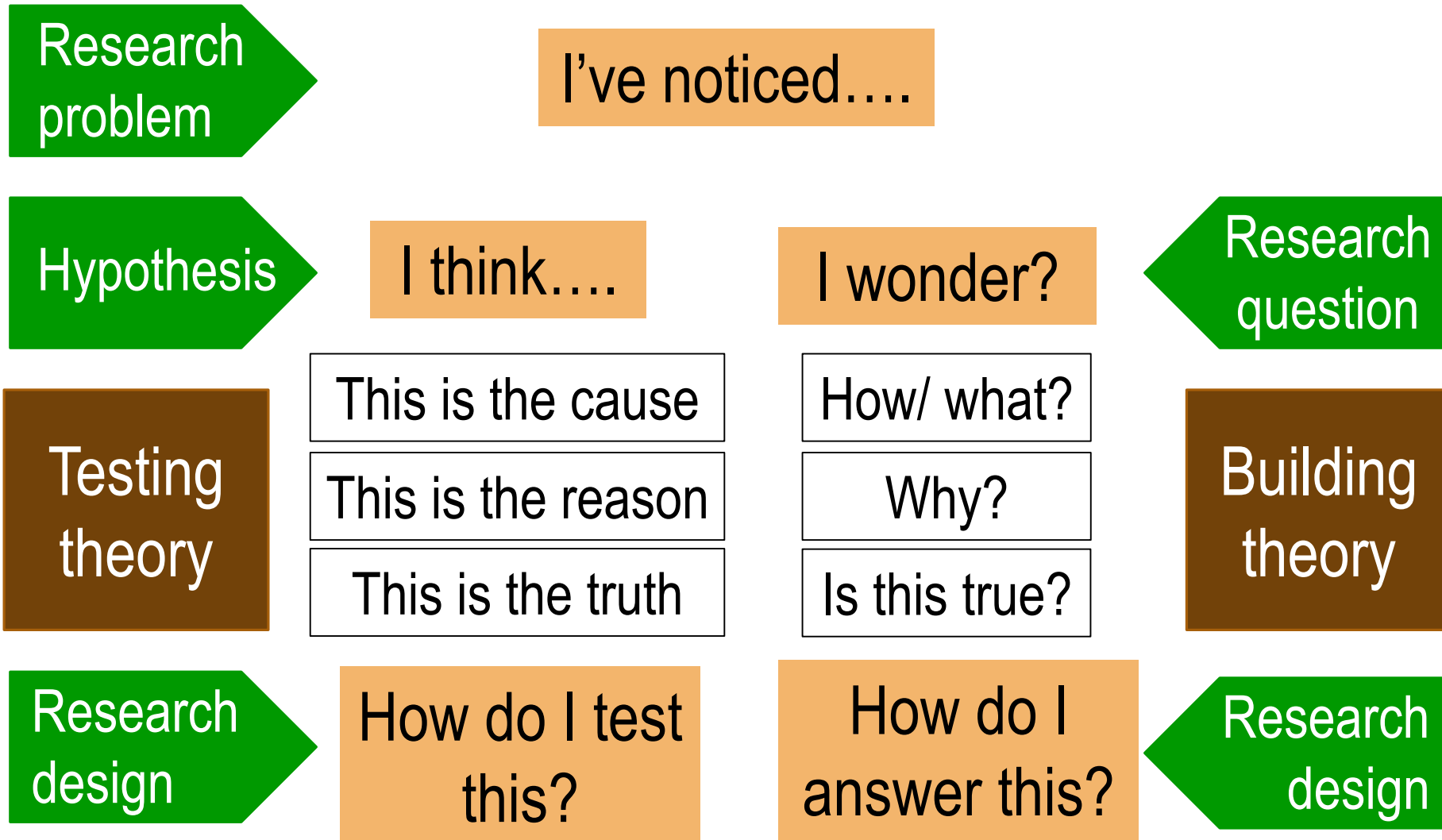


Choosing and Using Quantitative Research Methods and Tools

PROF CME MCCRINDLE





Research project steps



METHODS:THREE STAGES

PLANNING



DATA COLLECTION



DATA ANALYSIS

Research topics

How to select a research topic

https://www.youtube.com/watch?v=nXNztCLYgxc&list=PL6dr1_iNtkeirR9FHM5QbcMrDGZH0dEGr&index=1

https://www.youtube.com/watch?v=Ga7w-czB7lo&index=2&list=PL6dr1_iNtkeirR9FHM5QbcMrDGZH0dEGr

