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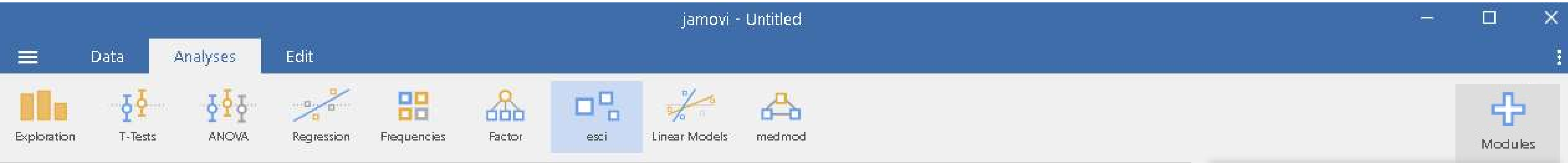
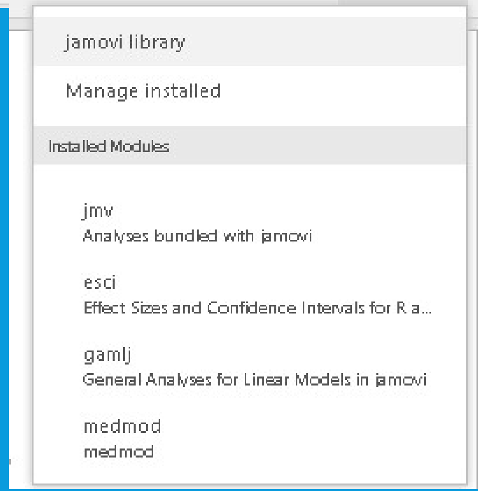
ES, CI AND POWER ANALYSIS IN JAMOVI

A QUICK 360° DEGREES EXCURSUS

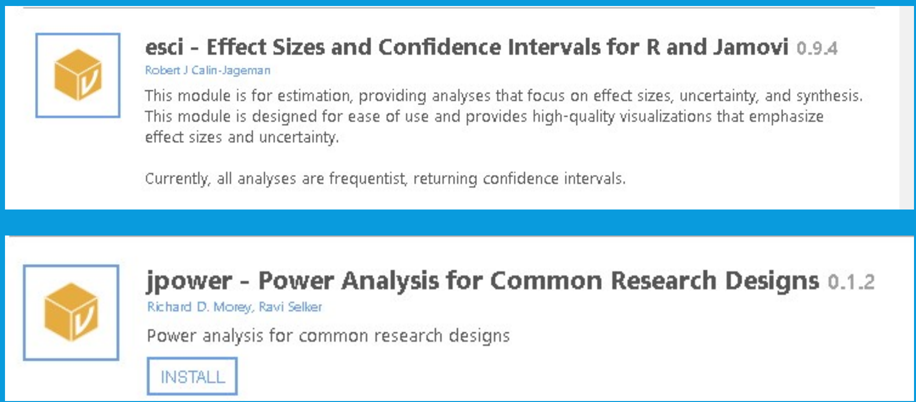
Ph.D Programme in Psychology, Linguistics and Cognitive Neurosciences

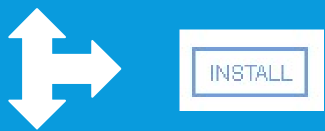
A PREMISE: HOW TO INSTALL NEW MODULES IN JAMOVI





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





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 America 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

