process Would Dig Into Past.**

The Four Cannons of Science

- In order to understand the scientific approach to experimental psychology as well as other areas of scientific research, it is useful to know the four fundamental principles that appear to be accepted by almost all scientists.
- **Determinism: Events have a systematic cause.** One of the first cannons of science is the assumption of determinism. **This canon assumes that all events have meaningful, systematic causes**. The principle of determinism has a close corollary, that is, the idea that science is about theories. Scientists accept this canon largely on faith and also to the fact that theories wouldn't be very useful in the absence of determinism, because in the absence of determinism, orderly, systematic causes wouldn't exist.
- **Empiricism: Observation is the best tool to understand the scientific world. The** canon of empiricism simply means to make observations. This is the best method of figuring out orderly principles. This is a favorite tool among scientist and psychologists because they assume that the best way to find out about the world is to make observations.

The Four Cannons of Science

- **Parsimony: Choose a simpler theory than a complex one in testing events.** The third basic assumption of most scientific schools of thought is parsimony. **The canon of parsimony says that we should be extremely frugal (economical) in developing or choosing between theories by steering away from unnecessary concepts.** Almost all scientist agree that if we are faced with two competing theories, that both do a great job at handling a set of empirical observations, we should prefer the simpler, or more parsimonious of the two. The central idea behind parsimony is that as long as we intend to keep simplifying and organizing, we should continue until we have made things as simple as possible. One of the strongest arguments made for parsimony was by the medieval English philosopher William of Occam. For this reason, the principle of parsimony is often referred to as Occam's razor.
- **Testability: Experiments are testable and replicable The final and most important canon of science is the assumption that scientific theories should be testable using currently available research techniques.** This canon is closely related to empiricism because the techniques that scientists typically use to test their theories are empirical techniques. In addition to being closely related to empiricism, the concept of testability is even more closely associated falsifiability. **The idea of falsifiability is that scientists go an extra step by actively seeking out tests that could prove their theory wrong**. If in any cases the theory is not proved wrong it is then accepted and generalized. Among psychologists, the concepts of testability and falsifiability are extremely important because many really theories like the work of Freud and other psychoanalysts were difficult to put to any kind of objective test.

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Experimental Method of Data Collection: Overview

- Adding catalyst to some lab experiments is to speed up the pace of the reaction. Adding catalyst doesn't mean controlling or varying the variable.
- We keep either the pressure or volume constant in case of experiments of gas and vary the remaining variable.
- Control and experimental variables (which are basically statistical controls) are used to avoid the interference of a lot of factors.
- Does adding variables to a phenomenon means experiment? I think yes. What do you?
- In a science experiment, there are three variables that are either controlled or varied. These are length (also volume, L), Mass (M, or weight) or time (T) and their unit are meter, kg and second in standard unit (MKS). Time is a very important factor in experimental design either with experimental or control variable.
- **<u>The experimental method of data collection, which is the classical method used in physical science, is the method where the researcher either control or vary all variables involved in the study at will and observes the effect in dependent variable.</u>** Usually all variables are controlled expect one which is manipulated (independent variable). By varying this one and monitoring changes in the output, the relationship between variables can be carefully studied and documented. Mathematically the relationship is:
  y-------- x
- Or **<u>$y = F(x_1 \ldots\ldots x_n)$</u>** <u>where y is dependent</u> variable called output; f= function and x's are independent variables or inputs. Here x's are made to vary or controlled.

Experimental Method of Data Collection: Examples

- Example: Lets suppose y is the crop output or yearly yield. The yield is affected by different independent variables say x1 = seed quality, x2= amount of irrigation used, x3= amount of manure/ fertilizer used and x4 = Labour inputs. Now keeping x1, x2, x3 as constants or controlling them, we can observe change in y as per unit change in x4.
- Though such controlling is possible in physical sciences, it is hardly so in case of variables associates with social phenomenon and where human are used as subject of inquiry. We need to bring about the notion of multi factorial design to address such psychosocial phenomenon. Because variables not only yield outputs but also interact in some way or other to bring about interactive effect.
- Examples of such design are **<u>Pre test, training in between and post test control designs</u>**. Here two groups will be taken. Each group will contain managers (say) who has been randomly assigned to a group. Data is then collected about the individuals managerial style (say leadership behaviour or attitude to the work). This is a sort of pre test and will yield data.
- Then one group of managers (here the experimental group) is sent away for particular training activity say leadership. After the completion of the training, the data about those trained and those untrained are again taken and compared with the previous data collected. The effect of leadership training is observed as the difference in data in the group which had experienced training (the experimental group) with the group which had not.

Types of Experiments: Lab vs. Field

- The main notion or rationale behind the experiments is to know the cause and effect relationships by varying some variables and controlling some.
- Lab experiments aims to find an absolute cause and effect relationship of the phenomenon under study whereas the field experiments aims to find the consequences/ effect of a phenomenon and not the cause.
- Broadly speaking there are two types of experiments. The **Laboratory Experiment** (not the **Lavatory** Experiment, which basically means the Toilet. Ha! Ha!) and the Field Experiments.
- While most of the experiments in physical science are done in laboratories, many of the experiments in social or managerial sciences are performed in the field. If the research problem is such that it is divorced from the real world surrounding it, laboratory experiments are to be carried out. A laboratory can be considered as any setting in which the researcher is able to closely control the conditions under which observations are made.
- The **undoubted** hypothesis (as considered in Veda) that, " energy can neither be created nor can be destroyed but can only be transformed from one form to another" is very applicable in lab experiments because either mass or energy is conserved in lab experiments.

Types of Experiments: Lab vs. Field

- On the other hand where attempts are made to study the problem with the real setting and to minimize the influence of seemingly unconnected variable (we don't actually control variable in real world setting as we can only reduce their effect). With the growth and development of statistics, the need for a special laboratory for the purpose of the experimentation is no longer regarded as necessary for adequately controlled research (but how? **Can randomization or simply replication can replace the controlling of variable part of the lab experimentations?**).
- It is said **that Replication, Randomization and use of certain statistical control** method help the conduction of field experiments with little interference from the extraneous variable and even with several variables being manipulated at once.

Types of Experiments: Field Experiments

- The use of experimental and control group is the most common approach of controlling a field experiment. **An experimental group would consists a group of people subjected to the experimental variables or treatment while the control group would consist of a group sufficiently similar to the experimental group but not subjected to the experiments**. (They are treated with the natural flow or time and let us idea about whether or not by experimenting a variable or subject can actually produce an outcome. Its more about the relationship between the change in mass/ energy with time).
- There are several statistical designs which are used in field experiments. A design is a plan of allocating experimental treatment to experimental units. The designs help in estimating the effects of individual treatment, their interactions and significant difference in their effects, etc.
- There are several **problems in carrying out experimental researches where study elements as human subjects are used.**
- **1)** They often change their response because of their interaction with the environment and along with relationships that are developed and present during experiments (more during field experiments). The subjects give different response than they had planned regardless of experimental manipulation.
- 2) Awareness among the subjects about them being in the process of experiments would make them give different response than when they were not aware of being in the research and experimentation process. They usually want to give ideal answer or fake good or even bad. This is more about being socially desirable or ideal.

Ex- Post Facto Research

- We treat the experimental group and don't manipulate any of the control group (usually in case of field experiments). Or , either we vary the experimental variable and keep other extraneous variable constant in case of lab experiments.
- **Usually ex-post facto research is a reporting format field based experimental research and are usually done when some phenomenon have already occurred.** E.g. Investigation of suicide. When the cause has already established and we need to report the effect then we use the ex-post facto research.
- In a ex-post facto research direct control is not possible. Neither manipulation nor random assignment can be used by the researcher.
- There are two essential differences between the experimental and ex-post facto approaches. **As this research doesn't either control the variables (extraneous) or vary a experimental variable, the truth of hypothesized relation between x and y cant be ascertained with the confidence of experimental situation.**
- For example an investigator measuring the creativity of a sample **of boys and girls, test the significance of the difference between the means of two sexes. If the mean of boys is significantly higher than the mean of girls, he concludes that boys are more creative than girls.** But this may not be a valid conclusion. Since many other variables are correlated with sex, it might have been one or more of these variables that produced the difference between the creativity scores of two sexes. Usually all the field experiments are ex-post facto researches because the experimental manipulations are subjected to the real world on which the investigator has no control

Ex- Post Facto Research

- So **ex-post facto research** is a systematic empirical inquiry in which the researcher does not has any direct control over the independent variables because their manipulation has already occurred or because they are inherently not manipulative. When we go to research the anxiety of flood victim, a lot of variables have already been manipulated. In a person we also cant control intelligence and creativity. Inferences also acquired without establishing any relationships between the independent and dependent variables.
- **Technique:** The ex-post facto research generally moves from present to future. Suppose it is proposed to study the influence the boarding and non boarding schools education upon future adjustability of students, we take an equal number of students in two groups, one group consisting of one type of education and other consisting other type of education. The groups are selected keeping in mind that other variables like age, economic status, intelligence are matched in both cases.
- After ten year (seems longitudinal study), we shall again try to locate those person and see how well they are adapted in the psychosocial atmosphere of life. The difference between the two groups may be attributed to the nature of education received.
- **But since it is often very difficult to locate the persons after sufficient period of time, the observations are made from present to past. Mr. Chaplin studied the relation between scouting training and delinquency by using this method. For this purpose he took matched samples from older boys one consisting of delinquents and other consisting of non delinquents. The two samples were similar in all respects. Then he tried to find how many among the two groups have scout training.**

Reliability of Research Process and Validity of Tool

Validity and reliability [edit]

Validity is the relative accuracy or correctness of a study. Like many other concepts that are often broad in nature, validity takes a variety of forms and ranges greatly in meaning including internal, external, conceptual, and construct validity.

Internal validity [edit]

Internal validity refers to the extent to which a set of research findings provides compelling information about causality.[16] When a study is high in internal validity, there can be a confident conclusion that variations in the independent variable caused any observed changes in the dependent variable. Internal validity is highly important to testing theories because theories are all about causality.

External validity [edit]

External Validity refers to the extent to which a set of research findings provides an accurate description of what typically happens in the real world. When a study is high in external validity, or generalizability, the conclusion can confidently be made that the findings of the study will apply to other people, other physical or social environments, or even other cultures.[17] One concern of researchers is generalizability with respect to people. In this case, researchers want to know that the results that they may get in one sample will also occur in other samples or for other kinds of people.[18] Another concern regarding generalizability is generalizability with respect to situations. This form of external validity has to do with the degree to which a set of research findings applies to real world settings or contexts. Passive observational studies that are conducted on diverse groups of people in real-world situations tend to be very high in external validity.

Construct validity [edit]

A third important form of validity is construct validity. Construct validity refers to the extent to which the independent and dependent variables in a study really represent the abstract hypothetical variables of interest.[19] In simpler terms, it has to do with whether the manipulated and/or measured variables in a study accurately reflect the variables the researcher hoped to manipulate. Construct validity is also a direct reflection of the quality of one's operational definitions. If a researcher has done a good job of converting the abstract to the observable, construct validity is high.

Conceptual validity [edit]

Another form of validity is called conceptual validity. Conceptual validity refers to how well a specific research hypothesis maps onto the broader theory that it was designed to test. Conceptual and construct validity have a lot in common with one another being that they both have to do with how well a specific manipulation a measure maps onto what the researcher should have done, but conceptual validity lies on a much broader scale. Construct validity has more to do with specific manipulations and measures in specific studies, and conceptual validity has more to do with research hypothesis and even research programs.

Reliability [edit]

Another crucial aspect of almost all research is reliability. This refers to the consistency or repeatability of a measure or an observation. One of the most sensible ways to assess the reliability of a measure is to assess test-retest reliability by measuring a group of participants at one time and then having them tested a second time to see if the results are consistent. It is also

Early Research as Experimental Method in Psychology

Wilhelm Wundt [edit]

Main article: Wilhelm Wundt

Experimental psychology emerged as a modern academic discipline in the 19th century when Wilhelm Wundt introduced a mathematical and experimental approach to the field. Wundt founded the first psychology laboratory in Leipzig, Germany.[2] Other early experimental psychologists, including Hermann Ebbinghaus and Edward Titchener, included introspection among their experimental methods.

Charles Bell [edit]

Main article: Charles Bell

Charles Bell was a British physiologist, whose main contribution was research involving nerves. He wrote a pamphlet summarizing his research on rabbits. His research concluded that sensory nerves enter at the posterior (dorsal) roots of the spinal cord and motor nerves emerge from the anterior (ventral) roots of the spinal cord. Eleven years later, a French physiologist Francois Magendie published the same findings without being aware of Bell's research. Due to Bell not publishing his research, the discovery was called the Bell-Magendie law. Bell's discovery disproved the belief that nerves transmitted either vibrations or spirits.

Ernst Heinrich Weber [edit]

Main article: Ernst Heinrich Weber

Weber was a German physician who is credited with being one of the founders of experimental psychology. His main interests were the sense of touch and kinesthesis. His most memorable contribution is the suggestion that judgments of sensory differences are relative and not absolute. This relativity is expressed in "Weber's Law," which suggests that the just-noticeable difference, or **jnd** is a constant proportion of the ongoing stimulus level. Weber's Law is stated as an equation:

$$\frac{\Delta I}{I} = k,$$

where I is the original intensity of stimulation, ΔI is the addition to it required for the difference to be perceived (the **jnd**), and k is a constant. Thus, for k to remain constant, ΔI must rise as **I** increases. Weber's law is considered the first quantitative law in the history of psychology.[3]

Gustav Fechner [edit]

Main article: Gustav Fechner

Fechner published in 1860 what is considered to be the first work of experimental psychology, "Elemente der Psychophysik."[4] Some historians date the beginning of experimental psychology from the publication of "Elemente." Weber was not a psychologist, and it was Fechner who realized the importance of Weber's research to psychology. Fechner was profoundly interested establishing a scientific study of the mind-body relationship, which became known as psychophysics. Much of Fechner's research focused on the measurement of psychophysical thresholds and just-noticeable differences, and he invented the psychophysical method of limits, the method of constant stimuli, and the method of adjustment, which are still in use.

Methodology in Experimental Psychology

- Experimental psychologists study human behavior and animal behavior in a number of different ways. **Human participants often respond to visual, auditory or other stimuli, following instructions given by an experimenter; animals may be similarly "instructed" by rewarding appropriate responses.** Since the 1990s, computers running various software packages have automated much of the stimulus presentation and behavioral measurement in the laboratory. **Experiments with both humans and animals typically measure reaction time, choices among two or more alternatives, and/or response probability, rate, or strength.** Experiments with humans may also obtain written responses before, during, and after experimental procedures; they may also record movements, facial expressions, or other behaviors of participants.
- **Experiments:** The complexity of human behavior and mental processes, the ambiguity with which they can be interpreted and the unconscious processes to which they are subject gives rise to an emphasis on sound methodology within experimental psychology.
- Control of extraneous variables, minimizing the potential for experimenter bias, counterbalancing the order of experimental tasks, adequate sample size, the use of operational definitions, emphasis on both the reliability and valid of results, and proper statistical analysis are central to experimental methods in psychology. Because an understanding of these matters is important to the interpretation of data almost all fields of psychology, undergraduate programs in psychology usually include mandatory courses in *Research Methods and Statistics*.

Methodology in Experimental Psychology

- **Other methods:** A pilot study may be run before a major experiment, in order to test out different procedures or determine optimal values of the experimental variables before the researcher moves on to the main experiment. It can help the researcher find weaknesses in the experiment.
- **A crucial experiment is an experiment that is meant to test all possible hypotheses simultaneously. If one hypothesis is confirmed, then it will also reject another hypothesis. This type of experiment could confirm multiple hypotheses, which will then lead a researcher to do more experiments that will lead to one confirmed hypothesis.**
- In a **field study**, participants work in a naturalistic setting outside the laboratory. Field studies can vary from a description of behaviors in situations not under experimental control (for example, interactions of people at a party) to a true experiment with variables planned in advance (for example, use of different toys in a nursery school). In either case, control is typically more lax/ negligent or little than it would be in a laboratory setting.
- While other methods of research—case study, interview, and naturalistic observation—are used by psychologists, the use of well-defined, controlled experimental variables with appropriate randomization and isolation from unwanted variables remains the preferred method for testing hypotheses in scientific psychology.

Research Design: One-way; Two Group Design

- **One-way designs: The simplest experimental design is a one-way design. In this type of design, there is one and only one independent or experimental variable. Furthermore, the simplest kind of one-way design is called two-group design**. In a two-group design, there is only one independent variable and this variable has two levels. A two-group design mainly consists of an experimental group (a group that receives treatment) and a control group (a group that doesn't receive treatment).In addition to two group designs, experimenters often make use of another kind of one-way design called the one-way, multiple groups design. This is another design in which there is only a single independent variable, but the independent variable takes on three or more levels.[26] This type of design is useful in studies such as those that measure perception. Although these types of designs may be simple, they do have limitations.
- **Factorial designs:** One major limitation of one-way designs is the fact that they allow researchers to look at only one independent variable at a time. The problem is that a great deal of human behavior is a result of multiple variables acting together. Because of this, R.A Fisher popularized the use of factorial designs. Factorial designs are designs that contain two or more independent variables that are completely crossed. This means that every level of the independent variable appears in combination with every level of every other independent variable. There are a broad variety of factorial designs, so researchers have specific descriptions for the different designs. The label given to a factorial design specifies how many independent variables exist in the design and how many levels of each independent variable exist in the design. Therefore a 2x3 factorial design has two independent variables (because there are two numbers in the description), the first of which has two levels and the second having three levels.

Research Design

- **Main effects and interactions:** The simple straightforward effects of independent variables in factorial studies are referred to as main effects. Main effects are the factorial equivalent of the only kind of effect that you can detect in a one-way design. This refers to the overall effect of an independent variable, averaging across all levels of the other independent variables.[27] Main effects are simple. They only have to do with one variable. In addition to providing information about main effects, studies can also produce a second, very important kind of information called interactions. Interactions exist when the effect of one independent variable on a dependent variable depends on the level of a second independent variable.

Research Design

Within-subjects designs [edit]

The two basic approaches to research design include between-subjects design and within-subjects design. Between-subjects designs are designs in which each participant serves in one and only one condition of an experiment. In contrast, within-subjects or repeated measures designs are those in which each participant serves in more than one or perhaps all of the conditions of a study.[28] Within-subjects have some huge advantages over between-subjects designs especially when it comes to complex factorial designs that have many conditions. Within-subjects designs eliminate person confounds. When researchers use this type of design, they eliminate person confounds in a much more direct approach. They ask the same people to serve in the different experimental conditions in which they happen to be interested. In a sense, these designs take advantage of the only perfect form of matching and in doing so, they totally eliminate person confounds. While there are advantages to this type of design, there are disadvantages as well. There are three closely related biases that are applicable to within-subjects designs. The first bias has to do with the fact that people's psychological states change as they spend time working on one or more tasks. More specifically, sequence effects can pose serious problems. Sequence effects occur when the simple passage of time begins to take its toll on people's responses. A second closely related problem has to do with carry-over effects. Carry-over effects occur when people's responses to one stimulus in a study directly influence their responses to a second stimulus.[29] Another kind of carry-over effect can occur when participants knowingly or unknowingly learn something by performing an experimental task. When a participants' experience with one task makes it easier for them to perform a different task that comes along later, they have benefited from practice effects. This is a problem because researchers cannot tell if people's superior performance on the second task happened because of an experimental manipulation or because of simple practice.

Some research area that employ experimental method

- The use of experimental methods was perhaps the main characteristic by which psychology became distinguishable from philosophy in the late 19th century.[34] Ever since then experiments have been an integral part of most psychological research. Following is a sample of some major areas that use experimental methods.
- **Cognitive psychology:** Some of the major topics studied by cognitive psychologists are memory, learning, problem solving, and attention. **Most cognitive experiments are done in a lab instead of a social setting; this is done mainly to provide maximum control of experimental variables and minimal interference from irrelevant events and other aspects of the situation.** A great many experimental methods are used; frequently used methods are described on the main pages of the topics just listed. **In addition to studying behavior, experimenters may use fMRI or PET so they are able to see what areas of the brain are active during cognitive processing.**
- **Sensation and perception:** The main senses of the body (sight, touch, smell, auditory, and taste) are what generally get tested for sensation and perception. An experimenter may be interested in the effect color has on people, or what kind of sound is pleasing to a person. (preference over colour can be done through Field Experiments where as to know the frequency of sound one must do a controlled lab experiment) These answers require experimental methods to get an answer. Depending on what sense is being tested an experimenter has many experimental instruments to choose from to use in their experiment. These instruments include audio oscillator, attenuator, stroboscope, photometer, colorimeter, algesiometer, algometer, and olfactometer. Each instrument allows the experimenter to record data on what they are researching and helps expand the knowledge of sensation and perception.

Some research area that employ experimental method

- **Behavioral psychology:** Behavioral psychology has had a vast array of experimentation completed and much more still going on today. A few notable founders of experiments in behavioral psychology include John B. Watson, B.F. Skinner, and Ivan Pavlov. Pavlov used experimental methods to study the digestion system in dogs, which led to his discovery of classical conditioning. Watson also used experimental methods in his famous experiments with Little Albert. Skinner invented the operant conditioning chamber at first to study rat behavior, and later pigeon behavior, under varying schedules of reinforcement. It was experiments like these that helped the science of behavior become what it is today.
- **Social psychology: Social psychology often employs the experimental method in an attempt to understand human social interaction.** Social psychology conducts its experiments both inside and outside of the laboratory. Notable social psychology experiment is the Stanford prison experiment conducted by Philip Zimbardo in 1971, although the extremity of this field experiment is not prototypical of the field. Another notable study is the Stanley Milgram obedience experiment, often known as the Milgram experiment.

Triangulation Method of Data Collection

- This method can simply be referred as triangulation in research.
- In the social sciences, **triangulation** is often used to indicate that two (or more) methods are used in a study in order to check the results. **"The concept of triangulation is borrowed from navigational and land surveying techniques that determine a single point in space with the convergence of measurements taken from two other distinct points."** The idea is that one can be more confident with a result if different methods lead to the same result. (Can Triangulation be considered as Meta Analysis?)
- **Triangulation is a powerful technique that facilitates validation of data through cross verification from two or more sources.** In particular, it refers to the application and combination of several research methodologies in the study of the same phenomenon.
- It can be employed in both quantitative (validation) and qualitative (inquiry) studies.
- It is a method-appropriate strategy of founding the credibility of qualitative analyses.
- **It becomes an alternative to traditional criteria like reliability and validity and so triangulation is used to establish the validity and reliability of qualitative studies.**
- It is a blend of two or more method so can be referred as eclectics (diverse) or cross sectional method. So it is the preferred line in the social sciences.
- **By combining multiple observers, theories, methods, and empirical materials, researchers can hope to overcome the weakness or intrinsic biases and the problems that come from single method, single-observer and single-theory studies. Also this approach can reduce the question over the result obtained.**

* Triangulation Method of Data Collection : History

- The idea of triangulation is very much associated with measurement practices in social and behavioral research. An early reference to triangulation was in relation to the idea of UNOBTRUSIVE METHOD (because it provides freelancing approach to research) proposed by Webb et al. (1966), who suggested**, "Once a proposition has been confirmed by two or more independent measurement processes, the uncertainty of its interpretation is greatly reduced. The most persuasive evidence comes through a triangulation of measurement processes" .**
- **Thus, if we devise a new survey-based measure of a concept like emotional labor (as because emotional labour is a very qualitative and subjective concept and it is hard to interpret it through the eyes and lens of psychophysics) our confidence in that measure will be greater if we can confirm the distribution and correlates of emotional labor through the use of another method, such as structured observation (does it means that structured observation is more of lab experiments?).**
- Of course, **the prospect is raised that the two sets of findings may be inconsistent, but as Webb et al. observed, such an occurrence underlines the problem of relying on just one measure or method.** Equally, the failure for two sets of results to converge may prompt new lines of inquiry relating to either the methods concerned or the substantive area involved. A related point is that even though a triangulation exercise may yield convergent findings, we should be wary of concluding that this means that the findings are unquestionable. It may be that both sets of data are flawed.
- **Even though there is less, less inconsistency through triangulation, it doesn't mean that this method of data collection is the shield to errors (can't prevent errors)**

The purpose or the necessity of Triangulation Method of Data Collection: Overview

- **The purpose of triangulation in qualitative research is to increase the credibility and validity of the results.** Several scholars have aimed to define triangulation throughout the years.
- Cohen and Manion (2000) define triangulation as an **"attempt to map out, or explain more fully, the richness and complexity of human behavior by studying it from more than one standpoint."**
- Altrichter et al. (2008) contend that triangulation **"gives a more detailed and balanced picture of the situation."**
- According to O'Donoghue and Punch (2003), **triangulation is a "method of cross-checking data from multiple sources to search for regularities in the research data."**
- According to Erina Audrey (2013) **"Triangulation also crosschecks information to produce accurate results for certainty in data collection"**
- Triangulation refers to the use of more than one approach to the investigation of a research question in order to enhance confidence in the ensuing findings. **Since much social research is founded on the use of a single research (also single theory) method and as such may suffer from limitations associated with that method or from the specific application of it, triangulation offers the prospect of enhanced confidence.** Triangulation is one of the several rationales for **MULTIMETHOD RESEARCH**.
- **The term derives from surveying, where it refers to the use of a series of triangles to map out an area.**

Types Of Triangulation

- Denzin (1970) extended the idea of triangulation beyond its conventional association with research methods and designs. He distinguished four forms of triangulation. Denzin (1978) identified four basic types of triangulation:
- **Data Triangulation**: Involves time, space, and persons or use of more than one resource for the collection of data. Here it involves more than two different times of research, two different persons or two different places for conducting research.
- **Investigator Triangulation**: Involves multiple researchers in an investigation and later trying for a meta analysis or pattern identification for finding the similar pattern in the result of the study.
- **Theory Triangulation: I**nvolves using more than one theoretical scheme (or hypothesis) in the interpretation of the phenomenon. It is called interdisciplinary triangulation.
- **Supplementary:** Sometimes this meaning of triangulation is taken to include the combined **use of QUANTITATIVE RESEARCH and QUALITATIVE RESEARCH to determine how far they arrive at convergent findings (MULTIMETHOD RESEARCH).**

Types Of Triangulation

- **Methodological Triangulation:** Involves using more than one method to gather data, such as interviews, observations, questionnaires, and documents.
- **Environmental Triangulation** (not as identified by Denzin): **Data Triangulation and Environmental Triangulation are identified by Denzin as similar.**
- **Validity of the tool and reliability of the process should be established for every research.**
- **Validity, in qualitative research, refers to whether the findings of a study are true and certain—"true" in the sense that research findings accurately reflect the situation, and "certain" in the sense that research findings are supported by the evidence.** Triangulation is a method used by qualitative researchers to check and establish validity in their studies by analyzing a research question from multiple perspectives. Patton (2002) cautions that it is a common misconception that the goal of triangulation is to arrive at consistency across data sources or approaches; in fact, such inconsistencies may be likely given the relative strengths of different approaches. In Patton's view, these inconsistencies should not be seen as weakening the evidence, but should be viewed as an opportunity to uncover deeper meaning in the data.
- **Brain Teaser:** Research Phenomenon should be as the possibilities of life and not the absolute measure. **Is it?**

Types Of Triangulation

Denzin (1970) extended the idea of triangulation beyond its conventional association with research methods and designs. He distinguished four forms of triangulation:

1. *Data triangulation*, which entails gathering data through several sampling strategies, so that slices of data at different times and social situations, as well as on a variety of people, are gathered.
2. *Investigator triangulation*, which refers to the use of more than one researcher in the field to gather and interpret data.
3. *Theoretical triangulation*, which refers to the use of more than one theoretical position in interpreting data.
4. *Methodological triangulation*, which refers to the use of more than one method for gathering data.

Types Of Triangulation: Data Triangulation

- Data triangulation entails gathering data through several sampling strategies, so that slices of data at different times and social situations, as well as on a variety of people, are gathered. It involves **using different *sources of* information in order to increase the validity of a study.** In extension, these sources are likely to be stakeholders in a program-participants, other researchers, program staff, other community members, and so on. In the case of an afterschool program, for example, the research process would start by identifying the stakeholder groups **(snowball sampling or through the clustered or stratified sampling)** such as youth in the program, their parents, school teachers, and school administrators.
- **In-depth interviews could be conducted with each of these groups to gain insight into their perspectives on program outcomes.** During the analysis stage, feedback from the stakeholder groups **(probably through focus group discussion)** would be compared to determine areas of agreement as well as areas of divergence.
- **This type of triangulation, where the researchers use different sources, is perhaps the most popular because it is the easiest to implement; data triangulation is particularly well suited for Extension given the different stakeholder groups that have vested interest in these programs.**
- **Supplementary:** Focus group discussion method of data collection not only supply you with additional or complementary information regarding the data of the study, it also helps as an overview for different methods of data collection that you have on your head to implement on your research study.

Types Of Triangulation: Investigator Triangulation

- **Investigator triangulation involves using several different investigators in the analysis process**. **Typically, this manifests as an evaluation team consisting of colleagues (students doing research in same area with different variables under consideration and later having a cross check: Variable analysis Investigator Triangulation)** within a field of study wherein each investigator examines the program with the same qualitative method (interview, observation, case study, or focus groups).
- The findings from each evaluator would then be compared to develop a broader and deeper understanding of how the different investigators view the issue. If the findings from the different evaluators arrive at the same conclusion, then our confidence in the findings would be heightened. **This type of study gives a sense of focus to the same area of consideration and gives a rich conclusion.** This type of study helps to determine the prospect within a area and not only evaluating a area or phenomenon.
- **For example, suppose a researcher is conducting pre- and post-observations of youth in the 4-H public speaking program to assess changes in nonverbal communication and public speaking skills**. In order to triangulate the data, it would be necessary to line up different colleagues in the same field to serve as evaluators. They would be given the same observation check sheet for pre- and post-observations, and after analysis, validity would be established for the practices and skills that were identified by each observer. While this is an effective method of establishing validity, it may not always be practical to assemble different investigators given time constraints and individual schedules.

Types Of Triangulation: Methodological Triangulation

observation. Sometimes this meaning of triangulation is taken to include the combined use of QUANTITATIVE RESEARCH and QUALITATIVE RESEARCH to determine how far they arrive at convergent findings (see MULTIMETHOD RESEARCH). For example, a study in the United Kingdom by Hughes et al. (1997) of the consumption of "designer drinks" by young people employed both structured interviews and focus groups. The two sets of data were mutually confirming in that they showed a clear pattern of age differences in attitudes toward these types of alcoholic drinks.

Types Of Triangulation: Methodological Triangulation

- Methodological triangulation involves the use of multiple qualitative and/or quantitative methods to study the program. For example, results from surveys, focus groups, and interviews could be compared to see if similar results are being found. If the conclusions from each of the methods are the same, then validity is established.
- 1) **For example-** a survey regarding how much a youth consume a drink can be quantitative in approach. At the same time if we determine the attitude of youths regarding that particular drink, it becomes qualitative in approach. We use both of these methods of data collection to draw out inferences. Not this approach becomes methodological triangulation.
- **2) <u>For example-</u> suppose a researcher is conducting a case study of a Welfare-to-Work participant to document changes in her life as a result of participating in the program over a one-year period (other example may be like studying a scout recruit over the years and knowing about whether there is juvenile delinquencies). <u>A researcher</u>** would use interviewing, observation, document analysis, or any other feasible method to assess the changes. A researcher could also survey the participant, her family members, and case workers as a quantitative strategy. If the findings from all of the methods draw the same or similar conclusions, then validity has been established. While this method is popular, it generally requires more resources. Likewise, it requires more time to analyze the information yielded by the different methods.
- **<u>Brain teaser:</u>** Defining different types of Triangulation in Research show the peculiar advantage of Methodological Triangulation over other types.

Types Of Triangulation: Theory Triangulation

- **<u>Theory triangulation involves the use of multiple perspectives to interpret a single set of data.</u>** Unlike investigator triangulation, this method typically entails using professionals outside of a particular field of study. Theory triangulation is also called **<u>interdisciplinary triangulation</u>**.
- **One popular approach is to bring together people from different disciplines; however, individuals within disciplines may be used as long as they are in different status positions.** In theory, it is believed that individuals from different disciplines or positions bring different perspectives. Therefore if each evaluator from the different disciplines interprets the information in the same way, then validity is established.
- For example, suppose a researcher is interviewing participants from a nutrition program to learn what healthy lifestyle practice changes they attribute to participating in a program. To triangulate the information, a researcher could then share the transcripts with colleagues in different disciplines (i.e., nutrition, nursing, pharmacy, public health education, etc.) to see what their interpretations are. As with investigator triangulation (investigator from the same filed), this method can be time-consuming and may not be feasible in all situations.
- **Theory triangulation is more like investigator triangulation but theory triangulation uses investigator from different disciplines and in investigator triangulation investigator from the same field are used to study a phenomenon.**
- **<u>Brain Teaser:</u>** What about using different hypothesis to test a phenomenon and concluding to the same result? Is it possible?

Types Of Triangulation: Environmental Triangulation

- This type of triangulation involves the use of different locations, settings, and other key factors related to the environment in which the study took place, such as the time, day, or season. The key is identifying which environmental factors, if any, might influence the information that is received during the study. **These environmental factors are changed to see if the findings are the same across settings. If the findings remain the same under varying environmental conditions, then validity has been established.**
- For example, suppose a researcher wants to evaluate the effectiveness of a money-management program in order to determine if the program helps participants develop budgets to increase savings. If the evaluation occurs during the holiday season, there may be different results because spending is greatly increased during that time of year. In order to triangulate the data, a researcher would need to evaluate the budgeting, spending, and saving habits of participants throughout the year in order to gather true and certain information on their behavior changes. **Unlike the other types of triangulation, environmental triangulation cannot be used in every case. It is only used when it is likely that the findings may be influenced by environmental factors.**
- As a social worker observing a depression patients (under medication), we can frame up his observation at different times of the day and also use any depression inventory to evaluate what is his depression at these points of the day. It may be helpful to ascertain whether there is similar pattern in his behaviour or not due to the depression.
- Also environmental triangulation can be used in studying the reproductive behaviour of birds and animals.

Advantages of Triangulation

- The benefits of triangulation include “increasing confidence in research data, creating innovative ways of understanding a phenomenon, revealing unique findings, challenging or integrating theories, and providing a clearer understanding of the problem” (Thurmond, 2001, p. 254). These benefits largely result from the diversity and quantity of data that can be used for analysis.
- For example, *Burr (1998) used multiple triangulations to obtain a more comprehensive view of family needs in critical care. Through the use of questionnaires and selective participant interviews, this researcher found that family members who were interviewed found the sessions therapeutic, but those who were not interviewed could only communicate their frustrations on questionnaires (Thurmond, 2001, p. 254).*
- Thus, using interviews as well as questionnaires added a depth to the results that would not have been possible using a single-strategy study, thereby increasing the validity and utility of the findings.

Disadvantages of Triangulation

- One of the primary disadvantages of triangulation is that it can be time-consuming Collecting more data requires greater planning and organization—resources that are not always available to lead researchers (Thurmond, 2001). It is also costly and tedious because of the complexity in collecting, organizing data and drawing out results and inferences using whole lot of the statistical tool.
- Other disadvantages include the "possible disharmony based on investigator biases, conflicts because of theoretical frameworks, and lack of understanding about why triangulation strategies were used" (Thurmond, 2001, p. 256).
- **Conclusion:** Quite simply, triangulation is a useful tool to use in qualitative research, but one should weigh the advantages and disadvantages before application in Extension (use of triangulation has been referred to as extension of the world of qualitative inquiry) work.
- If researchers decide that triangulation is desired, there are several types of triangulation that can be used: data, investigator, theory, methodological, and environmental.
- Triangulation can be used to deepen the researchers' understanding of the issues and maximize their confidence in the findings of qualitative studies.

Criticism to Triangulation

The idea of triangulation has been criticized on several grounds. First, it is sometimes accused of subscribing to a naive REALISM that implies that there can be a single definitive account of the social world. Such realist positions have come under attack from writers aligned with CONSTRUCTIONISM and who argue that research findings should be seen as just one among many possible renditions of social life. On the other hand, writers working within a constructionist framework do not deny the potential of triangulation; instead, they depict its utility in terms of adding a sense of richness and complexity to an inquiry. As such, triangulation becomes a device for enhancing the credibility and persuasiveness of a research account. A second criticism is that triangulation assumes that sets of data deriving from different research methods can be unambiguously compared and regarded as equivalent in terms of their capacity to address a research question. Such a view fails to take account of the different social circumstances associated with the administration of different research methods, especially those associated with a between-methods approach (following Denzin's [1970] distinction). For example, the apparent failure of findings deriving from the administration of a STRUCTURED INTERVIEW to converge with FOCUS GROUP data may have more to do with the possibility that the former taps private views as opposed to the more general ones that might be voiced in the more public arena of the focus group.

Criticism to Triangulation

- A second criticism is that triangulation assumes that sets of data deriving from different research methods can be unambiguously compared and regarded as equivalent in terms of their capacity to address a research question (which is not because of different source there is considerable changes in value (numerical) of data). Such a view fails to take account of the different social circumstances associated with the administration of different research methods, especially those associated with a between-methods approach (following Denzin’s [1970] distinction).
- Research are for defining and discovering the possible realities of life. Using triangulation we can’t lock it into the core of absoluteness.
- Can data derived from different ways and source be compared to conclude to a conclusion? This is one of the critical avenue in using the triangulation.

