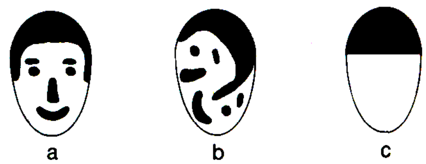
Final Exam PS 217, Spring 2003

1. Faces appear to be interesting stimuli to children (e.g., Fantz, 1961). To test that hypothesis, suppose that one of three different kinds of stimuli were presented to children of four different ages (1, 2, 3, and 4 months of age). The three different ovoids (seen below) were filled with face-like features (Face), filled with the same features in a scrambled fashion (Scrambled Face), or filled with an equivalent amount of black ink at the top of the ovoid (No Face). First of all, tell me why these particular stimuli were chosen. [2 pts]



The stimuli keep the proportion of black ink constant (*a* = *b* = *c*), so the stimuli are roughly equal in contrast. Stimulus *b* and Stimulus *a* are identical in complexity, with the features scrambled in Stimulus *b* so that they are not face-like. Thus if the children look at Stimulus a more than the other two stimuli, it shows that they are drawn to face-like stimuli and not stimuli that exhibit similar contrast or similar complexity.

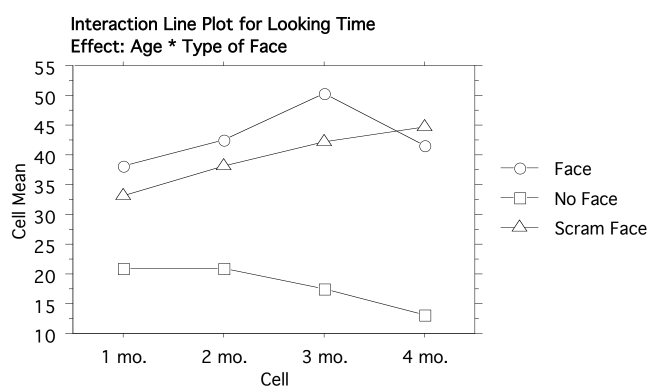
The DV is the amount of time (in seconds) that the children spend looking at the stimuli in a 2-min test. Complete the source table below and interpret the results of this study as completely as you can. [18 pts]

ANOVA Table for Looking Time

	DF	Sum of Squares	Mean Square	F-Value	P-Value	Lambda	Power
Age	3	286.067	95.356	47.284	<.0001	141.851	1.000
Type of Face	2	7349.033	3674.517	1822.074	<.0001	3644.149	1.000
Age * Type of Face	6	724.833	120.806	59.904	<.0001	359.421	1.000
Residual	48	96.800	2.017				

Means Table for Looking Time
Effect: Age * Type of Face

	Count	Mean	Std. Dev.	Std. Err.
1 mo., Face	5	38.000	1.581	.707
1 mo., No Face	5	20.800	1.924	.860
1 mo., Scram Face	5	33.000	1.581	.707
2 mo., Face	5	42.400	2.074	.927
2 mo., No Face	5	20.800	1.483	.663
2 mo., Scram Face	5	38.200	1.304	.583
3 mo., Face	5	50.400	1.673	.748
3 mo., No Face	5	17.600	.894	.400
3 mo., Scram Face	5	42.200	.837	.374
4 mo., Face	5	41.600	1.140	.510
4 mo., No Face	5	13.000	1.000	.447
4 mo., Scram Face	5	44.800	.837	.374



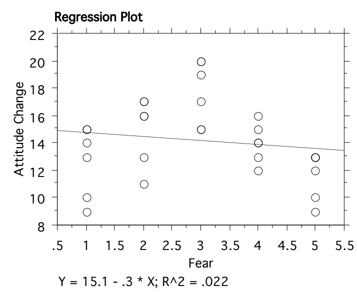
$F_{Max} = 4.3/.7 = 6.1$**, and** $\mathbf{F_{MaxCrit}}$ **= 51.4, so there is little concern about heterogeneity of variance and we would use** α **= .05 for the ANOVA. Thus, there is a significant interaction between Age and Type of Face, *F*(6,48) = 59.90, *MSE* = 2.017, *p* < .001. The main effects of Age and Type of Face were also significant, but we will focus our attention on the interaction. To interpret the interaction (seen in the graph above), I would compute**

