Formulating Hypotheses, Building Models, and Accounting for Variance

May 24-25, 2010

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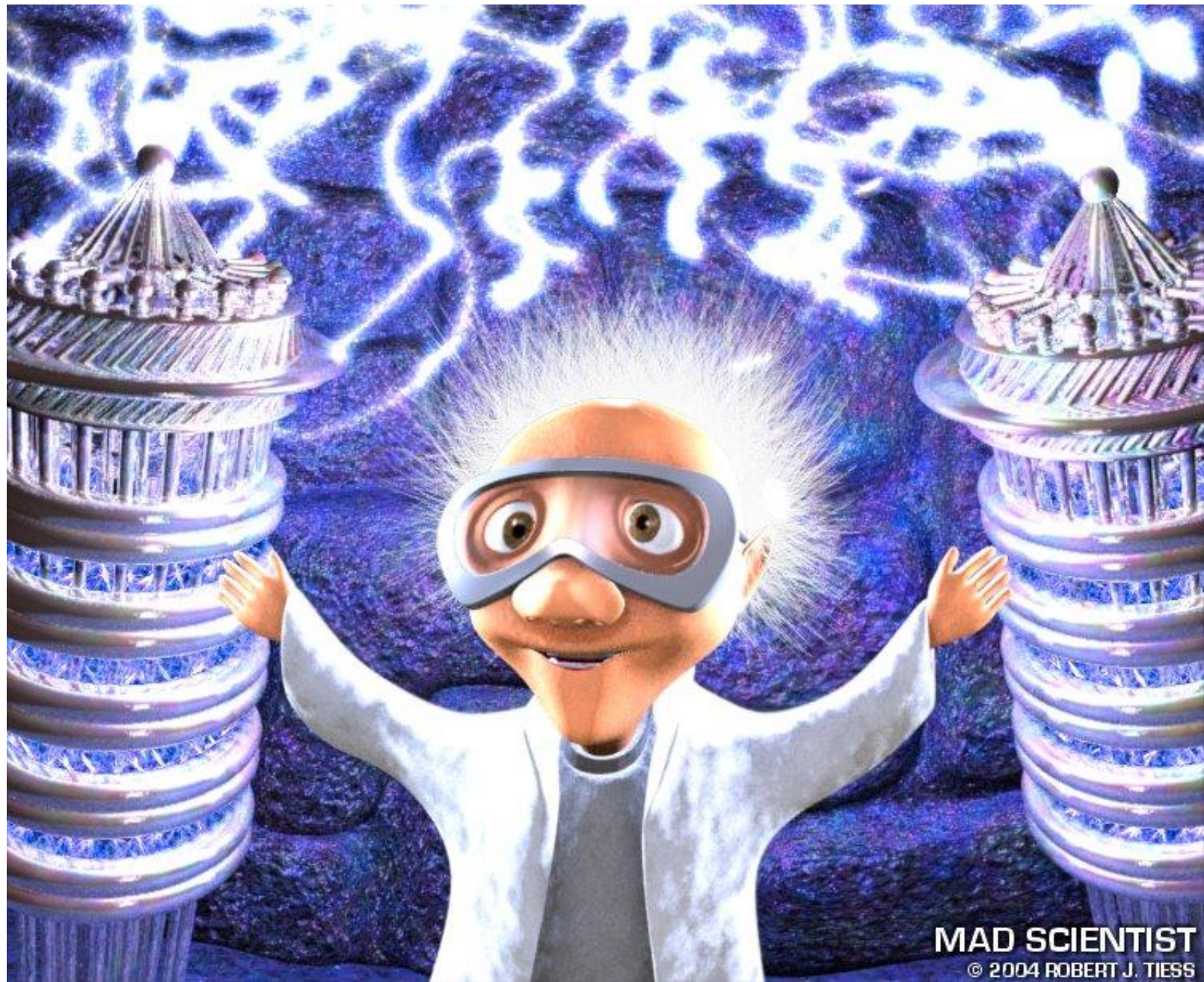
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Allen Hicken

Prepared for Presentation at SESRI, May 2010

MAD SCIENTIST
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"The wrong view of science betrays itself in the craving to be right; for it is not his *possession* of knowledge, of irrefutable truth, that makes the man of science, but his persistent and recklessly critical *quest* for truth."

Sir Karl Popper (2003 [1959]: 281)

Openness

Criticism

Scientific Method

1. Puzzle/Question
2. Theory/Model
3. Implications/Hypotheses
4. Observe the world (test hypotheses)
5. Evaluation

Scientific Method

1. Puzzle/Question

   – ~~Eureka!~~

   – What? Why? How?