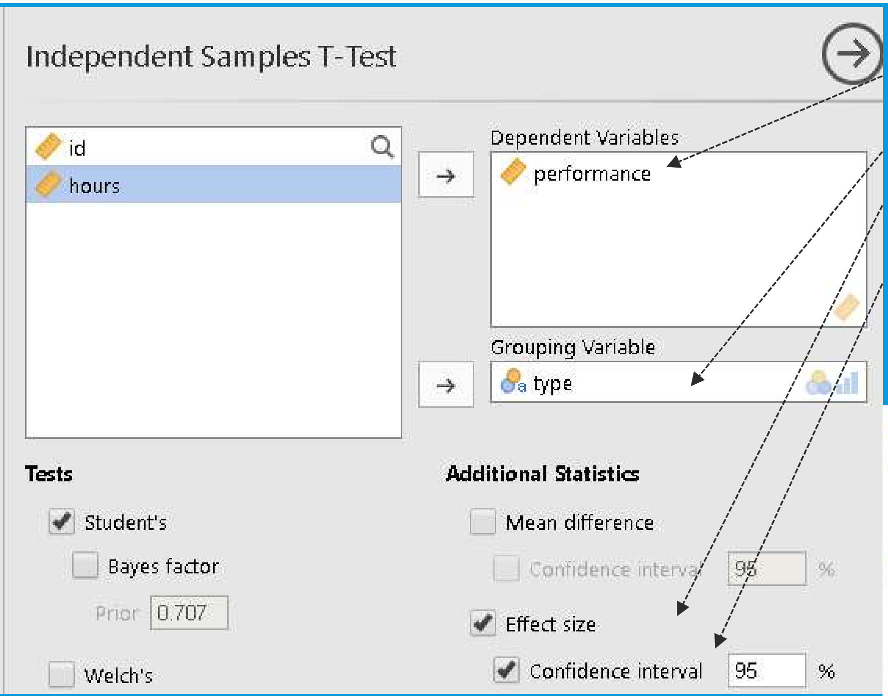
- Some procedures (i.e. specific analysis) allow us to compute ES .

- A dedicated module to CI for the 'new statistics' , ESC, linked to the volume by Geoff Cummings::
  - *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



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 corrrespondence between the CI under the null hypothesis and NHST

