Design Conditions & Variables

- Limitations of 2-group designs
- "Kinds" of Treatment & Control conditions
- Kinds of Causal Hypotheses
- Explicating Design Variables
- Kinds of "IVs"
- Identifying potential confounds
- Why control "on the average" is sufficient
- Characteristics & varieties of design variables

Limitations of 2-cond Designs

- 2-cond designs work well to conduct basic treatment evaluations
  - they allow us to investigate whether or not a specific treatment has "an effect"
  - usually by comparing it to a "no treatment" control
  - e.g., does a new treatment program work to help socially anxious clients (compared to no treatment)?
- However as research questions/hypotheses become more sophisticated and specific, we often require designs that have multiple IV conditions

"Kinds" of Conditions to Include in Research Designs

Tx Conditions

- Ways treatment conditions differ
  - amount of treatment
    - receiving therapy once vs. twice each week
    - getting 0, 1, 5 or 10 practice trials before testing
  - kind of treatment
    - receiving Cognitive vs. Gestalt clinical therapy
    - whether or not there is feedback on practice trials
  - combinations of treatment components
    - receiving both "talk" therapy vs. "combined drug & talk" therapy
    - receiving "10 practices without feedback" vs. "2 practices with feedback"

The "Secret" is to be sure the selection of conditions matches the research hypotheses you started with !!!

Different Kinds of "Control" Conditions

- "No Treatment" control
  - Asks if the Tx works "better than nothing"
- "Standard Tx" control
  - Asks if the Tx works "better than usual"
- "Best Practice" Control
  - Asks if the Tx works "better than the best known"
- "Pseudo Tx" Control
  - Asks if TX works "without a specific component"

The "Secret" is to be sure the selection of conditions matches the research hypotheses you started with !!!

An important point to remember...

Not every design needs a "no treatment control" group !!!!

Remember, a design needs to provide "an comparison of appropriate conditions" to provide a test of the research hypothesis !!!

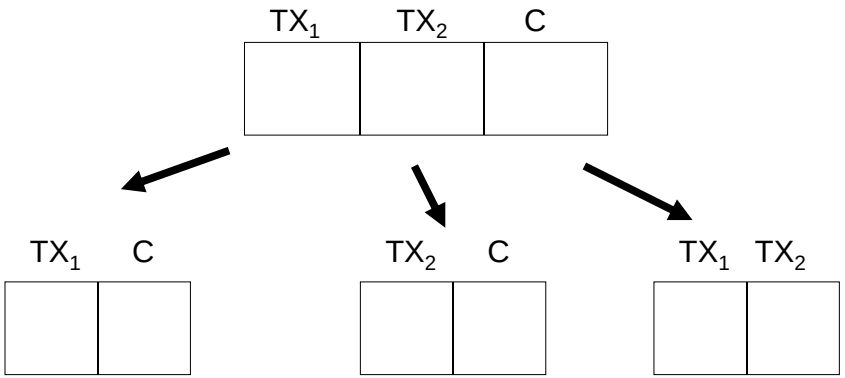
What would be the appropriate "control group" to answer each of the following ?

My new Tx works better than the currently used behavioral therapy technique	Group receiving the behavioral therapy.
My new Tx works better than "no treatment"	Group receiving no treatment.
My new Tx works because of the combo of the usual and new behavioral components	Pseudo-Tx group
My new TX works better when given by a Ph.D. than by a Masters-level clinician	Groups receiving the Tx from the two types of clinicians.

The "Secret" is to be sure the selection of conditions matches the research hypotheses you started with !!!

Of course …

Any multiple conditions design could be "reproduced" by the right combination of 2-conditions studies…



Running the 3 2-group studies gives replications of the conditions but not the comparisons! "Spending" the 6 conditions on two 3-condition studies gives us replication of the condition comparisons – which is what we need!

Causal Hypotheses for Multiple Condition Designs

Sometimes there is more than one component to a "treatment," and so, there are multiple differences between the IV conditions. When this happens, you must distinguish..

