Variable Measurement

PSY 4433

Jonathan A. Pedroza, PhD

Cal Poly Pomona

2022-02-02

Agenda

- Variable Measurements
- Measurement Modalities
- Other Aspects of Measurement

Measurement Scales

- **Scales of measurement** is the procedure of classifying individuals into categories*
    - **categorical** variables are those that can be put into groups/categories/conditions
    - **continuous** variables are those that provide a unique value for each participant; can have a decimal

Categorical Measurements

- **Binary variables**

  - there are only two categories (sex)

- **Nominal variables**

  - categorize into groups; categories are not ordered (race/ethnicity groups)
  - can be binary and nominal

- **Ordinal variables**

  - ordered categories
  - categories indicate rank order (race order)

Continuous Variables

- **Interval variables**

  - equal intervals on the variable represent equal differences in measurement
  - zero is not an absolute zero

- **Ratio variables**

  - similar to interval
  - true zero (zero is the smallest number)

Examples

- Are the following examples categorical (nominal/ordinal) or continuous(interval, ratio)

- Money

- Grades
- Temperature
- Time spent online

Examples

- Money
  - Cash
  - Bank Account(s)
- Grades
  - (A, B, C, D, F)
  - Exact Grades
  - Grade Brackets (100%-90%, 89%-80%, 79%-70%, etc.)
- Temperature
  - Fahrenheit
  - Celcius
  - Kelvin
- Time spent online
  - Hours/Minutes
  - Self-report

Dealing with Equivocal Measurements

- We deal with numbers in weird ways sometimes

    - Likert Scale 1 (Strongly Agree) - 5 (Strongly Disagree)
    - Is this nominal? Ordinal? Interval?

- JP Note/Book: If using a single variable, then treat it on a nominal/ordinal scale

    - Unless, there are 10 or more categories (1-10 scale) then you can treat it as an interval scale

Measurement Modalities

- Different types of modalities when collecting data
  - for this class, we will primarily be focused on self-reported data

Self-Report

- common measurement modality in social sciences

    - **self report** is when participants report their own answers for surveys/questionnaires/forms/etc.

- advantage is that it is the most direct way of collecting data

    - offers good face validity
    - participants may answer differently to show a better image of themselves

Physiological

- **physiological** measures collect data from physiological manifestations of a construct

    - stress --> increased heart rate or sweat (galvanic skin response[GSR])
    - cognitive processing --> frontal lobe of brain (fMRI)

- commons measures

    - GSR
    - fMRI/MRI (functional tasks/still images of the brain)
    - PET (brain function/cancer)
    - EEG (sleep studies)

- advantage is that these measures are objective

Physiological

- disadvantage is that these require training, equipment

    - can also have subjective interpretation parts
    - parts of the brain --> what it means

- are they actually measuring the construct

    - sweating may not be from the experiment manipulation
    - could be from being connected to a weird device

Behavioral

- **behavioral** measures can be both based on observation or through more structured manners to test the construct

  - behavioral test to measure smartphone use by seeing how many times participants unlock their phone
  - measuring disruptive behavior in a classroom

- are they actually measuring the core construct or are they situational

  - are they compulsive in constantly unlocking their phones
  - are disruptive kids always disruptive or just having a bad day

- best to measure a cluster of behaviors rather than one sole indicator

Other Aspects of Measurement

- other than knowing how to measure your study/experiment constructs, you'll want to know
    - do you need more than one measure of each construct
    - will there be enough variation in each measure
    - how can you avoid unwanted noise in your data

Multiple Measures

- if you wanted to test validity of a measure

  - you would use at least two measures of the same construct

- a better alternative would be to collect data on a measure through different modalities

  - the measures may not behave in the same way
  - statistics with both measures can result in different findings

Sensitivity & Range Effects

- if you expect small effects in your study, then you should have a measure that is **sensitive** enough to detect that effect

- one specific sensitivity issue is when scores group together because the task is either too hard or too easy

  - Ex: giving a spelling test, with grade school words
  - if your experiment is to help promote study tips, it could be useful but you won't see a difference

- when there is no room for improvement/change, there is a **range effect**

Range Effects

- there are two instances of range effects

    - **ceiling effects**, which are when participants are already scoring high and cannot score any higher
    - **floor effects**, which are when participants are scoring too low and there is no way to score lower

- this is a difficult concept because unless you test this beforehand, you won't really know how easy or hard your task is

- JP Note: I gave a high school rated math exam and experienced a floor effect from CPP students from all grade levels

Artifacts: Experimenter Bias & Participant Reactivity

- **artifacts** are external factors (not part of the experiment) that can influence your experiment

    - Ex: explaining the point of the study and someone walks into the study setting

- **experimenter bias** is when someone administering the study/experiment has some sort of effect on participants' responses/answers

    - could be part of the study (manipulating how you administer experiment materials) or an artifact
    - could be done intentionally or unintentionally

- Examples from the book:

    - tone of voice
    - facial expressions
    - body language

Experimenter Bias

YOU HAVE TO STOP DOING THAT

- one way to limit bias is to standardize the experiment

    ○ have a script

- "Blind" Experiments

    ○ **single-blind** experiments are when those administering experiments do not know the design of the study
    ○ **double-blind** experiments are better because both administers and participants do not know the design of the study

- experiments where participants do not know the

Demand Characteristics

- because we are using human participants, sometimes participants try to act accordingly to a study and behave in their best manner

- **demand characteristics** are cues of the study that suggest to participants what the purpose(s)/hypothesis(es) are

  - influence participants to react a certain way

- participant **reactivity** is when participants modify their behavior because they know they are being watched or know what is being measured

  - often a problem in a controlled **laboratory** setting
  - **field** research allows a more natural environment

Different Roles

- **good subject role**

    - know the purpose/hypothesis and want to help the researcher by supporting the hypothesis

- **negativistic subject role**

    - know the purpose/hypothesis and want to act contrary to the hypothesis

- **apprehensive subject role**

    - try to answer in a way that is socially desirable, instead of truthfully

- **faithful subject role**

    - follow instructions and avoid trying to find the purpose/hypothesis
    - either know how science works and don't want to disrupt the study OR they don't care and want compensation (SONA credits or $)

Different Roles

Selecting Measurement Procedure

- think about how you should measure each construct
    - validity & reliability
    - feasibility
    - what is the field doing/using?
    - if creating something, how will you test to make sure there are no range effects?