Hypotheses and Causality

RSM 321 (Lecture 8)

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Outline

- Hypotheses
- Causality

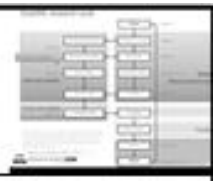
Hypotheses

- Research usually starts from hypotheses, e.g.,
  - A higher level of CO2 in the air increases the probability of a rise in temperature (global warming)
  - A higher level of education increases the probability of adoption of 'Improved Fallow Technique' more for organic than for industrial farmers

- Hypotheses state expectations about reality

Definition: 'A hypothesis is a conjectural statement of the relationship between two or more variables' (Karlinger, 1986)

Examples



Research question:	Hypothesis:
What is the effect of the degree of acidity of the soil on the sustainability of the ecosystem?	
Does receiving information about global warming make people reduce their car use?	

Functions of Hypotheses

- It provides a study with focus, and tells what specific aspects of a research problem to investigate
- It tells what data to collect and what not to collect
- It enhances objectivity in a study
- It may enable you to add to the formulation of theory and it enables researcher to conclude specifically what is true or what is false.

Characteristic of a Hypothesis

- A hypothesis should be simple, specific and conceptually clear
- A hypothesis should be capable of verification
- A hypothesis should be related to the existing body of knowledge
- A hypothesis should be operationalisable

Types of hypotheses

- Non-relational hypothesis: states the existence/level/condition
  - A is (B). (e.g., Soil salinity in Dumki is 1500 ppm)

- Correlational hypothesis: states a relation between variables
  - There is a relationship between A & B. (e.g., Soil salinity is related to plant growth)

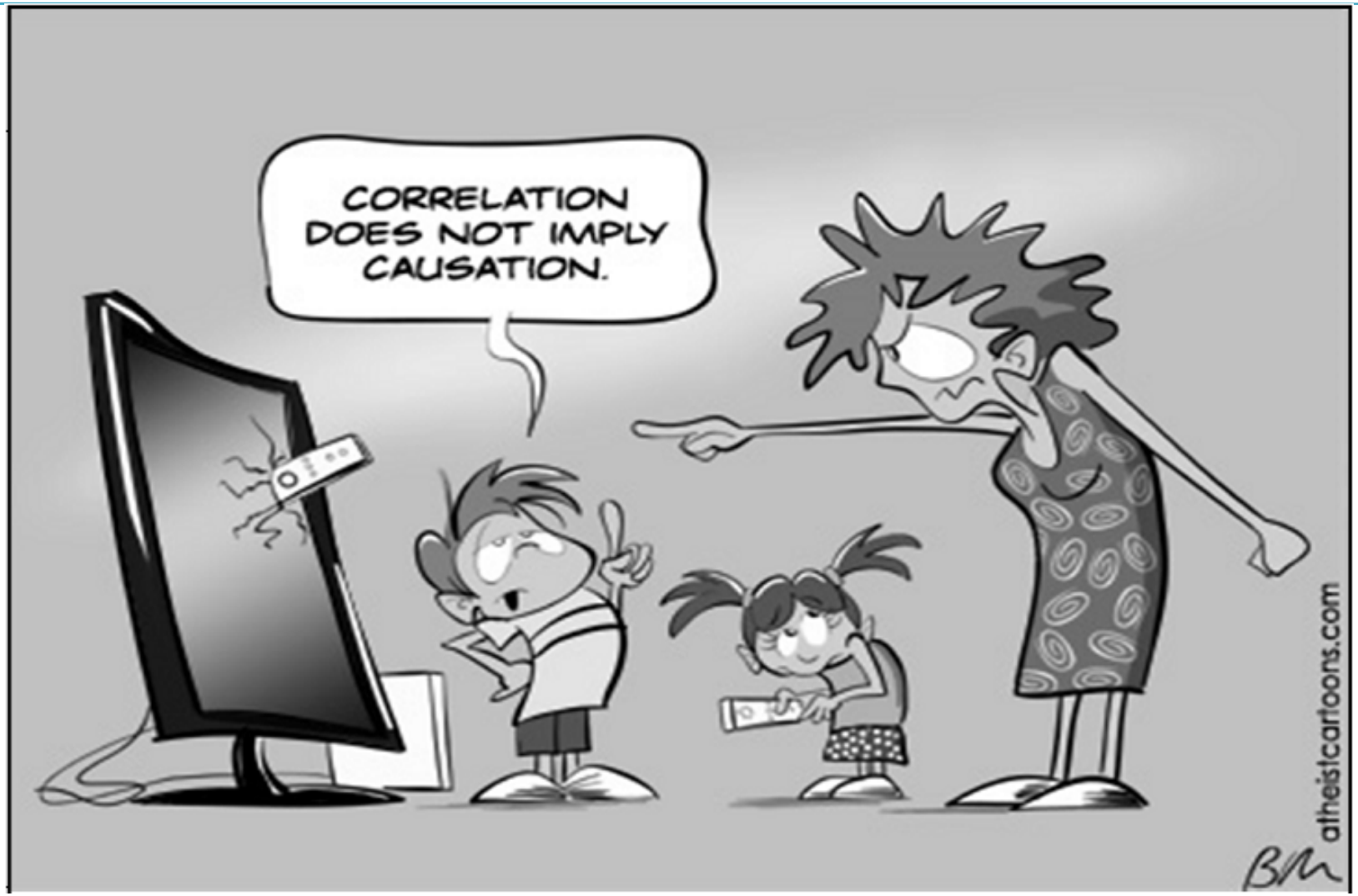
- Developmental hypothesis: states a development of one or more variables in time
  - A changes with time. (e.g., Soil salinity in Dumki is increasing)
- Causal hypothesis: states a causal relation between variables
  - X causes Y. (e.g., Soil salinity affects plant growth)

