

# Discovering Statistics Using JASP

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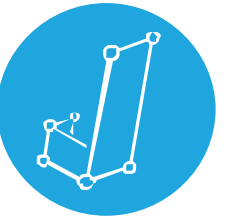
**JASP**

2025 Workshop

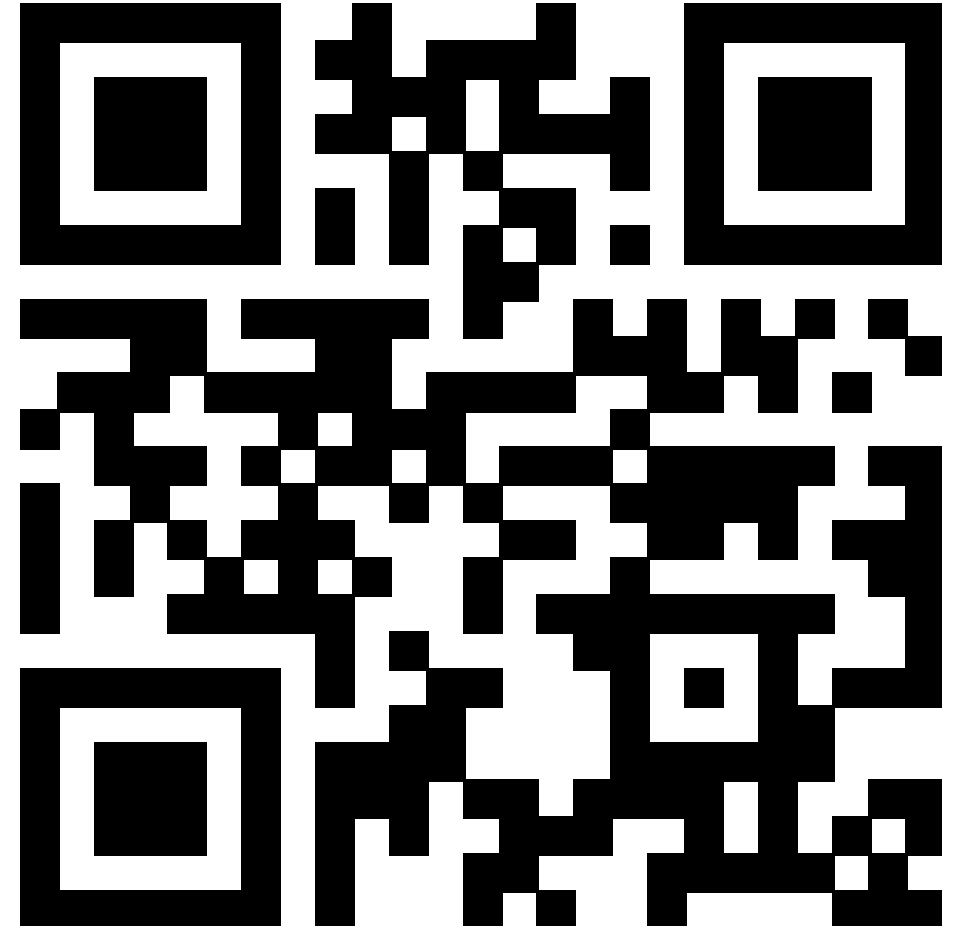


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# Outline



- JASP Intro
- Correlation
- Regression
- PROCESS
- T-test
- ANOVA's
- Free-for-all



[edu.nl/knhfd](https://edu.nl/knhfd)

# Goals of this Workshop

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- Get you familiar with JASP
- Show JASP workflow
- Know how to get in touch
- Have ran your favorite analysis in JASP

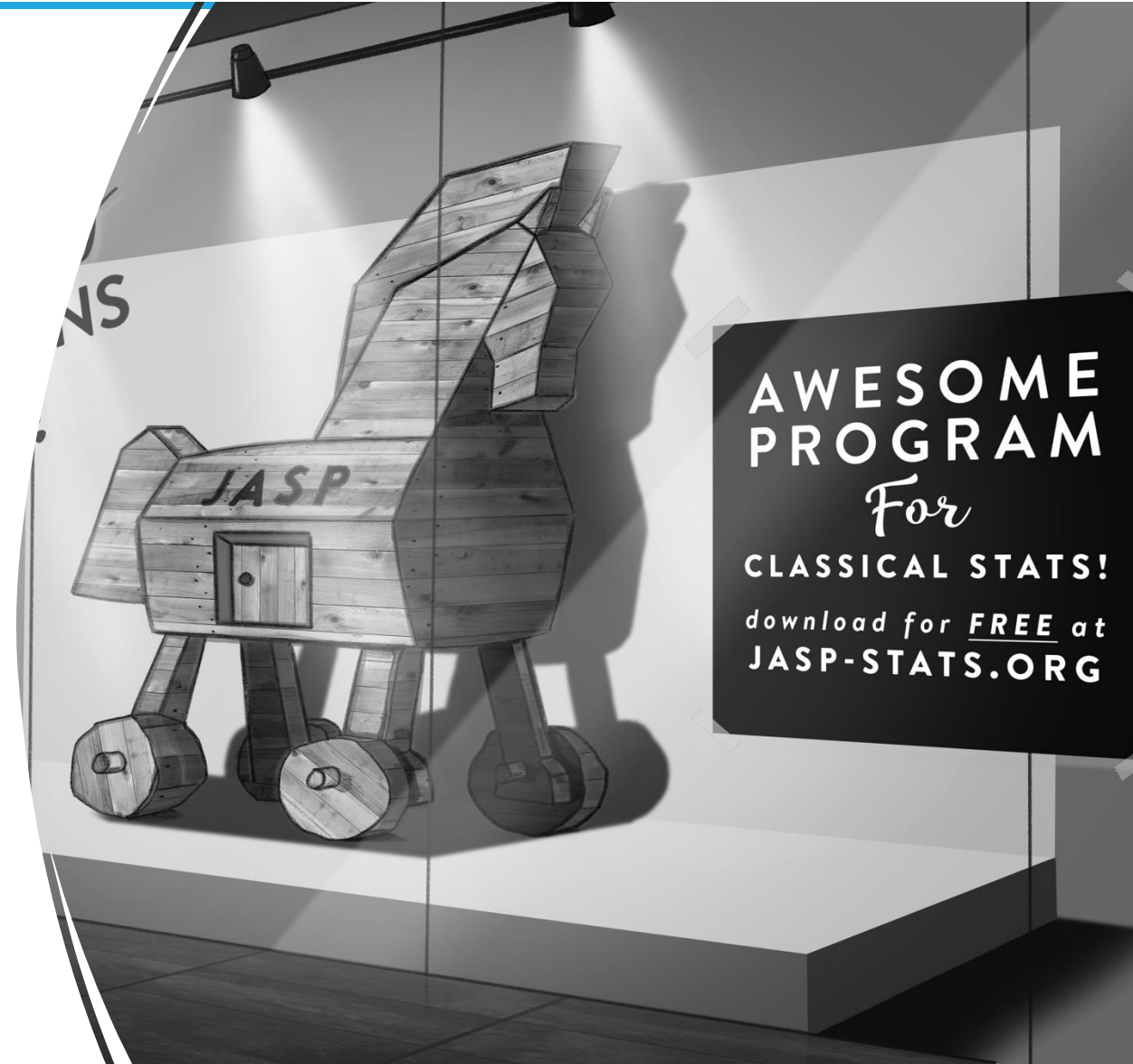
# What is JASP?



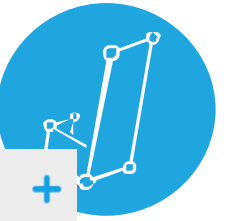
Developed at UvA over the past 10 years, funded by research grants (NWO/EU)

Graphical user interface for conducting frequentist and Bayesian statistics

<https://jasp-stats.org/>



# What is JASP?



Descriptives T-Tests ANOVA Mixed Models Regression Frequencies Factor BSTS

► Descriptive Statistics

► Linear Regression

► Correlation

▼ Linear Regression

Dependent Variable: sales

Method: Enter

Covariates: adverts, airplay, attract

Factors:

WLS Weights (optional):

Model

Components: adverts, airplay, attract

Model Terms: adverts, airplay, attract

☒ Include intercept

► Statistics

► Method Specification

► Plots

## Linear Regression ▼

```
jaspRegression::RegressionLinear(  
  version = "0.17.1",  
  formula = sales ~ attract + airplay + adverts,  
  isNuisance = ~ adverts,  
  covariates = list("adverts", "airplay", "attract"),  
  coefficientCI = TRUE,  
  collinearityDiagnostic = TRUE,  
  descriptives = TRUE,  
  rSquaredChange = TRUE,  
  residualCasewiseDiagnostic = TRUE,  
  residualCasewiseDiagnosticCookDistanceThreshold = 0,  
  residualCasewiseDiagnosticZThreshold = 2,  
  residualHistogramPlot = TRUE,  
  residualQqPlot = TRUE,  
  residualVsFittedPlot = TRUE)
```

And now to the multiple linear regression!

Previously, we already computed the regression using only advertisement budget to predict the sales. Now, we will include two more variables: airplay and attract. Because we already know that adverts predict the sales, it is certain that a new model will explain at least the same amount of variance of sales. Because of this, we can test whether including the two new predictors *explains the album sales better* than including just adverts. After we included the three variables as covariates, we can add the adverts to the null model in the 'Model' panel. Now, we will test the new model against the one we fitted moments before (predicting sales by adverts).

## Model Summary - sales ▼

| Model          | R     | R <sup>2</sup> | Adjusted R <sup>2</sup> | RMSE   | R <sup>2</sup> Change | F Change | df1 | df2 | p      |
|----------------|-------|----------------|-------------------------|--------|-----------------------|----------|-----|-----|--------|
| H <sub>0</sub> | 0.578 | 0.335          | 0.331                   | 65.991 | 0.335                 | 99.587   | 1   | 198 | < .001 |
| H <sub>1</sub> | 0.815 | 0.665          | 0.660                   | 47.087 | 0.330                 | 96.447   | 2   | 196 | < .001 |

Note. Null model includes adverts

The first line of the model summary shows the 'null model'. See that the statistics correspond to the ones we computed earlier (predicting sales by adverts). The second line is about the new model with three predictors. Based on the R<sup>2</sup> Change and F-Test of the change, we can see that the new model does significantly better than the previous one. The adjusted R<sup>2</sup> of the model also drops only a little, showing robust model (probably not very high overfitting).