Results

ES

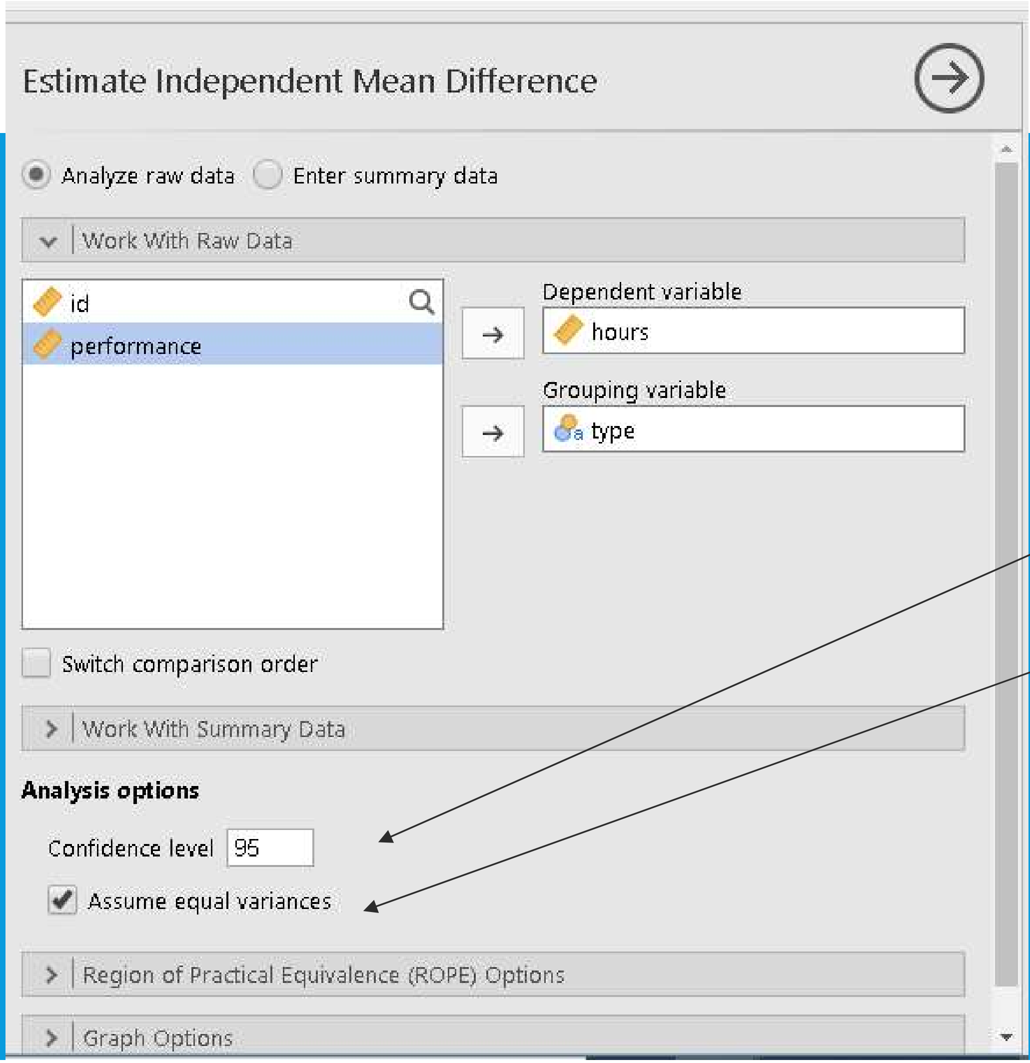
CI of the ES

Independent Samples T-Test

Independent Samples T-Test

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

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



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 Lower	95 % CI Upper	s	N
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

CIs 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

$d_{unbiased}$ = -0.22 95% CI [-0.62, 0.18]
Note that the standardized effect size is d_unbiased
because the denominator used was SDpooled
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

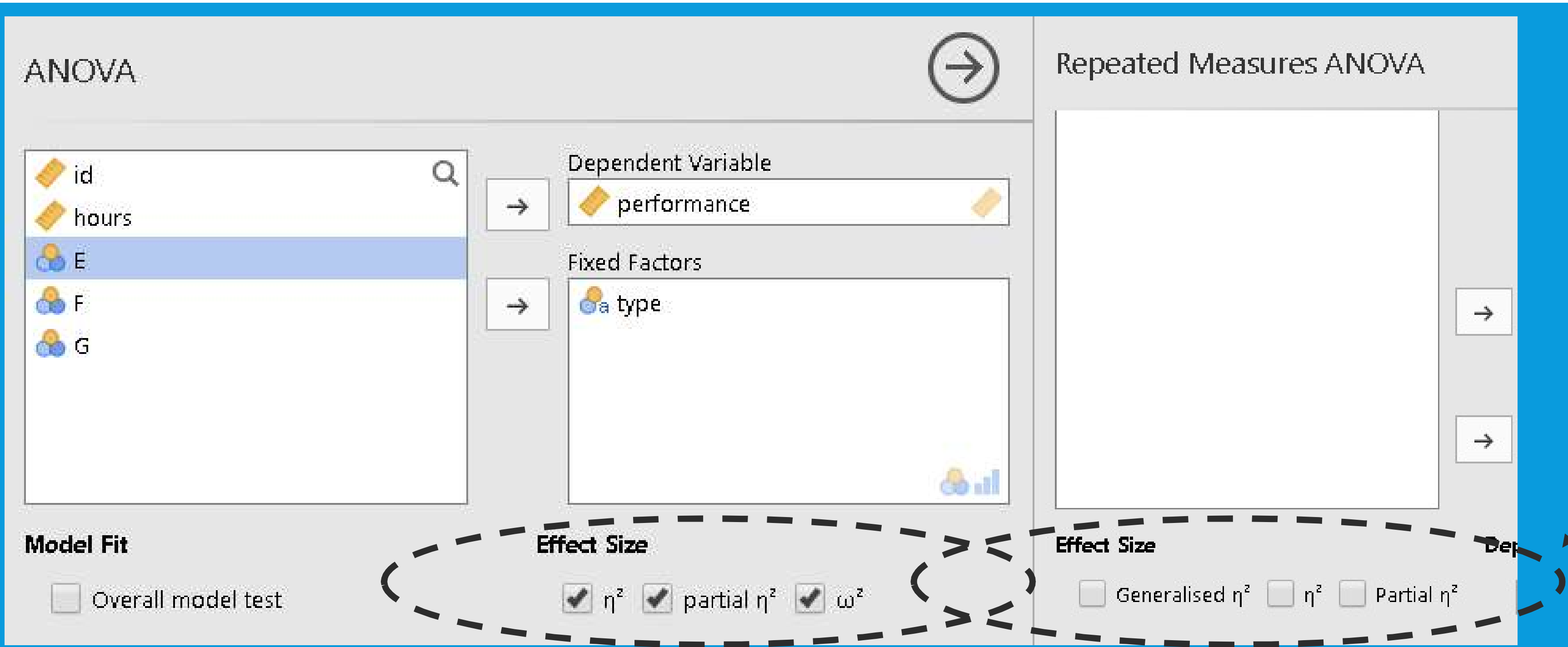
If we estimate all possible CI, 95% will include its true value, in a small range