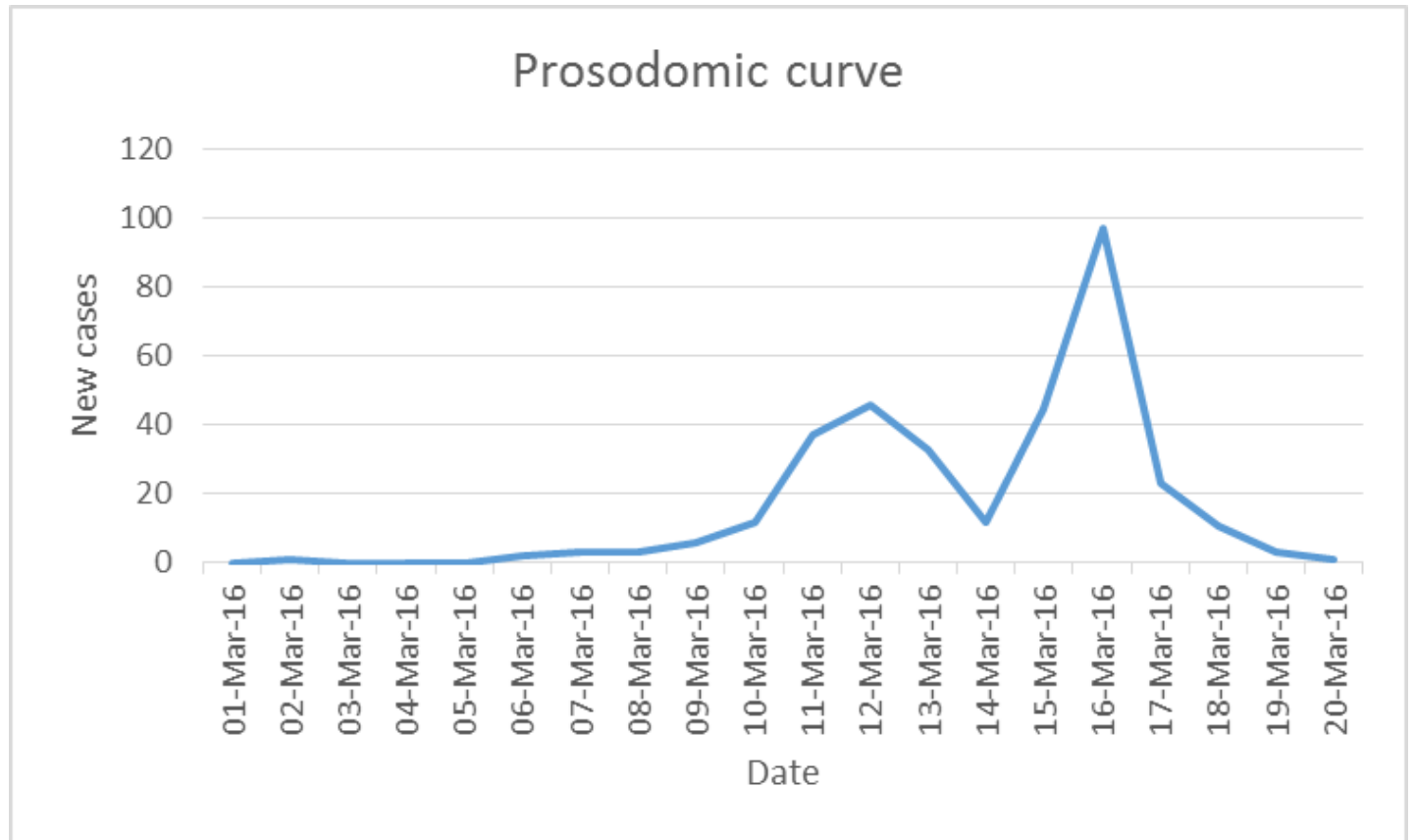
Dependent and Independent variables :