   – Existing theories of how the world works

Scientific Method

1. Puzzle/Question

2. Theory/Model
    –   Simplicity/Parsimony
    –   Predictive Accuracy
    –   Importance
        •   Does it address a pressing problem?
        •   How does it affect pre-existing theory?
        •   Is it generalizable?

Scientific Method

1. Puzzle/Question
2. Theory/Model
3. Implications/Hypotheses
   – Implications of theory other than what we have already observed

Hypothesis Definition

- A testable statement about the empirical relationship between an independent and a dependent variable. (Pollock 2009)

Hypothesis Design

1: Identify both an independent (cause) and dependent (effect) variable

- Example: Some students perform better on exams than others
- Fix: Students who sit near the front of the class perform better on exams than students who sit near the back

Hypothesis Design

2: Make an explicit comparison

- – Example: Southern voters are more likely to be religious

- – Fix: Compared to voters in other regions of the country Southern voters are more likely to be religious

Hypothesis Design

3: State the nature of the relationship

- Example: In a comparison of countries, female education attainment and infant mortality are related

- Fix: In a comparison of countries, female education attainment is negatively related to infant mortality

Hypothesis Design

4: Be specific

- Example: Differences among immigrants account for different voting behavior.

- Fix: In a comparison of immigrants to the United States individuals with higher levels of English proficiency are more likely to vote than those with lower levels of proficiency.

Hypothesis Design

5: Be sure it is testable/falsifiable

- Example: Strong states are able to overcome special interests in order to implement policies that are best for the nation

- Example: Those who value education are more likely to attend school.

- Fix: In a comparison of students in Qatar individuals with more positive attitudes about school perform better than those with negative attitudes.

Hypothesis Template

In a comparison of [units of analysis], those having [one value on the independent variable] will be more likely to have [one value on the dependent variable] than will those having [a different value on the independent variable]. (Pollock 2009)

Exercise I

1) Identify and describe at least one reason why each statement is a poor hypothesis. 2) Rewrite the statement as a proper hypothesis.

A. In a comparison of individuals, some people will be more likely to have served in the military than other people will

B. Decentralized workplaces have highly satisfied workers

C. Education and smoking are related

D. Some people support increased funding for space exploration

Deterministic v. Probabilistic Hypotheses

- Clouds versus clocks (Karl Popper)
- Deterministic: If X then Y (or, if ~X, then ~Y)
- Probabilistic: The presence of X increases the probability or likelihood of Y
- Why are probabilistic hypotheses preferred ?
  - Measurement error
  - We study clouds

