MAVIS: Meta-Analysis via Shiny

Interactive Shiny application for running a meta-analysis

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What is Meta-Analysis?

Introduction

- Meta-analysis is the statistical analysis of effect sizes.
- An effect size summarizes the effect of an intervention, manipulation, or observation of a phenomenon being studied.[1]
- Meta-analysis was defined by Gene Glass as the "The analysis of analyses."[2]
- A Method for summarizing research findings across numerous studies.

[1] Cheung, M. & Vijayakumar, R. (2016). A Guide to Conducting a Meta-Analysis. Neuropsychology Review

[2] Glass, G. (1976). Primary, Secondary, and Meta-Analysis of Research. Educational Researcher

What is Meta-Analysis?

Common Uses

- Social scientists and education researchers utilize meta-analytic methods to answer questions about social phenomena and educational testing.
- Within the fields of medicine and public health, it has become an essential method for medical professionals and scholars on the known effects of medical treatments.[3]

[3] Shadish, W. & Lecy, J. (2015). The meta-analytic big bang. Research Synthesis Methods

What is MAVIS?

Overview

Features

- Tool for teaching and conducting a meta-analysis.
- Support for both random-effects and fixed-effects models.
- Multiple methods for the detection of publication bias.
- Many effect size calculators, including single-case design.
- Uses R and the Shiny package from RStudio.
- Data is inputted through your web browser. All computational work and graphics rendering is done with R and the metafor package.[4]

[4] Viechtbauer, W. (2010). Conducting Meta-Analyses in R with the metafor Package. Journal of Statistical Software

What is MAVIS?

Rationale & Goals

Project Goals

- Current statistical tools based in R are hard to use for those who are less technically inclined.
- Remove barriers that prevent users form adopting R and advanced statistical methods.
- The learning curve for most first and second year graduate students in the social sciences is extremely steep.

What is MAVIS?

Rationale & Goals

Project Goals

- Publish these tools online for anyone to use free of charge.
- Open-source project, allow anyone or any institution to improve these tools for their own use.
- Translate into other languages to increase ease of use for non-English speakers.
- Arabic and Spanish translations are currently in progress.

MAVIS

Behind the Scenes – Front End

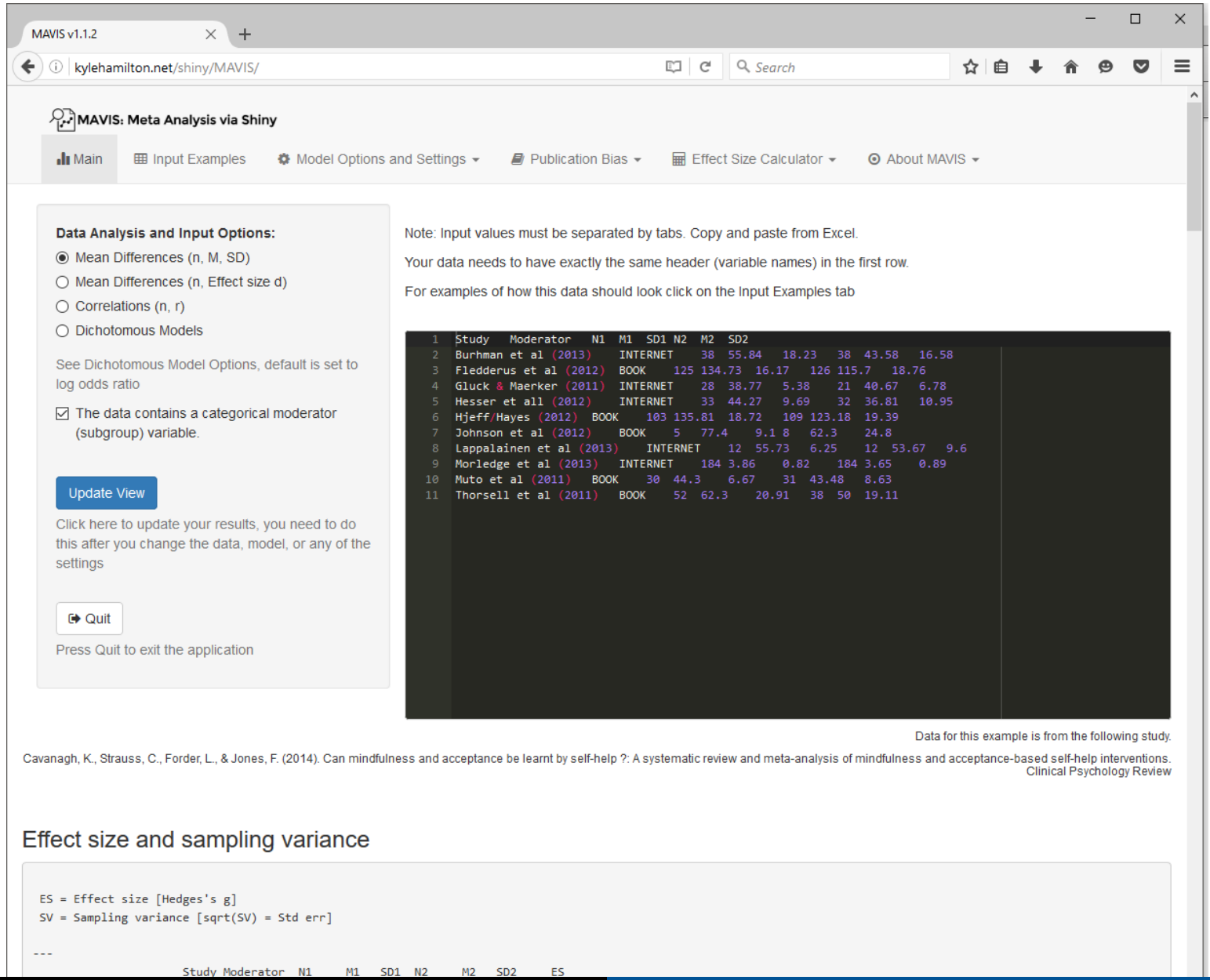
- **shiny** Used to run the web application GUI
- **shinyAce** Used to allow users to enter data into MAVIS.
- **shinyBS** Enhances user interface.

