

G&W #19, Ch. 15 (6 ed.)

DV: attention span (# of minutes child was able to concentrate on a specific task)

	Drug (b1)	No Drug (b2)	
Counseling (a1)	n=10 T=140 SS=40 m=14	n=10 T=80 SS=36 m=8	220
No Counseling (a2)	n=10 T=120 SS=45 m=12	n=10 T=100 SS=59 m=10	220
	260	180	

$\sum X^2 = 5220$
 $N = 40$
 $G = 440$

Main Effect of A: $H_0: \mu_{\text{counseling}} = \mu_{\text{no counseling}}$
 $H_1: \mu_{\text{counseling}} \neq \mu_{\text{no counseling}}$

Main Effect of B: $H_0: \mu_{\text{drug}} = \mu_{\text{no drug}}$
 $H_1: \mu_{\text{drug}} \neq \mu_{\text{no drug}}$

Interaction: H_0 : The effect of counseling does NOT depend on whether drugs are administered.
 H_1 : The effect of counseling DOES depend on whether drugs are administered.

$$1) SS_{\text{TOTAL}} = \sum X^2 - \frac{G^2}{N} = 5220 - \frac{440^2}{40} = 5220 - 4840 = 380$$

$$SS_{\text{B/tw Treat.}} = \sum \frac{T^2}{n} - \frac{G^2}{N} = \frac{140^2}{10} + \frac{80^2}{10} + \frac{120^2}{10} + \frac{100^2}{10} - \frac{440^2}{40} = 1960 + 640 + 1440 + 1000 - 4840 = 200$$

$$SS_{\text{w/in Treat.}} = \sum SS_{\text{in each cell}} = 40 + 36 + 45 + 59 = 180$$

$$SS_A = \sum \frac{T_{\text{row}}^2}{n_{\text{row}}} - \frac{G^2}{N} = \frac{220^2}{20} + \frac{220^2}{20} - \frac{440^2}{40} = 2420 + 2420 - 4840 = 0$$

$$SS_B = \sum \frac{T_{\text{column}}^2}{n_{\text{column}}} - \frac{G^2}{N} = \frac{260^2}{20} + \frac{180^2}{20} - \frac{440^2}{40} = 3380 + 1620 - 4840 = 160$$

$$SS_{A \times B} = SS_{\text{B/tw Treat.}} - SS_A - SS_B = 200 - 0 - 160 = 40$$

G&W #19, Ch. 15 (cont.)

$df_{total} = N - 1 = 40 - 1 = 39$

$MS_A = \frac{SS_A}{df_A} = \frac{0}{1} = 0$

$df_{b/tw\ treatment} = (\#cells) - 1 = 4 - 1 = 3$

$MS_B = \frac{SS_B}{df_B} = \frac{160}{1} = 160$

$df_{w/in\ treat} = \sum(n-1) = 9 + 9 + 9 + 9 = 36$

$df_A = (\#levels\ of\ A) - 1 = 2 - 1 = 1$

$MS_{A \times B} = \frac{SS_{A \times B}}{df_{A \times B}} = \frac{40}{1} = 40$

$df_B = (\#levels\ of\ B) - 1 = 2 - 1 = 1$

$df_{A \times B} = df_{b/tw} - df_A - df_B = 3 - 1 - 1 = 1$

$MS_{w/in\ Treat} = \frac{SS_{w/in\ Treat}}{df_{w/in\ Treat}} = \frac{180}{36} = 5$

$F_A = \frac{MS_A}{MS_{w/in\ Treat}} = \frac{0}{5} = 0$ Retain H_0 $F_B = \frac{160}{5} = 32$ Reject H_0 $F_{A \times B} = \frac{40}{5} = 8$ Reject H_0
 $F_{crit}(1, 36) = 4.11$

