



<https://www.vox.com/future-perfect/21504366/science-replication-crisis-peer-review-statistics>fbclid=IwAR3lIJXfXBVwFWaE5aw4RXHKY

ES, CI AND POWER ANALYSIS IN JAMOVI

A QUICK 360° DEGREES EXCURSUS

Ph.D Programme in Psychology, Linguistics and Cognitive
Neurosciences

A PREMISE: HOW TO INSTALL NEW MODULES IN JAMOVI



From the library we can choose the module we are interested in.
For our purposes, we need:

esci - Effect Sizes and Confidence Intervals for R and Jamovi 0.9.4
Robert J. Calin-Jageman

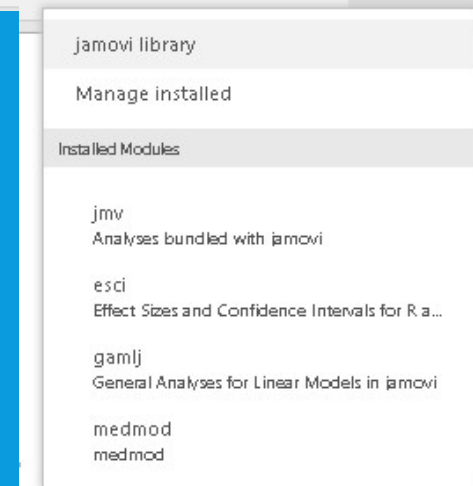
This module is for estimation, providing analyses that focus on effect sizes, uncertainty, and synthesis. This module is designed for ease of use and provides high-quality visualizations that emphasize effect sizes and uncertainty.

Currently, all analyses are frequentist, returning confidence intervals.

jpower - Power Analysis for Common Research Designs 0.1.2
Richard D. Money, Ravi Selker

Power analysis for common research designs

INSTALL



NHST : ES, CI AND POWER FOR SAMPLE SIZE PLANNING

- In our lesson we saw the NHST (Neyman-Pearson approach) and the possible decisions. We saw that we need to fix the significance level (minimum 0.05) and the power (minimum 0.80).
- To meet these requirements, we need sample size planning.
- According to the American Psychological Association (Apa), the types of sample size planning are:
 1. Power analysis, when the existence of an effect is at stake;
 2. Accuracy in parameter estimation (AIPE) , when the magnitude of of an effect is the primary aim.
- Here we tackle:
 1. The power analytic perspective in sample size planning.
 2. Estimation of the ES.

both in Jamovi, in order to have a homogeneous learning setting. We will still need G*Power,, and R, but becoming familiar with statistical concept within a single setting first allows us to go further.

EFFECT SIZE WITH RELATIVE CI

- Some procedures (i.e. specific analysis) allow us to compute ES .
- A dedicated module to CI for the 'new statistics' , ESC, linked to the volume by Geoff Cumming:
 - *Understanding The New Statistics: Effect Sizes, Confidence Intervals, and Meta-Analysis*
 - *Introduction to the New Statistics*
- For introductory documentation see: <https://thenewstatistics.com/itns/esci/jesci/>. The link provides the correspondence between standard statistical terminology and the author's one.
- The module is in development

T-TEST ON DIFFERENCE IN MEANS BETWEEN TWO INDEPENDENT GROUPS. ES AND CI ARE INCLUDED

Independent Samples T-Test

id
hours

Dependent Variables
performance

Grouping Variable
type

Tests

Student's
 Bayes factor
Prior: 0.707
 Welch's

Additional Statistics

Mean difference
 Confidence interval 95 %
 Effect size
 Confidence interval 95 %

Response: hours
Groups: type (2 types)
Request of ES
Request of CI (95%)

The CI of the ES is the CI generated by the test. There is a one-to-one correspondence between the CI under the null hypothesis and NHST

Results

Independent Samples T-Test

Independent Samples T-Test

					95% Confidence Interval		
		Statistic	df	p	Effect Size	Lower	Upper
performance	Student's t	-0.908	98.0	0.366	Cohen's d -0.182	-0.574	0.213