Causal Hypotheses about "treatment comparisons"
-- hypothesis that the difference between the DV means of the IV conditions is caused by the ***combination*** of treatment component differences

Causal Hypotheses about "identification of causal elements"
-- hypothesis that the difference between the DV means of the IV conditions is caused by a specific (out of two or more) treatment component difference (good use of pseudo-Tx controls)

The "Secret" is to be sure the condition comparison matches the specific type of causal research hypotheses !!!!

For example… I created a new 1-session treatment for social anxiety that uses a combination of group therapy (gets them used to talking with other folks) and cognitive self-appraisal (gets them to notice when they are and are not socially anxious). Volunteer participants were randomly assigned to the treatment or a no-treatment control. I personally conducted all the treatment conditions to assure treatment integrity. Here are my results using a DV that measures "social context tolerance" (larger scores are better) obtained during an exercise conducted at the end of the 4-hour therapy session.

$F(1,38) = 9.28, p = .001, Mse = 17.3$

Group therapy & self-appraisal	Cx
52	25

Which of the following statements will these results support?

"Here is evidence that the combination of group therapy & cognitive self-appraisal increases social context tolerance." ???

Yep -- treatment comparison causal statement

" You can see that the treatment works because of the cognitive self-appraisal; the group therapy doesn't really contribute anything."

Nope -- identification of causal element statement & we can't separate the role of group therapy & self-appraisal

Same story... I created a new 1-session treatment for social anxiety that uses a combination of group therapy (gets them used to talking with other folks) and cognitive self-appraisal (gets them to notice when they are and are not socially anxious). Volunteer participants were randomly assigned to the treatment or a no-treatment control. I personally conducted all the treatment conditions to assure treatment integrity. Here are my results using a DV that measures "social context tolerance" (larger scores are better) obtained during an exercise conducted at the end of the 4-hour therapy session.

What conditions would we need to add to the design to directly test the second of these causal hypotheses...

The treatment works because of the cognitive self-appraisal; the group therapy doesn't really contribute anything."

Group therapy & self-appraisal	Group therapy	Self-appraisal	No-treatment control

Let's keep going …

Here's the design we decided upon. Assuming the results from the earlier study replicate, we'd expect to get the means shown below.

Group therapy & self-appraisal	Group therapy	Self-appraisal	No-treatment control
52	25	52	25

What means for the other two conditions would provide support for the RH:

The treatment works because of the cognitive self-appraisal; the group therapy doesn't really contribute anything."

Another example… The new on-line homework I've been using provides immediate feedback for a set of 20 problems. To assess this new homework I compared it with the online homework I used last semester which 10 problems but no feedback. I randomly assigned who received which homework and made sure each did the correct type. The DV was the % score on a quiz given right after the homework was completed. Here are the results ...

F(1,42) = 6.54, p = .001, Mse = 11.12

Old Hw	New Hw
72	91

Which of the following statements will these results support?

"Here is evidence that the new homework is more effective because it provides immediate feedback!"

Nope -- identification of causal element statement -- with this design we can't separate the role of feedback and number of problems

"The new homework seems to produce better learning!"

Yep -- treatment comparison causal statement

Same story... The new on-line homework I've been using provides immediate feedback for a set of 20 problems. To assess this new homework I compared it with the online homework I used last semester which 10 problems but no feedback. I randomly assigned who received which homework and made sure each did the correct type. The DV was the % score on a quiz given right after the homework was completed. Here are the results ...

What conditions would we need to add to the design to directly test the second of these causal hypotheses...

"Here is evidence that the new homework is more effective because it provides immediate feedback!"

Hint: Start by asking what are the "differences" between the "new" and "old" homeworks -- what are the "components" of each treatment???

