Lecture 7

DEVELOPING HYPOTHESIS

- **Introduction**
- **Processes involved before formulating the hypotheses.**
- **Definition**
- **Nature of Hypothesis**
- **Types**
- **How to formulate a Hypotheses in**

Quantitative Research Qualitative Research

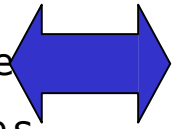
- **Testing and Errors in Hypotheses**
- **Summary**

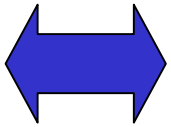
The research structure helps us create research that is :

Quantifiable Verifiable Replicable Defensible

Corollaries among the model, common sense & paper format

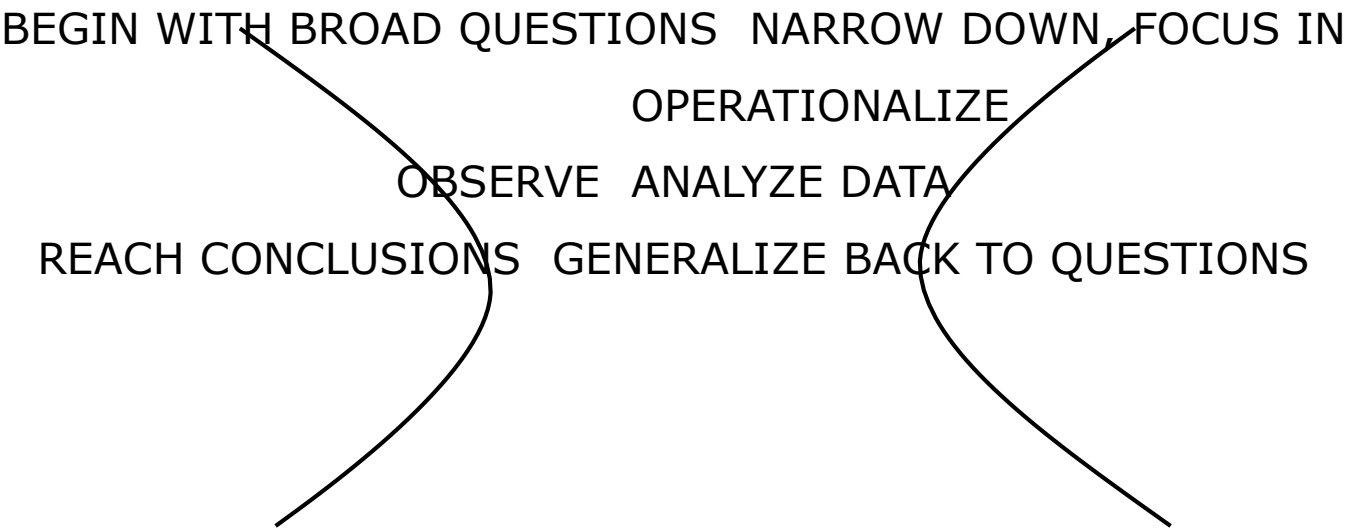
Model	Common Sense	Paper Format
Research Question	Why	Intro
Develop a Theory	Your Answer	Intro
Identify Variables (if applicable)	How	Method
Identify hypothese	Expectations	Method
Test the hypotheses	Collect/Analyze data	Results
Evaluate the Results	What it Means	Conclusion
Critical Review	What it doesn't Mean	Conclusion





Most research projects share the same general structure, which could be represented in the shape of an hourglass.

The "Hourglass" notion of research

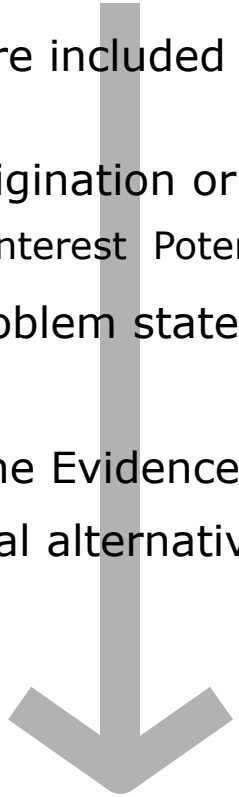


Some of the methods that are included for research formulation are

- Where does the problem origination or discovery begin?

Previous Experience Triggered Interest Potential problem fields

- Criteria of problems and problem statement
- Goals & Planning
- Search, Explore & Gather the Evidence
- Generate creative and logical alternative solutions



Making the educated guess- the hypothesis!

Definitions of hypothesis

- "Hypotheses are single tentative guesses, good hunches – assumed for use in devising theory or planning experiments intended to be given a direct experimental test when possible". (Eric Rogers, 1966)

- "A hypothesis is a conjectural statement of the relation between two or more variables". (Kerlinger, 1956)

- "Hypothesis is a formal statement that presents the expected relationship between an independent and dependent variable."(Creswell, 1994)

- "A research question is essentially a hypothesis asked in the form of a question."