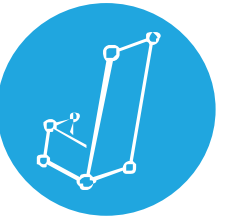
## ANOVA

| Model          |            | Sum of Squares         | df  | Mean Square | F       | p      |
|----------------|------------|------------------------|-----|-------------|---------|--------|
| H <sub>0</sub> | Regression | 433687.833             | 1   | 433687.833  | 99.587  | < .001 |
|                | Residual   | 862264.167             | 198 | 4354.870    |         |        |
|                | Total      | 1.296×10 <sup>+6</sup> | 199 |             |         |        |
| H <sub>1</sub> | Regression | 861377.418             | 3   | 287125.806  | 129.498 | < .001 |
|                | Residual   | 434574.582             | 196 | 2217.217    |         |        |
|                | Total      | 1.296×10 <sup>+6</sup> | 199 |             |         |        |

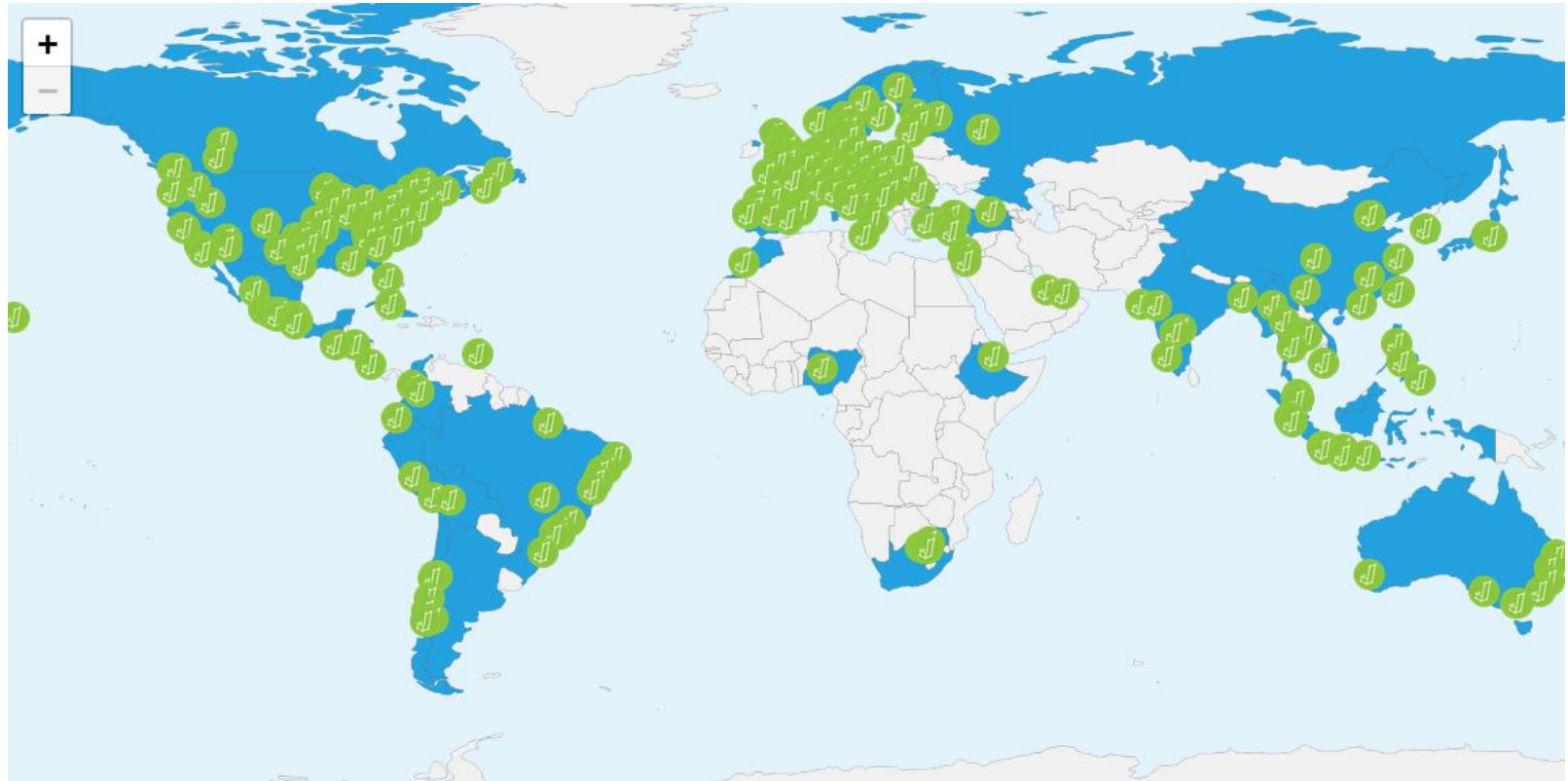
Note. Null model includes adverts

The test of the fit of the model. Both models are highly significant, indicating that either of them significantly improves our estimate of sales to the true 'null model' (which is just the mean of sales).

# What is JASP?



Used at 271 universities  
across 64 countries  
80,000 monthly downloads



<https://jasp-stats.org/teaching-with-jasp/#worldmap>

# Features

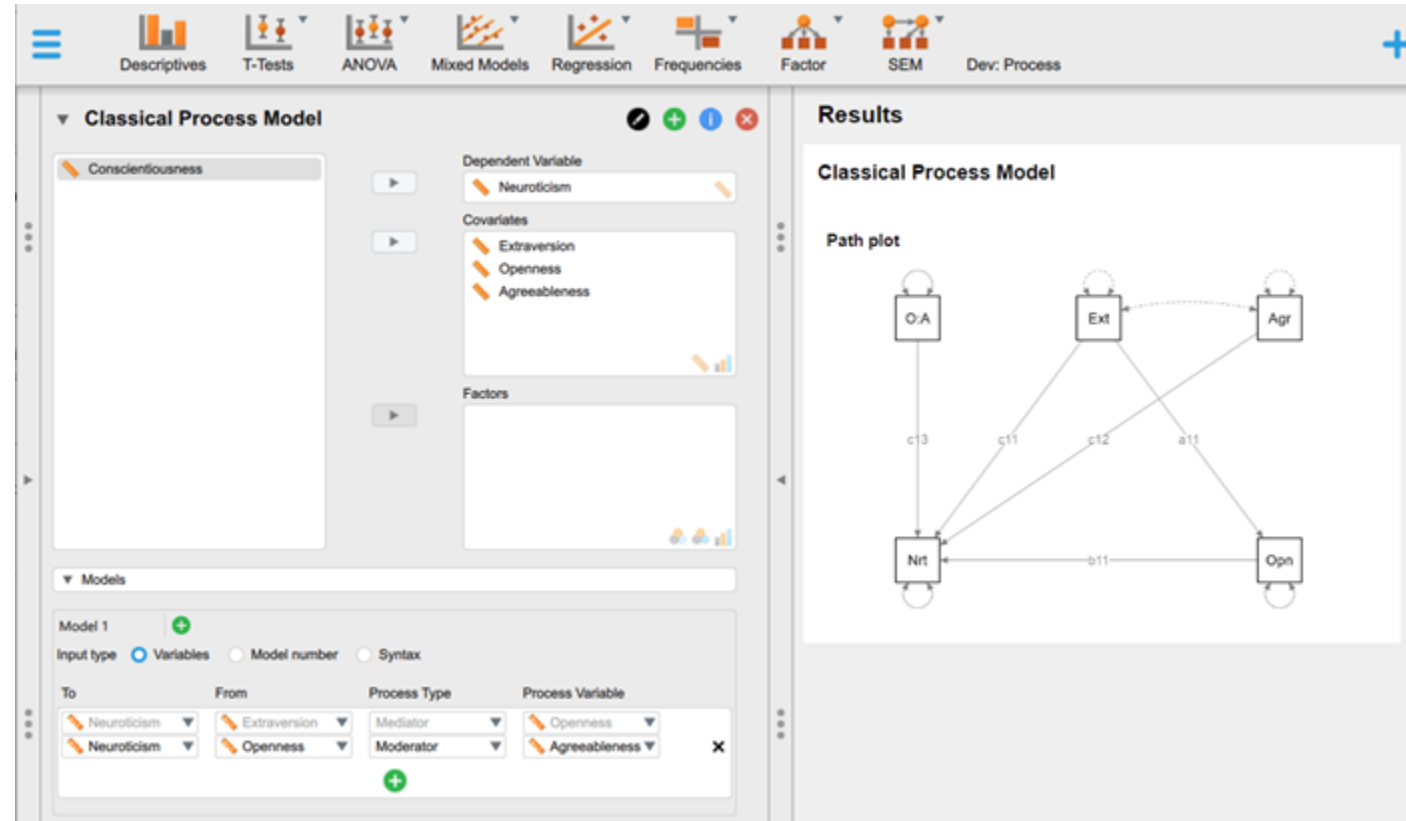


- [Website overview](#)
- [JASP vs. SPSS feature comparison](#)
- Data formats: .sav, .xls, .txt, .csv, .ods, .tsv, .dta, .por, .sas7bdat, .sas7bcat, and the .jasp format
- APA tables
- OSF integration
- R console
- Compute columns
- Filtering

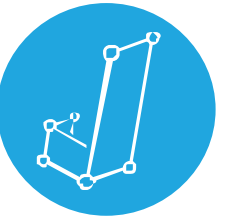
# Feature Roadmap



- Full syntax mode ([blog about the first implementation](#))
- More data manipulation
- Select filters



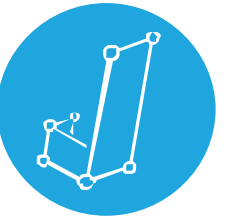




# Other Handy Resources

- [How to Use JASP – Inventory of blogs/videos/gifs for frequentist and Bayesian analyses](#)
- [JASP YouTube page](#)
- [The JASP Video Library](#)
- [Step By Step Guide: 1. Bayesian One-Way ANOVA](#) and the [full playlist](#)
- JASP on Bluesky - <https://bsky.app/profile/jaspstats.bsky.social>
- JASP forum - <https://forum.cogsci.nl/index.php?p=/categories/jasp-bayesfactor>
- Found a bug? Please report on Github: <https://github.com/jasp-stats/jasp-issues/issues>
- [JASP Verification Project](#)
- More JASP workshops: <https://jasp-stats.org/workshop/>

# JASP Literature



- [The JASP Data Library](#)
- [Discovering Statistics Using JASP](#)
- [Learning Statistics with JASP: A Tutorial for Psychology Students and Other Beginners by Danielle J. Navarro, David R. Foxcroft, and Thomas J. Faulkenberry](#)
- [Statistics of Doom by Erin Buchanan](#)
- [Statistical Analysis in JASP. A Guide for Students by Mark Goss-Sampson](#)
- [Quantitative Analysis with JASP open-source software by Chris Halter](#) (amazon)

# Some Examples/Demos

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From my own course (Research Methods & Statistics)

- <https://johnnydoorn.github.io/IntroductionBayesianInference/06-exercises.html>

OSF integration

- <https://osf.io/u2e9d/files/osfstorage>

Discover JASP

- <https://discoverjasp.com/>



# Data Management



## The JASP data editor for the Metallica data

|   | <div><div></div><div></div><div></div></div> <div>Name</div> | <div><div></div><div></div><div></div></div> <div>Instrument</div> | <div><div></div><div></div><div></div></div> <div>Current member</div> | <div><div></div><div></div><div></div></div> <div>Headbanging intensity</div> |   |
|---|--|--|--|---|---|
| 1 | Lars Ulrich  | Drums  | Yes1   | Light   | 1 |
| 2 | James Hetfield   | Guitar   | Yes1   | Heavy   | 3 |
| 3 | Kirk Hammett   | Guitar   | Yes1   | Light   | 1 |
| 4 | Rob Trujillo   | Bass   | Yes1   | Moderate  | 2 |
| 5 | Jason Newsted  | Bass   | No0  | Heavy   | 3 |

# The Variable View

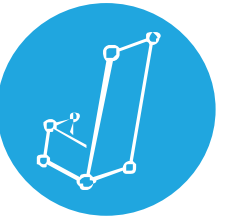








Figure 4.6 The variable settings for 'Name'

Name:  Long name:

Column type:  Nominal ▼ Description:

Computed type: Not computed ▼

Label editor Missing values

|   | Filter | Value          | Label          |
|---|--------|----------------|----------------|
|    | ✓      | Lars Ulrich    | Lars Ulrich    |
|   | ✓      | James Hetfield | James Hetfield |
|  | ✓      | Kirk Hammett   | Kirk Hammett   |
|  | ✓      | Rob Trujillo   | Rob Trujillo   |
|  | ✓      | Jason Newsted  | Jason Newsted  |

# Variable Types



## Scale

- Numbers (e.g., 7, 0, 120, 8.5)

## Nominal

- Categories (e.g., 'Control group', 'Experimental group')

## Ordinal

- Ordered values (e.g., 'Dislike', 'Neutral', 'Like')

# Variable Settings

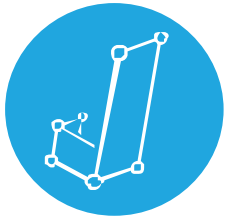



Figure 4.7 Specifying the values for an ordinal variable

Name:

Column type:  Ordinal ▼

Computed type:  ▼

Label editor Missing values

1  
N  
↓

1  
N  
↻

↑  
↓

▲

▼

| Filter | Value | Label    |
|--------|-------|----------|
| ✓      | 1     | Light    |
| ✓      | 2     | Moderate |
| ✓      | 3     | Heavy    |
|        |       |          |



