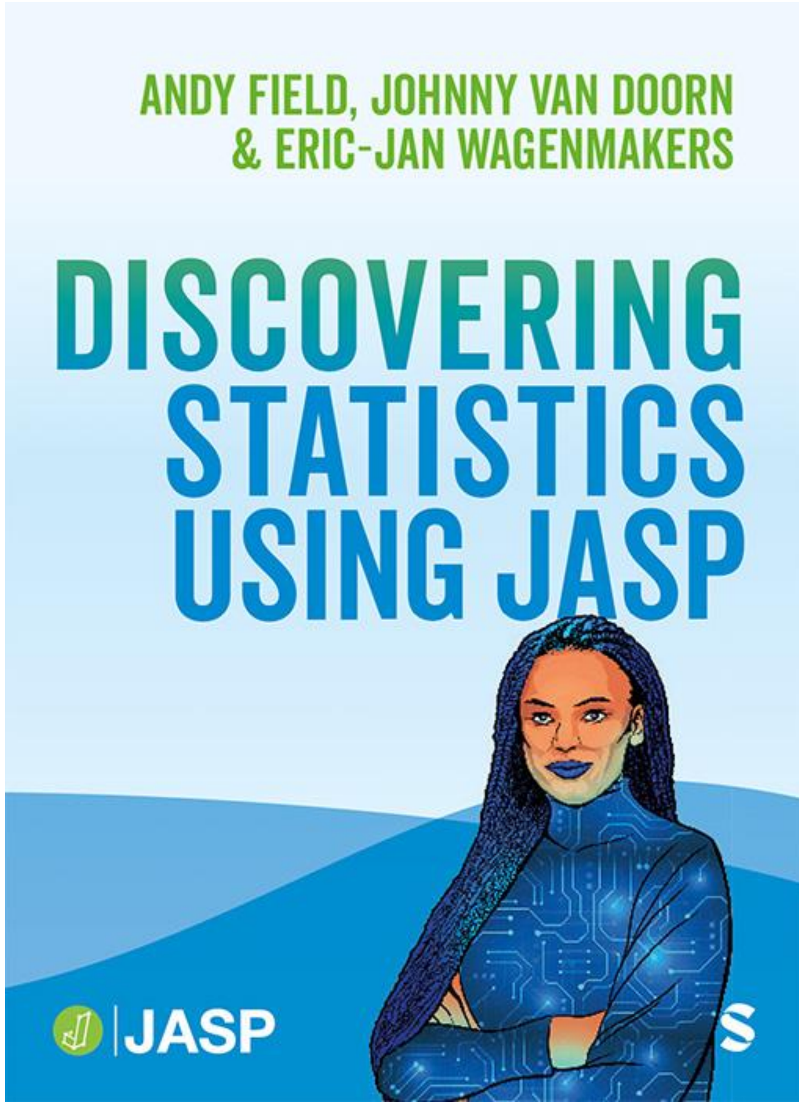
Discovering Statistics Using JASP

JASP

2025 Workshop

Universiteit van Amsterdam



Outline

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

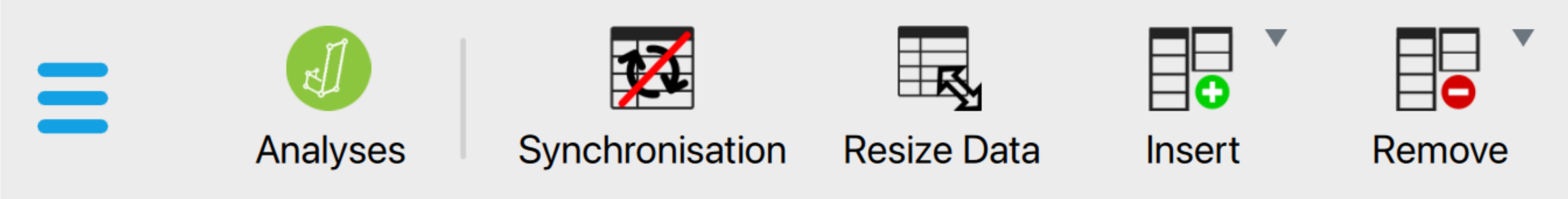
Goals of this Workshop

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

JASP

Data Management

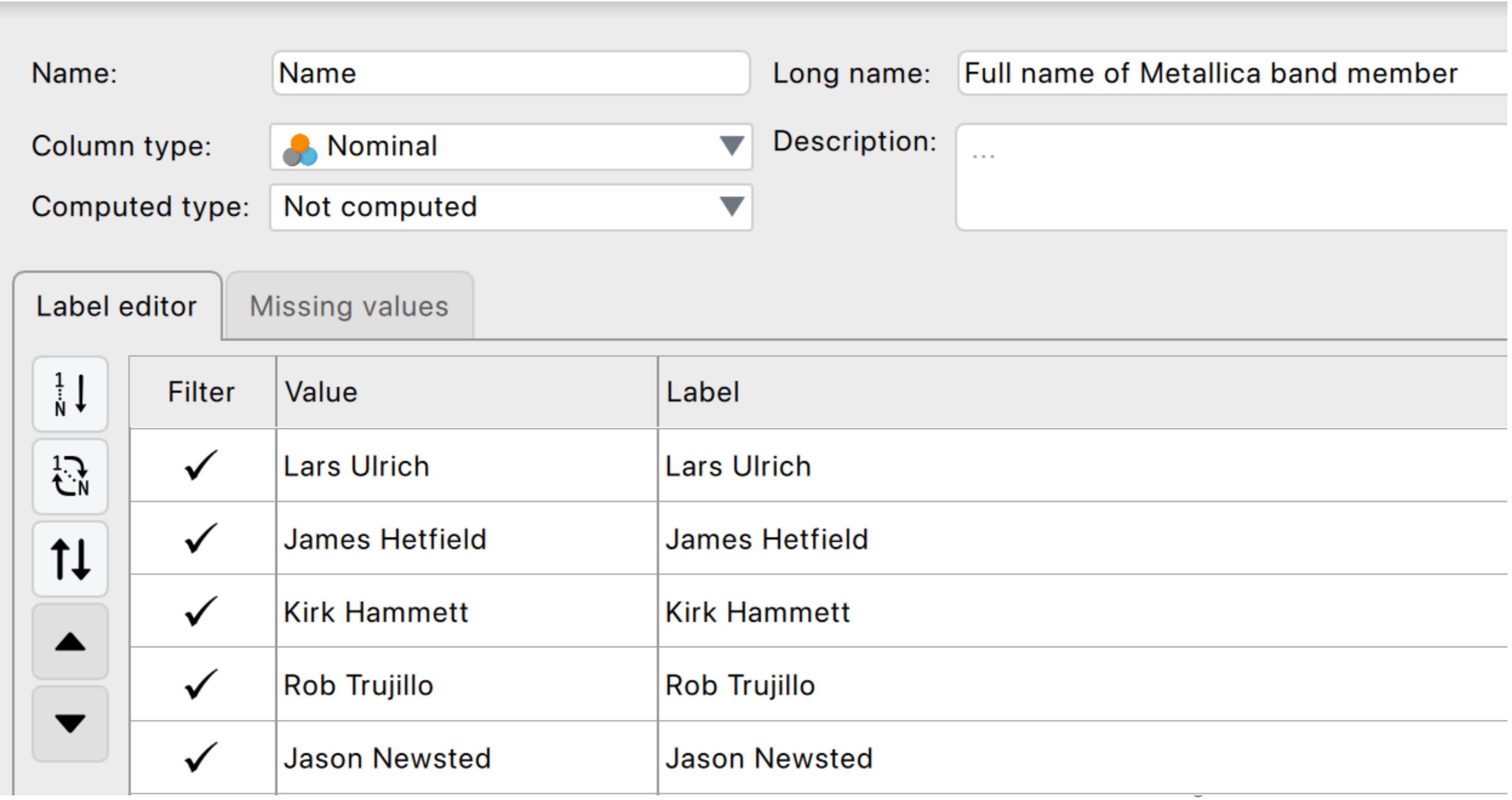
The JASP data editor for the Metallica data



	Name	Instrument	Current member	Headbanging intensity
1	Lars Ulrich	Drums	Yes 1	Light 1
2	James Hetfield	Guitar	Yes 1	Heavy 3
3	Kirk Hammett	Guitar	Yes 1	Light 1
4	Rob Trujillo	Bass	Yes 1	Moderate 2
5	Jason Newsted	Bass	No 0	Heavy 3

The Variable View

Figure 4.6 The variable settings for ‘Name’



Variable Types

Scale

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

Nominal

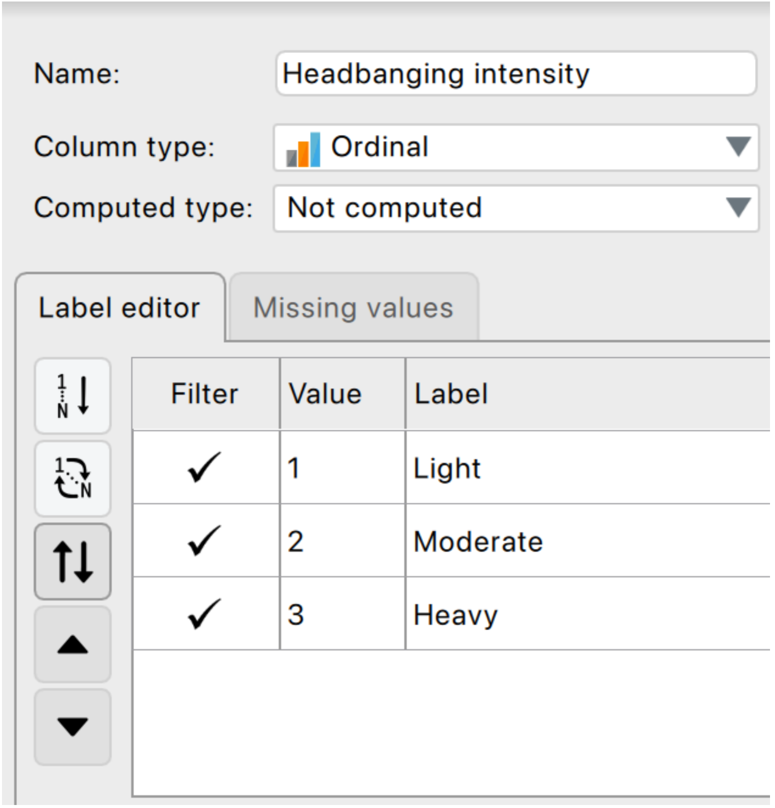
- Categories (e.g., ‘Control group’, ‘Experimental group’)