Statistical Procedures

Unit V

Introduction

Statistical Procedures: Overview (Definition and Necessity)

- **Statistics is understood as the set of data collected by using scientific methods (in contrast research involve the whole process of inquiry or investigation and also include data collection method), and analyzing those data for the presentation of in tables, diagrams and textual writings.**
- **Thus collection, analysis and drawing out inferences and presenting those inferences can be said as the statistics.**
- Analysis can be inductive or deductive. (How?) We can form a larger inferences from smaller inferences (does it means adding value to the variables?). Analysis can be deductive when we derive a small inference from a large chunk of statistical data.
- **Statistical activities are understood as: 1) Inference making by estimating the statistical parameters and testing the hypothesis about those parameters. 2) Establishing of the casual relationships between various variables under investigation. 3) Making predictions and forecast i.e. hypothesis setting and then testing(and then analyzing result and interpreting them). This process is the predicting of the phenomenon.**
- If the statistical inference or result of data collected is according to the hypothesis set (null hypothesis), the hypothesis is said to be predicted (accepted) or otherwise the alternative hypothesis is said to be accepted ~~(which in sense applies that the hypothesis set is rejected, is it?).~~
- Probability asserts that events have chances of happening. Theory of probability states that every events or phenomenon is the probability of events and their occurrence is not absolute.

Statistical Procedures: Overview

- **<u>Variability</u>**: You can either add some values to the variable or deduct or multiply the existing value.
- Independent variables, their variations or control is said to be the manipulation. This manipulation is the cause of a phenomenon and not the variable alone. Whereas dependent variables are the byproduct or effect of a phenomenon.
- **<u>History:</u>** Statistics as referred as the **State Of The Art Craft** and **Science Of Information**, in ancient times, were used for counting the population and for collecting information about economic activities. Thus it was then used in political decisions so then this discipline was also counted as **Political Arithmetic**. Then statistics should have primarily been used in taxation.
- Definition: As according to J.F. Von Biefiled statistics is defined as the – science that teaches us what is the political arrangement of all modern states of the known world.
- However as states moved from their primitive stage of development to earlier development stages, the coverage of statistics also expanded to cover other social variables. Later the development of the theory of probability (Theory of probability states that every events or phenomenon is the probability of events and their occurrence is not absolute or every events have the equal chances of happening) and its application in explaining many physical and social phenomenon made is possible for the development of present day statistics used to explain the cause and effect relationship of variables.

Statistical Procedures: Overview

- The term "**Statistics**" appear to have been derived from the Latin word '*status*' or the Italian word statista, both meaning a political state. It is a controversial argument as who brought this word statistic into practice. It has been taken granted that the Gottfried Achenwall in 1749 was the first to use the term who referred this to a subject matter as a whole and defined as the " the political science of the several countries."
- In those days statistics was used only to collect the information regarding to the population of the state military and the fiscal polices. So at the time statistics was considered only as the science of statecraft. However with the passage of time the science of statistics has been applied very widely. There is hardly any place of human activity where statistics has not been applied.
- **<u>Supplementary:</u> Parameters here means statistical consideration or boundary. Parameters are the statistical measures (mean, standard deviation, variance, etc.) that deals (or measure) with the population characteristics as height, weight, education, intelligence etc. The measure that deal with the sample from the population is called Statistics.**

Statistical Procedures: Overview

- **Definitions of Statistics:** There are many definitions of statistics and the most general one is, *'Statistics is the branch of scientific method which deals with the data obtained by counting or measuring the properties of natural phenomenon.'*
- The more specific definitions by different writers are:
- A.L Bowley: 'statistics is the science of coursing and is also the science of averages'
- Boddigton has defined 'statistics as the science of estimates and probabilities'
- Croxton and Cowden have given a very comprehensive definition of statistics 'statistics may be defined as the collection, presentation, analysis and interpretation of numerical data.'
- So, this definition cleverly covers the following aspects of statistics:
- **Collection of data**: For any statistical investigation the data must be collected first. The result of analysis and its interpretation depends upon the data collected. So the data should be collected very carefully. If the data collected are faulty the result or the conclusion derived may not be reliable.
- **Organization:** The data may be obtained from different sources. If the data is obtained form the published source, it will generally be in the organized form. If the data is obtained from some sort of survey then it needs organization. The data are organized by editing, classifying and tabulating them.

Statistical Procedures: Overview

- **Presentation**: After collecting and organizing the data, the next step is to present them systematically so that they can be presented in various forms such as table, diagrammatic representation in the form of graphs, etc. Even textual presentation of data can be done.
- **Analysis**: After the collection, organization and presentation of data, the next step is to analyze the data. Various statistical tools like average, dispersion, correlation, test of significance etc. can be used to analysis the data. Statistical tool or appropriate technique of analysis depends upon the nature of the data and the purpose of the inquiry.
- **Interpretation**: This step of the statistical inquiry is to interpret the result obtained from the analysis. To interpret means to draw a valid conclusion form the data that has been analyzed. For the interpretation of data high degree of skill, experience is necessary because without it may be we are not able to interpret the data properly and may derive false conclusion. Actually interpretation of data is required to signify the analysis or the conclusion.

Statistical Procedures: FACTS AND SCOPE

- Modern statistics is the collection, analysis and interpretation of the data.
- Statistics is applicable to a wide variety of academic disciplines, including natural and social sciences, government, and business.
- Statistical relationships and estimates are not exact as in case of mathematics. There are always probable errors and degree of uncertainties (significance level; where as degree of certainty is called confidence level) in statistical findings.
- Statistical calculations can be done only when the information, facts or message called data are in numerical form or can be converted to numerical figures by proper scaling. As said, “ No statement or a sentence is a fact unless it is presented by numerical figures.”
- As like the objectives of statistics align towards the research topic, the hypothesis should align towards the objectives.
- Statistics has emerged as integral part of decision making procedures of the model world.
- Statistics has been considered as soft mathematics, otherwise until 1970’s statistics was said to be the part of mathematics as must of the works in statistics were done by physicists and mathematicians like Pascal, James Bernoulli, Laplace, Gauss, etc. many still refer statistics as the numerical data and record published by government and other agencies.
- **Supplementary:** “Its better to be further away from the truth and know how far than to be nearer and not know how near.”
- **How a statistician thinks about data is very important!**

Functions of Statistics

- Modern day statistics is basically of two distinct branches.
- The first branch being **Statistical Method**, that deals with the technique varying from collection of data to inference drawing from the analysis of those data. This method helps to identify causes to the events or phenomenon, predict the value of one variable based on the value of other variables and also to make forecasts and prediction on the basis of observed relationships among variables
- The next branch being **Theory of Probability**. This branch is mainly concerned with the chances of happening and not happening of a event and also with the prediction and establishment of relationships between various variables.
- Overall the **Function of Statistics** can be summarized based on these retrospect:
- Collection of information by using scientific methods;
- Generation of numerical data by appropriate coding or scaling;
- Presentation of data (in tabular form);
- Analysis of the data and inference drawing from the analysis of data;
- Study of probability of happening and non happening of the evens;
- Making decision with the certain risks or drawing out the inferences.
- **Brain Teaser:** Nominal: very small or so called or in name only or supposed (What about nominal scale?)

Types of Statistics

- Statistical methods can summarize or describe a collection of data. This is called *descriptive statistics*. This is particularly useful in communicating the results of experiments and research. In addition, data patterns may be modeled in a way that accounts for randomness and uncertainty in the observations.
- These models can be used to draw inferences about the process or population under study—a practice called *inferential statistics*. Inference is a vital element of scientific advance, since it provides a way to draw conclusions from data that are subject to random variation. To prove the propositions being investigated further, the conclusions are tested as well, as part of the scientific method. Descriptive statistics and analysis of the new data tend to provide more information as to the truth of the proposition.
- "Applied statistics" comprises descriptive statistics and the application of inferential statistics. Theoretical *statistics* concerns both the logical arguments underlying justification of approaches to statistical inference, as well encompassing *mathematical statistics*. Mathematical statistics includes not only the manipulation of probability distributions necessary for deriving results related to methods of estimation and inference, but also various aspects of computational statistics and the design of experiments.

Types of Statistics

- Descriptive statistics summarize the population data by describing what was observed in the sample numerically or graphically. Numerical descriptors include mean and standard deviation for continuous data types (like heights or weights), while frequency and percentage are more useful in terms of describing categorical data (like race).
- Inferential statistics uses patterns in the sample data to draw inferences about the population represented, accounting for randomness. These inferences may take the form of: answering yes/no questions about the data (hypothesis testing), estimating numerical characteristics of the data (estimation), describing associations within the data (correlation) and modeling relationships within the data (for example, using regression analysis). Inference can extend to forecasting, prediction and estimation of unobserved values either in or associated with the population being studied; it can include extrapolation and interpolation of time series or spatial data, and can also include data mining.
- Supplementary: "... **it is only the manipulation of uncertainty that interests us. We are not concerned with the matter that is uncertain. Thus we do not study the mechanism of rain; only whether it will rain.”** Dennis Lindley,

Statistics: Probability and Sampling

- Statistics is closely related to probability theory, with which it is often grouped. The difference is, roughly, that probability theory starts from the given parameters of a total population to deduce probabilities that pertain to samples. Statistical inference, however, moves in the opposite direction—inductively inferring from samples to the parameters of a larger or total population. Statistics has many ties to machine learning and data mining. More or so in undergraduate course the theory of probability is just meant to derive a probabilistic or representative sample so that we can inquiry over.
- In applying statistics to a scientific, industrial, or societal problem, it is necessary to begin with a population or process to be studied. Populations can be diverse topics such as "all persons living in a country" or "every atom composing a crystal". **A population can be said as the whole subjects, phenomenon or events or variables under study scope/ area (is it?).** A population can also be composed of observations of a process at various times, with the data from each observation serving as a different member of the overall group. Data collected about this kind of "population" constitutes what is called a time series.
- For practical reasons, a chosen subset of the population called a sample is studied—as opposed to compiling data about the entire group (an operation called census). Once a sample that is representative of the population is determined, data is collected for the sample members in an observational or experimental setting. This data can then be subjected to statistical analysis, serving two related purposes: description and inference.

Statistics: Probability and Sampling

- To use a sample as a guide to an entire population, it is important that it truly represent the overall population. **Representative sampling assures that inferences and conclusions can safely extend from the sample to the population as a whole. A major problem lies in determining the extent that the sample chosen is actually representative.** Statistics offers methods to estimate and correct for any random trending within the sample and data collection procedures. There are also methods of experimental design for experiments that can lessen these issues relating with whether a sample is representative or not.
- Misuse of statistics can produce subtle, but serious errors in description and interpretation—subtle in the sense that even experienced professionals make such errors, and serious in the sense that they can lead to devastating decision errors. For instance, social policy, medical practice, and the reliability of structures like bridges all rely on the proper use of statistics. See below for further discussion.

Statistics: Use in experimental and observation studies

- A common goal for a statistical research project is to investigate causality, and in particular to draw a conclusion on the effect of changes in the values of predictors or independent variables on dependent variables or response. There are two major types of causal statistical studies: experimental studies and observational studies. In both types of studies, the effect of differences of an independent variable (or variables) on the behavior of the dependent variable are observed. The difference between the two types lies in how the study is actually conducted. Each can be very effective. An experimental study involves taking measurements of the system under study, manipulating the system, and then taking additional measurements using the same procedure to determine if the manipulation has modified the values of the measurements. In contrast, an observational study does not involve experimental manipulation. Instead, data are gathered and correlations between predictors and response are investigated.

Postulates

- There are three basic postulates of measurements. These postulates concerns about the relationships between objects being measured. These postulates are:
- **1) Either x=y or x# (is not equal to) y but not both**
- **2) If x=y and y = z then x = z**
- **3) If x>y and y> z then x> z**
- It should be understood that when we say x= y, it is not necessary that x and y are same. It needs to be understood that they are sufficiently similar to be classified as member of the same set (e.g.. Person with schizophrenia) if viewed with same criterion or seen under same classification.
- In physical measurements the postulates 3 is always true. However in behavioural science, it is not so. For example if **a** is longer than **b** and **b** is longer than **c** then definitely **a** is longer than **c**. But suppose **a** (wife) dominates husband **b** and **b** dominates child **c**. It is not necessary **a** (wife) dominates **c** (child) instead child may dominate mother.
- Therefore the postulates formulated above should not be assumed to be true. They can be proved true.
- **There are basically 4 types of measurement scales. They are nominal, ordinal, interval and ratio scale.**

Levels of Measurements

- Various attempts have been made to produce a taxonomy of levels of measurement. The psychophysicist Stanley Smith Stevens **defined nominal, ordinal, interval, and ratio scales.**
- Nominal measurements do not have meaningful rank order among values, and permit any one-to-one transformation.
- Ordinal measurements have imprecise differences between consecutive values, but have a meaningful order to those values, and permit any order-preserving transformation.
- Interval measurements have meaningful distances between measurements defined, but the zero value is arbitrary (as in the case with longitude and temperature measurements in Celsius or Fahrenheit), and permit any linear transformation.
- Ratio measurements have both a meaningful zero value and the distances between different measurements defined, and permit any rescaling transformation. (How?)
- The issue of whether or not it is appropriate to apply different kinds of statistical methods to data obtained from different kinds of measurement procedures (by the use of methods of data collection) is complicated by issues concerning the transformation of variables and the precise interpretation of research questions.
- **"The relationship between the data and what they describe merely reflects the fact that certain kinds of statistical statements may have truth values which are not invariant under some transformations.** Whether or not a transformation is sensible to contemplate depends on the question one is trying to answer“.

* Levels of Measurements

Main article: Levels of measurement

Various attempts have been made to produce a taxonomy of levels of measurement. The psychophysicist Stanley Smith Stevens defined nominal, ordinal, interval, and ratio scales. Nominal measurements do not have meaningful rank order among values, and permit any one-to-one transformation. Ordinal measurements have imprecise differences between consecutive values, but have a meaningful order to those values, and permit any order-preserving transformation. Interval measurements have meaningful distances between measurements defined, but the zero value is arbitrary (as in the case with longitude and temperature measurements in Celsius or Fahrenheit), and permit any linear transformation. Ratio measurements have both a meaningful zero value and the distances between different measurements defined, and permit any rescaling transformation.

Because variables conforming only to nominal or ordinal measurements cannot be reasonably measured numerically, sometimes they are grouped together as categorical variables, whereas ratio and interval measurements are grouped together as quantitative variables, which can be either discrete or continuous, due to their numerical nature.

Other categorizations have been proposed. For example, Mosteller and Tukey (1977)[20] distinguished grades, ranks, counted fractions, counts, amounts, and balances. Nelder (1990)[21] described continuous counts, continuous ratios, count ratios, and categorical modes of data. See also Chrisman (1998),[22] van den Berg (1991).[23]

The issue of whether or not it is appropriate to apply different kinds of statistical methods to data obtained from different kinds of measurement procedures is complicated by issues concerning the transformation of variables and the precise interpretation of research questions. "The relationship between the data and what they describe merely reflects the fact that certain kinds of statistical statements may have truth values which are not invariant under some transformations. Whether or not a transformation is sensible to contemplate depends on the question one is trying to answer" (Hand, 2004, p. 82).[24]

Nominal Scale

- The lowest level of measurement is the nominal scale. In this scale, the numerals (may be digit but not number with values) or the symbols are assigned to objects in order to distinguish one object or event or phenomenon from other. The numerals or symbols used have no numerical meanings. They cant be added or assigned in order.
- **The requirements of nominal scale are simple. The first requirements is- all the members of a set are assigned the same numerals or symbols and no two sets are assigned the same numeral or symbol.**
- Assignments of numeral or jersey numbers to football players are the examples of nominal scale. In psychiatric system of diagnosing the groups of depressed persons, the groups are classified as **People with schizophrenia (not Schizophrenics as now, because the word has been now stated as stereotyping or taboo), person with mania,** etc. Such classification is said to be done in nominal scale because groups are classified by some characteristics denoted by symbols.
- The second requirement is that postulates 1 and 2 are satisfied.
- Since the classification is the major objective of the nominal scale, it is also called **classification scale.** In nominal scale, the scaling operation is the partitioning of the given universe into a number of mutually exclusively subsets (common properties, common classification). Only the relation involved is that of equivalence. That is the members of any one subset must be equivalent in the property being scaled.

Ordinal Scale

- In this scale the postulates 3 is satisfied. The groups are compared to show one is higher or more than other. **The characteristics of a scale is that all objects within a group are equivalent and each and every member of this group is greater than each and every member of other group.** E.g. Colonel, Lieutenant, Hawaldar, Sepoy, etc. in this scale symbols used doesn't classify the army personnel of the groups but represent rank order or superiority. the value of superiority and his power can not be ascertained through ordinal scale. (e.g Sometimes a Hawaldar is responsible fro the resignation of a minister even though we know a minister is highly ranked than a Hawaldar)
- **Symbols used in ordinal scale indicate rank order and nothing more. The symbols or numerals don't indicate absolute quantities or values nor do they indicate that the intervals between the numerals are equal. For instance if two subjects have the ranks 6 and 5 and two other subjects have the rank 4 and 3, we can't say that the difference of ranks in the first and second pairs are equal.** There is also no way to know that any individual has none (zero) of the property being measured.
- Ordinal scales are not equal interval scales because they don't have absolute zero points. An ordinal scale also doesn't have a zero point that makes it difficult to know (if we wish) the zero rank in army.
- A good scale should have a defined continuum, should be reliable and valid.

Interval Scale

- It is extended form of ordinal scale where the distance between any two numeral must be exactly known, i.e. the mapping of several classes of objects is so precise that how large are the intervals (distances) between all the objects on the scale are completely know. To make it possible, therefore an interval scale is characterized by a common and constant unit of measurement which assigns real numbers to all pairs of subject in ordered set.
- This makes the rations of any two intervals independent of the unit of measurement and the zero point. That is , it is irrelevant whether the unit of temperature is taken as Fahrenheit or Celsius (Centigrade) Both the units provide the same amount of information. This is because the units can be transferred to one another by certain relationships.
- Similarly in psychology of mentally retarded, a mildly retarded is said to be the one with IQ 50/55 to 70. **For Mildly Retarded it is 50/55 to 70, for Moderately Retarded it is 35/40 to 50/55, for Severely Retarded it is 20/25 to 35/40 and for Profoundly Retarded it is below 20/25. Here there is 15 IQ score interval in between types of mentally retarded.**

Interval Scale

- In interval scale, the numerals with quantitative meaning may be associated with the position of the objects so that the operation of arithmetic may be meaningfully performed. In this scale therefore not only the equivalence (=) as in the nominal scale and the greater than (›) relations as in ordinal scale but also the ratio of any two intervals are specified (additional postulate namely 4). Because of this property, the interval scale is considered as first truly constructed quantitative scale. And this scale is extensively used in studies of physical sciences.

Ratio Scale

- **It is the extension of interval scale and the extension is made by including a true zero point as its origin.** In this scale, the ratio of two points is independent of the units of measurement. For example, the measurements of heights, weights have a true zero points and the heights measure in feet or centimeter, the weight measured in pounds or grams have the identical ratios.
- E.g. 4kg/3kg = 4gm/3gm
- The operation and relations which give rise to the numerical values in the ratio scale are such that the scale is isomorphic to the structure of arithmetic. The numbers associated with the ratio scale are "True Numbers with true zero". **~~In this scale, only the unit of measurement is arbitrary.~~ (What?) actually when we determine ratio, the ratio lack any unit.**

Needs for Scaling

- Various kinds of scales are used to measure the physical or psychosocial phenomenon. The measurement result in quantitative figures. The scales discussed above are meant actually for measuring the physical phenomenon. But in many social phenomenon, above scales couldn’t be used for measurement because the variables cant be directly quantified. Social phenomenon such as Social status, Standard of Living, Personality or abstract things like Attitude or Opinion of person cant be measured directly as like measuring the height of a person with a meter tape. But quantitative description of the phenomenon is necessary in order to make study scientific one and also taking the data into statistical consideration. Therefore the qualitative characteristics are to be converted to quantitative figures by using appropriate social scales developed by social scientists or developing own scale.
- **Usually calibrating the continuum of a phenomenon and marking each continuum as 0 to some easily countable numbers has been used in psychosocial studies as a form of measurement. In continuum scale every point in the scale should be in sequential order. There are 5 hierarchies (continuum) in Maslow's Hierarchy of Need Theory for motivation. Here we can make a scale of 0 to 4 or 1 to 5 for if we wish to convert some question item to numerical rank or score.**

Statistical Procedures

Unit V

Chapter a) Frequency and Frequency Distribution Bar Diagram, Histograms, Pie Chart, Frequency Curves, Frequency Polygon, Ogive

Frequency, Frequency Distributions and Class Intervals and Cumulative Frequency

- **Frequency is the number of times of occurrence of an event or object or phenomenon.**
- **Similarly** a **frequency distribution** is an arrangement of the values (frequency) that one or more variables take in a sample. Each entry in the table contains the frequency or count of the occurrences of values within a particular group or interval, and in this way, the table summarizes the distribution of values in the sample.
- Frequency distribution is meant for organizing disorganized (is it just collected data?) data to summarize it for statistical computation or drawing out an inference regarding results or frequency itself. Thus a **frequency distribution** shows us a summarized grouping of data divided into **mutually exclusive classes (the properties of a class doesn't match the properties of other class of organized data)** and the number of occurrences in a class. It is a way of showing unorganized data e.g. to show results of an election, income of people for a certain region, sales of a product within a certain period, student loan amounts of graduates, etc. Some of the graphs that can be used with frequency distributions are histograms, line charts, bar charts and pie charts. Frequency distributions are used for both qualitative and quantitative data.

Relative and Cumulative Frequency

- A table listing all classes and their relative frequencies is called a relative frequency distribution. The relative frequencies provide the most relevant information as to the pattern of the data. One should also state the sample size, which serves as an indicator of the creditability of the relative frequencies. Relative frequencies sum to 1 (100%).
- A cumulative frequency (cumulative relative frequency) is obtained by summing the frequencies (relative frequencies) of all classes up to the specific class. In a case of qualitative variables, cumulative frequencies makes sense only for ordinal variables, not for nominal variables.

Frequency Table

A different tabulation scheme aggregates values into bins such that each bin encompasses a range of values. For example, the heights of the students in a class could be organized into the following frequency table.

Height range	Number of students	Cumulative number
less than 5.0 feet	25	25
5.0–5.5 feet	35	60
5.5–6 feet	20	80
6.0–6.5 feet	20	100

A **frequency distribution** shows us a summarized grouping of data divided into mutually exclusive classes and the number of occurrences in a class. It is a way of showing unorganized data e.g. to show results of an election, income of people for a certain region, sales of a product within a certain period, student loan amounts of graduates, etc. Some of the graphs that can be used with frequency distributions are histograms, line charts, bar charts and pie charts. Frequency distributions are used for both qualitative and quantitative data.

Frequency, Frequency Distributions and Class Intervals and Cumulative Frequency*

- Application of frequency distributions: Managing and operating on frequency tabulated data is much simpler than operation on raw data. **There are simple algorithms to calculate median, mean, standard deviation etc. from these tables.**
- Statistical hypothesis testing is founded on the assessment of differences and similarities between frequency distributions. This assessment involves measures of central tendency or averages, such as the mean and median, and measures of variability or statistical dispersion, such as the standard deviation or variance.
- **A frequency distribution is said to be skewed when its mean and median are different.**
- **The kurtosis of a frequency distribution is the concentration of scores at the mean, or how peaked the distribution appears if depicted graphically—for** example, in a histogram.
- If the distribution is more peaked than the normal distribution it is said to be leptokurtic; if less peaked it is said to be platykurtic.
- Letter frequency distributions are also used in frequency analysis to crack codes and are referred to the relative frequency of letters in different languages. (????)
- **Brain Teaser:** In descriptive statistics we are more concerned with frequency distribution rather than values of variables. (Is it?) **Usually descriptive statistics deal with data and the result obtained, whereas inferential statistics deals with drawing our inferences from a research through hypothesis, correlation, regression, etc. Inferential statistics also helps us to estimate and expect new data or their frequency distribution.**

Bar Diagram

- It needs to be understood that diagrammatic presentation of variables or events are more about interpretation of results or inference drawn
- The first bar graph appeared in the 1786 book *The Commercial and Political Atlas*, by William Playfair (1759-1823). **Playfair** was a pioneer in the use of graphical displays and wrote extensively about them.
- A **bar diagram** or **bar chart** or **bar graph** is a chart with rectangular bars with lengths proportional to the values that they represent or the frequency of distribution. The breadth of these rectangles are taken as the same.
- For example: if f (frequency) = A (area of rectangle). For determining the ratio of two rectangles or bar diagram we can use: f1/f2 = L1* b/ L2*b
- Here we can say L1 and L2 are the length of the bar that represent the frequencies of the concerned distributions.
- Brain Teaser: What does "**lengths proportional to the values that they represent**" means? Does it mean for the frequency distribution or value of the variables? It actually means the frequency.
- How can you calculate the length of histograms for class distribution?

Bar Diagram

- **<u>The bars can be plotted vertically or horizontally.</u>** A vertical bar chart is sometimes called a column bar chart.
- A bar graph is a chart that uses either horizontal or vertical bars to show comparisons among categories. One axis of the chart shows the specific categories being compared, and the other axis represents a discrete value. **<u>Some bar graphs present bars clustered in groups of more than one (grouped bar graphs or multiple bar diagram), and others show the bars divided into subparts to show cumulate effect (stacked or divided bar graphs).</u>**
- **In order to determine the size of bars in multiple bar diagram, we need to identify the lowest value observed among different space points included in different time points. We can divide every other value by this lowest value. Then the lengths of other bars are computed as the product of quotients obtained and numerical unit considered for each value. Then for each time point multiple bars one for each component are drawn. E.g. $L_{99} = (T_{99} * L_1)/ T_1$**
- Bar charts have a discrete range. Bar charts are usually scaled (the size of the rectangle that we use as a bar) so all the data can fit on the chart. Bars on the chart may be arranged in any order.
- Bar charts arranged from **<u>highest to lowest incidence are called Pareto charts</u>**. **Normally, bars showing frequency will be arranged in chronological (time) sequence. Grouped bar (multiple) graph usually present the information in the same order in each grouping. Stacked bar (divided bar) graphs present the information in the same sequence on each bar.**

Bar Diagram

- Bar charts provide a visual presentation of **categorical data**. **Categorical data is a grouping of data into discrete groups, such as months of the year, age group, shoe sizes, and animals. These categories are usually qualitative. In a column bar chart, the categories appear along the horizontal axis; the height of the bar corresponds to the value of each category.**
- Bar graphs can also be used for more complex comparisons of data with grouped bar charts and stacked bar charts.[1] In a grouped bar chart, for each categorical group there are two or more bars. These bars are color-coded to represent a particular grouping. For example, a business owner with two stores might make a grouped bar chart with different colored bars to represent each store: the horizontal axis would show the months of the year and the vertical axis would show the revenue. Alternatively, a stacked bar chart could be used. The stacked bar chart stacks bars that represent different groups on top of each other. The height of the resulting bar shows the combined result of the groups. However, stacked bar charts are not suited to datasets where some groups have negative values. In such cases, grouped bar charts are preferable.
- **A bar chart is very useful for recording discrete (independent) data.** Bar charts also look a lot like a histogram, which record continuous data. The difference is NOT that bar charts (can) have spaces between columns and histograms don't (have to have) spaces, the difference is the type of data that each represent. Histogram represent continuous data and the horizontal axis in such diagrammatic representation is done through class intervals.

Example of Pie Chart and Bar Diagram

Nominal data is best displayed by pie chart and ordinal data by horizontal or vertical bar graph.

EXAMPLE 3.1. Let the blood types of 40 persons are as follows:

O O A B A O A A A O B O B O O A O O A A A A AB A B A A O O A O O A A A O A O O AB

Summarizing data in a frequency table by using SPSS:

Analyze -> Descriptive Statistics -> Frequencies,
Analyze -> Custom Tables -> Tables of Frequencies

Table 1: Frequency distribution of blood types

BLOOD

BLOOD		Statistics	
		Frequency	Percent
Valid	O	16	40.0
	A	18	45.0
	B	4	10.0
	AB	2	5.0
	Total	40	100.0

Graphical presentation of data in SPSS:

Graphs -> Interactive -> Pie -> Simple,
Graphs -> Interactive -> Bar

Example of Pie Chart and Bar Diagram

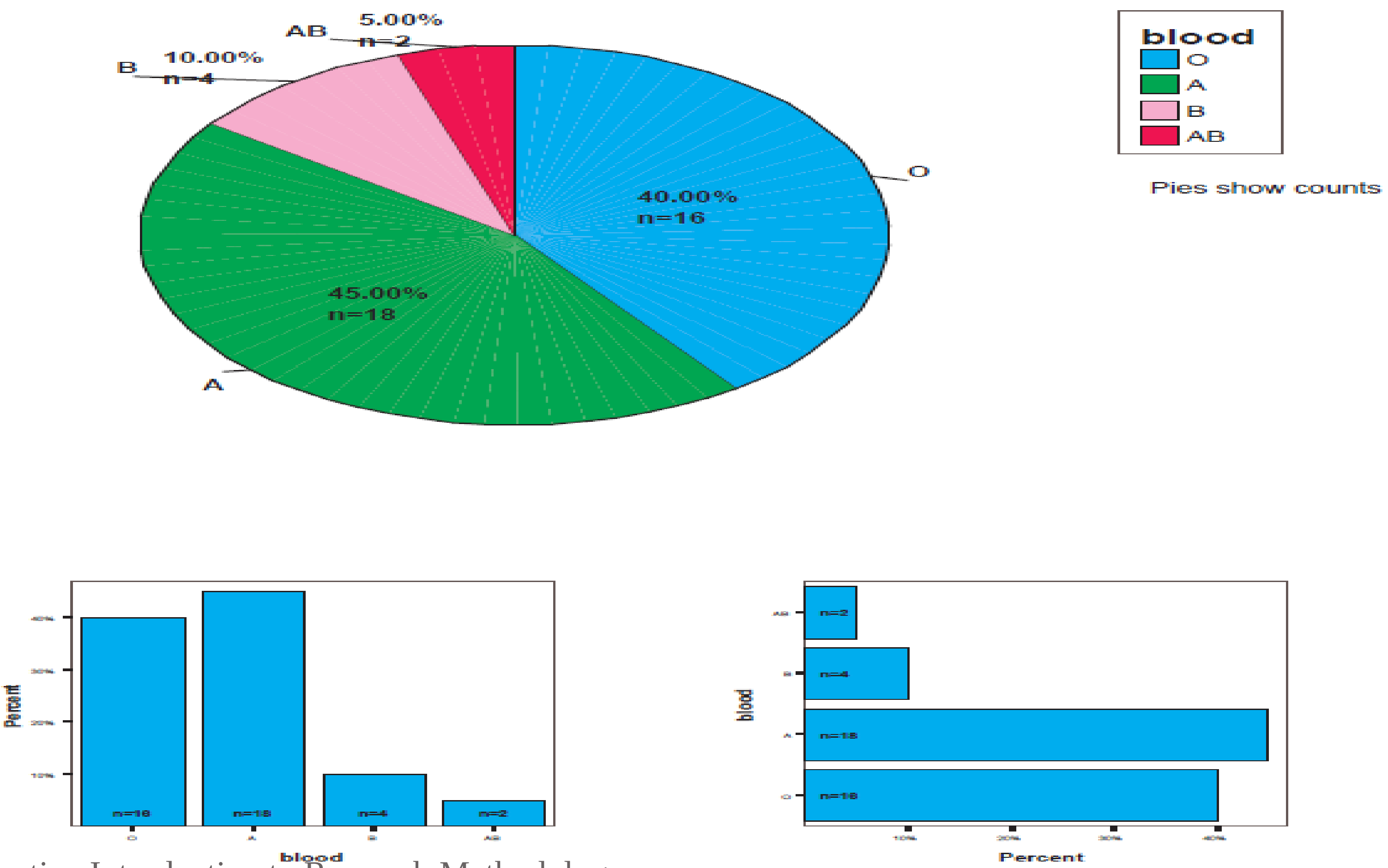


Figure 4: Charts for blood types

Histograms: Overview

- A continuous random variable graphically described by a certain bell-shaped density curve is said to have the **normal distribution**. This distribution is the most important one in statistics. It is important partly because it approximates well the distributions of many variables.
- Histograms of sample data often tend to be approximately bell-shaped. In such cases, we say that the variable is approximately normally distributed. The main reason for its prominence, however, is that most inferential statistical methods make use of properties of the normal distribution even when the sample data are not bell-shaped. Kurtosis relies on the normal distribution curve to determine whether values of variable are distributed around mean.
- The quantitative data are usually presented graphically either as a histogram or as a horizontal or vertical bar graph. The histogram is like a horizontal bar graph except that its bars do touch each other. The histogram is formed from grouped data, displaying either frequencies or relative frequencies (percentages) of each class interval.
- If quantitative data is discrete with only few possible values, then the variable should graphically be presented by a bar graph. Also if some reason it is more reasonable to obtain frequency table for quantitative variable with unequal class intervals, then variable should graphically also be presented by a bar graph!

Histograms: Overview

EXAMPLE 3.2. Age (in years) of 102 people:

34,67,40,72,37,33,42,62,49,32,52,40,31,19,68,55,57,54,37,32,
54,38,20,50,56,48,35,52,29,56,68,65,45,44,54,39,29,56,43,42,
22,30,26,20,48,29,34,27,40,28,45,21,42,38,29,26,62,35,28,24,
44,46,39,29,27,40,22,38,42,39,26,48,39,25,34,56,31,60,32,24,
51,69,28,27,38,56,36,25,46,50,36,58,39,57,55,42,49,38,49,36,
48,44

Summarizing data in a frequency table by using SPSS:

Analyze -> Descriptive Statistics -> Frequencies,
Analyze -> Custom Tables -> Tables of Frequencies

Table 2: Frequency distribution of people's age

Frequency distribution of people's age

		Frequency	Percent	Cumulative Percent
Valid	18 - 22	6	5.9	5.9
	23 - 27	10	9.8	15.7
	28 - 32	14	13.7	29.4
	33 - 37	11	10.8	40.2
	38 - 42	19	18.6	58.8
	43 - 47	8	7.8	66.7
	48 - 52	12	11.8	78.4
	53 - 57	12	11.8	90.2
	58 - 62	4	3.9	94.1
	63 - 67	2	2.0	96.1
	68 - 72	4	3.9	100.0
	Total	102	100.0	

Histograms: Overview

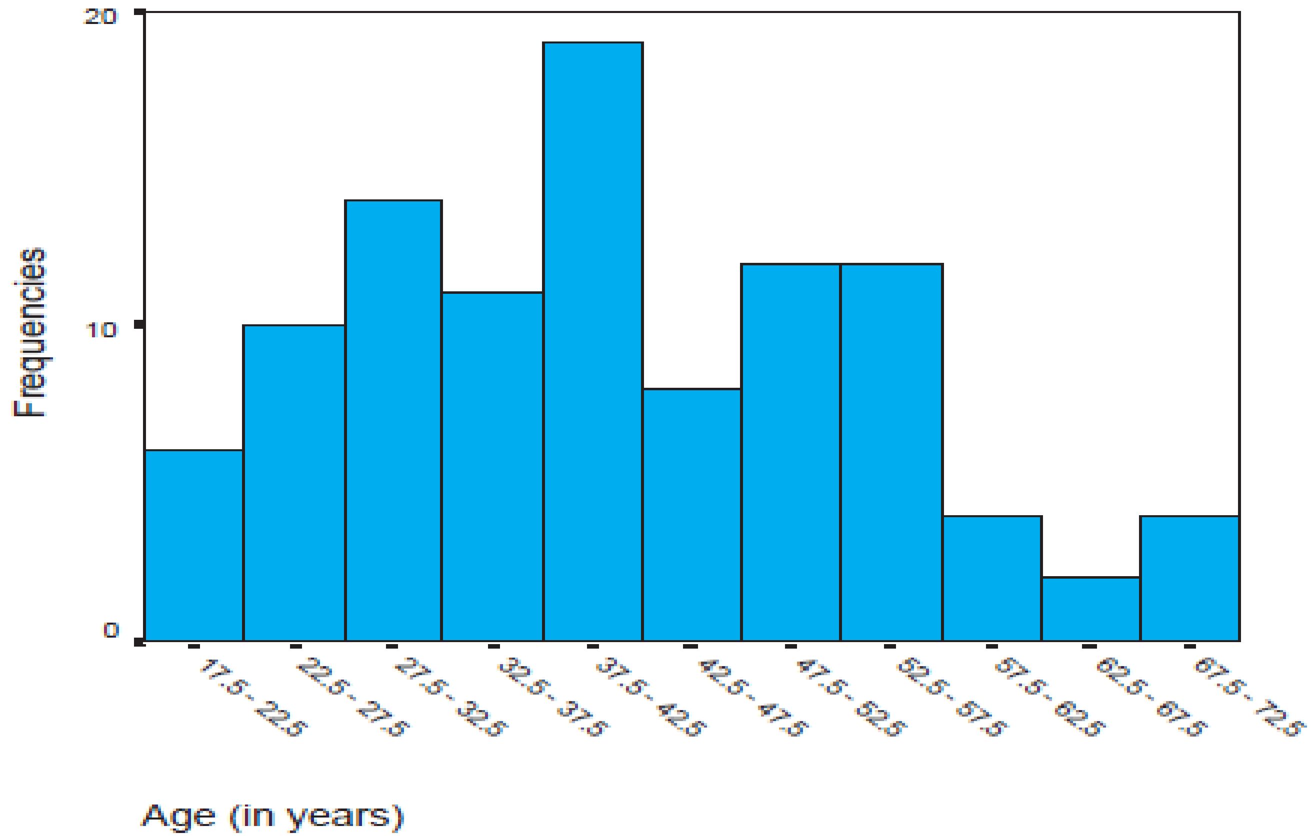


Figure 3: Histogram for people's age

Histograms: Definitions

- A **histogram** is a graphical representation of the distribution of data. It is an estimate of the probability distribution of a continuous variable and was first introduced by Karl Pearson.[1]
- A histogram is a representation of tabulated frequencies, shown as adjacent rectangles, erected over discrete intervals (bins), with continuous data (unlike bars which is erected from discrete data) with an area proportional to the frequency of the observations in the interval.
- The height of a rectangle (here also representing frequency) is also equal to the frequency density of the interval, i.e., the frequency divided by the width of the interval. The total area of the histogram is equal to the number of data.
- **The rectangles of a histogram are drawn so that they touch each other to indicate that the original variable is continuous.**
- In other words, a histogram represents a frequency distribution by means of rectangles whose widths represent class intervals and whose areas are proportional to the corresponding frequencies: the height of each is the average frequency density for the interval. The intervals are placed together in order to show that the data represented by the histogram, while exclusive, is also contiguous. (E.g., in a histogram it is possible to have two connecting intervals of 10.5–20.5 and 20.5–33.5, but not two connecting intervals of 10.5–20.5 and 22.5–32.5. Empty intervals are represented as empty and not skipped.)
- **Brain teaser:** How can we calculate the length of bar represented in histograms? Just calibrate the y-axis and put the bars as according to the value they represent. The first cm of the y axis can be assumed to be 20000 population.