2) Make a Summary Table

Source	SS	df	MS	F
B/tw Treatments	200	3		
A (counseling)	0	1	0	0.00 ^{ns}
B (drug)	160	1	160	32.00*
A x B	40	1	40	8.00*
W/in Treatments	180	36	5	
TOTAL	380	39		

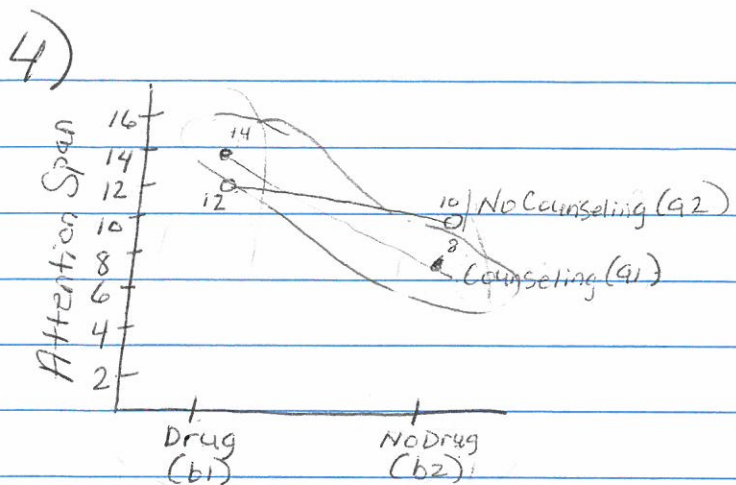
* $p < .05$

3) Effect Size OR $\eta^2 = \frac{SS_B}{SS_B + SS_{w/in}} = \frac{160}{160 + 180} = .471$

$\eta^2_B = \frac{SS_B}{SS_T - SS_A - SS_{A \times B}} = \frac{160}{380 - 0 - 40} = .4705$ or $.471$ large effect

$\eta^2_{A \times B} = \frac{SS_{A \times B}}{SS_{A \times B} + SS_{w/in\ Treat}} = \frac{40}{40 + 180} = .1818$ or $.182$ medium effect

Remember Cohen's Categories: $.01 < r^2 < .09$ small effect
 $.09 < r^2 < .25$ medium
 $r^2 > .25$ large



5) Simple Main Effects of b at each level of a

drug vs no drug for counseling
(or b at a1)

drug (b1) no drug (b2)

Counseling (a1) T=140 T=80 N=20

n=10 n=10 G=220
m=14 m=8

$H_0: \mu_{drug} = \mu_{no drug}$ for Ps getting Counseling

$F = \frac{\text{Variance for means in row 1 (a1)}}{\text{Variance expected by chance (MS}_{w/in\ Treat. \text{ from overall ANOVA)}}$

$$SS_{b/tw\ treat} = \frac{\sum T^2}{n} - \frac{G^2}{N} = \frac{140^2}{10} + \frac{80^2}{10} - \frac{220^2}{20} = 1960 + 640 - 2420 = 180$$

* based only on 2 treatments, so $df=1$. $MS_{B/tw\ Treat} = \frac{180}{1} = 180$

$F_{bata1} = \frac{180}{5} = 36$ Reject H_0

$MS_{w/in\ Treat} \rightarrow 5$ $F_{crit}(1, 36) = 4.11$
from the overall ANOVA

drug vs. no drug for no counseling (b at a2)

$H_0: \mu_{drug} = \mu_{no drug}$ for Ps NOT getting Counseling

$$SS_{b/tw\ treat} = \frac{120^2}{10} + \frac{100^2}{10} - \frac{220^2}{20}$$

Condition	Drug (b1)	No Drug (b2)
No Counseling (a2)	T=120 n=10 m=12	T=100 n=10 m=10

$$= 1440 + 1000 - 2420 = 20 \quad df = 1$$

$MS_{b/tw\ treat} = \frac{20}{1} = 20$ $F_{bata2} = \frac{20}{5} = 4$ Retain H_0
 $F_{crit}(1, 36) = 4.11$