Ordinal

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

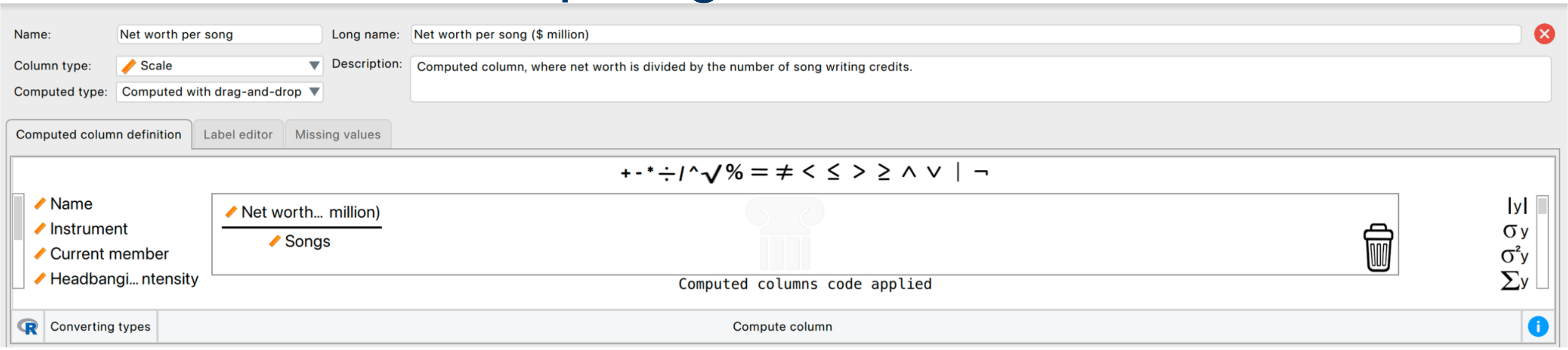
Variable Settings

Figure 4.7 Specifying the values for an ordinal variable



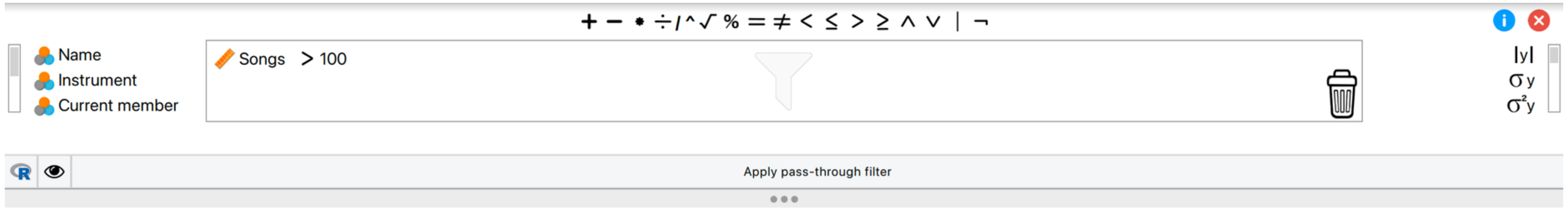
Computing a New Variable

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

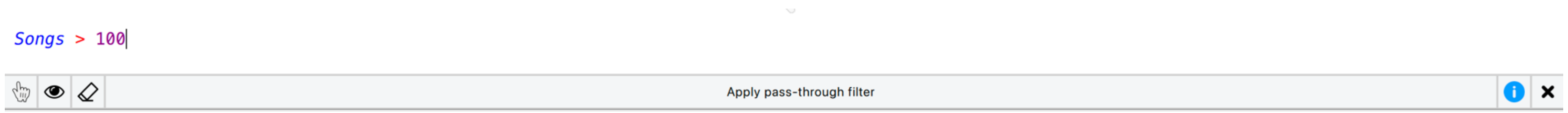


Filtering Data

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

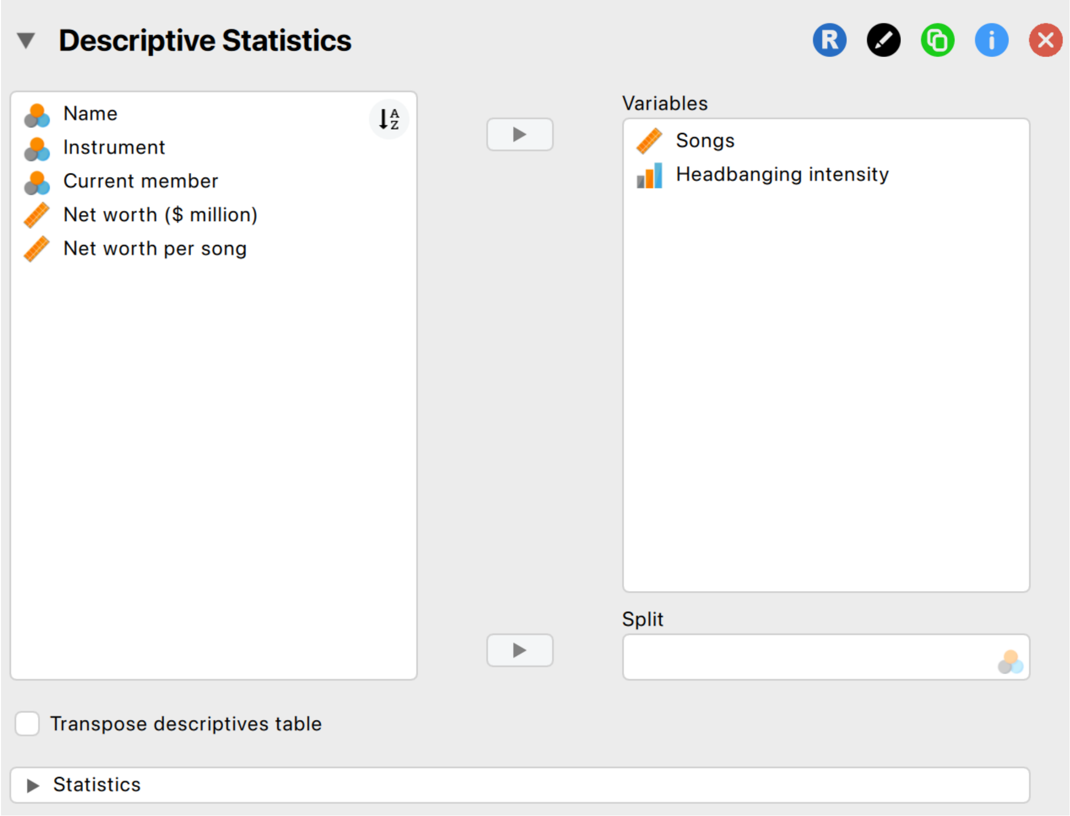


    - R-mode



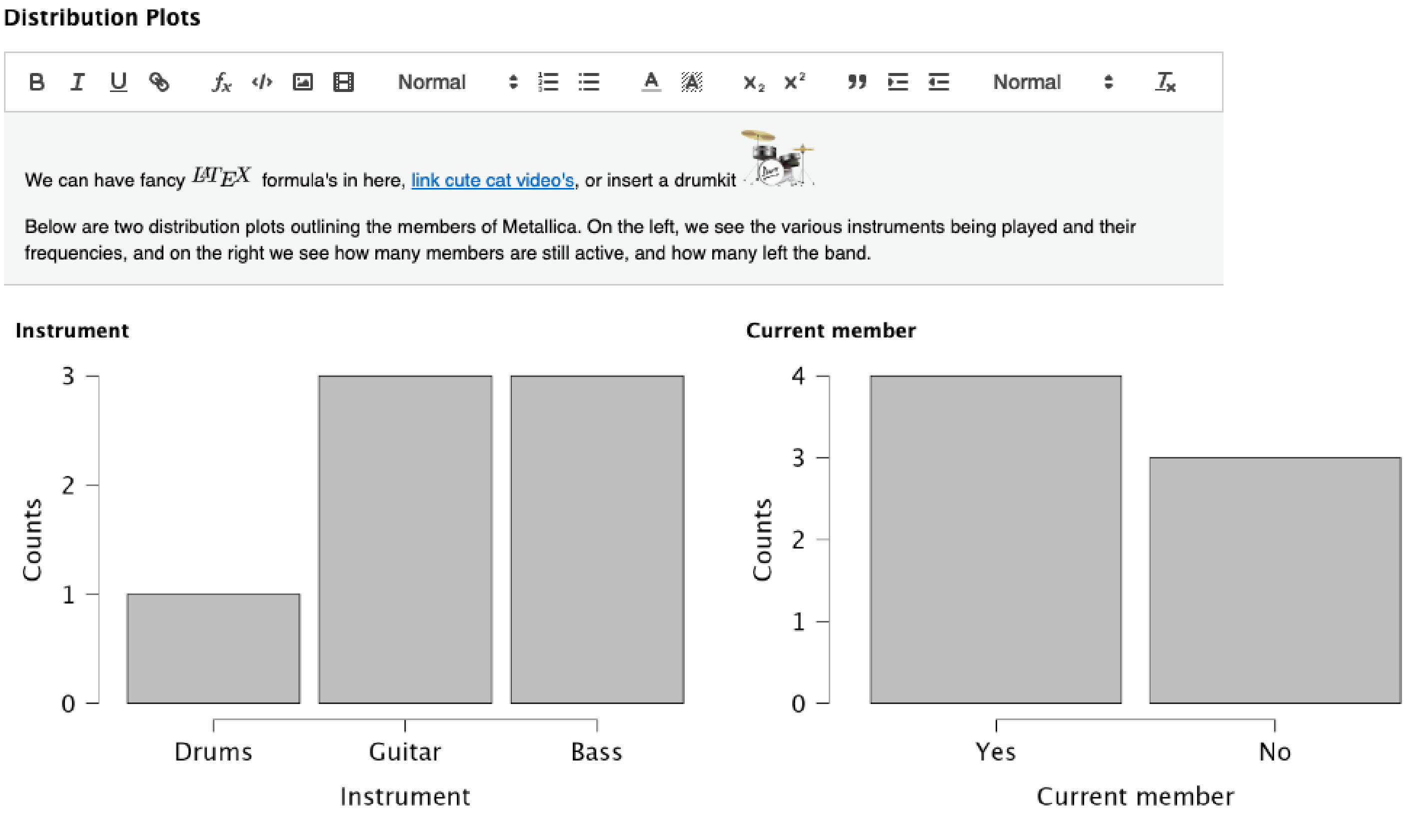
Descriptives

Figure 4.10 Input window for the Descriptives module



Output Window in JASP

Figure 4.11 Example of annotated output



Basic Flow of Data Analysis in JASP

- 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 with One Predictor

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

Data

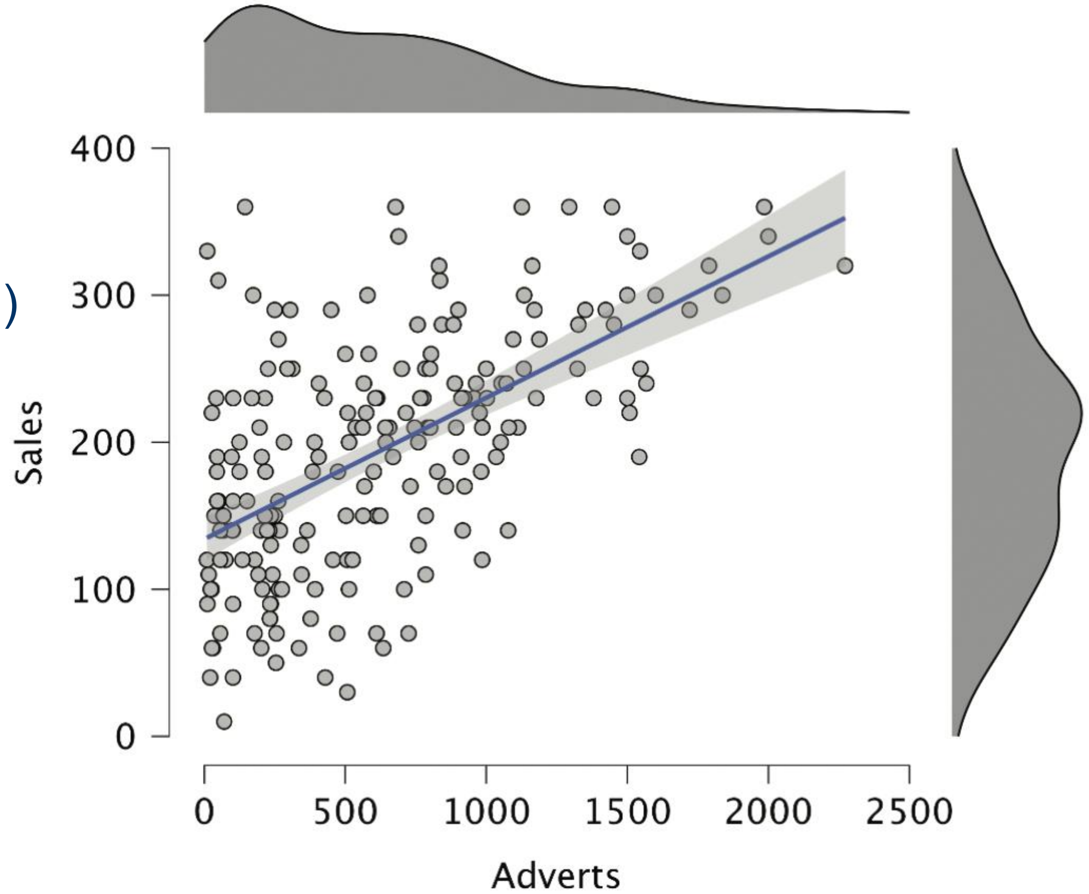
- 200 different album releases

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

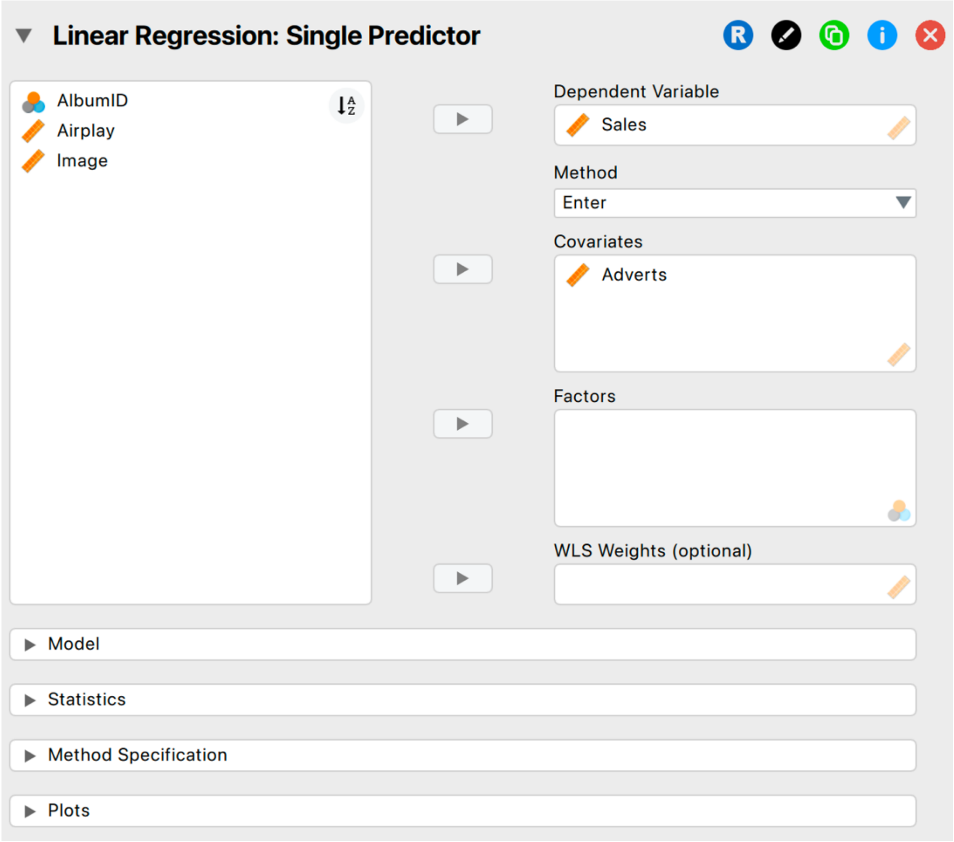