Pie Charts: Definitions

- A **pie chart** is a circular chart divided into sectors, illustrating numerical proportion. A **pie chart is the representation of frequency distribution in a circle but dividing the circle into segments as according to the proportion of various variable.**
- In a pie chart, the arc length of each sector (and consequently its central angle and area), is proportional to the quantity it represents. While it is named for its resemblance to a pie which has been sliced, there are variations on the way it can be presented. **The earliest known pie chart is generally credited to William Playfair's *Statistical Breviary* of 1801.**
- Pie charts are very widely used in the business world and the mass media. However, they have been criticized, and many experts recommend avoiding them, **pointing out that research has shown it is difficult to compare different sections of a given pie chart, or to compare data across different pie charts. Pie charts can be replaced in most cases by other plots such as the bar chart.**
- The earliest known pie chart is generally credited to William Playfair's *Statistical Breviary* of 1801, in which two such graphs are used. This invention was not widely used at first; the French engineer Charles Joseph Minard was one of the first to use it in 1858, in particular in maps where he needed to add information in a third dimension. It has been said that Florence Nightingale invented it, though in fact she just popularised it and she was later assumed to have created it due to the obscurity of Playfair's creation.

Frequency Curve

- A frequency curve is a graph which is obtained by plotting the points (x_i; f_i) where x_i represent the numerical value of i-th element and f_i is the frequency of x_i. X_i are plotted in x-axis and corresponding f_i are plotted in y-axis. The points (x_i; f_i) 's are plotted and joined by line segments. Some times instead of joining the points. Perpendicular to the horizontal line x- axis are drawn from these points. In such case the diagram is called frequency bar chart. **In case of frequency distribution given in class intervals, the mid points of class intervals are taken as x_i 's.**
- **(How can you calculate the mid point. Mid points need to be average or is it range or class interval divided by 2?)**
- **Unless given in question we cant randomly construct class interval. To determine the class interval we need to use the formula as suggested by HA Sturges.**
- **Width of the class interval, h = Range/ (1+3.322 $\log_{10}$ n)**
- **Here range = maximum value observed to the minimum value observed, n = no. of observation or total frequency.**

Frequency Polygon

- ~~Here the frequency corresponding to a discrete value $\underline{x_i}$ is spread over the interval (x_i – d)/2 ; (x_i + d)/2 where d is the difference of one value to the next higher or lower value. In case of equal class intervals, frequency polygon can be obtained by joining the middle points of upper sides of the rectangles. (more confusing)~~
- Frequency polygons are a graphical device for understanding the shapes of distributions. They serve the same purpose as histograms, but are especially helpful for comparing sets of data. Frequency polygons are also a good choice for displaying cumulative frequency distributions.
- To create a frequency polygon, start just as for histograms, by choosing a class interval. Then draw an X-axis representing the values of the scores in your data. Mark the middle of each class interval with a tick mark, and label it with the middle value represented by the class. Draw the Y-axis to indicate the frequency of each class. Place a point in the middle of each class interval at the height corresponding to its frequency. Finally, connect the points. We should include one class interval below the lowest value in your data and one above the highest value. The graph will then touch the X-axis on both sides.
- **This method is more like joining the middle points of the bars of** histogram**; the only difference being there is added one more class below the lowest value in your data and one above the highest value.**
- **Polygon means many faces. (Is it?).** Frequency polygons are useful for comparing distributions.

Frequency Polygon

A frequency polygon for 642 psychology test scores shown in Figure 1 was constructed from the frequency table shown in Table 1.

Table 1. Frequency Distribution of Psychology Test Scores.

Lower Limit	Upper Limit	Count	Cumulative Count
29.5	39.5	0	0
39.5	49.5	3	3
49.5	59.5	10	13
59.5	69.5	53	66
69.5	79.5	107	173
79.5	89.5	147	320
89.5	99.5	130	450
99.5	109.5	78	528
109.5	119.5	59	587
119.5	129.5	36	623
129.5	139.5	11	634
139.5	149.5	6	640
149.5	159.5	1	641
159.5	169.5	1	642
169.5	179.5	0	642

The first label on the X-axis is 35. This represents an interval extending from 29.5 to 39.5. Since the lowest test score is 46, this interval has a frequency of 0. The point labeled 45 represents the interval from 39.5 to 49.5. There are three scores in this interval. There are 147 scores in the interval that surrounds 85.

You can easily discern the shape of the distribution from Figure 1. Most of the scores are between 65 and 115. It is clear that the distribution is not symmetric inasmuch as good scores (to the right) trail off more gradually than poor scores (to the left). In the terminology of Chapter 3 (where we will study shapes of distributions more systematically), the distribution is *skewed*.

Frequency Polygon

the distribution is *skewed*.

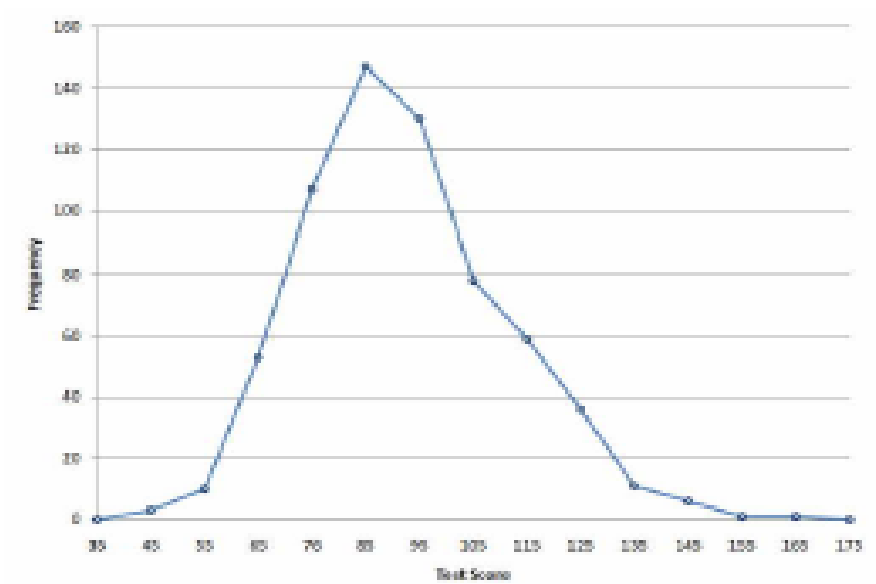


Figure 1. Frequency polygon for the psychology test scores.

Ogive

- When the cumulative frequencies are plotted against the values to which they correspond and if we join the points a cumulative frequency curve is obtained that is called **Ogive**. In drawing ogives, **the upper limit of the class interval is taken as x for less than type distribution and lower limit is taken as x for more than type distribution. (subtraction method can be used to bring out the required CLASS INTERVAL*.)**

Statistical Procedures

Unit V

Chapter b) Frequency Distribution, Specification of Class Interval

Class Interval

- Earlier we have already dealt with the frequencies as the number of times of occurrence of events and frequency distribution as the arrangement of data in an organized way. Now as we already know we have to arrange data into certain class interval (and non of the data should be missed from the arrangement), we need to be more focused with class intervals.
- Earlier we used to determine the **class intervals or H** (or the difference between the lower limit and upper limit) through formula: **Range/ no of class interval we desire.**
- But an unbiased method of determining the class interval is to use the formula suggested by H.A Sturges. The formula is:
- Width of the class interval, $\mathbf{H = Range/\ 1+ 3.322\ log_{10}\ n}$
- Here **Range = maximum value observed in the data given - (minus) minimum value observed in the data**
- **n = total number of observations**
- For a given data if range is 2.2 and n = 30 the class interval would be of 0.37 or 0.4 in round figure.

Specification of Class Interval

- For data analysis, the class interval used must be well defined. A class interval is defined as according to one of the following criteria-
- 1) $\mathbf{a < x < b}$ indicating any value of x greater than a and lesser (smaller) than b
- 2) $\mathbf{a <= x < b}$ where x is greater than or equal to a and smaller/ lesser than b
- 3) $\mathbf{a < x <= b}$ where x is greater than a and smaller/ lesser or equal to b
- 3) $\mathbf{a <= x <= b}$ where x is greater or equal to a and smaller/ lesser than or equal to b
- Here **a = lower limit of the class interval; b = upper limit of the class interval and x = any values in between upper and lower limits.** Of the four postulates for class specifications, second and fourth are mostly used in presentation of class intervals. Second type is used in continuous data and the fourth type is used in discrete data.

Specification of Class Interval

Table 1

Class Interval defined as - **a < = x < b (according to 2^{nd} Specification)**	Class Interval defined as - **a < = x <= b (according to 4^{th} Specification)**
0....5	0....4
5....10	5....9
10....15	10....14

In second type of classification shown in above table any observations which is equal to or greater than lower limit but less than upper limit of the class interval is included in the specified class interval. For instance, the observation of the values 5 and less than 10 are included in class interval (5-10). This definition allows every observation to be included in any of the classes considered. In this rule no observation can escape from being classified.

On the other hand according to the fourth definition any observation which is equal or greater than lower limit but less than or equal to upper limit is included in the class interval concerned. For instance according to the fourth definition, any observation equal to 5 or greater than 5 but less than or equal to 9 are included in the class interval 5-9. In discrete data there is no problem by defining classes by this rule because no observation escapes from being classified. But in continuous data, if this definition is used, many observations escape from being classified. For instance, if an observation result in a fractional value, 9.5 there is no class in which this value can be included.

Specification of Class Interval

- Therefore the best and practical way of defining class interval is to use 2nd criteria. When classes are given by fourth criteria, they are converted to new classes by increasing upper limit by 0.5 and decreasing the lower limit by 0.5. This makes converted classes consistent with the 2nd criteria. Now the class interval becomes as 0 – 4.5; 4.5 – 9.5; 9.5 – 14.5. as – 0.5 can be considered under observation so 0-0.5 is not done for the lowest interval to fix it with the 4th Specification.
- In demographic studies usually frequency distribution is given under the formulation of the 4th specification.

Specification of Class Interval

Though in most cases the widths of class intervals are taken equal sometimes it becomes necessary to present the data in unequal class intervals and with no lowest and no highest observation specified. For instance, to highlight the proportion of different labour force in a population, the age distribution is as shown. This types of data is more essential for human resource management.

Age group	% of population
Less than 15 (Children category)	45
15….59 (Labour category)	50
60 and above (Elderly category)	5
Total	**100**

Types of Frequency Distributions

- Ordinarily a frequency distribution is presented in ascending order of quantitative data. Sometimes cumulative frequencies are needed and they are obtained by adding the frequencies up to the class interval for which the cumulative frequencies is needed. These C.F. provide **Less Than Type Frequencies.** On the other hand, in many social sciences, particularly in Psychology, the quantitative data are presented in descending order and accordingly C.F. are presented in **More Than Type Frequencies.** These two types can be converted from one to the other type.

Types of Frequency Distributions

Table 2

Marks obtained by students	No of students or frequency	Cumulative Frequency
0....0	5	5
10....20	10	15
20....30	25	40
30....40	50	90
40....50	60	150
50....60	40	190
60....70	15	205
70....80	10	215
80....90	5	220
90....100	2	222

Table 2 is about cumulative frequencies. For data arranged in ascending order, frequencies for **Less than type** are obtained by adding successive frequencies up to the desired limit from beginning. On the other hand, for data arranged in descending order, the frequencies for more than type are obtained by adding successive frequencies beginning from highest class interval.

Less than type		More than type	
Marks	Frequency (CF)	Marks	Frequency (CF)
Less than 10	5	More than 90	2
Less than 20	15	More than 80	7
Less than 30	40	More than 70	17
Less than 40	90	More than 60	32
Less than 50	150	More than 50	72
Less than 60	190	More than 40	132
Less than 70	205	More than 30	182
Less than 80	215	More than 20	207
Less than 90	220	More than 10	217
Less than 100.	222	More than 0	222

Types of Frequency Distributions

- Also when frequency data are presented by Less than or More than type **ordinary frequencies are obtained by simply subtracting the consecutive frequencies. It is very important to remember that frequencies stated in less than or more than types are simply just cumulative frequencies.**
- For instance, if ordinary frequency for the class interval 90-100 is to be obtained from frequencies stated in less than type table ; frequencies for less than 90 is subtracted from frequency for less than 100 i.e. 222-220 = 2. Note that marks less than 100 minus marks less than 90 provides the marks in the interval 90-100.

Statistical Procedures

Unit V

Chapter c) Measure of Central Tendency

Mean (AM; GM; HM), Median, Mode

Central Tendency: Overview

- In statistics, a **central tendency** (or, more commonly, a **measure of central tendency**) is a central value or a typical value for a probability distribution.
- It is occasionally called an average or just the **center** of the distribution. The most common measures of central tendency are the arithmetic mean, the median and the mode.
- A central tendency can be calculated for either a finite set of values or for a theoretical distribution, such as the normal distribution. Occasionally authors use central tendency (or **centrality**), to mean "the tendency of quantitative data to cluster around some central value." [2][3] This meaning might be expected from the usual dictionary definitions of the words tendency and centrality.
- Those authors may judge whether data has a strong or a weak central tendency based on the statistical dispersion, as measured by the standard deviation or something similar.
- The term "central tendency" dates from the late 1920s.
- **(Measure of Variability) Dispersion Includes Standard Deviation and Variance (is it only?)**

Central Tendency: Overview

- The following may be applied to one-dimensional data. Depending on the circumstances, it may be appropriate to transform the data before calculating a central tendency. Examples are squaring the values or taking logarithms. Whether a transformation is appropriate and what it should be depend heavily on the data being analyzed.
- Arithmetic mean (or simply, mean) – **the sum of all measurements divided by the number of observations in the data set**
- Median – **the middle value that separates the higher half from the lower half of the data** set. The median and the mode are the only measures of central tendency that can be used for ordinal data, in which values are ranked relative to each other but are not measured absolutely. **Median and mode are positional average.**
- Mode – **the most frequent value in the data set**. This is the only central tendency measure that can be used with nominal data, which have purely qualitative category assignments.
- Geometric mean – the *n*th root of the product of the data values, where there are n of these. This measure is valid only for **data that are measured absolutely on a strictly positive scale. (?)**
- Harmonic mean – **the reciprocal of the arithmetic mean of the reciprocals of the data values**. This measure too is valid only for data that are measured absolutely on a strictly positive scale.

Descriptive Statistics: Overview

- **<u>Third Moments is called Skewness</u>**, where mean and median are different and it helps to identify to which side of the central value (say mean) most observed values are distributed. Skewness is the amount of asymmetry in a distribution. In a skewed distribution, the mean and median are not identical.
- **<u>Fourth Moment is called Kurtosis</u>**, where mean equals to ~~0 and standard deviation is 1~~ and kurtosis helps to know how much the observed values are peaked around the central value and also to know the maximum deviations among the observation that clustered around a central point.
- Kurtosis describes the peakedness of a distribution. ”Leptokurtic” curves have long tails and ”platykurtic” curves have short tails. ”Mesokurtic” distributions have the same kurtosis as the **<u>normal distribution</u>**.
- **<u>In normal distributions mean value of sample means will equal the population mean. (is it?)</u>**

Mean

- In mathematics, **mean** has several different definitions depending on the context. Like mean can be defined as **percentage** defining all the marks achieved in subjects, it is the **average value, round about value, tentative value, etc.**
- In probability and statistics, **mean** and expected value are used synonymously to refer to one measure of the central tendency either of a probability distribution or of the random variable characterized by that distribution.[1] **In the case of a discrete probability distribution of a random variable *X*, the mean is equal to the sum over every possible value weighted by the probability of that value; that is, it is computed by taking the product of each possible value *x* of *X* and its probability P(*x*), and then adding all these products together,** giving $\mu = \Sigma\, x.\, p(x)$
- For a data set, the terms arithmetic mean, mathematical expectation, and sometimes average are used synonymously to refer to a central value of a discrete set of numbers: specifically, the sum of the values divided by the number of values. The arithmetic mean of a set of numbers $x_1, x_2, \ldots, x_n$ is typically denoted by , pronounced "*x* bar". If the data set were based on a series of observations obtained by sampling from a statistical population, the arithmetic mean is termed the **sample mean** (denoted by x bar) to distinguish it from the **population mean** (denoted or μ).

Mean

- For a finite population, the **population mean** of a property is equal to the arithmetic mean of the given property while considering every member of the population. For example, the population mean height is equal to the sum of the heights of every individual divided by the total number of individuals. The sample mean may differ from the population mean, especially for small samples. **The law of large numbers dictates that the larger the size of the sample, the more likely it is that the sample mean will be close to the population mean.**
- **In order to avoid the complication of computation or calculation of the large and decimal numbers, we use the following formula:**
- **u = (x-a)/ h. the transforming of x to u is called Mapping of x to u**
- **Here x = observed values or the values of the variable**
- **a = arbitrary value (assumed mean)**
- **h = class interval**
- **After deduction a similar functional formula is obtained for calculation of mean from the assumed mean, i.e. X (X bar meaning sample mean) = a + h u (u bar)**
- **Brain Teaser**: Is this formula easily applicable for continuous distribution? It must be more applicable for continuous distributions because they give more of the fractional numbers in calculations than integral numbers.

Characteristics of Mathematical Mean

- **AM: It is affected by large values i.e. more weights are given to larger values and when we misplace more frequencies to larger values surely the mathematical mean or average is changed significantly.** When we are not able to calculate the exact values then it may affect the overall procedure. **Basically AM are used in situations when the need is to determine absolute values.**
- **GM:** it assigns less weights to larger values and more weights to smaller values. (May be we are not very near to the exact exponential figure due to lesser values having larger weight. This may be a problem but it is said that there is no drastic change in the exponential figure x of b^x .) **Basically GM are used in situations when the need is to determine percent, rations and rates.**
- **HM:** It assigns too much weights to smaller values. **Basically HM are used in situations when the need is to determine rates per unit time. (Harmonic series are like that of musical notes.)**
- Though AM suffers from many limitations, it is widely used in statistical estimation. It is because, computation of AM is comparatively easy and it can be handled mathematically. Therefore in statistical studies, unless otherwise stated, mean mentioned should be understood as AM.
- AM, GM and HM cannot be calculated when upper limit of upper most class and lower limit of lower most class are not specified. When one of the observation is zero, GM and HM cannot be calculated in case of ungrouped data.

Mean: Arithmetic Mean

Arithmetic mean (AM) [edit]

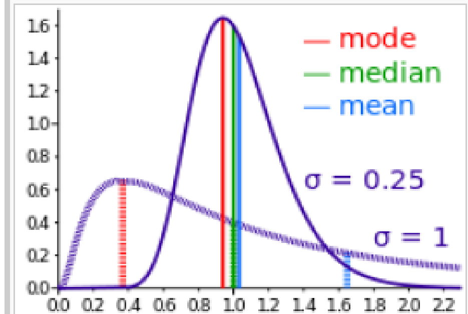
The *arithmetic mean* (or simply "mean") of a sample $x_1, x_2, \ldots, x_n$ is the sum the sampled values divided by the number of items in the sample:

$$\bar{x} = \frac{x_1 + x_2 + \cdots + x_n}{n}$$

For example, the arithmetic mean of five values: 4, 36, 45, 50, 75 is

$$\frac{4 + 36 + 45 + 50 + 75}{5} = \frac{210}{5} = 42.$$

The **mean** may often be confused with the median, mode or range. The mean is the arithmetic average of a set of values, or distribution; however, for skewed distributions, the mean is not necessarily the same as the middle value (median), or the most likely (mode). For example, mean income is skewed upwards by a small number of people with very large incomes, so that the majority have an income lower than the mean. By contrast, the median income is the level at which half the population is below and half is above. The mode income is the most likely income, and favors the larger number of people with lower incomes. The median or mode are often more intuitive measures of such data.



Comparison of the arithmetic mean, median and mode of two skewed (log-normal) distributions.

Nevertheless, many skewed distributions are best described by their mean – such as the exponential and Poisson distributions.

Mean: Geometric Mean and Harmonic Mean

Geometric mean (GM) [edit]

The geometric mean is an average that is useful for sets of positive numbers that are interpreted according to their product and not their sum (as is the case with the arithmetic mean) e.g. rates of growth.

$$\bar{x} = \left(\prod_{i=1}^{n} x_i \right)^{\frac{1}{n}}$$

For example, the geometric mean of five values: 4, 36, 45, 50, 75 is:

$$(4 \times 36 \times 45 \times 50 \times 75)^{1/5} = \sqrt[5]{24\,300\,000} = 30.$$

Harmonic mean (HM) [edit]

The harmonic mean is an average which is useful for sets of numbers which are defined in relation to some unit, for example speed (distance per unit of time).

$$\bar{x} = n \cdot \left(\sum_{i=1}^{n} \frac{1}{x_i} \right)^{-1}$$

Mean: Geometric Mean

In mathematics, the **geometric mean** is a type of mean or average, which indicates the central tendency or typical value of a set of numbers by using the product of their values (as opposed to the arithmetic mean which uses their sum). The geometric mean is defined as the *n*th root (where n is the count of numbers) of the product of the numbers.

For instance, the geometric mean of two numbers, say 2 and 8, is just the square root of their product; that is $\sqrt{2 \cdot 8} = 4$. As another example, the geometric mean of the three numbers 4, 1, and 1/32 is the cube root of their product (1/8), which is 1/2; that is $\sqrt[3]{4 \cdot 1 \cdot 1/32} = 1/2$.

A geometric mean is often used when comparing different items – finding a single "figure of merit" for these items – when each item has multiple properties that have different numeric ranges.[1] For example, the geometric mean can give a meaningful "average" to compare two companies which are each rated at 0 to 5 for their environmental sustainability, and are rated at 0 to 100 for their financial viability. If an arithmetic mean were used instead of a geometric mean, the financial viability is given more weight because its numeric range is larger- so a small percentage change in the financial rating (e.g. going from 80 to 90) makes a much larger difference in the arithmetic mean than a large percentage change in environmental sustainability (e.g. going from 2 to 5). The use of a geometric mean "normalizes" the ranges being averaged, so that no range dominates the weighting, and a given percentage change in any of the properties has the same effect on the geometric mean. So, a 20% change in environmental sustainability from 4 to 4.8 has the same effect on the geometric mean as a 20% change in financial viability from 60 to 72.

The geometric mean can be understood in terms of geometry. The geometric mean of two numbers, a and b, is the length of one side of a square whose area is equal to the area of a rectangle with sides of lengths a and b. Similarly, the geometric mean of three numbers, a, b, and c, is the length of one side of a cube whose volume is the same as that of a cuboid with sides whose lengths are equal to the three given numbers.

The geometric mean applies only to positive numbers.[2] It is also often used for a set of numbers whose values are meant to be multiplied together or are exponential in nature, such as data on the growth of the human population or interest rates of a financial investment.

The geometric mean is also one of the three classical Pythagorean means, together with the aforementioned arithmetic mean and the harmonic mean. For all positive data sets containing at least one pair of unequal values, the harmonic mean is always the least of the three means, while the arithmetic mean is always the greatest of the three and the geometric mean is always in between (see Inequality of arithmetic and geometric means.)

Mean: Geometric Mean

- **<u>Brain Teaser</u>**: Can you relate any examples in Psychology that shows you some exponential growth? Can stress and Mental Illness are seen in exponential figures?
- Exponential growths have been seen in microbes when they are cultured in some nutrient media.

* Application: Geometric Mean

Proportional growth [edit]

Further information: Compound annual growth rate

The geometric mean is more appropriate than the arithmetic mean for describing proportional growth, both exponential growth (constant proportional growth) and varying growth; in business the geometric mean of growth rates is known as the compound annual growth rate (CAGR). The geometric mean of growth over periods yields the equivalent constant growth rate that would yield the same final amount.

Suppose an orange tree yields 100 oranges one year and then 180, 210 and 300 the following years, so the growth is 80%, 16.6666% and 42.8571% for each year respectively. Using the arithmetic mean calculates a (linear) average growth of 46.5079% (80% + 16.6666% + 42.85261% divided by 3). However, if we start with 100 oranges and let it grow 46.5079% each year, the result is 314 oranges, not 300, so the linear average *over*-states the year-on-year growth.

Instead, we can use the geometric mean. Growing with 80% corresponds to multiplying with 1.80, so we take the geometric mean of 1.80, 1.166666 and 1.428571, i.e. $\sqrt[3]{1.80 \times 1.166666 \times 1.428571} = 1.442249$; thus the "average" growth per year is 44.2249%. If we start with 100 oranges and let the number grow with 44.2249% each year, the result is 300 oranges.

Applications in the social sciences [edit]

Although the geometric mean has been relatively rare in computing social statistics, starting from 2010 the United Nations Human Development Index did switch to this mode of calculation, on the grounds that it better reflected the non-substitutable nature of the statistics being compiled and compared:

> *The geometric mean decreases the level of substitutability between dimensions [being compared] and at the same time ensures that a 1 percent decline in say life expectancy at birth has the same impact on the HDI as a 1 percent decline in education or income. Thus, as a basis for comparisons of achievements, this method is also more respectful of the intrinsic differences across the dimensions than a simple average.*[5]

Note that not all values used to compute the HDI are normalized; some of them instead have the form $(X - X_{\min})/(X_{\text{norm}} - X_{\min})$. This makes the choice of the geometric mean less obvious than one would expect from the "Properties" section above.

Mean: Relationships between AM, GM and HM

For example, the harmonic mean of the five values: 4, 36, 45, 50, 75 is

$$\frac{5}{\frac{1}{4}+\frac{1}{36}+\frac{1}{45}+\frac{1}{50}+\frac{1}{75}} = \frac{5}{\frac{1}{3}} = 15.$$

Relationship between AM, GM, and HM [edit]

Main article: Inequality of arithmetic and geometric means

AM, GM, and HM satisfy these inequalities:

$$AM \geq GM \geq HM$$

Equality holds only when all the elements of the given sample are equal.

Median

- **In statistics and probability theory, the median is the numerical value separating the higher half (for sure in an ordered set of data in ascending orders, the higher half have variables that have higher values) of a data sample, a population, or a probability distribution, from the lower half.**
- The *median* of a finite list of numbers can be found by arranging all the observations from lowest value to highest value and picking the middle one (e.g., the median of {3, 3, 5, 9, 11} is 5). **If there is an even number of observations, then there is no single middle value; the median is then usually defined to be the mean of the two middle values** [1] [2] (the median of {3, 5, 7, 9} is (5 + 7) / 2 = 6), which corresponds to interpreting the median as the fully trimmed mid-range.
- The median is of central importance in robust statistics, as it is the most resistant statistic, having a breakdown point of 50%: so long as no more than half the data is contaminated, the median will not give an arbitrarily large result. **A median is only defined on ordered one-dimensional data, and is independent of any distance metric. A geometric median, on the other hand, is defined in any number of dimensions.**
- **In a sample of data, or a finite population, there may be no member of the sample whose value is identical to the median (in the case of an even sample size); if there is such a member, there may be more than one so that the median may not uniquely identify a sample member.** Nonetheless, the value of the median is uniquely determined with the usual definition.

Median

In a sample of data, or a finite population, there may be no member of the sample whose value is identical to the median (in the case of an even sample size); if there is such a member, there may be more than one so that the median may not uniquely identify a sample member. Nonetheless, the value of the median is uniquely determined with the usual definition. A related concept, in which the outcome is forced to correspond to a member of the sample, is the medoid. At most, half the population have values strictly less than the *median*, and, at most, half have values strictly greater than the median. If each group contains less than half the population, then some of the population is exactly equal to the median. For example, if $a < b < c$, then the median of the list $\{a, b, c\}$ is b, and, if $a < b < c < d$, then the median of the list $\{a, b, c, d\}$ is the mean of b and c; i.e., it is $(b + c)/2$.

The median can be used as a measure of location when a distribution is skewed, when end-values are not known, or when one requires reduced importance to be attached to outliers, e.g., because they may be measurement errors.

In terms of notation, some authors represent the median of a variable x either as $\tilde{x}$ or as $\mu_{1/2}$,[1] sometimes also M.[3] There is no widely accepted standard notation for the median,[4] so the use of these or other symbols for the median needs to be explicitly defined when they are introduced.

The median is the 2nd quartile, 5th decile, and 50th percentile.

Median

- The median is one of a number of ways of summarizing the typical values associated with members of a statistical population; thus, it is a possible location parameter. It is more of positional value.
- When the median is used as a location parameter in descriptive statistics, there are several choices for a measure of variability: the range, the interquartile range, the mean absolute deviation, and the median absolute deviation. Since the median is the same as the *second quartile*, its calculation is illustrated in the article on quartiles.
- **As an sample estimator, the sample mean is more statistically efficient than the sample median** when data are uncontaminated by data from heavy-tailed distributions or from mixtures of distributions, but less efficient otherwise, and that **the efficiency of the sample median is higher than that for a wide range of distributions. More specifically, the median has a 64% efficiency compared to the minimum-variance mean (for large normal samples), which is to say the variance of the median will be ~50% greater than the variance of the mean.**

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Median

- The medians of certain types of distributions can be easily calculated from their parameters:
- The median of a symmetric distribution with mean μ is μ.
  - **The median of a normal distribution with mean μ and variance σ^2 is μ. In fact, for a normal distribution, mean = median = mode.**
  - The median of a uniform distribution in the interval [*a*, *b*] is $(a + b) / 2$, which is also the mean.
- * The median of a Cauchy distribution with location parameter x_0 and scale parameter *y* is x_0, the location parameter. The median of an exponential distribution with rate parameter λ is the natural logarithm of 2 divided by the rate parameter: $\lambda^{-1}\ln 2$. The median of a Weibull distribution with shape parameter *k* and scale parameter λ is $\lambda(\ln 2)^{1/k}$.

Median: History

- The idea of the median originated[*citation needed*] in Edward Wright's book on navigation (*Certaine Errors in Navigation*) in 1599 in a section concerning the determination of location with a compass. Wright felt that this value was the most likely to be the correct value in a series of observations.
- In 1757, Roger Joseph Boscovich developed a regression method based on the L1 norm and therefore implicitly on the median.[38]
- The distribution of both the sample mean and the sample median were determined by Laplace in the early 1800s.
- Antoine Augustin Cournot in 1843 was the first[*citation needed*] to use the term *median* (*valeur médiane*) for the value that divides a probability distribution into two equal halves. Gustav Theodor Fechner used the median (*Centralwerth*) in sociological and psychological phenomena.[40] It had earlier been used only in astronomy and related fields. **Gustav Fechner popularized the median into the formal analysis of data, although it had been used previously by Laplace.**
- Francis Galton used the English term *median* in 1881, having earlier used the terms *middle-most value* in 1869 and the *medium* in 1880.

Mode

- **When the objective of the study is simply to identify the most occurring value of the variate in a series, mode is used as an average. Mode or modal value is thus a value of the variate which has the maximum frequency.**
- **The mode is the value that appears most often in a set of data. As this set of data is for sampled size it is the value we can say that is most likely to be sampled.**
- The mode of a discrete probability distribution is the value *x* at which its probability mass function takes its maximum value. The mode of a continuous probability distribution is the value *x* at which its probability density function has its maximum value, so, informally speaking, the mode is at the peak.
- Like the statistical mean and median, the mode is a way of expressing, in a single number, important information about a random variable or a population. The numerical value of the mode is the same as that of the mean and median in a normal distribution, and it may be very different in highly skewed distributions.
- **The mode is not necessarily unique, since the probability mass function or probability density function may take the same maximum value at several points x_1, x_2, etc.** The most extreme case occurs in uniform distributions , where all values occur equally frequently.

Mode

- **Brain teaser:** How can we calculate modal class where each variable value takes the frequency 1?) **The above definition tells us that only *global maxima (maximum number of repeated value)* are modes which has only one modal class.** Slightly confusingly, **when a probability density function has multiple local maxima it is common to refer to all of the local maxima as modes of the distribution. Such a continuous distribution is called multimodal (as opposed to unimodal).**
- * In symmetric **unimodal** distributions, such as the normal (or Gaussian) distribution (the distribution whose density function (??), when graphed, gives the famous "bell curve"), the mean (if defined), median and mode all coincide. For samples, if it is known that they are drawn from a symmetric distribution, the sample mean can be used as an estimate of the population mode. **Clearly when there is a normal distribution or bell curve distribution the mean, ;median and mode all are the same and coincide.**
- The mode of a sample is the element that occurs most often in the collection. For example, the mode of the sample [1, 3, 6, 6, 6, 6, 7, 7, 12, 12, 17] is 6. **Given the list of data [1, 1, 2, 4, 4] the mode is not unique - the dataset may be said to be bimodal, while a set with more than two modes may be described as multimodal.**

Mode

- For a sample from a continuous distribution, such as [0.935..., 1.211..., 2.430..., 3.668..., 3.874...], the concept is unusable in its raw form, since no two values will be exactly the same, so each value will occur precisely once. In order to estimate the mode, the usual practice is to discretize the data by assigning frequency values to intervals of equal distance, as for making a histogram~~, effectively replacing the values by the midpoints of the intervals they are assigned to.~~
- **The mode is then the value where the histogram reaches its peak.** For small or middle-sized samples the outcome of this procedure is sensitive to the choice of interval width if chosen too narrow or too wide; typically one should have a sizable fraction of the data concentrated in a relatively small number of intervals (5 to 10), while the fraction of the data falling outside these intervals is also sizable. An alternate approach is kernel density estimation, which essentially blurs point samples to produce a continuous estimate of the probability density function which can provide an estimate of the mode.
- The following MATLAB (or Octave) code example computes the mode of a sample.
- **Brain teaser**: What is the difference between continuous distributions and continuous class intervals? Probably when a set of data that are continuously distributed (or are in sequential interval order) when arranged in order of class interval they become continuous distribution.

Mode: Uses and Properties

- Unlike mean and median, the concept of mode also makes sense for "nominal data" (i.e., not consisting of numerical values in the case of mean, or even of ordered values in the case of median). For example, taking a sample of Korean family names, one might find that "Kim" occurs more often than any other name. Then "Kim" would be the mode of the sample. In any voting system where a plurality determines victory, a single modal value determines the victor, while a multi-modal outcome would require some tie-breaking procedure to take place.

* Properties of mean, median and mode

- As mean, media and mode are very defined, simple and unique, the following are some of the most interesting properties.
- All three measures have the following property: If the random variable (or each value from the sample) is subjected to the linear or affine transformation which replaces X by $aX+b$, so are the mean, median and mode.
- However, if there is an arbitrary monotonic transformation, only the median follows; for example, if X is replaced by $\exp(X)$, the median changes from m to $\exp(m)$ but the mean and mode won't.[*citation needed*]
- Except for extremely small samples, the mode is insensitive to "outliers" (such as occasional, rare, false experimental readings). The median is also very robust in the presence of outliers, while the mean is rather sensitive.
- In continuous unimodal distributions the median lies, as a rule of thumb, between the mean and the mode, about one third of the way going from mean to mode. In a formula, median ≈ (2 × mean + mode)/3. This rule, due to Karl Pearson, often applies to slightly non-symmetric distributions that resemble a normal distribution, but it is not always true and in general the three statistics can appear in any order.
- For unimodal distributions, the mode is within standard deviations of the mean, and the root mean square deviation about the mode is between the standard deviation and twice the standard deviation.

