Package ‘metaConvert’

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Type Package

Title An Automatic Suite for Estimation of Various Effect Size Measures

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Description Automatically estimate 11 effect size measures from a well-formatted dataset. Various other functions can help, for example, removing dependency between several effect sizes, or identifying differences between two datasets.
This package is mainly designed to assist in conducting a systematic review with a meta-analysis but can be useful to any researcher interested in estimating an effect size.

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`metaConvert-package` *metaConvert: An R Package Dedicated to Automated Effect Size Calculations*

Description

The **metaConvert** package automatically estimates 11 effect size measures from a well-formatted dataframe. Various other functions can help, for example, removing dependency between several effect sizes, or identifying differences between two dataframes. This package is mainly designed to assist in conducting a systematic review with a meta-analysis, but it can be useful to any researcher interested in estimating an effect size.

Overview of the package

To visualize all the types of input data that can be used to estimate the 11 effect size measures available in metaConvert, you can use the `see_input_data()` function.

Estimate effect sizes

To automatically estimate effect sizes directly from a dataset, you can use the `convert_df()` function.

Aggregate dependent effect sizes

To automatically aggregate dependent effect sizes using Borenstein's formulas, you can use the `aggregate_df()` function. This function can handle dependent effect sizes from multiple subgroups, or dependent effect sizes from the same participants.

Flag differences between two datasets

If pairs of data extractors have generated similar datasets that should be compared, you can use the `compare_df()` function.

Prepare a dataset extraction sheet

If you have not started data extraction yet, you can use the `data_extraction_sheet()` function to obtain a perfectly formatted data extraction sheet.

Well-formatted dataset

One of the specificities of the **metaConvert** package is that its core function (`convert_df`) does not have arguments to specify the names of the variables contained in the dataset. While this allow using a convenient automatic process in the calculations, this requires that the datasets passed to this function respect a very precise formatting (which we will refer to as `well-formatted dataset`).

Rather than a long description of all column names, we built several tools that help you find required information.

1. You can use the `data_extraction_sheet()` function that generates an excel/csv/txt file containing all the column names available, as well as a description of the information it should contain.
2. You can use the `see_input_data()` function that generates a list of all available types of input data as well as their estimated/converted effect size measures. This function also points out to the corresponding helper tables available in https://metaconvert.org

Effect size measures available

Eleven effect size measures are accepted:

- **"d"**: standardized mean difference (i.e., Cohen's d)
- **"g"**: Hedges' g
- **"md"**: mean difference
- **"r"**: Correlation coefficient
- **"z"**: Fisher's r-to-z correlation
- **"or"** or **"logor"**: odds ratio or its logarithm
- **"rr"** or **"logrr"**: risk ratio or its logarithm
- **"irr"** or **"logirr"**: incidence rate ratio or its logarithm
- **"nnt"**: number needed to treat
- **"logcvr"**: log coefficient of variation
- **"logvr"**: log variability ratio

Output

All the functions of the **metaConvert** package that are dedicated to effect size calculations (i.e., all the functions named `es_from_*`) return a dataframe that contain, depending on the function - some of the following columns:

`info_used`	input data used to generate the effect size.
`md`	value of the mean difference.
`md_se`	standard error of the mean difference.
`md_ci_lo`	lower bound of the 95% CI of the mean difference.
`md_ci_up`	upper bound of the 95% CI of the mean difference.
`d`	value of the Cohen's d.
`d_se`	standard error of the Cohen's d.
`d_ci_lo`	lower bound of the 95% CI of the Cohen's d.
`d_ci_up`	upper bound of the 95% CI of the Cohen's d.
`g`	value of the Hedges' g.
`g_se`	standard error of the Hedges' g.
`g_ci_lo`	lower bound of the 95% CI of the Hedges' g.

g_ci_up	upper bound of the 95% CI of the Hedges' g.
r	value of the correlation coefficient.
r_se	standard error of the correlation coefficient.
r_ci_lo	lower bound of the 95% CI of the correlation coefficient.
r_ci_up	upper bound of the 95% CI of the correlation coefficient.
z	value of the r-to-z transformed correlation coefficient.
z_se	standard error of the r-to-z transformed correlation coefficient.
z_ci_lo	lower bound of the 95% CI of the r-to-z transformed correlation coefficient.
z_ci_up	upper bound of the 95% CI of the r-to-z transformed correlation coefficient.
logor	value of the log odds ratio.
logor_se	standard error of the log odds ratio.
logor_ci_lo	lower bound of the 95% CI of the log odds ratio.
logor_ci_up	upper bound of the 95% CI of the log odds ratio.
logrr	value of the log risk ratio.
logrr_se	standard error of the log risk ratio.
logrr_ci_lo	lower bound of the 95% CI of the log risk ratio.
logrr_ci_up	upper bound of the 95% CI of the log risk ratio.
logirr	value of the log incidence rate ratio.
logirr_se	standard error of the log incidence rate ratio.
logirr_ci_lo	lower bound of the 95% CI of the log incidence rate ratio.
logirr_ci_up	upper bound of the 95% CI of the log incidence rate ratio.
logvr	value of the log variability ratio.
logvr_se	standard error of the log variability ratio.
logvr_ci_lo	lower bound of the 95% CI of the log variability ratio.