Definitions of hypothesis

- "It is a tentative prediction about the nature of the relationship between two or more variables."

- "A hypothesis can be defined as a tentative explanation of the research problem, a possible outcome of the research, or an educated guess about the research outcome." (Sarantakos, 1993: 1991)

- "Hypotheses are always in declarative sentence form, an they relate, either generally or specifically , variables to variables."

- "An hypothesis is a statement or explanation that is suggested by knowledge or observation but has not, yet, been proved or disproved." (Macleod Clark J and Hockey L 1981)

Nature of Hypothesis

- The hypothesis is a clear statement of what is intended to be investigated.

- It should be specified before research is conducted and openly stated in reporting the results. This allows to:

Identify the research objectives
Identify the key abstract concepts involved in the research
Identify its relationship to both the problem statement and the literature review

- A problem cannot be scientifically solved unless it is reduced to hypothesis form

- It is a powerful tool of advancement of knowledge, consistent with existing knowledge and conducive to further enquiry

Nature of Hypothesis

- It can be tested – verifiable or falsifiable
- Hypotheses are not moral or ethical questions
- It is neither too specific nor to general
- It is a prediction of consequences
- It is considered valuable even if proven false

An Example...

Imagine the following situation:

You are a nutritionist working in a zoo, and one of your responsibilities is to develop a menu plan for the group of monkeys. In order to get all the vitamins they need, the monkeys have to be given fresh leaves as part of their diet. Choices you consider include leaves of the following species: (a) A (b) B (c) C (d) D and (e) E. You know that in the wild the monkeys eat mainly B leaves, but you suspect that this could be because they are safe whilst feeding in B trees, whereas eating any of the other species would make them vulnerable to predation. You design an experiment to find out which type of leaf the monkeys actually like best: You offer the monkeys all five types of leaves in equal quantities, and observe what they eat.

There are many different experimental hypotheses you could formulate for the monkey study. For example:

When offered all five types of leaves, the monkeys will preferentially feed on B leaves.

This statement satisfies both criteria for experimental hypotheses. It is a

- **Prediction:** It predicts the anticipated outcome of the experiment
- **Testable:** Once you have collected and evaluated your data (i.e. observations of what the monkeys eat when all five types of leaves are offered), you know whether or not they ate more B leaves than the other types.

Incorrect hypotheses would include:

When offered all five types of leaves, the monkeys will preferentially eat the type they like best.

This statement certainly sounds predictive, but it does not satisfy the second criterion: there is no way you can test whether it is true once you have the results of your study. Your data will show you whether the monkeys preferred one type of leaf, but not why they preferred it (i.e., they like it best). I would, in fact, regard the above statement as an assumption that is inherent in the design of this experiment, rather than as a hypothesis.

When offered all five types of leaves, the monkeys will preferentially eat B leaves because they can eat these safely in their natural habitat.

This statement is problematic because its second part ('because they can eat these safely in their natural habitat') also fails to satisfy the criterion of testability. You can tell whether the monkeys preferentially eat baobab leaves, but the results of this experiment cannot tell you why.

In their natural habitat, howler monkeys that feed in B trees are less vulnerable to predation than monkeys that feed on A, C, D, or E.

This is a perfectly good experimental hypothesis, but not for the experiment described in the question. You could use this hypothesis if you did a study in the wild looking at how many monkeys get killed by predators whilst feeding on the leaves of A, B etc. However, for the experimental feeding study in the zoo it is neither a prediction nor testable.

When offered all five types of leaves, which type will the monkeys eat preferentially?

This is a question, and questions fail to satisfy criterion #1: They are not predictive statements. Hence, a question is not a hypothesis.

Types of Hypotheses

NULL HYPOTHESES

Designated by: H_0 or H_N

Pronounced as "H oh" or "H-null"

ALTERNATIVE HYPOTHESES

Designated by: H_1 or H_A

The **null hypothesis** represents a theory that has been put forward, either because it is believed to be true or because it is to be used as a basis for argument, but has not been proved.

- Has serious outcome if incorrect decision is made!

The **alternative hypothesis** is a statement of what a hypothesis test is set up to establish.

- Opposite of Null Hypothesis.
- Only reached if H_0 is rejected.
- Frequently "alternative" is actual desired conclusion of the researcher!

EXAMPLE

In a clinical trial of a new drug, the **null hypothesis** might be that the new drug is no better, on average, than the current drug.

We would write H_0: **there is no difference between the two drugs on average.**

The **alternative hypothesis** might be that:

the new drug has a different effect, on average, compared to that of the current drug.

We would write H_1: **the two drugs have different effects, on average.**

the new drug is better, on average, than the current drug.