# Computing a New Variable



Figure 4.8 The drag and drop interface for computing a new variable

Name:  Long name:

Column type:  Description:

Computed type:

Computed column definition

Label editor Missing values

Computed columns code applied

Converting types Compute column



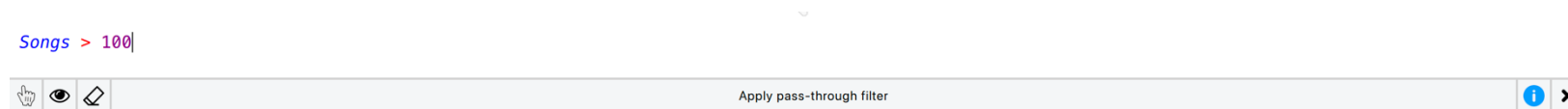
# Filtering Data



- Using Variable Settings
- Using the Filter functionality
  - Drag and drop



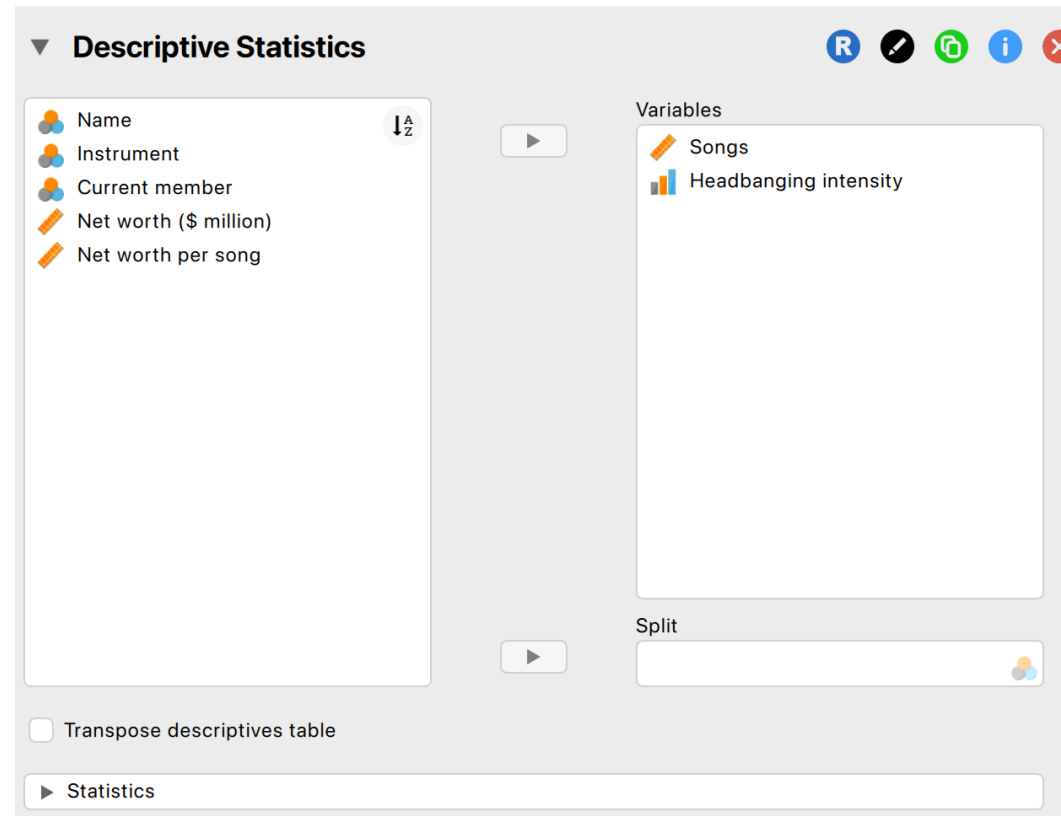
- R-mode



# Descriptives



Figure 4.10 Input window for the Descriptives module



# Output Window in JASP



Figure 4.11 Example of annotated output

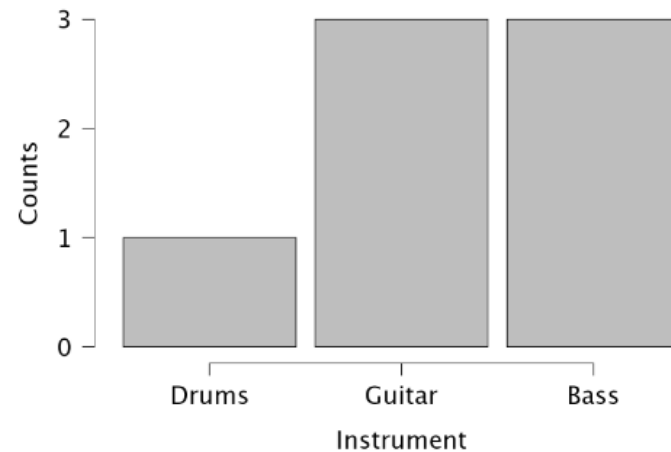
## Distribution Plots

B I U  $f_x$   $\langle \cdot \rangle$  Normal  $x_2$   $x^2$  ” “ ≡ ≡ Normal  $I_x$

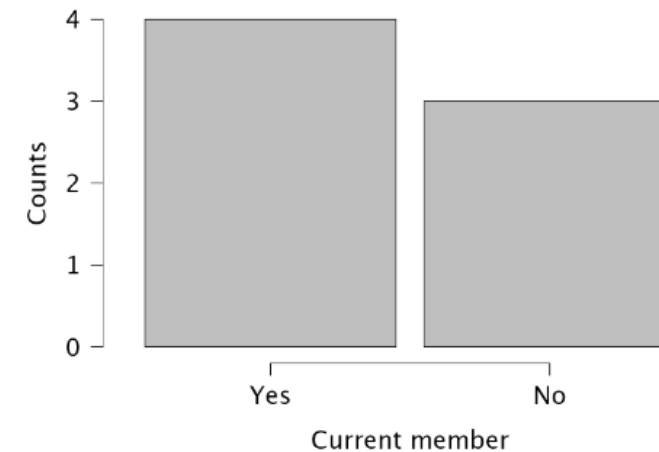
We can have fancy  $LaTeX$  formula's in here, [link cute cat video's](#), or insert a drumkit

Below are two distribution plots outlining the members of Metallica. On the left, we see the various instruments being played and their frequencies, and on the right we see how many members are still active, and how many left the band.

Instrument



Current member



# Basic Flow of Data Analysis in JASP

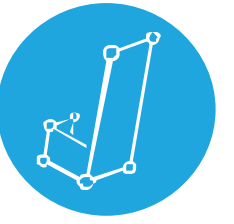
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- Describe/visualize data
- Specify the analysis in JASP
- Assess the assumptions (tip: see the help-files)
- Interpret the main analysis table
- Consider follow-up analyses

# Regression

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# Regression with One Predictor



A record company boss was interested in predicting album sales from advertising.

## Data

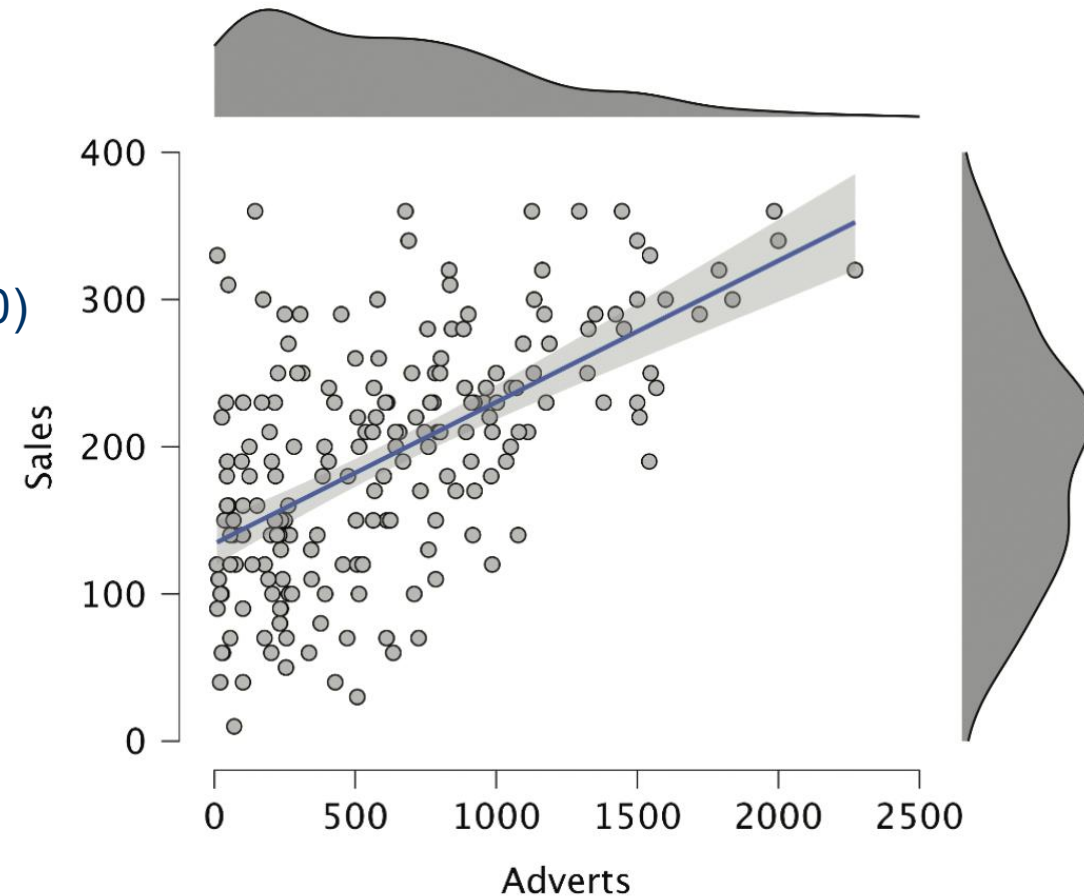
- 200 different album releases

## Outcome variable:

- Album sales in the week after release (x1000)

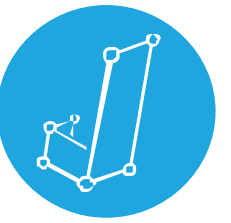
## Predictor variables

- Advertisement budget (in £1000)
- Number of plays on the radio
- Image of the band.



# The Model as an Equation

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- The model contains two regression weights:

$$Y_i = (b_0 + b_1 X_{1i}) + \varepsilon_i$$

- $b_0$  is the intercept
  - The intercept is the value of the  $Y$  variable when all  $X$ s = 0
  - E.g., how many albums are sold for 0£ advertisement budget
- $b_1$  is the coefficient for Adverts.



