Sampling

Definition, Goal, Problem

If you can obtain data on every member of a *population*, you don't need to sample

If you can't, you need to sample from the population from which to analyze your data, perform your experiment, etc.

THIS PRODUCES CHANCE OF "SAMPLING ERROR"

Goal: your sample should permit generalization of findings from the sample to the population

Goal restated -> Choose a *representative* sample

Goal restated again -> Avoid biased samples

Problem of nonresponse

Problem: Variability

Error of estimation

Sampling error - how to quantify?

the error of estimation or 'margin of error'

With a probability sample (see below), one can estimate the error of estimation - error due to factors other than nonrepresentativeness

Three factors

Formula for error of estimation

$$E = 2\sqrt{\frac{s^2}{n}\left(\frac{N-n}{N}\right)}$$

n = sample size, N = Population size

The mean calculated +/- E is a 95% confidence interval

Economic sample

Choose the smallest sample size sufficient to estimate the mean accurately

Can use this formula to determine what n is necessary to achieve a desired level of error

Probability samples

Gain access to the entire population

Must be able to **identify** the entire population of interest and have access to all members.

Without this you don't know what you're sampling from so you can't definitely say whether a sample is representative.

Nonprobability sampling

Sometimes you don't have access to the entire population of interest.

Sometimes variability is low enough that you don't have to worry about probability sampling

Sometimes the effort and cost isn't worth it and you're willing to take the risk of non-generalizability

Correlational Research

Description of *naturally occurring* covariation

- **No attempt made to manipulate one factor to observe changes on the other.**
- **No causal direction**
- **Problems:**
  - There is a moderate correlation between milk consumption and cancer incidence across societies (relative wealth of societies).
  - Small negative correlation between death rates and divorce rates
  - New Hebrides Islands: body lice are considered a sign of good health.

Easy to conduct correlational research since you merely measure what's already out there. I believe that ALL of you did a correlational study for your first project.

- **Recall, to qualify as an 'experiment', you must manipulate the IV and measure it's effects on the dv. That would require things like:**
  - manipulating gender to observe effects on GPA
  - making some students sit in the front vs. back rows on a consistent basis and measuring effects on GPA
  - forcing some people to be truck drivers and others not to be and observing effects on average weight
  - moving baseball teams around, randomly placing them in different parts of the country, and measuring performance.

How to measure correlation

- **The Pearson correlation coefficient, r.**
- **Always between -1 and 1 with 0 being no correlation**
- **Sign**
  - Positive correlation - define
  - Negative correlation - define
- **Magnitude**
  - The closer to 1 (positive) the stronger the correlation
  - The closer to -1 (negative) the stronger the correlation
  - So, which is stronger, a correlation of .5 or -.75???
- **Measure of *linear relationship***
  - When you look at a scatterplot, how well is the relationship described by a straight line
  - Can transform some data to make it lie on a straight line

Graphing correlation

- **Scatterplots**
- **ALWAYS look at a scatterplot before calculating a correlation!!!**
- **ALWAYS ask whether a researcher presenting a correlation value is confident that the relationship is linear.**

Assessing the strength/magnitude of the correlation coefficient

- **A correlation of .6 is not twice as strong as one of .3**
- **r is not on a ratio scale**
- **R^2 = Coefficient of determination**

R^2 is on a ratio scale

Approximately equal to amount of variance accounted for

Examples

r of 1, $R^2 = 1 = 100\%$ of variance in one variable accounted for by changes in the other

r of -1, $R^2 = 1 = 100\%$

r of 0, $R^2 = 0 = 0\%$

r of .7, $R^2 = .49 = 49\%$

Considerations in Interpretation

Restricted range

Outliers

on-line vs. off-line

r is a parametric statistic

Nonlinear relationships

transformation of the data

nonparametric measure of correlation

use nonlinear regression techniques

Reliability of measures

Less reliability makes data messier which increases variability which decreases correlation

Advanced correlational techniques

Regression - using correlations to predict behavior

Line fitting.