MAVIS

Behind the Scenes – Back End

- **metafor** Calculates both fixed-effect and random-effect models. Generates funnel plots and handles other publication bias models. Cited over 1,400 times. Does most of the work.
- **compute.es** Generates required effect sizes.
- **ggplot2** Provides graphics generation for moderator plots.
- **MAc** Computes correlational meta-analysis models.
- **MAd** Computes mean difference meta-analysis models.
- **weightr** Publication bias using the Vevea and Hedges weight-function model (1995).
- **SCMA** Generates effect sizes for single-case design.
- **SCRT** Generates graphics from single-case design data.

MAVIS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Data Analysis and Input Options:
Mean Differences (n, M, SD)
Mean Differences (n, Effect size d)
Correlations (n, r)
Dichotomous Models
See Dichotomous Model Options, default is set to log odds ratio
The data contains a categorical moderator (subgroup) variable.
Update View
Click here to update your results, you need to do this after you change the data, model, or any of the settings
Quit
Press Quit to exit the application
Note: Input values must be separated by tabs. Copy and paste from Excel.
Your data needs to have exactly the same header (variable names) in the first row.
For examples of how this data should look click on the Input Examples tab
Study Moderator N1 M1 SD1 N2 M2 SD2
Burhman et al (2013) INTERNET 38 55.84 18.23 38 43.58 16.58
Fledderus et al (2012) BOOK 125 134.73 16.17 126 115.7 18.76
Gluck & Maerker (2011) INTERNET 28 38.77 5.38 21 40.67 6.78
Hesser et all (2012) INTERNET 33 44.27 9.69 32 36.81 10.95
Hjeff/Hayes (2012) BOOK 103 135.81 18.72 109 123.18 19.39
Johnson et al (2012) BOOK 5 77.4 9.1 8 62.3 24.8
Lappalainen et al (2013) INTERNET 12 55.73 6.25 12 53.67 9.6
Morledge et al (2013) INTERNET 184 3.86 0.82 184 3.65 0.89
Muto et al (2011) BOOK 30 44.3 6.67 31 43.48 8.63
Thorsell et al (2011) BOOK 52 62.3 20.91 38 50 19.11
Data for this example is from the following study.
Cavanagh, K., Strauss, C., Forder, L., & Jones, F. (2014). Can mindfulness and acceptance be learnt by self-help ?: A systematic review and meta-analysis of mindfulness and acceptance-based self-help interventions. Clinical Psychology Review
Effect size and sampling variance
ES = Effect size [Hedges's g]
SV = Sampling variance [sqrt(SV) = Std err]