Types of hypotheses (Cont'd)

❑ Correlational and causal hypotheses can be further refined into...

- ❖ **Directional hypothesis**: States the direction
  - •As A increases/decreases, B increases/decreases. (e.g., As soil salinity increases, plants grow slower)

- ❖ **Non-directional hypothesis**: Does not state the direction
  - •As A changes, B changes. (e.g., Soil salinity is related to plant growth)


CORRELATION DOES NOT IMPLY CAUSATION.
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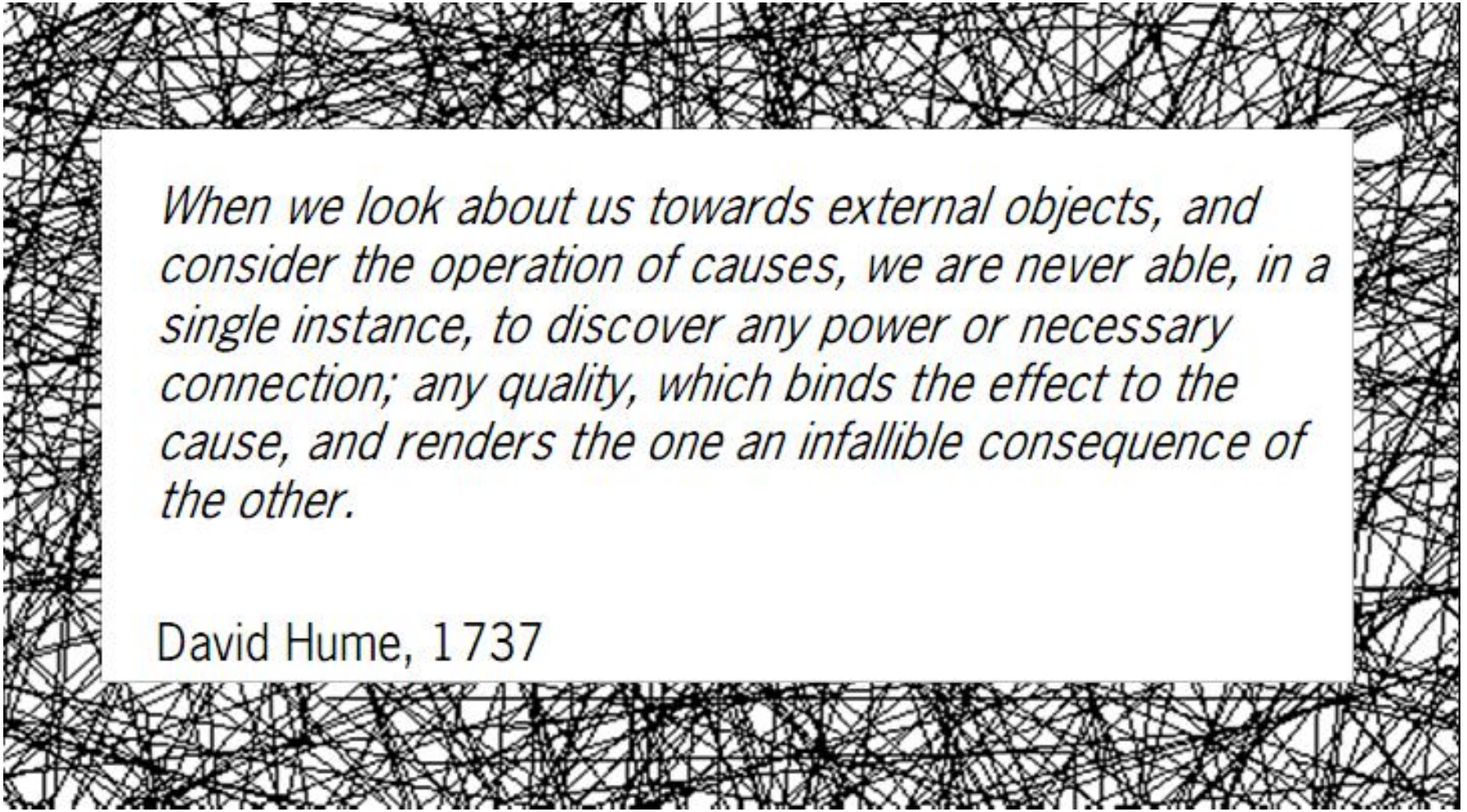
Causal hypotheses



Causal hypotheses

Causal relationships

- Independent variable (the cause) = X

  (also known as *treatment* variable, *experimental* variable, *predictor* variable, *change* variable)

- Dependent variable (the effect) = Y

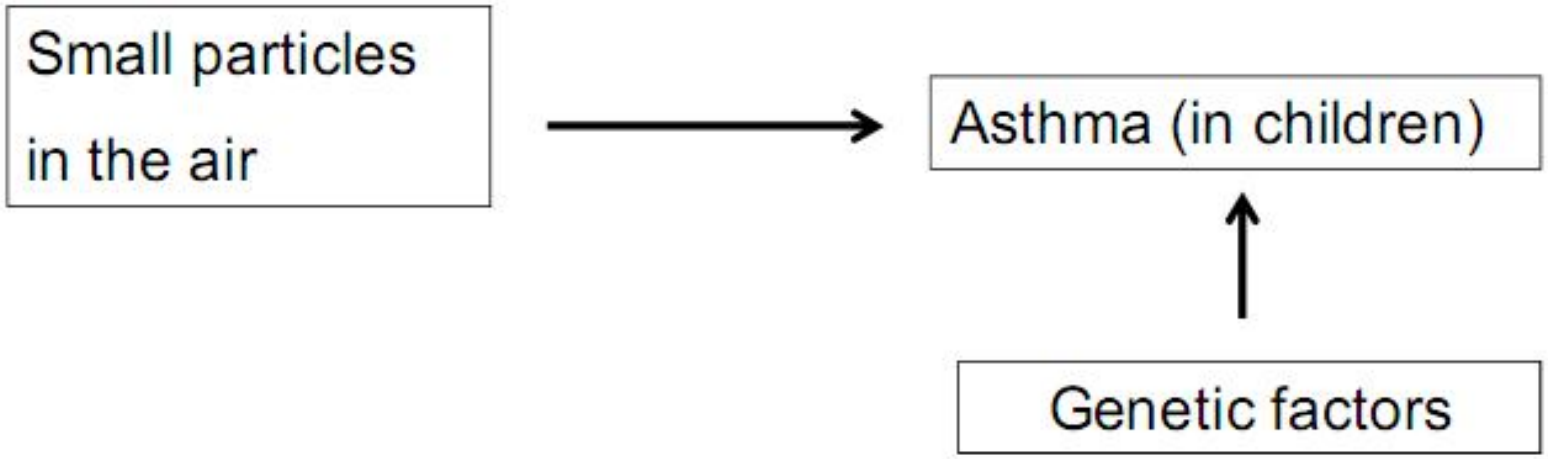
  (also known as *outcome* variable or *criterion* variable)