ES

CI of the ES

ESCI MODULE: T-TEST ON DIFFERENCE IN MEANS BETWEEN TWO INDEPENDENT GROUPS

Estimate Independent Mean Difference

Analyze raw data Enter summary data

Work With Raw Data

id
performance

Dependent variable: hours

Grouping variable: type

Switch comparison order

Work With Summary Data

Analysis options

Confidence level: 95

Assume equal variances

Region of Practical Equivalence (ROPE) Options

Graph Options

Response: hours

Groups: type (2 types)

We can fix the confidence level for CI

Beware: the analysis option is homoscedasticity

Out of curiosity, in the t-test a research design? Yes, it is a one way Anova, with a factor with 2 values.

T-TEST ON DIFFERENCE IN MEANS BETWEEN TWO INDEPENDENT GROUPS

Estimate Independent Mean Difference

Compare Two Means

Condition	M	95 % CI		s	N
		Lower	Upper		
P	7,300	6,34	8,258	3,41	50
A	8,000	7,15	8,851	3,03	50
Difference	-0,700	-1,98	0,581	3,23	100

Group P
Group A

Notes

CI's are at the 95 % level.
This comparison was made on unpaired data.
Equal variance was assumed.
s in the row for the difference is the pooled standard deviation

Standardized Mean Difference

$d_{\text{unbiased}} = -0.22$ 95% CI [-0.62, 0.18]

Note that the standardized effect size is d_{unbiased} because the denominator used was SD_{pooled} which had a value of 3.23

The standardized effect size has been corrected for bias.

The bias-corrected version of Cohen's d is sometimes also (confusingly) called Hedges' g .

Decision Making

t-table

ES $d = -0.22$ check Cohen's thresholds

CI for the ES: [-0.68; 0.18]

Is the CI informative?

The smaller the CI, the more informative

Why? The likely value of the ES is included in a short range

If we estimate all possible CI, 95% will include its true value, in a small range

ES AND CI FOR ALL TYPES OF T-TEST

The same requests are available for all types of t-tests

1. Single sample
2. Independent samples
3. Paired samples

ES IN THE GLM MODEL: ANOVA BETWEEN AND WITHIN

The image shows two dialog boxes from SPSS: "ANOVA" and "Repeated Measures ANOVA".

ANOVA Dialog:

- Dependent Variable: performance
- Fixed Factors: type
- Model Fit: Overall model test (unchecked)
- Effect Size: η^2 , partial η^2 , ω^2

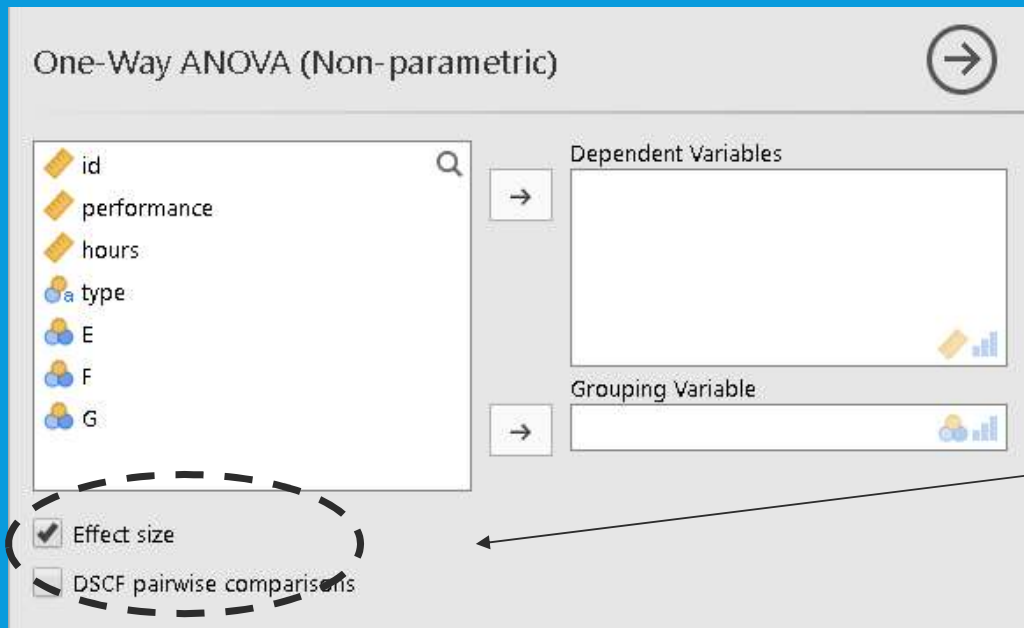
Repeated Measures ANOVA Dialog:

- Effect Size: Generalised η^2 , η^2 , Partial η^2

A dashed black oval highlights the "Effect Size" sections of both dialog boxes. An arrow points from the text on the right to this oval.

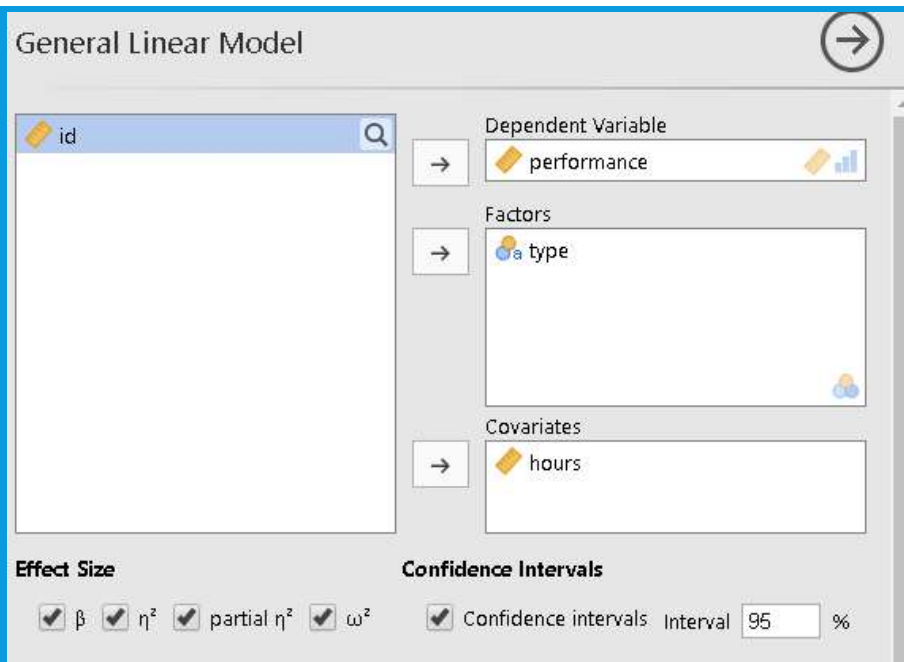
ES are available in factorial Anova and between subjects Anova

ES IN NON PARAMETRIC ANOVA



ES are available in factorial Anova and between subjects Anova

ES IN MODULE GAMLJ - GENERAL LINEAR MODEL ANOVA – REGRESSION – ANCOVA



ES for the model and for single
covariates/factors

	F	p	η^2	η^2p	ω^2
Model	35.06	< .001	0.4196	0.420	0.405
type	4.31	0.041	0.0258	0.043	0.020
hours	68.74	< .001	0.4113	0.415	0.403
Residuals					
Total					