Relationships between Mean, Median and Mode

- **We can see a relationship from derivation statistics:**
- **Mode = 3 Median - 2 Mean**
- **As accordingly: If Mean = Median = Mode, the distribution is called symmetrical.**
- **If Mean > Median > Mode, the distribution is called positive skew.**
- **If Mean < Median < Mode, the distribution is called negative skew.**

Supplementary

- **Supplementary:** In probability theory and statistics, **variance** measures how far a set of numbers is spread out. (A variance of zero indicates that all the values are identical.) Variance is always non-negative: A small variance indicates that the data points tend to be very close to the mean (expected value) and hence to each other, while a high variance indicates that the data points are very spread out from the mean and from each other.
- Earlier I thought that variance shows the difference in value between mean (the mean value is also one of the value of variable) and values of other variables. I was partially right as we see through the definition of **Standard Deviation**.
- In statistics and probability theory, the **standard deviation** (**SD**) (represented by the Greek letter sigma, **σ**) shows how much variation or dispersion from the average (mean) exists. A low standard deviation indicates that the data points tend to be very close to the mean (also called expected value); a high standard deviation indicates that the data points are spread out over a large range of values.
- A useful property of the standard deviation is that, unlike the variance, it is expressed in the same units as the data. Note, however, that for measurements with percentage as the unit, the standard deviation will have percentage points as the unit.

Supplementary

Measure of Variations: Inter Quartile Range

- **Inter-Quartile Range:** It is computed by taking the difference between upper quartile (Q3) and lower quartile (Q2). Half of inter quartile range is called semi quartile range.
- The value of interquartile range is different from the range because the interquartile range is difference in two quartile position.
- Q2-Q1; Q3-Q2; and Q3-Q1 are the three interquartile ranges.
- **Mean Deviations from Central Value:** It is the average of absolute deviation for value of variable from any values of central tendencies (Mean, Median and Mode). Absolute values are to be taken because negative signs and positive signs in deviations sometimes make the sum equal to 0. The central tendency is represented as A.
- So mean deviation from A = $\mathbf{1/N \sum f \, |x - A|}$

Measure of Variations (Dispersion and Scatterness)

- In probability theory and statistics, **variance** measures how far a set of numbers is spread out. (A variance of zero indicates that all the values are identical.) Variance is always non-negative: A small variance indicates that the data points tend to be very close to the mean (expected value) and hence to each other, while a high variance indicates that the data points are very spread out from the mean and from each other.
- The square root of variance is called the standard deviation.
- The variance is one of several descriptors of a probability distribution. In particular, the variance is one of the moments of a distribution. In that context, it forms part of a systematic approach to distinguishing between probability distributions. While other such approaches have been developed, those based on moments are advantageous in terms of mathematical and computational simplicity.
- The variance is a parameter that describes, in part, either the actual probability distribution of an observed population of numbers, or the theoretical probability distribution of a sample (a not-fully-observed population) of numbers. In the latter case, a sample of data from such a distribution can be used to construct an estimate of its variance: in the simplest cases this estimate can be the sample variance.

Standard Deviation

- In statistics and probability theory, the **standard deviation** (**SD**) (represented by the Greek letter sigma, **σ**) shows how much variation or dispersion from the average (mean) exists. A low standard deviation indicates that the data points tend to be very close to the mean (also called expected value); a high standard deviation indicates that the data points are spread out over a large range of values.
- **A useful property of the standard deviation is that, unlike the variance, it is expressed in the same units as the data. (does this means variance doesn't have any unit??)** Note, however, that for measurements with percentage as the unit, the standard deviation will have percentage points as the unit.
- When only a sample of data from a population is available, the term **standard deviation of the sample** or **sample standard deviation** can refer to either the above-mentioned quantity as applied to those data or to a modified quantity that is a better estimate of the population standard deviation (the standard deviation of the entire population). (Does it mean for a only one sample available, the sample standard deviation is the roughly the population standard deviation?)

Standard Deviation

Corrected sample standard deviation [edit]

When discussing the bias, to be more precise, the corresponding estimator for the variance, the *biased sample variance:*

$$s_N^2 = \frac{1}{N}\sum_{i=1}^{N}(x_i - \overline{x})^2,$$

equivalently the second central moment of the sample (as the mean is the first moment), is a biased estimator of the variance (it underestimates the population variance). Taking the square root to pass to the standard deviation introduces further downward bias, by Jensen's inequality, due to the square root being a concave function. The bias in the variance is easily corrected, but the bias from the square root is more difficult to correct, and depends on the distribution in question.

An unbiased estimator for the *variance* is given by applying Bessel's correction, using $N - 1$ instead of N to yield the *unbiased sample variance,* denoted s^2:

$$s^2 = \frac{1}{N-1}\sum_{i=1}^{N}(x_i - \overline{x})^2.$$

This estimator is unbiased if the variance exists and the sample values are drawn independently with replacement. $N - 1$ corresponds to the number of degrees of freedom in the vector of residuals, $(x_1 - \overline{x}, \dots, x_n - \overline{x})$.

Taking square roots reintroduces bias, and yields the **corrected sample standard deviation,** denoted by *s:*

$$s = \sqrt{\frac{1}{N-1}\sum_{i=1}^{N}(x_i - \overline{x})^2}.$$

While s^2 is an unbiased estimator for the population variance, s is a biased estimator for the population standard deviation, though markedly less biased than the uncorrected sample standard deviation. The bias is still significant for small samples (n less than 10), and also drops off as $1/n$ as sample size increases. This estimator is commonly used, and generally known simply as the "sample standard deviation".

Population and Sample Variance

Population variance [edit]

In general, the ***population variance*** of a ***finite*** population of size N with values x_i is given by

$$\sigma^2 = \frac{1}{N}\sum_{i=1}^{N}(x_i-\mu)^2 = \left(\frac{1}{N}\sum_{i=1}^{N}x_i^2\right) - \mu^2$$

where

$$\mu = \frac{1}{N}\sum_{i=1}^{N}x_i$$

is the population mean. The population variance therefore is the variance of the underlying probability distribution. In this sense, the concept of population can be extended to continuous random variables with infinite populations.

Sample variance [edit]

In many practical situations, the true variance of a population is not known ***a priori*** and must be computed somehow. When dealing with extremely large populations, it is not possible to count every object in the population, so the computation must be performed on a sample of the population.[7] Sample variance can also be applied to the estimation of the variance of a continuous distribution from a sample of that distribution.

We take a sample with replacement of n values $y_1, \ldots, y_n$ from the population, where $n < N$, and estimate the variance on the basis of this sample.[8] Directly taking the variance of the sample gives the average of the squared deviations:

$$\sigma_y^2 = \frac{1}{n}\sum_{i=1}^{n}(y_i-\overline{y})^2$$

Here, $\overline{y}$ denotes the sample mean:

$$\overline{y} = \frac{1}{n}\sum_{i=1}^{n}y_i.$$

*Covariance

- **In probability theory and statistics, covariance is a measure of how much two random variables change together.** If the greater values of one variable mainly correspond with the greater values of the other variable, and the same holds for the smaller values, i.e., the variables tend to show similar behavior, the covariance is positive.[1] In the opposite case, when the greater values of one variable mainly correspond to the smaller values of the other, i.e., the variables tend to show opposite behavior, the covariance is negative. The sign of the covariance therefore shows the tendency in the linear relationship between the variables. The magnitude of the covariance is not easy to interpret. **The normalized version of the covariance, the correlation coefficient, however, shows by its magnitude the strength of the linear relation.**
- A distinction must be made between (1) the covariance of two random variables, which is a population parameter that can be seen as a property of the joint probability distribution, and (2) the sample covariance, which serves as an estimated value of the parameter.
- **Do you know?:** I don't think **covariance** mean **coefficient of variation (CV)**. Is it? Covariance is combined variance where as **CV is to determine the consistency of values observed in a series and compare the consistencies of tow or more series. Lesser the value of CV, the more is the consistent of the series.**
- **Covariance is to know about the relationships between the variables or distribution and how they affect each other, like as in linear correlation.** Where as coefficient of variation is to know about which of the following distributions are more consistent in regards to distribution of values in the variable.
- **Don't get confused with CV or Coefficient of Variation with Covariance.**

Coefficient of Variation (CV)

- **<u>Coefficient of Variation (CV)</u>** as also referred as Covariance or Coefficient of dispersion is used to determine the consistency of values observed in a series and compare the consistencies of two or more series. Lesser the value of CV, the more is the consistent of the series. Obviously CV is small when AM is high and when AM is zero, CV can't be computed.
- **CV = σ * 100/X**
- **<u>For example:</u>** CV_1 in case of Machine 1 for a mean length of screws of 5.2 cm with a standard deviation of 0.4cm
- **CV_1= 0.4*100/ 5.2 = 7.7%**
- Similarly, CV_2 in case of Machine 2 for a mean length of screws of 6.4 cm with a standard deviation of 0.6 cm
- **CV_2= 0.6*100/ 6.4 = 7.7%**
- Obviously, $CV_1 < CV_2$. We can say that machine 1 is more consistent than machine 2.
- **<u>Q: In regards to coefficient of variation can we consider different fashion of frequency distribution table of the same set of data under statistical calculations?</u>**

Variance of Combined Series

- **Variance of combined series:**
- In many instances, the mean and variance of combined series (Can different frequency distribution table be considered as series?) is needed. If X_i (mean) and **σ_i (standard deviation) and n_i (number of observations in each series) are given then the Mean of Combined Series becomes:**
- **$X = \sum n_i X_i / \sum n_i$**
- Here **$\sum n_i$ means total number of observations (all total number of observation in whole total of series) from all the included series**
- **Similarly Variance of Combined Series becomes**
- **$\sigma^2 = \sum n_i \sigma^2_i / \sum n_i + \sum n_i (X_i - X)^2 / \sum n_i$**
- Note: **μ** (mu) represents population mean and X represents sample mean. Otherwise **μ_1 μ_2 μ_3 μ_4** represents 1st to 4th order of central moments. **μ_i' represents moments from any arbitrary values (a).**

Hypothesis Testing

- Hypothesis is a set of assumption. Hypothesis is set to predict an outcome. Furthermore they help to establish the relationships between the independent and dependent variables.
- **The statistical procedure of testing the hypothesis about the nature of population on the basis of the sample observations (observations means data and data has to have numerical value in statistics) is called hypothesis testing**. The nature of the population may be statistical measures based on magnitudes of the observations or may be based on the positional values of the observations.
- **Hypothesis testing is a tentative explanation or prediction of relationships about the various variables in a study**
- In former case (when magnitudes are considered), the statistical measures are expressed by parameters like mean, standard deviation, moments, etc.
- In the later case, the statistical measures are often the order of occurrence such as median rather than the magnitude of the observations.
- Testing of hypothesis in the former case is called **parametric** test and in later case it is called **non parametric test**. Which of above tests are to be used depends on the nature of the data collected and problem formulated by the investigation.
- **In short we can say to test the reliability of the inferences or conclusion, derived from the sample statistical measure, we go for hypothesis testing. Hypothesis testing makes an inference valid. (RB)**

Parametric test

- Frequently used parametric tests are z-test, **Chi Square (χ^2) test, t-test and F-test. These tests are based on their distribution. It is proved that t and F distributions are derived from χ^2 distribution.**
- In the preceding sections, it has been described how population parameters (**μ, σ^2**, etc.) can be estimated from sample statistics (it needs to be taken into mind that statistics is always for sample).
- We can ask- Can the inference made about population parameters on the basis of computed sample statistics be relied upon? The answer to this question is given by testing statistical hypothesis.
- A statistical hypothesis is an assertion or conjecture about the distribution of one or more random variables.
- If the hypothesis completely specifies the distribution it is referred to as simple hypothesis, if not it is referred to as composite hypothesis. A simple hypothesis must therefore specify not only the functional form of underlining distribution but also the values of all parameters.

Parametric test

- A null hypothesis and two tailed alternative hypothesis are the examples of simple hypothesis because they specify the whole distribution.
- Suppose we have to decide on the basis of sample data that the average life time of a certain electrical bulb is at least 200 hours; one kind of fertilizer can produce higher yield than the other kind and that 90% of patients receiving a new medication will recover from certain disease. These decisions can be reached by testing the hypothesis formulated as: $\boldsymbol{\Theta > 200}$ hours in first case; $\boldsymbol{\Theta_1 > \Theta_2}$ in the second case and $\boldsymbol{\Theta = 0.90}$ in the third case. Here Ө's are the population parameters as population mean or variance **~~or even standard deviations~~**. (Can standard deviation be population parameter?)
- The first and 2nd case doesn't clearly define the statistical value and the parameter is directed one or other way in the direction. However in the third case the value of parameters equals to 0.90 is also to be ascertained. Thus the hypothesis formulated in the third case is simple hypothesis where as it is composite hypothesis in 1st and 2nd case.

Steps In Formulating Hypothesis

- Let's assume that the population parameter **Ɵ (that need to be tested and Θ_0 being the value of Ɵ)** is taken as **σ^2 (or variance)** as because in our statistical computation we mostly use variance or mean or standard deviation for hypothesis testing.
- **<u>For a single population:</u>**
- The **null hypothesis** is $H_{0:}$ **$\Theta = \Theta_0$ (simple hypothesis)**
- **e.g. $H_{0:}$ $\sigma^2 = 0.16$ oz.**
- Here theta Ɵ is parameter as like population mean or variance where as theta nut Θ_0 is its value.
- Similarly the **alternative hypothesis** is :
- **For two tail, $H_{1:}$ $\Theta \neq \Theta_0$**
- **For one tail, $H_{1:}$ $\Theta > \Theta_0$ or $H_{1:}$ $\Theta < \Theta_0$ (composite hypothesis)**
- For example, **$H_{1:}$ $\mu > 200$**
- Alternative hypothesis is the one that has to be accepted if null hypothesis is rejected. **<u>If alternative hypothesis is formulated without specifying the direction of inequality, it is called two tailed test.</u>** On the other hand if the direction is also specified it is called one tailed test.
- Alternative hypothesis formulated as one tail test is composite in nature.

Steps In Formulating Hypothesis

- **<u>In case of two population:</u>**
- The null hypothesis is $H_{0:}$ $\mathbf{\Theta_1 - \Theta_2 = \xi}$ (indicating that there is not statistical difference between the sample statistics and population statistics. Here Xi ξ is some specified value usually taken as 0.
- Similarly the **alternative hypothesis** is:
- **For two tail, $H_{1:}$ $\Theta_1 - \Theta_2 \neq \xi$**
- **For one tail, $H_{1:}$ $\Theta_1 - \Theta_2 > \xi$ or $H_{1:}$ $\Theta_1 - \Theta_2 < \xi$**
- **Or,**
- For null hypothesis, $H_{0:}$ $\mathbf{\Theta_{1/} \Theta_2 = \xi}$, here Xi ξ is some specified value usually taken as 1.
- **For alternative hypothesis in this case,**
- **For two** tail test, **H_1: $\Theta_1 / \Theta_2 \neq \xi$,**
- **For one tailed test, H_1: $\Theta_1 / \Theta_2 > \xi$ or H_1: $\Theta_1 / \Theta_2 < \xi$**

Some Notions Used In Formulating Hypothesis

- Is it? Sample statistics are observed and population statistics are expected?
- It is not confidence level or significance level. We have to say it level of confidence and level of significance.
- Note: **α** is called **Level of Significance** or probability of making type one error (rejecting null hypothesis when it is correct). It is also the error margin for the null hypothesis to be rejected.
- Similarly **1 – α is called Level of Confidence** indicating the probability of accepting null hypothesis when it is correct. It is the confidence level for which a null hypothesis can be accepted.
- ((In case of hypothesis testing, through the sample statistics we determine the observed values. When this observed values are lesser than the critical value or tabulated value or cut off score represented by $\boldsymbol{\tau_\alpha}$ **(tau alpha)** we accept the null hypothesis. If this τ_α is smaller than the calculated or observed score, we reject the null hypothesis and accept the alternative hypothesis.
- **For example $\boldsymbol{\tau_{0.05}}$ means we need to see the tabulated value at a level of significance of 0.05 or 5% or at 95% level of confidence.))**
- **For Z-score we have $\boldsymbol{\tau_\alpha = P[\,|z| >= 3] = 0.0027}$.**
- **This indicates that in 99.73% cases, the value of Z lies in the range from -3 to +3. For practical purpose the continuum of Z is taken as in the range; - 3 =<Z =<+3**

Errors in Testing Hypothesis

Errors in testing hypothesis:

In hypothesis testing we may come across two types of errors. These errors occur

a) Due to rejection of null hypothesis when it is true called type I error and

b) Due to the acceptance of Null hypothesis when it is not true and that when alternative hypothesis is true or correct. This is called type II error.

	H_0 is true	H_1 is true
H_0 is rejected	**Type I error**	**Correct decision**
H_0 is accepted	**Correct decision**	**Type II error**

α, β's: The probability of making type I error is denoted by α and the probability of making **type II** error is denoted by β. Thus α= 5% level of significance means out of 100, there are 5 chances of rejecting null hypothesis when it is correct.

Out of these two errors, statisticians should avoid **type II** error as far as possible because it is better to reject a good thing than to accept bad thing. The probability of not making type II error is called the **Power of the Test**. The **power of the test** is given by **$P(\Theta) = 1 - \beta(\Theta)$**

Critical and Acceptance Region

- The rejection of null hypothesis is equivalent to the acceptance of an alternative hypothesis. Broadly speaking, the problem of constructing a test for null hypothesis is the problem of choosing a critical region of the test. We define critical region of a test as that part of the sample space which corresponds to the rejection of the hypothesis to be tested (rejection space for null hypothesis). Its complementary region is termed as acceptance region.

Chi Square Test, t-test and Correlation: Overview

- Inference: One of the major objective of statistical analysis is to make INFERENCE (or to draw out assumption; to know the peculiar points about a distribution based on which we are able to work with that population) about the population on the basis of observed values of the sample taken from the population. To make such inference however one should have sound knowledge on distributions of different statistical measures such as mean, variance, moments and correlation coefficient computed from sample observations. Therefore technical aspects of distributions of some important statistical measures are necessarily to be known.
- ~~**To valid our inferences we test the hypothesis that we have set through many types of tests as chi square test or student t test, etc.**~~
- **Supplementary:** Autism is more about developmental abnormality/ disorder where as Down' s Syndrome is more about chromosomal abnormality but for both the conditions the nurturing environment has a great impact on the IQ score (or simply their level of intelligence).
- **Is it?** I think for covering the possible/ or expected outcomes with regards to observed outcomes we need to consider the notion of **~~Equal Probability Distribution Or~~ Discrete Uniform Distribution** (as while we toss out a coin there are 50-50 expected outcomes (chances) of Head to tail outcome. While a dice has 6 faces, when we toss 36 dices each one time, then the possible or expected outcome is 6 for each face. This whole concept is considered under equal probability distribution.

Chi Square Test (χ^2 test)

- A **chi-squared test**, also referred to as **chi-square test** or **χ^2 test**, is any statistical hypothesis test in **which the sampling distribution of the test statistic is a chi-squared distribution when the null hypothesis is true (or accepted)**. Also considered a chi-squared test is a test in which this is *asymptotically* true, **meaning that the sampling distribution (if the null hypothesis is true) can be made to approximate a chi-squared distribution as closely as desired by making the sample size large enough.**
- **It is defined as the sum of squares of standard normal variate.**
- **We need to understand that the main rationale behind Chi square test is to prove the null hypothesis and state that there is no significant difference between the expected frequency and observed frequency.**
- $\chi^2 = \sum u^2_i$, where $u_i = x_i - u_i / \sigma_i$
- *From the following equation for variance: $\sigma^2 = 1/N \sum f\,(x - X)^2$. If we deduce the formula then it becomes $N = \sum f\,(x - X)^2 / \sigma^2$. We can see that the derived N resembles the standard definition and formula for chi square. Can we refer this relation in any form of inferential statistics?*

Properties of Chi Square Test (χ^2 test)

- It is defined as the sum of squares of standard normal variate.
- It is the test of goodness of fit.
- It is used for finding the association or relationships between attributes or their independence.
- It is also used in comparing standard deviations when population means are known.
- It is used for the purpose of sampling technique, i.e. to compare the frequency of the distribution.
- **Brain Teaser: It is said that chi square tests have no parameter than how come it is a parametric test???**
- **Brain teaser:** So why are we studying this test in our syllabus? ~~May be we want to determine whether the sample frequency falls in the expected population frequency.~~ Also through this test we determine whether there is significant differences between the observed statistics and expected statistics.

Chi Square Test (χ^2 test)

- **For a given contingency table with n rows and m columns we can state $\chi^2 = \sum (O_i - E_i)^2 / E_i$**
- **Here O = Observed frequency for the i-th class**
- **E = Expected frequency for the i-th class**
- **The whole idea of chi square test is to whether accept or reject null hypothesis based on observed statistics or value of variables (of samples- so can be said as the sample statistics) and** expected value **(we expect that the samples represent the population and based on equal probability distribution we acquire some inferences about the population prior to actual measure of sample statistics)**
- **For the** Null Hypothesis (H_0): There is no significant statistical difference between the observed statistics and expected statistics. For n-1 (or k-1) degree of freedom (where n = total number of outcomes or classes in the contingency table) we accept the null hypothesis when the calculated value are lesser than critical values and reject the null when the calculated value are greater than the critical values for the following equation:
- It should be noted that the degrees of freedom are not based on the number of observations as with a Student's t or F-distribution. For example, if testing for a fair, six-sided die, there would be five degrees of freedom because there are six categories/parameters (each number). The number of times the die is rolled will have absolutely no effect on the number of degrees of freedom.

Chi Square Test (χ^2 test)

- Some examples of chi-squared tests where the chi-squared distribution is only approximately valid: Pearson's chi-squared test, also known as the **chi-squared goodness-of-fit test or chi-squared test for independence.** When the chi-squared test is mentioned without any modifiers or without other precluding context, this test is usually meant.
- One case where the distribution of the test statistic is an exact chi-squared distribution is the test that the variance of a normally distributed population has a given value based on a sample variance. **Such a test is uncommon in practice because values of variances to test against are seldom known exactly.**
- **Chi-squared test for variance in a normal population:** If a sample of size *n* is taken from a population having a normal distribution, **then there is a result which allows a test to be made of whether the variance of the population has a pre-determined value** (is it as like the standard deviation has an **Guess Value**?).

Some applicable formula for χ^2 test

- $\chi^2 = \sum u^2_i$, where $u_i = x_i - u_i / \sigma_i$
- $\chi^2 = \sum f (x - X)^2 / \sigma^2$ [I think sigma square σ^2 is out of the summation sign $\sum$ as variance is not any variable but an already computed population constant]
- ***Also,*** $\chi^2 = ns^2 / \sigma^2$, where s^2 is the sample variance and σ^2 is the population variance.
- **((From the following equation for variance: $\sigma^2 = 1/N \sum f (x - X)^2$. If we deduce the formula then it becomes $N = \sum f (x - X)^2 / \sigma^2$. *We can see that the derived N resembles the standard definition and formula for chi square. Can we refer this relation in any form of inferential statistics?))***
- H_0 = Null Hypothesis
- H_1 = Alternative Hypothesis
- **For a given contingency table with n rows and m columns we can state $\chi^2 = \sum (O_i - E_i)^2 / E_i$**
- **Here O = Observed frequency for the i-th class**
- **E = Expected frequency for the i-th class**

Chi Square Test (χ^2 test): Types

- Pearson's chi-squared test is used to assess two types of comparison: tests of goodness of fit and tests of independence.
- **A test of goodness of fit establishes whether or not an observed frequency distribution differs from a theoretical distribution.**
- A **test of independence** assesses whether paired observations on two variables, expressed in a contingency table, are independent of each other (e.g. polling responses from people of different nationalities to see if one's nationality is related to the response).
- The procedure of the test includes the following steps:
- Calculate the chi-squared test statistic, , which resembles a normalized sum of squared deviations between observed and theoretical frequencies.
- Determine the degrees of freedom, *df*, of that statistic, **which is essentially the number of frequencies reduced by the number of parameters of the fitted distribution. Also we can use the notion to derive the degree of freedom by reducing numbers of parameters used from the number of outcomes.**
- Compare χ^2 to the critical value from the chi-squared distribution with *df* degrees of freedom, which in many cases gives a good approximation of the distribution of χ^2 .

Chi Square Test (χ^2 test): Types

- * For example, a manufacturing process might have been in stable condition for a long period, allowing a value for the variance to be determined essentially without error. Suppose that a variant of the process is being tested, giving rise to a small sample of *n* product items whose variation is to be tested. **The test statistic *T* in this instance could be set to be the sum of squares about the sample mean, divided by the nominal value for the variance (i.e. the value to be tested as holding).** Then *T* has a chi-squared distribution with $n - 1$ degrees of freedom. For example if the sample size is 21, the acceptance region for *T* for a significance level of 5% is the interval 9.59 to 34.17.
- **It tests a null hypothesis stating that the frequency distribution of certain events observed in a sample is consistent with a particular theoretical distribution.** The events considered must be **mutually exclusive and have total probability 1**. A common case for this is where the events each cover an outcome of a categorical variable. A simple example is the hypothesis that an ordinary six-sided die is "fair", i. e., all six outcomes are equally likely to occur.
- In this case, an "observation" consists of the values of two outcomes and the null hypothesis is that the occurrence of these outcomes is statistically independent
- **Brain Teaser: Is there chances of probability being more than 1?**

Chi Square Test (χ^2 test): Assumptions

Assumptions [edit]

The chi-squared test, when used with the standard approximation that a chi-squared distribution is applicable, has the following assumptions:[citation needed]

- Simple random sample – The sample data is a random sampling from a fixed distribution or population where every collection of members of the population of the given sample size has an equal probability of selection. Variants of the test have been developed for complex samples, such as where the data is weighted. Other forms can be used such as purposive sampling[4]
- Sample size (whole table) – A sample with a sufficiently large size is assumed. If a chi squared test is conducted on a sample with a smaller size, then the chi squared test will yield an inaccurate inference. The researcher, by using chi squared test on small samples, might end up committing a Type II error.
- Expected cell count – Adequate expected cell counts. Some require 5 or more, and others require 10 or more. A common rule is 5 or more in all cells of a 2-by-2 table, and 5 or more in 80% of cells in larger tables, but no cells with zero expected count. When this assumption is not met, Yates's Correction is applied.
- Independence – The observations are always assumed to be independent of each other. This means chi-squared cannot be used to test correlated data (like matched pairs or panel data). In those cases you might want to turn to McNemar's test.

A test that relies on different assumptions is Fisher's exact test; if its assumption of fixed marginal distributions is met it is substantially more accurate in obtaining a significance level, especially with few observations. In the vast majority of applications this assumption will not be met, and Fisher's exact test will be over conservative and not have correct coverage.[citation needed]

Chi Square Test (χ^2 test): Goodness of Fit

Goodness of fit [edit]

For example, to test the hypothesis that a random sample of 100 people has been drawn from a population in which men and women are equal in frequency, the observed number of men and women would be compared to the theoretical frequencies of 50 men and 50 women. If there were 44 men in the sample and 56 women, then

$$\chi^2 = \frac{(44-50)^2}{50} + \frac{(56-50)^2}{50} = 1.44.$$

If the null hypothesis is true (i.e., men and women are chosen with equal probability), the test statistic will be drawn from a chi-squared distribution with one degree of freedom (because if the male frequency is known, then the female frequency is determined).

Consultation of the chi-squared distribution for 1 degree of freedom shows that the probability of observing this difference (or a more extreme difference than this) if men and women are equally numerous in the population is approximately 0.23. This probability is higher than conventional criteria for statistical significance (0.001 or 0.05), so normally we would not reject the null hypothesis that the number of men in the population is the same as the number of women (i.e., we would consider our sample within the range of what we'd expect for a 50/50 male/female ratio.)

Chi Square Test (χ^2 test): Problems

Problems [edit]

The approximation to the chi-squared distribution breaks down if expected frequencies are too low. It will normally be acceptable so long as no more than 20% of the events have expected frequencies below 5. Where there is only 1 degree of freedom, the approximation is not reliable if expected frequencies are below 10. In this case, a better approximation can be obtained by reducing the absolute value of each difference between observed and expected frequencies by 0.5 before squaring; this is called Yates's correction for continuity.

In cases where the expected value, E, is found to be small (indicating a small underlying population probability, and/or a small number of observations), the normal approximation of the multinomial distribution can fail, and in such cases it is found to be more appropriate to use the G-test, a likelihood ratio-based test statistic. Where the total sample size is small, it is necessary to use an appropriate exact test, typically either the binomial test or (for contingency tables) Fisher's exact test. This test uses the conditional distribution of the test statistic given the marginal totals; however, it does not assume that the data were generated from an experiment in which the marginal totals are fixed and is valid whether or not that is the case.

Notations of Greek Origin

- **Some important notations of Greek origin:**
- **τ = tau**
- **Θ = theta**
- **ς = small letter final sigma**
- **σ = small letter sigma (lower case)**
- **$\sum$ = upper case sigma**
- **ξ = Xi**
- **α = Alpha**
- **T test lets us know whether sample parameters obtained from two sources are significantly different or not.**
- We have been using "**u**" to shorten the calculation where as **μ** is the population mean.
- **S^2** has been represented as population variance and **s^2** has been represented as sample variances on the formulas that is to come ahead.

T- test: Overview

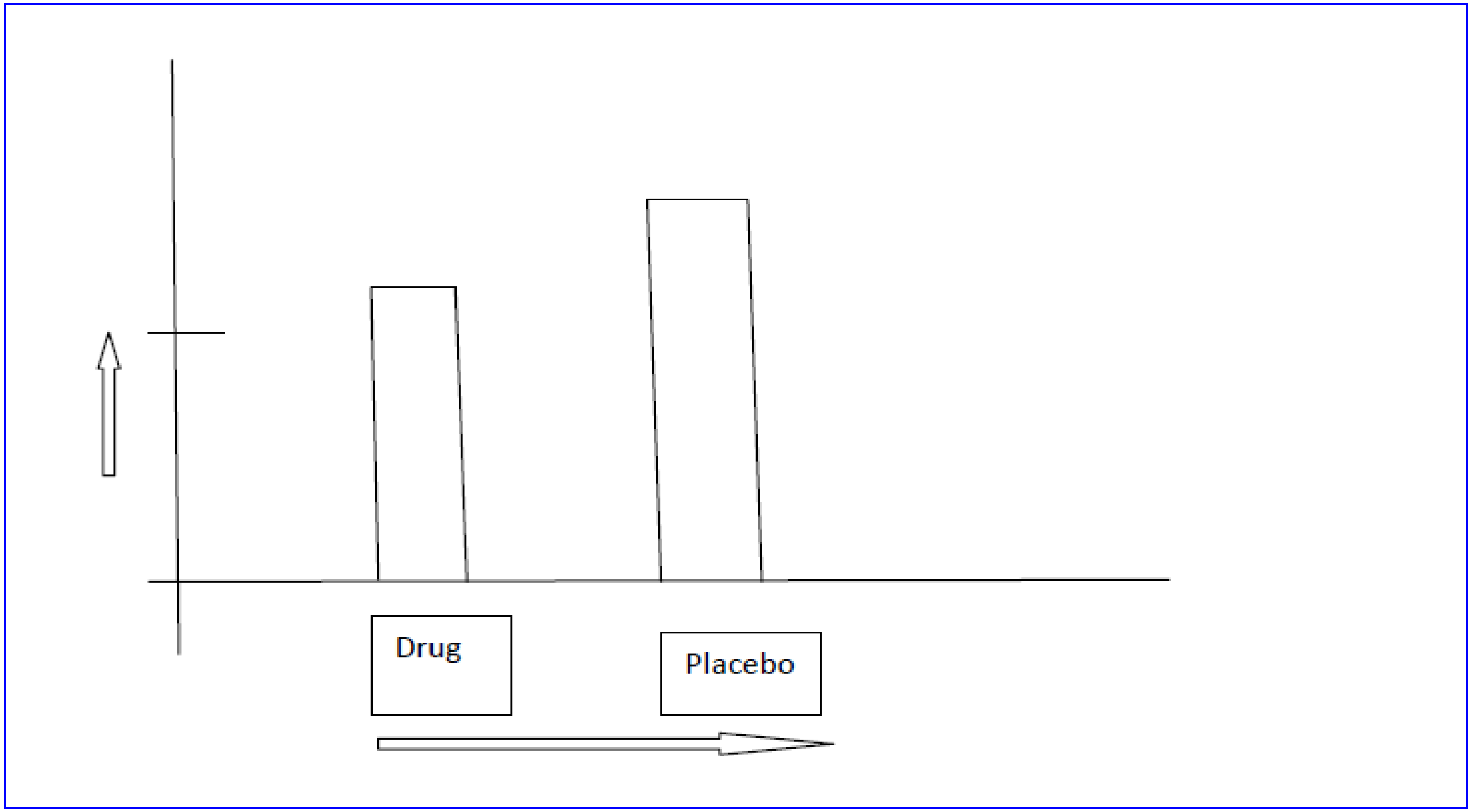
- A ***t*-test** is any statistical hypothesis test in which the test statistic follows a Student's *t* distribution if the null hypothesis is supported. It can be used to determine if two sets of data are significantly different from each other, and is most commonly applied when the test statistic would follow a normal distribution if the value of a **scaling term (as denoted by S or s)** in the test statistic were known. When the scaling term is unknown and is replaced by an estimate based on the data, the test statistic (under certain conditions) follows a Student's *t* distribution.
- T test lets us know whether sample parameters obtained from two sources are significantly different or not. (But I think the population where research is to be done is to be the same.).
- **A t-test is an inferential statistics that check if two mean (averages) are reliably or significantly different from each other.**
- As **inferential statistics** which not only describes sample but also tell us we can expect new samples even we don't have. In contrast, a descriptive statistics (mean, median, mode or variances) describe data you have, but can't be generalized beyond that. **Inferential statistics helps us to generalize our findings. When through the research if we find something new, we are able to generalize throughout the world. This is possible when it goes through t-test.**
- **The limitation for t-test is that the frequency distribution should be normal. (How?)**

T- test: History

- This test or distribution is also know as students distribution because it was derived by W.S Gosset and published under the nick name “**Student**”.
- The t-statistic was introduced in 1908 by William Sealy Gosset, a chemist working for the Guinness brewery in Dublin, Ireland ("Student" was his pen name).
- Gosset had been hired due to Claude Guinness's policy of recruiting the best graduates from Oxford and Cambridge to apply biochemistry and statistics to Guinness's industrial processes.[2] Gosset devised the *t*-test as a cheap way to monitor the quality of stout. The Student t-test work was submitted to and accepted in the journal *Biometrika*, the journal that Karl Pearson had co-founded and of which he was the Editor-in-Chief; the article was published in 1908. Company policy at Guinness forbade its chemists from publishing their findings, so Gosset published his mathematical work under the pseudonym "Student". Guinness had a policy of allowing technical staff leave for study (so-called study leave), which Gosset used during the first two terms of the 1906–1907 academic year in Professor Karl Pearson's Biometric Laboratory at University College London. Gosset's identity was then known to fellow statisticians and the Editor-in-Chief Karl Pearson.
- It is not clear how much of the work Gosset performed while he was at Guinness and how much was done when he was on study leave at University College London.

t- test: Demonstrations

The limitation for t-test is that the frequency distribution should be normal.



t- test: Demonstrations

- Here in the figure, the mean cholesterol level is marked –30. When drug therapy is used on such population it is seen that 34 is the cholesterol level where as without any drug use or under placebo test it is seen that 36 is the cholesterol level.
- Here t-test comes in action. **It ask "Whether there is significant difference in cholesterol level due to the use of therapy or not? Whether the improvement in cholesterol level can occur without any interventions? Whether the improvements are only by chance and not by interventions."**
- **These test are usually used in determining the quality of product or pharmaceutical in industries. (It's more about biostatistics. Can it be used in testing the effectiveness of psychiatric drug or psychotherapy?)**
- **<u>* Actually hypothesis testing tries to rule out (reject) the process that everything/ events or phenomena comes through ripening of the time. Eventually it asserts that we can bring out phenomena through external locus of control. (Is it?)</u>**

t- test: Demonstrations

- **In the above example/ figure:**
- **t-value = variance between the group/ variance within the group**
- **= 36-34/36-30**
- **= 2/6.**
- **Actually t-value has a corresponding p-value, which is the probability that the pattern of data in sample could be produced by random data. The p value helps us to give inferences as-**
- **If p =0.10, there is 10% chance**
- **If p =0.05, there is 5% chance of accepting the alternative hypothesis otherwise null hypothesis is accepted to infer that there is no significant differences (between two parameters of the same population).**
- **t- tests are more appropriate with 20 to 30 frequencies in each compared group.**
- This test or distribution is also known as student's distribution because it was derived by W.S Gosset and published under the nick name "Student".

