One Independent Variable Repeated Measures Design

Review:

1) Post test only Between Groups Design

Test the effects of Anxiety versus No Anxiety on Musical Performance

30 participants, 15 in each group (random)

Group 1: Induce Anxiety

Group 2: Do not Induce Anxiety

Test: ability to play music (count mistakes)

IV? DV? Stat test? Advantages/Disadvantages

One Independent Variable Repeated Measures Design

Review Continued:

2) One Independent Variable Between Groups Design

Test the effects of Anxiety versus No Anxiety on Musical Performance

What's different from Post Test Only Between Groups Design?

Stat test? Advantages? Disadvantages?

One Independent Variable Repeated Measures Design

Review Continued:

3) Pretest-Posttest only Design

Test the effects of Anxiety versus No Anxiety on Musical Performance

What would it look like?

Advantage: each participant acts as own control (Why is this good?)

Disadvantage: three threats to Internal Validity

One Independent Variable Repeated Measures Design

New: One Independent Variable Repeated Measures Design

What would it look like?

Even with just two levels, how does it improve on Pretest-Posttest only design?

What would it look like with three levels?

Advantages of using?

One Independent Variable Repeated Measures Design

Disadvantages:

1. Can't use if one application of IV forever changes participant

   Might have to use Between Subjects design

2. Order effects could be confounding
   1. Counterbalance orders (determine all)
   2. Randomly present orders

One Independent Variable Repeated Measures Design

Example:

The study reported here compares the usability of three types of message input format: Abbreviations, Numbers and Free-Form as alternatives for a Pull SMS (ATM) banking service. Participants (N = 74) used all three formats to carry out three banking transactions in a repeated measures experiment. The Abbreviations and Numbers versions of the service performed to generally equal levels in all metrics. Free-Form performed the worst as participants took significantly longer to complete tasks and it received significantly lower overall questionnaire and quality scores for satisfaction. The older age group found all three versions in general to be less usable than the younger age group. They took longer on the tasks, had lower completion rates and they also gave each version a lower overall mean satisfaction score. (PsycINFO Database Record (c) 2007 APA, all rights reserved)(from the journal abstract)

A usability comparison of three alternative message formats for an SMS banking service. Peevers, G.; Douglas, G.; Jack, M. A.; International Journal of Human-Computer Studies, Vol 66(2), Feb 2008. pp. 113-123. [Journal Article]

One Independent Variable Repeated Measures Design

Example:

This study investigated the effects of sweet taste and energy on subsequent short-term appetite in female habitual high and low consumers of artificially-sweetened beverages. The study was based on the proposal that effects of sweet taste on appetite may differ as a result of the habitual experience of sweetness with or without energy. Following a repeated measures design, 10 female habitual high and 10 female habitual low consumers of artificially-sweetened beverages consumed a non-sweet/low-energy, sweet/low-energy, and sweet/high-energy preload, and cumulative test meal intake (gram, kJ.), cumulative total intake (gram, kJ.), and subjective perceptions of appetite were subsequently assessed. Different effects of sweet taste were found in habitual high and low consumers of artificially-sweetened beverages. Low consumers of artificially-sweetened beverages demonstrated an increase in appetite in response to sweet taste, whereas high consumers did not. Effects of energy on appetite did not differ between consumers. The effects of energy are unsurprising. The effects of sweet taste, however, are of interest. The lack of response to sweet taste in high consumers of artificially-sweetened beverages can be explained as a result of the repeated experience of sweetness without energy by these consumers. This lack of response suggests an adaptation to sweet taste as a result of the habitual dietary pattern of these consumers. (PsycINFO Database Record (c) 2007 APA, all rights reserved)(from the journal abstract)

Habitual high and low consumers of artificially-sweetened beverages: Effects of sweet taste and energy on short-term appetite. Appleton, K. M.; Blundell, J. E.; Physiology & Behavior, Vol 92(3), Oct 2007. pp. 479-486. [Journal Article]

One Independent Variable Repeated Measures Design

Example:

Crowd size (observers) effects on behavior of gorillas at Disney Wild Animal Park

Group differences in captive gorillas' reaction to large crowds. Kuhar, Christopher W.; Applied Animal Behaviour Science, Vol 110(3-4), Apr 2008. pp. 377-385.