Study Moderator N1 M1 SD1 N2 M2 SD2 ES

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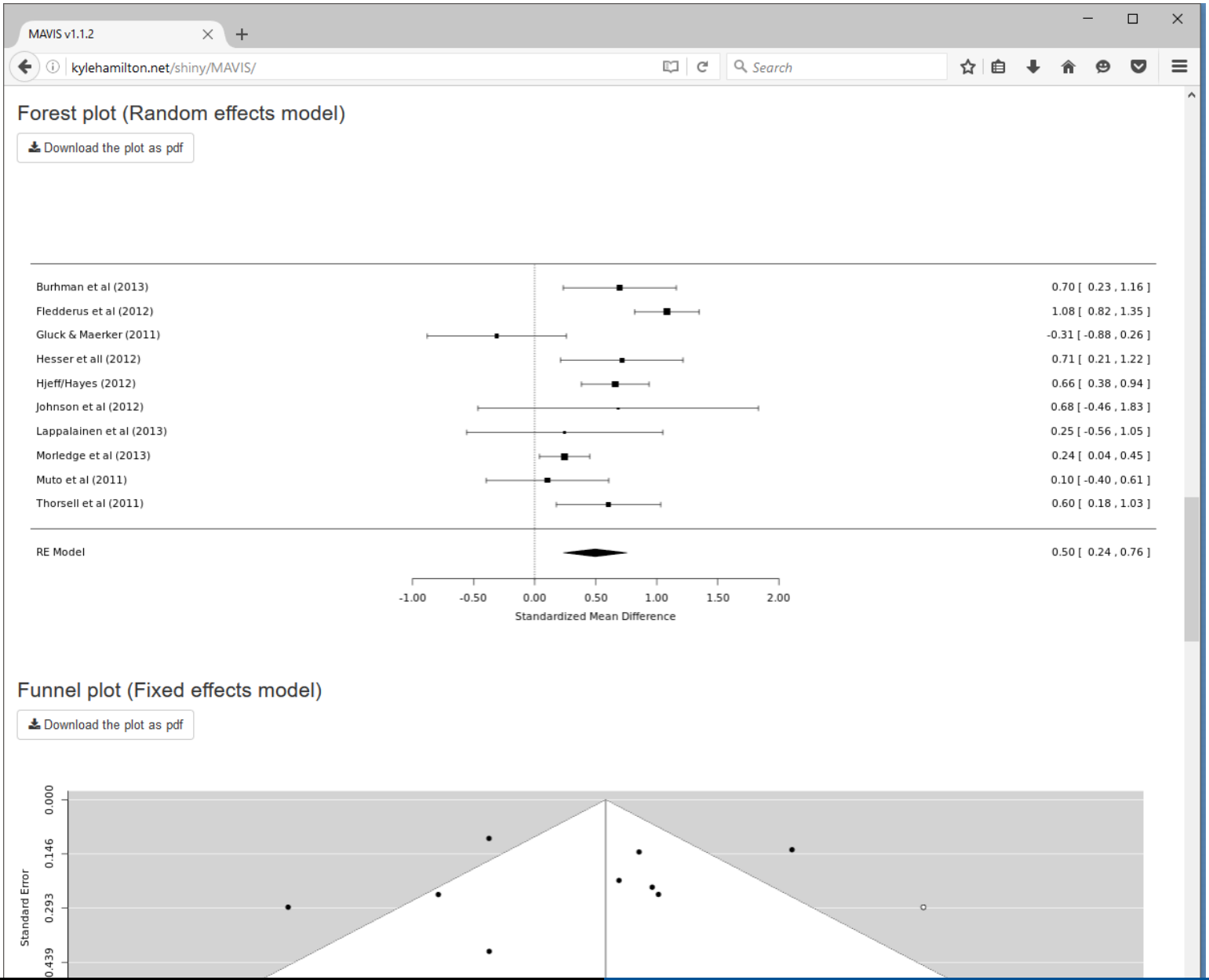
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Search
Forest plot (Random effects model)
Download the plot as pdf
Burhman et al (2013)
Fledderus et al (2012)
Gluck & Maerker (2011)
Hesser et all (2012)
Hjeff/Hayes (2012)
Johnson et al (2012)
Lappalainen et al (2013)
Morledge et al (2013)
Muto et al (2011)
Thorsell et al (2011)
RE Model
0.70 [0.23 , 1.16]
1.08 [0.82 , 1.35]
-0.31 [-0.88 , 0.26]
0.71 [0.21 , 1.22]
0.66 [0.38 , 0.94]
0.68 [-0.46 , 1.83]
0.25 [-0.56 , 1.05]
0.24 [0.04 , 0.45]
0.10 [-0.40 , 0.61]
0.60 [0.18 , 1.03]
0.50 [0.24 , 0.76]
-1.00
-0.50
0.00
0.50
1.00
1.50
2.00
Standardized Mean Difference
Funnel plot (Fixed effects model)
Download the plot as pdf
Standard Error
0.000
0.146
0.293
0.439