We would write H_1: **the new drug is better than the current drug, on average**.

We give special consideration to the null hypothesis…

- This is due to the fact that the null hypothesis relates to the statement being tested, whereas the alternative hypothesis relates to the statement to be accepted if / when the null is rejected.

- The final conclusion, once the test has been carried out, is always given in terms of the null hypothesis. We either 'reject H_0 in favor of H_1' or 'do not reject H_0'; we never conclude 'reject H_1', or even 'accept H_1'.

- If we conclude 'do not reject H_0', this does not necessarily mean that the null hypothesis is true, it only suggests that there is not sufficient evidence against H_0 in favor of H_1; rejecting the null hypothesis then, suggests that the alternative hypothesis may be true.

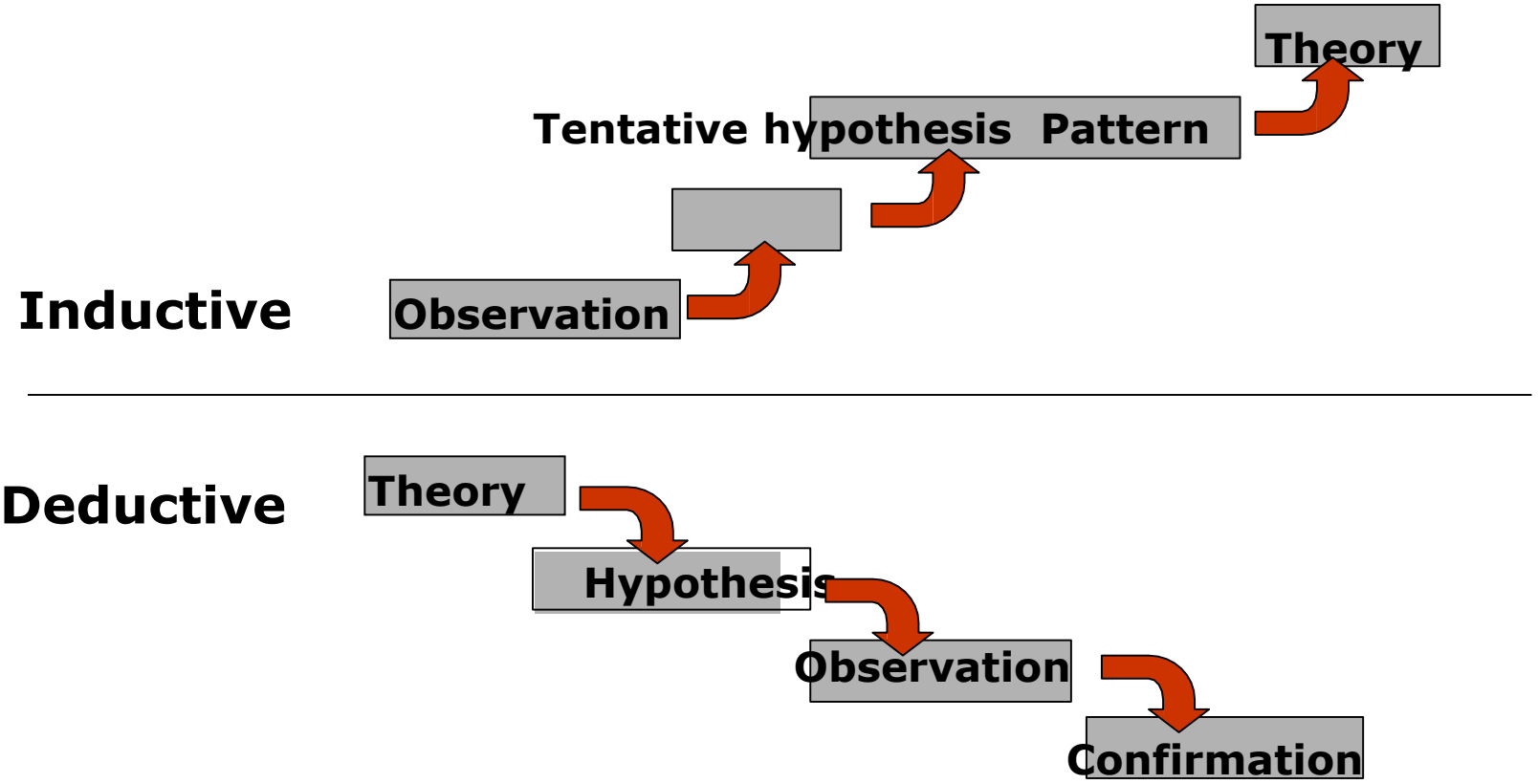
Formulating a hypothesis

…is important to narrow a question down to one that can reasonably be studied in a research project.