One Independent Variable Repeated Measures Design

Next:

1. Variations--

ABA Designs

Longitudinal Designs

Follow-up studies

2. Data analysis--

Repeated Measures ANOVA

One Independent Variable Repeated Measures Design

Variations—

ABA Designs

A = Baseline Condition

B = Intervention

A = Back to baseline

Examples:

1. Depression and Medication
2. Behavioral Intervention

One Independent Variable Repeated Measures Design

Variations (continued)

Multiple baseline design

TWO or more dependent measures

D1 and D2

A = Baseline

B = Intervention affecting D1(only)

C = Intervention affecting D2 (only)

Example: Behavioral Interventions

One Independent Variable Repeated Measures Design

Variations (Continued)

Longitudinal designs

- Measure predictor/outcome variables at at least three time points

Cannot show cause/effect relationship

Can show time-order relationship

Example: Relationship between hypothesized premorbid symptoms of schizophrenia and development of schizophrenia

One Independent Variable Repeated Measures Design

Variations (continued)

Follow – up studies

- Treatment, then follow up

Combination of Repeated measures experiment and longitudinal study

Example: Alcohol treatment study

One Independent Variable Repeated Measures Design

Data analysis:

Repeated Measures Analysis of Variance

1. Between Subjects variance is calculated, but it is not the variance that is of interest.
2. Within Subjects variance includes the variance due to Treatment (the Independent Variable) PLUS Variance due to error (random things that happened during each application of the treatment)

One Independent Variable Repeated Measures Design

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One Independent Variable Repeated Measures Design

F ratio in a Repeated Measures ANOVA is all taken from variance within subjects, since each subject serves as his/her own control:

F ratio =

$$\frac{\text{Variance due to treatment (within subject)}}{\text{Variance due to error (within subject)}}$$

One Independent Variable Repeated Measures Design

Calculation of degrees of freedom

df between subjects = N -1 (N = # subjects)

df for the Independent Variable = k – 1 (k = the number of treatment conditions AKA levels of the Independent Variable)

df for the error variance = (N – 1) (k – 1)

Total df = kN – 1

One Independent Variable Repeated Measures Design

Calculation of degrees of freedom

df between subjects =

df for the Independent Variable =

df for the error variance =

Total df =

One Independent Variable Repeated Measures Design

Calculation of degrees of freedom

20 subjects, 3 conditions

df between subjects =

df for the Independent Variable =

df for the error variance =

Total df =

One Independent Variable Repeated Measures Design

Calculation of degrees of freedom

20 subjects, 3 conditions

df between subjects = 19

df for the Independent Variable = 2

df for the error variance = 19 x 2 = 38

Total df = (3 x 20) – 1 = 59

One Independent Variable Repeated Measures Design

Experiment: Does enthusiastic praise motivate children to exercise more?

Independent Variable: Enthusiastic praise each 30 minutes of exercise

Dependent Variable: Amount of time exercising

10 subjects

1 month: monitor exercise only

1 month: coach praises/exercise monitored

1 month: monitor exercise only

One Independent Variable Repeated Measures Design

- Type of design? Variation? Null hypothesis?
- Results:
  - Month 1 – Mean of 10 minutes/day
  - Month 2 – Mean of 60 minutes/day
  - Month 3 – Mean of 15 minutes/day
- Conclusions, perhaps?
- Data analysis? F ratio = ?
- df IV = ? df error = ? Total df = ?

One Independent Variable Repeated Measures Design

Summary: Each participant acts as own control so variance is within subject

Independent variable can have three (or more) levels if they can be presented to all participants in random order

Variation ABA design

F ratio calculated differently than between subjects' design.