# Regression with One Predictor



Figure 8.10 Main menu for regression

**Linear Regression: Single Predictor**

AlbumID  
Airplay  
Image

Dependent Variable  
Sales

Method  
Enter

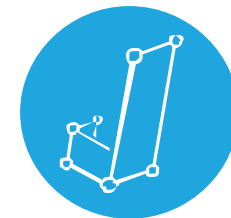
Covariates  
Adverts

Factors

WLS Weights (optional)

► Model  
► Statistics  
► Method Specification  
► Plots

# Model Summary



## Output 8.2

### *Model Summary - Sales*

| Model          | R     | R <sup>2</sup> | Adjusted R <sup>2</sup> | RMSE   |
|----------------|-------|----------------|-------------------------|--------|
| M <sub>0</sub> | 0.000 | 0.000          | 0.000                   | 80.699 |
| M <sub>1</sub> | 0.578 | 0.335          | 0.331                   | 65.991 |

*Note.* M<sub>1</sub> includes Adverts

# Multiple Regression



- With several predictors the model now contains multiple regression weights:

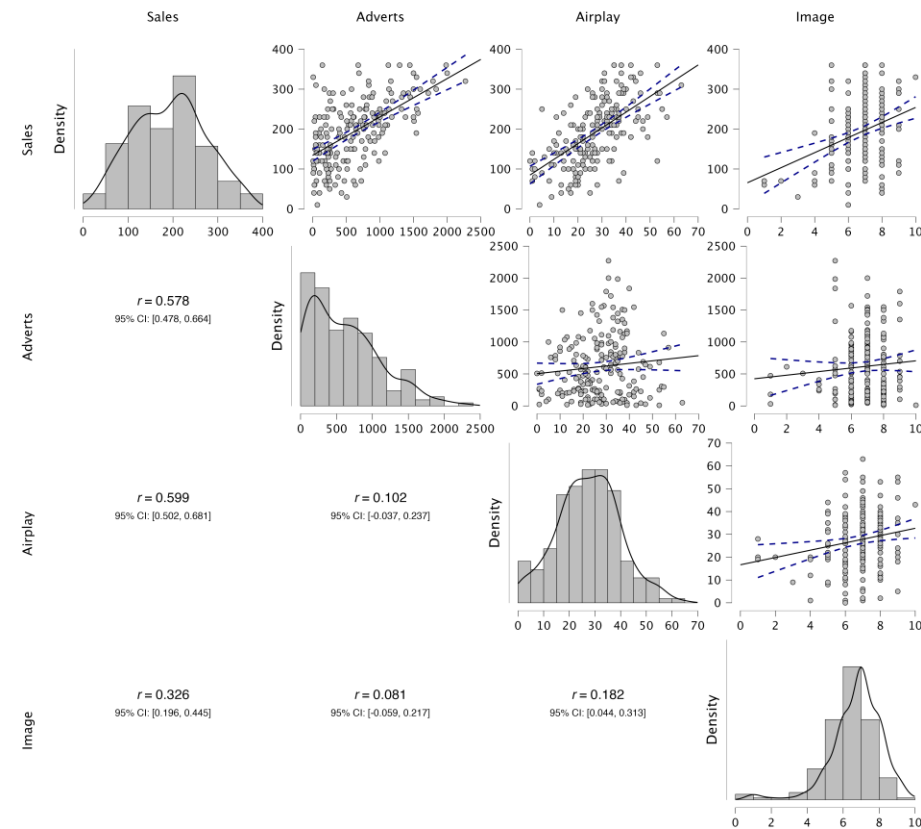
$$Y_i = (b_0 + b_1X_{1i} + b_2X_{2i} + \cdots b_nX_{ni}) + \varepsilon_i$$

- $b_0$  is the intercept.
  - The intercept is the value of the  $Y$  variable when all  $X$ s = 0
- $b_1$  is the coefficient for Adverts
- $b_2$  is the coefficient for Airplay
- $b_n$  is the coefficient for  $n^{\text{th}}$  variable.

# A model with Several Predictors



Figure 8.11 Matrix scatterplot of the relationships between advertising budget, airplay, image rating and album sales



# Multiple Regression



Figure 8.12 Main menu for block 2 of the multiple regression

▼ Model

- Adverts
- Airplay
- Image

Model 0

- Adverts

Model 1

- Adverts
- Image
- Airplay

☒ Include intercept

# Normality of Residuals: Histograms and Q-Q Plots

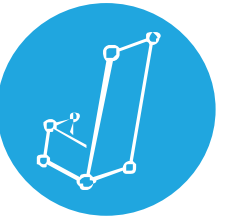
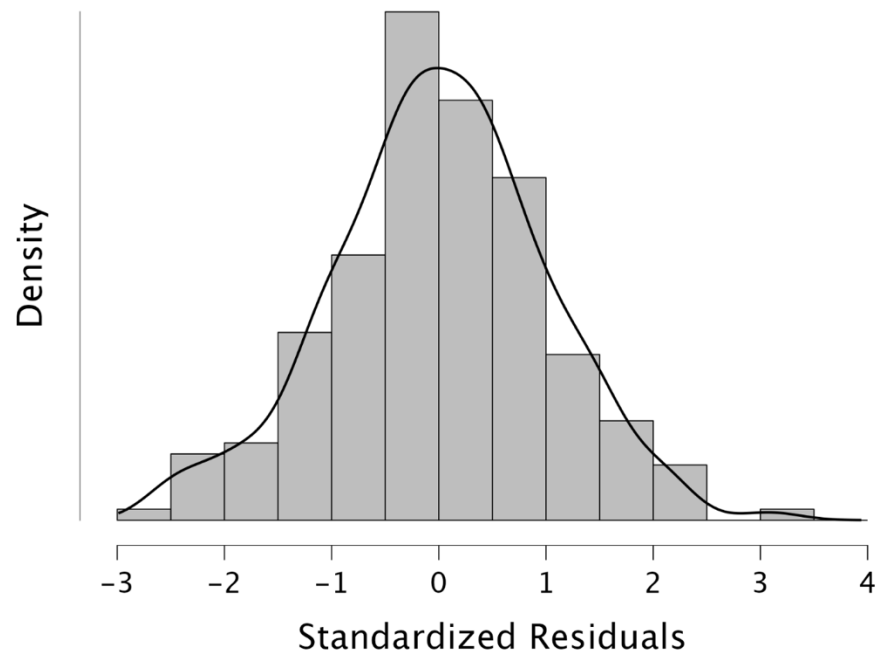
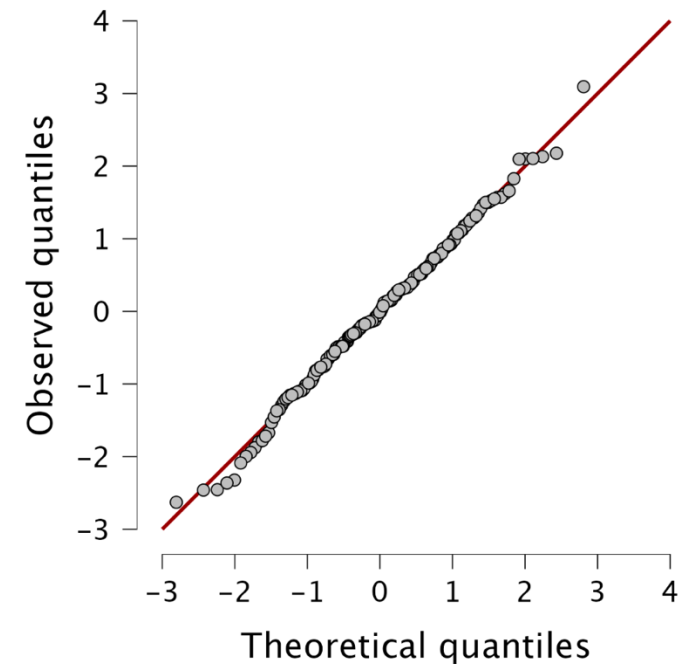


Figure 8.17 Histogram and Q-Q plot for the residuals from our model

Standardized Residuals Histogram



Q-Q Plot Standardized Residuals



# Model Parameters



## Output 8.7

### *Coefficients*

| Model          |             | Unstandardized | Standard Error | Standardized | t      | p      | 95% CI  |         | Collinearity Statistics |       |
|----------------|-------------|----------------|----------------|--------------|--------|--------|---------|---------|-------------------------|-------|
|                |             |                |                |              |        |        | Lower   | Upper   | Tolerance               | VIF   |
| M <sub>0</sub> | (Intercept) | 134.140        | 7.537          |              | 17.799 | < .001 | 119.278 | 149.002 |                         |       |
|                | Adverts     | 0.096          | 0.010          | 0.578        | 9.979  | < .001 | 0.077   | 0.115   | 1.000                   | 1.000 |
| M <sub>1</sub> | (Intercept) | -26.613        | 17.350         |              | -1.534 | 0.127  | -60.830 | 7.604   |                         |       |
|                | Adverts     | 0.085          | 0.007          | 0.511        | 12.261 | < .001 | 0.071   | 0.099   | 0.986                   | 1.015 |
|                | Image       | 11.086         | 2.438          | 0.192        | 4.548  | < .001 | 6.279   | 15.894  | 0.963                   | 1.038 |
|                | Airplay     | 3.367          | 0.278          | 0.512        | 12.123 | < .001 | 2.820   | 3.915   | 0.959                   | 1.043 |

# Interpreting Model Parameters



## *b*-values:

- The change in the outcome associated with a unit change in the predictor.
- E.g., **Advertising budget**:  $b = 0.085$ 
  - As advertising budget increases by one unit, album sales increase by 0.085 units. Both variables were measured in thousands; therefore, for every £1000 more spent on advertising, an extra 0.085 thousand albums (85 albums) are sold. This interpretation is true only if the effects of band image and airplay are held constant.



# Regression Exercises



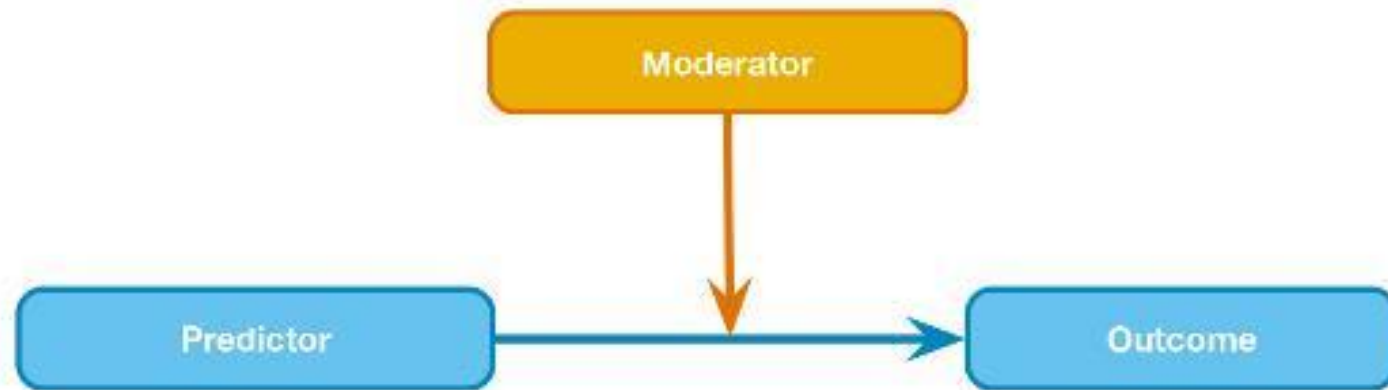
[Alex Examples](#)

[Leni Examples](#)

