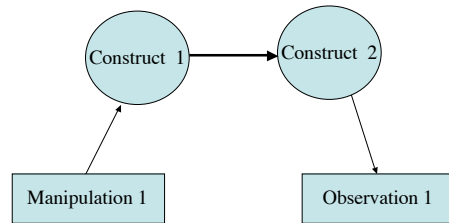


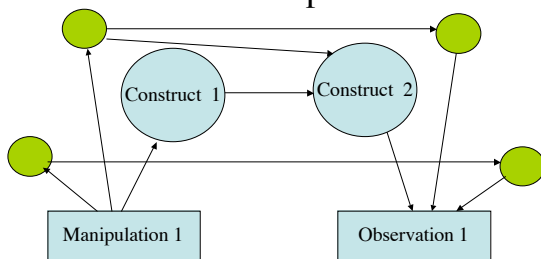
Research Designs

Between Subject Designs

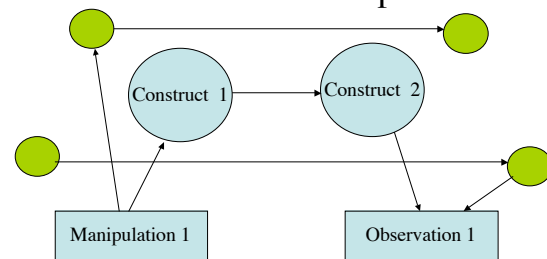
Theory and Theory Testing II: Experimental manipulation



Theory and Theory Testing III: Alternative Explanations



Theory and Theory Testing IV: Eliminate Alternative Explanations



Overview of the problem

- 1) Theoretical problem: understanding the relationship between latent variables (constructs)
 - a) relationships among latent variables
 - b) relationships between latent variables and observed variables
- 2) Generalization of results and threats to external validity
- 3) Proper design maximizes internal validity

Generalization of results and threats to external validity-I

- Limitations of generalization for subjects
- Limits of generalization for conditions -- interactions with other variables

Generalization of results and threats to external validity-I

- a) limitations of generalization for subjects
 - (1) freshman psych students at NU
 - (2) students at NU
 - (3) college students at selective research universities
 - (4) college students
 - (5) 18-24 year olds
 - (6) North Americans
 - (7) Humans
- b) limits of generalization for conditions -- interactions with other variables

Generalization of results and threats to external validity-II

- b) limits of generalization for conditions -- interactions with other variables
 - (1) problems and benefits of interactions
 - (a) xy relationship depends upon z
 - (b) example:
 - i) in the morning, caffeine hinders working memory performance
 - ii) in the evening, caffeine facilitates working memory performance
 - (2) interactions limit generalization
 - (3) interactions test theoretical limits

Practical problems and threats to internal validity

1 Manipulations affect more than the construct of interest

a) examples:

- (1) caffeine induces alertness and motor tremor
- (2) failure induces anxiety, depression, anger
- (3) practice leads to motivational changes as well as changes in skill

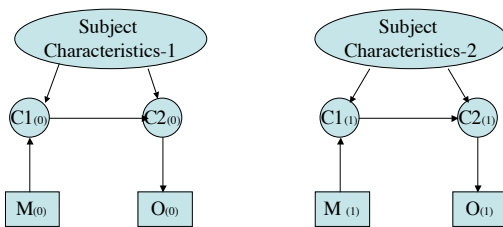
2 Observable variables reflect more than the construct of interest

- a) self report of alertness reflects base line differences
- b) cognitive performance--ability, motivation, training, practice
- c) slowness of responding reflects caution as well as process speed

Types of designs

- Within subject designs
 - controls for subject variability
 - confounds practice/order effects with manipulation
 - two or more conditions -- repeated many, many times
- Between subject designs
 - Subject variables as an alternative explanation of results -- threats to validity
 - Randomization as a control
- Mixed -- Within/Between

Theory and Theory Testing II: Experimental manipulation- Between Subjects



Possible confounding of subjects with conditions

Between Subject designs

- Subject variables as threat to external validity
 - Ability
 - Practice
 - Motivation
 - Interest
 - Gender
 - Age
 - Culture