t- test: Demonstrations

- ~~**Formula/ Calculations:**~~
- ~~t- Statistics is defined as t = [(**X- μ) √n]/ S**~~
- ~~**Where $S^2 = \sum (x\text{-}X)^2/ (n\text{-}1)$**~~
- ~~**i.e. $(n\text{-}1)\ S^2 = \sum (x\text{-}X)^2 = ns^2/ \sigma^2$ [$S^2 = \sigma^2$, meaning population variance]Or, $n\text{-}1 = ns^2/S^2 = ns^2/ \sigma^2$**~~
- ~~**Here, n-1 is the degree of freedom for a sample with sample size n and only one parameter in consideration and is represented as ν (nu) .**~~
- ~~**Therefore, $t^2/\nu = n\ (X\text{-}\ \mu)/ \sigma^2/ [ns^2/ \sigma^2]$**~~
- ~~Therefore, **t^2/ν** is the ration of two independent variates distributed with 1 and ν (1-n) degree of freedom.~~
- ~~**In derivative we can see this relationships through β (1/2; ν/2). (Is it?)**~~
- **I think I should follow the correction seen in the next slide.**

At least in case of paired t-test s means sample standard deviation

One-sample *t*-test [edit]

In testing the null hypothesis that the population mean is equal to a specified value μ_0, one uses the statistic

$$t = \frac{\overline{x} - \mu_0}{s/\sqrt{n}}$$

where $\overline{x}$ is the sample mean, *s* is the sample standard deviation of the sample and *n* is the sample size. The degrees of freedom used in this test are *n* − 1. Although the parent population does not need to be normally distributed, the distribution of the population of sample means, $\overline{x}$, is assumed to be normal. By the central limit theorem, if the sampling of the parent population is random then the sample means will be approximately normal.[11] (The degree of approximation will depend on how close the parent population is to a normal distribution and the sample size, n.)

t- test: Types

- **Independent sample t-test:** It is also called unpaired sample t-test or between sample t-test. It is used when we have to test the means of two groups.
- E.g. A two-sample location test of the null hypothesis that the means of two populations are equal. All such tests are usually called **Student's *t*-tests**, though strictly speaking that name should only be used if the variances of the two populations are also assumed to be equal; the form of the test used when this assumption is dropped is sometimes called Welch's *t*-test. These tests are often referred to as "unpaired" or "independent samples" *t*-tests, as they are typically applied when the statistical units underlying the two samples being compared are non-overlapping.[6]
- The independent samples *t*-test is used when two separate sets of independent and identically distributed samples are obtained, one from each of the two populations being compared. For example, suppose we are evaluating the effect of a medical treatment, and we enroll 100 subjects into our study, then randomly assign 50 subjects to the treatment group and 50 subjects to the control group. In this case, we have two independent samples and would use the unpaired form of the *t*-test. The randomization is not essential here – if we contacted 100 people by phone and obtained each person's age and gender, and then used a two-sample *t*-test to see whether the mean ages differ by gender, this would also be an independent samples *t*-test, even though the data are observational.

t- test: Types

- **<u>Paired sample t-test:</u>** It is also called dependent sample t-test. Actually it is used in ascertaining the quality of changes in a group before interventions and after interventions. Like if a group of drug abusers are given psychotherapy, it may help to distinguish between the level of stress before the therapy and after the therapy.
- E.g. A test of the null hypothesis that the difference between two responses measured on the same statistical unit has a mean value of zero. For example, suppose we measure the size of a cancer patient's tumor before and after a treatment. If the treatment is effective, we expect the tumor size for many of the patients to be smaller following the treatment. This is often referred to as the "paired" or "repeated measures" *t*-test.
- Paired samples *t*-tests typically consist of a sample of matched pairs of similar units, or one group of units that has been tested twice (a "repeated measures" *t*-test).
- A typical example of the repeated measures *t*-test would be where subjects are tested prior to a treatment, say for high blood pressure, and the same subjects are tested again after treatment with a blood-pressure lowering medication. By comparing the same patient's numbers before and after treatment, we are effectively using each patient as their own control. That way the correct rejection of the null hypothesis (here: of no difference made by the treatment that means there is no significant difference between) can become much more likely.

t- test: Types

- **One sample t-test:** It can be helpful in determining the changes in a sample against the standard expected value. Like the IQ of a group of workers based on standard measure of 100 IQ score.
- E.g. A one-sample location test of whether the mean of a population has a value specified in a null hypothesis.
- **(Through hypothesis testing at least we can generalize or infer that whether there was manipulation in drawing our samples; whether the samples belong to the same population that we are trying to research. Is it only for t-test? I think for F-test two different populations are considered.)**
- **T-tests are also used as a** test of whether the slope of a regression line differs significantly from 0.

t- test: Application

- To test the significance of sample mean when population variance is given.
- To test the significance difference between two sample means when population variances are not known.
- To test the significance of an observed correlation coefficient, regression coefficient, partial correlation coefficient and rank correlation coefficient.
- To test the significance differences in two paired sets of data.
- F-tests help us to acknowledge whether two samples are drawn from two population with the same variance. If the two populations are same, their mean should also be same. And this can be tested by the t-test.
- Chi square test desires to prove the null hypothesis where as paired sample t-test desire to prove the **alternative hypothesis that there is significant difference between the sample and the population parameter.**
- **Also the hypothesis testing deals with single variables but same or different population (as F test tries to elucidate on whether the variance of two population are same or not)**

Correlation

- **Correlation Coefficient:**
- Correlation coefficient [r (x,y)] are expressed in proportional value.
- r (x,y) is applicable for linear relationships as with the equations**: ax+ by + c = 0** (where x is independent variable; y is dependent variable, a and b are coefficient of variables and c is the intercept)
- **Outliers are some value of the variables out from the linear relationships.**
- **One variable distribution- Univariate**
- **Two variable distribution- Bi-variate (can we say Pearson's Correlation Coefficient as 0 order bivariate correlation coefficient?)**
- **Many variable distribution- Multi-variate**

Correlation

- So far, the statistical characteristics of one variable is dealt. Either we were trying to compute the central tendencies or variance regarding these variables in study. Or, (through hypothesis testing) we were also giving our effort to establish that these variables are taken from the population under study; i.e. they are the right sample that we have taken for study and their finding can be generalized in the whole population.
- But in practical situation two or more variables are to be investigated simultaneously to determine their statistical characteristics and relationships. Lets consider a research involving marriage of the boys and girls of a ethnic community at an early age and its psychological consequences (dependent variable).
- Here, age is one variable (x1), economy is the second factor (variable x2), social norms (x3); lack of education (x4).
- Now when we wish to determine the relationship between these variables and their impact on the psychological consequences (manasik asar haru) we have to go through the scanner of the correleation
- When only two variables are considered in investigation, the case is called bivariate distribution and when more than two are considered the case is called multivariate distributions. Of these variables, one is dependent variable and others are in***dependent variable***s.
- **In agriculture, the effect of fertilizer, irrigation, spacing, etc. on the amount of yield produced by a crop may be subject to investigation. The amount of yield is the dependent variable and is usually denoted by y where as fertilizer, irrigation and spacing are independent variables and denoted by x.**

Correlation

- In statistics, **dependence** is any statistical relationship between two random variables or two sets of data. **Correlation** refers to any of a broad class of statistical relationships involving dependence.
- Familiar examples of dependent phenomena include the correlation between the physical statures of parents and their offspring, and the correlation between the demand for a product and its price. **Correlations are useful because they can indicate a predictive relationship that can be exploited in practice.** For example, an electrical utility may produce less power on a mild day based on the correlation between electricity demand and weather. In this example there is a causal relationship, because extreme weather causes people to use more electricity for heating or cooling; however, statistical dependence is not sufficient to demonstrate the presence of such a causal relationship (i.e., correlation does not imply causation).
- There are several **correlation coefficients**, **often denoted *ρ* or *r***, measuring the degree of correlation. The most common of these is the Pearson correlation coefficient, which is sensitive only to a linear relationship between two variables (which may exist even if one is a nonlinear function of the other). Other correlation coefficients have been developed to be more robust than the Pearson correlation – that is, more sensitive to nonlinear relationships. Mutual information can also be applied to measure dependence between two variables.

Correlation

- Mathematically the degree of dependence of various variables is seen through the joint variance of variables (x,y) denoted by covariance [cov (x,y)] or μ_{11}. Covariance has its unit.
- When x and y are independent of each other their covariance is always zero. But the converse is not true i.e. the zero covariance doesn't imply that the variables are independent.
- Cov (x,y) =

Partial Correlation: Types

- In Partial Correlation coefficient, we take x and y's correlation while other variable under study are taken as control variable.
- Partial correlation: If a population or data-set is characterized by more than two variables, a partial correlation coefficient measures the strength of dependence between a pair of variables that is not accounted for by the way in which they both change in response to variations in a selected subset of the other variables.
- In probability theory and statistics, **partial correlation** measures the degree of association between two random variables, with the effect of a set of controlling random variables removed.
- A partial correlation coefficient is a measure of the linear dependence of a pair of random variables from a collection of random variables in the case where the influence of the remaining variables is eliminated. The partial correlation for variables x1, x2 and x3 with x3 taken as control variable is represented as:
- $\mathbf{r_{12.3} = (r_{12} - r_{13}.r_{23}) / \sqrt{} (1 - r_{13}^2)(1 - r_{23}^2)}$
- As we see through the formula the effect of the relationship of variable x1 and x2 with the variable x3 is removed in the form (-r13.r23).
- **Brain Teaser:** Is the Pearson's Product-Moment Correlation Coefficient called bivariate correlation coefficient of 0 order?

Writing Research Report

Unit VI

a) **Introduction: American Psychological Association**

b) **American Psychological Association (APA) format of research report**

Introduction: American Psychological Association

- The **American Psychological Association** (**APA**) is the largest scientific and professional organization of psychologists in the United States and Canada.[1] It is the world's largest association of psychologists with around 137,000 members including scientists, educators, clinicians, consultants and students. **The APA has an annual budget of around $115m**. There are 54 divisions of the APA—interest groups covering different subspecialties of psychology or topical areas.
- The APA has task forces which issue policy statements on various issues of social import such as the APA position on psychology of abortion; APA position on human rights such as detainee welfare, human trafficking, and rights for the mentally ill; APA position on IQ; APA position on treating homosexuality (sexual orientation change efforts); and APA position on men and women (gender differences).
- APA is a corporation chartered in the District of Columbia.
- Brain teaser: Can a psychological organization (that too a corporation and not a even a governmental organization) based in US influence the psychological lives of people in countries like Nepal?

Mission: American Psychological Association

- **Mission: The mission of the APA[3] is to advance the creation, communication and application of psychological knowledge to benefit society and improve people's lives.**
- The American Psychological Association aspires to excel as a valuable, effective and influential organization advancing psychology as a science, serving as:
- A uniting force for the discipline
- **The major catalyst for the stimulation, growth and dissemination of psychological science and practice**
- The primary resource for all psychologists
- The premier innovator in the education, development, and training of psychological scientists, practitioners and educators
- The leading advocate for psychological knowledge and practice informing policy makers and the public to improve public policy and daily living
- A principal leader and global partner promoting psychological knowledge and methods to facilitate the resolution of personal, societal and global challenges in diverse, multicultural and international contexts
- An effective champion of the application of psychology to promote human rights, health, well being and dignity

American Psychological Association: The Psychologically Healthy Workplace Program

- **The Psychologically Healthy Workplace Program** (PHWP) is a collaborative effort between the American Psychological Association and the APA Practice Organization designed to help employers optimize employee well-being and organizational performance. The PHWP includes APA's Psychologically Healthy Workplace Awards, a variety of APA Practice Organization resources, including PHWP Web content, e-newsletter, podcast and blog, and support of local programs currently implemented by 52 state, provincial and territorial psychological associations as a mechanism for driving grassroots change in local business communities. The awards are designed to recognize organizations for their efforts to foster employee health and well-being while enhancing organizational performance. The award program highlights a variety of workplaces, large and small, profit and non-profit, in diverse geographical settings. Applicants are evaluated on their efforts in the following five areas: employee involvement, work-life balance, employee growth and development, health and safety, and employee recognition. Awards are given at the local and national level.
- 2010 award winners: American Cast Iron Pipe Company, Tallahassee Memorial HealthCare, Advanced Solutions (an HP company), Toronto Police Service and Leaders Bank.

American Psychological Association

- **PsycINFO:** APA maintains an abstract database named PsycINFO. It contains citations and summaries dating from the 19th century, including journal articles, book chapters, books, technical reports, and dissertations within the field of psychology. As of January 2010, PsycINFO has collected information from 2,457 journals. Similar databases operated by other organizations include PsycLit and Psychological Abstracts. APA also operates a comprehensive search platform, PsycNET, covering multiple databases.
- **Supplementary:** It is stated in ML Singh's Understanding of Research Methodology that abstract is to be at the fore front of report just the next page to the title of thesis. It should be in about two paragraphs sentences about problems, methods and findings in short or like the synopsis.

American Psychological Association: History

- **Founding:** The APA was founded in July 1892 at Clark University by a group of 26 men, the first president was G. Stanley Hall. It is affiliated with 60 state, territorial, and Canadian provincial associations.[26]
- **Dominance of clinical psychology:** Due to the dominance of clinical psychology in APA, several research-focused groups have broken away from the organization. These include the Psychonomic Society in 1959 (with a primarily cognitive orientation), and the Association for Psychological Science (which changed its name from the American Psychological Society in early 2006) in 1988 (with a broad focus on the science and research of psychology). Theodore H. Blau was the first clinician in independent practice to be elected president of the American Psychological Association in 1977.

Thesis and Report Writing

- Universities and college are the centre for intellectual activities. They devote their time in many research activities. The basic differences in nature of the researches carried out in universities and research agencies is that researches carried out in universities aims to establish theories and laws which may or may not have immediate practical utility. But researches carried through research agencies or organizations are intended to immediate practical utility. As such researches carried out in universities are basic or academic in nature where as those carried out through agencies are more of applied nature.
- **Research in universities are classified on various types as: 1) Departmental research/ consultancy works 2) Individual teachers research works 3) Students research works**
- **Project work:** The research carried out by students for fulfilling academic requirement are known as project works. These works are done as a parts of curriculum for academic degree's write ups and known by different names such as dissertations, thesis, field reports, special studies and extended essays, etc. some extended essays are also named as Literature study or Term paper.

Thesis and Report Writing

- The main differences between the various types of project works lie in their originality, length and presentations of the work.
- **<u>Originality</u>**: The degree of originality expected is related to the level of the academic course. The more advanced the course, the more originality is expected. **<u>This written document of research work at this level (for fulfillment fo academic course) is known as thesis and it should be worthy of publication.</u>**
- At post graduate level, only some originality is expected. At undergraduate (bachelor) level it may be presentation of thesis of material drawn form secondary source (as books, websites, articles and journals) and secondary data which lacks originality. At PhD and post graduate level the students are expected to rely heavily on primary sources for their data.
- **<u>Scope: T</u>**he more advanced the course, the focused should be the study and hence more specialized will be the field of research and the greater will be depth of reviews and investigation required.
- **<u>Presentations:</u>** The more advanced the course the greater attention the researcher will have to pay especially in documentation, quotations, references and bibliography. They must be presented in prescribed format so that they are readable throughout the world.

Thesis and Report Writing

- **Length: The length of thesis tends to increase in proportion to the originality required. There is no hard and fast rule for the length of the thesis.** Quality is that matters in thesis writing. **However, it should be noted that thesis in physical sciences are much shorter than those written in social sciences.**
- Components or features of research: a) **Style**: Usually the style of writing a thesis is formal. **First person nouns such as I, we, He, etc are avoided as far as possible**. For instance, instead of writing, "I have seen," the formal sentences like it has been observed… is more appropriate and used. **However in Mathematics sciences, first person nouns are also used.** The sentence structuring is more of passive voice. Instead of writing- "I eat an apple" we should write- An apple was eaten.
- B) **Documentation**: In thesis writing, the sources of information have to be described fully as prescribed by rules and regulation of the university.
- **Supplementary:** We need to understand that report writing is meant for documenting the research, which can either be project work (more of discovering theories or phenomenon) for academic fulfillment or be intended agency research (more of applied ~~**or punctuation**~~ research).

Designing Thesis and Report Writing

- In unit I where we dealt with steps in scientific research, we already diffused those steps with the sequential procedure in the documenting and reporting of the research. However there are some steps that we may have missed in unit I that need to be followed in an unique way in thesis (intended for the project work). For instance, topic choosing, submission of reports are some unique and extra features of a project or thesis work. **<u>The steps to be followed in a thesis or the overall design of the report writing are:</u>**
- **Choosing a topic**
- **Preliminary reading- I**n case of academic research we can correlate this part with writing the introduction for the chosen problem and researcher being defined about what he wants to do. We also need to assemble a lot of materials including past literature tools and tests for psychological research.
- **Defining the topic- I**f the researcher is assured of the topic he can go for actual field research and collect data.
- **<u>Supplementary:</u>** The design of thesis is as similar to the design of the research in many ways along with some peculiarities in thesis.

Designing Thesis and Report Writing

- **Research and note taking** (data/ information and notes collection- its more about collecting information either from the original source (primary data) or already available/ used source as materials from to be referred reference book)
- **Organization of the notes and data, data analysis & presentation, result and discussion and finally conclusion**
- **Writing the draft- With beginning part; body part and end part**
- **Submitting the draft to the tutor or guide or instructor or the supervisor for the revision**
- **Modification and edition of the thesis as according to the APA style** (for our behavioural science research)
- **Preparing the final version**
- **Getting revised draft typed**
- **Binding for submission**
- **Oral or Via-va examination**

Designing Thesis and Report Writing

- **Supplementary:** It need to be understood that designing research is different from designing report (research design is basically designing how to collect data and interpreting the data)
- Research design mainly concerned with identification of methods to collect the data, analyzing the data and reporting the data. It is the procedures to be used in data collection and data analysis used for controlling the variances due to different factors.

Choosing of the Topic: Some pitfalls

- There are two ways in which one arrives at a topic. Either the **guide/ tutor/** department suggest it or one arrives at the choice oneself. But one should be careful about the pitfalls of the topic chosen.
- There are many pitfalls to be avoided and there are countless students who have failed to complete their research not because they were lazy or badly organized but their topic was not suitable for research.
- **Some pitfalls**: 1) Choosing a topic that is too large and vague or the topic that tries to associate a lot of variables but can't efficiently focus on one variable.
- 2) Choosing a topic which is too complex for research at the level at which the student is studying. E.g. A student of thesis year choose a topic " Emotional Intelligence" as research topic for which no enough research material, literature, tools and test were available in case of Nepal. Later he withdrew from the topic citing time, money and effort constraints. So the best topic chosen would be that topic that is **able to elicit primary interest, sustain the level of interest and continue with the interest for applying effort in that research.** Otherwise many times a lot of effort and time get wasted (goes in vain).
- 3) Not giving due consideration to the time factor. **This factor is important because the research work is to be completed within the prescribed time period**. It is suggested that a time schedule is to be prepared in doing research (like time frame for survey, allocation of time for interview) as well as documenting the research.
- 4) To choose the topic, for which materials are not easily accessible.
- 5) To choose the topic which is not researchable because the source of materials are already destroyed or the methodology of investigation is not yet developed.

Arranging of the Materials/Content While Preparing the Draft- ML Singh style

- The thesis has **three principal components- 1) Beginning part 2) Body part 3) End part**. Here beginning is the introductory part and the end is the conclusion and recommendatory part. The body is the main part and is composed of materials collected, analysed and tested. The body may be presented in several chapters, **each chapter written in the order of importance.**
- **The sequence/ order of the different part of research are as follows:**
- **A) Beginning part:**
- **1) <u>Title page of the thesis:</u>** this is cover page should include the following in order: Name of the university, Name of faculty and teaching department, name of the degree followed by the word " Dissertation", Title of the thesis, Name of the student preceded by the word **Year of the Submission of the Thesis** (it seems this approach has already outdated)
- **2) <u>* Abstract</u>: About two (or APA says one) paragraphs sentences about problems, methods and findings.** The abstract is a one-paragraph, self-contained summary of the most important elements of the paper.
- (Write around 2 page of summary. Compress it into one line statement. From these compressed points you can describe and elaborate. While presentation, write these points on the board or show it in projector and elaborate. This would make your presentation more precise. Also using these points or statements you can (are to) create an abstract of half page and put it into the front page of the final report that you would submit.)

Arranging of the Materials/Content While Preparing the Draft- ML Singh style

- **3) Acknowledgement**: it is the gratitude expressed to those who helped in the successful completion of the thesis.
- **(It is said the approval letter or recommendation in few sentences form the research guide stating that the thesis submitted has been guided by him and that to his knowledge is fit for approving for the degree of … (mention the course) has to be included in the beginning of the front page of the thesis) Is this front page the title page or before the abstract or after the acknowledgement?**
- **4) Preface:** Two to three pages write up giving idea about what main body of thesis are, information about what has been done in each chapter. Results are usually not stated. **(It seems more like summary at the start of the report than at the end)**
- **5) List of the contents (or table of the content or index)- the list must include the beginning part, body part and end part)**
- **6) List of Abbreviations used**
- **7) List of Tables**
- **8) List of Illustrations**
- **9) List of Annexes**
- **These write up page or beginning part should be numbered by page number in Roman letters like I, II, …IX, etc.**

Arranging of the Materials/Content While Preparing the Draft- ML Singh style

- **B) Body Part:**
- **Chapter I:** Introduction (prior to introduction "in our term paper: like report we also insert the **Statement of the problem) with**
- **Objective, rationale of study, hypothesis, limitation of the study, etc.**
- **Chapter II**: Review of Literature
- **Chapter III**: Methodology of Data Collection
- **Chapter IV**: Data presentation, Interpretation and Analysis (Result and Discussion)
- **C) End Part**
- **Chapter V:** Conclusion and Recommendations with
- List of references
- Bibliography
- Annexes
- **Brain teaser:** Isn't the objective of the study and the rationale of the study same? **Objectives** are purpose or set of goals where as **rationale** is the ideal or necessity or justification behind any research.

APA Style

- **American Psychological Association** (**APA**) **style** is an academic format specified for documenting report and thesis in ***The Publication Manual of the American Psychological Association .***
- ***It is*** a style **American Psychological Association** (**APA**) **style** is an academic format specified in ***The Publication Manual of the American Psychological Association*****, a style guide that offers academic authors guidance on various subjects for the submission of papers to the publications of APA.**
- **The APA states that the guidelines were developed to assist reading comprehension (universally acceptable norms) in the social and behavioral sciences, for clarity of communication, and for "word choice that best reduces bias in language".**
- The *Publication Manual of the American Psychological Association* contains guidelines on many aspects of academic writing as it is regarded as appropriate by the APA. **Among the topics covered are information on the structure of research papers of various kinds, spelling rules, an author-date reference style, construction of tables and graphs, plagiarism, formatting of papers, and much more.**
- **APA style is widely used, not only by APA publications but by various other scientific journals (including medical and public health journals, textbooks, and academia (for papers written in classes).**
- Along with MLA, CMOS, Turabian, AMA, and CSE, it is one of the major style regimes for such work.

* APA Style: History

- The *Publication Manual* was established in 1929 as a seven-page document with a set of procedures to increase the ease of reading comprehension (APA, 2009a, p. xiii).[4] Created under the sponsorship of the United States National Research Council, its originators included psychologists, anthropologists, and publishing professionals.
- In 1952, the booklet was expanded and published as a 55-page supplement in *Psychological Bulletin* with revisions made in 1957 and 1967 (APA, 1952, 1957, 1967).[5][6][7] The first edition covered word choice, grammar, punctuation, formatting, journal publication policies, and "wrapping and shipping" (APA, Council of Editors, 1952, p. 442).
- In response to the growing complexities of scientific reporting, subsequent editions were released in 1974, 1983, 1994, and 2001. Primarily known for the simplicity of its reference citation style, the *Publication Manual* also established standards for language use that had far-reaching effects. Particularly influential were the "Guidelines for Nonsexist Language in APA Journals," first published as a modification to the 1974 edition, which provided practical alternatives to sexist language then in common usage.[8][9] The guidelines for reducing bias in language have been updated over the years and presently provide practical guidance for writing about race, ethnicity, age, gender, sexual orientation, and disability status (APA, 2009, pp. 70–77; see also APA, 2009b).

* APA Style: 6th Edition

- **Sixth edition of the *Publication Manual:*** The sixth edition of the *Publication Manual of the American Psychological Association* was released in July 2009 after four years of development. The *Publication Manual* Revision Task Force of the American Psychological Association established parameters for the revision based on published criticism, user comments, commissioned reviews, and input from psychologists, nurses, librarians, business leaders, publishing professionals, and APA governance groups (APA, 2007a, 2007b). To accomplish these revisions, the Task Force appointed working groups of four to nine members in seven areas: Bias-Free Language, Ethics, Graphics, Journal Article Reporting Standards, References, Statistics, and Writing Style (APA, 2009, pp. xvii–xviii).
- The APA explained the issuing of a new edition only eight years after the fifth edition by pointing to the increased use of online source or online access to academic journals (6th edition, p. xv). The sixth edition is accompanied by a web presence.
- There were many errors noted in the first printing of the sixth edition.
- **Supplementary:** APA style is an academic format or style guide specified for documenting report and thesis.

APA Format Of Research Report: Brief Outline For Formatting Report

- **American Psychological Association** (**APA**) **Style** **is a set of rules developed to assist reading comprehension in the social and behavioral sciences.** Designed to ensure clarity of communication, the rules are designed to "move the idea forward with a minimum of distraction and a maximum of precision."[22] The *Publication Manual of the American Psychological Association* contains the rules for every aspect of writing, especially in the social sciences from determining authorship to constructing a table to avoiding plagiarism and constructing accurate reference citations.
- "The General Format of APA is most commonly used to cite sources within the social sciences. **General guidelines for a paper in APA style includes: typed, double-spaced on standard-sized paper (8.5" x 11") with 1" margins on all sides. The font should be clear and highly readable. APA recommends using 12 pt. Times New Roman font.”** Everything should be double-spaced --- including block quotations, footnotes, and references. Adding space before the paragraph and after the paragraphs would allow words to be readable.
- It is stated in ML Singh’s **Understanding of Research Methodology** that abstract is to be at the fore front of report just the next page to the title of thesis. It should be in about two paragraphs sentences about problems, methods and findings in short or like the synopsis.
- Adding space before the paragraph and after the paragraphs would allow words to be readable.

APA Format Of Research Report: Brief Outline For Formatting Report

- **Editing is one of the reason behind the texts to be in double space line.**
- Set hypothesis if you can correlate variables. Usually we set hypothesis in quantitative research but we need to remember it is not uncommon in qualitative researches too.
- **As we know there are two system for formatting the research report. The MLA style and APA style. They have their own and unique designation to cite information. We have to cite information because we can refer the cited information in the reference section to get enough material about that citation (**quote, mention or refer to.). We use citation as (Brooks, 247- According to MLA style or Brooks, 1968- according to APA style) in order that this part of the text can be referred in reference section. So we can say that reference section acts as an additional section for the cited materials. Cited materials are usually for approving the beliefs and content set out by other authors. Cited materials gives weight to the content of the research report.
- There are two main ways of citing sources within a text: (1) the author-page system, which is widely used in the humanities; and (2) the author-date system, which has been adopted by the social sciences and some of the natural sciences. Each of these systems has several variations. The recognized standard for the author-page system is *The MLA Style Manual*, which is published by the **Modern Language Association**. The most widely used version of the author-date system can be found in the *Publication Manual of the American Psychological Association* (APA), 3rd ed. The brief descriptions of each system that follow are based on these two sources.

Citation: MLA style (author-page system)

- The basic technique in both systems is to include just enough information in the text to enable the reader to find the relevant item in the reference list. In the **author-page system**, (used in MLA style) this information includes the author of the work referred to and the relevant page number in the book (~~**or article or journal**~~). E.g.. **American novelists have always had a difficult relationship with their public (Brooks 247).**
- If the author is mentioned in the text, then just the page number is needed in parentheses. E.g. **As Brooks has observed, American novelists have always had a difficult relationship with their public (247).**
- If the reference is to a work as a whole rather than to a specific part, then no additional citation is needed. E.g. **In *Gilded Twilight*, Brooks establishes himself as the most thoughtful of poststructuralists critics.**
- When there is more than one item in the reference list by the same author, **the title of the work referred to is included in the parentheses, usually in a shortened form. E.g. Brooks' comments on Melville are surprisingly negative (*Gilded* 83).**
- When works by different authors are referred to, all the references are included in the same parentheses.
- **Recently critics have surprisingly negative things to say about Melville (Brooks, *Gilded* 83; Adams and Rubens 432; Leibniz 239).**

Citation: APA style (author-date system)

- In the **author-date system,** the in-text citations include the author's name and the date of publication. As with the author-page system, material that already appears in the text is not repeated within the parentheses. E.g. **A recent study carried out a McGill came to the opposite conclusion (McBain, 1991)**
- **McBain (1991) demonstrates that there is at least one alternative to the accepted view.**
- **In a 1991 study, McBain showed that there is at least one alternative to the accepted view.**
- When the reference list contains more than one work published by a particular author in the same year, letters are used to distinguish among them. E.g. **Several innovative studies in the last few years have demonstrated that this matter is not as settled as was once thought (Brewer, 1989; Fischer & Rivera, 1988; McBain, 1989a, 1989b. 1991; Silvano, Blomstedt, & Meigs, 1987).**
- Ordinarily, page numbers are included only when there is a direct quotation. This style seems more of the blend of APA and MLA style. **E.g. One respected researcher notes that little notice has been taken of "the substantial number of counterexamples that have not been either questioned or explained" (McBain, 1991, p. 238).**
- Notice how the two systems differ in details: for example, one uses *and* , the other &; one follows the author's name with a comma, while the other does not.

Citation: APA style (author-date system)

- In some publications in the sciences, the items in the reference list are numbered and these numbers are used in citations in the text (instead of actual citation. I think this is the case with citation and reference in Wikipedia).
- **One group of experiments has led researchers to believe that despite the enormous difficulties, a vaccine will eventually be produced (3,22,39).**
- Much depends on the availability of funds and staff to carry out the work (14). Motley observes, however, that "whether the administration has the will to make the painful choices necessary is highly doubtful" (19.p.687).
- With a number system, the items in the reference list may be put in either alphabetical order or the order in which they occur in the text.

References

- **Any citations made in the manuscript must be presented in the reference section and vice versa. That is, if something is not cited in the text, then it should not appear in this section. In still other words, <u>this is not a bibliography</u>.**
- Start on a new page. Center the word References at the top. As usual, double space.
- In any of the previous sections, whenever you say something like studies have shown you must provide a citation. This section tells the reader where they can find these citations.
- This section is alphabetized by last name (of the first author involved in the study).
- ~~**<u>Normal paragraphs (i.e., five-space indented) are employed for each reference. ???</u>**~~
- **For each author, give the last name followed by a comma and the first (and middle) initials followed by periods.** Separate multiple authors with commas and the last author with the **<u>ampersand ('&')</u>** rather than the word "and".
- After the author(s) comes the year (in parentheses and **<u>followed by a period</u>**).
- For a journal reference, underline the title of the journal, volume number and adjacent punctuation marks with a single unbroken line. Note that issue numbers are typically **not** included. Also, capitalize the important words of the journal title.

References

- For a book reference, just underline (or has the trend now changed to italicizing the topic or title?) the title. Only capitalize the first word of the title. Do include the city, state (as a two-letter abbreviation without periods), and the publisher's name. e.g..
- Rossi, P.H. (1989). *Down and out in America: the origins of homelessness.* Chicago: University of Chicago Press.

Ibid.

- ***Ibid.*** (Latin, short for *ibidem*, meaning "in the same place") is the term used to provide an endnote or footnote citation or reference for a source that was cited in the preceding endnote or footnote. This is similar in meaning to *idem* (meaning something that has been mentioned previously; the same), abbreviated *Id.*, which is commonly used in legal citation.[1] To find the *ibid.* source, one must look at the reference preceding it. *Ibid.* may also be used in the Harvard (name-date) system for in-text references where there has been a close previous citation from the same source material.[2][3] The previous reference should be immediately visible, e.g. within the same paragraph or page. Many academic publishers now prefer that "ibid." should not be given in italics, as it is a commonly found term.[4]
- Notice that *ibid.* is an abbreviation where the last two letters of the word are not present; thus, it always takes a period (full stop) in both American and British usage.
- **Example:** [1] E. Vijh, *Latin for Dummies* (New York: Academic, 1997), p. 23.
- [2] *Ibid.*
- [3] *Ibid.*, p. 29.
- [4] Al Azif, *The Necronomicon* (Petrus de Dacia, 1994).
- [5] *Ibid.* 1, p. 34.
- Reference 2 is the same as reference 1: E. Vijh, *Latin for Dummies* on page 23, **whereas reference 3 refers to the same work but at a different location, namely page 29.** Intervening entries require a reference to the original citation in the form *Ibid.* <*citation #*>, as in reference 5.

Reference and Bibliography

- **The references are to be presented sequentially as they appear on the text. Where as in the Bibliography, bibliography has to be arranged in alphabetic order by the Names of the author or organizations. Also bibliography should be presented in following sequence/groups:**
- **1) Books 2) Journals/ Articles 3) Newspaper 4) Published documents 5) Unpublished documents, etc.**
- The bibliography may include material references useful for the topic o the study but not referred in the text.
- In the written form of many languages, an **indentation (applying TAB)** is an empty space at the beginning of a line to signal the start of a new paragraph.

Note taking- Source Card and Note Card

- May be at this time now, in this period/ era of Information Technology, we think the idea to use note cards to collect information is little outdated or out fashioned. But in the last decade (Nepal, 1997-2007; before the era of facebook) it was extensively used to collect some reliable data that was otherwise not available in internet. Use of already managed note cards are more reliable than the internet source even now and also due to the limitations that every resource and research material has not yet been encoded to the webpage, the demand is more. In the Central Library of Tribhuvan University, Kirtipur, Nepal, we can found the note card and source card kept in shelves.
- Note taking is a way of collecting research materials from written source. The most popular method of taking notes from written sources is to use **Record Cards** because they are easy to arrange and rearrange in group and classify. Only one note is written in each card. There are two sets of such cards.
- One set is used for recording the source of information. This we can say as **Source Card (also referred as index card as been called in Central Library of Tribhuvan University, Nepal or 5”x3” card)**. Usually this card is of **5”x3”** size.
- The following information are found in source card: 1) Name of the author or issuing body 2) Title of the publication 3) Editor/ Translator 4) The edition 5) Volumes 6) Place of publications 7) Publisher 8) Date of publication 9) Volume no. in Roman letter 10) Page number

Note taking- Source Card and Note Card

- If the source card is about thesis then it may include only the name of author, title of the thesis enclosed in inverted comma, the course or degree for which the thesis was submitted and the name of the university. Source cards can also be used for determining reference for books journal and thesis. An example of source card for thesis
- **E.g. Singh, ML. (1979) "Population Dynamics of Nepal- An analytical Study", T.U., Kathmandu.**
- The other set is used for recording the note or has the note. Usually this card is of 6"x4" size. We can call it note card and this contains a relevant information. On th upper right corner the name of the author and name of the issuing body is written. Then a note regarding important fact of some study or phenomenon is mentioned. Example,
  - **Moser and Kalton**
  - **Survey Methods**
- **The core of the interviewer's task is to locate sample members to obtain interview and record answer.**

Reports: Overview

- **Academic research called project work and document prepared and presented for the project work is called thesis, dissertation, literature study, etc.**
- **The research document prepared for non academic research is called report.**
- In non academic field research, the presentation of the whole research operation is in the form of a report.
- The report written for general population contains descriptions of findings and their implications. ***(Can the research report prepared for general population be considered as a factual newspaper article?)*** This style of writing at this level should be informal and should be free from technicalities.
- For those who are primarily interested in results and inference drawn rather than statistical aspects of sample design, data analysis, the report presented is **General Report**. But for those who are technical minded and for those who are interested to carry out follow up studies, **Technical Report** should be provided.

Reports: Types

- UN Statistics Office (1964) has distinguished the following type of report:
- **1) Preliminary report: A report that need to be presented as soon as possible and which is just able to give the details of available data of current interest.** Such results may relate to characteristics of the survey population and variable, and these results sometimes are based on a sub sample of the full sample. The report contains a brief statements about survey method, the limitations of the data, and the size of the sample used and the method of the selecting the sample. In a sense this is a pilot survey based non academic research report. The data used for reporting may not be so much classified. E.g. FIR (first investigation report)

Reports: Types

- **2) General report:** This type of research report doesn't focus on technicalities of sampling design and include information only on:
- a) purpose of the survey - o**bjective**
- b) description of the area of the coverage of the study – **population and area**
- c) nature of the information collected – **types of data**
- d) the method of collection
- e) the extent and causes of non response (even in single unit survey there are chances of non response with regards to some question items) – **limitations of the research**
- f) whether the survey is an isolated one or is one of a series of similar surveys
- g) Numerical results – **result and conclusion**
- h) the period to which the data is referred and the period of data collection
- i) accuracy – **may be through different hypothesis testing**
- j) **cost**
- k) assessment of the fulfillment of the purpose of survey – **application and knowing if the research result have utility value toward intended population.**
- l) names of the organization conducting and sponsoring - a**cknowledgement**
- m) **references** to available reports or papers relating to the survey
- E.g. Cooperative annual general meeting report

Reports: Types

- **Technical report:** in this report more emphasis is given to methodological part of the survey (methods and sample are more the focus of research). These report should include information on:
- A) Specification of the frame (list of population)
- B) Sample design
- C) Tools and equipments used for study
- D) Statistical analysis
- Supplementary: **Analysis is the use of different statistical measures as mean, median, variances to draw out some statistical inferences/ results to confirm the validity of some hypothesis.**
- E) Accuracy of the results including sampling and non sampling errors
- F) Comparison with other sources of information (meta analysis with already published research result)
- G) Cost analysis
- H) Efficiency of sample design
- The write ups for general and technical report may be preceded similar to the writing of thesis but all the formalities as required in thesis writing may not be needed (as in case of seminar paper, we may just include head, body and tail of the content and present it in some seminar)
- E.g. FIFA technical report on style of playing soccer of different countries

Appraisal writing

- The assessment of a situation is to be presented in the form of a report called Appraisal writing. A report on job performance is an example of appraisal writing and this given the name performance appraisal. If the assessment is done by comparing the situation before and after the application of development inputs, the report is called evaluation report.

