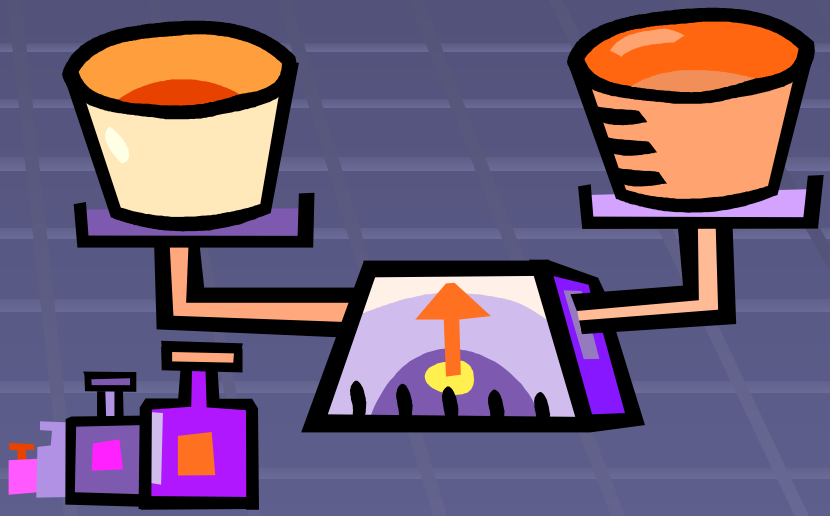
Measurement

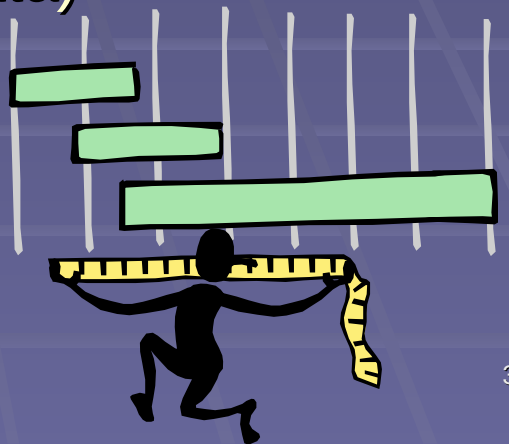
Measurement

- ***The process of assigning numbers or other symbols to characteristics or attributes of a concept according to specified rules.***
- Tools
  - Ruler, thermometer, stopwatch, weight scale.
- Scales
  - Beck Depression Scale
  - Family Environment Scale
  - Self-esteem Scale
  - Conflict Tactics Scale
- Self report / Other report
- Direct observation
- Analysis of interview or other records



Variables

- Something that can vary
  - If we study self-esteem, it varies from low levels to high levels.
  - Attitudes vary from strongly disagree to strongly agree.
- Measurement choices
  - Ask questions (Primary data)
  - Observe (Primary data)
  - Consult existing records (Secondary data)
- What is Measured
  - Frequency (how often)
  - Duration (how long)
  - Magnitude (how much)



Defining Variables

- Nominal definition (dictionary)
  - *Self-esteem*: one's overall feelings about their personal worth and value.
  - *Ethnic group*: identification with a group of people that have common culture, traditions, and history.
- Operational Definition Choices (*Self-esteem)*
  - Self-report (Lots, Some, Not at all)
  - Scale (Total score from 25 item questionnaire)
  - Teacher ranking (Highest to Lowest)
  - Rater report after interview (Good, Moderate, Poor)
- *How to operationalize "Ethnic Group"?*
  - *Check mark on a list of groups.*
  - *Response to open-ended question.*

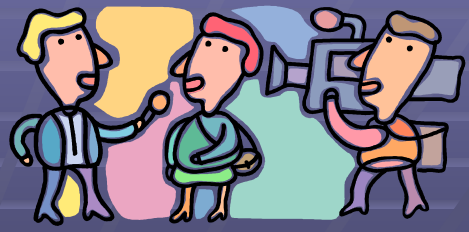
Levels of Measurement

- Nominal – categories
  - Sex, race, religious affiliation, political party
  - No numerical meaning.
- Ordinal – more or less: groupings
  - Satisfaction or Agreement: high, medium, low.
  - Education: high school, some college, college.
  - Quantitative meaning is unclear.
- Interval – category distance has meaning
  - I.Q. score. (But no zero I.Q.)
- Ratio – equal intervals and true zero.
  - Age, number of children, number of days absent.

Which Level of Measurement?

