PSY30100-03 -- Assignment 9

Two-Way Analysis of Variance
(Two-Way ANOVA)

TA: Laura Lu

April 19, 2010

Problem

- A psychologist who studies the legal system conducted a study of the effects of defendants' likability and nervousness on willingness to convict the defendant. Each participant read the same transcript, taken from an actual trial, in which the guilt or innocence of a male defendant was quite ambiguous. All participants also saw a brief videotape that supposedly showed the defendant on the witness stand. The way the actor played the part on the videotape included four possibilities: likable versus not and nervous versus not. After viewing the tape, participants rated the likelihood that the defendant is innocent (on a scale of 1, very unlikely, to 10, very likely). The data are as follows.

Problem

	Likeable	Not likeable
Nervous	7	3
	8	4
	6	2
Not nervous	3	7
	3	5
	3	9

Questions

1. What design is this?
2. Make a table of cell and marginal means. Determine whether there is a potential main effect of likability on willingness, a potential main effect of nervousness on willingness, and an interaction effect.
3. Make a clustered bar graph of the cell means.
4. Carry out the analysis of variance using alpha = .05. Draw your conclusion.

Review: Two-way ANOVA Steps

1. Compute row means, columns means and grand mean
2. Compute sums of squared deviations: SS_A , SS_B , SS_{AB}, SS_W (maybe SS_T)

(3. Check to see if $SS_T = SS_A + SS_B + SS_{AB} + SS_W$)

4. Obtain df_A , df_B , df_{AB}, df_W
5. Compute MS_A, MS_B, MS_{AB}, MS_W
6. Compute F and p-value (and create ANOVA source table)
7. Compare p to α (or $F_{observed}$ to $F_{critical}$) and decide…

Review: Two-Way ANOVA

- $SS_T = SS_A + SS_B + SS_{AB} + SS_W$

  SS_A , SS_B , SS_{AB}, SS_W

- $d.f._A$ = #of factor A levels -1

  $d.f._B$ = #of factor B levels -1

  $d.f._{AB} = d.f._A * d.f._B$

  $d.f._w$ = (n-1)(#of factor A levels)(#of factor B levels)

  = N-(#of factor A levels)(#of factor B levels)

  $d.f._T = d.f._A + d.f._B + d.f._{AB} + d.f._w$

  = N-1

Review: Two-Way ANOVA

- $MS_A = SS_A / d.f._A$

  $MS_B = SS_B / d.f._B$

  $MS_{AB} = SS_{AB} / d.f._{AB}$

  $MS_w = SS_w / d.f._w$

- $F_A = MS_A/MS_W$

  $F_B = MS_B/MS_W$

  $F_{AB} = MS_{AB}/MS_W$

Step 1

	Likeable	Not likeable	
Nervous	7 8 6 (M11=7)	3 4 2 (M12=3)	RM1=5
Not nervous	3 3 3 (M21=3)	7 5 9 (M22=7)	RM2=5
	CM1=5	CM2=5	GM=5

Step 2

$SS_R = 6[(5-5)^2+(5-5)^2]=0$

$SS_C = 6[(5-5)^2+(5-5)^2]=0$

$SS_W =(1+1)+(1+1)+(0)+(4+4)=12$

$SS_T =(4+9+1)+(4+1+9)+(4+4+4)+(4+0+16)=60$

$SS_{RC} =SS_T–SS_R-SS_C -SS_W= 60-12=48$

ANOVA source table

Source	Sum of Squares	DF	Mean Square	*F*	*sig*
Row	0	1	0	0	No
Column	0	1	0	0	No
Interaction	48	1	48	32	Yes
Within	12	8	1.5		
Total	60	11			

$F_{cv}(\text{alpha}=0.05, 1, 8) = 5.32$

Conclusions:

- There is no row main effect.
- There is no column main effect.
- The interaction effect is very significant.