The formulation of the hypothesis basically varies with the kind of research project conducted:

QUALITATIVE QUANTITATIVE

Can also be divided into:



Quantitative Approach

the use of research questions and objectives is more frequent

In experiments the use of hypotheses are more frequent

Represent → comparison between variables

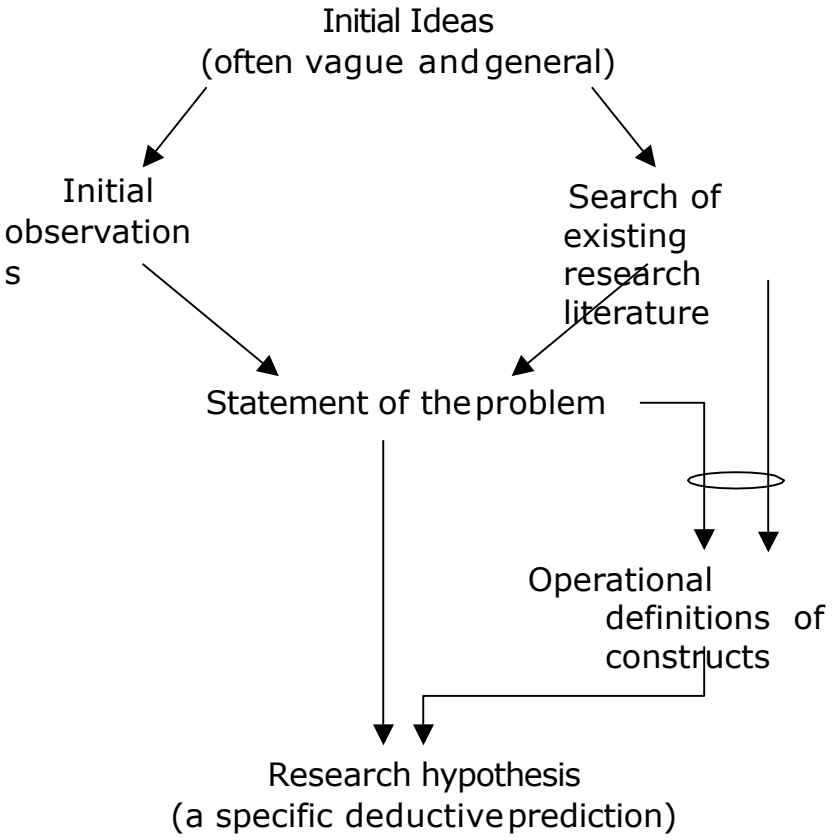
Represent → relationship between variables

Characteristics

- The testable proposition to be deduced from theory.
- Independent and dependent variables to be separated and measured separately.
- To be either writing-questions, or objectives or hypotheses, but not a combination.
- Consider the alternative forms for writing and make a choice based on the audience for the research

Generation of Research Hypothesis

Problem statements become research hypotheses when constructs are operationalized



Example:

Consider the example of a simple association between two variables, Y and X.

1.Y and X are associated (or, there is an association between Y and X).

2.Y is related to X (or, Y is dependent on X).

3.As X increases, Y decreases (or, increases in values of X appear to effect reduction in values of Y).

- **The first hypothesis** provides a simple statement of association between Y and X. Nothing is indicated about the association that would allow the researcher to determine which variable, Y or X, would tend to cause the other variable to change in value.

- **The second hypothesis** is also a simple statement of association between Y and X, but this time it may be inferred that values of Y are in some way contingent upon the condition of the X variable.

- **The third hypothesis** is the most specific of the three. Not only does it say that Y and X are related and that Y is dependent on X for its value, but it also reveals something more about the nature of the association between the two variables.

Testing & Challenging

The degree of challenge to the hypothesis will depend on the type of problem and its importance. It can range from just seeking "a good enough" solution to a much more rigorous challenge.

The term "challenging" may include

- Verification
- Justification
- Refutability
- Validity
- Rectification
- Repeatability
- Falsification

There are two possibilities

1. Nothing Happened — the Null Hypothesis -H_o
2. Something Happened — the Alternative Hypothesis -H_1

Hypothesis testing is a four-step procedure:

1. Stating the hypothesis (Null or Alternative)
2. Setting the criteria for a decision
3. Collecting data
4. Evaluate the Null hypothesis

Summary

"Research questions and hypotheses become "signposts" for explaining the purpose of the study & guiding the research…", Creswell

A hypothesis is an explanation, tentative and unsure of itself, for specific phenomena about which you have questions.

A well-crafted hypothesis very often suggests the best way to perform the research and gives you clues as to your research design.

There are different types of hypotheses. deductive

- inductive
- Research Hypothesis can either be non-directional or directional. There exists a hypothesis that is opposite of the positively stated one, i.e. the null hypothesis

Thus to conclude it would be fitting to say "hypothesis is perhaps the most powerful tool, man has invented to achieve dependable knowledge" – Fred Kerlinger…