https://www.youtube.com/watch?v=BmjujlZExQ&list=PL6dr1_iNtkeirR9FHM5QbcMrDGZH0dEGr&index=3

Dependent and Independent Variables

Which axis is the dependent variable?

Which is the independent variable?



From research question to thesis

Colorado State University has a detailed online course that explains how you **move from a research question to a hypothesis**:

“Examine your question and do a little brainstorming as to what the possible answer(s) might be: make some educated guesses and write them down.”

(<http://writing.colostate.edu/guides/page.cfm?pageid=436&guideid=21>)

A good way to do this is to read your research question to yourself a few times, then discuss it with a friend.

Then write about 100 -200 words that you think would be the conclusion of your thesis, starting with “it is concluded that”. This should answer your research question...

Definitions

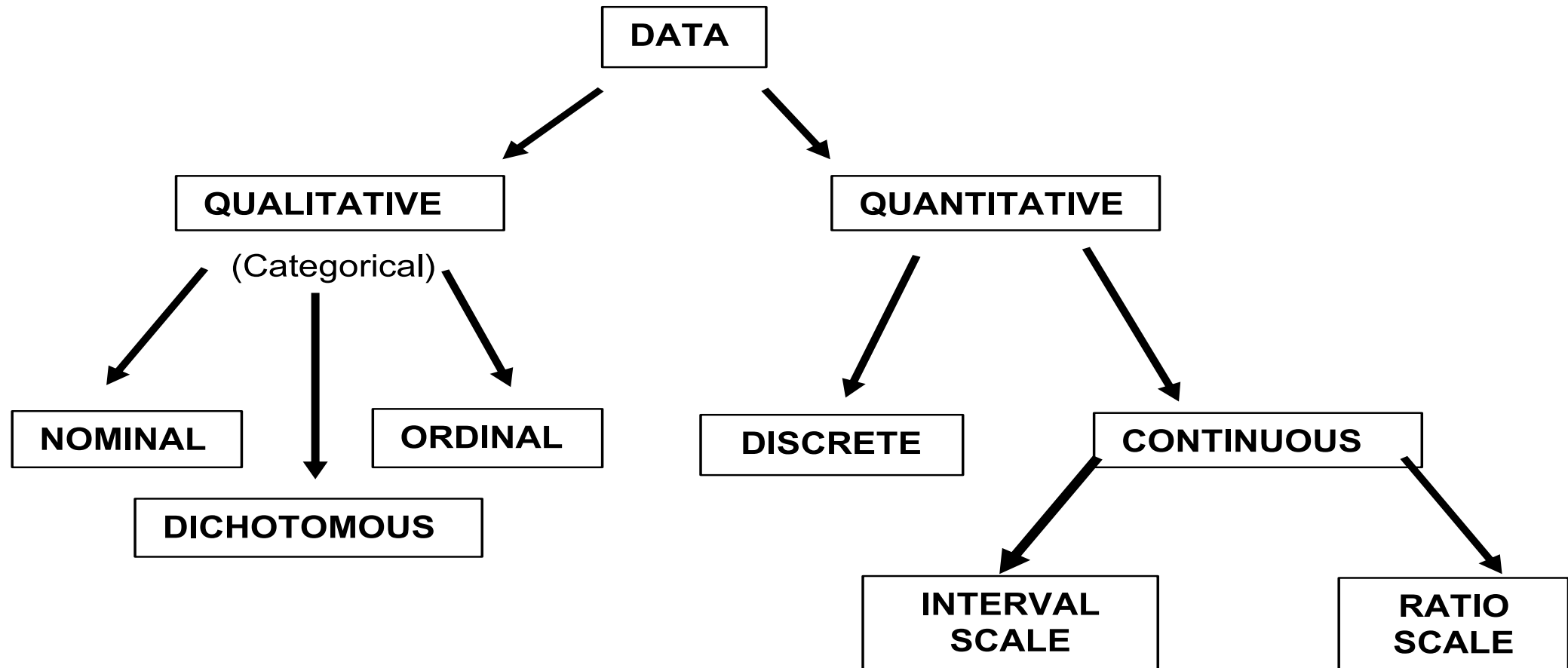
Data: *Facts of any kind.*

Data gathering: *Facts that are collected in a systematic way and carefully and accurately recorded in a **data base***

Data base: *A systematic collection of information, listed in written form or electronically, which can be used for statistic or epidemiological calculations.*

Classification of data

The following diagram illustrates the classification of data.



QUALITATIVE DATA

Attributes, labels
or non numerical
entries. This is
called Categorical
Data

QUANTITATIVE DATA

Numerical
measurements or
counts

City (qualitative)	Population (quantitative)
Polokwane	801 257
Johannesburg	2 845 968
Krugersdorp	350 125

QUALITATIVE

***Categorical data** are **qualitative** data that are grouped into categories. Examples are nominal (named), ordinal (ordered) and dichotomous (presence/absence or yes/no) data.*

Examples are species of animal (nominal=sheep, goat, cow), body condition score (ordinal=1.2.3.4.5), specimens tested either positive or negative for a disease (Dichotomous=positive/negative), or gender (Dichotomous=male or female),

QUANTITATIVE

- **Numerical data** are quantitative data that have values. Numerical data can be further divided into **discrete** or **continuous**.
- **Discrete data** are whole numbers such as number of cows and generate **counts** for data analysis.
- **Continuous data** are measurements like time (values between millions of years and nano-seconds are possible), distances or weights. Continuous data can be further divided into **interval** and **ratio scales**.
- The **ratio scale** has a true zero point (e.g. weight – an animal cannot have a weight of less than zero).