Example

2004 US Presidential Election Results
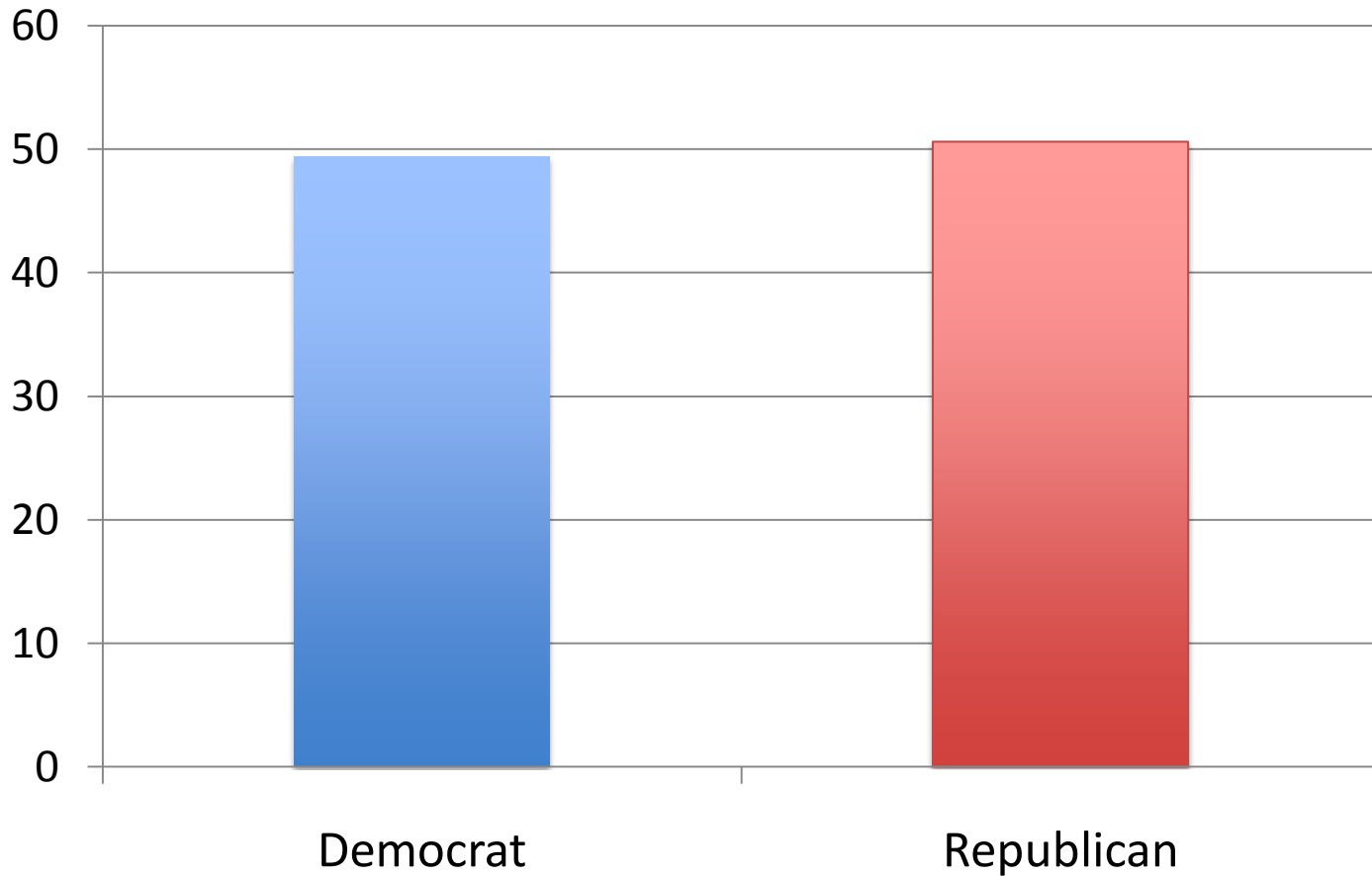
Probability of Marraige Success or Failure
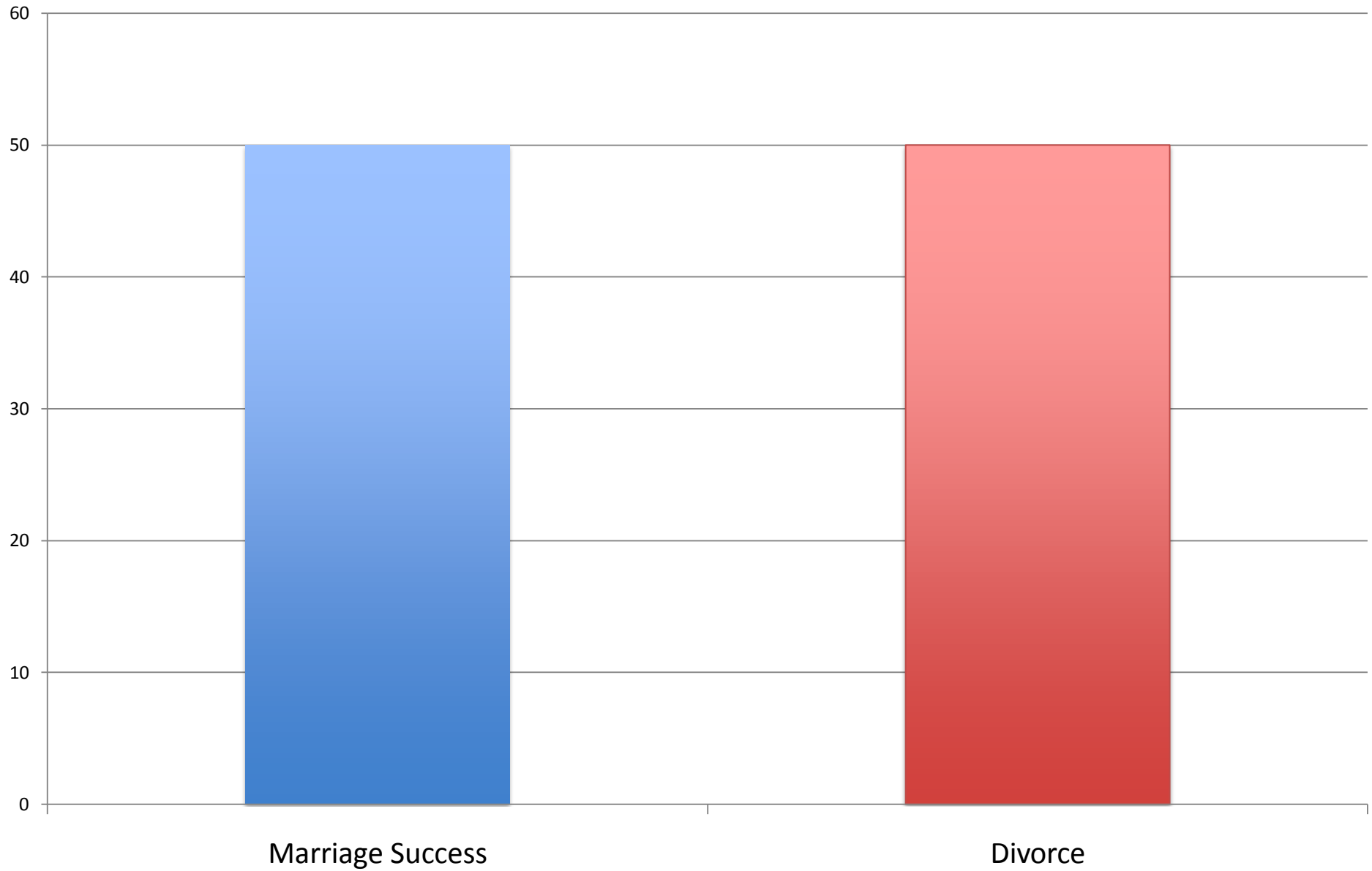
Scientific Method

