Simple Effects Analysis

**Review of Factorial ANOVA**

- **Main effects** - comparison of marginal (level) means
- **Interaction** - comparison of condition means to determine if differences between means for one level of an IV are the same as differences at the other level(s) of the IV

**Interactions**

- Breakdown the interaction to understand what’s driving it

**Simple Effects**
Simple Effects

- The goal is to characterize the interaction – to determine which differences are significant
- Comparison of condition means for one level of the IV

Example - Room Color x Room Size

Mean comfort ratings for room color by room size

<table>
<thead>
<tr>
<th></th>
<th>Blue</th>
<th>Orange</th>
<th>Yellow</th>
</tr>
</thead>
<tbody>
<tr>
<td>10 sq. ft.</td>
<td>2.2</td>
<td>2.4</td>
<td>2.0</td>
</tr>
<tr>
<td>25 sq. ft.</td>
<td>0.6</td>
<td>2.0</td>
<td>2.8</td>
</tr>
</tbody>
</table>

Example - Room Color x Room Size

To conduct simple effects we will compare means for each column separately.

<table>
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<tr>
<td>10 sq. ft.</td>
<td>2.2</td>
</tr>
<tr>
<td>25 sq. ft.</td>
<td>0.6</td>
</tr>
</tbody>
</table>

Calculations

- What we want to do is compare means for IV-B (e.g., room size) at one level at IV A (e.g., A1, room color = blue)
- Conduct a full set of comparisons (do this for all levels of IV-A)
- For our example, we can start by comparing means at blue, but then continue with orange and yellow to do a full set of simple effects
Calculations

- Compute the SS for this comparison only to use in an F ratio
- \( SS_{B \text{ at } A1} = n \frac{\sum(Y_{A1B} - \bar{Y}_{A1})^2}{\text{Sum of squares for factor B at A1}} \)
- \( df_{B \text{ at } A1} = b - 1 \)
- For our example with means, 2.2 and 0.6 and \( n = 5 \):
  - \( = 5[(2.2 - 1.4)^2 + (0.6 - 1.4)^2] \)
  - \( = 5[(.64 + .64)] \)
  - \( = 6.4 = SS_{B \text{ at } A1} \)
  - \( df_{B \text{ at } A1} = 2 - 1 = 1 \)

\[
\begin{align*}
\text{SS}_{B \text{ at } A1} & = 6.4 \\
\text{df}_{B \text{ at } A1} & = 1 \\
\text{MS}_{B \text{ at } A1} & = 6.4 / 1 = 6.4 \\
F & = \frac{\text{MS}_{B \text{ at } A1}}{\text{MS}_{S/AB}} \approx 10.98 \quad \text{vs.} \quad F_{\text{crit}}(1,24) = 4.26 \\
\text{Significant simple effect: blue/10 > blue/25} \\
\text{This is one simple effect – we need to complete the set by comparing 10 and 25 for orange and yellow too} \\
\text{Can also do opposite set - compare blue vs. orange vs. yellow for 10 sq. ft. room} \\
\text{But DO NOT do both sets - they are NOT orthogonal}
\end{align*}
\]

Notes

- It is up to the researcher to choose which set of simple effects to conduct
- If you are comparing more than two means per simple effect (e.g., blue vs. orange vs. yellow for 10 sq. ft. room) and the effect was significant - you would need to conduct pairwise comparisons to determine where the effect was
- Simple effects are not “pure interaction” - main effect variance is not subtracted out - but they help us understand what is driving the interaction

Calculations

- Simple effect test for IV-B at A2 (orange)
- For our example with means, 2.4 and 2.0 and \( n = 5 \):
  - \( = 5[(2.4 - 2.2)^2 + (2.0 - 2.2)^2] \)
  - \( = 5[(.04 + .04)] \)
  - \( = 0.4 = SS_{B \text{ at } A2} \)
  - \( df_{B \text{ at } A2} = 2 - 1 = 1 \)
  - \( MS_{B \text{ at } A2} = 0.4 / 1 = 0.4 \)
  - \( F = \frac{MS_{B \text{ at } A2}}{MS_{S/AB}} = 4 \approx .686 \quad \text{vs.} \quad F_{\text{crit}}(1,24) = 4.26 \)
  - Non-significant simple effect: orange/10 = orange/25
  - Try one on your own: conduct the simple effect test for IV-B at A3 (yellow)
How do we conduct simple effects on SPSS?
Alter the syntax code!
Start with an ANOVA on the full design
Pull up syntax by clicking on paste where you define the variables
Alter the syntax by including commands for simple effects
Run the syntax by clicking the arrow key at the top of the window (beside binoculars)