Week of April 20

1. Experiments with unequal sample sizes
2. Analysis of unequal sample sizes: ANOVA approach
3. Analysis of unequal sample sizes: MRC approach
4. An exercise

The Problem with Unequal Sample Sizes

- In a factorial design, if cell sizes are unequal, then the "independent" variables are no longer statistically independent of each other
  - This means that the information provided by factor A overlaps somewhat with the information provided by factor B
  - The researcher needs to figure out what to do about this overlapping variance

Unequal Sample Sizes: Analysis of Unweighted Means

- Analysis of unweighted means: Pretends that each cell has the same sample size; each cell contributes equally to the row/column/grand means and to the *A/B/AxB* sums of squares
  - Pro: After adjusting the cell sums, analysis is identical to the case of equal cell sizes
  - Con: The *F* statistics produced by this method tend to be positively biased (i.e., too big)
  - Con: SPSS will not conduct this analysis; calculations must be done by hand (see pp. 536-541)

Unequal Sample Sizes: Analysis of Weighted Means

- Analysis of weighted means: Cells with more participants contribute more to the row/column/grand means and to the *A/B/AxB* sums of squares than do cells with fewer participants
  - Pro: GLM Univariate will do this analysis automatically
  - Pro: The *F* statistics produced by this method are unbiased

Unequal Sample Sizes: MRC Approach

- The coding of treatment groups is identical to the case of equal sample sizes
- The analysis is different than in the case of equal sample sizes
  - Hierarchical regression analyses are used to find the variance in the dependent variable that is uniquely related to each effect (*A, B, AxB*)

Unequal Sample Sizes: MRC Analysis

- To get the R^2 for *A, B, or AxB:*
  1. Use Regression—Linear
  2. In a first Block, enter all coding vectors ***except those used to code the effect of interest*** as Independents
  3. In a second Block, add the coding vectors for the effect of interest as Independents
  4. In the SPSS output, change in R^2 from model 1 to model 2 is the R^2 for the effect of interest
- The R^2 for *S/AB* (the error term) is 1 – $R^2_{Y.A,B,AxB}$ (i.e., $R^2_{Y.MAX}$)

MRC Summary Table

Source	R^2	*df*	Mn R^2	*F*
A	$R^2_{Y.A,B,AxB} - R^2_{Y.B,AxB}$	$a - 1$	R^2_A/df_A	Mn R^2_A/ Mn $R^2_{S/A}$
B	$R^2_{Y.A,B,AxB} - R^2_{Y.A,AxB}$	$b - 1$	R^2_B/df_B	Mn R^2_B/ Mn $R^2_{S/A}$
A x B	$R^2_{Y.A,B,AxB} - R^2_{Y.A,B}$	$(a - 1)(b - 1)$	R^2_{AxB}/df_{AxB}	Mn R^2_{AxB}/ Mn $R^2_{S/A}$
S/A	$1 - R^2_{Y.A,B,AxB}$	$N - ab$	$R^2_{S/A}/df_{S/A}$	

An Exercise

- In a delay of gratification study, young children are seated (one at a time) in front of a cookie. The experimenter tells the child that they are going to leave the room for a while; if the child does not eat the cookie before they return, then the child will be rewarded with additional cookies
- The DV is the amount of time that the child waits before eating the cookie
- The IVs are the size of the reward (2 cookies or 5 cookies) and the instruction set: half of the children are told to find another activity to distract themselves from the cookie; the other half are not given this suggestion
- Some children did not show up for their scheduled session, resulting in unequal cell sizes

An Exercise (Continued)

http://psych205.50webs.com/presentations/data_060420.sav

- Working with a partner, conduct an MRC analysis to determine whether amount of reward, instruction set, and/or their interaction had an effect on the length of time that the children waited before eating the cookie
  - Interpret any significant results in terms of the pattern of cell means (it may be helpful to run a GLM—Univariate analysis and ask for a plot of the means)