ES AND CI FOR ALL TYPES OF T-TEST

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

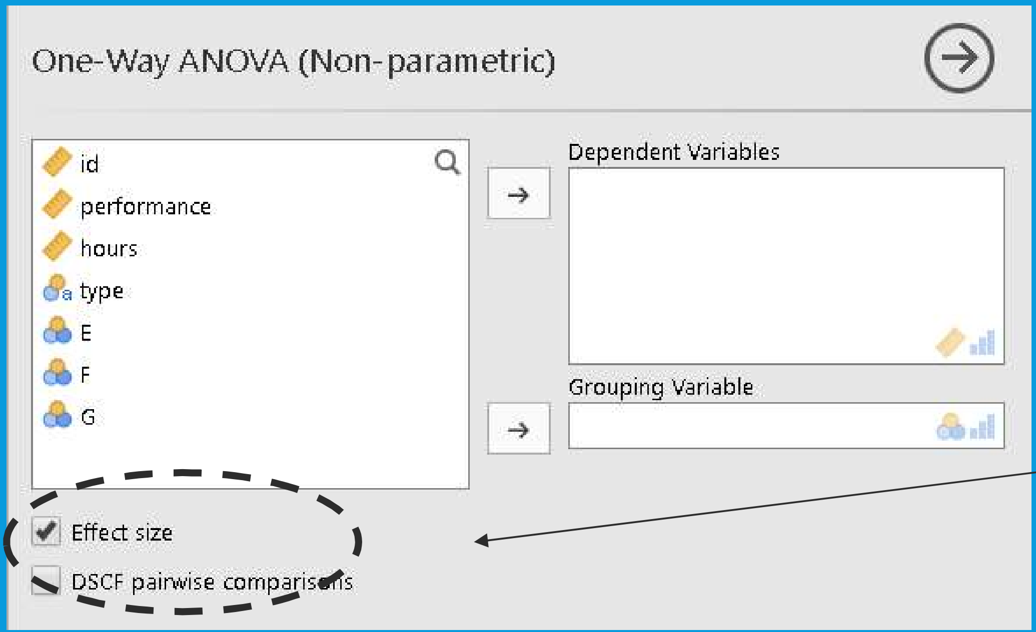
1. Single sample
2. Indipendent samples
3. Paired samples

ES IN THE GLM MODEL: ANOVA BETWEEN AND WITHIN



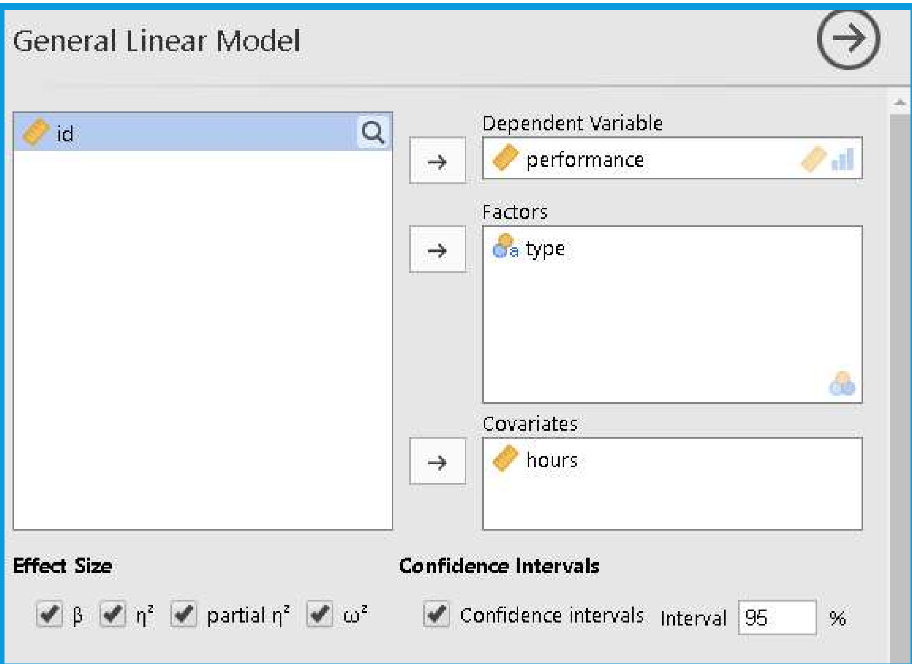
ES are available in factorial Anova and between subjects Anova

