Two-way ANVOA

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| Question | Answer |
| 1. What is your name? | Jacqueline Kent-Marvick |
| 1. When conducting statistical analyses,   we should always keep in mind the larger  context in which we are working with  data. What are steps in the research  process which are completed before we  analyze data? (Hint: This was on the week  1 assignment.) | Generate research questions  Generate research hypotheses  Determine study design, variables, levels of  measurement  Collect data |
| 2. Data needs to be examined and any  problems fixed before analyses can be  done. In statistics, what are 4 main  areas to examine as part of pre-analysis  checking? (Hint: This was on the week 2  assignment.) | 1. a. Data accuracy 2. b. Missing data 3. c. Outliers 4. d. Statistical assumptions |
| 3.What are important steps to  complete when checking data  accuracy? (Hint: This was on the  week 2 assignment.) | a. Make sure the data types are correct.   1. What is measurement of each variable?   b. Check the data for typos.  i. i.e. mailes for males, feemales for females  c. Check the data for nonsensical values.  i. i.e. 1000 year old people, BMI of 500  d. Check categories make sense.  i. i.e. variable is gender but has a category of blue  e. Correct problems if possible or omit the data from the analyses.  i. Use filtering to select the desired data and leave out the data not desired      f. Reverse code instrument items if needed.  i. Make sure to do needed recoding before calculating summary scores.  g. Calculate summary scores for any instruments that need it.  i. Make sure to use instrument scoring methods recommended by the  instrument developer.  h. Keep track of what you do so you can report it as part of the analysis steps you completed. (Be transparent. completed.  i. Make notes as you complete analysis steps. Keep the code you used with the output. |
| 5. Add needed modules to  Jamovi. | We're going to use some of the Jamovi modules. We need to install them first if they're not already installed.  Click on the Jamovi Modules icon on the right-hand side of the Jamovi window.  (It looks like a large plus (+) sign in the current version.) Install the following modules:   1. Statkat – Method selection tool 2. moretests 3. Jsq – Bayesian Methods 4. Walrus |
| 6. Open the Goggles.sav dataset in Jamovi.  (Note any difficulties.) | a. A note about the Goggles.sav dataset. I love Field’s explanation of ANOVA. But I don’t care much for this  dataset for this example. I personally would classify the Attractiveness variable as ordinal level of  measurement which is not really appropriate for the dependent variable in ANOVA. Go ahead and use  Attractiveness as a continuous variable for purpose of this assignment, but if you ever see a rating variable  like this with only 10 levels somewhere else in this class, I would call it ordinal. |
| 7.What are the variables in the dataset and the  level of measurement for each one?  Make sure the level of measurement for each  variable is correct in Jamovi.  \*  The Attractiveness variable is an example of the  gray area sometimes encountered between  ordinal level of measurement and interval level  of measurement. I would normally call a  10-point scale ordinal level of measurement.  Field went ahead and used this as a continuous  variable for an ANOVA example. I would not  have done that. To work this example in  Jamovi, you’ll need to label Attractiveness as a  continuous variable. | FaceType: Nominal; Alcohol: Ordinal; Attractiveness (should be ordinal); Continuous. |
| 8.Check the dataset for accuracy using visual  inspection, descriptive statistics, and plots.  Note any problems. What descriptive statistics  and plots should be used for each variable?  (Treat Attractiveness as a continuous variable.) | For the nominal variables of FaceType and Alcohol we will use bar plots, frequencies and percent.  For the “continuous” dependent variable of Attractiveness we will use histograms, box plots, m(sd) and sd |
| 9.How can you get descriptive statistics for each  group separately in Jamovi? \* You have 2  grouping variables. Should you look at  Attractiveness split by groups using FaceType  and Alcohol together or Attractiveness split by  FaceType and Attractiveness split by Alcohol  separately? | Jamovi - Analyses - Exploration - Descriptives - enter a categorical variable into the Split by box |
