Mixed ANOVAs

WITHIN + BETWEEN

Mixed Designs

Designs that include both between and within-subject factors

Advantages

- Balances the costs and benefits associated with either a completely within or completely between design
- Naturally suited to studying different groups of people across time

Allows for including either natural groups or individual differences in what would otherwise be impossible in completely between subject designs

Control groups for intervention studies or other longitudinal designs

- e.g. pre-post, control-intervention evaluation designs

Specific design considerations

"Fatal flaws" in using a within-subjects variable: good reasons to manipulate it between-subjects instead?

- Carry-over effects
- Practice effects
- Demand characteristics
- Fatigue

Worksheet

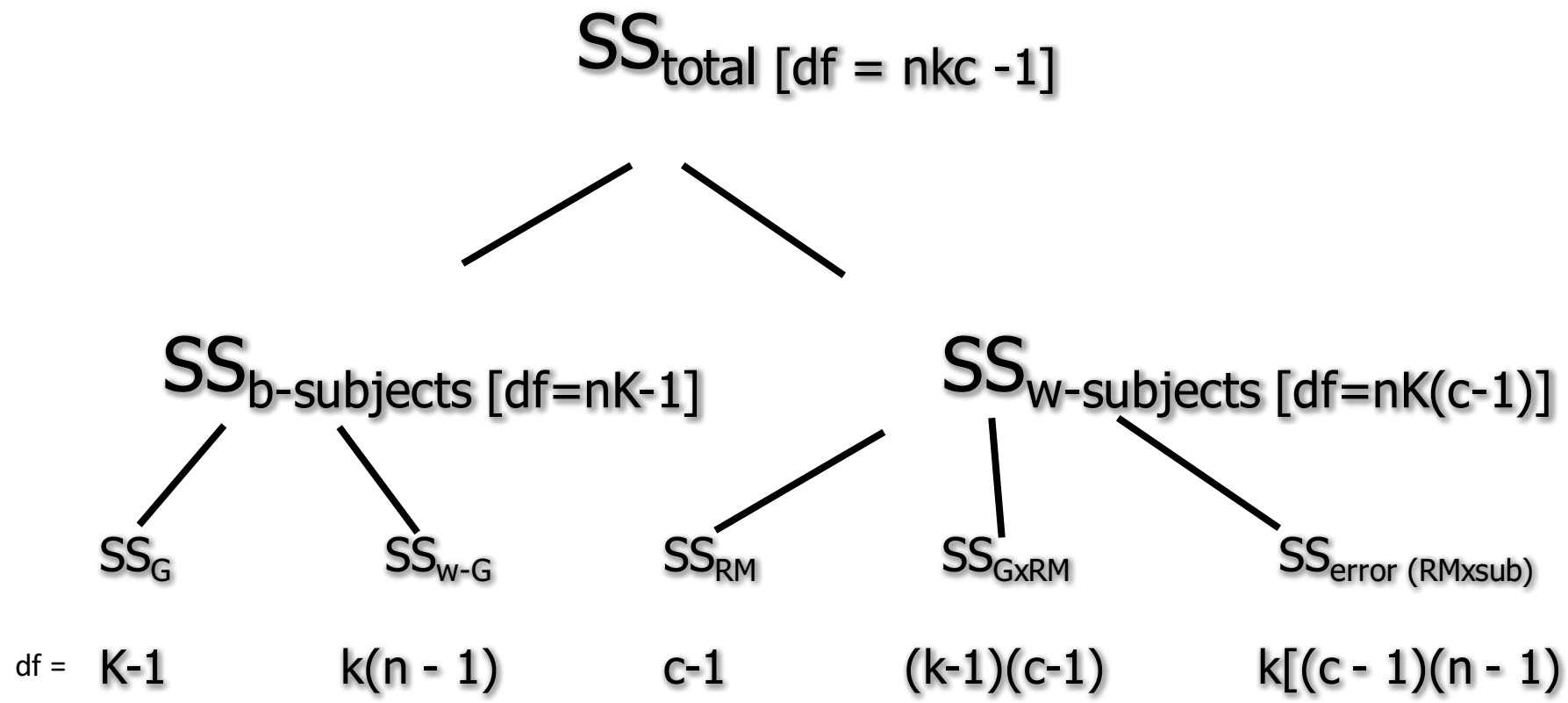
Logic of the analysis

Treatment effects

Error terms

- When can we partial out effects due to individual differences, and when can't we?
  - For within subject effects, we can parse out the effects of individual differences
  - For between subject effects we can not parse out the effects of individual differences

Parsing the Variance



Two Way Mixed Design

Source	SS	df	MS	F	$\eta^2_{from\ your\ book}$
Between-Subject	$SS_{BS} = C\ SS_{Row\ means}$	nk - 1	SS_{BS} / df_{BS}		
Group	$SS_G = C\ n\ SS_{Group\ means}$	k – 1	SS_G / df_G	MS_G / $MS_{W\text{-}G}$	$\eta^2_G = \frac{SS_G}{SS_G + SS_w + SS_{SxRM}}$
W_{group} {between error}	$SS_G = C\ SS_{Group\ scores} - SS_G$	k(n - 1)	$SS_{W\text{-}G}$ / $df_{W\text{-}G}$		
Within-Subject	$SS_{ws} = SS_t - SS_{BS}$	nk(c-1)	SS_{WS} / df_{WS}		
Within-Treatment (RM)	$SS_{RM_1} = K\ n\ SS_{RM\ means}$	c – 1	SS_{RM} / df_{RM}	MS_{RM} / MS_{SXRM}	$\eta^2 = \frac{SS_{RM}}{SS_{Total}}$
Interaction [G X RM]	$SS_{GxRM} = SS_{Col\ Means} - SS_G - SS_{RM}$	(k - 1)(c - 1)	SS_{GxRM} / df_{GxRM}	MS_{GXRM} / MS_{SXRM}	$\eta^2 = \frac{SS_{GxRM}}{SS_{Total} - SS_{RM}}$
Residual [S X RM] {within error}	$SS_{SxRM} = SS_{ws} - SS_{RM} - SS_{GXRM}$	(n - 1)(c - 1)	SS_{SxRM} / df_{SxRM}		
Total	$SS_T = SS_{all\ scores}$	N – 1			

