

## Version History

### Matlab Toolbox 'Measures of Effect Size'

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#### Version 1.5 (July 2017)

NOTE: this is the last version of the toolbox uploaded on SourceForge (<https://sourceforge.net/projects/mestoolbox/>). All further versions will be developed on GitHub (<https://github.com/hhentschke/measures-of-effect-size-toolbox>) and will be uploaded automatically on the Matlab Central File Exchange (<http://de.mathworks.com/matlabcentral/fileexchange/32398-measures-of-effect-size-toolbox>).

- mes1way, mes2way: renamed variable 'table' to 'summaryTable' (to avoid name intersection with the homonymous data type introduced in Matlab R2013b)
- correction of typos

#### Version 1.4 (January 2015)

- mes2way: it is now possible to run mixed within/between analyses with unequal sample sizes along the between-subjects factor. According changes were made to the documentation and help. Also, in the table of results mes2way now puts out summed squares, degrees of freedom etc. of the total error, too (which had simply been forgotten)
- correction of some typos in documentation (missing subscript 'p' in formula for partial omega squared for oneway designs)

#### Version 1.3 (April 2013)

- the documentation contained errors: the numerators in the formulas for Hedges' g, Glass's delta and mdbysd were given as  $m_2 - m_1$  (or  $m_{\text{exp}} - m_{\text{control}}$ ) whereas in the code (mes.m) they are computed as  $m_1 - m_2$ , which is the correct and intended way (thanks to Philippe Terrier for the hint).
- exact confidence intervals for g1 are implemented
- setting up a twoway analysis, particularly with contrasts and if each factor has many levels, is not easy. In order to facilitate this and to give the user some visual orientation an option to plot the data was implemented in mes2way.m: if input variable 'doDataPlot' is set to true, function mesdplot.m will be called from within mes2way.m and generate a figure with a subplot layout reflecting the layout of the analysis. Furthermore, repeated measures data will be marked by color, as will be contrast weights (via the subplot background color). For specifics see the help for mes2way.m, msdplot.m and/or the documentation.

- the documentation is corrected and extended in the points listed above.

## **Version 1.2 (March 2012)**

We have deliberately taken a small step back, namely from standardized to unstandardized mean differences: it is now possible to obtain as an output the mean difference between two samples (`mes.m`) and the oneway and twoway equivalents, contrasts (`mes1way.m` and `mes2way.m`). Mean differences are of course trivial to compute, but confidence intervals may pose a challenge, particularly those of contrasts in oneway and twoway analyses. We included these unstandardized mean differences because statistics expressed in the original units of measurement (e.g. millivolts) may confer a better 'feeling' for the relevance of differences between groups, depending on the data at hand. Even unstandardized mean differences including confidence intervals provide more information than p values from t-tests. Similar arguments apply to contrasts and confidence intervals. So, the details:

### **mes.m**

- new output fields `md` and `mdCi` (mean difference and corresponding confidence intervals)
- the code computing t statistics has been streamlined: instead of resorting to the Matlab-provided functions `ttest.m` and `ttest2.m` the code now computes all relevant terms from scratch. This is more economical than the previous version because many terms computed in this section are building blocks not only for the t statistic but also for e.g. Hedges' g. Please note that values of the terms affected by this change (`t`, `p`, `mdbysd`, `requiv`, Hedges' g, and confidence intervals thereof) may differ between versions 1.1. and 1.2. in the very remote digits (by ca.  $10^{-15}$  for typical test examples) due to different arithmetics and, consequently, rounding errors, in both versions.
- field `stats.t.sd` (the estimate of the population standard deviation) is gone as this term is probably of little use for most users
- minor edits of comments

### **mes1way.m**

- new output fields `psi` and `psiCi` (contrast and corresponding confidence interval)
- correction of a silly bug in the computation of confidence intervals of contrast-related MES for dependent data with option `'tDenom'` set to `'msw'` (the code would crash with bootstrapped data because of an indexing error)
- minor edits of comments

### **mes2way.m**

- new output fields `psi` and `psiCi` (contrast and corresponding confidence interval)
- minor edits of comments

### **mestab.m**

- minor edits of comments

## documentation

- enlarged section on confidence intervals
- included mean difference and contrasts
- minor edits

## Version 1.1 (October 2011)

### mes.m

- U3 and U3\_1 behaved incorrectly with discretized data (e.g. histogram data). Consider an extreme example: `mes(zeros(10,1), zeros(10,1), 'U3')`. The two groups are identical, so the result should be 0.5, the zero effect value, but the old version yielded U3=1. This is now corrected, by counting the number of values in the 'lower' group which are exactly at the median of the 'higher' group with a factor of 0.5.

### mes1way.m

- for *dependent* data, there was an inconsistency in the computation of F and p values of *contrasts*: F values were computed as the ratio of  $SS_{\psi}$  and  $MS_{\text{between} \times \text{subject}}$ . While not wrong, this was at odds with the confidence intervals of  $g_{\psi}$ , computed from the standard deviation of the contrast's difference score,  $S_{D\psi}$ . In other words, while the confidence intervals depended only on the groups participating in the contrast, F and p depended on all groups in the data set. Consequently, this could lead to the confusing situation of p and confidence intervals of  $g_{\psi}$  signalling contradictory messages, depending on the data. This is fixed; the user now has a choice (via new input parameter 'tDenom') between the two methods of computing F, p and confidence intervals of  $g_{\psi}$ , and the output of mes1way on the command line includes a note if the (probably) less common method is chosen. In the documentation, introductory notes to mes1way were added which explain the two methods in detail.
- if contrast weights containing more than one entry of zero are specified, a warning is issued because if this choice of weights reflects the user's wish to exclude groups from analysis it had better be done by eliminating the corresponding data prior to input to mes1way.

### mes2way.m

- minor edits of H1 and help text
- main contrasts and MES depending on it were not computed correctly: they were too large by a factor of [number of levels in the non-analyzed factor]. This is fixed.
- when fed oneway data sets mes2way originally interpreted a (properly shaped) array of contrast weights as an instruction to compute an interaction contrast, although a main contrast would have been more appropriate. This is now fixed.

### mestab.m

- minor edits of H1 and help text

**documentation**

- addition of introductory notes to mes1way
- included table of input arguments
- minor edits

**Version 1.0, first release (July 2011)**