ES IN NON PARAMETRIC ANOVA



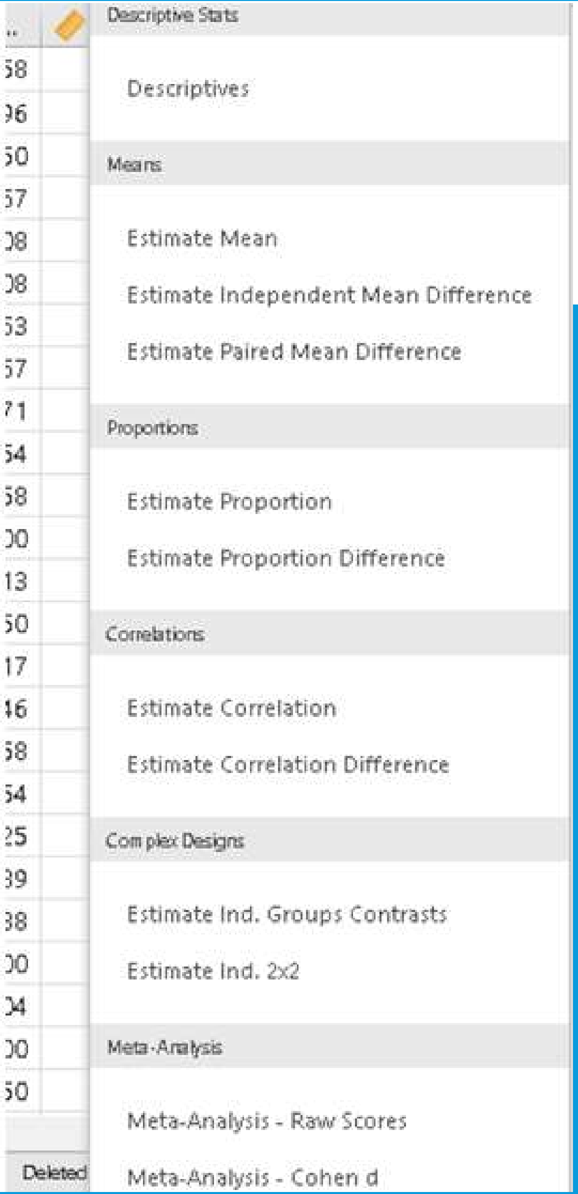
ES are available in factorial Anova and between subjects Anova