The idea is to find a way to **summarize** a **relationship**

Get the equation of a best fit line from historical data.

$y = mx + b$

regression equation: $y = b_0 + b_1 x$

How do you get the equation?

The equation

Summarizes the relationship between variables.

It also allows one to predict the value of one variable, e.g. y, from the other, e.g. x, when given new x values....

Forms of regression

Simple linear regression

Multiple (linear) regression

Multivariate regression

Linear regression vs. nonlinear regression

Cautions:

Data not linearly related

Too many predictors

Too few predictors

Relationship among variables may be complex

Don't use regression equation to predict scores outside the range of the data used to compute coefficients (PROBLEM OF EXTRAPOLATION).

EXAMPLES

Predicting Final exam score given midterm or project grade.

Experimental Research - Basic Issues (Ch. 5-7).

AGAINST ALL ODDS VIDEO #11 (1513)

The search for causal relations

To be interpreted as a "cause" of an effect,

the cause should covary with the effect (correlation)

the cause should precede the effect in time

the effect should depend on the occurrence of the cause

Independent variable - candidate causes

Dependent variables - possible effects

Loose use of terminology to date

In correlational research

We're hypothesizing a causal direction and label variables accordingly.

Part of the motivation for IV/DV choices in your correlational studies were motivated by convenience - we needed an interval or ratio scale for the dv. and an ordinal or categorical for the IV.

Independent variables

Types of IVs / classes of causes

Environmental manipulations

Instructional manipulations

Invasive manipulations

SO.... what about causes like "age" or "gender"????

Organismic variables - a relatively stable physical charactersitic such as sex, eye color, height, weight, intelligence, educational level, prejudice or personality.

Experimental and Control Groups

The goal in an EXPERIMENT is thus to identify the causes of an effect.

Must isolate the cause and create (at least) 2 groups

If the two groups differ in other factors, these other factors are CONFOUNDS.

Confound vs. Nuisance variable

Dependent variables - the effects

Operationalization of DVs is particularly important.

e.g. audience size and its effect on public speaking performance

e.g. word length and reading ability (rate? comprehension?)

e.g. hippocampus and memory (how to measure memory?)

SO, you have an IV and a DV chosen. The next step is...
Assigning subjects to "Conditions" (i.e. levels of the IV).

Must avoid any systematic differences or you'll have a confound (e.g. mostly women in one condition and mostly men in another).

Simple random assignment (between-subject)

Matched random assignment (between-subject)

Repeated measures designs (within-subject)

Backtrack - Define between-subject and within-subject designs

Advantages

Disadvantages

Experimental Control

Validity of Experiments

Internal validity

External validity

Recall that the principal goal of an experiment is to determine the effects of the IV's.

Must control for the effects of extraneous factors.

1. Eliminating Confounds

Internal validity

Threats to internal validity

2. Error variance

Power to detect the effect of the IV - systematic variance

Sources of error variance

Dilemma - Control vs. Generalizability

In the attempt to increase internal validity (using methods described below) you can sacrifice external validity

Experimental Design

One IV = One-way design

Three basic varieties all discussed in text (simple, matched, repeated measures)

Between-subject aka independent groups design

Within-subject or repeated measures design

Multiple IVs = Factorial Designs

When you have more than 1 IV, you have more than one "Factor"

Simplest is 2 factors, each with 2 levels: 2x2 (2 by 2) design.

Other examples (3 x 3, 2 x 6, etc.)

Concrete example - audience size and noise level

Assigning subjects to conditions (a condition here is a "cell" in the table).

Completely randomized factorial design

Matched factorial design

Repeated measures factorial design

Within- and between-subject factors in a single experiment

Main effects and interactions

Interpreting the results of a factorial design

Main effect - the effect of a single IV

Interaction - present when the effect of an IV differes across levels of the other IV

Higher order designs

More than 2 Ivs

Discuss the issue of 2 and 3 way interactions