

If our experimental factor in the ANCOVA *had* been significant, we could have looked at the pairwise comparisons reported by *emmeans* to determine what condition was different from what other condition...

```
$contrasts
contrast
Double Espresso - Single Espresso -0.5521505 0.4779448 41 -1.155 0.2547
Double Espresso - Water -1.0084959 0.7614421 41 -1.324 0.1927
Single Espresso - Water -0.4563454 0.4179276 41 -1.092 0.2812
```

But once we take account of the influence of our covariate we found no effect of Condition...

Note, if we had used the `aov()` function the F-tests would have been conducted using Type I (sequential) Sums of Squares. For Type III, we need to use the `aov_4()` function.

# Type I vs. II vs. III Sums of Squares

- Type I Sum of Squares is calculated sequentially - e.g., first for Factor A main effect, then for Factor B main effect, then for the interaction. The order in which they are calculated matters and can be misleading for unbalanced design or cases where predictors are correlated. Total SS is the sum of the individual effect SS.
- Type II Sum of Squares assumes no interaction(s) when testing main effects or higher order interaction(s) when testing lower order interaction(s).
- Type III Sum of Squares tests for effects adjusted for the presence of the other effects (so does not depend on the order of terms).
- Much debate about which one is 'correct' - each has their own purpose - for factorial designs where you're interested in testing an interaction (or when your predictors correlate), Type III is most commonly used.