Three Main Elements of the Traditional Model of Science

• 1. Theory
• 2. Operationalization
• 3. Observation

Theory

• “A logically interrelated set of propositions about empirical reality.” (from text)
• “A systematic set of interrelated statements intended to explain some aspect of social life” (a different text)
• More simply – our ideas about social phenomena (how the world works)
• Multiple competing theories for explaining the same phenomenon could co-exist.
  – e.g., Why do married men earn more than unmarried men?
• Where does theory come from?

Operationalization

• Operationalization is the actual and concrete implementation of a theoretical measurement.
• We will devote a class to this topic later this semester.
Variables

- Variables are operationalized versions of concepts.
- For example, Race on the Census (self-identification).
- Example I: Age at marriage as a function of educational attainment and race.
- Example II: Occupational success as a function of physical attractiveness.

Observation

- Observation is a term used here to describe the process of gathering data, gathering facts.
- We could conduct a survey, do field work, run an experiment, or analyze data from existing surveys.
- Many surveys now available electronically.
- Data analysis is key part of observation – core of research

How do we evaluate theories?

- Hypotheses
- In social science, we usually cannot direct test theories. What we do is to test hypotheses derived from theories.
- Hypotheses are expectations derived from theories using deductive logic.
- Typically of “If……then…..” structure
- Example: Stress theory and school completion.
Two Logical Systems

• Deduction
  Deduction is a logical process by which one goes from the general to the particular.

• Induction
  Induction is the development of generalizations from many specific observations.  (e.g., Darwin’s theory of evolution).

Two Logical Systems (Continued)

• The Interaction between Deduction and Induction
  Most scientists, however, believe that both induction and deduction are important. There is an intrinsic interaction between deduction and induction.

Example 1: Why Education is Positively Related to Earnings?

• Human Capital Theory (in economics):
  More education ➔ more productivity ➔ higher pay

• Credentialism Theory (based on Marxism):
  More education ➔ membership in select group ➔ higher pay
Example 1: Why Education is Positively Related to Earnings?
- Both theories explain the same phenomenon.
- The key hypothesis that differentiates the two theories is whether more education leads to higher levels of productivity. If it does, human capital theory is correct. If it does not, credentialism theory is correct.

Example II: Why So Few Women in Science and Engineering?

<table>
<thead>
<tr>
<th>Socialization</th>
<th>Math Ability</th>
<th>Family Resp.</th>
<th>Discrimination</th>
<th>Career in Science and Engineering</th>
</tr>
</thead>
<tbody>
<tr>
<td>-</td>
<td>+</td>
<td>+</td>
<td>-</td>
<td>+</td>
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<tr>
<td>Sex (F vs M)</td>
<td>+</td>
<td>-</td>
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<td>-</td>
</tr>
</tbody>
</table>

Relationship between theory and research
- Essential link between theory development and causal analysis
  - Analysis of small N or non-random sample may not be generalizable
  - Theory developed w/o reference to analysis may be even less generalizable (may be completely unsupported)
  - Need to test theory with analysis
  - Need to refine theory based on findings of analytic research