logvr_ci_up	upper bound of the 95% CI of the log variability ratio.
logcvr	value of the log coefficient of variation.
logcvr_se	standard error of the log coefficient of variation.
logcvr_ci_lo	lower bound of the 95% CI of the log coefficient of variation.
logcvr_ci_up	upper bound of the 95% CI of the log coefficient of variation.
nnt	number needed to treat.

---

aggregate_df *Aggregate a dataframe containing dependent effect sizes*

Description

Aggregate a dataframe containing dependent effect sizes

Usage

```
aggregate_df(
  x,
  dependence = "outcomes",
  cor_unit = 0.8,
  agg_fact,
  es = "es",
  se = "se",
  col_mean = NA,
  col_weighted_mean = NA,
  weights = NA,
  col_sum = NA,
  col_min = NA,
  col_max = NA,
  col_fact = NA,
  na.rm = TRUE
)
```

Arguments

x	a dataframe that should be aggregated (must contain effect size values and standard errors).
dependence	The type of dependence in your dataframe (can be either "outcomes" or "subgroups"). See details.

cor_unit	The correlation between effect sizes coming from the same clustering unit (only used when dependence = "times" or dependence = "outcomes").
agg_fact	A character string identifying the column name that contains the clustering units (all rows with the same agg_fact value will be aggregated together).
es	A character string identifying the column name containing the effect size values. Default is "es".
se	A character string identifying the column name containing the standard errors of the effect size. Default is "se".
col_mean	a vector of character strings identifying the column names for which the dependent values are summarized by taking their mean.
col_weighted_mean	a vector of character strings identifying the column names for which the dependent values are summarized by taking their weighted mean.
weights	The weights that will be used to estimated the weighted means.
col_sum	a vector of character strings identifying the column names for which the dependent values are summarized by taking their sum.
col_min	a vector of character strings identifying the column names for which the dependent values are summarized by taking their minimum.
col_max	a vector of character strings identifying the column names for which the dependent values are summarized by taking their maximum.
col_fact	a vector of character strings identifying the column names that are factors (different values will be separated by a "/" character).
na.rm	a logical vector indicating whether missing values should be ignored in the calculations for the col_mean, col_weighted_mean, col_sum, col_min and col_max arguments.

Details

1. In the dependence argument, you should indicate "outcomes" if the dependence within the same clustering unit (e.g., study) is due to the presence of multiple effect sizes produced from the same participants at the same time-point (e.g., multiple outcome measures)
2. In the dependence argument, you should indicate "times" if the dependence within the same clustering unit (e.g., study) is due to the presence of multiple effect sizes produced from the same participants at the different time-points (e.g., an RCT with several follow-up waves).
3. In the dependence argument, you should indicate "subgroups" if the dependence within the same clustering unit (e.g., study) is due to the presence of multiple effect sizes produced by independent subgroups (e.g., one effect size for boys, and one for girls).

If you are working with ratio measures, make sure that the information on the effect size estimates (i.e., the column passed to the es argument of the function) is presented on the log scale.

Value

The object returned by the aggregate_df contains, is a dataframe containing at the very least, the aggregating factor, and the aggregated effect size values and standard errors. All columns indicated in the col_* arguments will also be included in this dataframe.

`row_id`	the row number in the original dataset.
`es`	the aggregated effect size value.
`se`	the standard error of the aggregated effect size.
`...`	any columns indicated in the `col_*` arguments.

Examples

```
res <- summary(convert_df(df.haza, measure = "d"))
aggregate_df(res, dependence = "outcomes", cor_unit = 0.8,
             agg_fact = "study_id", es = "es_crude", se = "se_crude",
             col_fact = c("outcome", "type_publication"))
```

`compare_df` *Flag the differences between two dataframes.*

Description

Flag the differences between two dataframes.

