

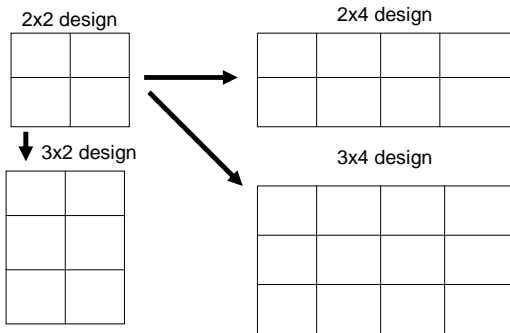
kxk BG Factorial Designs

- expanding the 2x2 design
- reasons for larger designs
- statistical analysis of kxk BG factorial designs
- F & LSD -- using the right tests for the right effects

Basic and Expanded Factorial Designs

The simplest factorial design is a 2x2, which can be expanded in two ways:

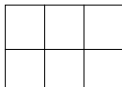
1) Adding conditions to one, the other, or both IVs



Factorial designs are all labeled as ? x ? Designs

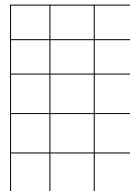
- the first number tells the number of rows in the design
 - the second number tells the number of columns in the design
- What is each of the following

a.



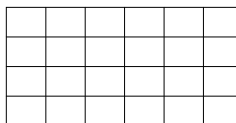
2 x 3

c.



5 x 3

b.



4 x 6

This time try to "draw the boxes" (be sure to label each IV and specify each of its conditions) based on the description of the design -- whatever IV is described first will define the rows

1. Males and females completed the task, either under instructions to work quickly, work accurately, to work as quickly as possible without making unnecessary errors or no instructions.

2. Folks completed a depression questionnaire either under instructions to "respond like someone with acute depression," "respond like someone with chronic depression" or "respond like someone who is trying to 'fake' being depressed". Participants were either clinical psychologists, clinical Ph.D., or volunteers from a local social club.

#1 was a 2x4 design that looks like this...

Gender	Instructions			
	Quick	Accurate	Both	None
Male				
Female				

#2 was a 3 x 3 design that looks like ...

Respond like a ..	Participant		
	Clinician	Clin. Grad.	Soc. Club
Acute depressive			
Chronic depressive			
"Fake" depressive			

kxk BG Factorial Designs

We've worked extensively with the 2x2 design -- the basic factorial

Larger factorial designs are often used for the same reasons that multiple-condition 1-factor designs are used . . .

- You may need more than 2 IV conditions to properly test a RH:
 - Want multiple "experimental conditions" (qual or quant diffs)
 - Want multiple "treatment conditions " (standard vs. none, etc)
 - Want to "dissect" a multiple element treatment

You might want to test the replicability of an IV's effect across more than two situations/settings

- testing the generality of a TX across gender requires just 2 conditions of the 2nd IV
- testing generality of that TX across ages would require more

The omnibus ANOVA for the kxk is the same as for the 2x2

$$BG \quad SS_{total} = SS_A + SS_B + SS_{INT} + SS_{Error}$$

$$df_{total} = df_A + df_B + df_{INT} + df_{Error}$$

$$(N - 1) = (a - 1) + (b - 1) + (a - 1)(b - 1) + ab(n - 1)$$

$$F_A = \frac{SS_A / df_A}{SS_E / df_E} \quad F_B = \frac{SS_B / df_B}{SS_E / df_E} \quad F_{INT} = \frac{SS_{INT} / df_{INT}}{SS_E / df_E}$$

Things to notice:

- There is a single error term that is used for all the Fs

Statistical Analysis of kxk Factorial Designs

Only a couple of differences from the 2x2

1. Tell IVs and DV
2. Present data in table or figure
3. Determine if the interaction is significant
 - if it is, describe it in terms of one of the sets of simple effects using LSD_{mmd} to compare the cell means
4. Determine whether or not the first main effect is significant
 - if so, describe it using LSD_{mmd} compare 3+ marginal means
 - determine if that main effect is descriptive or misleading using the interaction LSD_{mmd} to compare SEs
5. Determine whether or not the second main effect is significant
 - if so, describe it using LSD_{mmd} compare 3+ marginal means
 - determine if that main effect is descriptive or misleading using the interaction LSD_{mmd} to compare SEs

The LSD follow-ups are a little different than for the 2x2

- the 2x2 uses the LSD only for comparing cell means
 - describe the simple effects to explicate the interaction pattern
 - not needed for MEs, since they involve only 2 conditions
- the kxk uses the LSD for comparing cell & marginal means
- different LSD mmd values are computed for different effects
 - if the interaction is significant, then an LSD is computed to compare the cell means -- describe SEs, interaction, etc.
 - If a ME with 2 conditions is significant - no LSD needed
 - If a ME with 3 or more conditions is significant, then LSD is computed to compare the marginal means of that ME

Be sure to use the proper "n" to compute each LSD

- "n" = mean number of data points used to compute the means being compared (more on demo sheet)

When do you need a LSDmmd value ???

General rule: You will need an LSDmmd value to compare pairs of means whenever a significant effect has $k > 2$ conditions

#1 Whenever the interaction is significant \rightarrow LSDmmd for the cell means is needed to :

- describe the pattern of the SEs to describe the interaction pattern
- describe the pattern of the SEs to determine whether each ME is descriptive or misleading (necessary to do for each ME -- whether the ME is significant or not)

#2 Whenever a ME is significant \rightarrow LSDmmd for those marginal means is needed to

- describe the patter of that ME

What statistic is used for which factorial effects????

There will be 5 statistics

1. F_{Gender}
2. F_{Age}
3. Age LSD_{mmd}
4. F_{Int}
5. Int LSD_{mmd}

Age	Gender		
	Male	Female	
5	30	30	30
10	20	30	25
15	25	30	27.5
	25	30	27.5

1. Main effect of gender
2. Main effect of age
3. 5 vs. 10 marginals
4. 5 vs. 15 marginals
5. 10 vs. 15 marginals
6. Interaction of age & gender
7. 5 vs. 10 yr old males
8. 5 vs. 15 yr old males
9. 10 vs. 15 yr old males
10. 5 vs. 10 yr old females
11. 5 vs. 15 yr old females
12. 10 vs. 15 yr old females
13. male vs. female 5 yr olds
14. male vs. female 10 yr olds
15. male vs. female 15 yr olds

Back to \rightarrow 100 males and 100 females completed the task, either under instructions to work quickly, work accurately, to work as quickly as possible without making unnecessary errors or no instructions.

Gender	Instruction			
	Quick	Accurate	Both	None
Male				
Female				

For the interaction $p = .03$

- will we need an LSD_{mmd} to compare cell means? why or why not?
- what will "n" be?

For the main effect of instruction $p = .02$

- will we need an LSD_{mmd} to compare marginal means? why or why not?
- what will "n" be?
- will we need an LSD_{mmd} to compare cell means? why or why not?
- what will "n" be?

For the main effect of gender $p = .02$

- will we need an LSD_{mmd} to compare marginal means? why or why not?
- what will "n" be?
- will we need an LSD_{mmd} to compare cell means? why or why not?
- what will "n" be?