- For the **interval scale** the distance between two points on a scale is accurately measured on either side of a zero point (e.g. Temperature)

Qualitative versus quantitative

Classifications	Qualitative Research	Quantitative Research
Purpose	<i>To understand & interpret social interactions.</i>	<i>To test hypotheses, look at cause & effect, & make predictions.</i>
Group Studied	<i>Smaller & not randomly selected.</i>	<i>Larger & randomly selected.</i>
Variables	<i>Study of the whole, not variables.</i>	<i>Specific variables studied</i>
Type of Data Collected	<i>Words, images, or objects.</i>	<i>Numbers and statistics.</i>
Form of Data Collected	<i>Qualitative data such as open- ended responses, interviews, participant observations, field notes, & reflections.</i>	<i>Quantitative data based on precise measurements using structured & validated data-collection instruments.</i>
Type of Data Analysis	<i>Identify patterns, features, themes.</i>	<i>Identify statistical relationships.</i>
Objectivity v Subjectivity	<i>Subjectivity is expected.</i>	<i>Objectivity is critical.</i>
Role of Researcher	<i>Researcher & their biases may be known to participants in the study, & participant characteristics may be known to the researcher.</i>	<i>Researcher & their biases are not known to participants in the study, & participant characteristics are deliberately hidden from the researcher (double blind studies).</i>
Results	<i>Particular or specialized findings that is less generalizable.</i>	<i>Generalizable findings that can be applied to other populations.</i>
Scientific Method	<i>Exploratory or bottom-up: the researcher generates a new hypothesis and theory from the data collected.</i>	<i>Confirmatory or top-down: the researcher tests the hypothesis and theory with the data.</i>
View of Human Behavior	<i>Dynamic, situational, social, & personal.</i>	<i>Regular & predictable.</i>
Most Common Research Objectives	<i>Explore, discover, & construct.</i>	<i>Describe, explain, & predict.</i>
Focus	<i>Wide-angle lens; examines the breadth & depth of phenomena.</i>	<i>Narrow-angle lens; tests specific hypotheses.</i>
Nature of Observation	<i>Study behavior in a natural environment.</i>	<i>Study behaviour under controlled conditions; isolate causal effects.</i>
Nature of Reality	<i>Multiple realities; subjective.</i>	<i>Single reality; objective.</i>
Final Report	<i>Narrative report with contextual description & direct quotations from research participants.</i>	<i>Statistical report with correlations, comparisons of means, & statistical significance of findings.</i>

