

## Chapter 14: Two-Way Analysis of Variance

Statistics is the art of never having to say you're wrong  
and never having to say you're certain. ~~ author unknown

### Learning Objectives

Upon completion of this chapter, students should know

- When to use a two-way analysis of variance test.
- How variation (variance estimates) is partitioned between and within groups when there is more than one independent variable.
- How to compute and interpret main effects and interactions.
- How to graph interactions.
- How to compute and interpret standard scores.

### Key Terms

**Factorial experiment** is an experiment that has two or more independent variables. This design also examines the effects of the combination of the two independent variables on the dependent variable.

A **main effect** is the effect of one independent variable on the dependent variable.

An **interaction** is the effect of the combination of the two independent variables on the dependent variable. The cell means of the interaction are graphed to illustrate the interaction.

### Lecture and Demonstration Aids

The two-way analysis of variance adds an additional variable to the analyses and the interaction of the two variables. Students tend to do fine with the long computations of the two-way is tedious although computational errors occur. Practice, practice, and more practice helps. Graphing the cell means and interpreting interaction from the graph, seems to be very helpful.

**Hair Color & Cosmetic Use.** Use the dataset shown on Handout 14-A to introduce students to the two-way analysis of variance. This is a partial dataset from Kyle and Mahler's (1986) study examining hair color and perception of ability. Participants were randomly assigned to review a job resume with a photograph of

a woman depicted with either brown or blond hair and with or without cosmetics. Participants evaluated the capability of the applicant relative to an accounting position on a scale of 1 to 7 (1 = not capable and 7 = very capable). (Note: There were other conditions in the other study, but for simplification purposes, these were not included.) The solution is shown on Transparency 14-3. Note: As in the original study, there were no significant interactions between hair color and cosmetic condition on perception of ability.

### **Active-Learning Activities**

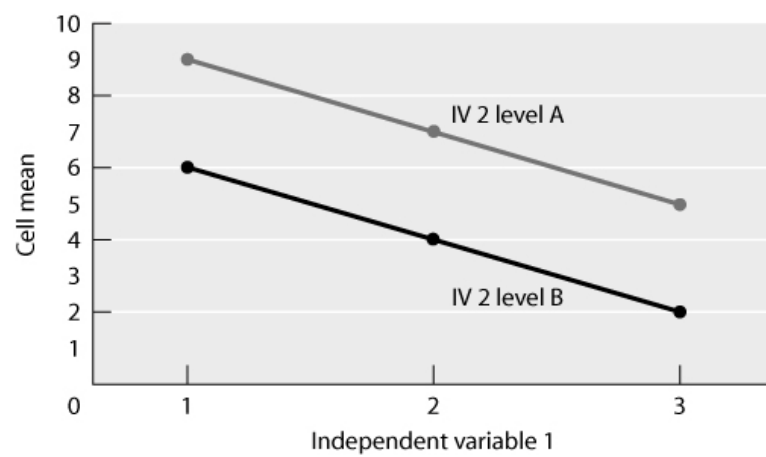
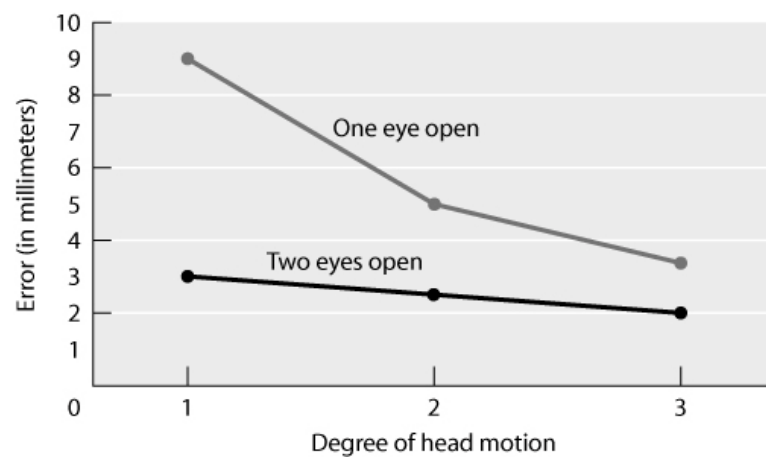
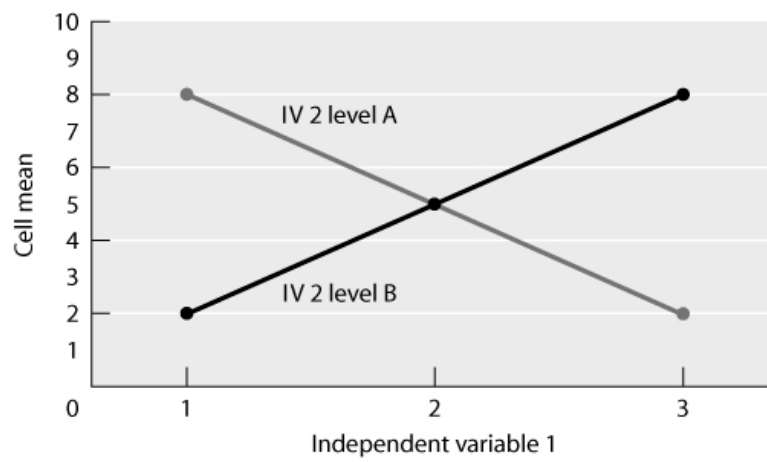
**Datasets.** Have students either individually or in groups, analyze one of the datasets available in the Instructor's area of the text website. This give student the extra experience of new data in a somewhat different format. The Internet and Cyber Sex study has a number of variables and should be interesting to students.