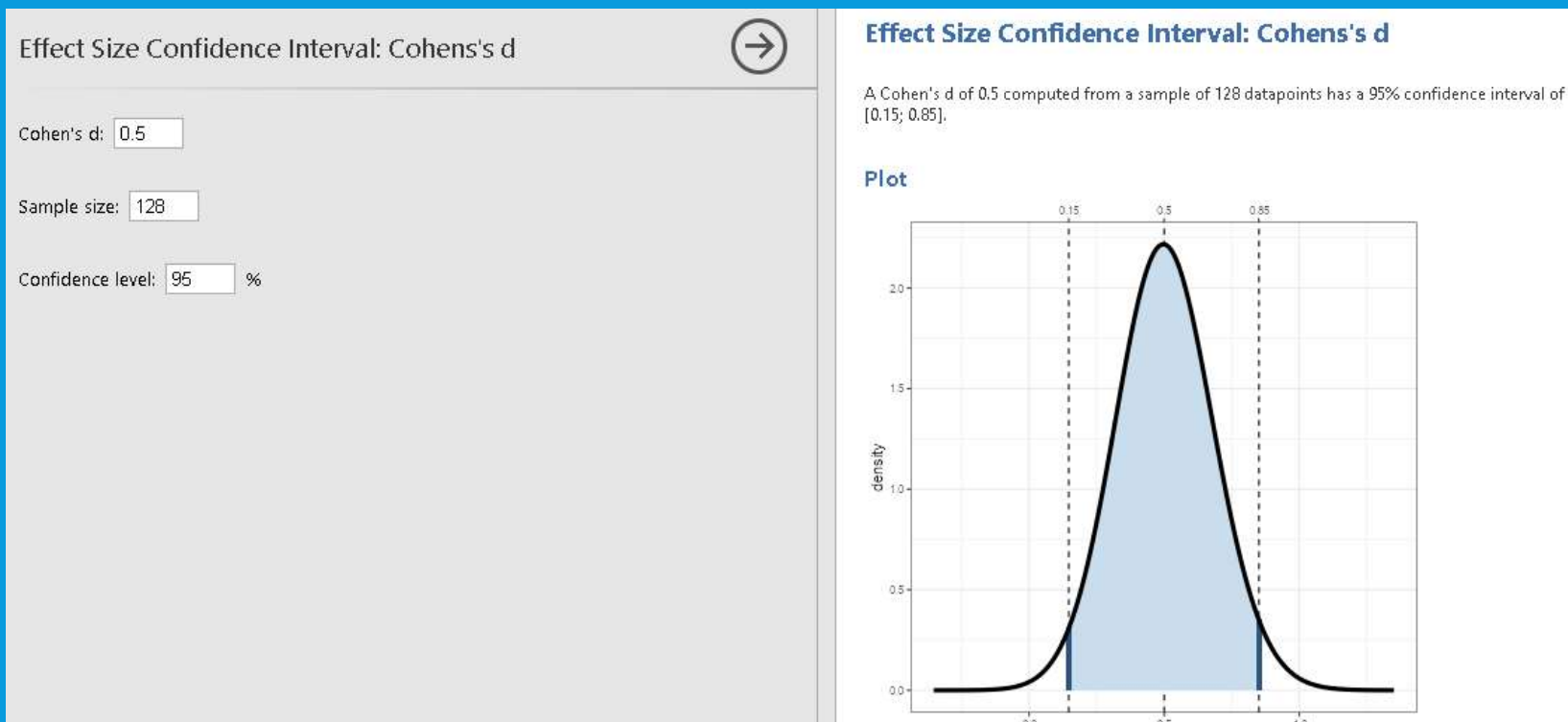
SOME CI ESTIMATION IN MODULE ESCI

Descriptive Stats	
58	Descriptives
36	
Means	
57	
38	Estimate Mean
38	Estimate Independent Mean Difference
53	Estimate Paired Mean Difference
57	
Proportions	
71	
54	
58	Estimate Proportion
30	Estimate Proportion Difference
13	
Correlations	
50	
17	
16	Estimate Correlation
58	Estimate Correlation Difference
54	
Complex Designs	
25	
39	
38	Estimate Ind. Groups Contrasts
30	Estimate Ind. 2x2
34	
Meta-Analysis	
30	
50	
	Meta-Analysis - Raw Scores
Deleted	Meta-Analysis - Cohen d

- The modul ESCI enables one to estimate ES and their CI for other types pf analysis, as it can be seen in the drop down menu.
- This methodological perspective is useful in the replication 'stance'
- Reference from the author is available at the link: <https://thenewstatistics.com/itns/esci/jesci/>