Content Analysis: With regards to newspaper article

- It is the analysis of the contents of the communication materials or preferably qualitative data such as newspaper article, editorials, television programs, written documents as thesis, letters, diaries, ethnographic material, the minute of meeting, etc.
- **The unit of the analysis may be one of the following: words, themes, characters, item and space & time measure.**
- **The analysis is done to determine the relative emphasis or frequencies of various communication phenomenon such as <u>propaganda, trends, style, change in the contents and readability of data.</u> Analysis can be regarded as quantitative phenomenon as they help to explain the relationships of different variables involved in a phenomenon.**
- The word is the smallest unit used in content analysis and is categorized as value words: Difficult, medium and easy words. In the thematic units, sentences making prepositions about some thins are categorized.

Content Analysis: With regards to newspaper article

- **The self reference sentences that use- I, me and other words indicating references to the writer self is an example of thematic sentences.** Note taking by the observer is often made in thematic manner. So the categorization of this unit is not of any interest in behaviour studies. However one can use character unit in analyzing stories.
- Space and time units are actual physical measurements of the content. They include: Number in inches in space, number of pages, no of paragraphs, number of minutes of discussions and so on.
- Of all units item unit is most important. Item unit is a whole production of communication such as essay, news story, television programs and projective stories. The whole write up or a program is used as a unit for classification into categories such as creative and non creative writing.
- the measurements of the objects of content analysis are made either by nominal or ranking or rating scales.
- The process of content analysis is first the universe of the content U is analyzed and defined. Then U is partitioned into major categories and number of sub categories. Partitioning of U is the most important part of the content analysis because it is a direct reflection of the theory and problem of the study. It spells out in effect the variable of the hypothesis.

Content Analysis: Demonstration

- **However the content analysis of data or information from the behavioural science research is all about the identification of the focal element of the documented material or deriving the conclusion or inferences from the research.**
- **The purpose of content analysis in behavioural science is also to identify the relationship or link between the variables and draw out single inference or conclusion regarding the character, content of a documented study or phenomenon under investigation.**
- **Demonstration**: Lets the students of your class join their hands (referring to a continuous link). Then they are asked to spell or speak aloud a single word of their choice (as honesty or anything- Jews have the notion that human can define themselves in a single word they say, when they are free to choose the word). If there is a link between the words they say, we can derive a conclusion from the word they say. This whole process is the content analysis.
- **E.g. Meta analysis:** It is the process of identifying the similar pattern in results in different studies regarding the investigation of the similar phenomenon. Here also at first we have to determine the link or identify the similar pattern. Meta analysis is also referred to as **Pattern Identification**. The identified pattern helps in drawing out conclusion.

Critically Evaluating Studies

Unit VII

Critical Evaluation: An overview

- The big question is that, **<u>" Is critically analysing or critically evaluating or critical review the same?"</u>**
- **<u>You are allowed to ask the right question in a critical evaluation session but not any question! We must be more of judgmental and not over criticizing and nagging in critical evaluation.</u>**
- **Critical: Disapproving; being judgmental, analytical**
- **<u>Are we wrong?</u>** Do we really bother to apply theory in qualitative research? Or is it that we work with the qualitative research to find the theory? I suppose testing of theory is more applicable in quantitative research. Isn't it?
- **Rationale: The underlining principle; foundation; basis; ground**
- Critical evaluation is not about criticism but a thoughtful evaluation . The purpose of the critical review is to review or critically evaluate an article or book.
- **To be critical means that you are required to:** *ask questions about the ideas and information presented in the text and; to comment thoughtfully by engaging in a process of evaluating or; making judgments about the validity or relevance of the text to your research or field of study.*
- Part of the process of being critical is to use the information gathered from questioning to understand the topic from different perspectives and in relation to relevant theoretical frameworks in the field. Furthermore, asking the right questions will help you to make links with previous information, develop a position and arguments to support it.

Evaluation, Analysis and Summary

- **Evaluation** is the process that encourages you to show an understanding of the text content by analysing the purpose and the structure of the text, assessing and making judgements about its appropriateness according to various academic criteria.
- **Analysis** it to approach a topic analytically is to examine carefully the content, issues and structure, by separating them into component parts and explaining how they interrelate.
- The ability to **summarize** is another skill that is essential to writing a critical review. To summarize means to express the main points of an idea or topic in fewer words and without including examples or details.
- **The Criteria For Evaluating Academic Texts:** Critical evaluation necessitates understanding and analysing the text and then evaluating according to various criteria. The following is a list of criteria that can be referred to when reviewing academic texts and included in your critical commentary.
- A) Writing and structure of the article or book. (e.g. the style and expression) – Usually we don't critically review style and expressions in social science B) Argumentation and use of evidence C) Methodology D) Relevance E) Significance and contribution to its field
- There will also be other criteria for evaluating texts which are specific to individual disciplines and will vary from one discipline to another.

Questions To Consider When Evaluating Research

- Questions that help to identify the type of study e.g. theoretical article, report on an experiment or review of research.
- Establish problem or the aim and discuss the extent the aim has been achieved.
- How logical is the argument supporting the hypothesis? How is the argument supported? Is it supported well?
- How relevant is the evidence? What type of evidence is used?
- Is the evidence valid? Is the evidence accurate and relevant?
- Does the research seem objective? Consider the methodology.
- What conclusions are drawn by the experimenter on the basis of the finding? Do you consider that these are justified by the results or has the experimenter made unjustifiable conclusions?

The Structure of Critical Review

- The Critical Review has 3 specific structures:
- **1) Introduction**
- • The title of the article or book.
- • The author
- • An overview of the article or book stating its aim and identifying the aim argument
- • Your response to the article (positive, negative, mixed (For an article the introduction should be about one paragraph; for a book review the introduction should be about two - three paragraphs)
- **What are the results of each research (or study or experiment) should be highlighted in introduction of each review? Whether the null or alternative hypothesis is accepted should also be clearly pointed if the statistical measure was used to analyse the quantitative data. (RB)**
- **2) Summary of the critical review**
- • The main points and arguments presented in the article should be summarised (this section should be no longer than half the review).

The Structure of Critical Review

- **Comment critically on the text including: We rarely criticize the text, style and expression in Psychological Research Review.**
- • discussion of the points raised,
- • questioning the arguments,
- • expressing agreement / disagreement,
- • considering agreement / disagreement.
- • positive and / or negative judgements on the author's ideas, methods, argument, expression, organization etc.
- suggestions for how the article could be improved can be explained here also.
- A discussion for each critical question with the evaluator own ideas and assertion can be annexed with the question. Example: It should have been done this way and that should have been done that way.
- **3) Conclusion and Recommendation**
- • What conclusions are drawn by the experimenter on the basis of the findings?
- • Do you consider that these are justified by the results or has the experimenter drawn unjustifiable conclusions?

How to Critically Analyze Psychological Research?

- We can critically analyze a research from the following approach for the content of the documented research (we would be critiquing the research process and not the research article). It can be said as the overall layout for the critical analysis:
- **A) The Theory**
- **B) The Research Rationale**
- **C) The Participants**
- **D) The Design and Procedure**
- 1. Research method 2. Lab vs. field research 3**. Demand characteristics 4. Experimenter bias 5. Social desirability** 6. Validity of the experimental manipulation 7. Stimulus sampling 8. Reliability and validity of measures of the independent and/or dependent variables 9. Confounding variables in 10. Order of items/events
- **Brain Teaser:** What about the role of enumerator or field worker in accessing data and methods and approach he uses?
- **Are there not high chances from the side of researcher to manipulate the research findings and discuss and disseminate results based on his intentions and biases?**

How to Critically Analyze Psychological Research?

- **E) The Statistical Analyses**
- 1. Excluded participants 2. Missing data 3. Validity and reliability of dependent variables 4. **Sufficient statistical power** 5. Statistical assumptions (type I error) 6. Correct use of inferential statistics 7. Correct interpretation of analyses 8. Alternative analyses
- **F) The Discussion**
- 1. Alternative explanations 2. Cause-effect ambiguities 3. Third variable 4. Mediators and moderators 5. Replication 6. Interaction or main effect?
- **G) Place the Research in the Context of Similar Research (for meta analysis)**
- **H) Suggestions for Future Research**
- **I) Inappropriate Criticisms**
- 1. Criticizing the article rather than the research 2. Ethical criticisms 3. Incomplete criticisms 4. Criticisms of the reliability or effectiveness of methodology that produced the predicted results 5. Random allocation of participants to conditions (this doesn't mean randomization of participants for sampling)
- **J) Structuring a Critical Review**

Critical Evaluation: The Theory, Research Rationale

- **A) The Theory:** You may wish to criticize the theory that the researchers are testing. **How does it compare against competing theories in the area?** What are its strengths and weaknesses? An excellent resource for thinking about theory construction is the Special Issue on "Theory construction in social personality psychology: Personal experiences and lesson learned" in the *Personality and Social Psychology Review* (Vol. 8).
- **B) The Research Rationale:** Is there a fault in the logic of the theoretical rationale for the research? Have the researchers interpreted the theory that they are basing their hypotheses on correctly? Do the hypotheses follow logically from the theory? Does the research design provide a satisfactory test of the research hypotheses? **Are all of the necessary experimental and control conditions included? Are all of the necessary variables measured?** See McGuire (2004) for a good discussion on these points.

Critical Evaluation: The Participants

- **C) The Participants: About 70% percent of psychology research is conducted using young, educated, white, middle-class, Western, volunteer, psychology undergraduate students (Sherman et al., 1999; Wintre, North, & Sugar, 2001). Hence, it is possible that 70% of psychology research cannot be generalized to the rest of the world's population.** However, you should consider two points before making reference to this sample generalisation problem. First, the sample generalisation problem is unlikely to threaten the external validity of research investigating basic cognitive and perceptual processes such as vision, because there is no reason to believe that psychology undergraduates see differently to other types of people (Stanovich, 2007, p. 112). Second, the sample generalisation problem is widely recognised among psychologists (Stanovich, 2007, p. 117), and it does not need to be stated explicitly unless the characteristics of the sample pose a particular problem in relation to the specific independent and dependent variables being investigated.

Critical Evaluation: The Design and Procedure

- **<u>1) Research method</u>**: Every research method has its advantages and its disadvantages. Did the researchers choose the most appropriate research method for the particular research question that they were investigating? Did they deal with the disadvantages of that method? If not, how do you think that those disadvantages may have affected the results? For example, did the researchers conduct their research on the internet, and if so did they address the limitations of this particular methodology (Birnbaum, 2004; Skitka & Sargis, 2006; Van Selm & Jankowski, 2006)?
- **A lot of times researcher does research in a population where the intended variable or phenomena for study rarely exists or can be defined. Like a lot of times psychology students apply a personality test in a population/ volunteers who can rarely have such personality disorder (RB)**

Critical Evaluation: The Design and Procedure

- **<u>2) Lab vs. field research</u>:** Was the research conducted under artificial conditions in the laboratory or was it conducted under more naturalistic conditions in a real world setting? Lab research has the advantage of providing more control over extraneous variables. This means that it is often easier to draw firmer conclusions about the results from lab research than from field research. However, field research is often more naturalistic and realistic and can generate less suspicions in participants. Be careful to make your criticisms specific to the particular research that you are looking at. Don't just say that the researchers used lab research and so the results may not be generalizable to real world situations. Instead, specify which results may not be generalizable to which real world situations and explain why you think they may not be generalizable (i.e., what is different about the real world situation in comparison with the lab situation).
- **By any effort either lab or field experimental research, we can't control every desired extraneous variable. Concerning this we can say no any findings are absolute. (RB)**

Critical Evaluation: The Design and Procedure

- **<u>3) Demand characteristics</u>:** Demand characteristics are "the totality of cues which convey an experimental hypothesis to the subject" (Orne, 1962, p. 779; see also the Special Issue in *Prevention and Treatment*, 2002; Strohmetz, 2008). The most common sources of demand characteristics are the research setting, the implicit and explicit research instructions, and the research procedure. **<u>Demand characteristics are a problem because, if participants are able to deduce the research hypotheses, then they may respond in a manner that they think will confirm the hypothesis in order to be a "good" participant and not "ruin" the research (e.g., Norenzayan & Schwarz, 1999).</u>**
- What demand characteristics do you think existed in the research? As Strohmetz (2008) noted, the impact of demand characteristics depends on participant's receptivity to these characteristics and their motivation and ability to comply with them. **Do you think that participants were able to guess the research hypotheses from these demand characteristics?** Do you think that participants were motivated to try to confirm these hypotheses? How do you think that their attempts to confirm the hypotheses will have affected the results? Was any deception and/or concealment used in the research in order to prevent demand characteristics from having an effect, and if so, how effective do you think that this deception/concealment was?

Critical Evaluation: The Demand Characteristics

- **Also demand characteristics are "the must to be component of research". When a research is being done in fatness of school children, in order to comprehensively know about the result, one of the phenomena under consideration would be height of the children. Lack of demand characteristics may deviate a research finding but visible demand characters can let respondent the motive behind research or they are able to sense they hypothesis and they may fake good or fake bad. Or intrinsically manipulate and give false data (RB)**

Critical Evaluation: The Design and Procedure

- **<u>4) Experimenter bias</u>**: The experimenter's nonverbal behaviour may give away clues about how the participant is expected to respond (Rosenthal & Rosnow, 1969). As per demand characteristics (see above), this nonverbal behaviour may then influence participants' responses and produce results that are caused by artificial factors that depend on the participants' knowledge that they are taking part in an experiment, rather than by genuine psychological processes that can be generalized outside of the experimental context.
- Usually, experimenter bias can be avoided if the experimenter/ or actually enumerator is actually unaware of the research hypotheses or if his/her nonverbal behaviour is unable or unlikely to influence the participants' responses. Was the experimenter blind to the experimental conditions? If not, was there any way that his/her nonverbal behaviour could have systematically influenced participants' responses? **Ethnocentrism is also a type of experimenter bias.**
- **<u>5) Reactivity</u>**: Sometimes the act of measuring a thought or behaviour can change that thought or behaviour (for an overview, see French & Sutton, 2011). **For example, the act of measuring the same attitude or behaviour at different times during a research study may lead participants to assume that the researchers predict the attitude or behaviour to change from one measurement to the next. If researchers make multiple measurements of the same attitude or behaviour, have they addressed the <u>potential reactivity</u> of this procedure?**
- <u>There are chances that the respondent may become used to the process and may deliver extra confidence during the response or interview.</u>

Critical Evaluation: The Design and Procedure

- **6) Social desirability**: **People want to present themselves in a good light when they take part in research (Crowne & Marlowe, 1964; Paulhus & Reid, 1991). They don't want to be seen as "bad" or "wrong".** To avoid these labels, participants will often downplay their socially undesirable attitudes or behaviours.
- So, for example, participants may describe themselves as being less aggressive than they actually believe that they are in order to present themselves in a more positive light. **Was the research likely to have been influenced by participants' desire to appear socially desirable? If so, how might this motivation have affected the pattern of results that the researchers found?** Researchers can use safeguards against socially desirable responding such as allowing participants to make anonymous responses or measuring individual differences in social desirability and then controlling for this variable in their statistical analyses. Were any of these safeguards in place and, if so, how effective do you think that they were?
- **Socially desired research topic can produce maximum of data and rich qualitative data. (RB)**
- People are willing to give their consent in **vox-pop** organized by television channel and radio rather than filling some self administered questionnaire.

Critical Evaluation: The Design and Procedure

- **7) Validity of the experimental manipulation:** Did the experimental manipulation (either varying the value of the variable or keeping control over the variable) alter the independent variable as predicted? Did it alter any other variable as well as the independent variable?
- **For example, researchers might attempt to manipulate self-esteem by asking their participants to watch either a happy or sad video. But this procedure may manipulate mood instead of self-esteem. Hence, the experimental manipulation is invalid because it is not manipulating self-esteem, but mood instead.**
- **Sometimes, researchers may include a *manipulation check* in their research. This is a measure that is intended to show that the experimental manipulation has had a significant effect in manipulating the correct variable.** Was a manipulation check included? If a manipulation check was included, did it show that the manipulation was effective? **In other words, did it indicate significant differences in the independent variable between relevant experimental conditions?** Note that, even if the manipulation check is successful, it remains possible that the experimental manipulation manipulated more than just the independent variable (e.g., self-esteem) and that an additional, confounding (puzzling, confusing) variable (e.g., mood) was actually the one that was responsible for the significant effects that were observed.

Critical Evaluation: The Design and Procedure

- **8) <u>Stimulus sampling</u>:** A related issue is that of stimulus sampling (Wells & Windschitl, 1999). Were the observed effects due to the independent variable or the particular stimuli that were used to represent the independent variable? For example, suppose a researcher tests the hypothesis that women like children more than men do. To test this hypothesis, the researcher presents male and female participants with a single picture of a child and asks them to rate how much they like that child. In this case, any gender effects may be more to do with the specific picture of the child that the researcher has chosen to represent the general category of "children" (e.g., perhaps the child's own gender is having an effect). In order to ensure the content validity of this variable, the researcher should sample a variety of different pictures of children (stimuli) with different gender, age, appearance, etc. in order to rule out these potentially confounding variables from the research.
- **<u>9) Reliability and validity of measures of the independent and/or dependent variables</u>**: **<u>Have measures (tool to measure the variables- psychometric scale)</u>** of the independent and dependent variables been shown to be a reliable in the present research and in previous research (e.g., test-retest reliability, internal reliability)? Has they been shown to be a valid measures in the present research and in previous research (e.g., face validity, content validity, criterion validity)? **Have the psychometric scales been developed in an appropriate manner** (e.g., Clark & Watson, 1995; Haynes, Richard, & Kubany, 1995).

Critical Evaluation: The Design and Procedure

- **10) Confounding variables in measures of the independent and/or dependent variables**: Did the measures of the independent and/or dependent variables assess one or more additional variables to the one that the researchers were interested in? **For example, the items in a scale measuring aggressive behaviour might also tap self-esteem to some extent. In this case, perhaps the significant effects that the researchers found represent differences in self-esteem rather than differences in aggression. Researchers can attempt to control for variation due to self-esteem by including a self-esteem scale in their research and using this as a covariate in their statistical analyses.**
- Confounding variables are additional and extraneous variable

Critical Evaluation: The Design and Procedure

- **11) Order of items/events:** The order in which researchers present items or events to participants can make a big difference to the way in which participants interpret those items or events (e.g., Bless, Strack, & Schwarz, 1993; Hilton, 1995; Schwarz, 1999).
- **Participants will attempt to build up a picture of what the research is about from the questions they are being asked and tasks that they have to complete. Try to put yourself in the participants' position at each stage of the procedure.** If you were a participant, how would you interpret the experiment based on the order of things that you are asked to do? Is your interpretation consistent with the researchers' assumptions?
- **Another aspect of order is practice and fatigue effects. Participants who are asked to do the same sort of thing again and again may get better at it through practice effects.** Do practice effects account for the research results? Alternatively, participants may get tired of completing hundreds of items and we might find significant effects for scales placed at the beginning of the research, but non-significant effects for scales placed at the end of the research. The researchers might claim that these different effects are due to the content of the scales. You might argue that the different effects are simply because participants aren't really attending to the items in the last scale (i.e., a fatigue effect). One way researchers can deal with these sorts of order effects is to counterbalance the order in which the present things. Do they need to do this in the research you are looking at?

Critical Evaluation: Statistical Analysis

- **1) Excluded participants**: Were any participants excluded from the analyses and if so why? Did the researchers justify any exclusions appropriately? While doing research in college adjustment one may purposively miss the sample students from rural college.
- **2) Missing data: If participants leave questions or items blank, we end up with what we call missing data.** There are various different methods of dealing with missing data (Schafer & Graham, 2002). Did the researchers choose the most appropriate method?
- There are also high chances of not responding the questionnaire when the number of question is about 20 or 20+. It is observed through one research that the drop out rate is 6% for such cases and even the rate is flat for a questionnaire for more than 20 questions.
- **3) Validity and reliability of dependent variables:** Did the researchers provide convincing evidence for the validity of each of the dependent variables that they used (including psychometric scales)? In other words, **did each dependent variable show significant and appropriately sized correlations with the variables that it was supposed to be related to (*convergent validity*) and, equally importantly, weak non-significant relationships with the variables that it was not supposed to be related to (*discriminant validity*)?** Also, was there good evidence of the internal reliability of the dependent variables? For example, did each psychometric scale have a suitable factor structure and/or acceptable Cronbach alpha coefficients (> .70)?

Critical Evaluation: Statistical Analysis

- **4) Sufficient statistical power**: If researchers find a significant effect, then, **ipso facto**, they must have had sufficient statistical power to detect this effect.
- **Consequently, it would be inappropriate to criticise the researchers for have low statistical power due to small sample size even if the researchers' sample size is smaller than that used in previous research.** However, if the researchers found null findings, then this can either be interpreted as indicating that there is no effect present or that an effect is present but the researchers had insufficient statistical power to detect this effect (i.e., a Type II error; see Cohen, 1988, 1992). Hence, statistical power is a critical concern when interpreting null findings. **When interpreting a null finding, consider whether the research contained enough participants to detect the effect. Look back at previous research that has found the effect in order to see how many participants were used in that research.**
- Meta-analyses and other reviews are good sources for this information. **Does the research use significantly fewer participants than previous successful research?** If so, then the null findings may be due to a lack of statistical power. Faul, Erdfelder, Lang, and Buchner (2007) provide a free downloadable power analysis software that you can use to investigate whether researchers have sufficient power. It is available at: http://www.psycho.uni-duesseldorf.de/abteilungen/aap/gpower3/download-and-register

Critical Evaluation: Statistical Analysis

- **4) Sufficient statistical power**: In addition, Maxwell (2004) provides some useful calculations regarding recommended sample sizes. Assume that researchers want to conduct a statistical test with Cohen's (1992) recommended power of .80 to detect a medium-sized effect using an alpha value of .05 and with equal numbers of participants in each condition. If the researchers are using a 2 x 2 between-subjects ANOVA and a single dependent variable, then, in order to detect a single, prespecified effect (e.g., a main effect), the researchers should use 30 participants in each of the four cells of the 2 x 2 design (i.e., 120 participants). In order to detect all three effects (i.e., both main effects and the interaction), the researchers should use 48 participants in each cell (i.e., 192 participants). Obviously, cell sizes will need to be larger if (a) cell sizes are unequal, (b) the ANOVA is larger (e.g., 2 x 3 ANOVA), or (c) there is more than one dependent variable.
- Supplementary: The probability of not making type II error is called the **Power of the Test**. The **power of the test** is given by $\mathbf{P(\Theta) = 1- \beta(\Theta)}$
- Type II errors are those errors when the null hypothesis is accepted when it should have been rejected and alternative hypothesis should have been accepted.
- Also, **when there is rejection of null hypothesis when it is true is called type I error.**

Critical Evaluation: Statistical Analysis

- **5) Statistical assumptions**: Did the researchers meet all of the assumptions that are associated with the particular statistical tests that they used (e.g., equal cell sizes, normal distribution, homogeneity of variance).
- **6) Correct use of inferential statistics**: **All statistical techniques have their limitations. Did the researchers take these limitations into account?** Have a look at some general introductions to the techniques of exploratory factor analysis (Floyd & Widaman, 1995; Russell, 2002), path analysis (Stage, Nora, & Carter, 2004), or structural equation modelling and confirmatory factor analysis (MacCallum & Austin, 2000; Schrieber, Stage, King, Nora, & Barlow, 2006) correctly? Was their dichotomization of quantitative variables appropriate (MacCallum, Zhang, Preacher, & Rucker, 2002; Maxwell & Delaney, 1993)?
- **7) Correct interpretation of analyses**: **Did the researchers interpret the results correctly? Look back at the precise predictions (in hypothesis setting) that the researchers made and match them against the actual pattern of results. Researchers are like politicians: They will try to place a positive spin on their results, emphasize supportive evidence, and downplay unsupportive evidence. As a critical analyst, it's your job to see through the rhetoric and spin and analyze the cold hard facts!**
- **8) Alternative analyses**: **Different statistical tests can be used to address different questions. However, different statistical tests can also be used to address the *same* question. Did the researchers use the correct** (i.e., most powerful, most precise. This is more about the cross checking the validity of research procedure) statistical test to investigate their hypotheses? Were there any alternative, more appropriate statistical analyses that could have been used to test the researchers' hypotheses?

Critical Evaluation: The Discussion

- 1) Alternative explanations: Are any other explanations able to account for the results more parsimoniously? **The authors will have attempted to rule out potential alternative explanations for their results in their paper. You may wish to highlight problems with the way in which they have dealt with these alternative explanations. For example, if the authors say that Problem X is not really a problem because of Solution Y, then you may wish to explain why Solution Y is not very effective at dealing with Problem X.**
- Alternatively, you may propose new potential alternative explanations that the researchers did not consider in their paper. An important issue here is that of "loose ends": **It is rare that researchers will find a pattern of results that perfectly fits their hypotheses. There will often be some loose end results that are not consistent with the hypotheses. These may either be null findings or significant results that contradict the researchers' predictions. The researchers will have attempted to explain away these loose ends in their article. Are their explanations satisfactory? Is there an alternative explanation that might provide a better account for the overall pattern of results, including the loose ends? Remember to be as precise, explicit, and specific as possible when discussing your own alternative explanations. Explain the processes involved.**

Critical Evaluation: The Discussion

- **<u>2) Cause-effect ambiguities</u>:** Cause and effect is sometimes difficult to establish in correlational studies. **The researchers may conclude that X causes Y because X is positively correlated with Y. But is it possible that the causal relationship is reversed and that Y causes X? For example, there might be a correlation between watching violent films and being an aggressive person. The researchers may conclude that violent films change people's personalities to make them aggressive. But it is also possible that aggressive people deliberately seek out and watch violent films.**
- **<u>3) Third variable</u>: The other problem with correlation designs is that a third, unspecified, variable may cause the correlation between X and Y.**
- For example, a person's weight might correlate positively with their income, not because there is any relationship between these two variables, but because they are both correlated with a third variable: age. The older people get, the more weight they put on *and* the more income they earn (Baron & Bryne, 2003).
- Is it?

Critical Evaluation: The Discussion

- **<u>4) Mediators and moderators</u>:** Psychologists use the terms *mediator* and *moderator* in very particular ways (Baron & Kenny, 1986; Judd, Kenny, & McClelland, 2001; MacKinnon, Fairchild, & Fritz, 2007). **If A causes B, and B causes C, then B can be said to *mediate* the effect of A on C**. **So, for example, seeing a lion (A) might cause you to run away (C). But being afraid of the lion (B) mediates this relationship: Seeing a lion causes you to be afraid, and it is this fear that causes you to run away (you wouldn't run away from the lion if you weren't afraid of it!).** Hence, fear mediates the effect of seeing a lion on your behaviour. If A causes C, but only under B conditions, then B can be said to *moderate* the effect of A on C. **So, for example, seeing a lion in the jungle might cause you to run away, but seeing a lion in a zoo might not cause you to run away. Here, the situational context (jungle vs zoo) moderates the effect of seeing a lion on your behaviour:** Seeing a lion only causes you to run away when you are in jungle conditions, not when you are in zoo conditions. Mediators answer the question "*how* does the process operate?" **<u>Mediators account for the relationship between the independent variable and the dependent variable.</u> <u>Moderators answer the question "*when* does the process operate?" Moderators alter the direction or strength of the relationship between the independent variable and the dependent variable.</u>** Have the researchers attempted to test for mediators and/or moderators in their research? Spencer, Zanna, and Fong (2005, p. 848) pointed out several potential problems with mediational analyses. I list three key ones here: (1) Mediational analyses are essentially correlational analyses, and so are open to cause-effect and third variable interpretations (see above).

* Critical Evaluation: The Discussion

- **<u>5) Replication:</u>** Have the researchers been able to replicate their effect? Finding a significant effect once at $p < .05$ means that there is a 1 in 20 chance that the effect represents a Type I error (i.e., reporting an effect to be significant when, in fact, it does not exist). However, finding the same effect twice on separate occasions at $p < .05$ means that there is a 1 in 400 chance that the effect represents a Type I error (Hays, 1994). **So, replicating an effect can greatly increase our confidence in the reliability of that effect.**
- **<u>6) Interaction or main effect?:</u> In some studies, independent variables can be defined relative to other independent variables. For example, in intergroup studies, the independent variable "in-group/out-group" may be defined relative to a participant's gender (male/female) and the type of target group that they are responding to (men/women).**
- In this case, a two-way interaction involving the independent variable defined in relative terms is statistically equivalent to the main effect when the independent variable is defined in absolute terms. **So, for example, the interaction between participants' gender (male/female) and target group (in-group/out-group) is statistically identical to the main effect of target group when target group is defined as "men/women" rather than as "in-group/out-group" (for further details, see Brauer & Judd, 2001).** Are the authors interpreting a two-way interaction when it is more appropriate to conceive the effect as a main effect?

Critical Evaluation

- **Place the Research in the Context of Similar Research:** What are the strengths and weakness of the present research compared with other similar studies in this area? The authors will have already addressed this point in their article. However, they may have missed something or their conclusions may biased or incorrect. Does the research advance our understanding of the phenomena in the ways that the researchers claim? Does the research confirm or contradict previous findings? If it contradicts previous findings, is there a clear reason why?
- **Suggestions for Future Research:** You may also be awarded marks if you make intelligent and specific suggestions for future research. So, based on your critical analysis of the research, what would your suggestions be for a more appropriate piece of research? Don't come up with 'half-baked' ideas: E.g., "Future research should look at X and Y". Follow your ideas through and be explicit: E.g., "Future research should look at X and Y. For example, **future research should manipulate X using the ABC procedure and measure Y using the Blah-Blah scale. This will overcome the problems in the present research because the ABC procedure has such-and-such advantages and the Blah-Blah scale has been shown to be a more accurate measure of Y (Smith, 1982)". Make sure that you include your own predictions when discussing ideas for future research. For example, don't just say, "future research should investigate the relationship between A and B". Instead say, "future research should investigate the relationship between A and B. On the basis of the present research, I predict that A will be negatively correlated with B".**
- **<u>One obvious avenue for future research concerns the issue of generalization. If the effect was demonstrated under laboratory conditions, will it generalize to real world settings? Under what conditions do you think that the effect will get stronger or weaker and why? What personality variables might influence the effect and why? Will the effect generalize to other cultures?</u>**

Critical Evaluation: Inappropriate Criticism

- **1) Criticizing the article rather than the research: Your job is to criticize the research, not the paper reporting the research. In other words, your should critically evaluate the ideas and methods involved in the research, not the way in which these ideas and methods are presented in the paper**. More specifically, you should not normally comment on (a) the clarity of the article (e.g., “the hypotheses followed in a logical manner from the research rationale”, “the authors did not provide a clear discussion of the implications of their research”), (b) the writing style of the authors (e.g., “the article was too long”, “the authors used too much terminology”, **“the authors did not conform to APA style”), or (c) any omissions in the paper (e.g., “the authors did not say how they dealt with missing data”,** “no information about participants’ age range was provided”). You will not gain marks for making these types of criticisms. You should focus your comments on the research, not the research article.
- There are always methodological related criticism in evaluation of research.
- **2) Ethical criticisms: Unless you are specifically instructed to do so, it is usually not appropriate to comment on the ethical aspects of the research methodology that you are criticising.** You should assume that the research has been approved by a human research ethics committee and that, therefore, ethical considerations have already been dealt with.
- As in pharmacological testing or drug testing there are a lot of ethical criticism and we really can’t avoid that.

Critical Evaluation: Inappropriate Criticism

- **3) Incomplete criticisms:** You need to be as explicit, specific, detailed, and comprehensive as possible when making your criticisms. (here we can quote that "half truth is no truth at all".)
- In general, each critical idea that you put forward should contain: (a) a **general introduction** (e.g., "It is possible that social desirability influenced the results"), (b) a specific **elaboration** of the criticism (e.g., "In other words, participants may not have been prejudiced because they perceived this form of behaviour to be socially undesirable"), (c) **citations to theoretical and/or empirical work that supports your assertions** (e.g., "Smith and Jones (1982) found that levels of prejudice were reduced when participants were aware that this form of behaviour was the subject of the researchers' investigations"), (d) examples of your criticism that are taken from the research (e.g., "Participants were told that the current research was investigating 'prejudice'"), (e) **reference to any evidence in the target research that supports your claim (e.g., "Post-experimental feedback from participants did seem to show that they were concerned about the impression that their responses were making on others"),** (f) a discussion of the implications of your criticism with respect to the research results and/or conclusions (e.g., "This problem may have reduced the level of prejudice that was found"), (g) suggestions for future research based on your criticisms (e.g., "**Future research should attempt to conceal from participants the fact that prejudice is being measured").**
- You will get very few marks if you only include incomplete criticisms in your research. For example, you would not get many marks for simply saying "It is possible that social desirability influenced the results" and leave it at that!
- **Social Desirability: T**o fit into the ideal approved by the society.

Critical Evaluation: Inappropriate Criticism

- **4) Criticisms of the reliability or effectiveness of methodology that produced the predicted results: It is usually only appropriate to criticise the reliability or effectiveness of a study's methodology when that methodology has failed to produce the predicted results.**
- It is *inappropriate* to criticise the reliability or effectiveness of methodology when it has produced the predicted results. **So, for example, researchers might use a self-esteem scale that previous research has found to be extremely unreliable. However, in their research, the researchers find that the self-esteem scale showed significant differences in the predicted directions. In this case, it would be inappropriate to criticise the self-esteem scale for being unreliable because the fact that it has revealed the predicted results means that it must have been reliable enough to do so.**
- **However, it would be appropriate to criticise the reliability of the researchers' self-esteem scale if it produced unexpected null results.**
- Note that, although you should not criticise the reliability or effectiveness of methodology when it has produced the predicted results, you may still criticise the *validity* of that methodology. This type of criticism may lead to a more general criticism of the conclusions that the researchers reached. **For example, you might argue that a self-esteem scale was an invalid measure of self-esteem and that it really measured self-awareness. In this case, you would be able to challenge the researchers' conclusions and argue that they should significant differences in self-awareness rather than self-esteem.**
- **When the research tool measure something other than it was meant to, then we can question over the validity of that tool.**

Critical Evaluation: Inappropriate Criticism

- **5) Random allocation of participants to conditions:** One of the most problematic criticisms that students make concerns the random allocation of participants to conditions. In experimental studies, participants should be randomly assigned to experimental conditions. So, for example, imagine that some researchers manipulate participants' self-esteem by giving them either positive or negative feedback about their performance on an intelligence test. They then measure participants' aggressive behaviour in order to determine what effect differences in self-esteem have on levels of aggression.
- Further imagine that the researchers find that participants who received negative feedback showed significantly more aggressive behaviour than people who received positive feedback. The researchers might conclude that low self-esteem causes aggression. A student might attempt to criticize this conclusion by arguing that "if there happened to be a few extra aggressive people in the negative feedback condition, then this could also explain the result". Admittedly, it is possible that a few extra aggressive people might have ended up in the negative feedback condition by pure chance alone.
- However, the statistical tests that the researchers used in order to determine whether or not there was a significant difference between the positive and negative conditions already takes this possibility into account. If the *p* value is less than .05, we know that there is a 1 in 20 chance that the student's explanation (or some other explanation) is correct. However, as scientists, we have agreed to conform to the convention of accepting this 1 in 20 risk as being low enough for us to effectively ignore it.