$HSD = 4.87\sqrt{\frac{2}{5}} = 3.1$ **. Thus, it appears that for children aged 1, 2, and 3 months, Facial stimuli are preferred to Scrambled Faces and No Face stimuli. Scrambled Faces are preferred to No Faces. However, for 4-mo-old children Scrambled Faces are preferred to Facial Stimuli and No Faces, and Facial Stimuli are preferred to No Face stimuli. (Thus, there is an indication that these children to prefer more complex stimuli, but for the younger children there is a clear preference for looking at the Facial Stimuli. Can you come up with an explanation for why the older children might look longer at Scrambled Faces? N.B. These data are completely made up!)**

2. Some researchers, such as McGuire (1968), have studied the relationship between the amount of fear invoked in a persuasive message and the extent of attitude change. Suppose that you observed a set of results such as those seen below. Interpret the results as completely as you can. If a person had a Fear Score of 3, what would be your best estimate of that person's Attitude Change score? [5 pts]

Regression Summary
Attitude Change vs. Fear

Count	30
Num. Missing	0
R	.149
R Squared	.022
Adjusted R Squared	•
RMS Residual	2.924



ANOVA Table
Attitude Change vs. Fear

	DF	Sum of Squares	Mean Square	F-Value	P-Value
Regression	1	5.400	5.400	.632	.4335
Residual	28	239.400	8.550		
Total	29	244.800			

Regression Coefficients
Attitude Change vs. Fear

	Coefficient	Std. Error	Std. Coeff.	t-Value	P-Value
Intercept	15.100	1.252	15.100	12.061	<.0001
Fear	-.300	.377	-.149	-.795	.4335

First of all, you should note that there is not a significant linear relationship between the two variables, *r*(28) = .149, *p* = .434. However, if you look carefully at the scattergram, you'll notice that there does appear to be a fairly straightforward relationship between the two variables, but it's not a simple linear relationship. Thus, it appears that there is a fairly good positive linear relationship between Attitude Change and Fear Scores up to 3. For Fear Scores from 3-5, the Attitude Change Scores decrease, creating a negative linear relationship. You could either say that you could not predict the Attitude Score for a Fear Score of 3, given the lack of a significant linear relationship, or you could say that it would be somewhere around 18, but you'd need to compute a separate analysis to determine the value precisely.

3. In an attempt to determine the extent to which fear is an important tool in persuasive messages, Janis and Feshbach (1953) assigned high school students to one of four groups. The message was concerned with dental hygiene and degree of fear arousal was manipulated by the number and nature of consequences of improper care of teeth which were referred to (and shown in color slides); each message also contained factual messages about the causes of tooth decay and some advice about caring for teeth.

The *high fear* condition made 71 references to unpleasant effects, including toothache, painful treatment, and possible secondary diseases, including blindness and cancer; the *moderate fear* condition made 49 references and the *low fear* condition just 18. (Control participants heard a talk about the eye.)

After one week, the effectiveness of the persuasive communications was examined. Suppose that the DV was the extent to which the participants adopted better dental care behaviors (1 = adopted few, 10 = adopted many). Complete the source table below and interpret the results of this study. [15 pts]

ANOVA Table for Behav Adopted

	DF	Sum of Squares	Mean Square	F-Value	P-Value	Lambda	Power
Fear Condition	3	508.938	169.646	191.719	<.0001	575.156	1.000
Residual	76	67.250	.885				

Means Table for Behav Adopted
Effect: Fear Condition

	Count	Mean	Std. Dev.	Std. Err.
Control	20	2.150	.813	.182
High	20	2.800	1.056	.236
Low	20	5.850	.933	.209
Moderate	20	8.450	.945	.211

The first step in completing this ANOVA is to recall that the MS_{Error} (Residual) is the average of the separate group variances. StatView provides you with standard deviations, so you'd have to square the standard deviations to get the variances. The average of the four variances (.66, 1.11, .87, and .89) would be ~.88. With the completed source table, you would need to compute F_{Max} to determine the appropriate significance level. $F_{Max} = 1.11 / .66 = 1.68$**, and $F_{MaxCrit} = 3.29$, so there is no concern about heterogeneity of variance and we would use $\alpha = .05$. Thus, we would conclude that there is a significant effect of the Fear manipulation, $F(3,76) = 191.72$, $MSE = .885$, $p < .001$ (rejecting H_0). To determine which conditions differ, we would next compute a post hoc test,** $HSD = 3.72\sqrt{\frac{.885}{20}} = 0.78$ **. The High Fear and the Control conditions produced similar rates of adopting better dental behaviors, which were lower than the rates obtained with Moderate and Low Fear manipulations. The Moderate Fear manipulation also produced higher rates of adopting better dental care behaviors than the Low Fear manipulation.**