# Moderation



Figure 10.2 Diagram of the *conceptual* moderation model



# Example



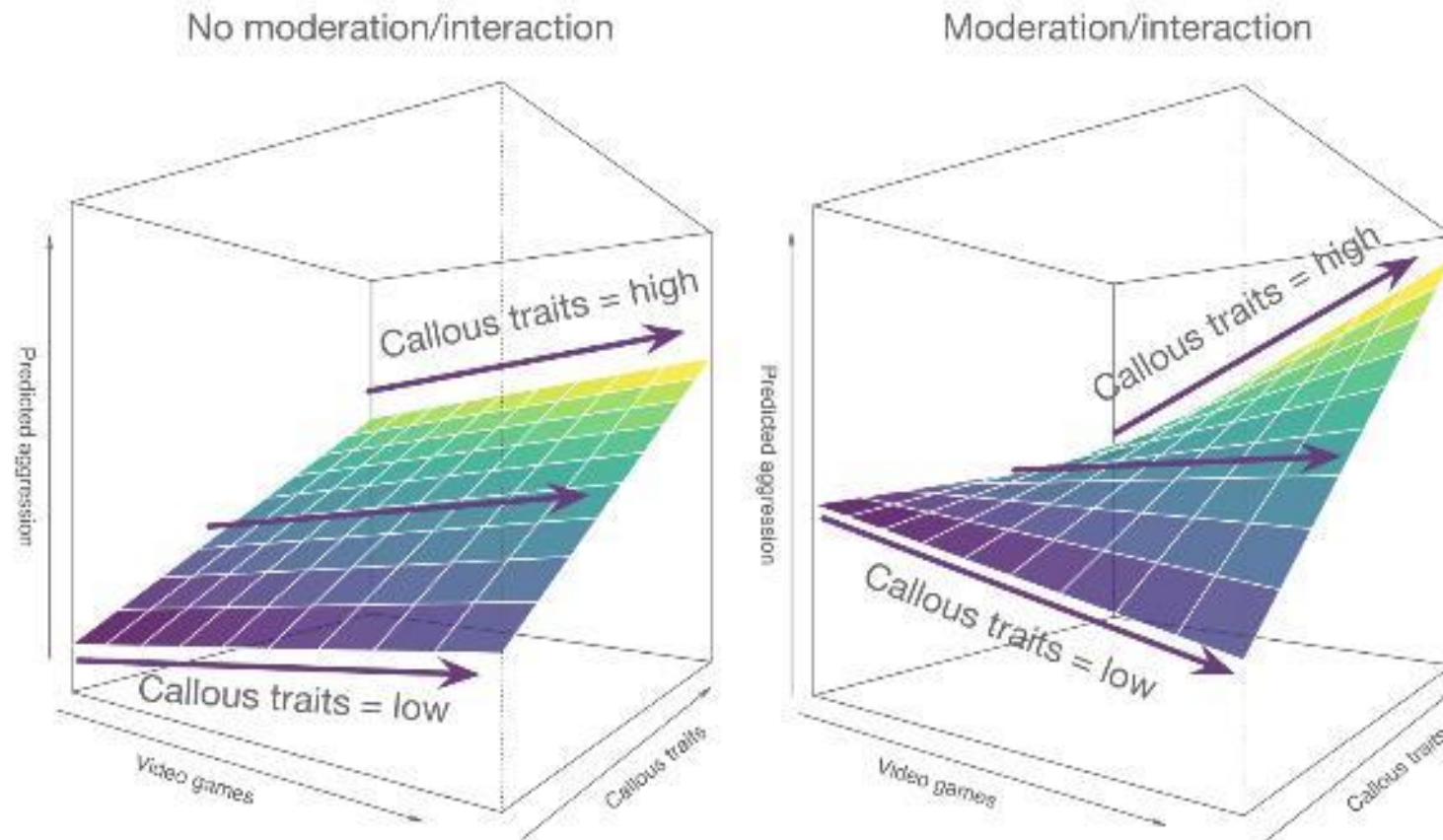
- Do violent video games make people antisocial?
- Participants
  - 442 youths
- Variables
  - Aggression
  - Callous unemotional traits (CaUnTs)
  - Number of hours spent playing video games per week
- Is 'CaUnTs' a moderator?
- Warning
  - That's a Lot to Process! Pitfalls of Popular Path Models



# Moderation



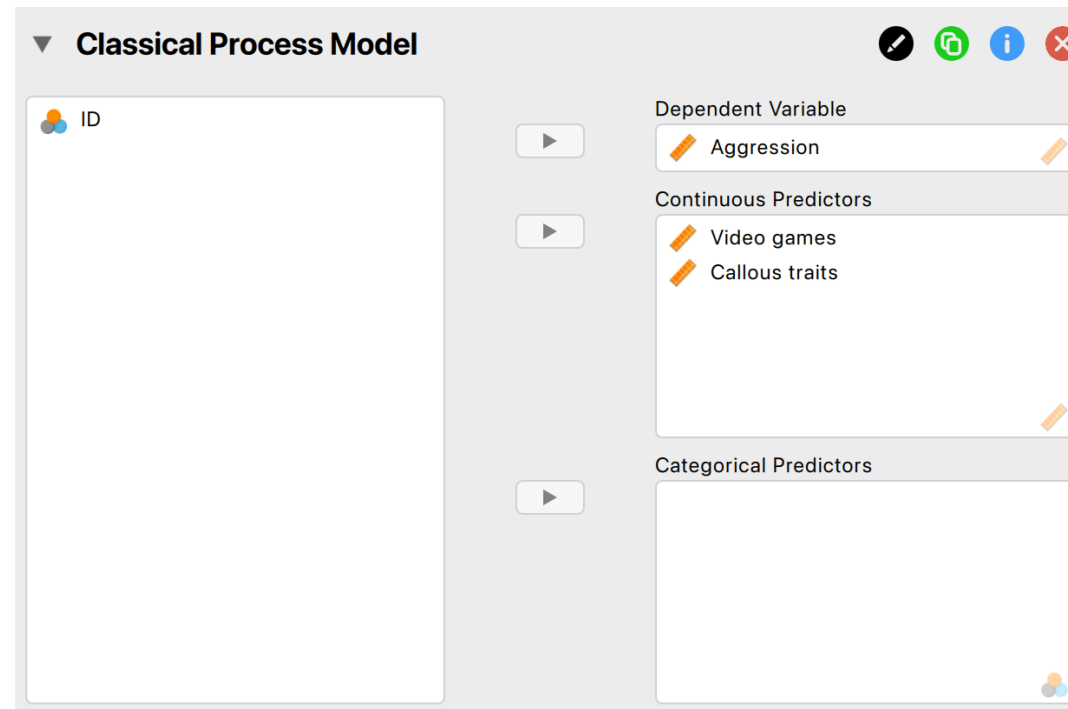
Figure 10.4 Callousness as a moderator



# Moderation Analysis in JASP



Figure 10.6 The main menu for running moderation analysis in the Process module



# Moderation Analysis in JASP

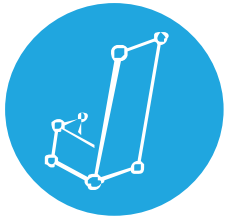
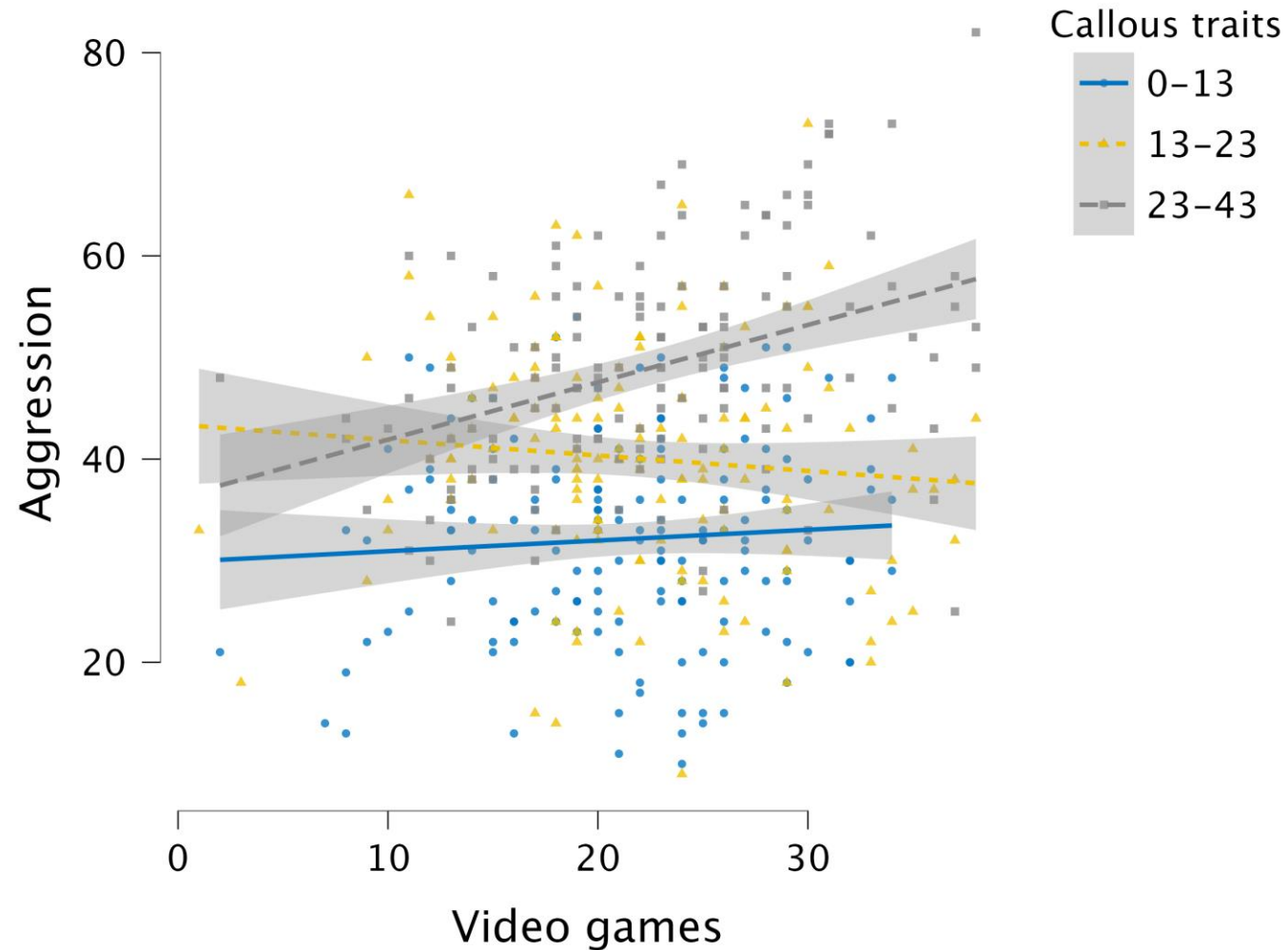


Figure 10.7 Menu for the model builder for a moderation analysis

The screenshot shows the JASP model builder interface. At the top, there is a dropdown menu labeled 'Models'. Below it, a tab labeled 'Model 1' is active, with a green plus icon to its right. Under the 'Input type' section, the 'Paths' radio button is selected, and the 'Hayes configuration' radio button is unselected. Below this, there is a table with four columns: 'From', 'To', 'Process Type', and 'Process Variable'. The 'From' column contains a dropdown menu with 'Video games' selected. The 'To' column contains a dropdown menu with 'Aggression' selected. The 'Process Type' column contains a dropdown menu with 'Moderator' selected. The 'Process Variable' column contains a dropdown menu with 'Callous traits' selected. Below the table, there is a green plus icon.

| From          | To           | Process Type | Process Variable |
|---------------|--------------|--------------|------------------|
| Video games ▼ | Aggression ▼ | Moderator ▼  | Callous traits ▼ |

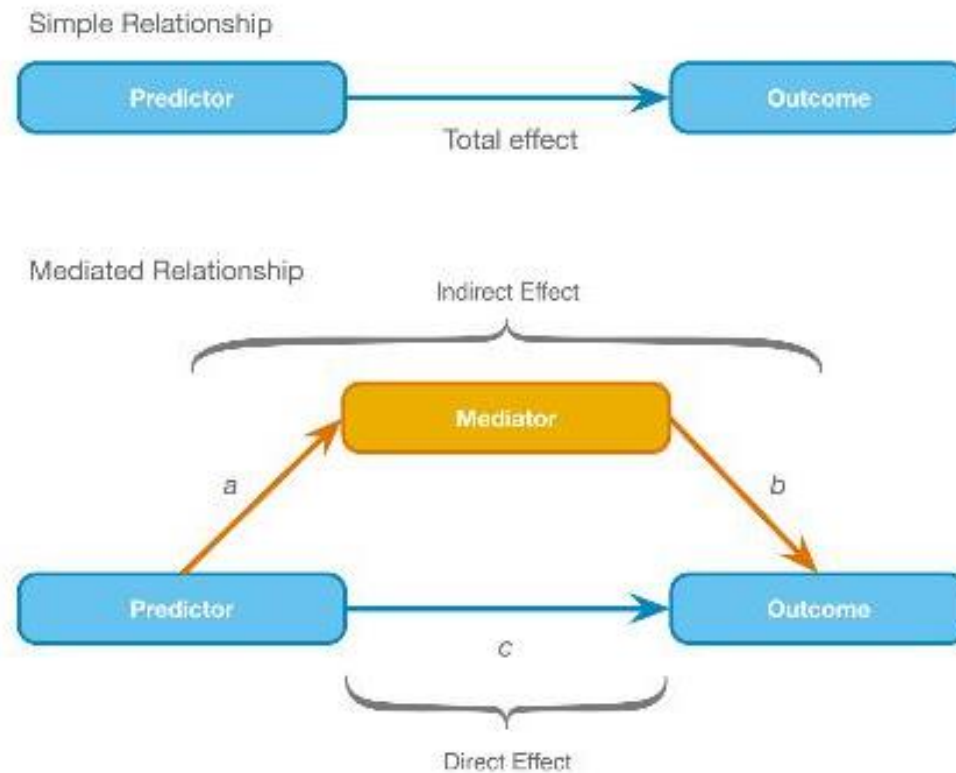
Figure 10.9 Plotting the interaction effect using Flexplot, where Callous traits is binned



