Help with Essay #16

In factorial designs the IVs are **correlated** (collinear, non-orthogonal, etc) **or not** (non-collinear, orthogonal, etc) **based on the cell sample sizes** in each of the design!

For this Equal-N design

- Numbers in design cells are number of participants in that cell
- This is an orthogonal design (IVs are not collinear)

	Tx (code=1)	Cx (code=2)
Pop1 (code=1)	n = 4	n= 4
Pop2 (code=2)	n= 4	n= 4

Correlations

		Tx_Cx	Pop1_Pop2
Tx_Cx	Pearson Correlation	1	.000
	Sig. (2-tailed)		1.000
	N	16	16
Pop1_Pop2	Pearson Correlation	.000	1
	Sig. (2-tailed)	1.000	
	N	16	16

The data for this sample would look like:

Tx_Cx	Pop1-Pop2
1	1
1	1
1	1
1	1
1	2
1	2
1	2
1	2
2	1
2	1
2	1
2	1
2	2
2	2
2	2
2	2

For this Unequal-N design

- Numbers in design cells are number of participants in that cell
- This is an non-orthogonal design (IVs are collinear)

	Tx (code=1)	Cx (code=2)
Pop1 (code=1)	n = 6	n= 3
Pop2 (code=2)	n= 2	n= 5

Correlations

		Tx_Cx	Pop1_Pop2
Tx_Cx	Pearson Correlation	1	.378
	Sig. (2-tailed)		.149
	N	16	16
Pop1_Pop2	Pearson Correlation	.378	1
	Sig. (2-tailed)	.149	
	N	16	16

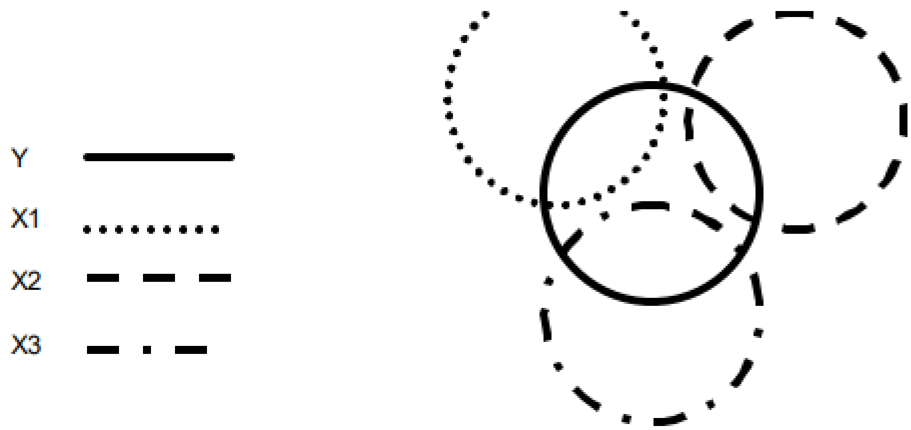
The data for this sample would look like:

Tx_Cx	Pop1-Pop2
1	1
1	1
1	1
1	1
1	1
1	1
1	2
1	2
2	1
2	1
2	1
2	2
2	2
2	2
2	2
2	2

Alright – we can have Orthogonal designs where the IVs are not correlated (not collinear) and we can have Non-orthogonal designs where the IVs are correlated (collinear) !!! How does this help me understand this?

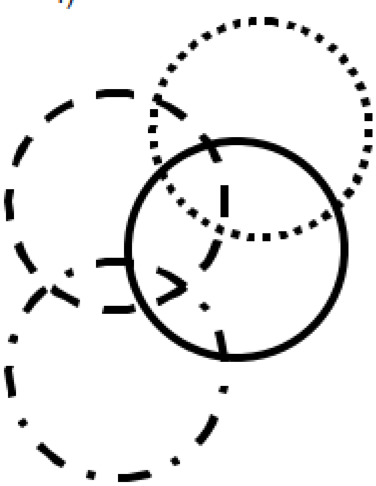
The key to this is remembering something that we emphasized when studying multiple regression. If the predictors in the model are correlated (collinear), then there may be a “different story” told by the correlation of a given predictor with the criterion and the multiple regression weight of that same predictor (with the other predictors in the model).

Like this – remember these??



In the unlikely situation where the predictors are uncorrelated (orthogonal, not collinear, etc), the bivariate correlation and multivariate regression weight (unique contribution to the model) will be the same.

1)



In the more likely situation where the predictors are correlated (collinear, non-orthogonal, etc.) then the bivariate correlation and multiple regression weight will be different.

Usually (except for suppressors which can’t be portrayed in a venn diagram) the correlation is larger than the standardized regression weight, because the predictors share part of the relationship with the criterion with other predictors.

Yeah – got that…. But what does that have to do with factorial ANOVA?

Ya gotta see the parallel between “correlated predictors” in multiple regression and “correlated IVs” in factorial ANOVA

Here is the parallel!

Bivariate effects look only at the relationship between that variable (IV or predictor) and the criterion, ignoring all other variables. Bivariate analyses pretend it is a "bivariate world" with just the IV & DV.

Multivariate effects look at the relationship between that variable (IV or predictor) and the criterion, after controlling that variable for the other variables in the model. Multivariate analyze recognize it is a "multivariate world" and only part of the variable has a unique relationship with the DV and the rest of the relationship be shared with other IVs.

Think of a 2-Factor ANOVA as a 3-predictor model:

- 1st IV
- 2nd IV
- Interaction of the two IVs

Here's the parallel…

Correlation & Multiple Regression		Factorial ANOVA
r of that predictor	← bivariate effect →	Comparing marginal means of that IV
multiple regression b of that predictor	← multivariate effect →	Main effect F-test of that IV

Got it! But, what's the problem??

If you have an non-orthogonal design, F-test of a given man effect is not comparing the marginal means shown in the Descriptives table! The main effect F-test is comparing he "corrected marginal means" after the effects of the other IV and the interaction have been controlled for.

It is as if, in a multiple regression, they had given you **the correlation** of that predictor and the criterion, but then they gave you **the p-value from the multiple regression weight** (without showing you the multiple regression weight!)!!

They would never do that! Because correlations and multiple regression weights are "different things" and some sometimes (depending on the collinearity pattern amongst the predictors) tell "apparently different stories"!

But, for reasons that are tangled in the web of statistical package history (and it is seriously tangled), EVERY package does just that! They show you the uncorrected or raw marginal means, and then show you the F-test of the corrected marginal means!

What's the poor analyst to do?

- Check and be aware if you have an orthogonal or non-orthogonal design
- If you have a non-orthogonal design (which you normally will unless both IVs are RA & Manip and you were trying for equal-n), remember that the F-test is comparing corrected marginal means, not the raw/uncorecte
- Use whatever process is available in the particular package you are using to obtain the corrected marginal means (EMMEANS in SPSS).