4. Dr. Alphonse Dente studies taste perception. In a recent study, he was interested in studying the impact of amount of salt added to a tomato sauce on ratings of the quality of the gustatory experience. He used three levels of salt (1 tablespoon per quart, 2 tablespoons per quart, and 3 tablespoons per quart). Other than the level of salt, the composition of the tomato sauce was identical. An equal amount of one sauce with one of the three salt levels was poured over spaghetti and served to each participant. Because Dr. Dente thought that the accompanying beverage might have an impact on the ratings of the food quality, one third of the participants for each level of salt consumed a beer along with their spaghetti, one third of the participants consumed a glass of wine, and one third of the participants consumed a glass of water. The dependent variable was a rating by each participant of the overall quality of the spaghetti using a 9-pt rating scale (1 = not so good and 9 = great). Complete the source table below and interpret the results of this study as completely as you can. [15 pts]

ANOVA Table for Rating

	DF	Sum of Squares	Mean Square	F-Value	P-Value	Lambda	Power
Salt	2	89.911	44.956	69.759	<.0001	139.517	1.000
Beverage	2	69.378	34.689	53.828	<.0001	107.655	1.000
Salt * Beverage	4	1.956	.489	.759	.5591	3.034	.216
Residual	36	23.200	.644				

Means Table for Rating
Effect: Salt

	Count	Mean	Std. Dev.	Std. Err.
1	15	7.400	1.242	.321
2	15	6.267	1.668	.431
3	15	4.000	1.558	.402

Means Table for Rating
Effect: Beverage

	Count	Mean	Std. Dev.	Std. Err.
Beer	15	6.800	1.521	.393
Water	15	4.133	1.767	.456
Wine	15	6.733	1.668	.431

The first step would be to compute $F_{Max} = {}^{1.0}\!/_{.33} = 3.33$**, which is lower than** $F_{MaxCrit}$**, which would be around 41, so there is no concern about heterogeneity of variance and we'd use** $\alpha = .05$**. Thus, we would conclude that there is no significant interaction between the two factors. However, there is a main effect for both Salt Level and for Beverage. To determine which of the conditions differed, we would need the condition means (provided above) and HSD.** $HSD = 3.46\sqrt{\frac{.64}{15}} = 0.71$ **for both effects. Thus, we could conclude that people rate the quality of the spaghetti as higher when it is accompanied by Wine or Beer (which don't differ) compared to Water. People also prefer the spaghetti when it has less salt. One tablespoon of salt in the sauce leads to a preference over two and three tablespoons of salt. And two tablespoons leads to a sauce such that the spaghetti is rated higher than when three tablespoons are used. You should also note that a 0 Salt control group would make a lot of sense.**

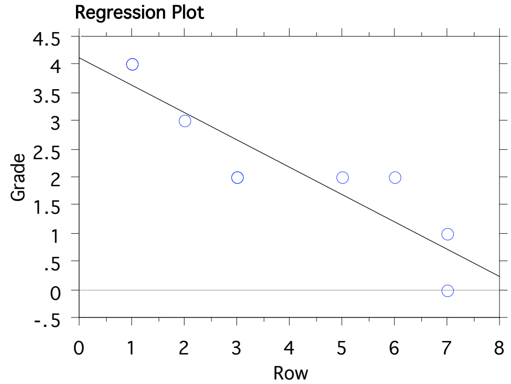
5. Have you ever wondered if there is a relationship between where people tend to sit in a classroom and their performance in the class? Suppose that I decided to investigate this tendency by looking at the row in which a student sat and the student's grade in the course (A=4, B=3, etc.). The data from a sample of students from an introductory psychology class are seen below. Interpret these data as completely as you can. [15 pts]

Student	Row	Grade	XY
1	3	2	6
2	1	4	4
3	6	2	12
4	2	3	6
5	7	1	7
6	1	4	4
7	3	2	6
8	5	2	10
9	7	0	0
ΣX	35	20	55
ΣX^2	183	58	

Regression Summary
Grade vs. Row

Count	9
Num. Missing	0
R	.903
R Squared	.816
Adjusted R Squared	.790
RMS Residual	.596