Usage

```
compare_df(
  df_extractor_1,
  df_extractor_2,
  ordering_columns = NULL,
  tolerance = 0,
  tolerance_type = "ratio",
  output = "html",
  file_name = "comparison.xlsx"
)
```

Arguments

`df_extractor_1`	a first dataset. Differences with the second dataset will be flagged in green.
`df_extractor_2`	a second dataset. Differences with the first dataset will be flagged in red.
`ordering_columns`	column names that should be used to re-order the two datasets before running the comparisons
`tolerance`	the cut-off value used to flag differences between two numeric values
`tolerance_type`	must be either 'difference' or 'ratio'

output	type of object returned by the function (see 'Value' section). Must be either 'wide', 'long', 'html', 'html2' or 'xlsx'.
file_name	the name of the generated file (only used when output="xlsx")

Details

This function aims to facilitate the comparison of two datasets created by blind data extractors during a systematic review. It is a wrapper of several functions from the 'compareDF' package.

Value

This function returns a dataframe composed of the rows that include a difference (all identical rows are removed). Several outputs can be requested :

1. setting output="xlsx" returns an excel file. A message indicates the location of the generated file on your computer.
2. setting output="html" returns an html file
3. setting output="html2" returns an html file (only useful when the "html" command did not make the html pane appear in R studio).
4. setting output="wide" a wide dataframe
5. setting output="long" a long dataframe

References

Alex Joseph (2022). compareDF: Do a Git Style Diff of the Rows Between Two Dataframes with Similar Structure. R package version 2.3.3. https://CRAN.R-project.org/package=compareDF

Examples

```
df.compare1 = df.compare1[order(df.compare1$author), ]
df.compare2 = df.compare2[order(df.compare2$year), ]

compare_df(
  df_extractor_1 = df.compare1,
  df_extractor_2 = df.compare2,
  ordering_columns = c("author", "year")
)
```

---

convert_df — *Automatically compute effect sizes from a well formatted dataset*

Description

Automatically compute effect sizes from a well formatted dataset

Usage

```
convert_df(
  x,
 measure = c("d", "g", "md", "logor", "logrr", "logirr", "nnt", "r", "z", "logvr",
   "logcvr"),
  main_es = TRUE,
  es_selected = c("auto", "hierarchy", "minimum", "maximum"),
  selection_auto = c("crude", "paired", "adjusted"),
  split_adjusted = TRUE,
  format_adjusted = c("wide", "long"),
  verbose = TRUE,
  max_asymmetry = 10,
  hierarchy = "means_sd > means_se > means_ci",
  table_2x2_to_cor = "tetrachoric",
  rr_to_or = "metaumbrella",
  or_to_rr = "metaumbrella_cases",
  or_to_cor = "bonett",
  smd_to_cor = "viechtbauer",
  pre_post_to_smd = "bonett",
  r_pre_post = 0.5,
  cor_to_smd = "viechtbauer",
  unit_type = "raw_scale",
  yates_chisq = FALSE
)
```

Arguments

`x`	a well formatted dataset
`measure`	the effect size measure that will be estimated from the information stored in the dataset. See details.
`main_es`	a logical variable indicating whether a main effect size should be selected when overlapping data are present. See details.
`es_selected`	the method used to select the main effect size when several information allows to estimate an effect size for the same association/comparison. Must be either "minimum" (the smallest effect size will be selected), "maximum" (the largest effect size will be selected) or "hierarchy" (the effect size computed from the information specified highest in the hierarchy will be selected). See details.
`selection_auto`	a character string giving details on the best "auto" hierarchy to use (only useful when `hierarchy="auto"` and `measure= "d", "g" or "md"`). See details.
`split_adjusted`	a logical value indicating whether crude and adjusted effect sizes should be presented separately. See details.
`format_adjusted`	presentation format of the adjusted effect sizes. See details.
`verbose`	a logical variable indicating whether text outputs and messages should be generated. We recommend turning this option to FALSE only after having carefully read all the generated messages.

max_asymmetry
: A percentage indicating the tolerance before detecting asymmetry in the 95% CI bounds.

hierarchy
: a character string indicating the hierarchy in the information to be prioritized for the effect size calculations. See details.

table_2x2_to_cor
: formula used to obtain a correlation coefficient from the contingency table. For now only 'tetrachoric' is available.

rr_to_or
: formula used to convert the rr value into an odds ratio.

or_to_rr
: formula used to convert the or value into a risk ratio.

or_to_cor
: formula used to convert the or value into a correlation coefficient.

smd_to_cor
: formula used to convert the cohen_d value into a coefficient correlation.

pre_post_to_smd
: formula used to obtain a SMD from pre/post means and SD of two independent groups.

r_pre_post
: pre-post correlation across the two groups (use this argument only if the precise correlation in each group is unknown)

cor_to_smd
: formula used to convert a correlation coefficient value into a SMD.

unit_type
: the type of unit for the unit_increase_iv argument. Must be either "sd" or "value" (see es_from_pearson_r).

yates_chisq
: a logical value indicating whether the Chi square has been performed using Yate's correction for continuity.

Details

This function automatically computes or converts between 11 effect sizes measures from any relevant type of input data stored in the dataset you pass to this function.