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



ES for the model and for single covatiates/factors

	F	p	η^2	$\eta^2 p$	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

- 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/
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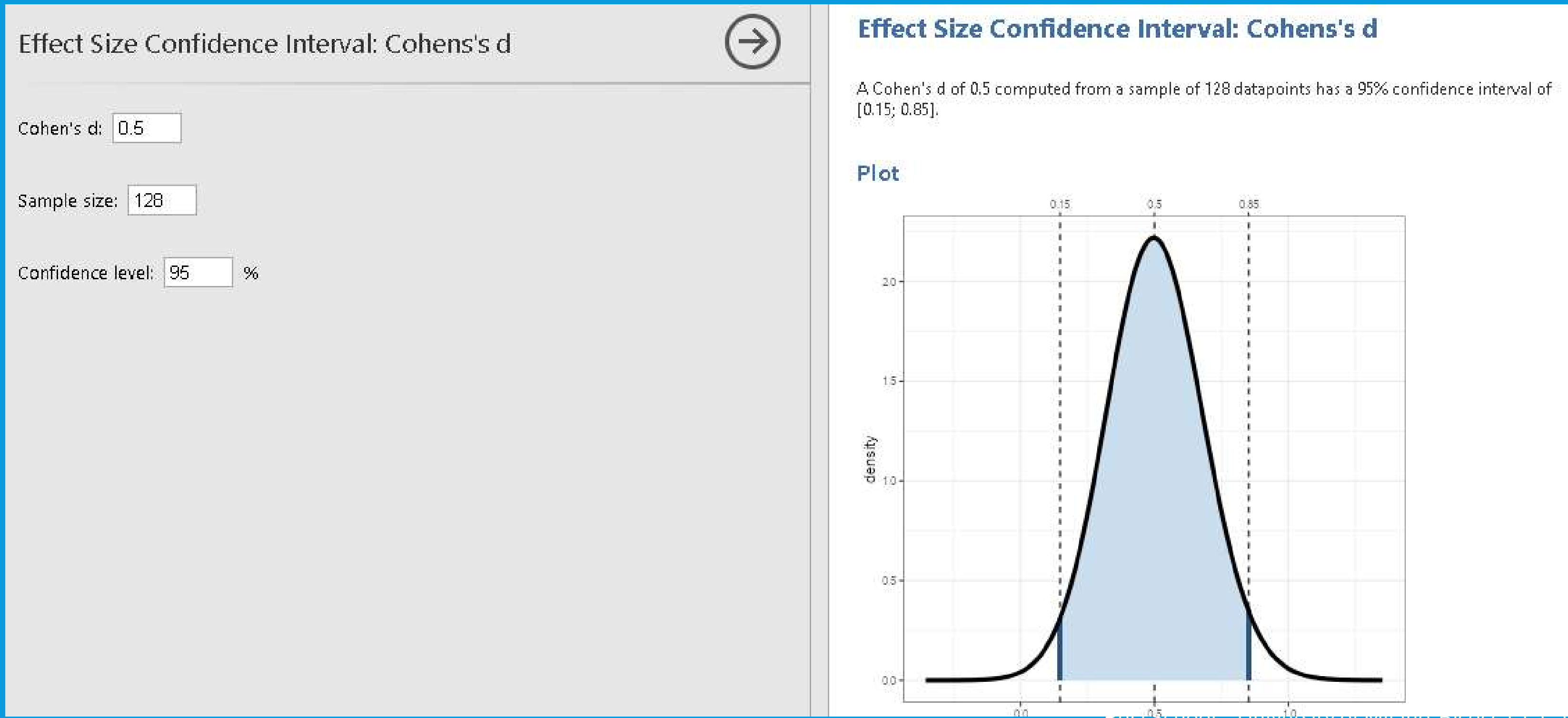
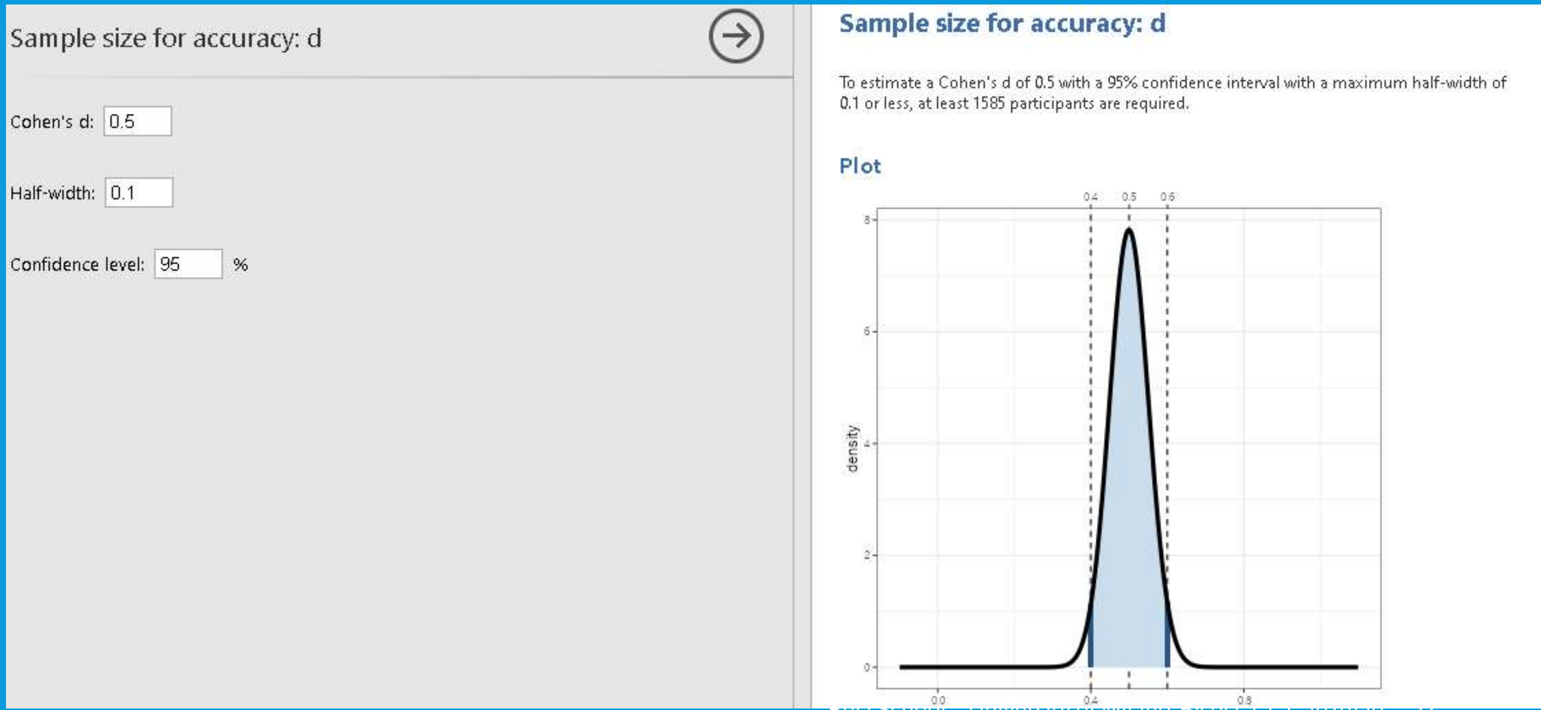
ES IN MODULE UFS