- The model contains two regression weights:

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

- b_0 is the intercept
  - The intercept is the value of the *Y* variable when all *Xs* = 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



Model Summary

Output 8.2

Model Summary - Sales

Model	R	R^2	Adjusted R^2	RMSE
M_0	0.000	0.000	0.000	80.699
M_1	0.578	0.335	0.331	65.991

Note. M_1 includes Adverts

Multiple Regression

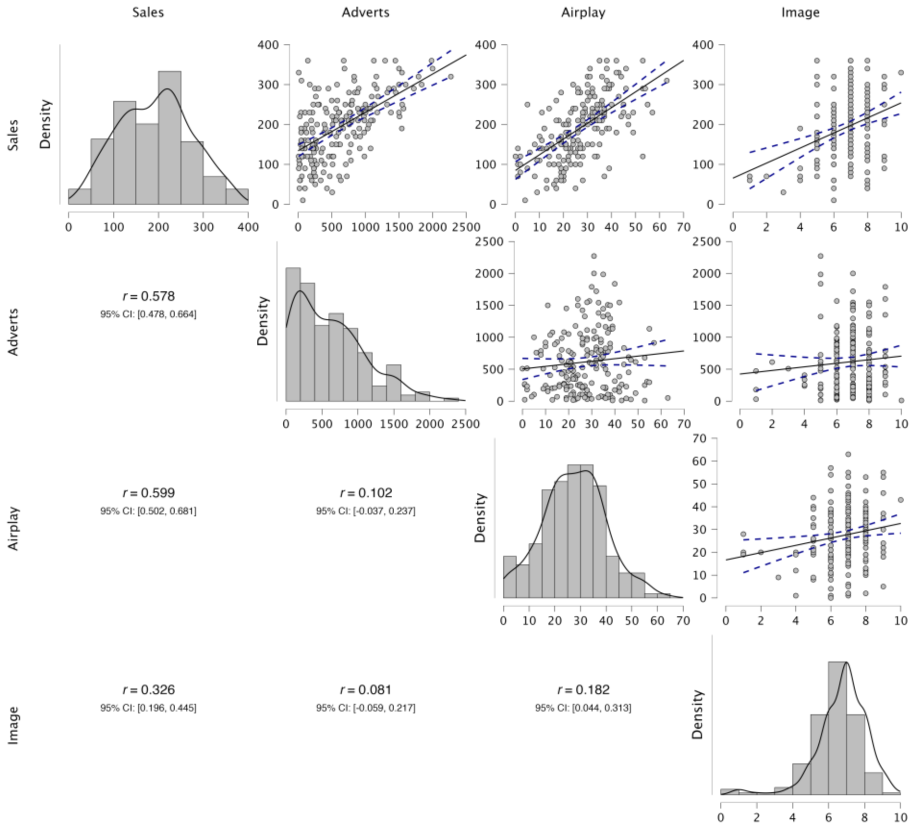
- With several predictors the model now contains multiple regression weights:

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

- 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^{th} variable.

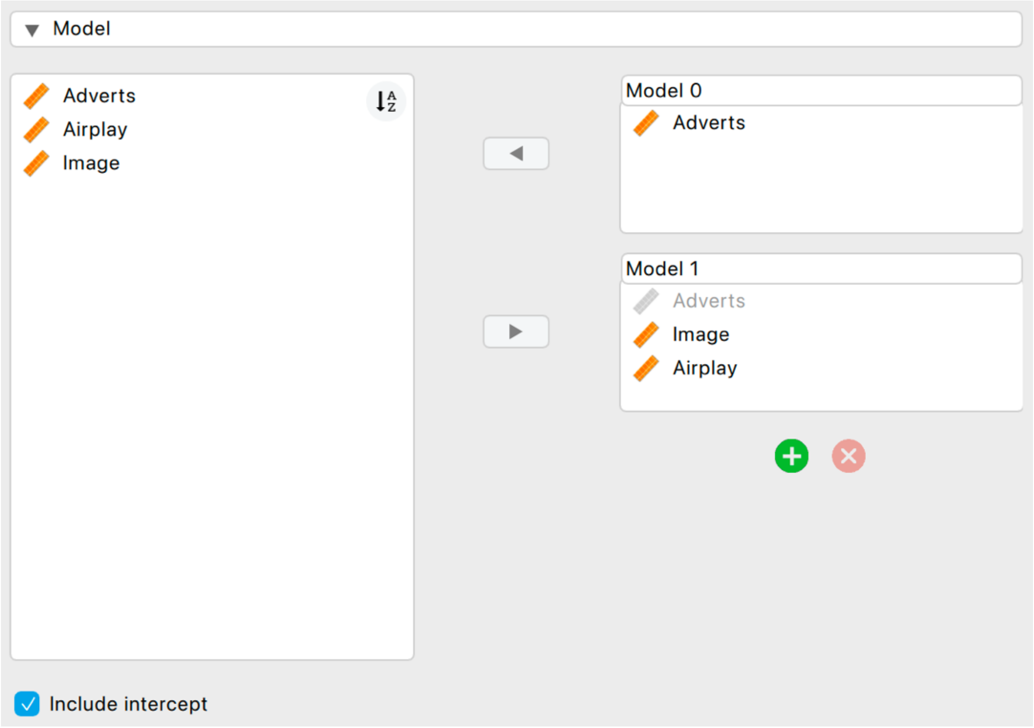
A model with Several Predictors

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



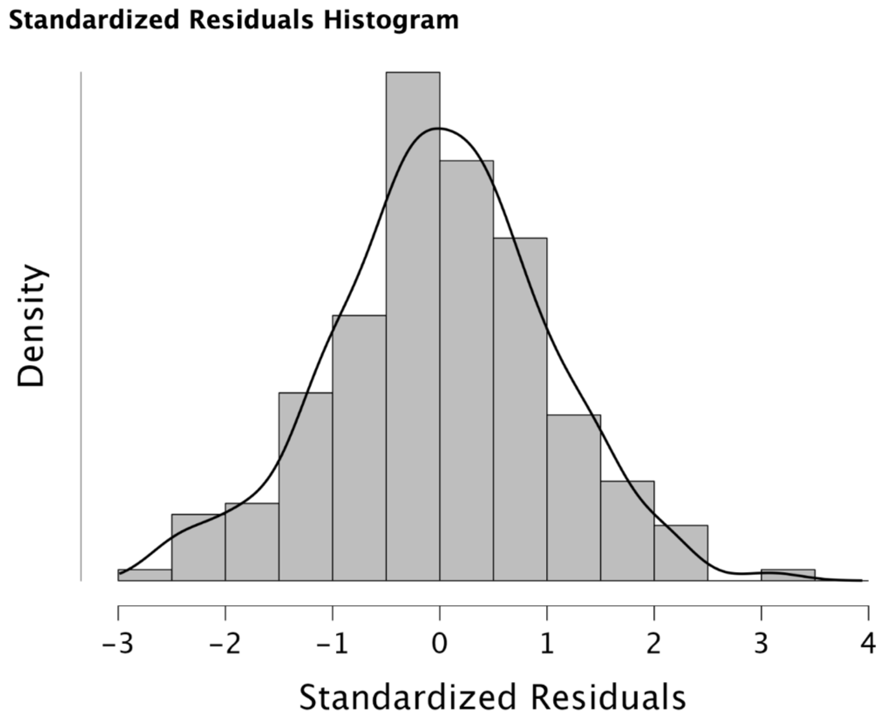
Multiple Regression

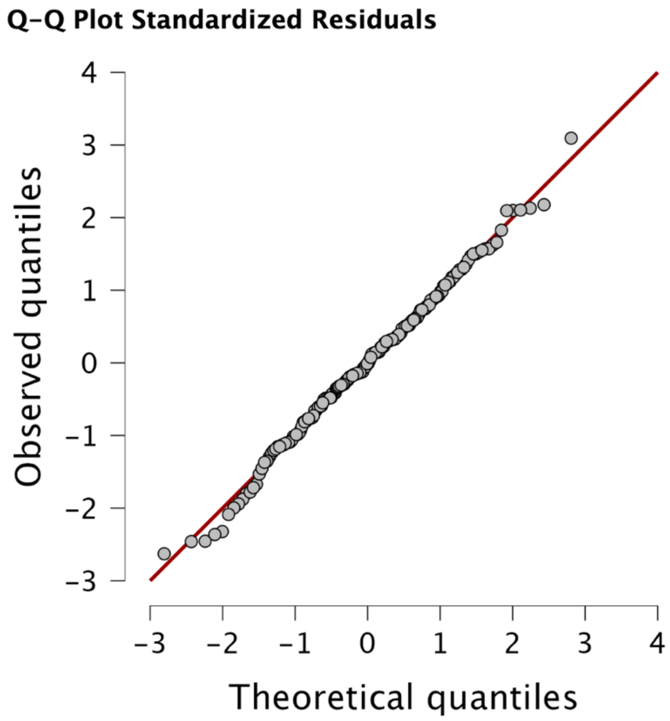
Figure 8.12 Main menu for block 2 of the multiple regression



