Hands On 7 – Instructions
Main Effects and Interactions

In this assignment, you will gain familiarity with factorial experimental designs and discerning their main effects and interactions. In Part II, you will also practice using Excel formulas. You are welcome to work together with other student(s) on this assignment, but each of you should do your own work and upload your own document.

Part I: Practice identifying main effects and interactions (optional, but strongly encouraged)

1. From the Hands On 7 folder, download the "Practice - Main Effects + Interactions" document. (If the formatting looks weird on the Word doc, there is also a PDF.)

2. Inspect the bar and line graphs in each row, as well as the example experiment given that would generate these results. The bar and line plots depict the same results in two different formats. In the "Effects Observed" column, determine whether the graphs show a main effect of IV A (yes or no), a main effect of IV B (yes or no), and/or an interaction (yes or no).

3. Check your answers in the "Practice - Main Effects + Interactions - ANSWERS" document, which is also in the Hands On 7 folder. This document also includes lots of example interpretations of main effects and interactions, which may come in handy as a model when subsequent questions in this assignment ask you to briefly interpret main effects and interactions.

4. Confused? Unsure? Reach out to Prof. Turetsky or Jullia for help before proceeding to the rest of the assignment. Main effects and interactions can be very confusing at first, so the point of this step is to gain practice and check your understanding in a low-stakes, ungraded way.

Part II: Interpret the results of a factorial version of the notetaking experiment (Problem 1 in Questions document)

5. Download the "Hands On 7 - Questions" document and the "Notetaking Experiment Mock Data - Factorial.xlsx" spreadsheet. Open the spreadsheet in either Google Sheets or Excel.

   This spreadsheet imagines what the results of the Notetaking Experiment would have been if we had collected data from both younger people (Generation Z) and older people (Boomers). Column A shows which condition participants were randomly assigned to (writing their notes by hand vs. typing their notes on the computer). Column B shows participants' generation. Column C shows participants' scores on the memory test after the distractor task. The table highlighted in blue shows the total number of participants in each cell, as well as

how many participants total were assigned to write vs. type their notes and how many participants were Gen Z vs. Boomer.

6. First, we will determine whether there is a main effect of notetaking format. To do that, we need to **calculate the mean memory test scores for everyone in the writing condition and everyone in the typing condition, *regardless of what generation they were***. We will use Excel's "AVERAGEIF" function.

   In cell F12, copy-paste or type the formula:

   =AVERAGEIF(A2:A114, "write", C2:C114)

   This formula calculates the average of the memory test scores (in column C) among those who were in the writing condition (i.e., when column A says "write"). Literally, it is telling Excel to find all the cells A2 through A114 that say "write" and take the average of those rows' values in column C.

   Enter the same formula into cell F13, but change "write" to "type" in order to calculate the average memory test score for participants in the typing condition.

   → Complete #1-2 in the Hands On 7 Questions document.

7. Second, we will determine whether there is a main effect of generation. To do this, we will **calculate the mean memory test scores for every Gen Z participant and every Boomer participant, *regardless of what their notetaking format was***.

   In cell F15, copy-paste or type the formula:

   =AVERAGEIF(B2:B114, "Gen Z", C2:C114)

   This formula calculates the average of the memory test scores (in column C) among Gen Z participants (i.e., when column B says "Gen Z").

   Enter the same formula into cell F16, but change "Gen Z" to "Boomer" in order to calculate the average memory test score for Boomer participants.

   → Complete #3-4 in the Hands On 7 Questions document.

8. Next, we will calculate the means of each of the four unique cells (Gen Z who wrote notes, Boomers who wrote notes, Gen Z who typed notes, and Boomers who typed notes). We will use the "AVERAGEIFS" function.

   In cell F19, copy-paste or type the formula:

   =AVERAGEIFS(C2:C114, A2:A114, "write", B2:B114, "Gen Z")

This formula calculates the average of the memory test scores (in column C) among those who were in the writing condition (column A says “write”) and whose generation is Gen Z (column B says “Gen Z”).

Enter the same formula into cells F20, G19, and G20, changing “write” to “type” and “Gen Z” to “Boomer” as necessary based on the cell you are calculating the mean for.

→ Complete #5 in the Hands On 7 Questions document.

9. Finally, let’s calculate the effect of typing (vs. writing) separately among Gen Z participants and among Boomer participants.

   In cell H19, copy-paste or type the formula:

   = G19 - F19

   This is the average effect of typing among Gen Z participants (the mean memory score of Gen Z participants who typed their notes minus the mean memory score of Gen Z participants who wrote their notes – a negative difference means participants scored worse after typing their notes than writing their notes).

   In cell H20, copy-paste or type the formula:

   = G20 - F20

   This is the average effect of typing among Boomer participants (the mean memory score of Boomer participants who typed their notes minus the mean memory score of Boomer participants who wrote their notes).

→ Complete #6-8 in the Hands On 7 Questions document.

Part III: Interpret main effects and interactions from a bar graph (Problem 2 in Questions document)

Problem 2 is self-contained in the Hands On 7 Questions document. It uses a real research study recently published in *Nature* to give you practice interpreting main effects and interactions from a bar graph.

→ Complete #9-13 in the Hands On 7 Questions document.

Part IV: Design your own factorial experiment (Problem 3 in the Questions document)

In Problem 3, you will propose your own 2 x 2 factorial experiment using two independent variables and one dependent variable of your choice. At least one of

the independent variables should be a true IV so that it is an experiment – the other can be a true IV or a pseudo-IV (your choice).

Once you think of the two IVs and DV (make sure to fully operationalize these variables), think about whether you would hypothesize main effects of each IV and/or an interaction between the IVs if you actually ran this experiment. Based on your hypotheses, you will use a table format to record your predicted results.

For example, if my two IVs are social media use and social media platform, I might fill out the table like this:

DV: Self-esteem scale (self-reported from 0-5)		**IV 1: Social media use**	
		5 minutes per day	**1 hour per day**
IV 2: Platform	**Instagram**	4	2
	Twitter	4	4

Here, I am predicting:

- **A main effect of platform** *(I predict self-esteem will be lower on average among people who used Instagram than among those who used Twitter, because I think Instagram involves more social comparison than Twitter)*
- **A main effect of social media use** *(I predict self-esteem will be lower on average among people who used social media for 1 hour per day than among people who used social media for 5 minutes per day, because using social media for a longer time offers more social comparison opportunities)*
- **And a platform x social media use interaction** *(I predict that the effect of social media use will depend on the platform used; time spent on social media will not affect self-esteem among people using Twitter because spending more time on Twitter will not increase social comparison opportunities much, but spending 1 hour per day on Instagram will reduce self-esteem relative to spending 5 minutes per day on Instagram because the longer time will result in many more social comparison opportunities)*

If you don't have an idea for your experiment, you can turn one of the single-IV studies from class into a factorial design by adding a second IV (true or pseudo):

- Effect of acting introverted vs. extraverted for one week on mood
- Effect of sharing vs. not sharing an experience on liking of the experience
- Effect of social media use on mental health **(if you choose this, your other variable cannot be platform – choose a new variable)**
- Effect of presence vs. absence of an audience on sports performance (if you choose this, your other variable cannot be cheering – choose a new variable)

→ Complete #14-17 in the Hands On 7 Questions document.
→ When you are done, upload the Hands On 7 Questions document. You do not need to upload any other file.