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



ACCURACY FOR ES AND SAMPLE SIZE IN MODULE UFS

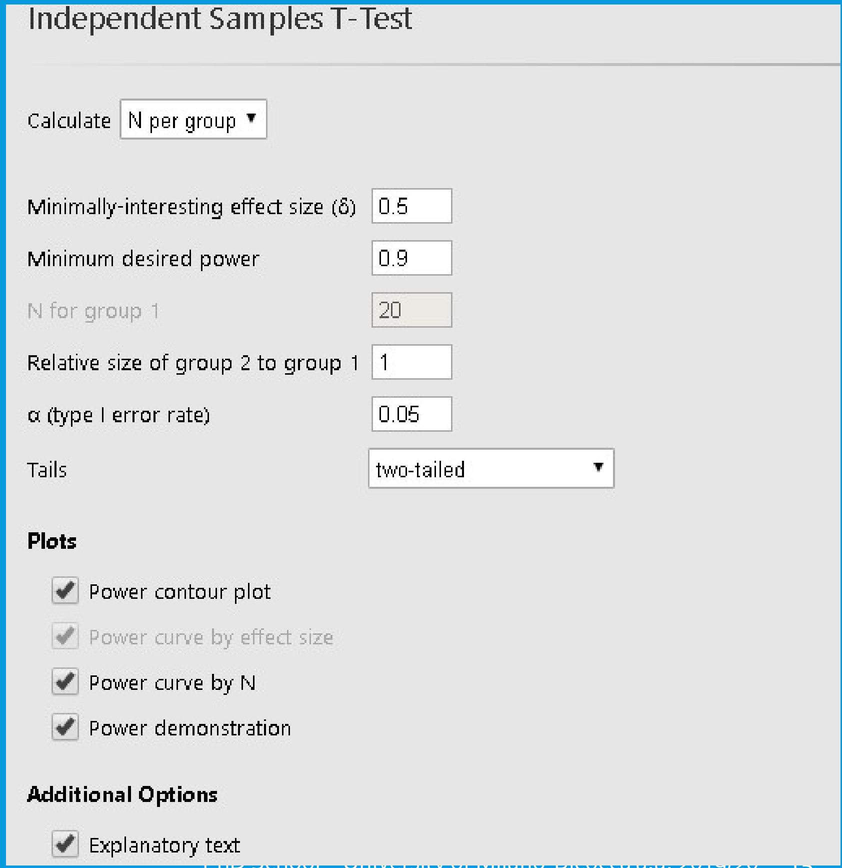
- Given the accuracy of the ES (i.e. the width of its CI), we can also obtain the sample size needed



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 packace 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/