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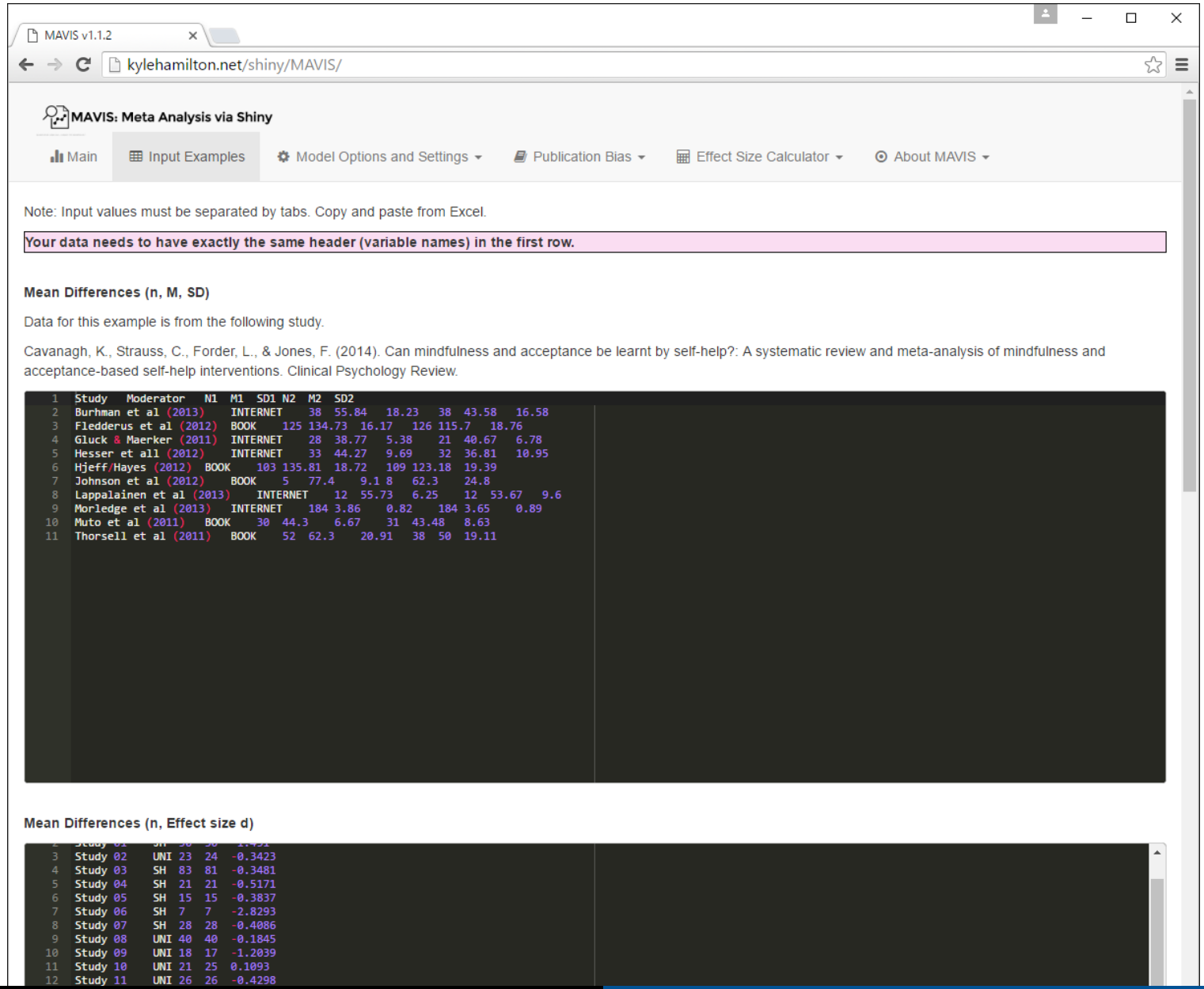
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Muto et al (2011) BOOK 30 44.3 6.67 31 43.48 8.63
Thorsell et al (2011) BOOK 52 62.3 20.91 38 50 19.11
Mean Differences (n, Effect size d)
Study 02 UNI 23 24 -0.3423
Study 03 SH 83 81 -0.3481
Study 04 SH 21 21 -0.5171
Study 05 SH 15 15 -0.3837
Study 06 SH 7 7 -2.8293
Study 07 SH 28 28 -0.4086
Study 08 UNI 40 40 -0.1845
Study 09 UNI 18 17 -1.2039
Study 10 UNI 21 25 0.1093
Study 11 UNI 26 26 -0.4298