1. Puzzle/Question
2. Theory/Model
3. Implications/Hypotheses
4. Observe the world (test hypotheses)

```
Concept
   │
   ▼
Variable
   │
   ▼
Indicator
   │
   ▼
Operationalization
```

Defining Concepts

- Concepts
  - Must be concrete (measurable)
  - Must vary
- Conceptual Definition must communicate:
  1. The variation within a measurable characteristic or set of characteristics
  2. The subjects or groups to which the concept applies
  3. How the characteristic is to be measured
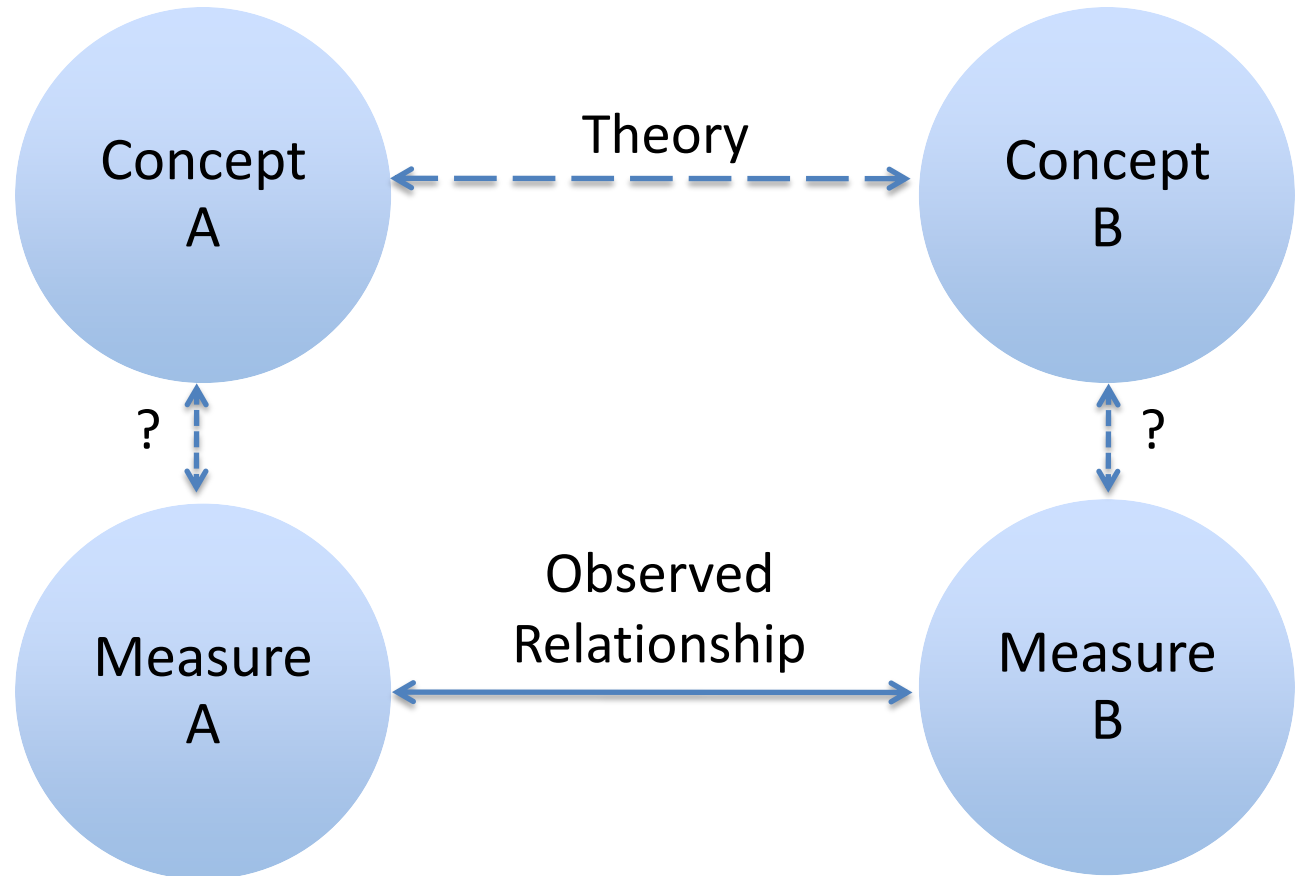
Defining Concepts