Critical Evaluation: Inappropriate Criticism

- **<u>5) Random allocation of participants to conditions:</u>** As a critical analyst, you should also conform to this universal scientific convention and accept that, although it is possible that more aggressive people may have ended up in the negative feedback condition by chance alone, it is not an acceptable to criticise the research on this basis because the chances of it having happened are relatively low given the statistical results. Note that this whole argument rests on the assumption that the researchers have randomly assigned participants to the positive and negative feedback conditions in their experiment. The random allocation of participants to conditions means that we can be relatively confident that the same types of people are equally represented within each condition. So, for example, as well as having the same proportion of aggressive and nonaggressive people in each condition, we will probably have the same proportion of men and women in each condition. This proportion may not necessarily be equal: There could only be 30% men in each condition. But this doesn't matter when it comes to interpreting differences between conditions. The crucial thing is that BOTH conditions contain 30% men and so gender cannot be used as an explanatory variable when considering any differences in aggression that are found between the two experimental conditions. Note that this argument applies to ALL personality-based variables (e.g., aggression, intelligence, conscientiousness, extraversion, etc.). **So, the main point is that principle of random allocation means that you cannot use personality variables to explain differences between experimental conditions.**
- **<u>You should know that:</u> Randomization meant for equal probability sampling or chances of the representativeness of each unit of the population may produce representative samples but the sample may not exhibit the phenomenon we desire to study. Randomization is not free from drawbacks.**

Structuring a Critical Evaluation

- We can basically see there are three part in critical evaluation, that we have to present through paper or orally:
- **<u>Introduction:</u> What is the particular research all about that is being evaluated?**
- **<u>Summary:</u> The summary of critical evaluation towards various aspects and faces of that research.**
- **<u>Conclusion and recommendation:</u> It's all about how the problems in the research can be addressed and how come there the need of my own research to address adequately the pitfalls of the earlier research. Its more about to avoid the challenges faced by the research.**
- **Structuring a Critical Review:** It is not good having a list of incisive criticisms if you don't present them in a well-structured manner. This is particularly important if you are conducting a critical review in order to build up a rationale for a research study that you aim to conduct.
- To illustrate, imagine that there are three studies that are relevant to your methodological rationale: Blogs (2010), Jones (2011), and Smith (2012). Imagine that each study has a problem: Blogs' study has a small sample size, Jones's study has an invalid measure, and Smith's study suffers from **<u>demand characteristics</u>**. Further imagine that your study addresses all three of these issues: It has the right sample size, valid measures, and protection against demand characteristics. There are three ways of structuring a critical review of this literature in order to build up a methodological rationale for your own study:

Structuring a Critical Evaluation

- Describe the work of Blogs (2010), Jones (2011), and Smith (2012), then describe the criticisms of these three studies, and then describe how your study addresses these critical issues in your own methodology. (The Goldilocks and the Three Bears approach to Critical Reviews!)
- Describe the work of Blogs (2010) and the criticisms of Blogs. Describe the work of Jones (2011) and the criticisms of Jones. Describe the work of Smith (2012) and the criticisms of Smith. Then describe how your study addresses these three critical issues.
- Describe the work of Blogs (2010), the criticisms of Blogs, and how you address these criticisms in your own study. Describe the work of Jones (2011), the criticisms of Jones, and how you address these criticisms in your own study. Describe the work of Smith (2012), the criticisms of Smith, and how you address these criticisms in your own study.
- You need to consider which of these three approaches works best in the context of your own critical review. Possibly the least effective approach is the first approach. Effective criticisms often rely on background information about a study's methodology, and the reader may forget this information if you use the first approach. You could repeat some of this information when you get to the criticisms part, but this would be a relatively inefficient approach compared to the other two approaches. Hence, either the second or third approaches is recommended.

Sandra Bem

- For reviewing this research we have to consult the following article:
- Bem, Sandra L. (1974). "The measurement of psychological androgyny". *Journal of Consulting and Clinical Psychology*. 42, 155-62
- **Sandra Ruth Lipsitz Bem** (June 22, 1944 – May 20, 2014) was an American psychologist known for her works in androgyny and gender studies. Her pioneering work on gender roles and gender stereotypes led directly to more equal employment opportunities for women in the United States. She was born as Sandra Ruth Lipsitz Bem. She is a psychologist best known for her **Gender Schema Theory and Bem Sex Role Inventory.**

Personal Life and Death of Bem

Personal life [edit]

Bem was born June 22, 1944 in Pittsburgh, Pennsylvania to Peter and Lillian Lipsitz. She grew up in a "working class" family with one younger sister, Beverly. Both of Bem's parents worked throughout her life, so she grew up with the assumption that she would always be working. Her mother instilled great morals in her daughter and encouraged her to be the absolute best that she could be, and that "being just a housewife was not very desirable."[11]

Bem's first career goal was to be a secretary like her mother, so that she could have her own phone and desk — symbols of autonomy and status that her father never had.[3] Bem was raised by her Jewish "working class" parents in a government-subsidized neighborhood for the first eight years of her life. During Bem's childhood, her mother would have violent outburst and fights with her father causing her family much distress.[9] Her mother was the dominant figure in her parents' relationship, and Bem recalls having a very tumultuous childhood, during which Mrs. Lipsitz would become extremely emotional while upset and throw objects during arguments.[12] Bem also stated that she was quite unsuccessful in her attempts at flirting and dating with males, and so she internalized a belief that no man would ever want to marry her, which helped to solidify her career ambitions.[3]

Bem did eventually get married, to Daryl Bem, also a psychology professor.[13] The two met when she took his social psychology class at Carnegie-Mellon University. She was 20 years old at the time. She initially rejected his marriage proposal, having concerns about her own career. During that time, the expectation of the wife upon marriage was to stay at home, take care of the house, raise their kids, and fully embrace her domain of domesticity. Any hope of a working career was gone and to pursue one while married would be extremely inappropriate, unconventional, and a blatant disregard for her duties as a wife. When Bem expressed these concerns to her beau, he chose to honor them by promising to create a plan that would work for the both of them. An egalitarian marriage was a novel concept for the time, and they agreed to share in making decisions, doing household chores, supporting each others' careers, and performing parenting duties — all as equally as possible. With this in place, she consented to the marriage.[7] After months of dating, the two were married on June 6, 1965. Much of Bem's family, including her mother, would not attend the wedding because it was a non-Jewish affair and they did not agree with this decision.[9]

The Bems would go on to have two children together.[9] They also had a grandson, Felix Viksne Bem (son of daughter Emily). While they eventually chose to live separately, they remained married until Sandra's death on May 20, 2014.

Illness and death [edit]

Bem was diagnosed with Alzheimer's disease and, four years after diagnosis and after pursuing experimental treatments, she followed through with her plan to commit suicide at her home in Ithaca on May 20, 2014.[1] Her husband, Daryl, was present with her when she died.

Education and Career of Sandra Bem

- Bem attended Margaret Morrison Carnegie College, now known as Carnegie-Mellon University,[9] (1961-1965) and majored in psychology. She recalls the head of the counseling center, Bob Morgan, encouraging her to study to become a psychiatrist. This was the first time such a high-status career had ever been suggested to her.[10] This likely reinforced her beliefs and motivations to strive for what she wanted, regardless of her gender, even though she did not ultimately become a psychiatrist. Subsequently, she entered the University of Michigan in 1965 and obtained her Ph.D. in developmental psychology in 1968.[11] Her dissertation focused primarily on cognitive processing and problem solving with young children. Her main influence while at the University of Michigan was experimental psychologist David Birch. Her early work focused on the behavior of young children and their ability to solve problems, and utilize self-control and instruction.
- After obtaining her Ph.D., Bem got a full-time tenure-track position as a professor at Carnegie-Mellon for three years and then moved on to work at Stanford University, where she worked until 1978. She left Stanford University because her application for tenure was denied. She and husband Daryl Bem both took tenured teaching positions at Cornell University in 1978, where she became a psychology professor and the director of the women's studies program.[7][9] While at Cornell, Bem focused research on gender schema theory, sexuality, and clinical psychology until she retired in 2010.[4]

Work of Sandra Bem

- Bem was an American psychologist known for her works in androgyny and gender studies.[2] Bem and her husband Daryl Bem took the public by storm with their revolutionary concept of egalitarian marriage. The husband-wife team became highly demanded as speakers on the negative impacts of sex role stereotypes on individuals and society. At the time, there was a lack of empirical evidence to support their assertions because this was uncharted territory, and so Sandra Bem became very interested and determined to gather data that would support the detrimental and limiting effects of traditional sex roles. **In her early career, she was heavily involved in women's liberation movement, and she did work on sex-biased job advertising. Her involvement lead to being a contributor to landmark cases concerning recruitment of women in the work force against companies such as AT&T and the Pittsburgh Press.**
- **Brain Teaser**: Can we say gender schema as sex typing and role given to these individuals according to their sex?
- **Rating scale** is about giving value to some attribute where **as ranking scale** is about giving order or sequence or preference to the item indicating some attribute.

Bem’s Sex Role Inventory

- Early on in Sandra's career she created the Bem Sex Role Inventory (BSRI), which is an inventory that acknowledges that individuals may exhibit both male and female characteristics. **The BSRI is a scale developed to tell what kind of sex role an individual fulfills (being a male he may be fulfilling the female role or vice versa).**
- **It is a self-report inventory that asks participants how well 60 different attributes describe themselves by using a seven-point scale.**
- These attributes reflect the definition of masculinity (20 questions) and femininity (20 questions), and the remaining 20 questions were merely filler questions (Bem, 1993**). In this inventory the feminine and masculine items were chosen on what was culturally appropriate for males and females at that time in the early 1970s. The BSRI was later used to measure psychological flexibility and behavioral indicators.**
- **Brain Teaser:** It need to be understood that playing the role (taking the responsibility) of the other sex is different from showing the attitude of the other sex. So what does this BSRI measure? Is it responsibility or attitude? Because as role has been the asserted word probably this sex inventory measures the responsibility.
- **Somewhere in some medical journal it has been cited- “Though apparently reliable, the validity of the BSRI remains problematic.”**

Bem’s Gender Schema Theory

- Bem also developed the gender schema theory. **<u>This theory states that an individual uses gender as a way to organize various things in a person's life into categories.</u>**
- **<u>Her research questioned the social beliefs and assumptions that sex roles are opposite, bipolar, and mutually exclusive.</u>** The data she collected were supportive of a merging of male and female traits to enable a person to be a fully functioning, adaptive human over an emphasis on gender stereotypes.
- She asserted that masculine and feminine dimensions could be divided into two spheres, rather than one: **<u>A person with high masculine and low feminine identification would be categorized as "masculine".</u>**
- A person with high feminine identification and low masculine identification, would be categorized as "feminine". **A person who had high identification with both characteristics would be categorized as "<u>androgynous</u>". <u>A person who has low identification with both dimensions would be considered "undifferentiated".</u>**
- In Nepali society ideal **Masculinity** is more about responsibility and **Femininity** is more about emotion and love. (RB)
- **<u>One of Bem's main arguments was that traditional gender roles are restrictive for both men and women, and can have negative consequences for individuals as well as society as a whole. (as we say Badminton is Ladies Game; there are more female psychologist, etc.)</u>**
- **Egalitarianism**: Social equality

* Social Relevance of Bem’s Theory

- **Social context:** To fully appreciate Sandra Bem’s role in psychology, it is important to understand the context in which she was working. Today, egalitarianism is not a new concept because more women have been stepping up and demanding the respect and value they deserve. During Bem’s time in the 1960s and 70s, “sexism” was not a word that existed yet, and women were expected to follow the expectations of their gender: agreeable, kind, supportive, domestic, and setting aside everything for the husband to take center stage. However, the beliefs were not only how it should be, but there was widespread opinion that these traditional sex roles were innate and unchangeable. Women liked the idea of equality, but Bem was repeatedly told that she would be unable to uphold her ideal of egalitarianism once she had children. She was challenging not only the norms surrounding her immediate life, but also the norms surrounding society’s values, interactions, and beliefs and permeating the fabric of people’s lives. In addition, she was working in a university setting dominated by white men – not in a ring of liberal women bent on busting through the patriarchy. She was alone, with the support of her partner, Daryl, giving her the strength to push forward and head the movement she had helped establish. There is an incredible amount of pressure and anxiety surrounding a situation in which one person is standing against a system. At that time, another obstacle for women in university was the lack of open advertising for jobs that exists today. All positions were filled through the "old-boy network," where a trusted colleague would be called upon for recommendations for graduating doctorates. This enabled all ends of discrimination against women for university positions.

Introduction to Measuring Masculinity and Femininity: "The Measurement of Psychological Androgyny"- Sandra Bem

- Cited from:
- Bem, Sandra L. (1974). "The measurement of psychological androgyny". *Journal of Consulting and Clinical Psychology*. 42, 155-62
- To conduct the study she use the BSRI: The **Bem Sex-Role Inventory (BSRI)** is a measure of masculinity-femininity and gender roles. It assesses how people identify themselves psychologically. **Bem's goal of the BSRI was to examine psychological androgyny and provide empirical evidence to show the advantage of a shared masculine and feminine personality versus a sex-typed categorization. (this is the underlining theoretical rationale or hypothesis set)**
- **The test is formatted with 60 different personality traits which participants rate themselves based on a 7 point Likert scale. Traits are evenly dispersed, 20 masculine, 20 feminine, and 20 filler traits thought to be gender neutral.[2] All traits in the BSRI are positively valued personality aspects.[3] Numerous past studies have found that gender categorizations are correlated with many stereotypical gendered behaviors.[2]**
- **Brain Teaser:** How can you be assured that the personality trait listed on the BSRI and asked for rating are exactly for masculine or feminine or gender neutral?

Introduction to Measuring Masculinity and Femininity: “The Measurement of Psychological Androgyny”- Sandra Bem

- **Research conducted:** Gender roles may be defined as "expectations about what is appropriate behavior for each sex". It is the socially desirable role for each sex. One can also add to this definition the expectations which are held about appropriate personality characteristics."
- **The Bem Sex-Role Inventory was created by Sandra Bem in an effort to measure androgyny.** It was published in 1974. Stereotypical masculine and feminine traits were found by surveying 100 Stanford undergraduate students on which traits they found to be socially desirable for each sex. The original list of 200 traits was narrowed down to the 40 masculine and feminine traits that appear on the present test (along with the filler or neutral gender trait).
- Normative data was found from a 1973 sample for 444 males and 279 females and a 1978 sample of 340 females and 476 males all also from Stanford University undergraduates.

Introduction to Measuring Masculinity and Femininity: "The Measurement of Psychological Androgyny"- Sandra Bem

- **Scoring and interpretation**
- Participants are asked to rate themselves on each trait using a likert scale. One indicates never or almost never true, while a seven would indicate always or almost always true.[5] Originally androgyny was calculated by finding the t-ratio difference between masculine and feminine scores; however, in 1981 Bem advises users to utilize a split median technique for more accurate scoring.[2]
- The Bem Sex-Role Inventory offers four different possible resulting categorizations: masculine, feminine, androgynous and undifferentiated. Previously, an androgynous score was thought to be the result of equal masculine and feminine traits, while a sex-typed masculine or feminine score is the result of more traits belonging in one or the other category.The fourth type of score, undifferentiated, was seen as the result of extremely low masculine and feminine traits.
- Although, after the change in scoring technique, androgynous is the result of scoring above the median in both masculine and feminine categories. Sex-typed scores, masculine and feminine, are the result of scoring above the median in one gender and below the median in the other. An undifferentiated score is now a result of scoring below the median in both masculine and feminine categories. In other words, since scores are based on normative data, an androgynous classification occurs when a subject scores above 50% of the comparison group in both masculine and feminine categories, while a sex-typed classification is the result of scoring above half the comparison group in only one gender category.[6]

“The Measurement of Psychological Androgyny”- Sandra Bem

- **Reliability and validity**
- The BSRI is very empirically sound. Bem reports coefficient alphas of .78 for femininity scales and .87 for the masculinity scale. BSRI, also has demonstrated high test-retest reliability.[2]
- However, since this is a self-report inventory how reliable the assessment is depends on how accurately participants rate themselves. An androgynous score is the result of extremely masculine and feminine scores and an undifferentiated score is the result of extremely low masculine and feminine scores. It has been theorized that perhaps tendencies to rate oneself extremely low and extremely high on traits can affect a subjects' resulting gender placement.[5]
- The degree of reliability of each scoring technique is up for debate. When comparing the old t ratio scoring to the newly endorsed median split technique, 42.3% of participants had a different resulting categorization. Since the median split method bases scores more heavily on the normative data of that population, a participant can be categorized differently based on the population of subjects they take the test with. For example results may differ if the test was administered to a group of marines versus students at a private girls highschool. This challenges the test's between sample reliability.[6] As stated by Elazae Pedhazur in a clip from his critique, "Bem concludes her discussion by stating, "Finally, we urge investigators to further analyze their data without categorizing individual subjects in any way, i.e., through the use of multiple regression technique". While endorsing what appears to be a suggestion to conduct studies within the framework of trait-treatment interactions, one cannot help wondering: Where has androgyny gone?"[7]

Summary Evaluation to : "The Measurement of Psychological Androgyny"

- Validity of the research tool or psychological test: How can you be assured that the personality trait listed on the BSRI and asked for rating are exactly for masculine or feminine or gender neutral? May be 60 attributes or the psychological characteristics mentioned can by both masculine and feminine gender role. (We are here not concerned what is the sex of the respondent but more with what gender role a person prefer or rate high. It is not about the gender but gender role a person assumes.)
- Does this test exactly measures psychological androgyny?
- There are lot of lapses regarding the scoring and test interpretation.

Introduction to talking to animal: “Teaching Sign Language to Chimpanzee”- Gardner & Gardner

- The following research belongs to Comparative Psychology
- There has long been an interest in whether or not non-human animals have the ability to acquire and use language (language here not only refer to the talking but to use of sign language and also the use of emotional gestures) successfully.
- **Animals, human and even microbes have the ability to communicate which is the relay of information between the source and the destination. This doesn’t mean animals have the ability to talk. A successful talking is when these animals are able to produce sound from the vocal cord that have vowels and consonants in them and able to convey meaning that is comprehended by most and which can be repeated by that individual over time and again. This doesn’t imply that parrot can talk. They can just imitate and not just through their own conscience and effort. (RB)**
- **Communication ability; use of language (may be sign) and talking belongs to the order in the same continuum. May be chimpanzee are able to acquire the ability to use language in sign language or lexigram but are not able to talk.**
- Some linguists <u>argue there is an evolutionary continuum that exists between animal and human language</u>, and examining this could tell us more about how humans evolved such a complex and efficient capacity for communication through language.

Introduction to talking to animal: “Teaching Sign Language to Chimpanzee”- Gardner & Gardner

- Many linguists have conducted experiments to investigate animal language ability, and research in this area is most common using chimpanzees, such as Gua, Kanzi, Nim Chimpsky, and Washoe, the latter being the project we focus on the latter discussion.
- <u>**Originally, attempts to study language acquisition in chimps was done in a similar way to studies of language acquisition in human children,**</u> such as Gua, who was raised by the Kelloggs (a family name) alongside their own 10 month old son Donald. **However, many of these projects were doomed to failure, and researchers soon realised that chimps are simply physically unable to produce the voiced sounds required for oral language.**
- Because of this, chimps have been exposed to language through other means. For example, the Kanzi project used **lexigrams, a system of visual symbols used to refer to words (more like Khanzi in Japanese), while Washoe and Nim <u>were taught sign language in order to express themselves.</u>** These later studies have had much more success in aiding our understanding of the linguistic capabilities of chimpanzees.
- We will focus on the findings from <u>**Allen and Beatrix Gardner's research that they completed together in 1969 and 1984 on four chimpanzees named Washoe, Moja, Tatu and Dar, who were exposed to sign language.**</u> This project was named <u>**Project Washoe**</u>.

Chimpanzee Washoe

Introduction to talking to animal: “Teaching Sign Language to Chimpanzee”- Project Washoe

- Gardner and Gardner's work in 1969 involved a chimpanzee named Washoe, who they aimed to teach American Sign Language (ASL) as a form of communication at the University of Nevada in Reno.
- **The chimp was taken from the wild at around 8-14 months by the US Air Force, but was then cross-fostered by the Gardner's and raised similarly to a human child, giving her the opportunity to acquire language in the same settings. She would often wear clothes, eat human-like food, use toilets and was taught tasks such as clearing the table and washing dishes after a meal.**
- **Washoe’s language acquisition was observed for 22 months and each sign that was learnt had to follow specific criteria in order to be accepted as a successful new sign. It had to be used correctly in a spontaneous way, every day over a 15-day period (means the sign should be repeated in a spontaneous way for at least 15 times a day).**
- **Overall, only 30 words at this time managed to fit the strict criteria such as ‘sorry’, ‘flower’ and ‘you’.** However, Washoe continued to learn signs and was reported to have learnt 250 by the time she died.
- **Supplementary: How we acquire language ability is a matter of concern, interest and whole lot of psychological effort with a balance between nature and nurture!**

Introduction to talking to animal: “Teaching Sign Language to Chimpanzee”- Project Washoe

- **Moja, Tatu and Dar (1984)**
- **Gardner and Gardner went on to raise other chimpanzees similarly to Washoe – Moja, Tatu and Dar. The research method was improved, as all of the chimps were new-borns when they arrived in Reno and they grew up together like siblings, also learning ASL.**
- The four chimps, including Washoe, were tested for their vocabulary use. They were shown pictures on slides that were projected onto a screen and asked to sign what it was they could see. Two observers watched the chimps as they signed and recorded their correct or incorrect use of signs. **Only the chimp could see the pictures, and neither of the observers could see each other. One observer was the questioner in the testing room with the chimp, and another was in a separate room, behind one-way glass.**
- There were only some minor differences between the tests of each chimpanzee. To expose the picture, Washoe had to open a sliding door that the picture screen was behind. Tatu and Dar had to press a button which would then display the picture for them, and when Moja pressed the button, this only acted as a request. The experimenter would later approve of Moja's request and present the picture to her. Washoe, Tatu and Dar each received two tests, while Moja only took part in one.
- To make sure that the chimpanzees were using signs appropriately, four pictures of the same vocabulary item were shown at once. For example, for 'flower', four different types of flowers were displayed to ensure that the sign wasn't used to refer only to one specific type of flower. Before the tests, the target sign for each vocabulary item was agreed on and it was only this sign that would be recorded as correct when used by the chimps.

Introduction to talking to animal: “Teaching Sign Language to Chimpanzee”- Project Washoe

- **Findings:** Agreements of both correct and incorrect signing in the observers' recordings were reliable - ranging from 86% to 95%. The average correct use of signs by the chimps was also high, apart from with Moja:
- **Washoe** 79%; **Moja** 54%; **Tatu** 82%; **Dar** 81%
- **It is assumed that Moja's signing in the test was impaired because she did not receive a series of preliminary tests like Washoe, Tatu and Dar had before the final tests took place.**
- **She therefore had less practice with this procedure (for sure language improves with practice).** Pre-tests were used to help the chimps to understand a routine of testing but these were not frequent and would only last less than half an hour at a time.
- **Conclusions: Gardner and Gardner have not hurried to conclude from the findings that it is possible for chimpanzees to acquire language, or made any comparisons between human and non-humans abilities.**
- **However, the overall data from their studies has shown that it is practical to teach chimpanzees more than a few American Sign Language vocabulary terms, which are each suggested to be used individually and naturally, not always with prompts from human ASL users.** To grasp a real picture of non-human language use, Gardner and Gardner proposed that there is far more research that would need to take place.

Introduction to talking to animal: "Teaching Sign Language to Chimpanzee"- Project Washoe

- Describe the strengths and limitation of **case study design** on the basis of Gardner and Gardner research "Teaching Sign Language to Animals".
- Actually this study can initially be categorized as Experimental Study with later as structured observation. So can we categorize experiments and observation as case study? What is actually case study?
- **We need to accept the fact that every or some type of research is in fact case study as we sample population and do our research or investigation on that particular part of population.**
- **Case Study:** When **a single or group of cases**/ units are intensively studied or examined for a long time and various facets are measured or observed, it is called case study. It enables us to explore, understand problems, issues and relationships and the findings in one case study may be a theory in other upcoming case study or research. In case studies data are collected through observations, interviews, protocols (Set of rules), tests, examinations of records, and collections of writing samples, etc.

Introduction To Robber's Cave: Experiments In Group Conflict- M. Sherif

- In this study, **Sherif used an elaborate field experiment to examine group dynamics (social interaction and conflict) using randomly created groupings.** (Its not always that research meant to test hypothesis, it is often used to test the reliability of methods of data collection, reliability and validity of research tool and also to examine group dynamics.)
- This was carried out by bringing 11-12 year old boys to a summer camp. The boys were randomly assigned to one of two groups. **During the first phase of the experiment, group members (of the same group) participated in challenging tasks with each other (i.e., hiking). This lead to social hierarchies being created in which clear leaders emerged.**
- **During the second phase of the experiment,** the groups had to compete against each other in various types of contests with trophies and prizes being offered to the winning group. **During this phase, in group cohesiveness increased or widened while intergroup conflict and animosity (hostility and bitterness) strengthened.**
- **During the third phase of the experiment,** Sherif attempted to reconcile the two groups. This was accomplished by presenting them with problems in which they must all work together to solve. **A specific example of this was having a truck "break down" and requiring members from both groups to push the truck. These activities served to forge bonds between members of each group.**
- **Brain Teaser:** What are the independent (that is manipulated) and dependent variables in these studies? Is the **competition independent and conflict dependent** variable here?

Introduction To Robber’s Cave: Experiments In Group Conflict- M. Sherif

- This study belongs to a classic study in Social Interaction.
- **This study is a classic in social psychology in that it demonstrated that prejudices and animosity towards members of other groups occurs when they are in competition for the same resources. This was very important on the heels of the Holocaust, explaining how the Germans, who saw the Jews as competition for economic resources, could support the egregious (cruel and inhuman) acts that were inflicted on this group of people.**
- This study is cited from: **Sherif, M. (1956). Experiments in group conflict. Scientific American, 195, 54-58.**
- **Supplementary:** You need to remember that group conflict is a part of social interaction but may be more on negative wheel (RB).
- But as communist say; conflict is necessary to lead ahead a civilization and bring about changes. The latter quotation may be partially true.
- A) Conflict when brings about change it is called interaction and when the conflict brings destruction it is called battle. B) Conflict and Change both are interactions. C) Its easy to win a battle with swords but hard to win a war because winning a war is all about moral domination. Lack of morality will loose your war.

Introduction To Robber's Cave: Experiments In Group Conflict- M. Sherif

Introduction To Robber's Cave: Experiments In Group Conflict- M. Sherif

Introduction To Robber's Cave: Experiments In Group Conflict- M. Sherif

- What are the conclusion of Robber's Cave Experiments?
- It aims to study the group conflict.
- Social interactions can be studied experimentally in the form of field research. Outcomes can be observed, can be predicted, can be changed.

Introduction to The Visual Cliff: Gibson and Walk (1960)

- **<u>Depth Perception:</u>** A type of perception that lets us know whether one is able to access the speed of the vehicle while crossing the road, whether he is exactly able to interpret what is the distance between him and the vehicle. It is a matter of physical and visual maturity.
- **Visual cliff: Bhul bhulaiya**
- **A visual illusion was said to be constructed in the palace of King Udhisthir at Indraprasta during the period of Mahabharat. Duryodhan is said to have fallen there and Dhropati laughed at him. Duryodhan revenged her.**
- A visual cliff involves an apparent, but not actual drop from one surface to another. This tool was originally developed to determine if infants had developed depth perception. A visual cliff is created by connecting a transparent glass surface to an opaque patterned surface. The floor below has the same pattern as the opaque surface. This apparatus creates the visual illusion of a cliff, while protecting the subject from injury.
- The visual cliff consists of a sheet of Plexiglas that covers a cloth with a high-contrast checkerboard pattern. On one side the cloth is placed immediately beneath the Plexiglas, and on the other, it is dropped about 4 feet below. Since the Plexiglas supports the weight of the infant this is a visual cliff rather than a drop off. Using a visual cliff apparatus, Gibson and Walk examined possible perceptual differences at crawling age between human infants born preterm and human infants born at term without documented visual or motor impairments.

Introduction: The Structure of Visual Cliff

- In order to investigate depth perception, psychologists E.J. Gibson and R.D. Walk developed the visual cliff test to use with human infants and animals. Gibson and Walk described their visual cliff apparatus in the following way:
- "**The cliff is a simulated one and hence makes it possible not only to control the optical and other stimuli (auditory and tactual, for instance) but also to protect the experimental subjects.** It consists of a board laid across a large sheet of heavy glass which is supported a foot or more above the floor. On one side of the board a sheet of patterned material is placed flush against the undersurface of the glass, giving the glass the appearance as well as the substance of solidity. On the other side a sheet of the same material is laid upon the floor; this side of the board thus becomes the visual cliff."
- In short this is a glass made platform that looks like a cliff (rock face or Bhir').
- In the test, a child is placed on one end of the platform and the caregivers stands on the other side of the clear surface. **The assumption was that if a child had developed depth perception, he or she would be able to perceive the (illusionary) visual cliff and would be reluctant or refuse to crawl to the caregiver.**

The Original Visual Cliff Study: Facts

- **Gibson and Walk (1960) hypothesized that depth perception is inherent (by birth) as opposed to a learned process.**
- **To test this, they placed 36 infants, 6 to 14 months of age, on the shallow side of the visual cliff apparatus**.
- Once the infant was placed on the opaque end of the platform, the caregivers (typically a parent) stood on the other side of the transparent Plexiglas, calling out for them to come or holding some sort of enticing (alluring; tempting and attractive) stimulus such as a toy so that the infant would be motivated to crawl across towards them.
- **It was assumed if the child was reluctant to crawl to their caregiver, he or she was able to perceive depth, believing that the transparent space was an actual cliff.**
- The researchers found that 27 of the infants crawled over to their mother on the "shallow" side without any problems. A few of the infants crawled but were extremely hesitant. Some infants refused to crawl because they were confused about the perceived drop between them and their mothers. The infants knew the glass was solid by patting it, but still did not cross.
- The frequency of children crawling over their mother side (which is more here) suggests that infants of that age hasn't the depth perception. In this case null hypothesis has to be rejected and we have to accept or opt for the alternative hypothesis.

Introduction: Understanding the Visual Cliff

- **In this experiment, all of the babies relied on their vision in order to navigate across the apparatus.** This shows that when healthy infants are able to crawl, they can perceive depth.
- **However, results do not indicate that avoidance of cliffs and fear of heights is innate.**
- **Initially, psychologists believed that perception of the visual cliff was a matter of physical and visual maturity.** Babies **could see the difference by the age of eight-months, while younger infants with less developed depth perception could not see the cliff. Because six-month-old infants could be enticed to wiggle across the visual edge, while ten-month-old babies refused to cross the threshold, it was assumed that the younger children had not yet developed depth perception while the older children had (Berger, 2000).**
- **Later research has demonstrated, however, that children as young as three-months are able to perceive the visual cliff. When placed over the apparent "edge," their heart rate quickens, eyes widen and breathing rate increases. The issue is that children of this age do not yet fully realize that the consequence of going over this visual cliff is potentially falling.**
- This realization only comes later when the child begins to crawl and gains real experience with taking tumbles (Campos, et al., 1978).

Other Studies In Response To Visual Cliff: Human

- **<u>Preterm infants:</u>** Sixteen infants born at term and 16 born preterm were encouraged to crawl to their caregivers on a modified visual cliff. **Successful trials, crossing time, duration of visual attention, duration of <u>tactile exploration</u>, <u>motor strategies</u>, and <u>avoidance behaviors</u> were analyzed.** A significant surface effect was found, with longer crossing times and longer durations of visual attention and tactile exploration in the condition with the visual appearance of a deep cliff. **Although the two groups of infants did not differ on any of the timed measurements, infants born at term demonstrated a larger number of motor strategies and avoidance behaviors by simple tally.** This study indicates that infants born at term and those born preterm can perceive a visual cliff and change their responses accordingly.
- **<u>Prelocomotor infants:</u>** Another study measured the cardiac responses of <u>human infants</u> younger than crawling age on the visual cliff. This study found that the infants exhibited distress less frequently when they were placed on the deep side (illusionary deep side) of the apparatus in contrast to when they were placed on the shallow side. This means that prelocomotor infants can discriminate between the two sides of the cliff.

Other Studies In Response To Visual Cliff: Human

- **Maternal signaling:** James F Sorce et al. tested to see how maternal emotional signaling affected the behaviors of 1-year-olds on the visual cliff.
- **To do this they placed the infants on the shallow side of the visual cliff apparatus and had their mothers on the other side of the visual cliff eliciting different emotional facial expressions.**
- When the mothers posed joy or interest most of the babies crossed the deep side but if the mothers posed fear or anger, most of the babies did not cross the apparatus. In the absence of depth, most of the babies crossed regardless of the mother's facial expressions.
- This suggests that babies look to their mother's emotional expressions as an advice most often when they are uncertain about a situation.
- **Supplementary**: These studies helps in demonstrating how can we critically evaluate past studies.

* Other Studies In Response To Visual Cliff: Animal

- The visual cliff was not only tested on human infants, it was applied to other species as well. A few of these species included rats, cats, turtles, cows, and chickens.
- **Rats:** Rats do not depend upon visual cues like some of the other species tested. Their nocturnal habits lead them to seek food largely by smell. When moving about in the dark, they respond to tactual cues from their stiff whiskers (vibrissae; Junga') located on the snout (chuchoo' or thon'd). Hooded rats tested on the visual cliff show little preference for either side of the visual cliff apparatus as long as they could feel the glass with their vibrissae. When placed upon the glass over the deep side, they move about as if there was no cliff.
- **Cats:** Cats, like rats, are nocturnal animals, sensitive to tactual cues from their vibrissae. But the cat, as a predator, must rely more on its sight. Kittens proved to have excellent depth-discrimination. At four weeks, the earliest age that a kitten can skillfully move about, they preferred the shallow side of the cliff. When placed on the glass over the deep side, they either freeze or circle backward until they reach the shallow side of the cliff.

Findings on Rat

Depth Perception

Based on their early findings, Gibson and Walk concluded that visual experience is not necessary for the development of depth discrimination (Walk, et al., 1957) and that animals are prepared to discriminate depth and avoid a drop-off as soon as they are independently mobile, even if locomotion begins at birth as in precocial chicks, kids, and lambs (Gibson & Walk, 1960). However, later studies revealed a more complicated story. Dark-reared rats avoided the deep side of the visual cliff upon emerging from the dark at 27 and 90 days, suggesting that perception of depth at an edge develops without visual experience. But at 140 or 300 days, depth discrimination was absent, suggesting that long-term deprivation caused permanent deficits (Nealey & Riley, 1964; Walk, Trychin, & Karmel, 1965).

* Other Studies In Response To Visual Cliff: Animal

- **Turtles:** The late Robert M. Yerkes of Harvard University found in 1904 that aquatic turtles have somewhat worse depth-discrimination than land turtles. **On the visual cliff one might expect an aquatic turtle to respond to the reflections from the glass as it might to water and prefer the deep side for this reason. They showed no such preference, 76% of the aquatic turtles crawled onto the shallow side.**
- **The large percentage that choose the deep side suggests either that this turtle has worse depth-discrimination than other animals, or that its natural habitat gives it less occasions to "fear" a fall.**
- **Cows:** The ability for cows to perceive a visual cliff was tested by NA Arnold et al. Twelve dairy **heifers (a breed of cow)** were exposed to a visual cliff in the form of a milking pit while walking through a milking facility. **Over this five day experiment the heifers' heart rates were measured along with the number of times they stopped throughout the milking facility.**
- Dairy heifers in the experimental group were exposed to a visual cliff while dairy heifers in the control group were not. The experimental group was found to have significantly higher heart rates and stop more frequently than the heifers in the control group. Depth exposure did not have any effect on cortisol levels or the ease of handling of the animals. These findings provide evidence of both depth perception and acute fear of heights in cows. This may lead to a reorganization of the way milking factories function.

* Other Studies In Response To Visual Cliff: Animal

- **Chicks:** Two-day-old chicks responded to the visual cliff when tested by PR Green et al. As the depth of the visual cliff below the chicks was increased, the latency for the chick to move towards the incentive, another chick on the far side of the apparatus, was increased while the speed at which they moved decreased. On the other hand, chicks that were given the same incentive to jump over a visible edge, onto the deep side of the apparatus, were less inclined to move at all depths. This illustrates that the absolute depth of a surface and the relative depth of an edge affect behavior differently in chicks.
- **Lamb:** Lamb are able to stand and learn to walk almost as soon as they are born. Just like chicks, they were able to be tested as soon as they could stand. They did not make one error when tested on the visual cliff. When placed on the deep side of the glass, they would become scared and they would tense up and be afraid to move. However, when they were moved to the shallow side they would relax and jump onto the visually shallow surface.[1] This showed that visual sense, instead of the ability of the animal to feel the stableness of the glass, was in control.

Summary: Understanding the Visual Cliff

- People have their own inference and conclusion to the things and phenomena which shouldn't happen in critical evaluation. Critical evaluation should be proof based (to large extent).
- One of the criticisms of the visual cliff study was; did they really prove that depth perception was innate in humans? One issue was about the glass over the deep part of the visual cliff. By covering up the deep side with glass the researchers enabled the babies to feel the solidity of the glass before they would cross over. This response was repeated over and over again in tests. Another criticism has to do with the experience of the infant. Infants who learned to crawl before 6.5 months of age had crossed the glass, but the ones that learned to crawl after 6.5 months of age avoided crossing the glass. This helps prove that experience does have an impact on avoidance of the glass, rather than just being innate.