# Mediation



Figure 11.9 Diagram of a mediation model

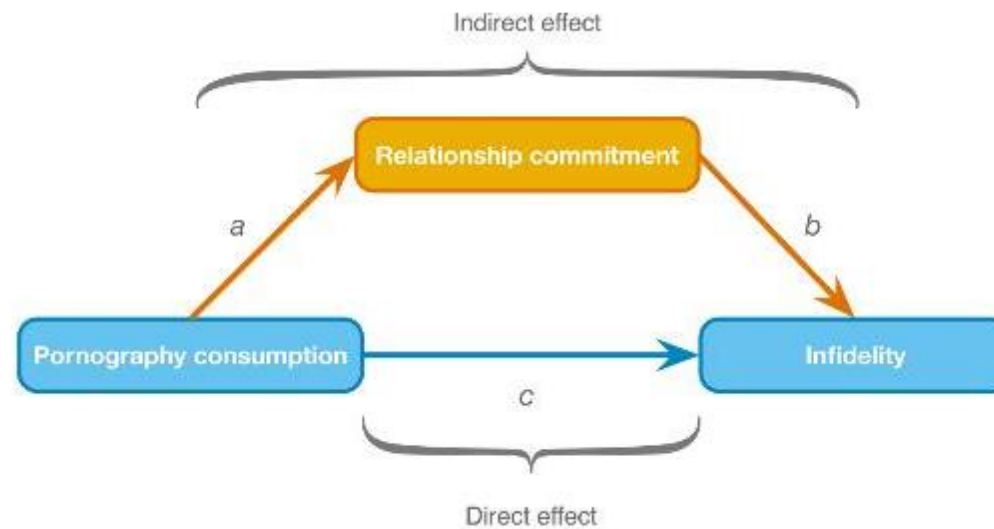




# Mediation Example



Figure 10.12 Diagram of a mediation model from Lambert et al. (2012)



# Mediation Analysis in JASP

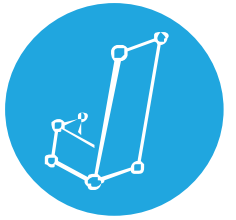


Figure 10.14 The menu for specifying a mediation path

The screenshot shows the JASP interface for specifying a mediation path. At the top, a dropdown menu shows 'Models' with a plus icon to add a new model. Below this, 'Model 1' is selected. The 'Input type' is set to 'Paths' (radio button selected). The 'From' variable is 'ConsumptionLn', the 'To' variable is 'Infidelity', the 'Process Type' is 'Mediator', and the 'Process Variable' is 'Commitment'. Below these fields is a green plus icon. The 'Residual Covariances' section has checkboxes for 'Independent variables' (checked), 'Mediators' (unchecked), and 'Dependent variables' (unchecked). The 'Parameter Estimates' section has checkboxes for 'Paths' (checked), 'Intercepts' (unchecked), 'Indirect' (checked), 'Total' (checked), and 'Residual covariances' (unchecked). The 'Tests' section has a checkbox for 'Local tests' (unchecked), a 'Test type' dropdown set to 'Linear', a checkbox for 'Bootstrap' (checked), and a 'Replications' input field set to '1000'. At the bottom, the 'Path Plots' section has checkboxes for 'Conceptual' (checked) and 'Statistical' (checked).

# Mediation Model with Two Mediators

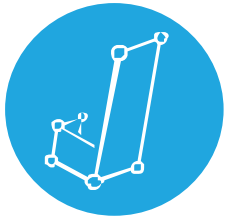
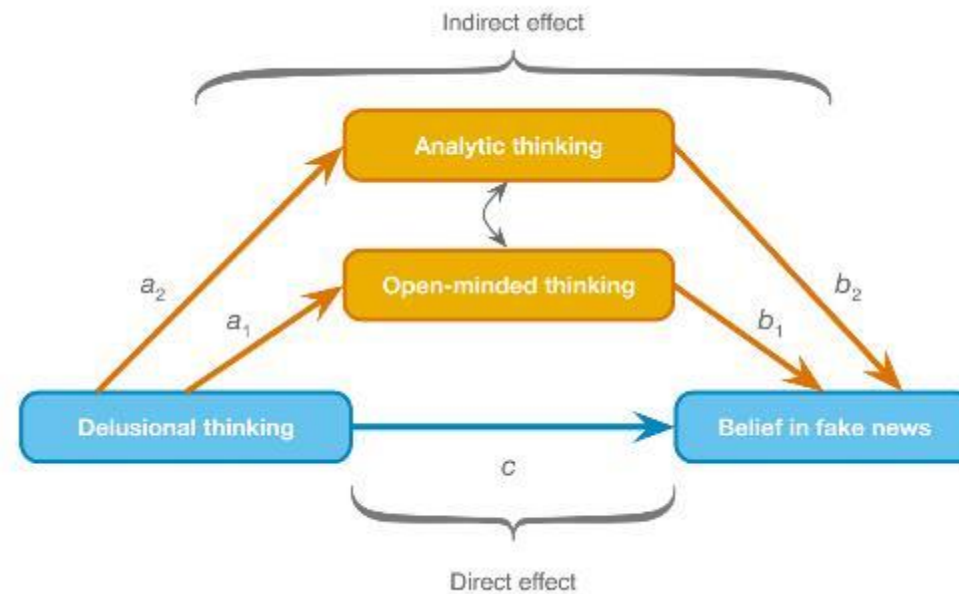


Figure 10.16 A mediation model with two mediators  
(Bronstein, 2019)



# Figure 10.17 The dialogue boxes for running mediation analysis with two mediators



▼ Models

Model 1 +

Input type ☒ Paths ☐ Hayes configuration

| From                | To                  | Process Type | Process Variable       |
|---------------------|---------------------|--------------|------------------------|
| Delusion thinking ▼ | Fake news belief ▼  | Mediator ▼   | Open thinking ▼        |
| Delusion thinking ▼ | Fake news belief ▼  | Mediator ▼   | Analytic thinking ▼    |
| Open thinking ▼     | Analytic thinking ▼ | Direct ▼     | <no choice> ▼ <b>x</b> |

+

# Moderation & Mediation

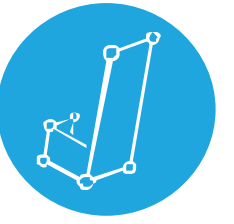


[Alex Examples](#)

[Leni Examples](#)

# Comparing Means

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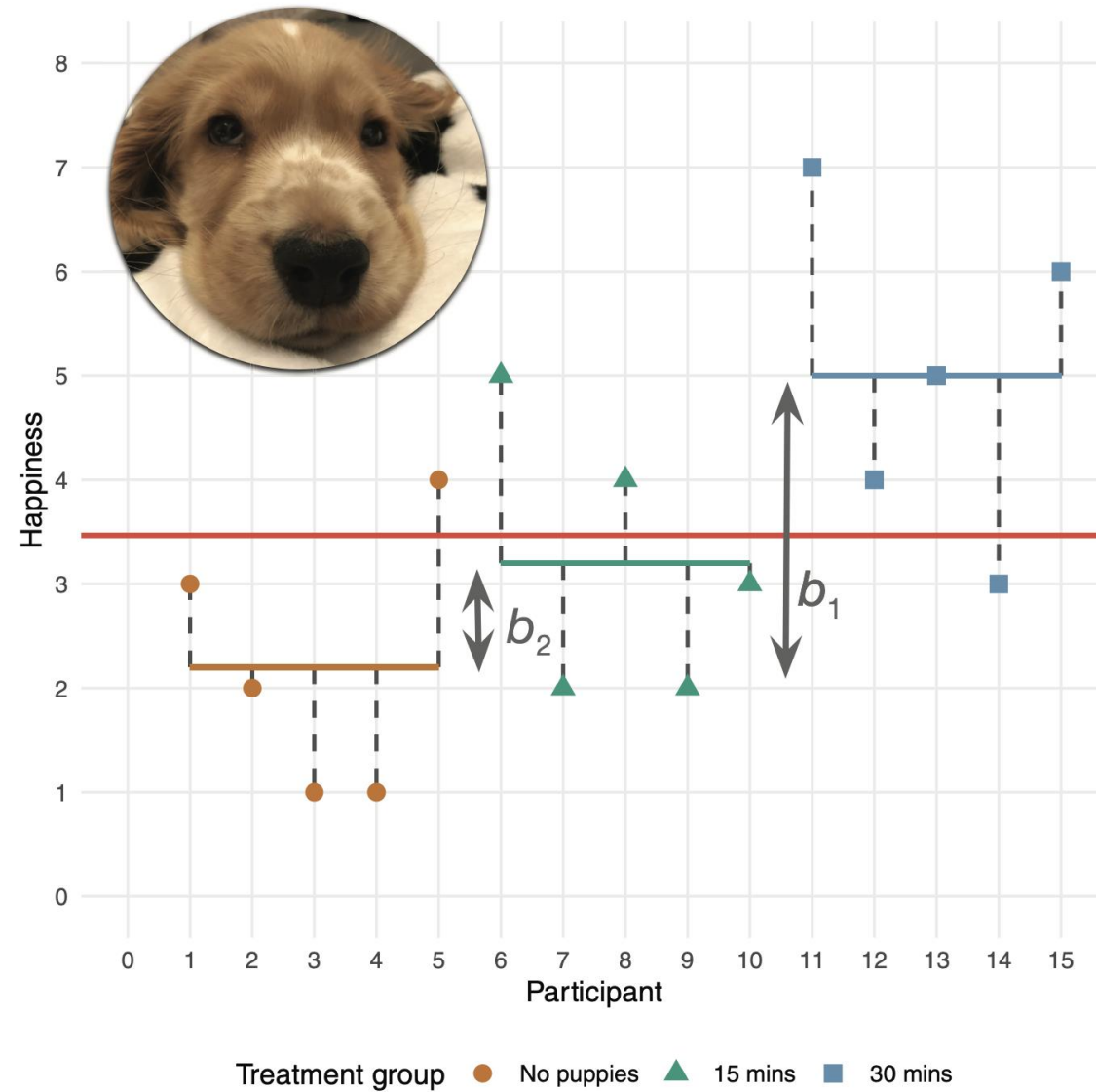