Normality of Residuals: Histograms and Q-Q Plots

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





Model Parameters

Output 8.7

Coefficients

Model		Unstandardized	Standard Error	Standardized	t	p	95% CI Lower	95% CI Upper	Collinearity Statistics Tolerance	Collinearity Statistics VIF
M_0	(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_1	(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

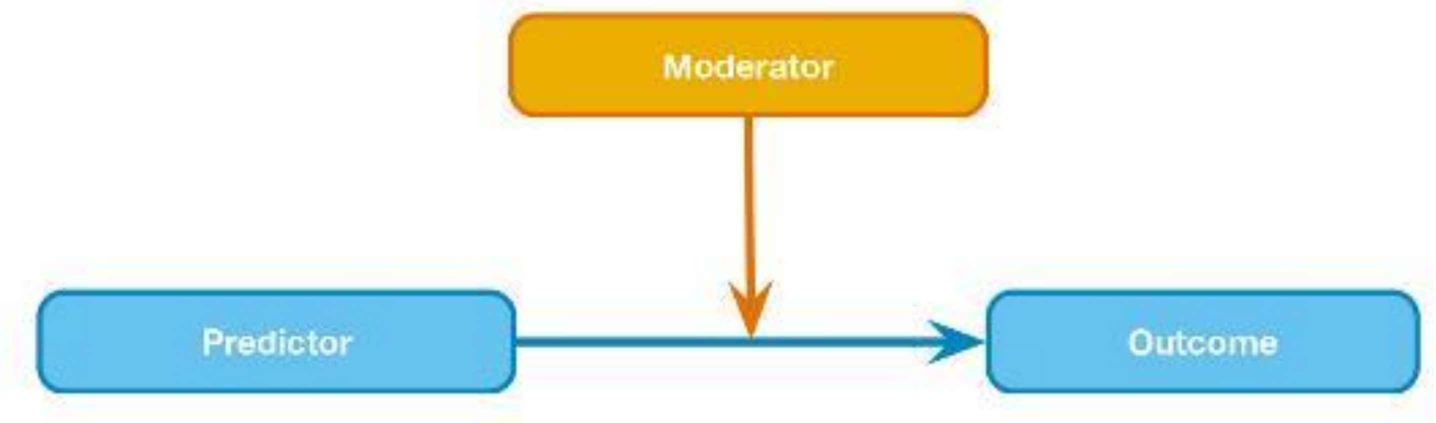
b-values:

