Intro to Statistics with R: Analysis of Variance (ANOVA)

Intro to Factorial ANOVA

Factorial ANOVA

- Two independent variables
- One continuous dependent variable

Factorial ANOVA example

- Assess impact on driving error (dependent variable)
- Randomly assign people to different (simulated) driving conditions
- Independent variables
  - Driving difficulty
  - Conversation demand

Factorial ANOVA example

We can test 3 hypotheses:

- More errors in the difficult simulator?
- More errors with more demanding conversation?
- More errors due to the interaction of driving difficulty and conversation demand?

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Hypotheses, F-ratios, and effects

Driving error example

We can test 3 hypotheses:

- More errors in the difficult simulator?
- More errors with more demanding conversation?
- More errors due to the interaction of driving difficulty and conversation demand?

Factorial ANOVA

- Three F-ratios
  - F_A → **1st Independent variable; driving difficulty**
  - F_B → **2nd Independent variable; conversation demand**
  - F_{AxB}

Factorial ANOVA

- Main effect → **Effect of one independent variable ignoring the other one**
- Interaction effect → **Effect of one independent variable depends on the other**
- Simple effect → **Effect of one independent variable at a particular level of the other**

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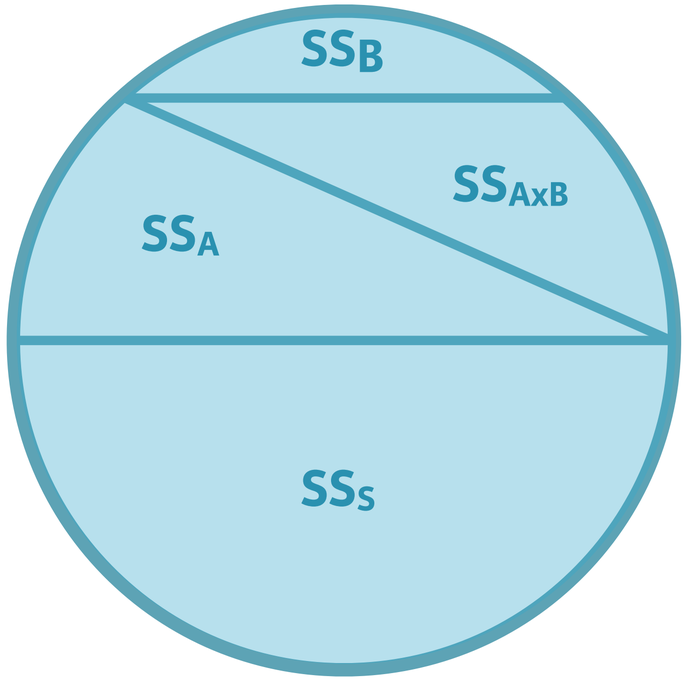
Post-hoc tests and effect sizes

Factorial ANOVA

- Calculate 3 F-ratios
- Post-hoc tests for significance of pairwise comparisons
- Investigate interaction effects with simple effects analysis
  - One-way ANOVAs
  - Estimates of effect size

Effect size

- Complete η^2 $\eta^2 = SS_{AxB} / SS_{total}$
- Partial η^2 $\eta^2 = SS_{AxB} / (SS_{AxB} + SS_{S/AB})$



Assumptions

Assumptions underlying factorial ANOVA:

- Dependent variable is continuous (i.e. interval or ratio variable)
- Dependent variable is normally distributed
- Homogeneity of variance