Effect size measures:

Possible effect size measures are:

1. Cohen's d ("d")
2. Hedges' g ("g")
3. mean difference ("md")
4. (log) odds ratio ("or" and "logor")
5. (log) risk ratio ("rr" and "logrr")
6. (log) incidence rate ratio ("irr" and "logirr")
7. correlation coefficient ("r")
8. transformed r-to-z correlation coefficient ("z")
9. log variability ratio ("logvr")
10. log coefficient of variation ("logcvr")
11. number needed to treat ("nnt")

Computation of a main effect size:

If you enter multiple types of input data (e.g., means/sd of two groups and a student t-test value) for the same comparison i.e., for the same row of the dataset, the convert_df() function can have two behaviours. If you set:

- `main_es = FALSE` the function will estimate all possible effect sizes from all types of input data (which implies that if a comparison has **several types of input data**, it will result in **multiple rows** in the dataframe returned by the function)
- `main_es = TRUE` the function will select one effect size per comparison (which implies that if a comparison has **several types of input data**, it will result in a **unique row** in the dataframe returned by the function)

Selection of input data for the computation of the main effect size:

If you choose to estimate one main effect size (i.e., by setting `main_es = TRUE`), you have several options to select this main effect size. If you set:

- `es_selected = "auto"`: the main effect size will be **automatically** selected, by prioritizing specific types of input data over other (see next section "Hierarchy").
- `es_selected = "hierarchy"`: the main effect size will be selected, by prioritizing specific types of input data over other (see next section "Hierarchy").
- `es_selected = "minimum"`: the main effect size will be selected, by selecting the lowest effect size available.
- `es_selected = "maximum"`: the main effect size will be selected, by selecting the highest effect size available.

Hierarchy:

More than 70 different combinations of input data can be used to estimate an effect size. You can retrieve the effect size measures estimated by each combination of input data in the `see_input_data()` function and online `https://metaconvert.org/input.html`.

You have two options to use a hierarchy in the types of input data.

- an automatic way (`es_selected = "auto"`)
- an manual way (`es_selected = "hierarchy"`)

Automatic:

If you select an automatic hierarchy, here are the types of input data that will be prioritized.

Crude SMD or MD (`measure=c("d", "g", "md")` *and* `selection_auto="crude"`*):*

1. User's input effect size value
2. SMD value
3. Means at post-test
4. ANOVA/Student's t-test/point biserial correlation statistics
5. Linear regression estimates
6. Mean difference values
7. Quartiles/median/maximum values
8. Post-test means extracted from a plot
9. Pre-test+post-test means or mean change
10. Paired ANOVA/t-test statistics
11. Odds ratio value
12. Contingency table
13. Correlation coefficients
14. Phi/chi-square value

Paired SMD or MD (`measure=c("d", "g", "md")` *and* `selection_auto="paired"`*):*

1. User's input effect size value
2. Paired SMD value
3. Pre-test+post-test means or mean change
4. Paired ANOVA/t-test statistics
5. Means at post-test
6. ANOVA/Student's t-test/point biserial correlation
7. Linear regression estimates
8. Mean difference values
9. Quartiles/median/maximum values
10. Odds ratio value
11. Contingency table
12. Correlation coefficients
13. Phi/chi-square value

Adjusted SMD or MD (`measure=c("d", "g", "md")` *and* `selection_auto="adjusted"`*):*

1. User's input adjusted effect size value
2. Adjusted SMD value
3. Estimated marginal means from ANCOVA
4. F- or t-test value from ANCOVA
5. Adjusted mean difference from ANCOVA
6. Estimated marginal means from ANCOVA extracted from a plot

Odds Ratio (`measure=c("or")`*):*

1. User's input effect size value
2. Odds ratio value
3. Contingency table
4. Risk ratio values
5. Phi/chi-square value
6. Correlation coefficients
7. (Then hierarchy as for "d" or "g" option crude)

Risk Ratio (`measure=c("rr")`*):*

1. User's input effect size value
2. Risk ratio values
3. Contingency table
4. Odds ratio values
5. Phi/chi-square value

Incidence rate ratio (`measure=c("irr")`*):*

1. User's input effect size value
2. Number of cases and time of disease free observation time

Correlation (`measure=c("r", "z")`*):*

1. User's input effect size value
2. Correlation coefficients
3. Contingency table
4. Odds ratio value

5. Phi/chi-square value
6. SMD value
7. Means at post-test
8. ANOVA/Student's t-test/point biserial correlation
9. Linear regression estimates
10. Mean difference values 11 Quartiles/median/maximum values
11. Post-test means extracted from a plot
12. Pre-test+post-test means or mean change
13. Paired ANOVA/t-test

Variability ratios (`measure=c("vr", "cvr")`*):*

1. User's input effect size value
2. means/variability indices at post-test
3. means/variability indices at post-test extracted from a plot

