

BSSn4495: Qualitative research in security studies

Validity, reliability,
error, and bias

April 25, 2024

Miriam Matejova, PhD



LOGIC LANE



Agenda

- Measuring concepts
- Bias, error
- Data quality

How to measure...?

- ...racism
- ...democracy
- ...political knowledge

Criteria for measures

- **Validity**

- The degree of fit between a measure and the concept it is intended to measure
- How well a measure “captures” the concept
- If a measure is not valid, it can lead us to incorrect conclusions about the *causes or effects of the underlying concept*
- **Problems:** the measure does not cover enough of the concept; covers things outside the concept; captures different things in different units

Criteria for measures (cont.)

- **Reliability**

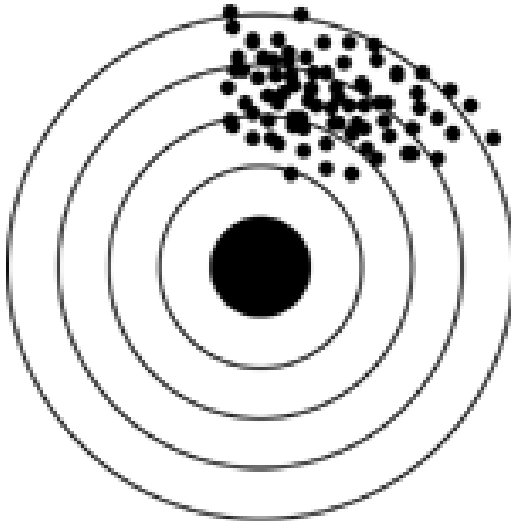
- **How consistently a measurement procedure produces the same result when the procedure is repeated**

- If two researchers use the same procedure, do they get the same result?
- If we use the same procedure at two different times, do we get the same result?

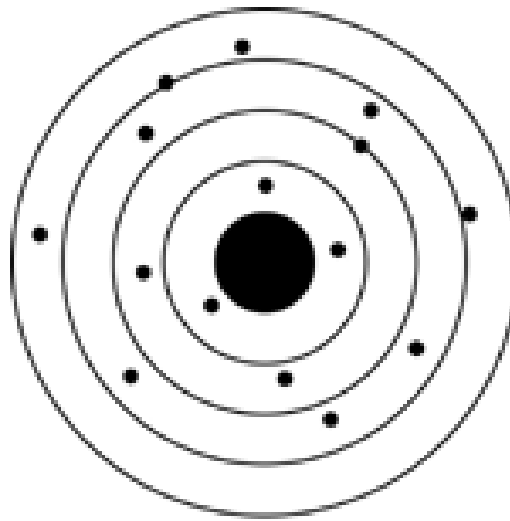
- Requires a well-defined and transparent procedure

- Reduces subjectivity and the possibility of individual biases affecting measurements

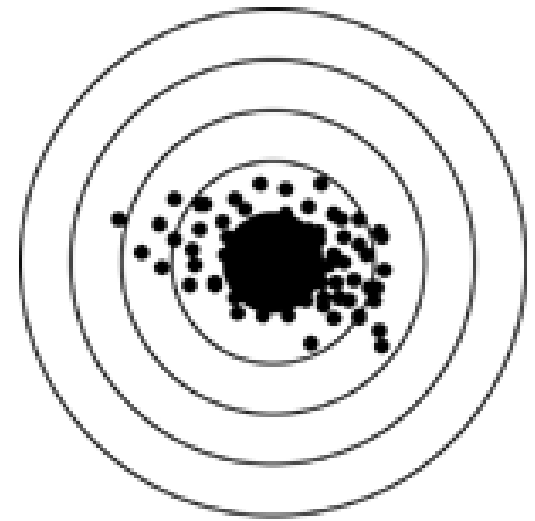
Validity and reliability



Reliable but Not Valid



Valid but Not Reliable



Valid and Reliable

Measuring political knowledge

Two measures:

A. Ask respondents a specific set of factual questions; more answers right = more political knowledge

MORE RELIABLE,
LESS VALID

B. Have interviewer provide rating of respondent knowledge after 2-hour in-depth conversation with the respondent

MORE VALID, LESS
RELIABLE

Measurement error

Poor validity or reliability → **measurement error.**

Two kinds of measurement error:

- **1) Bias (systematic error)**
 - Error produced when our measurement procedure produces scores that are, on average, either too high or too low relative to the truth.
 - **Upward** bias vs. **downward** bias

Measurement error

- **2) Random error**

- Error that derives from **random** features of the measurement process or the phenomenon
- On average, random error cancels out over lots of iterations (but **bias** does not)

Random error in measurement

$$\text{Measured Value} = \text{True Value} + \text{Bias} + \text{Random Error}$$


Measurement Error

Bias is a systematic source of error

Related to specific sources of discrepancy between operational definition and concept

Random error is an unsystematic source of error

Direction of error is unpredictable, **not related to specific sources of discrepancy** between operational definition and concept

Sources of random error

- Imperfect memory (for survey/interview measures),
- Calculation/counting errors

Random error: the good news

Random errors **cancel out** over lots of iterations, so to minimize random error you can:

- Repeat measure for lots of cases/individuals,
- Repeat measure for same case at many points in time

Too much to measure

For many measurement tasks, we cannot measure **all** instances of a phenomenon. We can only take measures of a **subset**.

Population

The full set of cases that we're interested in learning about.

Sample

The subset of the population that we actually measure.

Selection bias

- Occurs when the selection of cases in a *sample* is not representative of the *population* because the sample **over-represents certain types of cases or under-represents certain types of cases** *in the population*.

Sources of selection bias

- **Sampling frame is not representative of the population**
 - E.g., election poll based on random sampling from phone book
 - Sample frame: phone book
 - Population: all voters
- **Self-selection**
 - Respondents often have control over whether they join your sample
 - E.g., who decides to take a survey on environmental issues?

How to avoid selection bias?

Random sampling

Selecting cases from the population in a manner that gives every case an equal probability of being chosen.

- Random sampling relies on the law of large numbers
 - As the sample size gets larger, the random sample characteristics will get closer to the population characteristics

Random sampling error

Random sampling error: caused by *random variation* between samples

- By pure chance, **one random sample** of a population will be somewhat different from **another random sample** of the **same** population
- To minimize random sampling error, increase the size of your sample.

Measurement error due to social norms: “social desirability bias”

- Do you have negative feelings towards people of other ethnicities?
- Have you used illegal drugs in the past two years?
- Have you ever cheated on a test?

Minimizing social desirability bias: list experiments

“I am going to read you a list of things that sometimes make people angry. After I read them, just tell me HOW MANY of them upset you. I don’t want to know which ones.”

- (1) The government increasing the tax on gasoline
- (2) Professional athletes getting million-dollar contracts
- (3) Large corporations polluting the environment
- (4) A black family moving in next door

Measurement error due to costs of revealing truthful information

- Bureaucrat admitting to accepting a bribe,
- Politicians admitting to have links with certain big businesses,
- Authoritarian leaders admitting to engaging in electoral fraud,
- Teachers admitting to helping students cheat



**Data
quality**