Example of Mixed

	Depressed			
Subject	Time 1	Time 2	Time 3	Row Means
1	10	12	8	10.00
2	7	9	4	6.67
3	13	15	9	12.33
4	18	12	6	12.00
5	6	8	3	5.67
	Control			
6	7	14	13	11.33
7	5	10	11	8.67
8	10	18	13	13.67
9	14	13	9	12.00
10	5	11	7	7.67

Means of Clinical Status (Between)		
Depressed	Control	Row Means
10.00	11.33	10.67
6.67	8.67	7.67
12.33	13.67	13.00
12.00	12.00	12.00
5.67	7.67	6.67

Means of Time (Within)		
Time 1	Time 2	Time 3
8.5	13	10.5
6	9.5	7.5
11.5	16.5	11
16	12.5	7.5
5.5	9.5	5

Go to Excel and Calculate the mixed based on the table

One way ANOVA of Each Factor

One-way RM

	SS	DF	MS	F	pvalue	np2	ng2
RM1	35.99	2	17.99	3.30	0.09	0.45	0.21
Within	133.60	12	11.13				
Sub	90.00	4	22.50				
Error	43.60	8	5.45				
Total	173.50						

Means of Time (Within)		
Time 1	Time 2	Time 3
8.5	13	10.5
6	9.5	7.5
11.5	16.5	11
16	12.5	7.5
5.5	9.5	5

One-way Between

	SS	DF	MS	F	p	eta
BTW	3.40	1	3.40	0.44	0.524	0.052
WTH	61.33	8	7.67			
Total	65.78	9				

Means of Clinical Status (Between)		
Depressed	Control	Row Means
10.00	11.33	10.67
6.67	8.67	7.67
12.33	13.67	13.00
12.00	12.00	12.00
5.67	7.67	6.67

Two-Way Mixed

	SS	DF	MS	F	pvalue	n2	
Between-S	197.33	9	21.93				
Group [Clinical]	13.33	1	13.33	0.58	0.47	0.05	
W [Within-Groups]	184.00	8	23.00				
Within-S	238.67	20	11.93				
Within (RM) [Time]	79.80	2	39.90	6.91	0.01	0.18	
GxRM	66.47	2	33.23	5.75	0.01	0.19	
Residual (SxRM)	92.40	16	5.78				
Total	436	29					

Merging

Mixed Design

	SS	DF	MS	F	pvalue
Between-S	197.33	9	21.93		
Group [Clinical]	13.33	1	13.33	0.58	0.47
W [Within-Groups]	184.00	8	23.00		
Within-S	238.67	20	11.93		
Within (RM) [Time]	79.80	2	39.90	6.91	0.01
GxRM	66.47	2	33.23	5.75	0.01
Residual (SxRM)	92.40	16	5.78		
Total	436	29			

X3

One-way Between

	SS	DF	MS	F	p
BTW	4.44	1	4.44	0.58	0.468274
WTH	61.33	8	7.67		
Total	65.78	9			

X2

One-way RM

	SS	DF	MS	F	pvalue
RM1	39.90	2	19.95	3.66	0.07
Within	133.60	12	11.13		
Sub	90.00	4	22.50		
Error	43.60	8	5.45		
Total	173.50				

Mixed vs Fully between vs Fully Within

Find where they the same and where they different?

Mixed

	SS	DF	MS	F	pvalue	n2
Between-S	197.33	9	21.93			
Group [Clinical]	13.33	1	13.33	0.58	0.47	0.05
W [Within-Groups]	184.00	8	23.00			
Within-S	238.67	20	11.93			
Within (RM) [Time]	79.80	2	39.90	6.91	0.01	0.18
GxRM	66.47	2	33.23	5.75	0.01	0.19
Residual (SxRM)	92.40	16	5.78			
Total	436	29				

Fully between

2-way	SS	DF	MS	F	pvalue	np2
Between-T	159.60	5	31.92	0.96	0.581	0.577
Time	79.80	2	39.90	1.20	0.454	0.289
Clinical	13.33	1	13.33	0.40	0.591	0.048
Time X Clinical	66.47	2	33.23	1.00	0.500	0.240
Within	276.40	24	11.52			
Total	436.00	29				

Fully Within

		SS	DF	MS	F	pvalue	ng2
Time	RM1	79.80	2	39.90	3.66	0.07	0.13
Clinical	RM2	13.33	1	13.33	13.33	0.02	0.00
Time X Clinical	RM1x2	66.47	2	33.23	51.13	0.00	0.10
	Within	276.40	24	11.52			
	Sub	180.00	4	45.00			
	Inter1	87.20	8	10.90			
	Inter2	4.00	4	1.00			
	Inter1x2	5.20	8	0.65			
	Total	436.00	29				