# ANOVA: Puppy Example



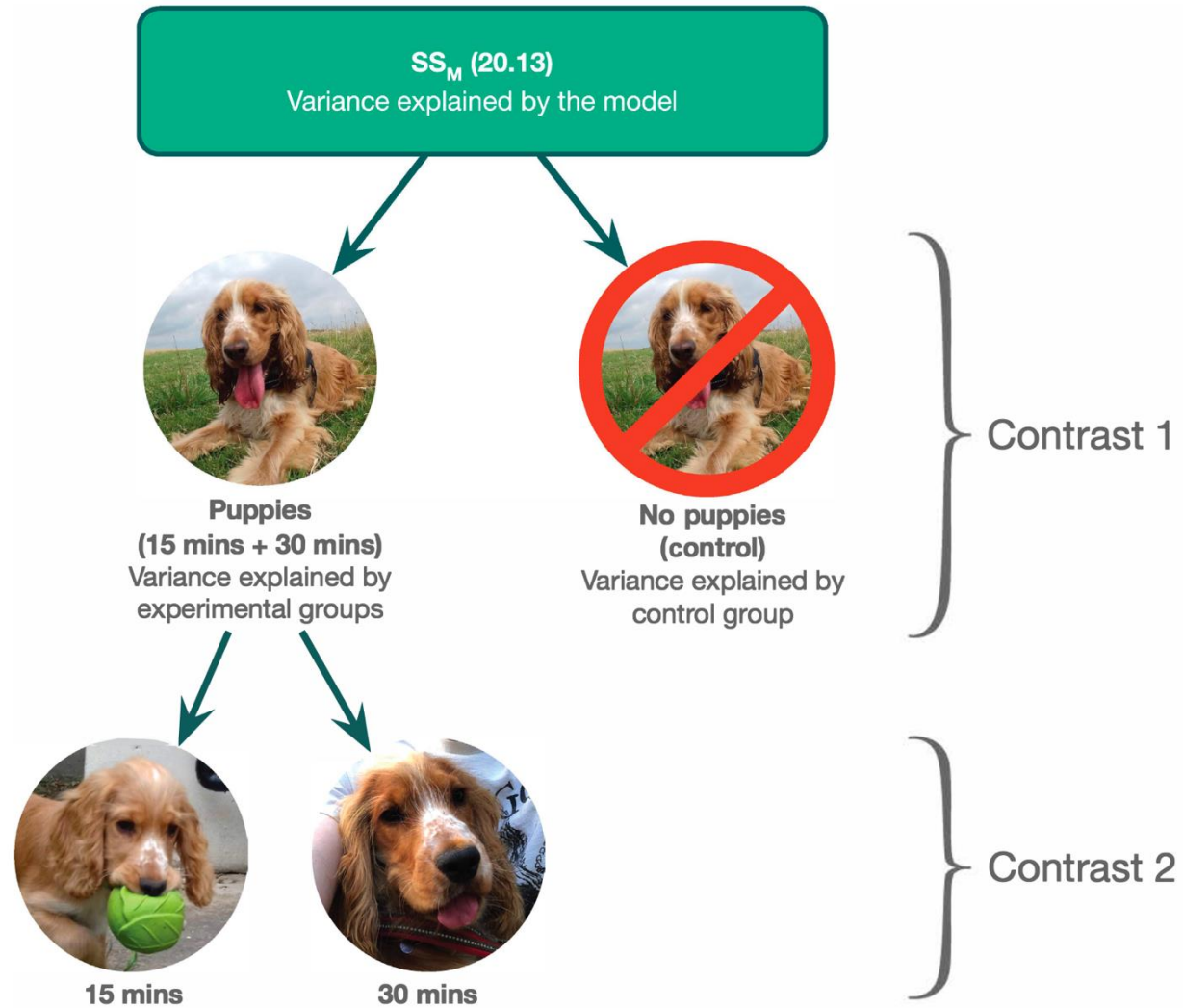
- A puppy therapy RCT in which we randomized people into three groups:
  1. A control group
  2. 15 minutes of puppy therapy
  3. 30 minutes of puppy contact
- The DV is happiness (0 = unhappy) to 10 (happy)
- Predictions:
  1. Any form of puppy therapy should be better than the control (i.e. higher happiness scores).
  2. A dose-response hypothesis that as exposure time increases (from 15 to 30 minutes), happiness will increase too

# ANOVA

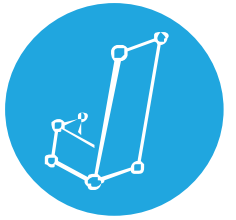




# Contrasts




# Contrasts in JASP



▼ Contrasts

Factors

 Dose

custom ▼

Custom for Dose

Add Contrast

Delete Contrast

Reset

|   | Dose       | Contrast 1 | Contrast 2 |
|---|------------|------------|------------|
| 1 | No puppies | -2         | 0          |
| 2 | 15 mins    | 1          | -1         |
| 3 | 30 mins    | 1          | 1          |

☒ Confidence intervals

95.0 %

☒ Effect size

# Post Hoc Tests



- Compare each mean against all others.
- In general terms, they use a stricter criterion to accept an effect as significant.
  - Hence, control the family-wise error rate.
  - Simplest example is the Bonferroni method:

$$P_{crit} = \frac{\alpha}{K}$$

# *Post Hoc Tests*

---



- Assumptions met:
  - Tukey HSD
- Safe Option:
  - Bonferroni
- Unequal variances:
  - Games-Howell

# ANCOVA



- Reduces error variance
  - By explaining some of the unexplained variance (SSR) the error variance in the model can be reduced
- Greater insight
  - By including more variables, we gain deeper insight into their interplay (e.g., interactions, shared variance)
- Warning
  - Hidden multiplicity in exploratory multiway ANOVA: Prevalence and remedies



# ANCOVA

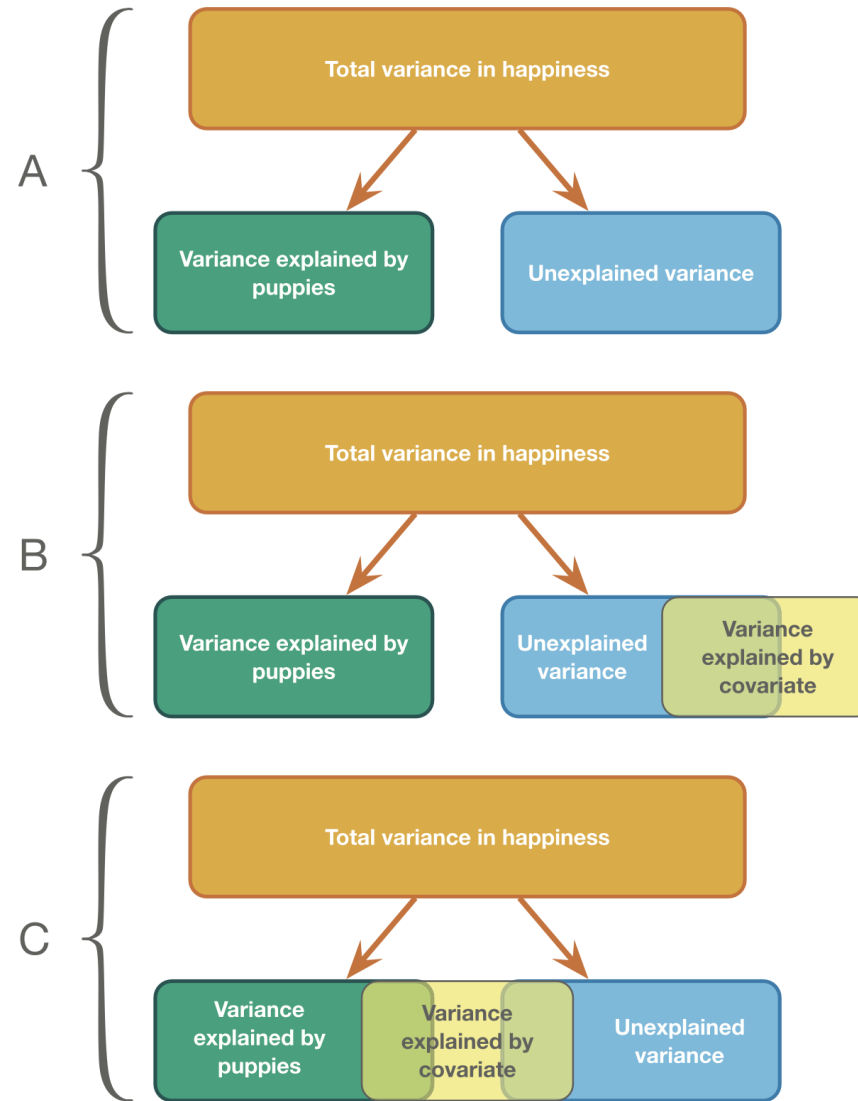
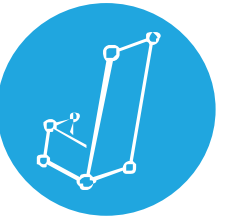
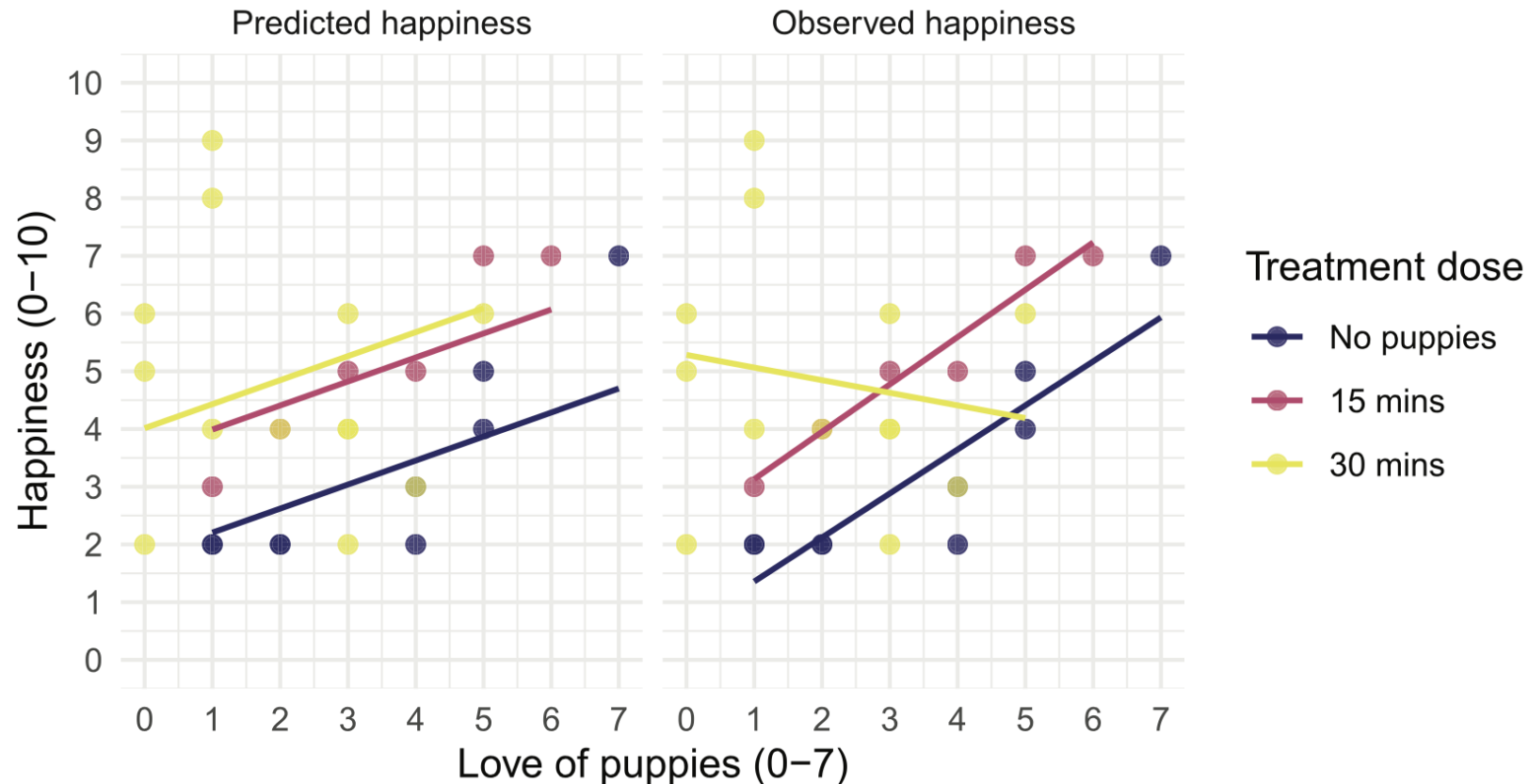


Figure 12.2 The role of the covariate in ANCOVA

# Homogeneity of Slopes



Figure 12.3 Scatterplot and linear models of happiness against love of puppies for each therapy condition