#### **References:**

Kyle, D. J., & Mahler, H. I. M. (1996). The effects of hair color and cosmetic use on perception of a female's ability. *Psychology of Women Quarterly*, 20, 447-458.

Handout 14-A.**Hair Color and Cosmetic Data****IV: Hair Color: Brunette, Blonde****IV: Cosmetics: With, Without****DV: Perceived Capability**

Brunette	With Cosmetics	5.400
Brunette	With Cosmetics	5.800
Brunette	With Cosmetics	3.500
Brunette	With Cosmetics	1.700
Brunette	With Cosmetics	2.600
Brunette	With Cosmetics	4.100
Brunette	Without Cosmetics	6.000
Brunette	Without Cosmetics	6.200
Brunette	Without Cosmetics	7.000
Brunette	Without Cosmetics	6.500
Brunette	Without Cosmetics	5.900
Brunette	Without Cosmetics	6.400
Blonde	With Cosmetics	3.500
Blonde	With Cosmetics	1.800
Blonde	With Cosmetics	3.700
Blonde	With Cosmetics	3.800
Blonde	With Cosmetics	2.100
Blonde	With Cosmetics	3.000
Blonde	Without Cosmetics	3.000
Blonde	Without Cosmetics	5.200
Blonde	Without Cosmetics	4.300
Blonde	Without Cosmetics	3.800
Blonde	Without Cosmetics	4.200
Blonde	Without Cosmetics	6.100

Transparency 14-1.**Interactions**

Transparency 14-3.

## Results of Hair Color & Cosmetic Study

Source Table

Source	Sums of Squares	<i>df</i>	Mean Square	<i>F</i>	<i>p</i>
ROWS(Hair Color)	11.482	1	11.482	10.032	< .05
Col (Cosmetics)	23.207	1	23.207	20.277	<.05
Interaction	1.602	1	1.399	.251	>.05
Within	22.890	20	1.144		
Total	59.180	23			

Condition	Means	Standard Deviation
Brunette With Cosmetics	3.85	1.566
Brunette Without Cosmetics	6.333	.398
Blond With Cosmetics	2.983	.852
Blond Without Cosmetics	4.433	1.086