| 10. Choose the correct statistical test. One of the  challenges of conducting a statistical analysis is  choosing the correct test to perform. Jamovi  provides some help knowing what statistical  analyses are possible given your data. Try it out.  Jamovi – Analysis – Statkat – Relationships,  Prediction, and Group Comparison. Put the  categorical variables in the Independent  Variables box. Put a continuous variable in  the Dependent Variables box. | 1. What test does Statkat in Jamovi recommend? Two-way ANOVA |
| 11. NHST steps. Different statistical texts list  the steps for NHST slightly differently. But  most contain some variation of the following  steps (Hint – This was discussed in the week 5  assignment.): | 1. State the null and alternative hypotheses. 2. Set the criterion for rejections (alpha level). 3. Calculate the test statistic. 4. Draw conclusion about the null hypothesis. 5. Report the results. |
| 12.What are the assumptions for a two-way  ANOVA? Does our data meet those  assumptions? | observations are independent: **Known from the study design**;  Sampling distribution normally distributed within each group: **Histogram for each group;**  homogeneity of variance: **Levene’s test**  Our data meets those assumptions |
| 13.What are the null and alternative hypotheses  for the two-way ANOVA? \* Note: There is a  null and alternative for each main effect and the  interaction.  From Navarro, page 364: H0: row means are the  Same  H1: at least one row mean is different | 1. H\_0 (null) main effect 1: 2. H\_1 (alternative) main effect 1: 3. H\_0 (null) main effect 2: 4. H\_1 (alternative) main effect 2: 5. H\_0 (null) interaction effect: 6. H\_1 (alternative) interaction effect: |
| 14. What is the criteria for rejection? There  are situations where you may want to use a  different alpha level than alpha = .05. If you're  doing pilot studies you're mostly looking for  trends and possibilities. The alpha level may be  relaxed to alpha = .10. If you're doing something  like drug studies where there could be negative  consequences for false positives the alpha level  may be reduced to alpha = .01. We're going to  stick to alpha = .05 for class exercises. | 1. a. alpha = 0.05 |
| 15. What is the advantage of conducting a  two-way ANOVA instead of conducting two  one-way ANOVA tests using each grouping  variable separately? | The main advantage of two-way ANOVA over one-way ANOVA is you can test if there's an interaction between the two independent variables. |
| 16.What effect size for ANOVA does Field  12.10 and Navarro & Foxcroft 13.4 recommend  for ANOVA? | Omega squared |
| 17. Calculate the two-way ANOVA to assess  the main effect of FaceType and the main effect  of Alcohol and the interaction on the outcome  Attractiveness. Jamovi - Analyses - ANOVA –  ANOVA. \* Move Attractiveness to the  Dependent Variables box. \* Move FaceType  and Alcohol to the Fixed Factors box. \*  Check omega under effect size. \* Check  everything under Assumption checks  \*  Check Tukey and Cohen’s d under Post-hoc  tests. | 1. Look at the Reporting one-way ANOVA section in Field 12.11 2. What information did Field include in the section reporting the results for the one-way   ANOVA? Sum of squares, df, mean square, F, sig., Bayes Factor   1. F = 15.58 (FaceType); 6.04 (Alcohol); 8.51 (FaceType \* Alcohol) 2. degrees of freedom = 1 (FaceType); 2 (Alcohol); 2 (FaceType \* Alcohol) 3. p = <0.001 (FaceType); 0.005 (Alcohol); <0.001 (FaceType \* Alcohol) 4. effect size omega squared = 0.166 (FaceType); 0.115 (Alcohol); 0.171 (FaceType \* Alcohol) 5. Which groups had a significant difference between means in post-hoc tests? Alcohol High   Dose; Unattractive/attractive   1. Which group had the highest happiness? (Not sure how to answer this one). |
| 18. Levene’s test | 1. Was Levene’s test significant? No 2. Did we pass the homogeneity of variance assumption? Yes |
| 19. What is your decision about the  null hypothesis? \*  Do you reject or fail to reject the  null? | * 1. Interaction decision: Yes   2. Main effect FaceType decision: Yes   3. Main Effect Alcohol decision: Yes |