- 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

Moderation

Figure 10.2 Diagram of the *conceptual* moderation model

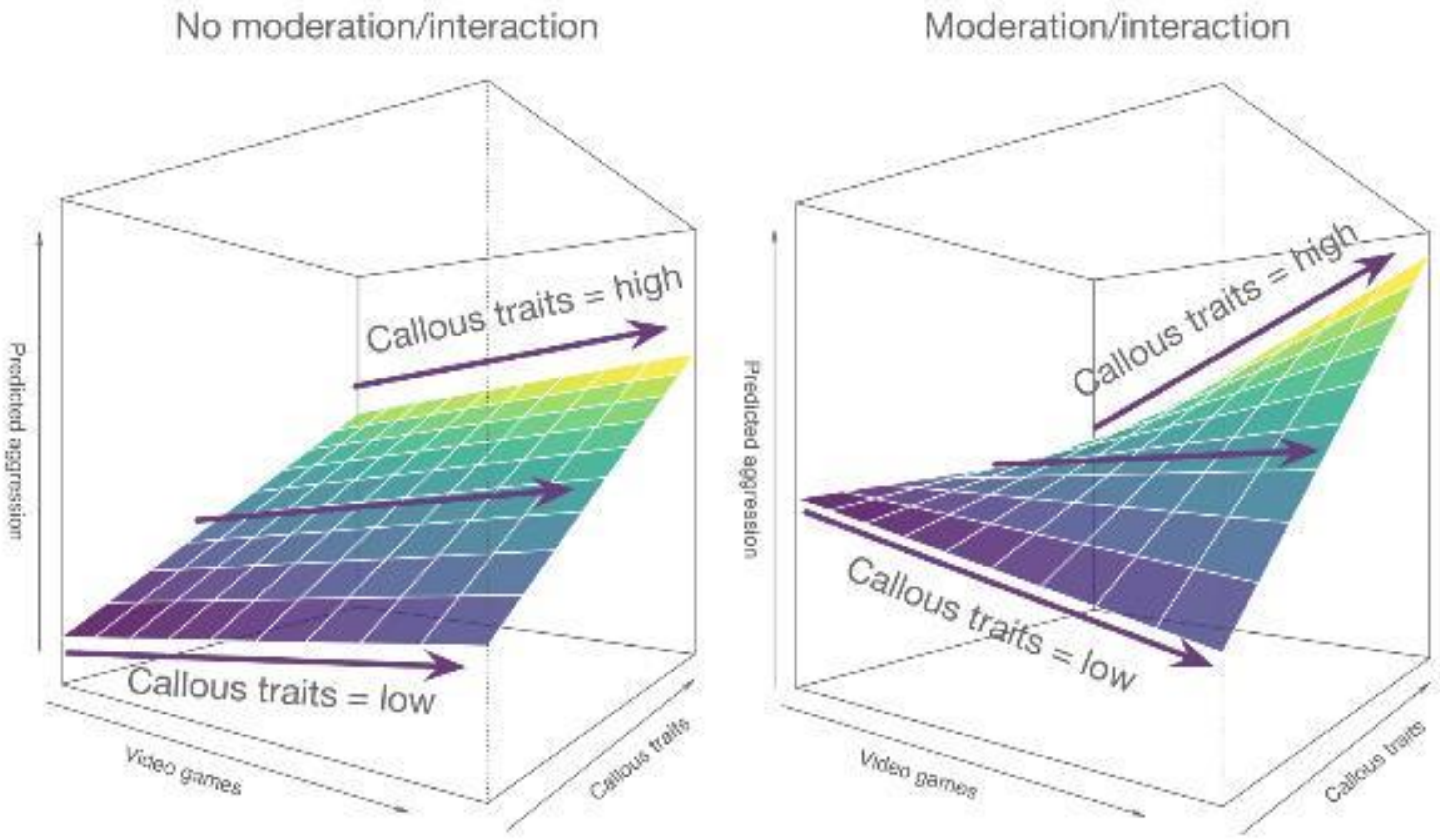


Example

- 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

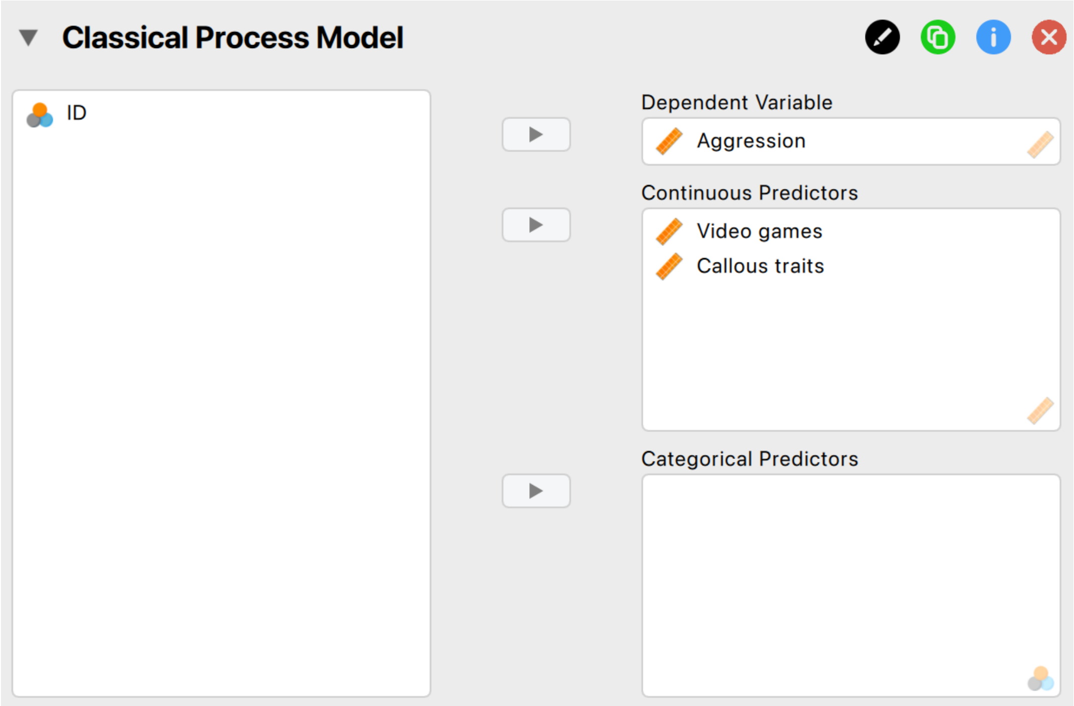
Moderation

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

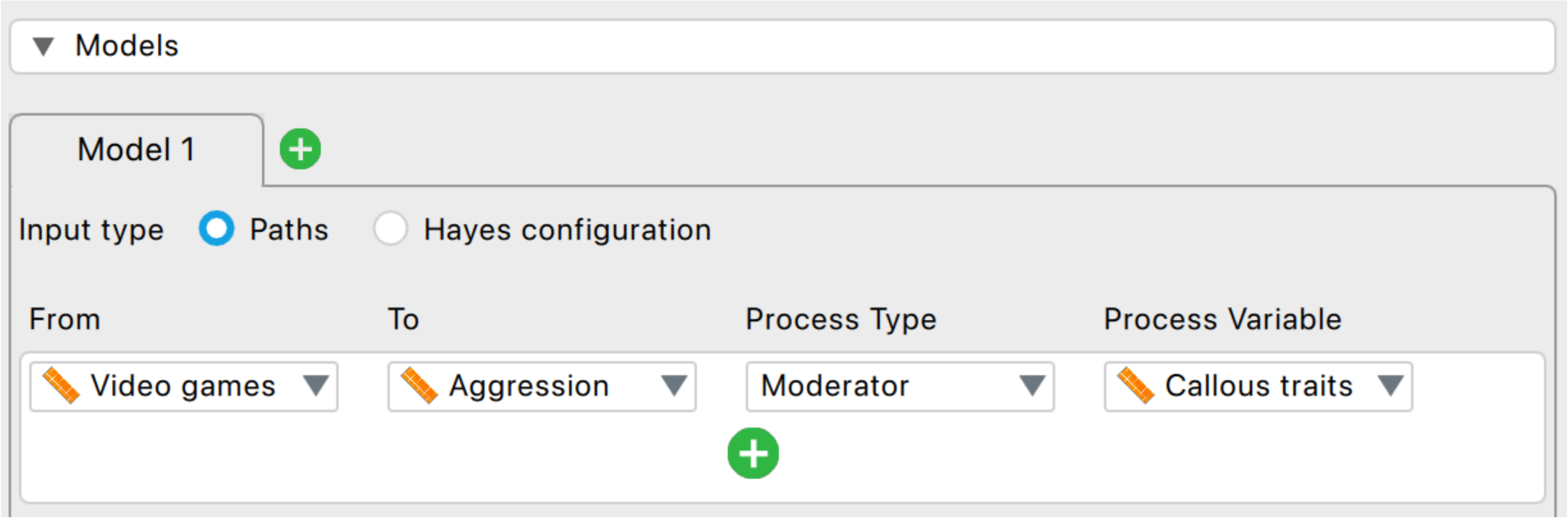
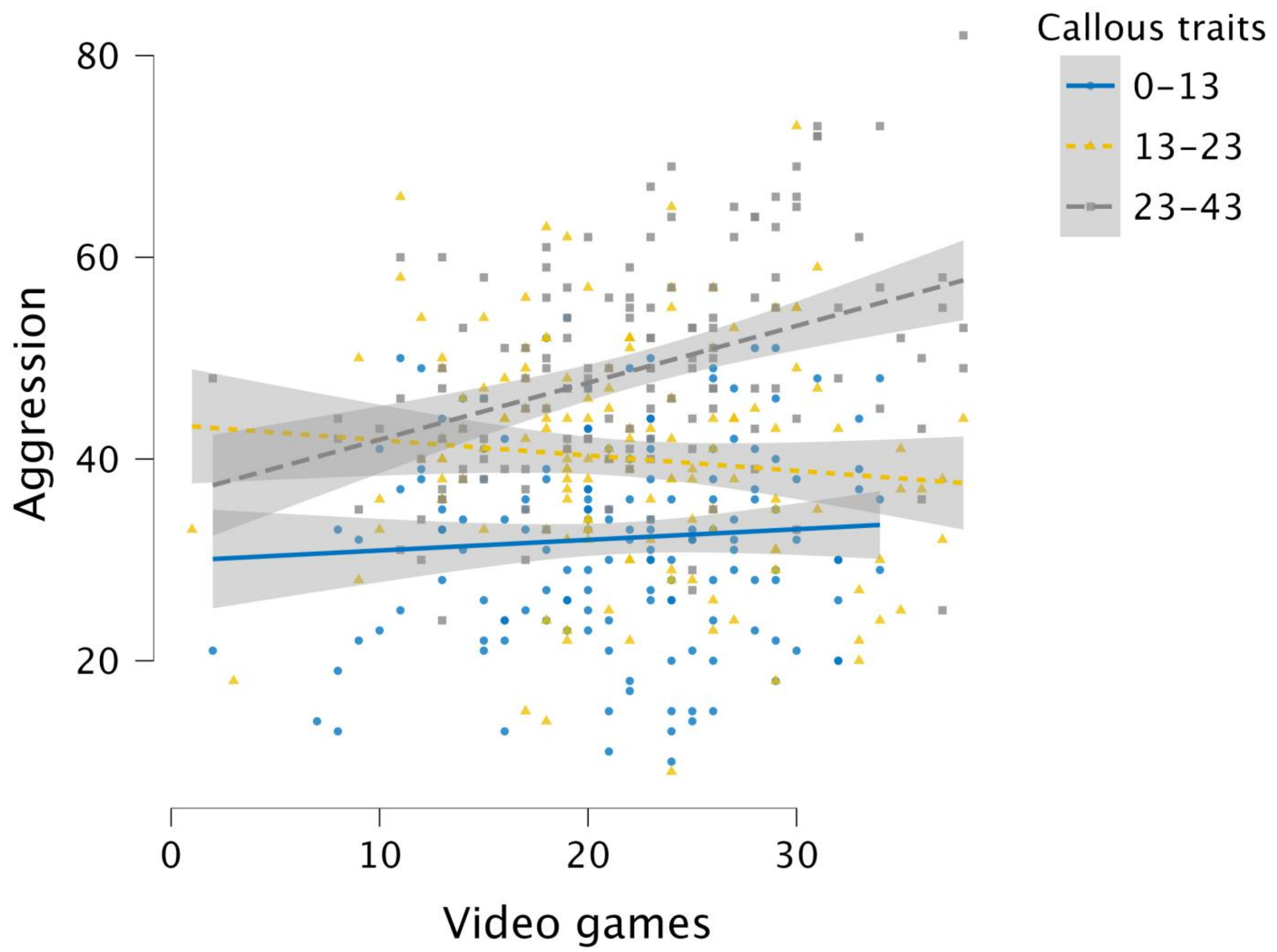
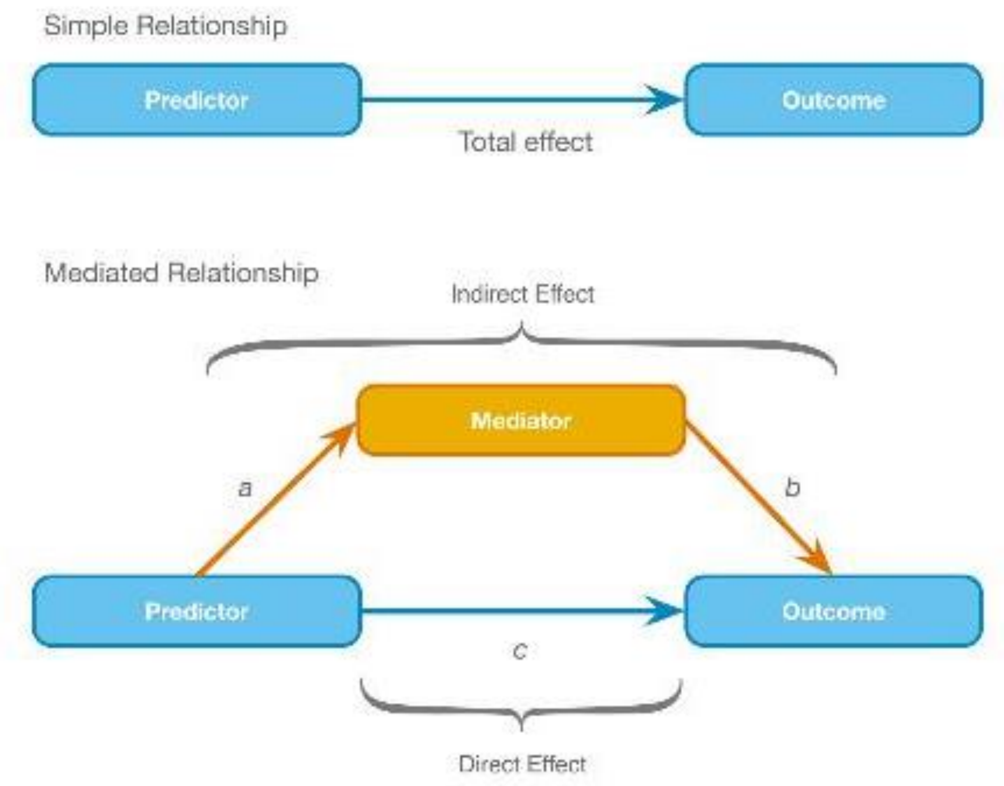


Figure 10.9 Plotting the interaction effect using Flexplot, where Callous traits is binned



