Week 4: Theories, Hypothesis framing and Testing

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October 13, 2011

Bummer Dude.

Make an appropriate graphical representation of each of these. You have 3 minutes.

Colors: {Red, Red, Red, Red, Blue, Blue, Green}

Ages: {16, 16, 17, 18, 22, 40, 51, 52, 53}

Theories

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  - Think about this in terms of Evolutionary Theory, or the Big Bang Theory.
  - Scientists do not *directly* test theories, but rather they test the Hypotheses that are entailed by their theories.
  - Theorizing, rather than getting stoned and talking about *"Its like Maaaaarx said bro..."* is a rigorous task.

Briefly, Independent and Dependent Variables

We want to know what is causing "things", right?

- "Things" are the **Dependent Variable**
  - Voting
  - Grades
  - School Admissions
- The factors that cause "things" are the **Independent Variable**
  - Education, Income, Gender, Race
  - Study Habits, Income, Gender, Race, Tutoring
  - Grades, Test Scores

Three Steps to Theorizing

1. Identify the effect we want to explain. What Variable (DV) do I want to understand?

2. Identify the possible factors (IVs) that could be *causing* changes in the Variable I am interested in.

3. What is the logical connection between the two sets?

A Formal Hypothesis

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- Form of a conditional statement: If {...}, then {...}.
- $X \rightarrow Y$

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- Form of a conditional statement: If $\{...\}$, then $\{...\}$.
- $X \rightarrow Y$
- If an election is fair, then no more that 20% of ballots cast will be time stamped after 5:00pm local time.
- If someone has more education, then she is more likely to be politically active.
- If the Detroit Lions win another game this season, then a miracle has occurred.

A Little Logic

This form of a conditional statement is a statement of implication. It holds that the presence of **X** implies the presence of **Y**.

- 5th year with surfboard $\rightarrow$ stoner
- Fixed Gear bicycle $\rightarrow$ hipster
- Drakar Noir and St...St...Stunner Shades $\rightarrow$ Frat Boys

Note that Frat boys, hipsters, and losers all may be present without cheap cologne, leg shredders, and scent of desperation.

Note the direction of the implication arrow.

A Little Logic

To disprove a conditional statement of the above form, it is not sufficient to show the absence of both **X** and **Y**. The presence of **X** must be shown with the absence of **Y**.

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- Fixed Gear bicycle $\longrightarrow$ Olympic qualifying sprint cyclist

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Political Science Examples

- **Democratic Peace**: Because democracy fosters a brotherhood of empowerment and mutual respect: In the case the two democratic countries have a dispute, it is less likely to develop into militarized conflict.

- *What are the Independent and Dependent Variables here?*

Political Science Examples

- **Democratic Peace**: Because democracy fosters a brotherhood of empowerment and mutual respect: In the case the two democratic countries have a dispute, it is less likely to develop into militarized conflict.
- H_0: Likelihood that two democratic countries are at war with each other is the same as any two randomly sampled dyads.
- H_A: Likelihood that two democratic countries are at war with each other is **NOT** the same as any two randomly sampled dyads.

- *What are the Independent and Dependent Variables here?*

Coin Toss for Buying Beer

- H_0: Alex has a fair coin. $P(H) = P(T) = 0.5$
- H_A: Alex is a cheapskate, will cheat his friends, and has a loaded coin. $P(H) \neq P(T)$.

Alex flips heads and the other TAs buy him beers 6 times in a row.

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- $P(H) = 0.5$
- $P(H,H) = (0.5)(0.5) = (0.5)^2$
- $P(H, H, H, H, H, H) = (0.5)^6 = 0.0156$

Example on Board.

Causality

1. Temporal Prescedence
2. Empirical Correlational Pattern
3. Causal Theory
4. No other plausible causes – omitted variables, interviening variables.

These are necessary conditions, but are by NO means sufficient to establish convincing causality in all cases.