0169 Quantitative Research Methods
Foundations of Quantitative Research
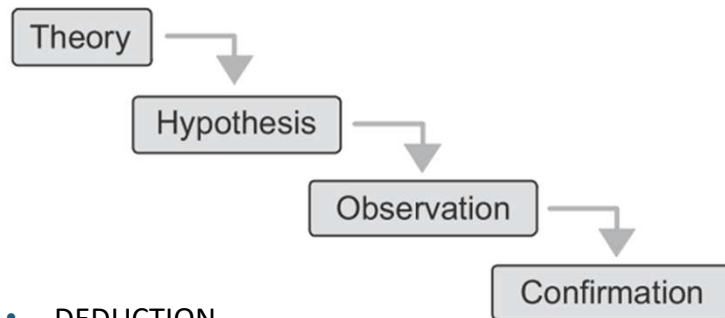
Prof William M.K. Trochim

Addendum

Foundations of Quantitative Research
2. Philosophy of Research: deductive and inductive reasoning
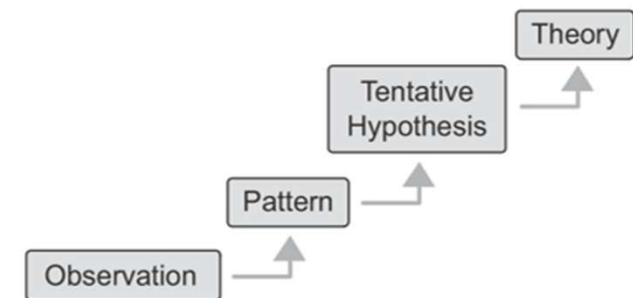
A schematic representation of deductive reasoning

- DEDUCTION
- "lead or bring away or down; derive" (in Medieval Latin, "infer logically"), from de "down" (see de-) + ducere "to lead,"[a]
- From general principle (theory)
- To individual fact (hypothesis)
- Observation/data
- Theory supported or disconfirmed (confirmatory research)

- *Traditionally associated with quantitative research*
- *Hypothesis follows logically from theory, but hypothesis might be rejected empirically; Statistical errors (α, β) associated with hypothesis testing*

[a] https://www.etymonline.com/word/deduction
[b] https://www.etymonline.com/word/induction

A schematic representation of inductive reasoning

- INDUCTION
- from Cicero's use of inductio to translate Greek epagoge "leading to" in Aristotle. *Induction* starts with known instances and arrives at generalizations[b]
- From individual fact (specific observation)
- To general principle (generalisation, bottom-up)

- No a priori expected principle (exploratory research)
- Hypothesis is data-driven

- Traditionally associated with qualitative research
- But frequently used in quantitative research
- The same data must not be used as evidence supporting theory
- Reason why? Mechanism?

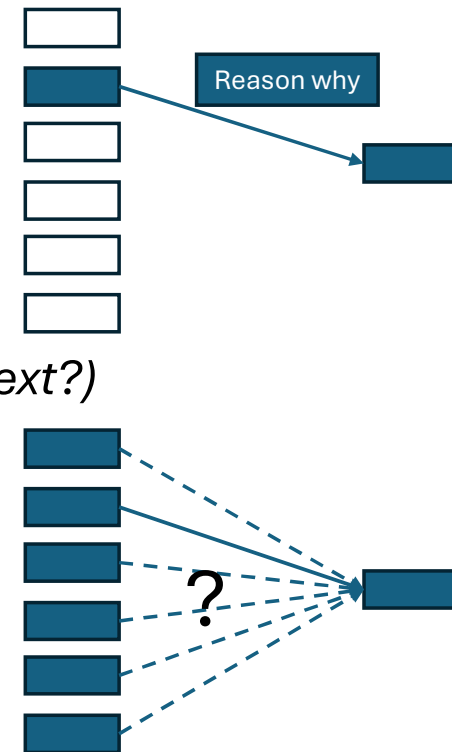# Epistemology: Deductive versus inductive reasoning

- Effect of some cause on effect variable

- Deductive:
  - Specific variable
  - Explanation
  - *If disconfirmed,*
    next step: explanation/theory might need to be revised
  - *If confirmed, next step: cross-validation (different context?)*

- Inductive:
  - Many variables observed as potential effect variables
  - No explanation
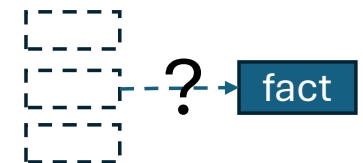 - *Next step: Developing theory including explanation*

Reason why

?

Peirce' Abductive Reasoning

Charles Sanders Peirce (1839-1914)
Leading representative of pragmatism

- Abductive reasoning
  - "a leading away," from Latin abductionem[c]

- Observing individual fact, phenomenon

- Inferring its most likely cause/explanation

- Economical explanation (simplicity; cf. Occam's razor)

- Theory-building

- But requires some prior knowledge (possible explanations)

- *Next step: testing theory empirically*

[c] https://www.etymonline.com/word/abduction