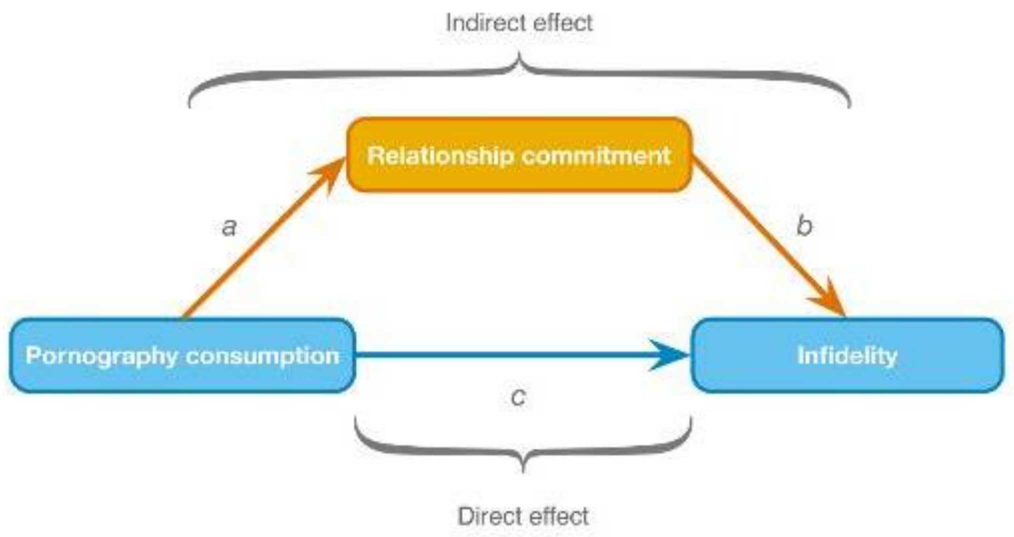
Mediation

Figure 11.9 Diagram of a mediation model



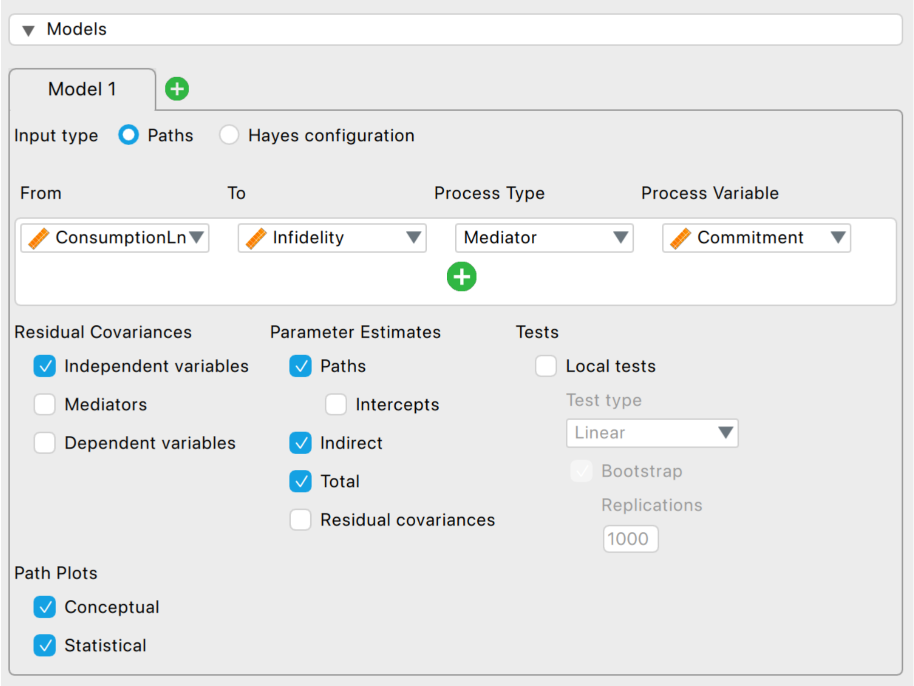
Mediation Example

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



Mediation Model with Two Mediators

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

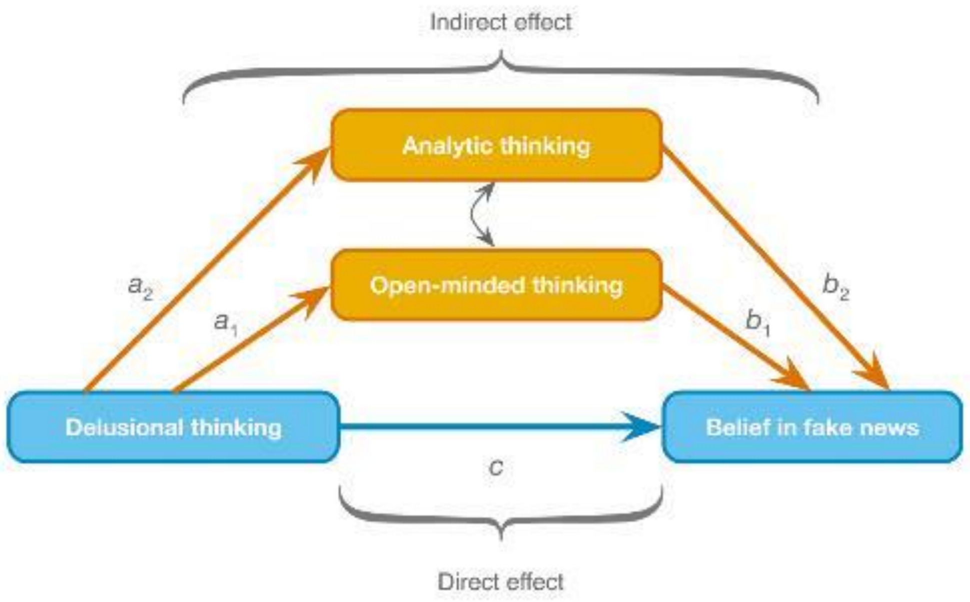
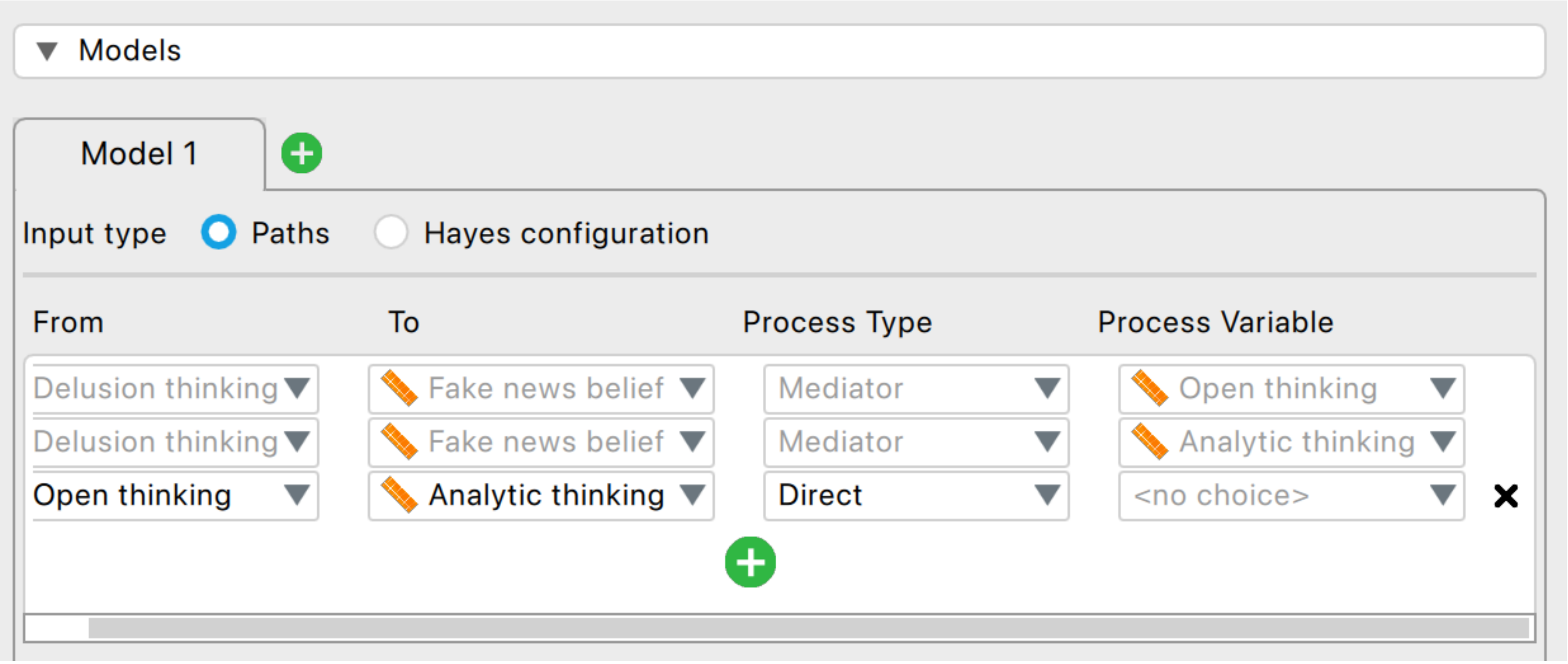


Figure 10.17 The dialogue boxes for running mediation analysis with two mediators