OUTPUT FOR POWER ANALYSIS IN JAMOVI/1

A Priori Power Analysis

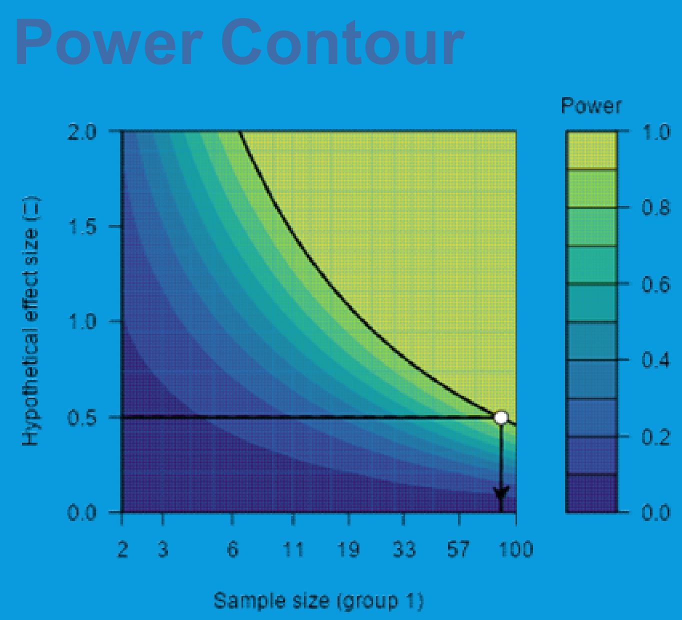
		User Defined		
N_1	N_2	Effect Size	Power	α
86	86	0.500	0.900	0.0500

We would need a sample size of 86 in each group to reliably (with probability greater than 0.9) detect an effect size of $\delta \geq 0.5$, 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

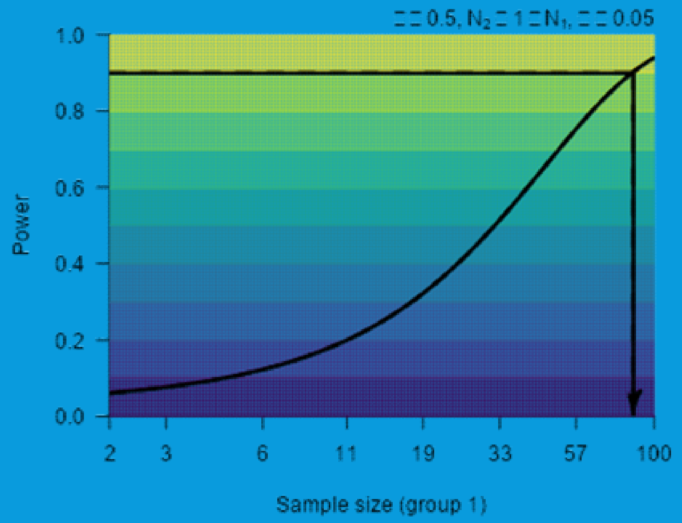
True effect size	Power to detect	Description
0 < d = 0.301	≤50%	Likely miss
0.301 < d = 0.430	50% – 80%	Good chance of missing
0.430 < d = 0.553	80% – 95%	Probably detect
d = 0.553	≥95%	Almost surely detect



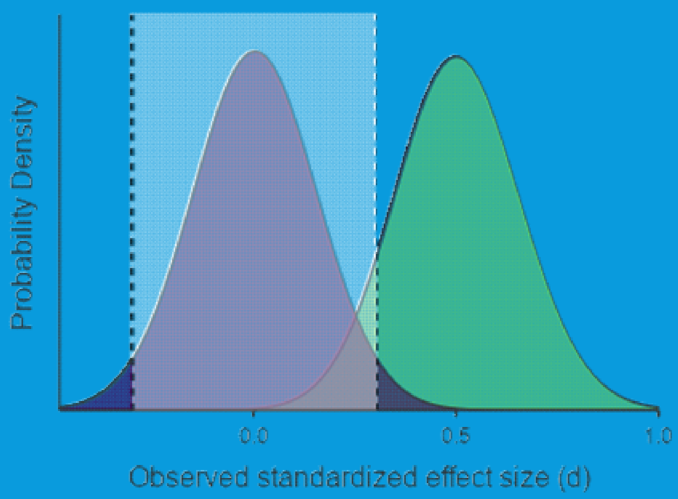
OUTPUT FOR POWER ANALYSIS IN JAMOVI/2

Results

Power Curve by N



Power Demonstration

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