

Homework Assignment 2

1. How is it possible that the simple effect of Factor A at level b1 could be significant, and the simple effect of Factor A at b2 not significant, and yet have the AxB interaction not be significant? What would this mean? If this happened in your data, what should you conclude? Draw a sample graph of data to illustrate your explanation.

Describing results in prose (without statistical tests):

Loosely based on: Rubin, Donald L. (1992). Nonlanguage factors affecting undergraduates' judgments of nonnative English-speaking teaching assistants. *Research in Higher Education*, 33:511-531.

Rubin is interested in what factors affect how well undergraduate students in college courses understand their instructors' speech, apart from how clear the instructor's speech actually is. As many of you know, undergraduates at American universities frequently complain that their international TA doesn't speak English well, and blame their low grades on the TA's English rather than on their own failure to study. This seems to be particularly prevalent for math and hard science courses. Rubin sought to determine whether the instructor's ethnicity influences how foreign-accented the students think the instructor's speech is, and how well the students understand a lecture.

Rubin recorded a monolingual native English speaker reading a hard-science passage and a humanities passage out loud. Rubin played the recordings to groups of undergraduate students. Rubin showed the students a photo of either a Caucasian woman or an Asian woman while the recording played, and told the students the person in the photo was the lecturer. The students took a comprehension test after hearing the recording. Furthermore, there were two kinds of students: students who rate themselves as highly motivated to learn in their classes, and those who rate themselves as having average motivation.

The dependent variable is the score on the comprehension test, in points. There are three independent variables: ethnicity of the photo (the supposed instructor, levels are Caucasian and Asian), topic of the lecture (science, humanities), and motivation (high, average). Data, averaged over all students in each condition, appears below. Assume that a difference of 2 or more points between conditions is meaningful (=likely to be significant when tested), but that a difference of 1 point or less is not. The factor of most interest here is what ethnicity the students think the instructor has (the photo ethnicity factor).

Number of points on comprehension test in each condition

Average-motivation students	Humanities	Hard Science
Asian photo	9.9	7.3
Caucasian photo	11.9	12.5

Highly motivated students	Humanities	Hard Science
Asian photo	15.1	15.2
Caucasian photo	17.2	17.5

[Note: this result should be truly frightening, and half of it is real data!]

2. Is there a 3-way interaction? How can you tell?
3. What sources will be tested for statistical significance in the overall ANOVA?
4. Give a description of the pattern of results. You may want to discuss main effects and/or simple effects, as well as two-way interactions and/or the three-way interaction, in your description. That is, describe any effect that seems to be interesting in order to give a good picture of what's happening in the data. (You will probably want to draw bar graphs.) I suggest focusing on the effect of photo ethnicity (=perceived instructor ethnicity), since the primary question is about that.
5. If the 3-way interaction of photo ethnicity x topic x motivation is significant, what should the researcher do next?
6. What if it is not, and the only 2-way interaction that is significant is the photo ethnicity x topic interaction?

Recognizing what type of effect is being described

Very loosely based on: Zesiger, P. et al. 2010. The acquisition of pronouns by French children: A parallel study of production and comprehension. Applied Psycholinguistics 31: 571-603.

For ease of understanding, I'm going to convert this study to English instead of French. The real study is very interesting, though.

Zesiger et al. are interested in how children learn to understand the gender and syntactic structure of pronouns. They use pictures and little stories showing a father putting a blanket on a child, and then a researcher says something like "What is Papa doing to Pierre? (male name)" and a puppet answers "He's covering her." or "She's covering him." Notice that in both cases, the gender of a pronoun is wrong (the object pronoun in the first case, the subject pronoun in the second case). The correct answer for some items is feminine instead (e.g. "What is Mama doing to Sophie?" "She's covering him."/"He's covering her."). The subjects, children of age 4, age 5, or age 6, are told that the puppet is just learning to talk and sometimes says things wrong, and that they should help the puppet learn to talk by telling it how to say things right when it says

something wrong. Each child hears several items (stories/incorrect sentences) for a condition. The dependent variable is what percentage of the puppet's incorrect sentences the child corrects. Sometimes the kids don't notice the puppet's error, and don't correct it, but often, they do.

The average results (percent of items corrected) are as follows. Assume that a difference of 5 or 10% is meaningful (=likely to be significant when tested), but that a difference of 1 or 2% is not.

4-year-olds	subject pronoun wrong	object pronoun wrong
masculine would be correct	31	30
feminine would be correct	20	21

5-year-olds	subject pronoun wrong	object pronoun wrong
masculine would be correct	69	51
feminine would be correct	50	40

6-year-olds	subject pronoun wrong	object pronoun wrong
masculine would be correct	92	60
feminine would be correct	60	49

7. What type of design is this (how many by how many)? What are the factors and their levels?

For each of the following statements describing the effects in this (made-up) dataset, state what statistical effect it is describing. That is, is the statement describing a main effect (of which factor?), a two-way interaction (of which factors, averaged across which factor), a two-way interaction (of which factors, at a particular level of the third, split factor separately), the three-way interaction, a simple effect (of which factor, at what levels of the other factors), or what?

8. Children correct subject pronouns more often than object pronouns, except for 4-year-olds, who correct them equally often.
9. Older children correct pronouns more often than younger children.
10. Children correct pronouns that should have been masculine more often than pronouns that should have been feminine.
11. However (continuing from point 3), this effect (greater correction of supposed-to-be-masculine pronouns) is stronger for older children correcting subject pronouns, but remains constant across ages when children are correcting object pronouns.
12. 6-year-olds correcting pronouns that should have been masculine correct more subject pronouns than object pronouns. (We probably wouldn't actually say this in describing the results, but figure out what type of effect it is anyway.)
13. If the correct pronoun would be feminine, 4-year-olds do not differ in how often they correct subject vs. object pronouns, but older children are more likely to correct subject pronouns. (We probably wouldn't say this in describing the results either.)