Number needed to treat (`measure=c("nnt")`*):*

1. User's input effect size value
2. Contingency table
3. Odds ratio values
4. Risk ratio values
5. Phi/chi-square value

Manual:

If you select a manual hierarchy, you can specify the order in which you want to use each type of input data. You can prioritize some types of input data by placing them at the begining of the hierarchy argument, and you must separate all input data with a ">" separator. For example, if you set:

- `hierarchy = "means_sd > means_se > student_t"`, the convert_df function will prioritize the means + SD, then the means + SE, then the Student's t-test to estimate the main effect size.
- `hierarchy = "2x2 > or_se > phi"`, the convert_df function will prioritize the contigency table, then the odds ratio value + SE, then the phi coefficient to estimate the main effect size.

Importantly, if none of the types of input data indicated in the `hierarchy` argument can be used to estimate the target effect size measure, the `convert_df()` function will automatically try to use other types of input data to estimate an effect size.

Adjusted effect sizes:

Some datasets will be composed of crude (i.e., non-adjusted) types of input data (such as standard means + SD, Student's t-test, etc.) and adjusted types of input data (such as means + SE from an ANCOVA model, a t-test from an ANCOVA, etc.).

In these situations, you can decide to:

- treat crude and adjusted input data the same way `split_adjusted = FALSE`
- split calculations for crude and adjusted types of input data `split_adjusted = TRUE`

If you want to split the calculations, you can decide to present the final dataset:

- in a long format (i.e., crude and adjusted effect sizes presented in separate rows `format_adjusted = "long"`)
- in a wide format (i.e., crude and adjusted effect sizes presented in separate columns `format_adjusted = "wide"`)

Value

The convert_df() function returns a list of more than 70 dataframes (one for each function automatically applied to the dataset). These dataframes systematically contain the columns described in metaConvert-package. The list of dataframes can be easily converted to a single, calculations-ready dataframe using the summary function (see summary.metaConvert).

Examples

```
res <- convert_df(df.haza,
  measure = "g",
  split_adjusted = TRUE,
  es_selected = "minimum",
  format_adjusted = "long"
)
summary(res)
```

---

data_extraction_sheet *Data extraction sheet generator*

Description

Data extraction sheet generator

Usage

```
data_extraction_sheet(
 measure = c("d", "g", "md", "or", "rr", "nnt", "r", "z", "logvr", "logcvr", "irr"),
  type_of_measure = c("natural", "natural+converted"),
  name = "mcv_data_extraction",
  extension = c("data.frame", ".txt", ".csv", ".xlsx"),
  verbose = TRUE
)
```

Arguments

measure	Target effect size measure (one of the 11 available in metaConvert). Default is "all".
type_of_measure	One of "natural+converted" or "natural" (see details).
name	Name of the file created
extension	Extension of the file created. Most common are ".xlsx", ".csv" or ".txt". It is also possible to generate an R dataframe object by using the "data.frame" extension.
verbose	logical variable indicating whether some information should be printed (e.g., the location where the sheet is created when using ".xlsx", ".csv" or ".txt" extensions)

Details

This function generates, on your computer, a data extraction sheet that contains the name of columns that can be used by our tools to estimate various effect size measures.

If you select a specific measure (e.g., `measure = "g"`), you will be presented only with most common information allowing to estimate this measure (e.g., you will not be provided with columns for contigency tables if you request a data extraction sheet for `measure = "g"`).

Measure:

You can specify a specific effect size measures (among those available in the `metaConvert-package`). Doing this, the data extraction sheet will contain only the columns of the input data allowing **a natural estimation of the effect size measure**. For example, if you request `measure="d"` the data extraction sheet will not contain the columns for the contingency table since, although the `convert_df` function allows you to **convert** a contingency table into a "d", this requires to convert the "OR" that is naturally estimated from the contingency table into a "d".

This table is designed to be used in combination with tables showing the combination of input data leading to estimate each of the effect size measures (https://metaconvert.org/html/input.html)

Extension:

You can export a file in various formats outside R (by indicating, for example, ".txt", ".xlsx", or ".csv") in the `extension` argument. You can also visualise this dataset directly in R by setting `extension = "data.frame"`.

Value

This function returns a data extraction sheet that contains all the information necessary to estimate any effect size using the metaConvert tools.