# Assessing Homogeneity of Slopes

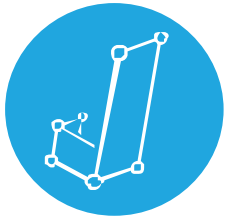


Figure 12.8 *Model* tab for ANCOVA

▼ Model

Components

Dose  
Puppy love

↓<sup>A</sup><sub>Z</sub>

▶

Model Terms

Dose  
Puppy love  
Dose \* Puppy love

Sum of squares Type III ▼



# ANCOVA



[Alex Examples](#)

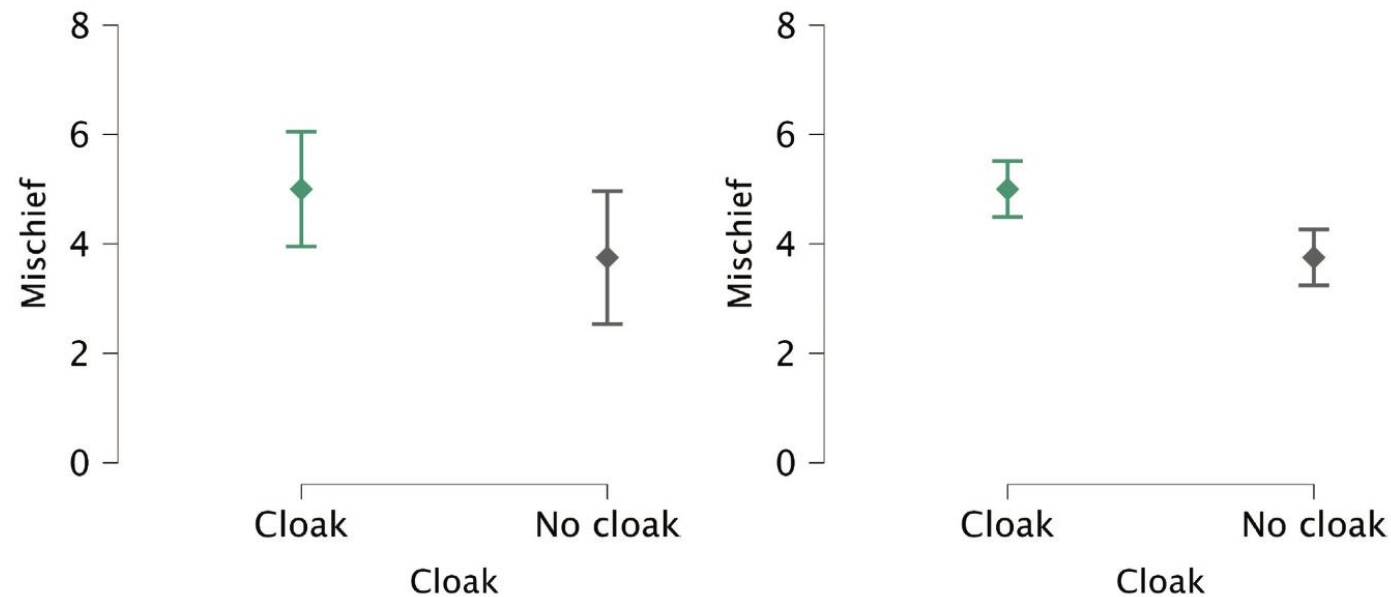
[Leni Examples](#)

# RM ANOVA



- Advantages
  - Unsystematic variance is reduced
  - More sensitive to experimental effects

Figure 9.7 Same data, between-subjects (left) and within-subjects (right)



# RM ANOVA Example

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- Training sniffer dogs to detect aliens
- After rigorous training, eight dogs sniffed each of four entities for 1 minute:
  - Alien space lizard in its natural form
  - Alien space lizard who had shapeshifted into humanoid form
  - Human
  - Human mannequin
- DV: Number of vocalizations made during each 1-minute sniffing session

# Data for Sniffer Dog Example



Table 14.1 Data for the sniffer-dog example

| Dog                     | Alien | Human | Mannequin | Shapeshifter | Mean | $s^2$ |
|-------------------------|-------|-------|-----------|--------------|------|-------|
| Milton                  | 8     | 7     | 1         | 6            | 5.50 | 9.67  |
| Woofy                   | 9     | 5     | 2         | 5            | 5.25 | 8.25  |
| Ramsey                  | 6     | 2     | 3         | 8            | 4.75 | 7.58  |
| Mr. Snifficus III       | 5     | 3     | 1         | 9            | 4.50 | 11.67 |
| Willock                 | 8     | 4     | 5         | 8            | 6.25 | 4.25  |
| The Venerable Dr. Waggy | 7     | 5     | 6         | 7            | 6.25 | 0.92  |
| Lord Scenticle          | 10    | 2     | 7         | 2            | 5.25 | 15.58 |
| Professor Nose          | 12    | 6     | 8         | 1            | 6.75 | 20.92 |
| Mean                    | 8.13  | 4.25  | 4.13      | 5.75         |      |       |

# The Assumption of Sphericity



- Assumes that the variances of *differences* between conditions are equal
- Estimated and adjusted *df* using:
  - Greenhouse-Geisser estimate
  - Huynh-Feldt estimate
- Tested using Mauchly's test (not recommended)
  - $P < .05$ , sphericity is violated
  - $P > .05$ , sphericity is met
- Rule of thumb: G-G is conservative and H-F liberal

# Defining the Repeated Factors

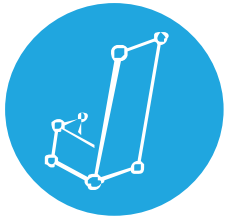


Figure 14.6 The *Repeated Measures Factors menu* for repeated-measures ANOVA

The figure displays two screenshots of the 'Repeated Measures Factors' dialog box, illustrating the process of defining repeated factors for ANOVA.

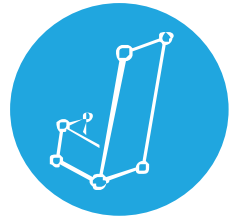
**Left Screenshot:**

- Repeated Measures Factors:** The factor is named 'RM Factor 1'. It has three levels: 'Level 1', 'Level 2', and 'New Level'. There is a 'New Factor' button at the bottom.
- Repeated Measures Cells:** This section contains two empty boxes for defining the cell structure. The first box is labeled 'Level 1' and the second box is labeled 'Level 2'.

**Right Screenshot:**

- Repeated Measures Factors:** The factor is named 'Entity'. It has five levels: 'Mannequin', 'Human', 'Shapeshifter', 'Alien', and 'New Level'. There is a 'New Factor' button at the bottom. The levels 'Shapeshifter' and 'Alien' have a small 'x' icon next to them, indicating they are selected or active.
- Repeated Measures Cells:** This section contains four empty boxes for defining the cell structure. The first box is labeled 'Mannequin', the second 'Human', the third 'Shapeshifter', and the fourth 'Alien'.

# Factorial: Post hoc comparisons



## Output 14.15

*Post Hoc Comparisons – Entity \* Scent – Conditional on Entity*

| Entity       |       |       | Mean Difference | 95% CI for Mean Difference |        | SE    | t       | Cohen's d | 95% CI for Cohen's d |        | P <sub>Holm</sub> |
|--------------|-------|-------|-----------------|----------------------------|--------|-------|---------|-----------|----------------------|--------|-------------------|
|              |       |       |                 | Lower                      | Upper  |       |         |           | Lower                | Upper  |                   |
| Human        | None  | Human | -1.180          | -1.669                     | -0.691 | 0.197 | -5.980  | -0.504    | -0.837               | -0.170 | < .001            |
|              |       | Fox   | -4.340          | -4.939                     | -3.741 | 0.242 | -17.950 | -1.852    | -2.577               | -1.128 | < .001            |
|              | Human | Fox   | -3.160          | -3.877                     | -2.443 | 0.289 | -10.932 | -1.349    | -1.972               | -0.726 | < .001            |
| Shapeshifter | None  | Human | 1.640           | 0.690                      | 2.590  | 0.383 | 4.281   | 0.700     | 0.096                | 1.304  | < .001            |
|              |       | Fox   | 1.580           | 0.611                      | 2.549  | 0.391 | 4.043   | 0.674     | 0.064                | 1.285  | < .001            |
|              | Human | Fox   | -0.060          | -0.937                     | 0.817  | 0.354 | -0.170  | -0.026    | -0.538               | 0.486  | 0.866             |
| Alien        | None  | Human | 2.080           | 1.143                      | 3.017  | 0.378 | 5.506   | 0.888     | 0.262                | 1.513  | < .001            |
|              |       | Fox   | 2.880           | 1.835                      | 3.925  | 0.422 | 6.833   | 1.229     | 0.488                | 1.970  | < .001            |
|              | Human | Fox   | 0.800           | -0.099                     | 1.699  | 0.363 | 2.207   | 0.341     | -0.196               | 0.879  | 0.032             |

# RM ANOVA



[Alex Examples](#)  
[Leni Examples](#)

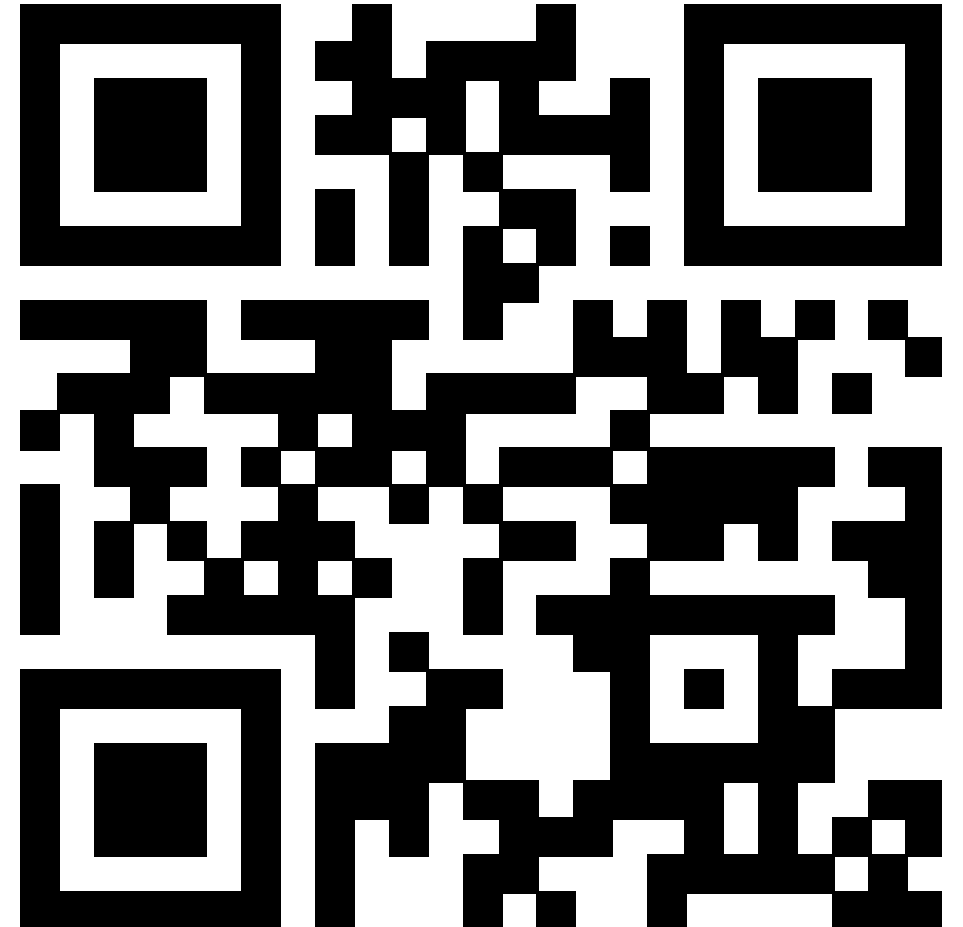




# Getting in Touch



- [JASP Mattermost channel](#)
- [GitHub page](#)
- [Priority feature requests](#)



edu.nl/knhfd