Quantitative Data Analysis

- The process of presenting and interpreting numerical data using statistical techniques
- Primary data analysis: analysing data you collect
- Secondary data analysis: analysing data someone else collected
- Statistics?
- Watch the youtube video “Introduction to Statistics”
<https://www.youtube.com/watch?v=zlfwdsEDC4Q&t=286s>
- Watch the youtube video “Statistics, variables, scales of measurement”
<https://www.youtube.com/watch?v=mWGMaUlzWFg&t=166s>

Sampling strategies

- Simple random sampling. This is the simplest form of probability sampling. ...
- Systematic sampling. ...
- Stratified sampling. ...
- Cluster sampling. ...
- Multi-stage sampling.

<https://www.youtube.com/watch?v=WKUAop1Pre0>

<https://www.youtube.com/watch?v=pTuj57uXWlk>

Which test to use?

Choosing which statistical test to use - statistics help

<https://www.youtube.com/watch?v=rulIUAN0U3w&t=5s>

Parametric and Nonparametric Statistical Tests

https://www.youtube.com/watch?v=pWEWHKnwg_0

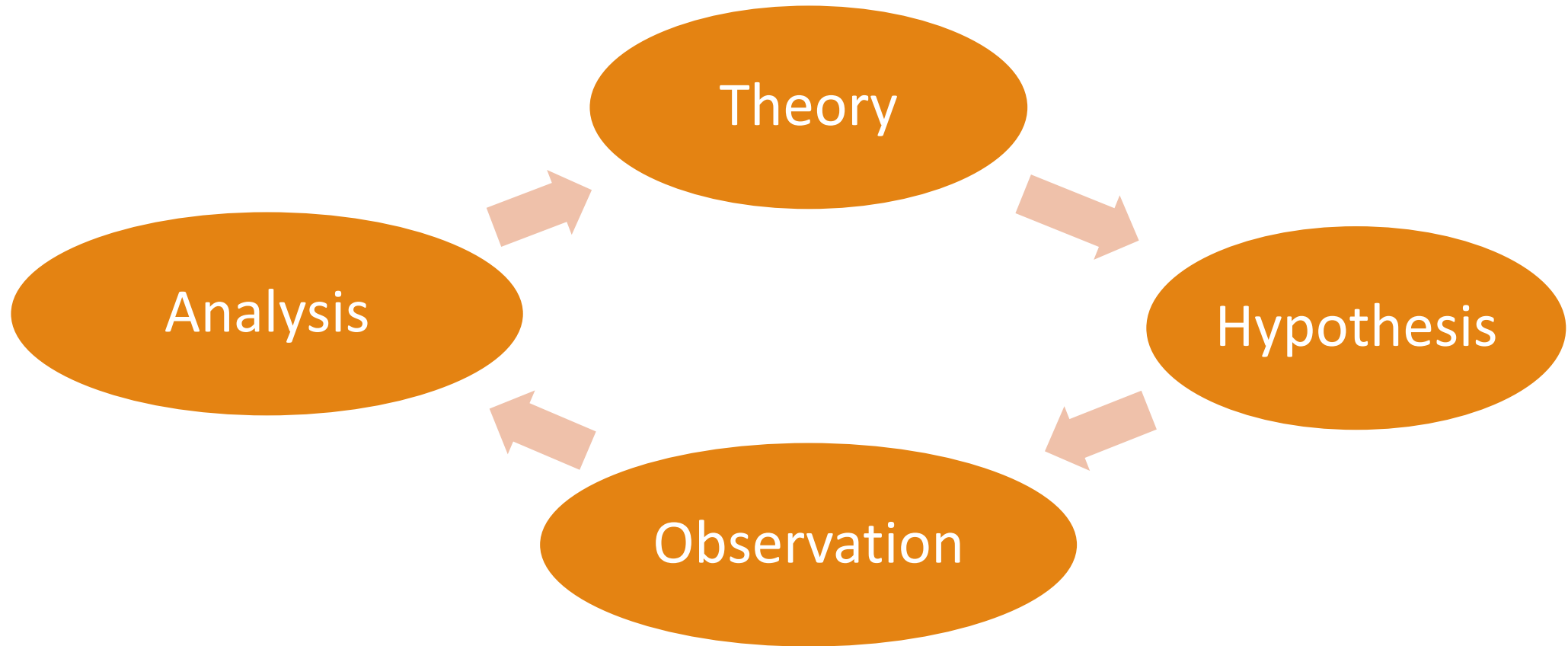
https://www.youtube.com/watch?v=MKUY_ZC18s4