Examples

```
data_extraction_sheet(measure = "md", extension = "data.frame")
```

`df.compare1` *Fictitious dataset 1*

Description

First fictitious dataset aiming to understand how the `compare_df` function works. Slightly different from `df.compare1`

Usage

```
df.compare1
```

Format

An object of class `data.frame` with 5 rows and 7 columns.

df.compare2 *Fictitious dataset 2*

Description

First fictitious dataset aiming to understand how the compare_df function works. Slightly different from df.compare2

Usage

```
df.compare2
```

Format

An object of class data.frame with 6 rows and 7 columns.

df.haza *Meta-analytic dataset inspired from Haza and colleagues (2024)*

Description

Dataset of a meta-analysis exploring the specificity of social functioning of children with ADHD (compared to healthy controls) in case-control studies. This dataset contains: 1. several information coming from the same participants (due to the completion of multiple outcomes). 1. several information coming from the same study (due to the presence of multiple subgroups). 1. overlapping information for the same comparison 1. several information types from which a standardized mean difference can be estimated/converted

Usage

```
df.haza
```

Format

An object of class data.frame with 170 rows and 106 columns.

Source

Haza B, Gosling CJ, Conty L & Pinabiaux C (2024). Social Functioning in Children and Adolescents with ADHD: A Meta-analysis. Journal of Child Psychology and Psychiatry and Allied Disciplines.

`df.short` *Short version of the df.haza dataset*

Description

This dataset is a shoter version of the `df.haza` dataset.

Usage

```
df.short
```

Format

An object of class `grouped_df` (inherits from `tbl_df`, `tbl`, `data.frame`) with 37 rows and 109 columns.

Source

Haza B, Gosling CJ, Conty L & Pinabiaux C (2024). Social Functioning in Children and Adolescents with ADHD: A Meta-analysis. Journal of Child Psychology and Psychiatry and Allied Disciplines.

`es_from_2x2` *Convert a 2x2 table into several effect size measures*

Description

Convert a 2x2 table into several effect size measures

Usage

```
es_from_2x2(
  n_cases_exp,
  n_cases_nexp,
  n_controls_exp,
  n_controls_nexp,
  table_2x2_to_cor = "tetrachoric",
  reverse_2x2
)
```

Arguments

n_cases_exp	number of cases/events in the exposed group
n_cases_nexp	number of cases/events in the non exposed group
n_controls_exp	number of controls/no-event in the exposed group
n_controls_nexp	number of controls/no-event in the non exposed group
table_2x2_to_cor	formula used to obtain a correlation coefficient from the contingency table (see details).
reverse_2x2	a logical value indicating whether the direction of generated effect sizes should be flipped.

Details

This function first computes (log) odds ratio (OR), (log) risk ratio (RR) and number needed to treat (NNT) from the 2x2 table. Note that if a cell is equal to 0, we applied the typical adjustment (add 0.5) to all cells. Cohen's d (D), Hedges' g (G) and correlation coefficients (R/Z) are then estimated from the OR.

To estimate an OR, the formulas used (Box 6.4.a in the Cochrane Handbook) are:

$$logor = log(\frac{n\_cases\_exp/n\_cases\_nexp}{n\_controls\_exp/n\_controls\_nexp})$$

$$logor\_se = \sqrt{\frac{1}{n\_cases\_exp} + \frac{1}{n\_cases\_nexp} + \frac{1}{n\_controls\_exp} + \frac{1}{n\_controls\_nexp}}$$

To estimate an RR, the formulas used (Box 6.4.a in the Cochrane Handbook) are:

$$logrr = log(\frac{n\_cases\_exp/n\_exp}{n\_cases\_nexp/n\_nexp})$$

$$logrr\_se = \sqrt{\frac{1}{n\_cases\_exp} - \frac{1}{n\_exp} + \frac{1}{n\_cases\_nexp} - \frac{1}{n\_nexp}}$$

To estimate a NNT, the formulas used are (Sedwick, 2013) :

$$pt = \frac{n\_cases\_exp}{n\_cases\_exp + n\_controls\_exp}$$

$$pc = \frac{n\_cases\_nexp}{n\_cases\_nexp + n\_controls\_nexp}$$

$$AAR = pc - pt$$

$$nnt = \frac{1}{AAR}$$

To convert the 2x2 table into a SMD, the function estimates an OR value from the 2x2 table (formula above) that is then converted to a SMD (see formula in `es_from_or_se()`).

To convert the 2x2 table into a correlation coefficient, For now, only the tetrachoric correlation is currently proposed

- `table_2x2_to_cor = "tetrachoric"`. Given the heavy calculations required for this effect size measure, we relied on the implementation of the formulas of the 'metafor' package. More information can be retrieved here (https://wviechtb.github.io/metafor/reference/escalc.html#-b-measures-for-two-dichotomous-variables).

Value

This function estimates and converts between several effect size measures.

`natural effect size measure`	OR + RR + NNT
`converted effect size measure`	D + G + R + Z
`required input data`	See 'Section 7. Contingency (2x2) table or proportions' https://metaconvert.org/input.html

References

Cooper, H., Hedges, L.V., & Valentine, J.C. (Eds.). (2019). The handbook of research synthesis and meta-analysis. Russell Sage Foundation.