"New Hw" 20 problems w/ feedback	20 problems w/o feedback	10 problems w/ feedback	"Old Hw" 10 problems w/o feedback

Let's keep going …

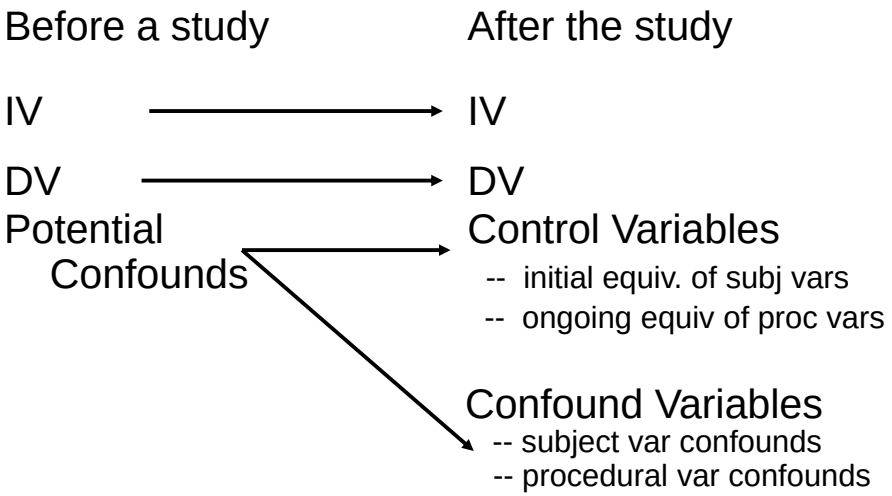
Here's the design we decided upon. Assuming the results from the earlier study replicate, we'd expect to get the means shown below.

"New Hw" 20 problems w/ feedback	20 problems w/o feedback	10 problems w/ feedback	"Old Hw" 10 problems w/o feedback
91	75	89	72

What means for the other two conditions would provide support for the RH:

"Here is evidence that the new homework is more effective because it provides immediate feedback!"

Kinds of variables before & after a study



About Potential Confounding Variables

Like IVs, potential confounds are causal variables

- they are variables that we think (fear) could have a causal influence on a subject's DV score
- if equivalent (on the average) across IV conditions, then they are "control variables " and contribute to the casual interpretability of the results
- if nonequivalent (on the average) across IV conditions, they are "confounds" that introduce alternative explanations of why the mean DV scores differed across the IV conditions

Candidates for Confounding Variables

- variables that researchers in your area have attempted to control (recognized confounds)
- variables know to be causal influences upon your DV (previously effective IVs) that are not the IV in your study

Why are initial and ongoing equivalence "on the average" sufficient for causal interpretation of the IV-DV relationship ??

- When we make the causal IV-DV inference/interpretation, we do it based on …
  - IV differences across the IV conditions
  - mean differences on the DV across the IV conditions
    - tells us there is a statistical IV-DV relationship
  - no other differences across the IV conditions
    - tells is the "only reasonable" source of the DV differences is the IV

Here's another way of describing this ...

- individual folks may differ on subject or procedural variables that influences their individual DV scores
- some folks in any condition will be higher and some lower on each of the potential confounds than folks in the other conditions -- creating higher or lower individual DV scores
- So, as long are there are no variables (confounds) that are different "on the average" across the IV conditions, then the "average DV differences" across the IV conditions are caused by the IV "on the average"

"Self-Selection" vs. "Self-Assignment"

Self-selection into the study

- the validity involved is the population representation aspect of external validity -- whether or not those who self-select to participate in the study represent the population of interest

Self-assignment into a condition of the study

- the type of validity involved is the initial equivalence portion of internal validity -- self-assignment means its is NOT a true experiment (no RA)

You have to be very careful about how these terms are used – be sure you know what they (and you) mean when using these terms

More about self-assignment… you need to distinguish among these three types of Non-experimental IVs

Self-assignment to Researcher Manipulated IV condition

• participants select the IV condition in which they will be – then the researcher manipulates the IV

• e.g., each surgery candidate is asked whether they would prefer that the "standard" or the "experimental" treatment be used for their surgery

Non-researcher Manipulated IV

• assignment other than RA by researcher & IV manipulation other than by researcher

• e.g., IV condition was determined by type of treatment they reported having received – "standard" or "experimental"

Subject Variable IV or Measured IV

• participants are "assigned" the to IV condition based on some measured personal attribute

• e.g., each participant was assigned to the "introvert" or "extrovert" IV condition, based on their score

None of these can be causally interpretable !!!