Sampling size

Confidence Intervals for a Proportion:
Determining the Minimum Sample Size

<https://www.youtube.com/watch?v=mmgZI2G6ibl>

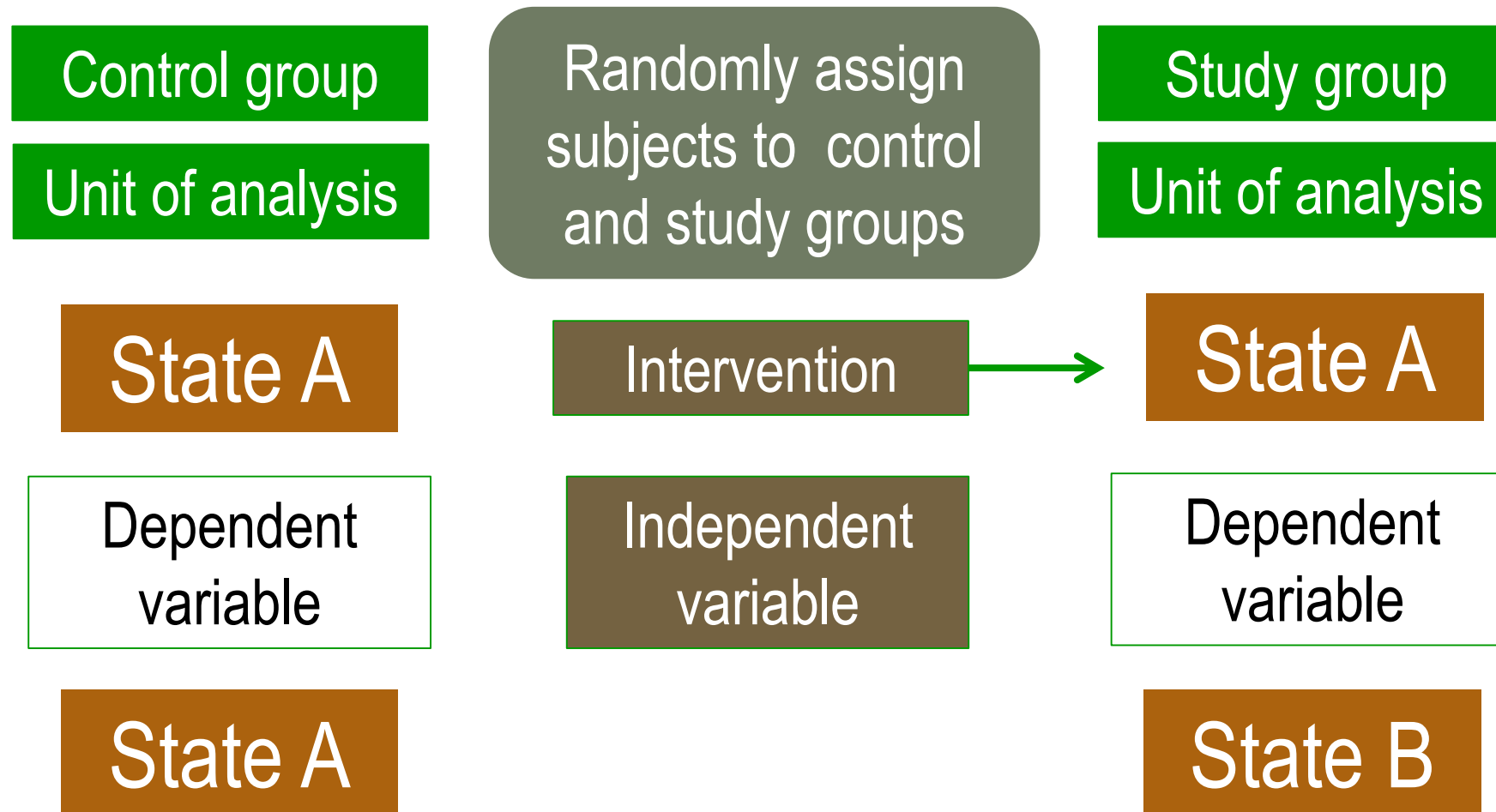
Inductive and Deductive: Research



Inductive and Deductive Research

- Inductive research begins with an observation and research question and leads to collection of empirical data, a hypothesis and a theory
- Deductive research begins with a theory and hypothesis which guides data collection and analysis

Experimental design



Laboratory vs field

Laboratory

- Any artificial environment where variables can be controlled
- Minimise nuisance variables

Field

- The actual environment in which a phenomenon was observed
- Cannot control all variables

Quasi-experimental research

Cannot randomly assign subjects to groups

Non-equivalent control group design

- **Use two pre-existing groups as experiment and control**
- **Measure both groups on the dependent variable before the experiment and again after**

The interrupted time-series design

- **Measure dependent variable more than once at equal intervals**

Non-experimental research

No planned intervention and no random assignment of research participants

Main types

- **Designs that take measurements once**
- **Longitudinal designs**
 - **Examine the same group at different time intervals**
 - **Panel – representative group**
 - **Cohort – already defined group (e.g. babies born in 1994)**
 - **Trend – different samples from same population**
- **Prediction studies**
 - **Retrospective or prospective**
- **Opinion polls (do not test hypothesis)**