- *Nominal, Ordinal, Interval, Ratio ?*
  - Democrat or Republican
  - Grade point average
  - Exercise: None, A little, Moderate, Great deal
  - SAT score
  - Marital Satisfaction Scale from 15 to 150
  - Which research class: 1=M, 2=W, 3=S
  - Classmate Popularity: rank order from most popular to least popular
  - Income (actual)
  - Income: 1 = <$20,000; 2=$20,000 – $50,000; 3=>$50,000

Survey Research



- A systematic way of gathering data using a structured format.
  - Measure what respondents know, believe, feel, or how they say they behave
- Self-administered questionnaire
  - A survey that is mailed to potential respondents or that is given in person
  - Web-based surveys are increasingly used
- Interview Schedule:
  - survey is administered face to face or by telephone.
    - CATI (Computer Assisted Telephone Interview)

Types of Surveys

- Structured – maintain uniformity
  - Closed-ended questions with forced choices
    - “Are you a Democrat, Republican, or Other?”
- Semi-structured
  - Interviewer is free to clarify the questions and follow-up on the participant’s responses, but questions are pre-arranged.
  - Use of open-ended questions – no choices
    - “How has caring for your elder parent affected you?”
- Unstructured
  - Totally open-ended interview with no predetermined direction for questions.
    - “Tell me a little about yourself.”

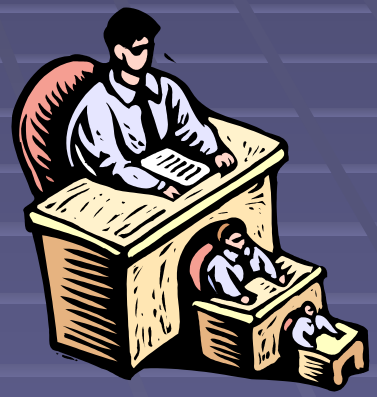
Observational Research

"Actions speak louder than words"

- Pure observation
  - Researcher remains apart from the observed:
    - Avoids **social desirability** – tendency to say the socially acceptable thing or to tell people what you think they want to hear.
- Participant observation
  - Observer becomes an active participant in the research setting.
    - **Reactivity –** people tend to change behavior when they know they are being observed.
    - **Observer Inference** – Observer interprets events from her/his own point of view.

Existing Records

- Paper and electronic documents, databases, and other non-document artifacts of human behavior. E.g., census data, agency files, police records.
  - Advantages:
    - Inexpensive, fast
  - Disadvantages:
    - No control over the types or accuracy of the data
    - Different data sets may be difficult to compare or combine

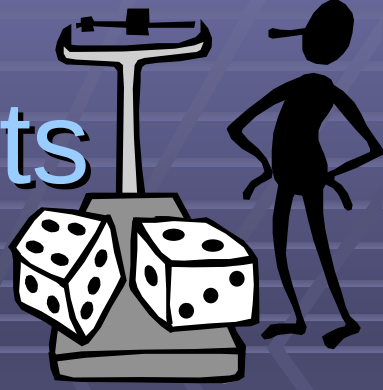


Apples or Oranges

- Quantitative
  - Consistent; standardized
  - Large samples; generalizable results
  - Reductionistic; limited number of predefined variables
- Qualitative
  - Open-ended, in-depth, insight-oriented
  - No preconceived answers to questions
  - Seeks patterns and processes
  - No limit on types of data or questions

Both provide useful infomation

Standardized Instruments



- A tool to measure a concept
  - **Item**: single indicator of a variable, e.g., one question.
  - **Index**: simple addition or mean of items.
  - **Scale:** includes different weighting of items.
- May be *normed*
  - Information about how various large groups scored on the instrument.
  - Need to assess the generalizability of the norms and when they were established.

All instruments have some degree of error.

Measurement Error

- Random error
  - Errors that are not consistent or patterned.
  - Anything that can't be controlled but is likely to be equally distributed among subjects.
    - Health, motivation, random answers, typos
    - Feelings about the researcher or subject matter
    - Reading level
  - Thought to balance out across the study.

Systematic Error

- *Patterned or consistent error*
  - *Bias in how questions are asked*
    Interviewer smiles when we get the right answer.
    - Keep data collectors and subjects “blind.”
  - *Response set*
    Tending to agree or disagree.
  - *Social desirability*
    Saying the nice or “right” thing to look good.
  - *Question wording*
    “Assistance to poor” versus “Welfare.”

Systematic Error (cont'd.)

- *Question order or questionnaire introduction*
  - Question: "Which are the most prevalent social problems today?"
  - Answers: CRIME, poverty, health
- *Subject selection*
  - Reading level doesn't match subject ability
- *Cultural / language bias*
  e.g., I.Q. tests, SAT

Always pretest your instrument

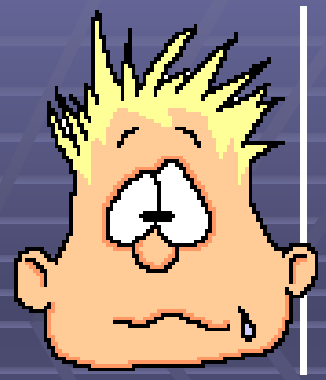
Validity

- *Does the instrument measure what you think it's measuring?* Real meaning.
- Face validity
  - Does it makes sense?
  - Will people take it seriously?
- Content Validity
  - How are the items selected?
  - Do they represent the full range of the concept?