Explicating Design Variables

What I want you to be able to do is to tell the specific "function" of any variable in any study you read -- even if that variable is not mentioned in the description of the method & procedure !

We'll start by reviewing basic elements of variables and functions

Subject variables and procedural variables

• Subject variables are things the value of which participants "bring with them" when they arrive at the study

  • age, gender, personality characteristics, prior history, etc.

• Procedural variables are thing the value of which are "provided" or "created" by the researcher during the study

Explicating the "role" of variables in research designs

any given variable must be …

- a manipulated variable or a subject variable
- a DV or an IV or a control variable or a confound
- a control variable has either been...

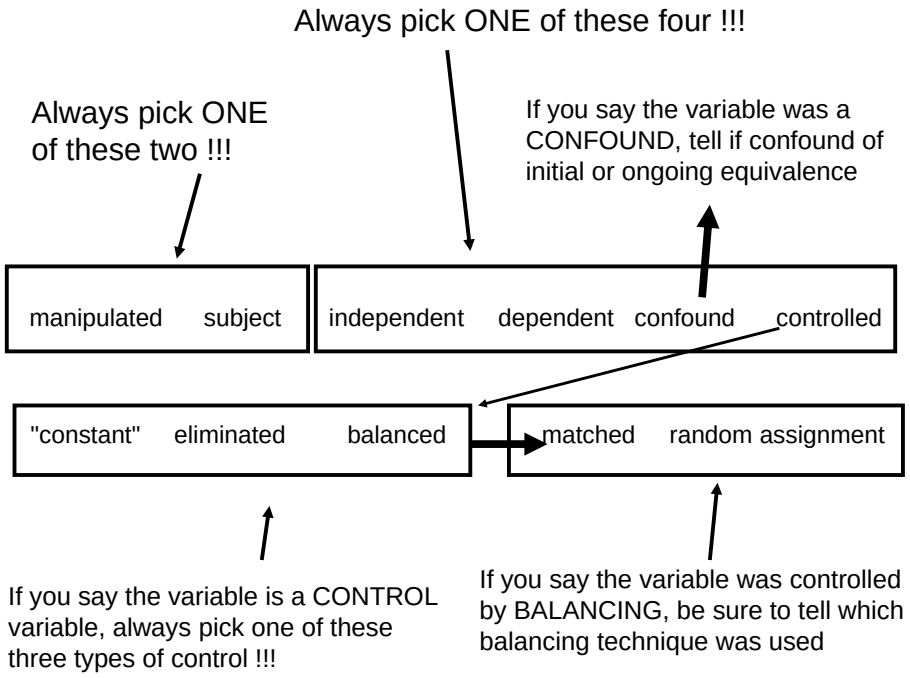
  balanced (usually by RA or matching) or held constant or eliminated
- a confounding variable is either a problem with initial equiv. (subject variable) or ongoing equivalence (procedural variable)

Remember:

• all subject variables are controlled by RA (of individuals)

• all subject variables are confounds in QE or NG designs (except for any that were used in ***post hoc*** matching)

• with ***a priori*** matching - all subject variables are controlled with ***post hoc*** matching -- only matching variable(s) is controlled


Always pick ONE of these four !!!
Always pick ONE of these two !!!
If you say the variable was a CONFOUND, tell if confound of initial or ongoing equivalence
manipulated
subject
independent
dependent
confound
controlled
"constant"
eliminated
balanced
matched
random assignment
If you say the variable is a CONTROL variable, always pick one of these three types of control !!!
If you say the variable was controlled by BALANCING, be sure to tell which balancing technique was used