- Template for Writing a Conceptual Definition

The concept of _____ is defined as the extent to which _____ exhibits the characteristic of _____.

The concept of <u>democracy</u> is defined as the extent to which <u>a country</u> exhibits the characteristic of of <u>regular, free and fair elections for all major legislative and executive offices</u>.
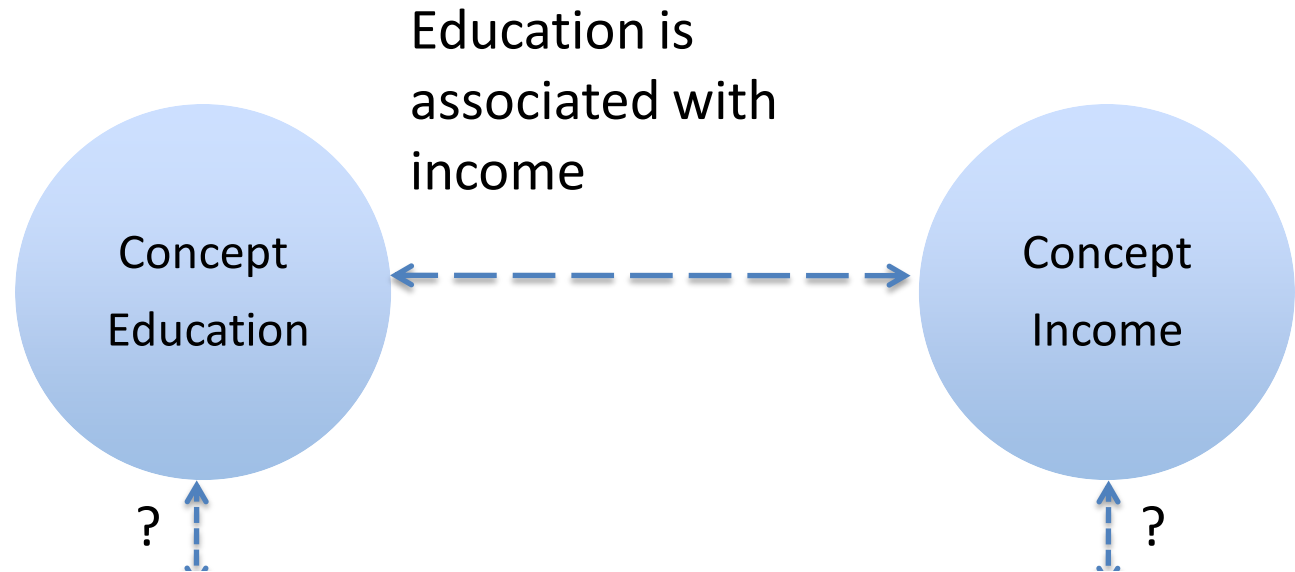
Problems of Measurement

1. Accuracy

Problems of Measurement

1. Accuracy

Education is associated with income

Concept Education

Concept Income

?

?

Problems of Measurement

- Accuracy
- Validity
- Reliability
- Precision

Exercise II

- Think about a possible relationship in your area of research.

1. Write a testable hypothesis for this relationship

2. How would you define your key concepts? (Write a conceptual definition for each)

3. What are some measures you might use as a proxy for your concept?

Sources

- Clark, Golder and Golder. 2008. *Principles of Comparative Politics*. CQ Press.

- Philip H. Pollock III. 2009. *The Essentials of Political Analysis.* CQ Press.

- W. Philips Shively. *The Craft of Political Research*. Pearson Prentice Hall.