| 20. When conducting a two-way ANOVA, the  result of the interaction determines what  follow-up analyses should be conducted. If the  interaction is significant then follow-up analyses  should focus on how groups behave differently.  If the interaction is not significant, then regular  post-hoc comparisons should be conducted for  each independent variable separately. You  should always interpret the interaction first  before looking at the main effect of each  variable separately because that is how you  decide what post-hoc analyses to report. | * 1. Is the interaction significant or not significant in this analysis? Significant.   2. In this analysis, should post hoc analyses look at interaction differences or post hoc tests for   each main effect variable separately? Interaction differences. |
| 21.When the interaction between independent  variables is significant in two-way ANOVA,  examining plots of the independent variables on  the outcome variable is the easiest way to see  how groups differ. Sometimes these plots can  be difficult to interpret. Creating interaction  plots using the independent variables in  different order sometimes helps to create a plot  which is easier to understand. \* Interaction  plots can be created in the Estimated Marginal  Means dropdown. We’re going to create two  plots, one plot which puts FaceType first in the  interaction, and one plot which puts Alcohol  first in the interaction. | * 1. a. Create plot 1: In the Estimated Marginal Means dropdown, select FaceType and move it to the Term 1   2. section in the Marginal Means box. Select Alcohol and move it to the Term 1 section. You should see a plot   3. which puts FaceType on the X axis and puts Alcohol groups in separate lines.   4. b. Create plot 2: Create a new line to make a different interaction plot by clicking the blue Add New Term   5. button in the Marginal Means box. Click on Alcohol and move it to the Term 2 box. Click on FaceType and   6. move it to the Term 2 box. You should see a second plot which puts Alcohol on the X axis and splits members   7. of the FaceType groups into separate lines.   8. c. Interpret a plot: Significant interactions will show lines that have different slopes. (One line may go up as the   9. other goes down, One line may have a shallow slope while the other has a steep slope. Significant interactions   10. often have lines that cross each other, or diverge from each other.) Non-significant interactions will show lines   11. where the slopes are about the same. (The lines look parallel to each other.)   12. d. Describe the difference: Analyzing the interaction mostly consists of describing the pattern in how the lines   13. differ in the plot. To me, the easiest plot to interpret is the second one with FaceType on separate lines. In the   14. Unattractive group, the rating for Attractiveness goes up as the dose of alcohol goes up. But, for the Attractive   15. group, the rating for Attractiveness stays about the same (even drops a little) as the dose of alcohol goes up.   16. The point is the groups reacted differently to increased doses of alcohol. |
| 22. Run the code in the included R markdown  (.Rmd). | * 1. Compare the output from the lm() function in R with the output from the linReg()   function in the jmv package and the output in Jamovi. Do the values match?   * 1. What values does Jamovi provide that you need to calculate separately in the lm() function?   2. Jamovi makes doing linear regression with categorical variables pretty easy.   Here’s a nice post <https://mattchoward.com/dummy-coded-regression-in-jamovi/> |
| 23.Save your Jamovi (.omv) file. You will turn  it in. |  |
| 24. After you finished reading through the  .Rmd file. Knit the file to markdown and save  the .md file. You will turn the file in as part of  your assignment. Describe any difficulties.  If you encounter errors close all instances of  RStudio and try opening it again. (Don’t save  your workspace.) If you encounter errors while  creating the file and can’t figure out how to fix  them before the assignment is due. You can  paste the text of the .Rmd file with the output  into a Word or pdf file and turn in that. |  |
| 25.What did you like/dislike about this  assignment? |  |
| 26. How would you change this assignment to  make it better for future students? | Item 17 on this worksheet wasn’t updated for this assignment. |
| 27. Complete the answer submission in Canvas  and turn in your RStudio and Jamovi files.  (The answer submission in Canvas allows  multiple attempts. You may want to save the  text you provide in open responses like the two  questions above so you can just paste it into the  answer field if you make additional attempts to  improve your score.) |  |