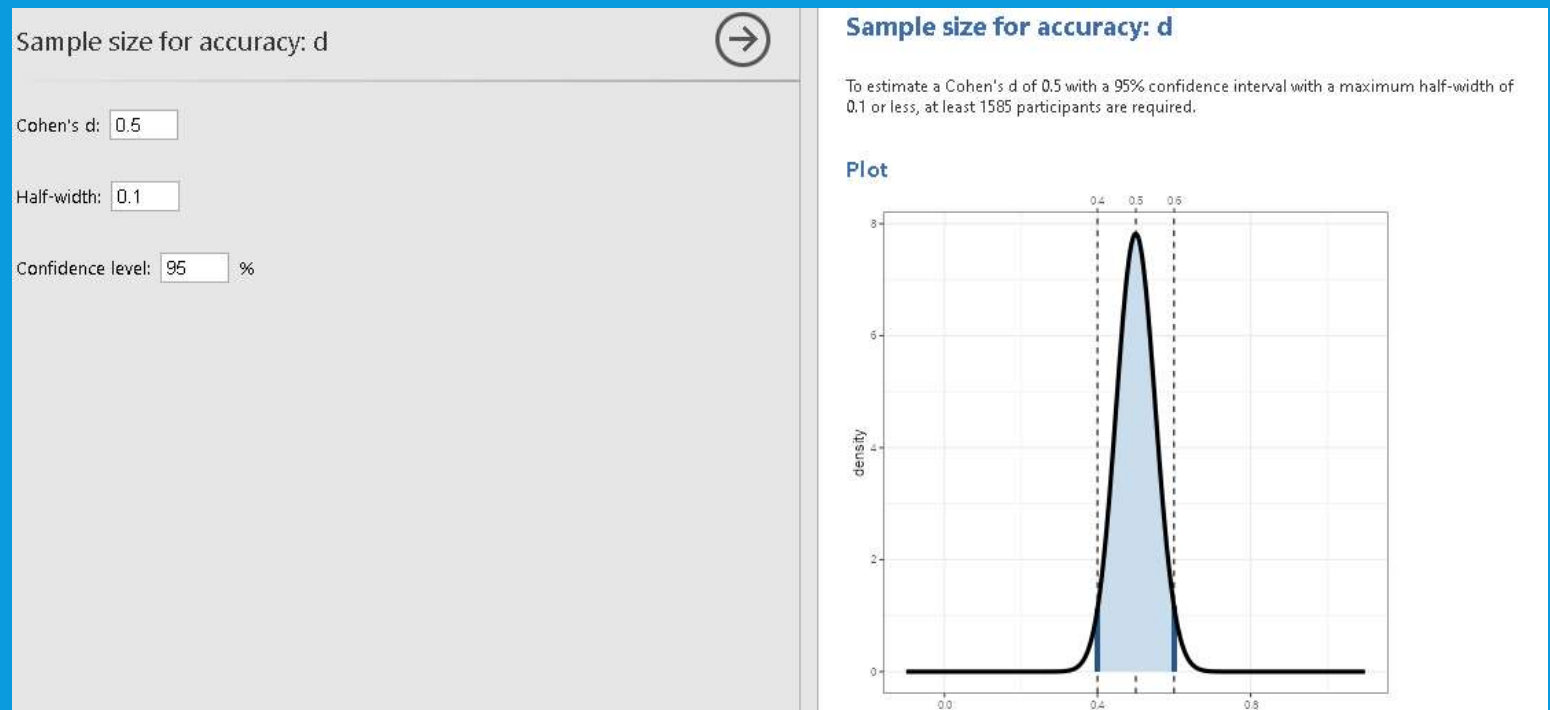
ES IN MODULE UFS

- Another module, UFS, computes CI for some statistical measures, including ES.



ACCURACY FOR ES AND SAMPLE SIZE IN MODULE UFS

- Given the accuracy of the ES (i.e. the width of its CI), we can also obtain the sample size needed



POWER ANALYSIS IN JAMOVI FOR T-TESTS

A module in Jamovi is devoted to power analysis, even if restricted to t-tests. As seen during the lesson, we can refer to G*Power for a user friendly package for GLM and to the R environment for a very wide of power analysis types., always in the context of open access software.

