

Psy 464
Advanced Experimental Design
Variables, Control, Validity &
Levels of Measurement

Overview

- Variables and operationalization
- Control and confounding
- Validity
- Levels of measurement
- SPSS introduction/overview – data manipulations – GUI vs. syntax

Variables types

- Independent vs. Dependent
- Independent variables
 - Varieties
 - An example
 - food and water deprived rats solving a maze
 - Condition 1 - food reward
 - Condition 2 - water reward
 - Condition 3 - food and water reward
 - Quasiexperiments
 - Changing continuous variable into groups

Dependent Variables

- The outcome we are interested in predicting
- Simple experiment example
 - Effects of rewards on learning in rats
 - Reward operationalized as different foods
 - Different types of food in a goal box and measuring learning for differences by type of food
 - How might we define learning?
 - Lots of possibilities
 - » Number of trials to some criterion
 - » Constant number of trials

Operationalizing

- Lots of possible choices
- Human example
 - Depression – how do we define for research purposes?
- How/what we measure depends on the goals of the research
- Most thorough and complete snapshot of a phenomena within resource constraints

Experimental Control

- Nuisance variables
 - Potential IV
 - If not careful, effects inseparable from the IV(s) we're interested in
- How NOT TO design an experiment
- How to design an experiment

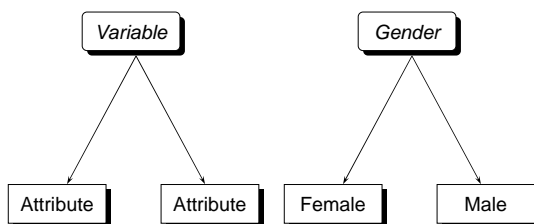
Validity

- Internal Validity
 - Randomization of group assignment
- External Validity
 - How do they differ?
 - Why are they important?
 - How can we maximize both?
- Trade offs often arise with respect to types of validity
 - Especially in research with humans on complicated behaviors

The Levels of Measurement

- Nominal
- Ordinal
- Interval
- Ratio

Some Definitions

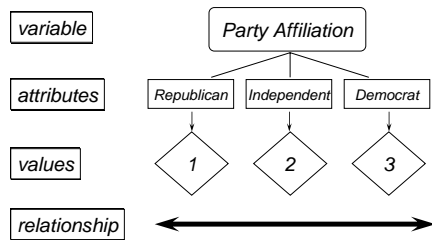


Qualities of Variables

- exhaustive - should include all possible answerable responses
- mutually exclusive - no respondent should be able to have two attributes simultaneously (e.g., employed, unemployed, or student)

What is Level of Measurement?

the relationship between the values that are assigned to the attributes for a variable



Why is Level of Measurement Important?

- helps you decide what statistical analysis is appropriate on the values that were assigned
- helps you decide how to interpret the data from that variable

Nominal Measurement

- the values just “name” the attribute uniquely
- does not imply any ordering of the cases
- for example, jersey numbers in football
- even though player 32 has a higher number than player 19, you can't say from the data that he's greater than or more than the other



Other Nominal Measures

- gender
- colors
- makes/models of cars

Ordinal Measurement

- when attributes can be rank-ordered
- distances between attributes do not have any meaning
- for example, code Educational Attainment as 0=less than H.S.; 1=some H.S.; 2=H.S. degree; 3=some college; 4=college degree; 5=post college



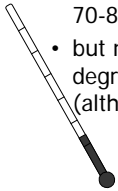
- *is distance from 0 to 1 same as 3 to 4?*

Other Ordinal Measures

- finishing place in a race
- likert-type scale items (Strongly Agree-Strongly Disagree)
- class rank

Interval Measurement

- when distance between attributes has meaning
- for example, temperature (in Fahrenheit) - distance from 30-40 is same as distance from 70-80
- but note that ratios don't make any sense - 80 degrees is not twice as hot as 40 degrees (although the attribute values are)



Other Interval Measures

- SAT/GRE scores
- IQ
- scale scores from Likert-type items

Ratio Measurement

- has an absolute zero that is meaningful
- can construct a meaningful ratio (fraction)
- for example, number of clients in past six months
- it is meaningful to say that "...we had twice as many clients in this period as we did in the previous six months"



Other Ratio Measures

- kelvin temperature
- income in \$
- time in a race