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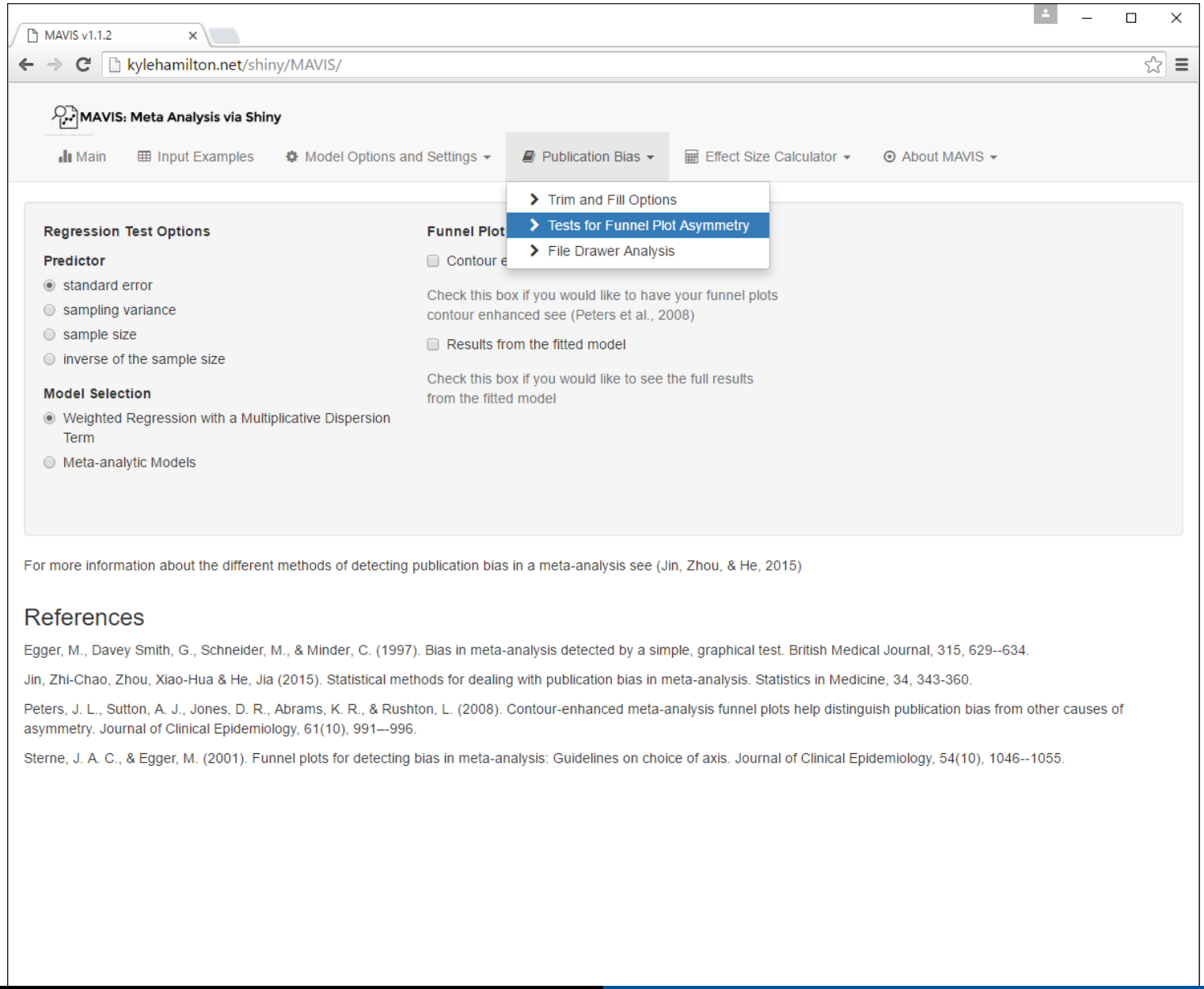
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standard error
sampling variance
sample size
inverse of the sample size
Model Selection
Weighted Regression with a Multiplicative Dispersion Term
Meta-analytic Models
Funnel Plot
Contour e
Check this box if you would like to have your funnel plots contour enhanced see (Peters et al., 2008)
Results from the fitted model
Check this box if you would like to see the full results from the fitted model
For more information about the different methods of detecting publication bias in a meta-analysis see (Jin, Zhou, & He, 2015)
References
Egger, M., Davey Smith, G., Schneider, M., & Minder, C. (1997). Bias in meta-analysis detected by a simple, graphical test. British Medical Journal, 315, 629--634.
Jin, Zhi-Chao, Zhou, Xiao-Hua & He, Jia (2015). Statistical methods for dealing with publication bias in meta-analysis. Statistics in Medicine, 34, 343-360.
Peters, J. L., Sutton, A. J., Jones, D. R., Abrams, K. R., & Rushton, L. (2008). Contour-enhanced meta-analysis funnel plots help distinguish publication bias from other causes of asymmetry. Journal of Clinical Epidemiology, 61(10), 991–-996.
Sterne, J. A. C., & Egger, M. (2001). Funnel plots for detecting bias in meta-analysis: Guidelines on choice of axis. Journal of Clinical Epidemiology, 54(10), 1046--1055.