Higgins JPT, Thomas J, Chandler J, Cumpston M, Li T, Page MJ, Welch VA (editors). Cochrane Handbook for Systematic Reviews of Interventions version 6.3 (updated February 2022). Available from www.training.cochrane.org/handbook.

Lipsey, M. W., & Wilson, D. B. (2001). Practical meta-analysis. Sage Publications, Inc.

Sedgwick, P. (2013). What is number needed to treat (NNT)? Bmj, 347.

Examples

```
es_from_2x2(n_cases_exp = 467, n_cases_nexp = 22087, n_controls_exp = 261, n_controls_nexp = 8761)
```

`es_from_2x2_prop` *Convert the proportion of occurrence of a binary event in two independent groups into several effect size measures*

Description

Convert the proportion of occurrence of a binary event in two independent groups into several effect size measures

Usage

```
es_from_2x2_prop(
  prop_cases_exp,
  prop_cases_nexp,
  n_exp,
  n_nexp,
  table_2x2_to_cor = "tetrachoric",
  reverse_prop
)
```

Arguments

`prop_cases_exp`	proportion of cases/events in the exposed group (ranging from 0 to 1)
`prop_cases_nexp`	proportion of cases/events in the non-exposed group (ranging from 0 to 1)
`n_exp`	total number of participants in the exposed group
`n_nexp`	total number of participants in the non exposed group
`table_2x2_to_cor`	formula used to obtain a correlation coefficient from the contigency table (see details).
`reverse_prop`	a logical value indicating whether the direction of generated effect sizes should be flipped.

Details

This function uses the proportions and sample size to recreate the 2x2 table, and then relies on the calculations of the `es_from_2x2_sum()` function.

The formulas used is to obtain the 2x2 table are

$$n\_cases\_exp = prop\_cases\_exp * n\_exp$$

$$n\_cases\_nexp = prop\_cases\_nexp * n\_nexp$$

$$n\_controls\_exp = (1 - prop\_cases\_exp) * n\_exp$$

$$n\_controls\_nexp = (1 - prop\_cases\_nexp) * n\_nexp$$

Value

This function estimates and converts between several effect size measures.

`natural effect size measure`	OR + RR + NNT
`converted effect size measure`	D + G + R + Z
`required input data`	See 'Section 7. Contingency (2x2) table or proportions' https://metaconvert.org/input.html

Examples

```
es_from_2x2_prop(prop_cases_exp = 0.80, prop_cases_nexp = 0.60, n_exp = 10, n_nexp = 20)
```

---

es_from_2x2_sum — *Convert a table with the number of cases and row marginal sums into several effect size measures*

Description

Convert a table with the number of cases and row marginal sums into several effect size measures

Usage

```
es_from_2x2_sum(
  n_cases_exp,
  n_exp,
  n_cases_nexp,
  n_nexp,
  table_2x2_to_cor = "tetrachoric",
  reverse_2x2
)
```

Arguments

`n_cases_exp`	number of cases/events in the exposed group
`n_exp`	total number of participants in the exposed group
`n_cases_nexp`	number of cases/events in the non exposed group
`n_nexp`	total number of participants in the non exposed group
`table_2x2_to_cor`	formula used to obtain a correlation coefficient from the contigency table (see details).
`reverse_2x2`	a logical value indicating whether the direction of generated effect sizes should be flipped.

Details

This function uses the number of cases in both the exposed and non-exposed groups and the total number of participants exposed and non-exposed to recreate a 2x2 table. Then relies on the calculations of the `es_from_2x2` function.

$$n\_controls\_exp = n\_exp - n\_cases\_exp$$

$$n\_controls\_nexp = n\_nexp - n\_cases\_nexp$$

Value

This function estimates and converts between several effect size measures.

natural effect size measure	OR + RR + NNT
converted effect size measure	D + G + R + Z
required input data	See 'Section 7. Contingency (2x2) table or proportions' https://metaconvert.org/input.html

Examples

```
es_from_2x2_sum(n_cases_exp = 10, n_exp = 40, n_cases_nexp = 25, n_nexp = 47)
```

---

es_from_ancova_f — *Convert a F-statistic obtained from an ANCOVA model into several effect size measures.*

Description

Convert a F-statistic obtained from an ANCOVA model into several effect size measures.

Usage

```
es_from_ancova_f(
  ancova_f,
  cov_outcome_r,
  n_cov_ancova,
  n_exp,
  n_nexp,
  smd_to_cor = "viechtbauer",
  reverse_ancova_f
)
```

Arguments

ancova_f	a F-statistic from an ANCOVA (binary predictor)
cov_outcome_r	correlation between the outcome and covariate(s) (multiple correlation when multiple covariates are included in the ANCOVA model).
n_cov_ancova	number of covariates in the ANCOVA model.
n_exp	number of participants in the experimental/exposed group.
n_nexp	number of participants in the non-experimental/non-exposed group.
smd_to_cor	formula used to convert the adjusted cohen_d value into a coefficient correlation (see details).