Summary: Understanding the Visual Cliff

- **<u>1) Participants:</u>** As far I see we can critically evaluate this study based on the **age of the participants**. Because we need to see the ethical part.
- **"To test this, they placed 36 infants, 6 to 14 months of age, on the shallow side of the visual cliff apparatus."**
- How can children who can't comprehensively respond to the experiment be used as subjects? By the age of 6 to 14 they may have developed perception (even depth perception) but not **conscience (sense of right or wrong; whether they would fall or not; Chetana)** and **Morality** (Swo-Bibek).
- Even though ethic related criticism is not allowed, I assert my question for evaluation.
- This is the experiment which seems more suitable for animals because they have the ability for depth perception even in the dark. But for human, whose depth perception in darkness is less developed and they have also fear of height (acrophobia) and fear of falling, we can't accurately measure the depth perception through a simulated experiment.
- Also children when repeated with the same experimental trail, they are sensitized to the fact that there is no cliff and they are easy with crossing the visual cliff apparatus.. This doesn't allows us the exact result we desire while conducting the experiment.
- **Thus, visual cliff studies report a single trial per infant (or one deep and one shallow trial).**

Summary: Understanding the Visual Cliff

- **2) Lab vs. Field Conditions:** As we see this experiment is more of simulated lab research, does the tendency of children to avoid the depth of cliff (perceiving the depth) also occur in real cliff conditions.
- **3) Stimuli Sampling:** As we know depth perception is all about knowing the three dimension of a object. We are precisely able to know the size and velocity of that object through the television and even with one eye closed. Depth perception is more about conscience.
- So here in the study the visual stimulus, the tactile stimulus and the physiological process are able to represent the whole phenomenon of depth perception correctly?
- Is this term " depth perception" a confounding term?
- **4) Statistical Analysis:** The assumptions of Gibson and Walk establishes in single trial experiment with the infants or animals. But in science we need to do comparative twin study, pre and post study and studies in among animals (which has been done here) in order to establish the validity of scale and reliability of the process and accept the result. Otherwise we can't generalize the findings or inference drawn here. The experimental procedure seems insufficient.
- **Brain Teaser:** It was assumed if the child was reluctant to crawl to their caregiver, he or she was able to perceive depth, believing that the transparent space was an actual cliff. Is this theoretical assumption correct?

Summary: Understanding the Visual Cliff

- **5) Cause and effect ambiguities:** Is this depth perception the real cause behind the avoidance of cliff (when enticed by mother to come to the next side of the apparatus)? We could also insert a third variable fear. **<u>The fear could be the actual cause behind the child not waggling (moving to) to the next part of the apparatus.</u>**
- **<u>There is also alternative explanation: fear could be the mediator between the child not going to the next side but also due to the cue on the floor of the visual cliff apparatus being solid and tactilely perceived by the child, he has no fear and then goes to the next side.</u>**
- Because as experiment suggest, there are lot of problems with the conclusion part of this experiment. Even the child sees the visual cliff, the assurance by the mother, the tactile senses of the child giving an evaluation to the child that the surface is safe for going may prompt the child to go to the safe or shallow side of the illusionary visual cliff. 27 of the children going to the shallow side doesn't imply that the child doesn't see the cliff. Somehow depth perception is innate. The children would have developed it by birth but whether to use it or not depends on the environmental situation.
- **"However, it has already been concluded from the Visual Cliff Experiment that, results do not indicate that avoidance of cliffs and fear of heights is innate." This is the point where critical question arises.**

Summary: Understanding the Visual Cliff

- **Rendezvous: Meeting; date; appointment**
- **Rendition: Version or performance**
- **Innate: Inborn and natural**
- **Inherent: Transferred through offspring**
- **Affordance**: It suggest that animals or human have certain physical capabilities and the environment also allow them to act.
- "Affordances"—**the fit between an animal's physical capabilities and the features of the environment that allow a particular action to be performed** (Gibson, 1988; Gibson & Schmuckler, 1989).
- **Supplementary: Eleanor J Gibson and Richard D Walk** first publication (1957, Science) reported findings from the dark-reared rats, and on its heels came the **1960** Scientific American article with the **famous photographs of infants and kittens on a checkerboard surface peering over the edge of a precipice**. Their most scholarly work, the 1961 monograph, described all of their comparative studies.

Supplementary: Perception and Cognition

- **Perception:** It is all about identifying the stimulus in an environment, evaluation or interpretation of that stimulus with the help of past experience and respond to it.
- Sense organs such as visual (eye); auditory (for hearing, ear); tactile (for touch sensation); olfactory (for smell); gustatory (for taste) are able to identify or sense the stimulus. The central nervous system including the spinal cord interpret those stimulus and finally response stimulus is released through the motor nerves.
- **Cognition** involves the process involved in knowing, or the act of knowing, which in its completeness includes **perception and judgment**. **Cognition includes all processes of consciousness by which knowledge is accumulated, such as perceiving, recognizing, conceiving, and reasoning.** Put differently, **cognition is an experience of knowing that can be distinguished from an experience of feeling or willing**. It is one of the only words that refers to the brain as well as to the mind. Determining what is right or wrong (evaluation) falls in cognition and is secondary to perception in this process.
- Cognition is the overall act of comprehending a situation and it is distinguished from feeling or willing.

Supplementary: Perception and Cognition

- The essence of cognition is judgment; this occurs when a certain object is distinguished from other objects and is characterized by some concept or concepts. The psychologist is concerned with the cognitive process as it affects learning and behaviour.
- There are two broad approaches to contemporary cognitive theory. **The Information-processing Approach** attempts to understand human thought and reasoning processes by comparing the mind to a sophisticated computer system that is designed to acquire (identify the stimulus), process (analyse and interpret the stimulus), store, and use information according to various programs (respond to the situation).
- **This approach is more concerned with perception and overall understanding. (RB)**
- American psychologist Robert Sternberg, for example, **examined the information-processing procedures used by people taking intelligence tests.**
- **Herbert A. Simon, another American social scientist, attempted to understand how the mind processes information by programming computers to mimic human thought processes. (this is more about giving artificial intelligence to the electronic gadget)** Researchers in this area strive to develop a unified theory of cognition by creating a computer program that can learn, solve problems, and remember as humans do.

Supplementary: Cognition

- The second approach is based on the work of Swiss **psychologist Jean Piaget, who viewed cognitive adaptation in terms of two basic processes: assimilation and accommodation. Assimilation is the process of interpreting reality in terms of a person's internal model of the world (based on previous experience**). Its more about knowing the reality through matching the present stimulus with the past schema.
- **The accommodation process represents the changes one makes to that model through the process of adjusting to life's experiences. The American psychologist Jerome S. Bruner broadened Piaget's concept by suggesting that the cognitive process is influenced by the three modes we use to represent our world: the enactive mode involves representation through action; the iconic mode uses visual and mental images/ schemas; and the symbolic mode uses language.**

Deprivation and Attachment

- **Emotional Deprivation** is a term that is more often related to the **Developmental Psychology or Psychology of Juvenile Delinquency.**
- **This study is be based on Case Study (or Is it longitudinal?).**
- The social smiling of two-month-old infants invites adults to interact with them; all normal human infants show a social smile, which is, in fact, their first true sign of social responsiveness. The social smile is apparently innate in the human species. **At about six months of age infants begin to respond socially to particular people who become the targets of attachment.** Although all infants develop some form of attachment to their caregivers, the strength and quality of that attachment depends partly on the parents' behaviour to the child. The sheer amount of time spent with a child counts for less than the quality of the adult-child interaction in this regard. The parents' satisfaction of the infant's physical needs is an important factor in their interaction, but sensitivity to the child's needs and wishes, along with the provision of emotional warmth, supportiveness, and gentleness are equally important.

Deprivation and Attachment

- **Interestingly, mothers and fathers have been observed to behave differently with their infants and young children: mothers hold, comfort, and calm their babies in predictable and rhythmic ways, whereas fathers play and excite in unpredictable and less rhythmic ways.**
- **(This seems the case of highly developed western countries. Is it the scenario in third world countries like Nepal too?)**
- One significant difference has been detected in the quality of infants' attachment to their caregivers—that between infants who are "securely" attached and those who are "insecurely" attached. **Infants with a secure attachment to a parent are less afraid of challenge and unfamiliarity than are those with an insecure attachment. (Does this situation apply when they are adult and left on their own to deal with the realities of life?)**
- **Privation**: Deprivation, hardship or poverty

Difference Between Privation and Deprivation

- Bowlby used the term maternal deprivation to refer to the separation or loss of the mother as well as failure to develop an attachment. Are the effects of maternal deprivation as dire as Bowlby suggested?
- **Michael Rutter (1972)** wrote a book called **Maternal Deprivation Re-assessed**. In the book, he suggested that Bowlby may have oversimplified the concept of maternal deprivation. Bowlby used the term 'maternal deprivation' to refer to separation from an attached figure, loss of an attached figure and failure to develop an attachment to any figure. These each have different effects, argued Rutter. In particular Rutter distinguished between privation and deprivation.
- **Michael Rutter (1981)** argued that if a child fails to develop an attachment this is privation, whereas deprivation refers to the loss of or damage to an attachment.
- **Deprivation might be defined as losing something in which a person once had, whereas privation might be defined as never having something in the first place**. Privation occurs when there is a failure to form an attachment to any individual, perhaps because the child has a series of different carers (which was the case for many of Bowlby's juvenile thieves) or family discord prevents the development of attachment to any figure (as Rutter proposed). Privated children do not show distress when separated from a familiar figure, which indicates a lack of attachment.

Difference Between Privation and Deprivation

- From his survey of research on privation, **Rutter** proposed that it is likely to lead initially to clinging, dependent behavior, attention-seeking and indiscriminate friendliness, then as the child matures, an inability to keep rules, form lasting relationships, or feel guilt. He also found evidence of anti-social behavior, affectionless psychopathy, and disorders of language, intellectual development and physical growth.
- **Rutter** argues that these problems are not due solely to the lack of attachment to a mother figure, as Bowlby claimed, but to factors such as the lack of intellectual stimulation and social experiences which attachments normally provide. In addition, such **problems can be overcome** later in the child's development, with the right kind of care.
- Many of the 44 thieves in Bowlby's study had been moved around a lot during childhood, and had probably never formed an attachment. This suggested that they were suffering from privation, rather than deprivation, which Rutter suggested was far more deleterious to the children. This led to a very important study on the long term effects of privation, carried out by Hodges and Tizard (1989).
- **Typically, research into privation uses the case study method to due to the obvious ethical issues of deliberately separating a child from their mother.**

Introduction to "Severe Deprivation in Twins": Jarmila Koluchova

- In 1972 Jarmila Koluchova began reporting the case of identical twin boys in Czechoslovakia who had suffered the most severe deprivations.
- **Andrei and Vanya** are identical twin boys born in 1960. The twins lost their mother shortly after birth, and were cared for by a social agency for a year, and then fostered by a maternal aunt for a further six months. Their development was normal. Their father remarried a few months later and the twins returned home when they were eighteen months old.
- Their stepmother had no interest in bringing up young children (despite having had four of her own) and was selfish and uncaring. The father was of below average intelligence, and his job on the railways took him away from home quite a lot. The family had recently moved to a city suburb where nobody knew them, or knew that the family should have contained six children.
- Their stepmother treated the twins terribly. They were kept in a small unheated room with a sheet of polythene for a bed and with very little furniture. They were poorly fed. **Sometimes the mother would lock them in the cellar and beat them with a wooden kitchen spoon, covering their heads with a mattress in case anyone heard their screams. The twins suffered these conditions for five-and-a-half years.**

Introduction to “Severe Deprivation in Twins”: Jarmila Koluchova

- When they were finally examined, at the age of seven, they were severely physically and mentally retarded. Their bodies were covered in scar tissue from the beatings. They had severe rickets (a disease of the bones caused by lack of vitamin D). They couldn’t stand up straight, walk or run, and their coordination was poor. They hadn’t been taught to speak, had no knowledge, of eating habits and were very frightened of people, and of the dark. It was impossible to give them a standard intelligence test as they couldn’t understand the instructions, and they weren’t familiar with things like pictures, which were included in some of the tests. It was estimated that their IQ would have been in the 40s. (The average IQ is 100.) Their stage of development was equivalent to that of a child aged three years.
- The twins were put in hospital until they were well enough to go to a special school for mentally disadvantaged children. There they made good progress. When they were more sociable they were fostered by a particularly kind and loving woman who lived with her sister, who had already fostered children. By the age of eleven the twins’ speech was normal for their age. They enjoyed reading and playing the piano, and they were both fairly active. By the age of fifteen, the twins’ 10 scores were normal, and their emotional state had improved greatly. The atmosphere at home was warm and friendly and, although the boys still remembered their early experiences, they rarely talked about them, even to their foster mother.

Introduction to “Severe Deprivation in Twins”: Jarmila Koluchova

- After basic education they went on to technical school, training as typewriter mechanics, but later undertook further education, specializing in electronics. Both were drafted for national service, and later married and had children. They are said to be entirely stable, lacking abnormalities and enjoying warm relationships. One is a computer technician and the other a technical training instructor.
- It appears that even these terrible early experiences could be overcome with the right kind of care.
- Brain teaser: (Can this happen to the emotionally deprived foster children due to the 10 years of armed conflict in Nepal? **Report any case where children had been severely maltreated and the case scenario is like that of Andrei and Vanya.**
- **Koluchova latest report on the twins (in 1991) showed that they had continued to make progress and they have made a full recovery from their earlier mistreatment. <u>Ann and Alan Clarke claim that if early experiences were so important then these children would be emotionally disturbed for the rest of their lives. At the very least they would suffer severe affectionless psychopathy, (self indulged, having no concern for anyone- apathetic person) they claimed – but they didn’t.</u>**

Summary of Critical Evaluation to "Severe Deprivation in Twins"

- The main question is that can severe deprivation be reversed?
- Does the fact of their being twins mean that their "secret language,"3 self-isolation, and attachment to each other preserved their potential for development or let not them enter psychopathy ?
- Briefly discuss research design of Koluchova's "Emotional Deprivation" research. Critically evaluate the findings.

Severe Deprivation in Twins: Jarmila Koluchova

Methodological consideration in Occupational Health – Conducting Research in OHP

- Chapter 1: Designing a Study- (Longitudinal, Cross-Sectional and Cohort Study?, Purpose/ Objective and Hypothesis setting)
- Chapter 2: Data collection – How to assemble tools to create the qualitative or quantitative data?
- Chapter 3: Measurement and Psychometrics (How can we create reliability and validity in the research?)
- Consider chapter 9, 10 and 26 from the Handbook of OHP; burnouts and personality issues to work elaborated in International Handbook of Work and Health Psychology (chapter 3) & The Handbook of Work and Health Psychology (chapter 19)

Methodological consideration in Occupational Health – Conducting Research in OHP

- **Introduction:** This research area covers employee's wellbeing and mental health , quality of working life and also about their **Positive Psychology In Workplace.**
- Emphasis in stress research needs to shift away from the work environment and so-called "objective" stressors even more towards personal perceptions than recent models of stress have recommended. Stress interventions, should, therefore, be focused at the person level (and the **FITness** of individuals) and not at the job factor, job design or organizational level. It is person, personality and biology of a human that is stressed and not a environment (which has just the ability to cause stress)
- In countries like Nepal, research in OHP, which is itself in first phase of emergence, should be focused on acknowledging the problem than verifying it on statistical parameter. Elaborate.
- Research on social aggression and backup, negative outcomes, work engagements and burnouts. Also **research should be done in personality issues and capacity issues.** (**Workers Fit In A Work And Not The Work Be Fitted In Worker**)
- Research shows that women were differentially selected for leadership positions in times of crisis where failure is an almost certain outcome (e.g., Ryan & Haslam, 2006). The researchers argue that men are placed in safer, more secure jobs while women are put in positions where they feel they have been set up for failure because the assignment comes with such a high risk of failure.

Conducting Research in OHP-Introduction

- **Many researches conclude that technology is not the source of stress.** However, stress may result from many concrete problems, such as malfunction and the lack of usability of software systems, as well as the poor **ergonomic design** of hardware equipment and furnishings, insufficient training and especially from poor task and job design.
- Hobfoll (1988) reported that perception of social support reinforces personal resources. Sarason *et al.* (1983) found that use of **social support as a means of coping was associated with positive self-concepts, low anxiety and higher perceived mastery.**
- General outline of research: Problem- Problem population- **Purpose of research or study- Hypothesis setting regarding to solve problem-** Sampling population- **Induction of experimental variable or study using a tool-** result or byproduct or important issues or facts known- Application of these entity in designing a tool for problem.
- One set of basic problems inherent in the almost exclusive application of quantitative methods in evaluation studies in work and health psychology stems from the fact **that generating data has often become equivalent to letting great numbers of subjects fill in standardized questionnaires. Sometimes the most readily available sources of data have been students: the fact that students rarely have much experience of working life has not been widely perceived as a great disadvantage. May be due to this error there may be great a lot of fallacies in either qualitative or quantitative research in psychology (as a whole) and its outcomes.** Also, thus psychology is traditionally more focused on central tendencies than on variation or individuality. It is to be accepted that like Psychology, statistics is all about the probabilities and possibilities.
- It is widely recognized that improving the design, management and organisation of work (often referred to as the "psychosocial" work environment) may be an important step in improving employee health and organisational productivity (World Health Organization, 1999).

Conducting Research in OHP-Introduction

- The study of well-being and health in work and organisations is represented by a conglomeration of many disciplines without a tradition of close interdisciplinary cooperation.
- **General Psychology** has provided us with **insights into psychological phenomena and processes** such as emotion, cognition, perception, learning, personality, individual differences, fatigue, stress and coping , as well as with methodological principles for research and measurement purposes. **Clinical Psychology** has focused on matters such as trauma and post-traumatic stress , burnout and therapeutic interventions for individuals and groups; it **leads us to prime process of diagnosis of any psychological ailments** . **Social Psychology** has taught us about **group dynamics, social support** and person–environment fit. **Developmental Psychology** has contributed knowledge about life stages and career-related issues. And finally, **Industrial, Organisational and Work Psychology** has examined matters such as **work stress (burnout, wornout) and fatigue, job characteristics,** and organisational issues and HRM interventions There are also considerable influences from other disciplines such as **Engineering, Management, Administrative and Business Science, Sociology, Political Science, Cultural Anthropology and, of Course, Biology and Medical Science**. **Engineering** has contributed several **systems designed** to accomplish an optimal integration of technical systems on the one hand and individual workers and their social system on the other. Examples of such systems are **Ergonomics** (focusing on the design of furniture, tools and machinery, attempting to accomplish optimal use for employees as according to their need and demands), **Occupational Hygiene** (focusing on the long-term health risks of jobs and work environments) and **Safety Technology** (focusing on the acute safety risks of tools, machines and other aspects of jobs and work environments). Managerial, administrative and business science have played an important role in shaping the study of work and organisations. Also biological and medical science have provided us with many insights into the physiology of health, well-being, stress, breakdown and illness, and medical treatments. Of course no one scientist can operate at all these levels and it is only logical that researchers in this area tend to become specialists. It seems very difficult to be specialist in **Occupational Health and Safety.** In the Netherlands for instance, work and health psychologists should have been trained, and must have worked, at least in two of these levels for their professional certification..
- Central tendencies are either based on average values as Mean or based on positional values as Median, Mode, Quartiles, Deciles, Percentiles, etc.

Conducting Research in OHP-Introduction

- **Work and health psychology has traditionally occupied itself predominantly with malfunction in work-related health and well-being, usually under the overall umbrella of stress.** It has paid considerably less attention to normal functioning, well-being and health. **This is not to deny that the study of malfunction is important. Stress phenomena, for instance, and their undesired consequences are not only important as such, but can teach us much about what goes wrong in organisations. However, there is currently an upsurge in interest in positive psychology.**
- **There need to be more focus on positive well-being and health as this avoids the trap of the classical medical model, focusing on curing manifest afflictions and illnesses rather than on prevention and proactivity.** What are the main characteristics of normal functioning? What does the ecology (environment and criterion) of normal functioning, well-being and health look like? Which environmental contingencies play an important part? How does organisational culture affect normal functioning and well-being? Why research in an organization? It is because the working atmosphere including the stakeholders wants improvements! Or is it prevention, remedy and growth? Do you have other answers to this question?
- **It is reasonable to assume that employees are the best experts on their own predicaments.** They are the ones who have the greatest interest in improvements. They know best how they feel, what they want, what they are able and allowed to do, as well as what constitutes an improvement. Moreover, as experts in their own work, it is highly likely that they have valid ideas about the way improvements might be brought about. Of course, it is possible that they do not know the answers to such questions.
- As a **Pragmatic And Applied Discipline**, Occupational Health Psychology can also focus on ways to establish common meanings among those who study and those who are studied. **As an applied and pragmatic science, OHP should strive towards understanding of the genesis, maintenance and development of its object—well-being and health in work and organisations—and produce applicable methods and techniques for continuous improvement.**

Conducting Research in OHP- Introduction

- In work and health psychology **Organisational Interventions** to improve occupational health are usually treated as if these interventions were "experiments". Interventions means there is always insertion of some variables that can be exploited or manipulated or also called introduction. Interventions can be evaluated as "experiments", but at least they should also be examined in terms of their conceptualization, design and implementation (macro processes), and be explored via the detail of the nature of change (micro-processes). Can surveys be a interventions only or is it possible to encode it as Appreciative Inquiry too?
- Experiments are designed to discover whether or not desired changes occur as a result of the manipulation of some important variable or the introduction of a particular treatment. In other words, they are conceptualized as tests of cause-and-effect hypotheses. **However, Experiments should be the last step, the ultimate test of a hypothesis well grounded in theory and research rather than a starting point.** Does it mean that in research testing of hypothesis is mainly to be based on collection of data and interpretation of it on statistical level? Yet in organisations these conditions rarely apply. Researchers are guests, not autocrats. Causal relationships are not simple; they are embedded within complex contexts.
- Y is the result of X (y-x). Here y is the dependent variable and x is the independent variable. But as x can be introduced it can also be exploited, y always remains as product of manipulation or consequence or byproduct
- As experimental research also tagged as "outcome" research and so researchers should frankly acknowledge the unavoidable constraints of their designs against ideal "experimental" principles, and attempt to explore some of the challenges in interpreting outcomes (the remaining threats to internal validity) by other means, such as demographic or attitudinal data or by qualitative approaches. Control group may do "Fake Good" giving only positive response (even if they have negative experiences) as they might respond by trying harder (**Compensatory Rivalry** in not getting enough treatment as like the experimental group). So such effects would make subsequent intervention–control group differences hard to interpret the data. Control group may opt for resentment, dissatisfaction, faking good, voicing against inequalities or self implication of experimental variable on themselves thus affecting the outcome of the experimentation

Conducting Research in OHP- Introduction

- There should be a process, code of conduct and ethics be thoroughly prepared and documented and revised before implementing interventions in both **intervention (experimental) and non-intervention (control) groups is crucial.**
- In the absence of documentation about the integrity of the intervention, even positive results do not make it clear what role the intended processes played in bringing about the outcome (interventions should bring about the positive change). Detailed questions should be asked about how the intervention was implemented. Did it reach the intended number of people? Did people comply with what they were supposed to do? If not, what appeared to be the barriers to compliance? **If the intervention involved a planned increase in the amount of consultative meetings, did those meetings actually take place? How many people attended? Were training interventions mandatory? If not, was there anything different about the attendees and non-attendees? Did the training/ survey/research appear to make a difference to participants' subsequent knowledge, attitudes or behaviour? More generally, what were the views of key stakeholders about the implementation of the intervention?** How did they conceptualize improvement? And, importantly, what were the **unintended spin-offs?** Much useful information about these kinds of issues can be revealed by qualitative methods. Such information facilitates judgments about why an intervention may or may not have had any impact; in other words, it informs the evaluation of outcome.

Conducting Research in OHP-Introduction

- **<u>Control and Health</u>: Control has been widely used in the work and health psychology literature to represent a collection of overlapping constructs. But particularly we represent control here as the degree of freedom in work settings.** Examples are ***participation in decision making, decision latitude, skill discretion (the breadth of skills a worker is allowed to use on the job), decision authority, autonomy, influence, challenge, empowerment, ownership, self determination and workplace democracy.*** <u>Control may be operationalized at many levels; for example, control over the task itself, control over the working environment, control over the organisation and management of work, control over the planning and achievement of career goals, or control over others</u>. **Even the original authors of the "job control–job demands" model admit that "it is difficult to be precise" about which aspects of control (or demands) are important (Theorell & Karasek, 1996).**
- **Distributive Justice** refers to the outcome of decisions; Procedural Justice concerns the procedures that led to that outcome. Procedural justice, often the actual or perceived possibility to influence decision making, is seen as more important than distributive justice in determining people's overall judgments about work. **People have less negative reactions to unfavorable outcomes when procedures are fair (Brockner&Wiesenfeld, 1996; Cohen, 1985).**
- Another important broad dimension in **"Healthy Work"** appears to be **Support**, particularly from line managers or supervisors. But there is little in the literature about the nature and origins of such support, and even less about its precise function. **How, precisely, does support affect people?** Outside the work context, it has long been established that social support can reduce ill-health and psychological disturbance, but here too there is a lack of studies that examine possible intervening mechanisms (Thoits, 1995). Furthermore, it appears that the positive effects of social support depend on the nature of the measures used and, that effects are not always positive, particularly where there is a mismatch between support and individual coping requirements (Frese, 1999)
- Do you think organizational intervention as an experimental design, control as the degree of freedom, distributive over procedural justice and social support , etc can be your concern of research? Why? How?

Conducting Research in OHP-Introduction

- **If you do research and abandon or don't apply the outcomes to other application of research it is just a waste of time, effort and money with relations that were probably used or consulted during research.**
- **Researchers should frankly acknowledge the unavoidable constraints of their designs against ideal "experimental" principles,** and attempt to explore some of the challenges in interpreting outcomes (the remaining threats to internal validity) by other means, such as demographic or attitudinal data (e.g. Cohen & Ledford, 1994) or by qualitative approaches.
- The content of the intervention, research or study and the necessary implementation issues are similar, all resting heavily on participation of employees and other key stakeholders.
- **Within survey or research there are some latent issues which we may be not considering under the study but are addressed (or must be, a lot of times by default) if the response format in such research are directed by open end questions.** Like in a multi ethnic and multi religious country like Nepal the issues of Culture, **Ethnicity or Religiosity are important from cross cultural point of view and at most of times addressed in a latent format.** They have a very important effect on the outcome of study.

Conducting Research in OHP- Introduction

- The anthropologist Clifford Geertz, describing the development of ideas over the past two decades among his fellow social scientists at the Institute for Advanced Study in Princeton, New Jersey, noted as in regards that social scientists are not be subjected to **Physics Envy** and can't demand for an absolute result of the work. **The research in social sciences unlike natural science are analysed a lot on social phenomenon and least on parameters of psychophysics:**
- We are hardly of one mind on everything and we have different interests and different problems before us; but we are all suspicious of casting the social sciences in the image of the natural sciences, and of general schemes which explain too much. Human beings, gifted with language and living in history are, for better or worse, possessed of intentions, visions, memories, hopes, and moods, as well as of passions and judgments, and these have more than a little to do with what they do and why they do it. An attempt to understand their social and cultural life in terms of objectified variables set in systems of closed causality, seems unlikely of success. **Objectivity is least a analytical parameter on social science.**
- Similarly, the psycholinguist Noam Chomsky (1988, p. 159) proposed that our verbal creativity may prove more fruitful than scientific skills for investigating human behaviour: It is quite possible—overwhelmingly probable, one might guess—that we will always learn more about human life and human personality from novels than from scientific psychology. The science-forming capacity is only one facet of our mental endowment. We use it when we can but are not restricted to it, fortunately.

Conducting Research in OHP-Introduction

- **In practice, this often implies that questions have to be asked at least three times, in very slightly different ways, in order to be scientifically acceptable.**
- Barbara Israel and her colleagues (e.g. *Hugentobler et al.*, 1992; Israel et al., *1995, 1998), after many years engaged in public health interventions,* have **emphasized the importance of acknowledging that knowledge is socially constructed, rather than a static, objective body that is separate from the knower.** Israel describes how a "constructionist" approach, acknowledging the social, cultural and historical contexts are taken into account to make research process more reliable. **The health-related outcomes of multi component workplace health promotion programmes, Heaney & Goetzel (1997) also recommended that such Qualitative Evaluation methods could confer certain advantages. Clearly the same argument is pertinent for work organisation interventions: by definition, an organisational intervention cannot take place outside the participation and experience of the people under study.**
- **Qualitative methodologies, based on people's verbal utterances or written reports, are interpretative in nature, use a smaller number of participants, and seek to identify the meaning of events in the social world. Qualitative approaches increases the richness of data or interventions.**
- **Experimental or quasi-experimental are quantitative methodologies.** Whether the data collected from **survey questionnaire (quantitative research but qualitative data)** can be generalized or inferred to new studies is a question (data accessed is more a pilot data that can be useful to modulate the survey questionnaire and cant be generalized). But it is also based on the tactics of the researcher whether he is able to emphasis or thrust his findings (if he thinks they are workable or worthy to disseminate).
- **The generalization of the principle or research rests on the diversity and not on the representativeness (no of samples represented) of subjects and settings in which instances arise.** The external validity of individual studies, or the lack thereof, plays no part in this inductive process.

Conducting Research in OHP- Introduction

- Large data sets allow for the use of sophisticated statistical methods and the discovery of significant relations, differences and generalities. **Exceptions are often removed from the data set as errors are minimized in large population or are not notable.** Thus, **psychology is traditionally more focused on central tendencies than on variation or individuality. In organisational research, however, the individuality of people, teams, departments and organisations is often of paramount importance.**
- In asserting the importance of qualitative research- Barbara Israel and her colleagues (e.g. *Hugentobler et al.*, 1992; Israel et al., *1995, 1998), after many years engaged in public health interventions,* have emphasized **the importance of acknowledging that knowledge is socially constructed, rather than a static, objective body that is separate from the knower.** Israel describes **how a "constructionist" approach, acknowledging the social, cultural and historical contexts, requires specific research methods which are determined also by theoretical perspectives (including "local" theory), the purpose of the study, the context, the involvement of participants themselves and how the information is to be used.** Under such conditions, both quantitative and qualitative methods may be used (Israel et al., 1998). In their review of the health-related outcomes of multi-component workplace health promotion programmes, Heaney & Goetzel (1997) also recommended that such qualitative evaluation methods could confer certain advantages. **Clearly the same argument is pertinent for work organisation interventions: by definition, an organisational intervention cannot take place outside the participation and experience of the people under study.**

Conducting Research in OHP- Conclusion

- There are different types of scientific endeavour relevant to **our interest in the effects of work organisation on health.** The first aims to identify broad patterns in the relationship between work and health i.e. **Introduction**. Another aims to **Explain** the underlying structures, mechanisms and mediating processes (i.e. Design, Data Collection and Measurement). And a third attempts to **Apply** this knowledge i.e. application, once gained. The latter tries to diagnose problems in the quality of work and to effect improvements for both employees and their organisations. modeling important general concepts such as control and support and exploring how they might serve as protective factors against the hazards at workplace.
- If our aim is to explain behaviour as it occurs in ordinary life, there is no escaping the ordinary description of behaviour and experience. Certainly causal mechanisms and structures discovered by **experimental psychology or other sciences apply to such behaviour, but by themselves they do not provide sufficient explanation, and they certainly do not enable us to dispense with ordinary language and to substitute a pure Language Of Behaviour.** (Manicas & Secord, 1990). Lets remember that knowledge is always socially constructed and psychological research aims that idiom.
- **Explaining behaviours (psychological) in terms of methods of natural sciences (empirical studies) have impactful limitations and lesser benefits because Psychological endeavours are not just ordinary experiments but an explanation in broad spectrum of social context.** The current psychological establishment and those engaged in organisational intervention research **have always put the methods of natural sciences in the forefront of psychological research and this over enthusiasm to make psychological research more the physics explained mechanism has brought ahead many problems in the Authenticity Of Psychological Research.** This flaw has been noted by many psychologist time and again. Understanding this flaw open systems demands more than experimental science alone can provide. Psychological research requires knowledge and acceptance of additional contexts and a variety of methods. We are confronted and disabled here by the heritage of behaviourism, with its logic of simple linear S–R (Stimulus vs. Response) relations, where the "R" is replaced by the summated scores of numerous questionnaires.

Conducting Research in OHP-Conclusion

- **In summary, it may be timely to advocate a more modest but realistic approach, one that is not so exclusively dominated by experimental and quasi-experimental designs, and one that involves more flexible ways of collecting data.**
- **There is a need for the investigation of new areas, with more descriptive research. Possible subjects might be emotional contagion, sense-making, or how motivating factors are shaped within and by organisational culture. Another possibility is exploring the role of historically oriented research.** This might give insights into the role of the “human factor” in the successes and failures of organisations. What are the factors behind extreme indices of occupational health and well-being? Can we analyse what exactly went well and what went wrong? What could have been done better? Still another option is developing scenarios for several possible futures. Such an approach would enable us to think through in advance how we can approach the opportunities and difficulties inherent in each of these optional futures. Such an approach helped Shell to use the oil crisis to become the biggest oil company in the world (De Geus, 1997).
- **We need to focus more on descriptive and observational methods to put reliability and validity into our research in order to find out reality, organisational culture and the disturbances that are relevant to them.** This kind of research can make use of the paradigms and methods of ethology and cultural anthropology, without excluding other measures and methods such as those employed in psychophysiological, clinical and social psychology. And of course, where possible, statistical analysis can be used. In principle, this approach of research in OHP can be compared to the approach used by cultural anthropologists or by some consultants, where **the researchers might be viewed as a combination of scientist, detective, investigative journalist and change agent.** Once employed, such approaches may enable us to understand far more about how the design, management and organisation of work affect the health of both employees and their organisations.

Conducting Research in OHP- Measurement and Psychometrics

- We start with the reverse order in dealing the chapters in Unit III like**- 1st Measurement and Psychometrics , 2nd Data Collection** and then 3rd **Designing a Study (**by the use of the tool we probably devise). As we are doing an **Appreciative Inquiry Regarding Stress And Psychosocial Wellbeing At Workplace**, in order to produce a pilot template of the questionnaire we would start the data collection by non random, purposive and convenience sampling. As a lot of times the disposition/effect of lot of constructs (concepts) is criteria related, and so we give the meaning to the construct we use i.e. designing the tools by the criterion validity.
- A survey questionnaire is a qualitative tool (description is a form of qualitative research and the data obtained for sure is would be quantified) for quantitative data ! (or is it vice versa)
- Psychometrics: The study of the Measurement of Psychological Variables (and construction of tools to measure this variable). **Eg. psychological tests , may be psychotherapy, screenings, appreciative inquiry, IQ or personality assessment Or??** A scale is **Reliable** when it gives the same measurement/ results under similar set of conditions. For example an **ECONOMIC STATUS SCALE** is reliable only if two persons with apparently same economic status show the same score in the scale. It **establishes dependability, stability, consistency, predictability and accuracy.** A scale is said to be **Valid** when it correctly measure what is expected to measure. From these ideas we can infer that reliability is result of statistics and validity is the measuring tool. **(reliability of the process and validity of the scale or tool)**
- In regards to **Proactive Coping Inventory**: Employees who believe that they have little control over work domains are less likely to engage in **Active Problem-solving Coping Strategies** and are more likely to employ **Emotion-Focused Coping Strategies** (Folkman, 1984). **Control strategies reflect a 'take charge' approach often involving making a plan of action, focusing efforts on solving the problem at hand and taking direct action.** Research indicates that perceived control is associated with decreased stress levels and improved worker health. Perceived control also buffers the potentially deleterious effects of stress on mental and physical health. **(Research Companion to OHP by Alexander Stamatios- Chapter 33)**

Tentative layout

- Psychology- If individual have problems it needed to be treated individually
- Social Work- If individual have problem it need to be treated as in social group outlining the root cause through social phenomenon
- Dealing of Course Structure: History; Current problem or problem faced; Research; Theoretical models to act on the problem; Solution or management
- Curriculum: Set of course
- Syllabus: Course outline
- **Obsolescence**: It is the state of being which occurs when an object, service, or practice is no longer wanted even though it may still be in good working order. When replacement is available then the skill, object or service is no longer desired and may be decline in popularity is an issue. e.g. Typewriters have been obsolete (outdated/ out of fashion) due to computer-laptop-android cell phone.

Introduction: What is Industry?

- The story of "**A Lecturer Motivational Class With A Jar And Different Sized Pebbles Stone**" for motivating students regarding setting the priority of their goals.
- Industry: The production of an economic (purchasable or saleable or bank guarantee) good or service within an economy
- Classification of Industry:
- Primary or extractable: It is the extraction of resource from the earth primarily farming, mining, logging
- Secondary or manufacturing: it includes manufacturing, processing the farmed good or refining minerals from ores and refining petrochemical.
- Tertiary or service: it includes service industry and products. It includes teachers, managers, bankers, hoteliers, transport industry owners and workers and service providers from governmental and corporate sector.
- Quaternary or Knowledge based: this group is involved in the research of science and technology. ~~They include scientists, educators, academicians, etc.~~
- Quinary (culture and research): Some consider it branch of quaternary sector also including personnel in highest of decision making officials. They includes officials in governmental agencies, universities, healthcare, culture and media. They form the most influential of all industries.

Supplementary

- People with **Schizophrenia occupy 30%** of bed in any hospital in **United States** and about 1% of Americans develop schizophrenia in their life time (life time prevalence).