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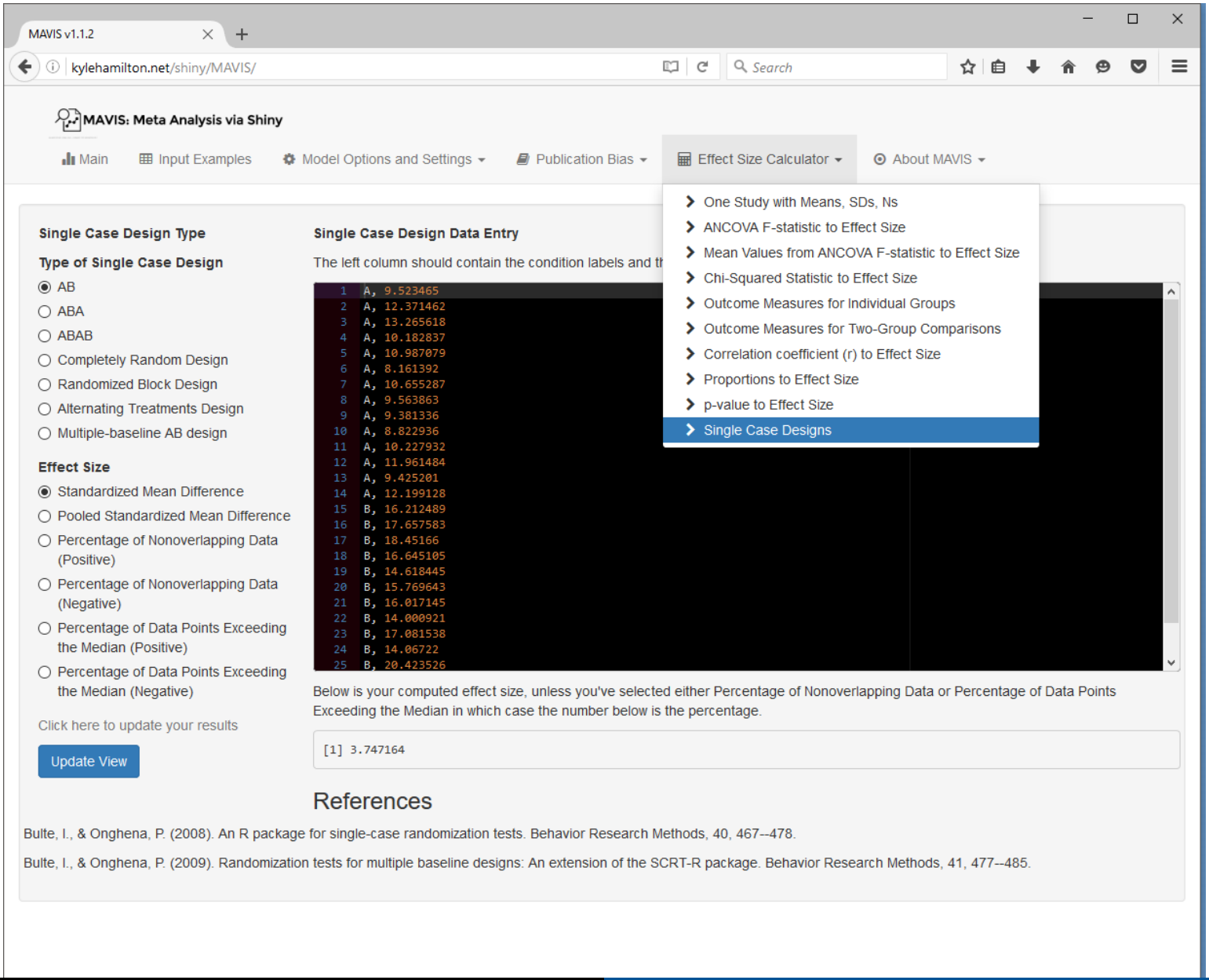
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Mean Values from ANCOVA F-statistic to Effect Size
Chi-Squared Statistic to Effect Size
Outcome Measures for Individual Groups
Outcome Measures for Two-Group Comparisons
Correlation coefficient (r) to Effect Size
Proportions to Effect Size
p-value to Effect Size
Single Case Designs
Single Case Design Type
Type of Single Case Design
AB
ABA
ABAB
Completely Random Design
Randomized Block Design
Alternating Treatments Design
Multiple-baseline AB design
Effect Size
Standardized Mean Difference
Pooled Standardized Mean Difference
Percentage of Nonoverlapping Data (Positive)
Percentage of Nonoverlapping Data (Negative)
Percentage of Data Points Exceeding the Median (Positive)
Percentage of Data Points Exceeding the Median (Negative)
Click here to update your results
Update View
Single Case Design Data Entry
The left column should contain the condition labels and th
1 A, 9.523465
2 A, 12.371462
3 A, 13.265618
4 A, 10.182837
5 A, 10.987079
6 A, 8.161392
7 A, 10.655287
8 A, 9.563863
9 A, 9.381336
10 A, 8.822936
11 A, 10.227932
12 A, 11.961484
13 A, 9.425201
14 A, 12.199128
15 B, 16.212489
16 B, 17.657583
17 B, 18.45166
18 B, 16.645105
19 B, 14.618445
20 B, 15.769643
21 B, 16.017145
22 B, 14.000921
23 B, 17.081538
24 B, 14.06722
25 B, 20.423526
Below is your computed effect size, unless you've selected either Percentage of Nonoverlapping Data or Percentage of Data Points Exceeding the Median in which case the number below is the percentage.
[1] 3.747164
References
Bulte, I., & Onghena, P. (2008). An R package for single-case randomization tests. Behavior Research Methods, 40, 467--478.
Bulte, I., & Onghena, P. (2009). Randomization tests for multiple baseline designs: An extension of the SCRT-R package. Behavior Research Methods, 41, 477--485.

Information

Download and Documentation

Available on CRAN

- https://cran.r-project.org/web/packages/MAVIS/index.html

Available on GitHub

- https://github.com/kylehamilton/MAVIS

Online Demo - English

- http://kylehamilton.net/shiny/MAVIS/

Online Demo - Turkish

- http://kylehamilton.net/shiny/aRma/

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