



HYPOTHESES: Characteristics, Types, & Errors in causal reasoning (through them)

Dr. Syed Owais

Department of Sociology

University of Peshawar

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Lecture Format

- **What is a hypothesis?**
- **Characteristics of a Hypothesis.**
- **Types of Hypotheses**
- **Levels & Units of Analysis in Quantitative Research**
- **Errors in Causal Reasoning**

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Hypothesis



- “is a proposition to be tested or a **tentative** statement of a relationship between two variables” (Neuman, 1994)

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Five characteristics of a hypothesis



1. Hypothesis has at least two variables
2. It expresses a causal or cause-effect relationship between the variables.
3. It can be expressed as a prediction or an expected future outcome.
4. It is logically linked to a research question and a theory.
5. It is falsifiable; that is, it is capable of being tested against empirical evidence and shown to be true or false.

Source: Neuman, 1994, P. 109

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Example of hypothesis on a single topic (Neuman, 1994: 109)



- Couples who attend religious services frequently have a lower divorce rate than do couples who rarely attend religious services. It can be stated in either of the following ways:
 1. Religious attendance **Causes** reduced divorce.
 2. Religious attendance **leads** to reduced divorce.
 3. Religious attendance **is related** to reduced divorce.
 4. Religious attendance **influences** the reduction of divorce.
 5. Religious attendance **is associated with** reduced divorce.
 6. Religious attendance **produces** reduced divorce.
 7. Religious attendance **results** in reduced divorce.
 8. Religious attendance **reduces** the likelihood of divorce.
 9. If people attend religious services, then the likelihood of divorce will be reduced.
 10. **The higher** religious attendance, **the lower** the likelihood of divorce.

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TESTING OF HYPOTHESES: Null & Alternate Hypothesis



- Quantitative researchers, especially, experimenters frame hypotheses in terms of a *null* hypothesis based on the logic of disconfirming hypotheses.
- They test hypotheses by looking for evidence that will reject or accept the null hypothesis.
- We frame hypothesis to *predict* a relationship; Null hypothesis predicts the opposite.

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Example



- If I think that students who live in Hostels get good grades than those coming to University from homes my null hypothesis can be:
 - *There is no relationship between a student's residence and grades*
- Or
- *The grades of hostels-residents/boarders and day-scholars are similar.*
- The ***alternative hypothesis***, states the opposite (the one that the researcher has in mind) showing a positive relationship between the variables. For instance,
 - *Students' living-in-campus is positively related to their grades*

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Null hypothesis



- Is based on the assumption that researchers try to discover a relationship, so hypothesis testing should be designed to make finding a relationship more demanding.
- Using a null hypothesis means, we are directly testing a null hypothesis:
 1. If evidence supports a null hypothesis, then alternative is rejected;
 2. If otherwise, then we say that 'alternative hypothesis is a possibility.
 3. We don't/can't prove *alternative* hypothesis;
 4. We keep alternative hypothesis in constant contention for refinement and further research;
 5. Proof against *Null* hypothesis, does enrich evidence for alternative hypothesis, but we don't claim final ***proof*** for alternative hypothesis.
BECAUSE ...

*There are no final proofs and final Truths in Science
(Social or Natural)!*

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Remember!

- As used in courts/journalism/advertisements etc. we never use the word **'Prove' or 'proof'** in research.
- Because scientific knowledge is always considered as **tentative** [something done provisionally or experimentally], knowledge creation is an ongoing process.
- **'Proof'** is a **very strong** for scientific knowledge creation.
- Even after 100s of studies on the same hypothesis, we never say that **it is proved**, instead we state ...
 - All studies to date/evidence to date overwhelmingly support or are consistent with the hypothesis.
- **Reason for this scepticism?** Scientists never want to close the possibility of discovering new evidence that might contradict past findings.

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Double-barrelled hypothesis



- A hypothesis that “puts two distinct relationships in one hypothesis” (Neuman, 1994: 112).

For example,

“Poverty and high concentration of teenagers in an area cause property crimes to increase” (Neuman, 1994: 112).

Questions: Does the proposer means...

- Poverty causes property crimes to increase? **OR**
- Teenagers concentration causes property crimes to increase? **OR**
- **Poverty along with high concentration of teenagers** in an area cause property crimes to increase

To avoid such a confusion, a researcher is required to state a **combination hypothesis** (i.e. A hypothesis with more than two variables) in clear-cut wording.

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Quantitative Social Research: Unit of analysis & level of analysis



- The Unit of analysis & level of analysis are restricted by the topic of research and research question.
- A level of analysis is “the level of social reality to which theoretical explanation refer” (Neuman, 1994: 113), i.e. Micro-level, macro-level.

The level of analysis includes:

- number of people,
- the amount of space,
- the scope of the activity, and
- the length of time

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Level of analysis



Delimits:

- Kinds of assumptions,
 - Concepts,
 - Theories
- ... That a researcher use.

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Unit of analysis



- “the type of unit a researcher uses when measuring variables” (Neuman, 1994: 113). e.g. Common units of analysis are:
 - Individual, group (family, peers, friends, neighbours),
 - organisation (University, corporation, a factory),
 - the social category (social class, gender, race, ethnicity),
 - the social institutions (religion, education, family), &
 - society (nation, tribe).

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Unit of analysis



- Determine how a researcher measures variables. They also correspond to the level of analysis in an explanation.
- They also correspond loosely to the level of analysis in an explanation: social-psychological or micro-level analysis fit with the individual as a unit of analysis; macro level analysis fit with the social category or institution as a unit of analysis.

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Potential errors in causal explanations



1. (error of) Ecological fallacy
2. (error of) reductionism
3. (error of) tautology
4. (error of) teleology
5. (error of) spuriousness

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1. (error of) Ecological fallacy



Refers to *“poor fit between the units of or which a researcher has empirical evidence and the units for which he or she wants to make statements”* (Neuman, 1994: 114).

- It arises from mismatch of units of analysis;
- It is due to imprecise reasoning and generalising beyond what the evidence warrants
- It occurs when a researcher gathers data at higher or aggregate unit of analysis but wants to make a statement about a lower or disaggregated unit.

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2. (error of) reductionism or Fallacy of non-equivalence



Occurs when “a researcher explains macro-level events but has evidence only about specific individuals” (Neuman, 1994: 116).

- When a researcher observes lower or disaggregated unit of analysis but makes statements about the operations of higher or aggregated units.
- It is the mirror-image of *ecological fallacy*.
- *It can be avoided by ensuring that the unit of analysis in the explanation is very close to the one for which a researcher has evidence.*

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3. (error of) Tautology



- Means circular reasoning. i.e. “something is true by definition” (Neuman, 1994: 117).
- A tautological statement looks like a causal-explanation/reasoning but is not causal in reality.
- Can be avoided by considering whether a hypothesis can be restated as a definition. If an equal sign (=) can be substituted for the causal arrow b/w independent and dependent variables, then it is a tautology.

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4. (Error of) Teleology



- Due to a slip in language, when “a vague future condition or an abstract, diffuse idea about the ‘nature of the world’ is used to explain something specific.

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5. (Error of) Spuriousness



- When “two variables are associated but are not causally related because there are not causally related because there is actually an unseen third factor that is the real cause.” (Neuman, 1994: 118).

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