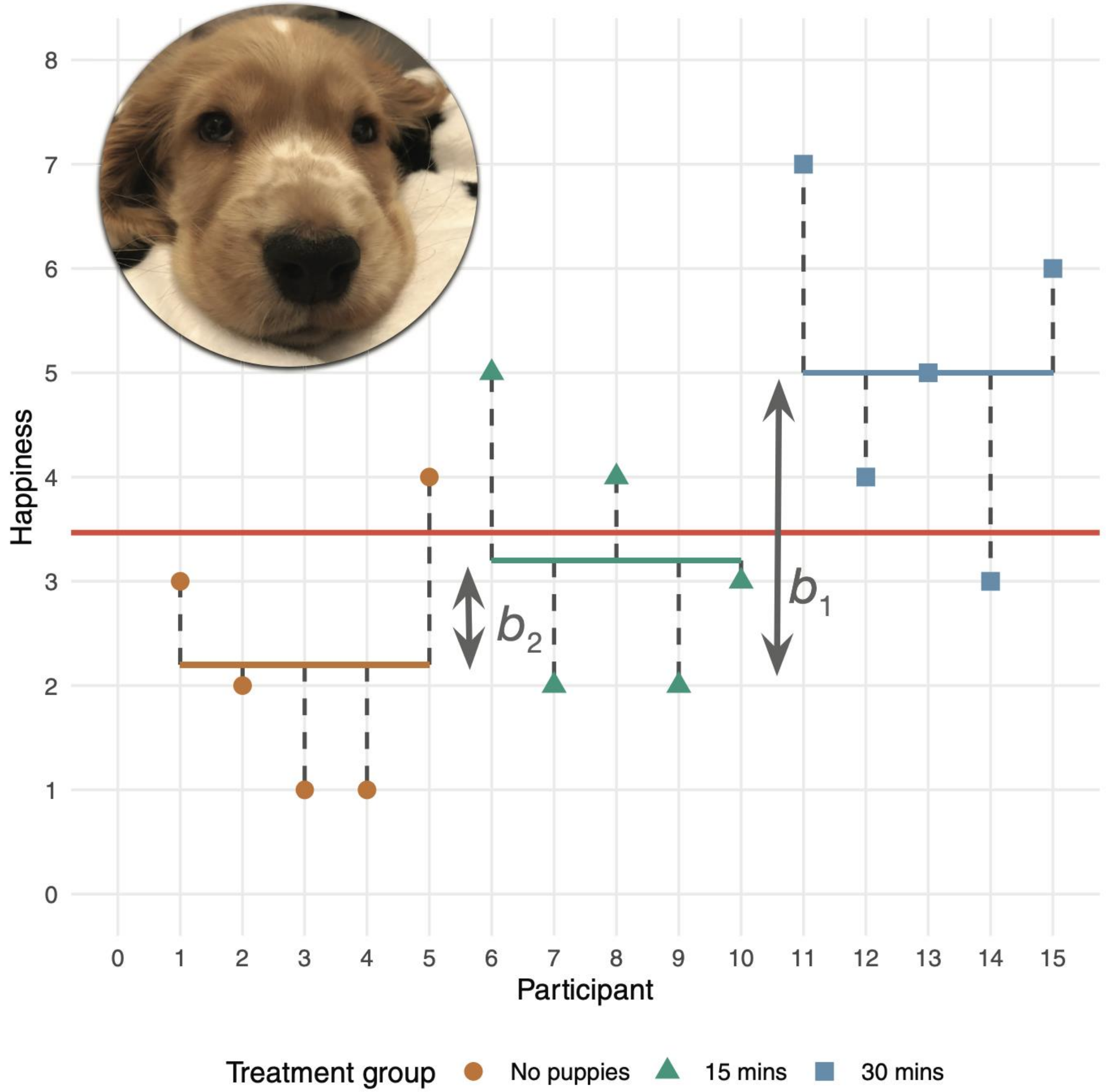


Moderation & Mediation

ANOVA: Puppy Example

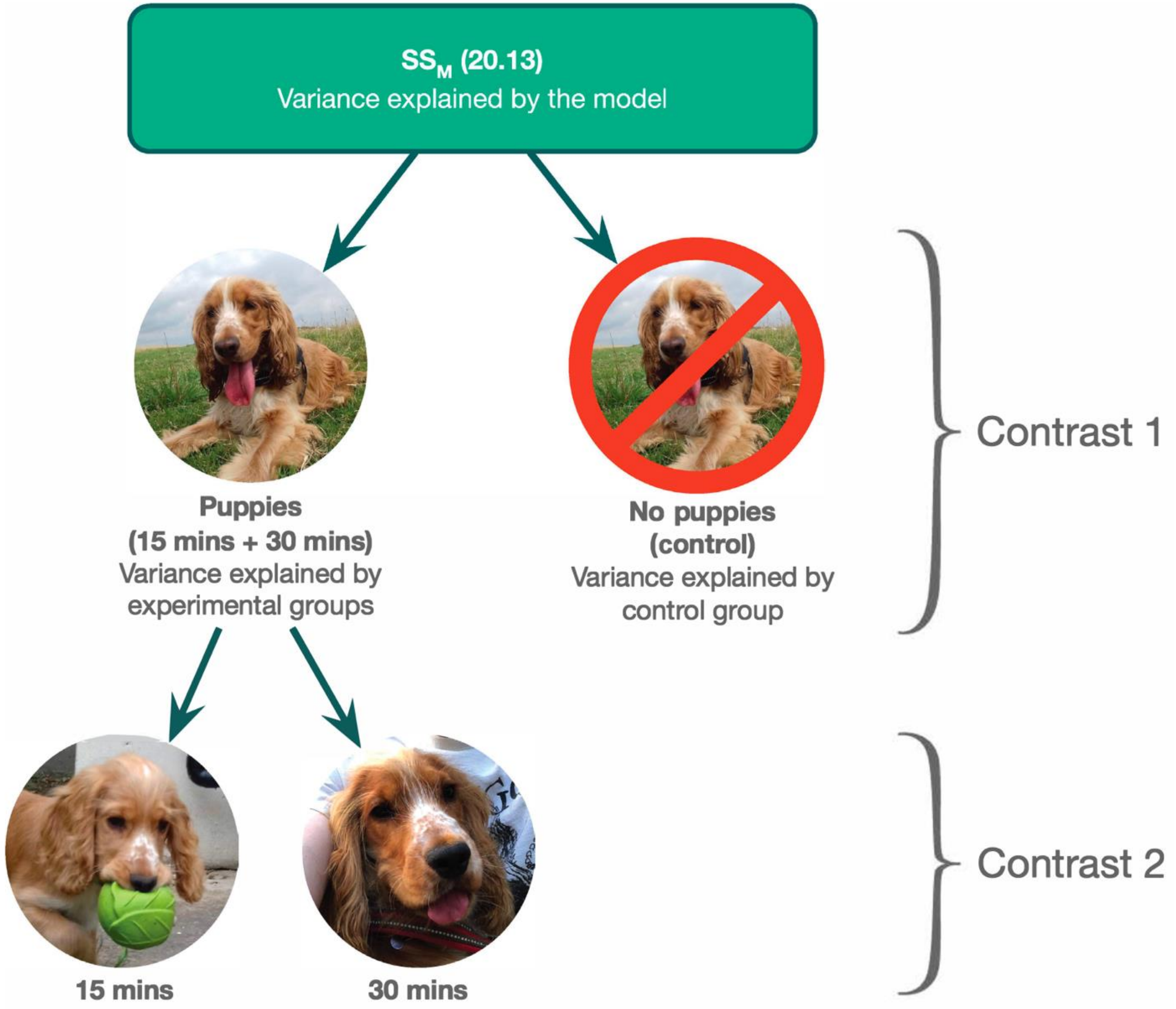
- A puppy therapy RCT in which we randomized people into three groups:
  1. A control group
  2. 15 minutes of puppy therapy
  3. 30 minutes of puppy contact
- The DV is happiness (0 = unhappy) to 10 (happy)
- Predictions:
  1. Any form of puppy therapy should be better than the control (i.e. higher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

ANOVA



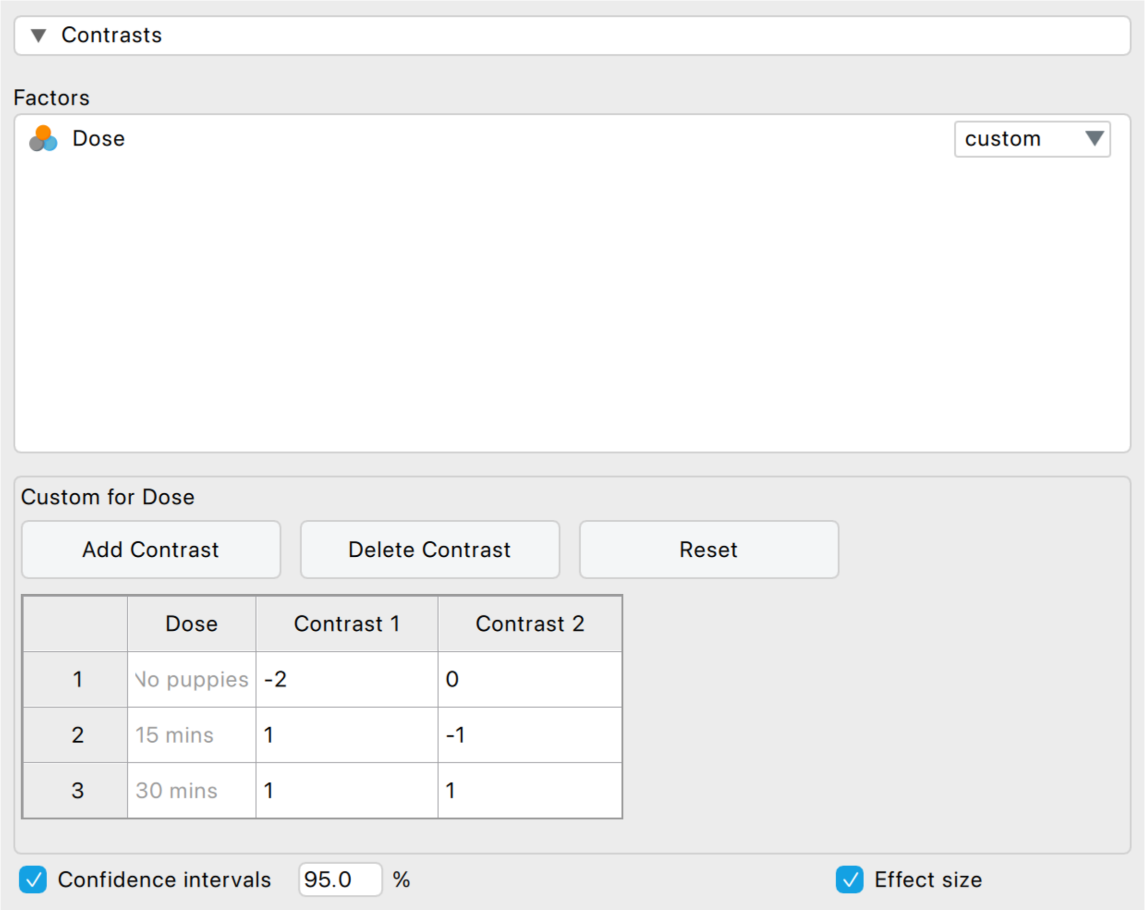
Happiness
Participant
b_1
b_2
8
7
6
5
4
3
2
1
0
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
Treatment group
No puppies
15 mins
30 mins

Contrasts



SS_M (20.13)
Variance explained by the model
Puppies
(15 mins + 30 mins)
Variance explained by experimental groups
No puppies
(control)
Variance explained by control group
Contrast 1
15 mins
30 mins
Contrast 2

Contrasts in JASP



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

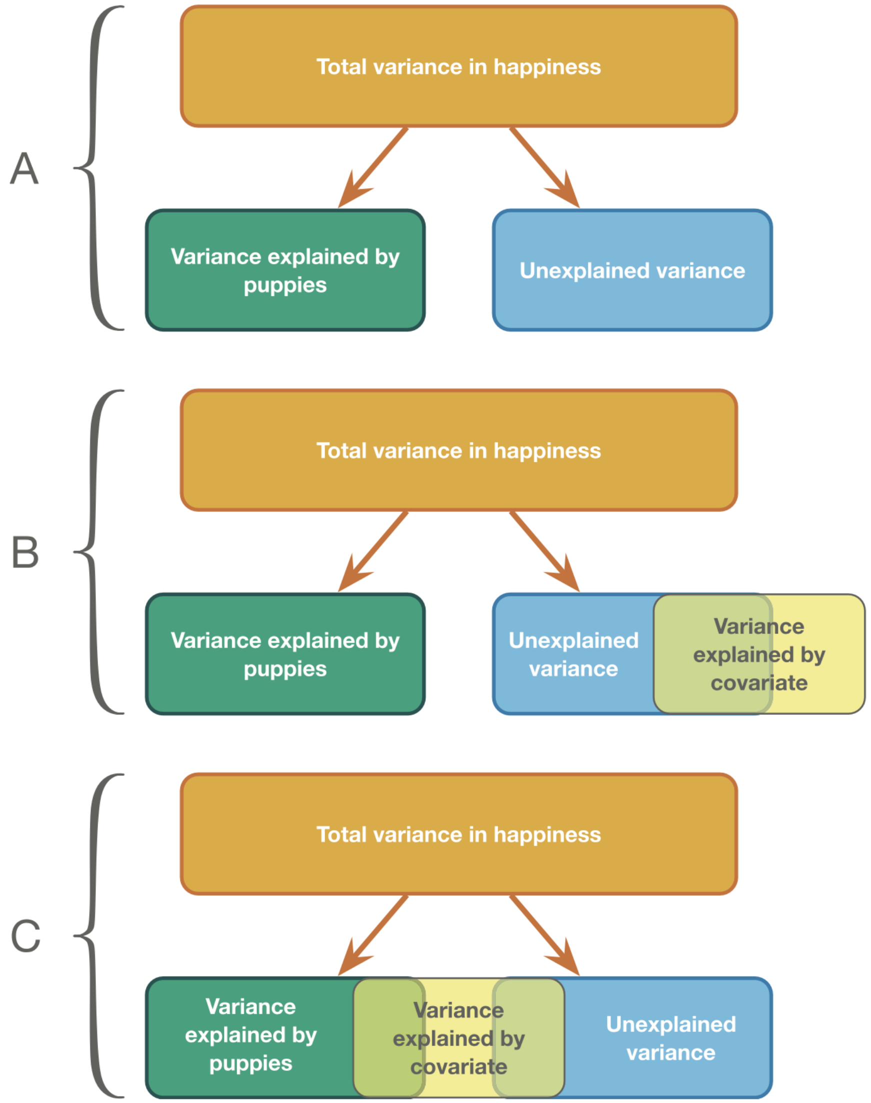
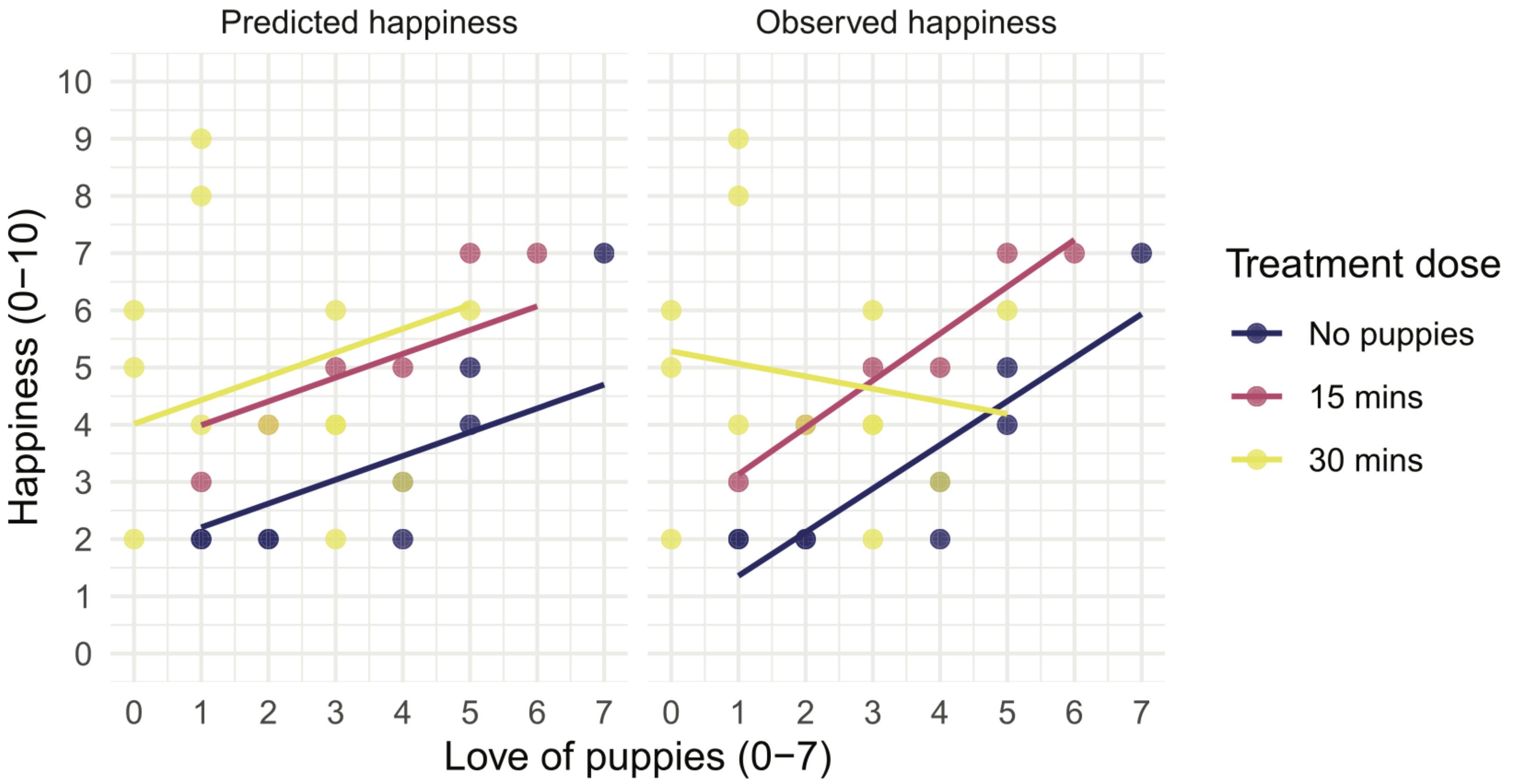


