Varieties of Research Designs

- 3x3 Structure for single-IV designs
  - (3) Design differences & causal interpretability
  - (3) Design differences & statistical models
- Operational Definitions & "kinds" of IVs

Varieties of Single-Factor Research Designs

Causal Interp.	Statistical Design		
	BG	WG	MG
True-Exp			
Quasi-Exp			
Nat. Grps			

Varieties of Research Designs -- Causal Interpretability

• True Experiment

• Quasi - Experiment

• Natural Groups Design

-- also called concomitant measurement design, natural groups design, correlational design, etc.

Note: **Choice of ANOVA is not influenced by which of these types of designs is used -- only the causal interpretability of results.**

Basic properties of a …

True Experiment

- individual participants are randomly assigned to conditions of the IV by the researcher before manipulation of the IV

- IV is manipulated by researcher

- DV is measured by experimenter

- try to maintain procedural control to minimize confounds of on going equivalence

    - field studies and longer-term studies make this more difficult

Basic properties of a …

Quasi - Experiment

- intact groups are assigned to IV conditions (hopefully randomly by the researcher – but some variability in the definition!) before manipulation of the IV

- IV is manipulated by the researcher (again some variability in the definition!)

- DV is (sometimes) measured by experimenter

- procedural control is usually limited or absent

    - usually longer-term field studies

    - usually "intruding & manipulating" on some ongoing process

Intact groups …

an "intact group" is assembled by any process other than by random assignment by the researcher

Examples:

- state, county, town, block where you live
- hospital, clinic, center
- school, class, section

Why randomizing intact groups doesn't produce initial equivalence,

1. There is some "reason" folks are in the groups they are -- not random or independent assignment

2. There is no reason to believe that different groups have initial equivalence relative to each other

3. So, randomly assignment groups doesn't endure initial equivalence of individuals

Often referred to "unit of assignment" (groups) not matching the "unit of analysis" (individuals)

Basic properties of a …

Natural Groups Design

• the preexisting groups or groups that are about to be
   "naturally formed" ARE the conditions of the IV
   (e.g., gender, age, personality, history, treatment by
   other than the researcher)

• DV is (sometimes) measured by experimenter

• procedural control is limited or absent

   • usually longer-term field studies

   • usually "intruding & manipulating" on some ongoing
      process

Varieties of Research Designs -- Statistical Design

Between Groups
-- also Between Subjects, Independent Groups, or
   Cross-sectional designs

Within-groups
-- also Within-subjects, Repeated Measures, or
   Longitudinal designs

Matched Groups
-- also Matched Pairs (when only 2 IV conditions) or
   Matched Groups

Note: Choice of ANOVA **is** influenced by which of these types
 of designs is used

Components of different research designs...

Between Subjects (Between Groups)
      -- each subject completes ONE of the IV conditions
      -- different group of subjects each completes ONE
            of the IV conditions

Within-subjects (Within-groups, Repeated Measures)
      -- each subject completes ALL of the IV conditions
      -- one groups of subjects completes ALL of the IV
            conditions

Matched Groups
      -- subjects measured on matching variable(s)
      -- form groups of subjects with "same" scores
      -- one member of each matched group completes
         each IV condition

Remember: Which ANOVA you use depends on which of these designs you have

Candidates for Matching Variables

• Subject/measured variables that are known or likely potential causal influences on the DV (besides the IV)

  • e.g., age, prior performance, SES, personality trait

  • if the groups are equivalent on a variable, by matching, it can't be a confounding variable

• a "pretest" on the DV is often a very good matching variable

  • if the groups are equivalent on the DV before the manipulation, then whatever "confounds" were operating on that DV are expected to be continue operating equivalently during the study

  • often this is more available than other variables

• Procedural variables can also be included (formally called "yoking")

  • e.g., "treatment deliverer," location, number of exposures

---

Remember, you must:

• have a good reason for using each matching variable

  • the more matching variables the harder it is to make a match

• get good measures on the matching variable

  • avoid "proxy" variables whenever you can

• have a large enough sample to form a useful number of good matches

  •there's a trade-off between the "exactness" of the matches and the number of matches you can make

• get the matching variable measured "before hand" so you can form the matches before time to manipulate the IV (or it be "naturally manipulated")

Which ANOVA for which design?

What we've called "Between Groups ANOVA" is more properly called "ANOVA for Independent Groups"

  • different participants are in different conditions – so the scores in the different conditions are "independent"

What we've called "Within-Groups ANOVA" is more properly called "ANOVA for Dependent Groups"

  • the same participants are in all conditions – so the scores in the different conditions are "dependent"

So, which ANOVA for Matched Groups ??

  • different participants in different conditions, but they are assembled into matched groups, so… the scores in the different conditions are "dependent"

  • Dependent Groups or Within-Groups ANOVA is used for Matched Groups designs

Kinds of Independent Variables …

Manipulated by the Experimenter
      -- required for causal interpretability of the results
      -- not all IVs can be manipulated
      -- limited by technology, ethics, cost, ingenuity

Measured by the Experimenter
      -- results are not be causally interpretable

Having the these two types of IVs means you have to pay careful attention to the operationalization of the IV & sometimes have to be specific about which variable is the IV and which is the DV (especially since Psychologists can be very clever about finding ways to manipulate IVs)

      e.g.,   Mood and Performance

Version #1 RH: Mood influences Performance

Upon entering the lab, each subject completed a questionnaire that was used to assign them to either the "good mood" or the "poor mood" condition. Each subject then completed a battery of complex concept formation tasks, from which a performance score is determined.

IV ??   Type ??

DV ??

Causally Interpretable ??

Version #2   RH: Mood influences Performance

Upon enter the lab, each subject was approached by a confederate of the researcher who sat next to them and (based upon the results of a coin-flip) either complimented their dress and appearance, etc., or "accidentally" knocked over their books, spilled a drink on them, etc. Each subject then completed a battery of complex concept formation tasks, from which a performance score was determined.

IV ??   Type ??

DV ??

Causally Interpretable ??

Was "mood" operationalized the same in the two studies?

Which version has better internal validity? … external validity?

Version #3 Performance influences mood

Upon entering the lab, each subject completed a battery of complex concept formation tasks from which it was determined whether the subject did well or poorly. The researcher then told the subject either that they did well on the tasks, or that they did poorly. Each subject then completed a questionnaire from which a mood score was determined.

IV ??   Type ??

DV ??

Causally Interpretable ??

Version #4   Performance influences mood

Upon entering the lab, each subject completed a battery of complex concept formation tasks. (Based upon the results of a coin-flip) the researcher told the subject either that they did very, very well on the tasks, or that they did very, very poorly. Each subject then completed a questionnaire, from which a mood score was determined.

IV ??   Type ??

DV ??

Causally Interpretable ??

Was "performance" operationalized the same in the two studies?

Why might the task have to be different for the two studies?

Which version has better internal validity? … external validity?