Validity (cont'd.)

- Criterion Validity
  - Same results as something known to measure the concept (e.g., skin-based blood sugar).
  - *Concurrent Validity*: test against another valid measure.
  - *Predictive Validity*: ability to predict future events, e.g., suicide scale predicts attempts.
  - *Discriminant Validity*: ability to discriminate known groups, e.g., abusers from non-abusers, depressed from not depressed.

Validity (cont'd.)



- Construct Validity
  - Correlation with expected concepts and propositions, NOT with others outside of the theory.
    - Abuse correlates with stress and social isolation but not with hair color or IQ.
    - Technology skills correlate with years of computer ownership, but not with birth order or life satisfaction.

Reliability

- Stability: Measures don't change:
  - Thermometer, bathroom scale
- Equivalence: all items measure the same concept.
  - Spelling test shouldn't have math items.
- Internal consistency
  - Items testing the same concept should have similar scores.
- Reliability does not equal accuracy
  - Bathroom scale off by 15 pounds is reliable.
  - Thermometer is broken, but is reliably wrong.

Promoting Reliability

- Questions
  - Keep it simple
  - Be sure people know the answer or opinion
- Interviewers / Raters
  - Training, regular check-ups
- Testing Reliability
  - Test-retest
  - Parallel forms or Split half
  - Interrater reliability (two or more)
  - Intrarater reliability (test same rater twice)
  - Internal consistency (consistency of item scores with each other)

Relationship

- If reliable, not always valid.
- If not reliable, never valid.
- If not valid, may be reliable.
- If valid, always reliable.

Finding Measures

- Program objectives and research needs determine measures to use.
- Places to find measures:
  - Measure is part of journal article.
  - Published in book of measures.
  - Contact the test author and request permission to use their test.
  - Use a directory published by scientific and professional associations like APA.
  - If these attempts to locate the author fail, contact the publisher holding the copyright to the original material and request permission from the publisher.
  - Search the Internet.

Designing Measures

- Maximize response rate
  - Use a professional looking instrument
    - Avoid the cluttered look and small type.
  - Be explicit in explaining to respondents why the research is being conducted.
  - Make assurances that the results will be kept confidential, and that no services will be withheld or denied even if the respondent chooses not to participate.
  - If potentially sensitive items are to be asked, keep them to a minimum and position them later in the instrument.

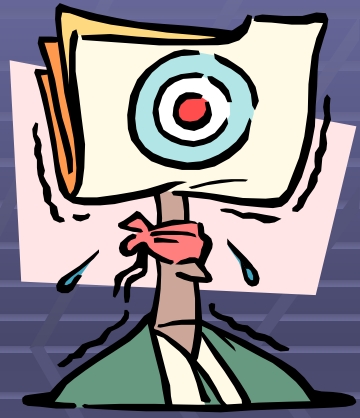
Design (cont'd.)

- Avoid asking questions that the target population is not expected to know anything about.
- Avoid biased questions
  - e.g., "Do you believe that all forms of abortion, the killing of pre-born babies, should be illegal?
- Keep open ended questions to a minimum.
- Keep survey as short as possible.
- Begin with interesting questions first.
- Explain transition to next section.

Design (cont'd.)

- Minimize Error
  - Consider the audience: age, education, etc
  - Have simple, clear questions
    - Keep questions short, under 20 words.
    - Avoid slang terms.
  - Position response categories vertically underneath the question stem rather than side-by-side.
  - Use the highest level of measurement possible.
    - Ask exact age rather than a category.
  - Don't ask for unavailable information
    - Asking college seniors, "How much did you study in the 7th grade?"

Design (cont'd.)



- Avoid double questions
  - *Do you support abortion or are you a conservative?*
- Avoid negative wording
  - *Do you not think the government should pay for school lunches?*
- Use clear instructions.
- Have instruments translated when necessary.
- Reduce social desirability
  - Anonymous
  - Remind users that there are no right answers

The Politics of Measures

- Definition of measures is political
  - Define “Marriage.” Who is included and who is not? How is it measured?
- Measures may not be generalizable to all groups
  - Many measures are tested on white, middle-class college students.
  - Some medicines are tested only on men, but their dosages may be different for women.
- Measurement may be used to reinforce stereotypes
  - Girls can’t do math.
  - Men have higher SAT scores. (Is the test biased?)