Out of curiosity, this link shows the use of power analysis in Jamovi and then moves to R : <https://jdleongomez.info/en/post/power/>

Independent Samples T-Test

Calculate

Minimally-interesting effect size (δ)

Minimum desired power

N for group 1

Relative size of group 2 to group 1

α (type I error rate)

Tails

Plots

- Power contour plot
- Power curve by effect size
- Power curve by N
- Power demonstration

Additional Options

- Explanatory text

OUTPUT FOR POWER ANALYSIS IN JAMOVI/1

A Priori Power Analysis

N ₁	N ₂	User Defined		
		Effect Size	Power	α
86	86	0.500	0.900	0.0500

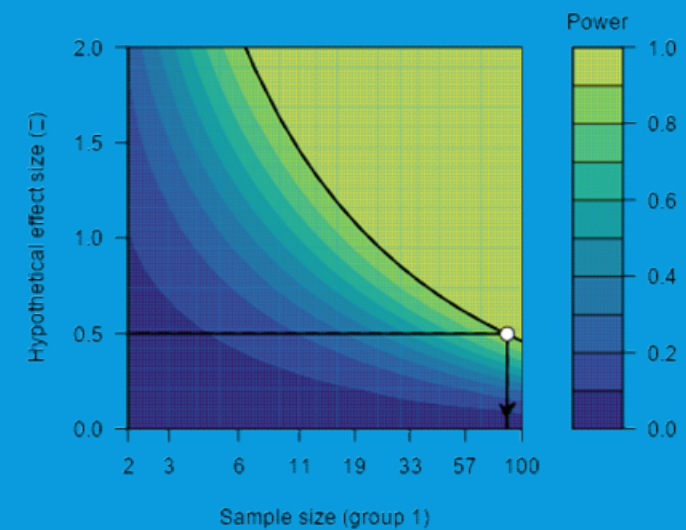
We would need a sample size of 86 in each group to reliably (with probability greater than 0.9) detect an effect size of $d \geq 0.5$, assuming a two-sided criterion for detection that allows for a maximum Type I error rate of $\alpha = 0.05$.

To evaluate the design specified in the table, we can consider how sensitive it is to true effects of increasing sizes; that is, are we likely to correctly conclude that $|\delta| > 0$ when the effect size is large enough to care about?

Power by Effect Size

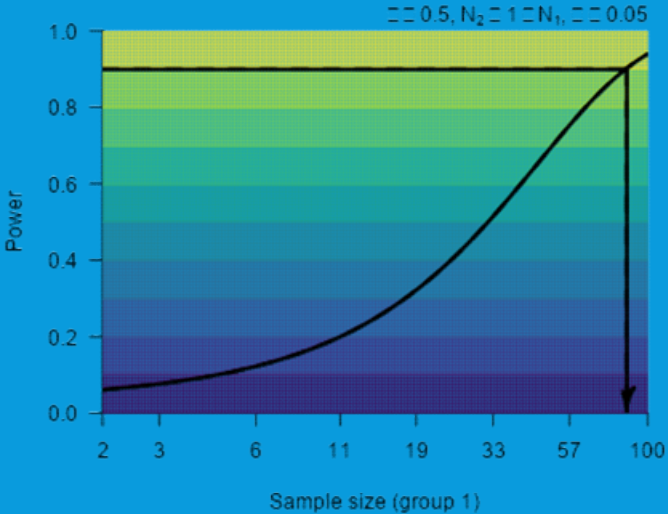
True effect size	Power to detect	Description
$0 < d = 0.301$	$\leq 50\%$	Likely miss
$0.301 < d = 0.430$	50% – 80%	Good chance of missing
$0.430 < d = 0.553$	80% – 95%	Probably detect
$d = 0.553$	$\geq 95\%$	Almost surely detect

Power Contour



OUTPUT FOR POWER ANALYSIS IN JAMOVI/2

Power Curve by N



Results Power Demonstration