Between Subject designs

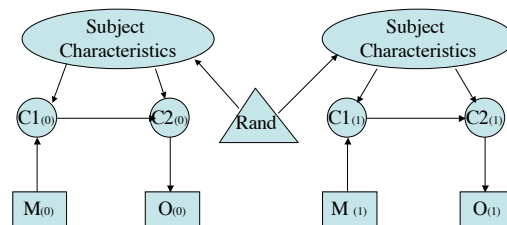
- Confounded effects that can lead to subject variability
 - Time of day
 - Naturally occurring rhythms of alertness
 - Classroom effects
 - Fatigue
 - Time of week, month, season, year
 - Class schedules
 - Mid terms
 - Papers
 - Weather
 - Volunteer effects
 - Experimenter-Subject interactions

Between Subject designs

- Subject variables as threat to external validity
- Confounded effects that can lead to subject variability
- Randomization as a control

- A YMCA official in a small town wanted some evidence to prove that his program was valuable in training future leaders. He went back to the membership records and got the names of those boys who were active members in his program 20 years before. He also took school records and got the names of boys who were not YMCA members. He compared the two groups and as to present occupations, salaries, and so on, and found that the YMCA group was doing much better. He concluded that this result was due to the influence of his program.
- What were the constructs of interest?
- What are possible threats to the validity of this study?

Theory and Theory Testing II: Experimental manipulation- Between Subjects



Randomization breaks the link confounding subjects and conditions

Randomization as a control

- Only the expected values of groups are equal --not the observed values
 - In any particular experiment, groups are not equivalent
 - Expected value of the (signed) group difference=0
 - Randomization does not introduce systematic bias

Types of Randomization

- Subjects matched on variable of interest and then assigned to condition
- Blocking to control for order effects
 - Ignores stable subject effects
 - Eliminates subject effects associated with time of appearance
- Complete randomization
 - “failures” of randomization
 - Problems at the end of the experiment
 - Power is maximized with equal cell sizes
 - Randomization will tend not to produce equal size groups
- Block Randomization
 - Randomize within blocks of subjects
 - Will lead to equal cell sizes, reduces chance of end effects

Complete Random (note unequal cell size)

Subject	Condition
1	0
2	1
3	1
4	0
5	1
6	0
7	0
8	0

Random with end effect

Subject	Condition	random w end
1	0	0
2	1	1
3	1	1
4	0	0
5	1	1
6	0	0
7	0	0
8	0	1

Block Randomization part 1 (Using Excel rand() function)

Subject	block	Condition	Random
1	1	0	0.01
2	1	1	0.42
3	2	0	0.94
4	2	1	0.29
5	3	0	0.33
6	3	1	0.86
7	4	0	0.36
8	4	1	0.67

Block Randomization (2)

Subject	block	Condition	Random
1	1	0	0.01
2	1	1	0.42
3	2	1	0.29
4	2	0	0.94
5	3	0	0.33
6	3	1	0.86
7	4	0	0.36
8	4	1	0.67

Flight instructors in the Air Force are interested in the effect of praise and blame on pilot performance. They have found that blame and criticism work much better than do praise. This is based upon the following design:

100 pilot trainees are evaluated at the end of every day of flying. Each trainee is rated in terms of their performance in taking off, executing 3 maneuvers, and then the tightness of their landing. They are rated on each activity by 3 experienced pilots on a 100 point scale. The best 50 pilots (group A) are then praised and rewarded while the worst 50 (group B) are punished by being criticized by the instructor and assigned extra duties around the base. The next day, those in group A are found to have decreased in their scores by 20 point, while those in Group B (punishment) are found to have increased by 20 points. From these results, the instructors have concluded that punishment works better than reward.

What are the constructs of interest?
What are possible alternative explanations for these effects?

Reliability and Regression effects

- Observed score = True score + Error
- Expected score = True score
- Variance of Observed Scores > Variance True
- Choice of subjects based upon observed scores => high scores expected to decline, low scores to improve

