3.36pt

Analyzing the Ringelmann Effect with the Repeated Measures ANOVA

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The Ringelmann Effect

- ⊡ Maximilian Ringelmann (1861-1931):
    - ▶ French professor of agricultural ingeneering
- ⊡ Work performance depends of number of group size
- ⊡ Decreasing individual performance with increasing group size
- ⊡ Example: Pulling weights with different sized groups

Overview

- ⊡ The Ringelmann Effect can be investigated with an experimental design
  - ▶ Dependent Variable: Indivual performance
  - ▶ Independent Variable / Factor: Group size
  - ▶ Realization of different factor levels
- ⊡ For our purpose: Data simulation Quantlet Data Simulation

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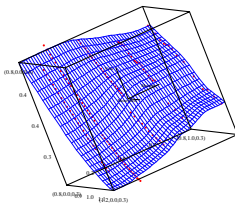
Code

The Ringelmann Effect

Figure 1: Include a short, but meaningful caption.

The Repeated Measures ANOVA: The ANOVA model

- ⊡ ANOVA: Analysis of Variance
- ⊡ Comparison of the k factor level means

$$H_0 : \mu_1 = \mu_2 = ... = \mu_k$$

$$H_1 : \exists i \neq j : \mu_i \neq \mu_j$$

- ⊡ Test is accomplished by decomposition of variance components

Code

The Repeated Measures ANOVA: An Advantegeous Model

⊡ Problem: In case of large variance between different subjects
⇒ High error variance ⇒ Loss of power in F-Test

⊡ Repeated Measures ANOVA considers the between subject variance separately
⇒ Relatively low error variance ⇒ Gain of power in F-Test
🔍 Reduction of error variance
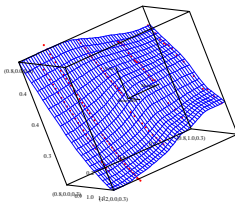
The Repeated Measures ANOVA: An Advantegeous Model

Figure 2: Include a short, but meaningful caption.

The Repeated Measures ANOVA: An Advantegeous Model

⊡ Design Requirement: Each subject hast to be measured under all factor levels

Title	Title
2.13	1.45
3.14	6.85

Table 1: Example Data Matrix

Code

Table

The Repeated Measures ANOVA: Confidence Intervals

⊡ The computation of the confidence intervals has to be adjusted in the Repeated Measures ANOVA   🔵 Confidence Intervals

Code
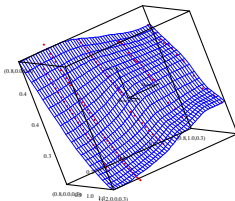
The Repeated Measures ANOVA: Confidence Intervals

Figure 3: Include a short, but meaningful caption.

The Repeated Measures ANOVA: Effect Size Measures

⊡ Two measures of effect size:

▶ η^2

▶ η_p^2

Code

Table

An Important Requirement

⊡ Sphericity: The variance of differences are equal for each pair of factor levels

⊡ Test for sphericity: Mauchly test

⊡ Measurement of sphericity ($\epsilon \in [0, 1]$):

▶ Greenhouse & Geisser: ϵ_{GG}

▶ Box: ϵ_B

▶ Huynh & Feldt: ϵ_{HF}

⊡ These can be used to correct the degrees of freedom and therefore adjust the p-values if sphericity is violated