Regression Plot



Y = 4.111 - .486 * X; R^2 = .816

ANOVA Table
Grade vs. Row

	DF	Sum of Squares	Mean Square	F-Value	P-Value
Regression	1	11.065	11.065	31.100	.0008
Residual	7	2.491	.356		
Total	8	13.556			

Regression Coefficients
Grade vs. Row

	Coefficient	Std. Error	Std. Coeff.	t-Value	P-Value
Intercept	4.111	.393	4.111	10.467	<.0001
Row	-.486	.087	-.903	-5.577	.0008

There is a significant negative linear relationship between Grade and Row, *r*(7) = -.90, *p* = .001. By hand, you would get $SP = 55 - \frac{35 \times 20}{9} = -22.78$**,** $SS_X = 183 - \frac{35^2}{9} = 46.88$**, and** $SS_Y = 58 - \frac{20^2}{9} = 13.56$**.**

6. Suppose that you are interested in the relationship between the time spent studying and the time it takes a person to complete an exam. You collect these data from 11 students and find that the coefficient of determination (r^2) is .81. Are you justified in computing the regression equation for prediction? Assuming that you are, and given the information from the students seen below, compute the regression equation to predict the time to complete an exam (Y) from the number of hours spent studying (X). (Hint: Think about the formula for r…you will be able to get to SP with the information you have here.) [15 pts]

	Hours Studying (X)	**Minutes to Complete Exam (Y)**
Mean	5	50
Variance	.2	7.2
SS	2	72
Sum	55	550

With r^2 = .81, you know that r = .9 or r = -.9. With n = 11, $r_{Crit}(9)$ = .602, so you would reject H_0: ρ = 0. Thus, you are completely justified in determining a regression equation, given the significant linear relationship. It might be more logical for the relationship to be negative (those who study more take less time to complete the exam), but we can't really tell from the data we're provided. But we can solve for either possibility for SP:

$r = \pm.90 = \frac{SP}{\sqrt{2 \times 72}} = \frac{SP}{12}$**, so SP = 10.8 or –10.8.**

If the relationship is negative, the regression equation would be $\hat{Y} = -5.4X + 77$**. If the relationship is positive, the regression equation would be** $\hat{Y} = 5.4X + 23$**.**

7. An educational psychologist is studying student motivation in an elementary school in Florida. A sample of special students is followed over three years from fourth grade to sixth grade. Each year the students complete a questionnaire measuring their motivation and enthusiasm for school, with higher numbers indicating greater motivation. The psychologist would like to know whether there are significant changes in motivation across the three grade levels. The data from this study are as follows:

Student	**Fourth Grade**	**Fifth Grade**	**Sixth Grade**	**P**
M. Mouse	4	3	1	8
E. Fudd	8	6	4	18
D. Duck	5	3	3	11
B. Bunny	7	4	2	13
J. Cricket	6	4	0	10
ΣX (T)	30	20	10	60
SS	10.0	6.0	10.0	

Analyze the results of this study as completely as you can. [15 pts]

ANOVA Table for Grade

	DF	Sum of Squares	Mean Square	F-Value	P-Value	Lambda	Power
Subject	4	19.333	4.833				
Category for Grade	2	40.000	20.000	24.000	.0004	48.000	1.000
Category for Grade * Subject	8	6.667	.833				

Means Table for Grade
Effect: Category for Grade

	Count	Mean	Std. Dev.	Std. Err.
Fourth	5	6.000	1.581	.707
Fifth	5	4.000	1.225	.548
Sixth	5	2.000	1.581	.707

$$SS_{Subject} = \frac{778}{3} - \frac{60^2}{15} = 19.3$$

$$SS_{Grade} = \frac{30^2 + 20^2 + 10^2}{5} - \frac{60^2}{15} = 40$$

$$SS_{Total} = 306 - \frac{60^2}{15} = 66$$

There is a significant difference among the three grades, *F*(2,8) = 24.0, *MSE* = .83, *p* < .001. To determine which grades differ, you would need to compute Tukey's HSD:

$$HSD = 4.04\sqrt{\frac{.83}{5}} = 1.66$$

Thus motivation decreases with each increase in grade level. Children in Fourth Grade have more motivation (*M* = 6) than children in Fifth (*M* = 4) or Sixth grade (*M* = 2). Children in Fifth grade have more motivation than children in Sixth grade.