- *Simple causal model*

Example of a causal research question

RQ: Do small particles in the air cause asthma in children?

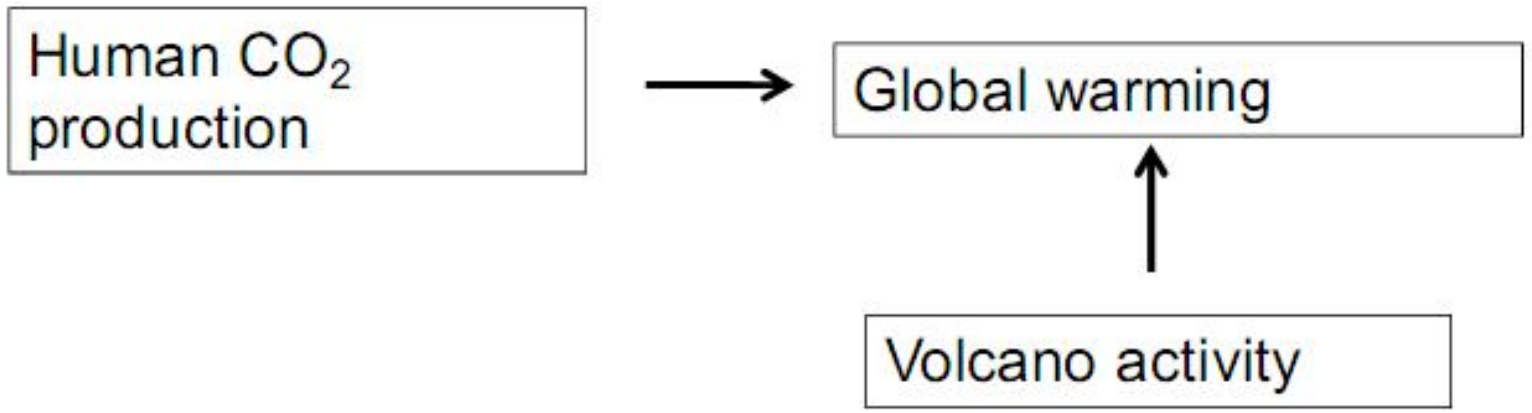
- What is the independent variable?
- What is the dependent variable?



Example of a causal research question

RQ: What is the effect of human CO2 production on global warming?

- What is the independent variable?
- What is the dependent variable?



Conditions for causality

1) Association (X and Y are related)
2) Time order (X precedes Y)
3) Rationale (plausible theory for the causal connection)
4) Non-spurious relation (elimination of competing explanations or plausible rival hypotheses)

Condition 4 (non-spurious relation) is the most difficult to meet!

Example of a causal research question

RQ: Does reading 'nutrition facts' on McDonalds' menu items make people reduce their calorie intake during next visits to McDonalds?

- What is the independent variable?
- What is the dependent variable?
- What are the research units?

Reading 'nutrition facts' → Calorie intake

Research units: people (visitors of McDonalds)

Thank YOU

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Questions??