Figure 12.2 The role of the covariate in ANCOVA

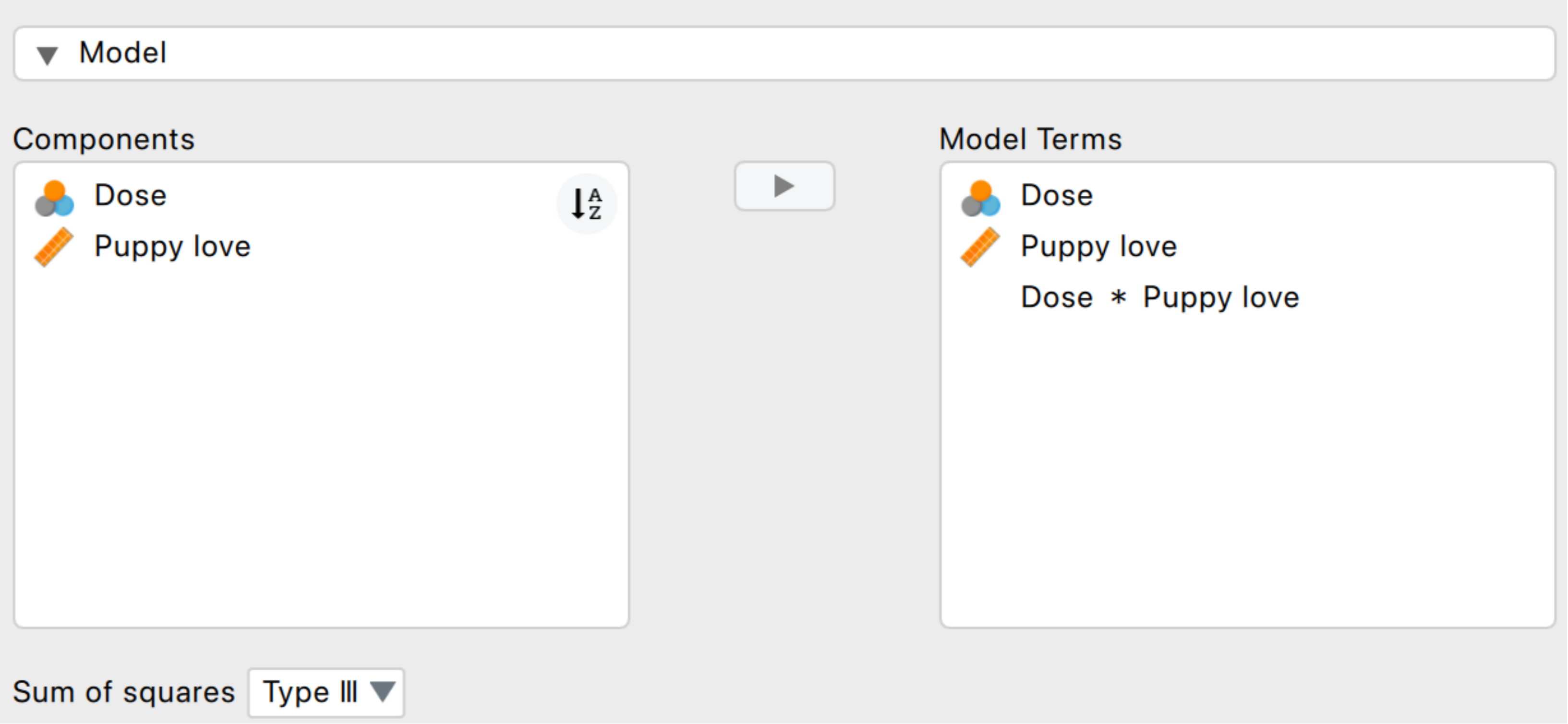
Homogeneity of Slopes

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

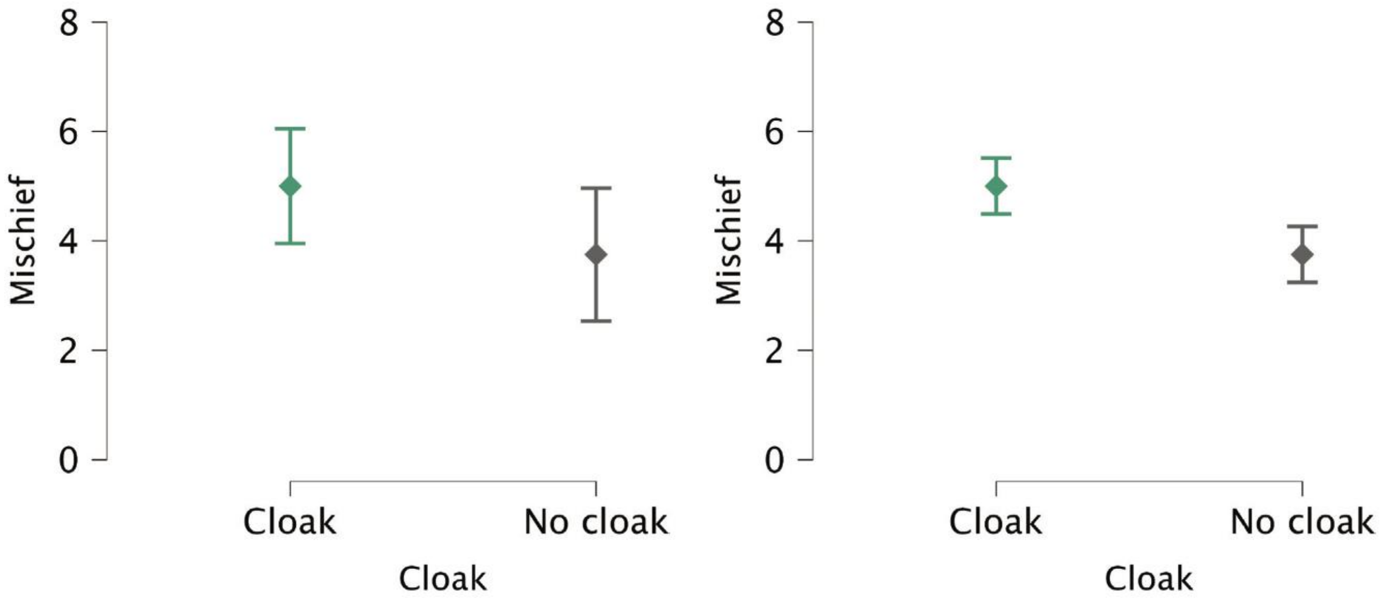


ANCOVA

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

- 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

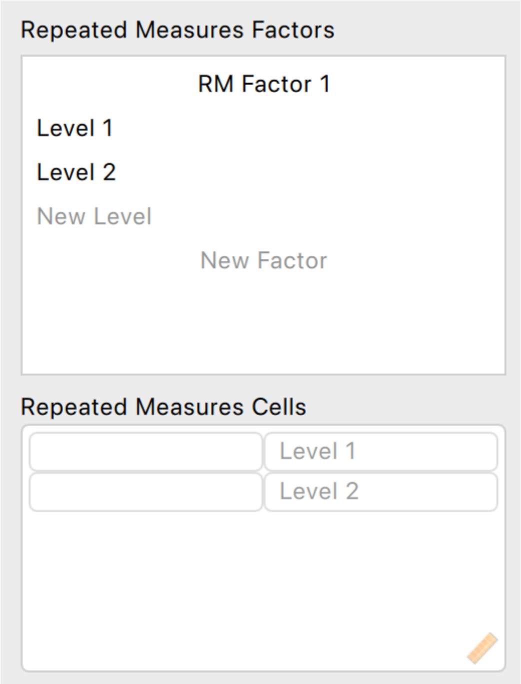
Dog	Alien	Human	Mannequin	Shapeshifter	Mean	s^2
Milton	8	7	1	6	5.50	9.67
Woofy	9	5	2	5	5.25	8.25
Ramsey	6	2	3	8	4.75	7.58
Mr. Snifficus III	5	3	1	9	4.50	11.67
Willock	8	4	5	8	6.25	4.25
The Venerable Dr. Waggy	7	5	6	7	6.25	0.92
Lord Scenticle	10	2	7	2	5.25	15.58
Professor Nose	12	6	8	1	6.75	20.92
Mean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

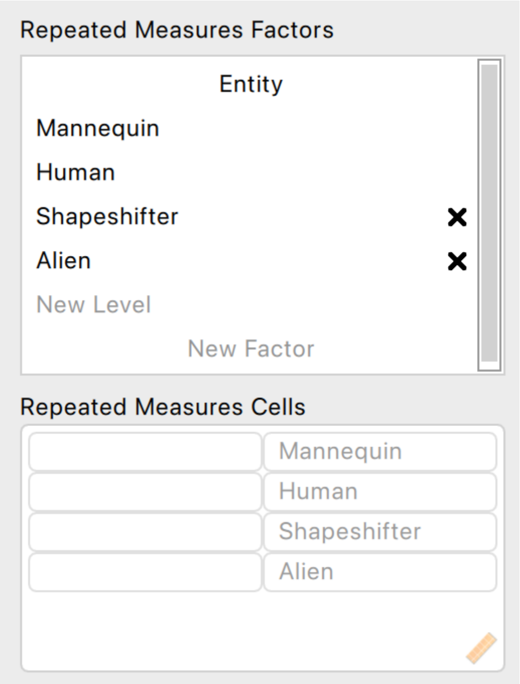
The Assumption of Sphericity

- 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





Factorial: Post hoc comparisons

Output 14.15

Post Hoc Comparisons – Entity ✻ Scent – Conditional on Entity

Entity			Mean Difference	95% CI for Mean Difference Lower	Upper	SE	t	Cohen's d	95% CI for Cohen's d Lower	Upper	p_{holm}
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

JASP