Validity

Internal validity

- The degree to which changes in the dependent variable is due to the independent variable rather than something else

External validity

- Population validity: degree to which the findings for a sample can be generalised to the total population
- Ecological validity: the degree to which the results may be generalised to all circumstances implied by the hypothesis

Developing a quantitative research plan

- Overview of quantitative research methods

<https://www.youtube.com/watch?v=cwU8as9ZNIA>

- Hypothesis testing

<https://www.youtube.com/watch?v=EhnzrQ2fkTs>

- Inductive and Deductive Research Approaches

https://www.youtube.com/watch?v=QB41z6_mUxk

Hypothesis testing

A hypothesis provides:

- **A testable statement about your research**
- **Direction for your research**
- **A framework for findings (results) and conclusions**
- **It can be supported or refuted through observations or experiments**
- **It aligns to the research problem and question**
- **It predicts the outcome or conclusion of your research**
- **Two types : Research (directional or non directional) and Null (no relationship)**

Hypothesis, significance and probability

- Hypothesis tests, p-value - Statistics Help

<https://www.youtube.com/watch?v=0zZYBALbZgg>

- Type I and II Errors, Power, Effect Size, Significance and Power Analysis in Quantitative Research

[https://www.youtube.c om/watch?v=OWn3Ko1WYTA](https://www.youtube.com/watch?v=OWn3Ko1WYTA)



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Thankyou for your attention!