Chapter 4 Post Hoc Comparisons

1. Just running an ANOVA is not the final answer:
   1. ANOVAs only tell if you if there is a difference in one of the means from the others. You have to do something after a significant F test to determine what is actually going on.
2. Need for analytical comparisons
   1. Analytical comparison – comparison between two or more treatment means that are part of a larger design
   2. Planned comparisons – running comparisons between two means in a larger design because of the specific hypothesis (sometimes run instead of an F test, sometimes run with specific questions)
   3. Back to the Math SSa
      1. SSa = the deviations from the grand mean
      2. What this does is also average the differences between all 2 way comparisons of the means
   4. Omnibus/overall F = the average difference between means
      1. But the good thing about that is after saying the overall is significant, we can break it down.
   5. Planned comparisons take 2 – usually you start a research experiment with an idea…however the hypothesis set up for ANOVA is vague (on purpose). After a significant F test, now you go about to test the specific hypotheses.
3. Example of planned comparisons (usually for complex designs where you know what you want to compare and the rest is controlled, but you don’t care to test them against each other).
   1. Give example of research design (at least two by two).
   2. QWERTY example:

|  |  |  |
| --- | --- | --- |
|  | Right Hand | Left Hand |
| Real Words | A | B |
| Fake Words | C | D |

* + 1. Show all ways you can compare

1. Comparisons among treatment means (go back to the original QWERTY data)
   1. Pairwise comparisons – comparisons that pit one group against another.
   2. Example hypothesis for QWERTY
      1. Are right handed words liked more than left handed words?
         1. Ho = right = left (u1 – u2 = 0)
      2. Are right handed words liked more than equal words?
         1. Ho = right = equal
      3. Are left handed words liked more than equal words?
         1. Ho = left = equal
      4. Are equal words liked more than either handed words?
         1. Ho = equal = (right+left)/2
   3. The last one is a complex comparison – where you are grouping means together (i.e. it’s more than one mean compared to one)
   4. Basically you will take these questions and do “mini experiments” and test each hypothesis individually = single df comparisons
      1. Meaning the SSa between subjects df = 1 because you have two groups – 1
      2. Usually you do not run them as ANOVAs, but it’s kind of a way to think about the problem (i.e. because single df ANOVAs = t-tests)
2. SKIP PAGE 65-71 ON CREATING CONTRASTS WITH COEFFICIENTS
   1. This view is useful for regression analyses and the *idea* of complicated contrasts. There’s no point in chugging through the math twice (i.e. it is the same math we did in the last chapter). Instead we’ll discuss the common way to do these comparisons.
3. Evaluating contrasts with a t-test
   1. This approach is more common in the literature.
   2. This approach is mathematically the same as running single df comparisons.
   3. T2 = F.
   4. SPSS HOW TO HERE. NOT TUKEY, JUST T.
4. Directional hypotheses
   1. Page 74 picture
   2. Everything to this point is that the means are not equal. Sometimes you might want to say mean 1 > mean 2 (which you can *say* in a research paper, but sometimes you want to test this idea = more power).
   3. A two-tailed test = we are not sure if it is larger or smaller, just want to see if they are different.
   4. One tailed test = single rejection region at the top or bottom end, puts p/alpha all in one basket so to speak.
   5. Usually used when you only want something to go up or down and don’t care if it goes the other way – but these are fairly uncommon as most people see it as “cheating”
5. Confidence intervals
   1. When you are talking about comparisons, you are discussing not the confidence interval of the mean, but confidence interval of the *mean difference*
   2. HOW TO GET THIS FROM SPSS (the math is the same +/- standard error and significance level)
6. The kicker on comparisons! Orthogonal contrasts
   1. Basically, you are only allowed to do as many comparisons as you have degrees of freedom from the omnibus test
      1. Otherwise you are using some of the variance we’ve partial-ed out twice and that’s cheating (there are ways to deal with this)
   2. SHOW QWERTY example
      1. Left versus right = ssa 11.25
      2. Left versus equal = 12.8
      3. SS full anova = 48.7
      4. Hence not orthogonal (can’t even do the last couple tests!)
   3. How to tell:

|  |  |  |  |
| --- | --- | --- | --- |
| Comparison | Left | Right | Equal |
| Left v right | +1 | -1 | 0 |
| Left v equal | +1 | 0 | -1 |
| Multiply | 1 | 0 | 0 |

* 1. If these do not add up to zero at the bottom – not orthogonal
  2. Orthogonality – contrasts reflect independent or non-overlapping pieces of information
     1. Can you make up a set that is orthogonal for this data?
  3. Do you have to have orthogonal contrasts in real life?
     1. No, you should have a more theoretical approach. However too many contrasts is still a problem (to be discussed later).

1. IGNORE SECTIONS 4.6 TO THE END PAGE 79-84.