`reverse_ancova_f`
: a logical value indicating whether the direction of the generated effect sizes should be flipped.

Details

This function first computes an "adjusted" Cohen's d (D), and Hedges' g (G) from the F-value of an ANCOVA (binary predictor). Odds ratio (OR) and correlation coefficients (R/Z) are then converted from the Cohen's d.

To estimate a Cohen's d the formula used is (table 12.3 in Cooper):

$$cohen\_d = \sqrt{ancova\_f * \frac{(n\_exp + n\_nexp)}{n\_exp * n\_nexp}} * \sqrt{1 - cov\_out\_cor^2}$$

To estimate other effect size measures, Calculations of the `es_from_cohen_d_adj()` are applied.

Value

This function estimates and converts between several effect size measures.

`natural effect size measure`	D + G
`converted effect size measure`	OR + R + Z
`required input data`	See 'Section 18. Adjusted: ANCOVA statistics, eta-squared' https://metaconvert.org/input.html

References

Cooper, H., Hedges, L. V., & Valentine, J. C. (Eds.). (2019). The handbook of research synthesis and meta-analysis. Russell Sage Foundation.

Examples

```
es_from_ancova_f(ancova_f = 4, cov_outcome_r = 0.2, n_cov_ancova = 3, n_exp = 20, n_nexp = 20)
```

`es_from_ancova_f_pval` *Convert a two-tailed p-value of an ANCOVA t-test into several effect size measures.*

Description

Convert a two-tailed p-value of an ANCOVA t-test into several effect size measures.

Usage

```
es_from_ancova_f_pval(
  ancova_f_pval,
  cov_outcome_r,
  n_cov_ancova,
  n_exp,
  n_nexp,
  smd_to_cor = "viechtbauer",
  reverse_ancova_f_pval
)
```

Arguments

`ancova_f_pval`	a two-tailed p-value of an F-test in an ANCOVA (binary predictor)
`cov_outcome_r`	correlation between the outcome and covariate(s) (multiple correlation when multiple covariates are included in the ANCOVA model).
`n_cov_ancova`	number of covariates in the ANCOVA model.
`n_exp`	number of participants in the experimental/exposed group.
`n_nexp`	number of participants in the non-experimental/non-exposed group.
`smd_to_cor`	formula used to convert the adjusted `cohen_d` value into a coefficient correlation (see details).
`reverse_ancova_f_pval`	a logical value indicating whether the direction of the generated effect sizes should be flipped.

Details

This function converts the p-value of an ANCOVA (binary predictor) into a t value, and then relies on the calculations of the `es_from_ancova_t()` function.

To convert the p-value into a t-value, the following formula is used (table 12.3 in Cooper):

$$df = n\_exp + n\_nexp + n\_exp - 2 - n\_cov\_ancova$$

$$t = |pt(ancova\_f\_pval/2, df = df)|$$

Then, calculations of the `es_from_ancova_t()` are applied.

Value

This function estimates and converts between several effect size measures.

`natural effect size measure`	D + G
`converted effect size measure`	OR + R + Z
`required input data`	See 'Section 18. Adjusted: ANCOVA statistics, eta-squared' https://metaconvert.org/input.html

References

Cooper, H., Hedges, L.V., & Valentine, J.C. (Eds.). (2019). The handbook of research synthesis and meta-analysis. Russell Sage Foundation.

Examples

```
es_from_ancova_f_pval(
  ancova_f_pval = 0.05, cov_outcome_r = 0.2,
  n_cov_ancova = 3, n_exp = 20, n_nexp = 20
)
```

---

es_from_ancova_md_ci *Convert an adjusted mean difference and adjusted standard deviation between two independent groups obtained from an ANCOVA model into several effect size measures*

Description

Convert an adjusted mean difference and adjusted standard deviation between two independent groups obtained from an ANCOVA model into several effect size measures

Usage

```
es_from_ancova_md_ci(
  ancova_md,
  ancova_md_ci_lo,
  ancova_md_ci_up,
  cov_outcome_r,
  n_cov_ancova,
  n_exp,
  n_nexp,
  max_asymmetry = 10,
  smd_to_cor = "viechtbauer",
  reverse_ancova_md
)
```

Arguments

`ancova_md` adjusted mean difference between two independent groups

`ancova_md_ci_lo`
lower bound of the covariate-adjusted 95% CI of the mean difference

`ancova_md_ci_up`
upper bound of the covariate-adjusted 95% CI of the mean difference

`cov_outcome_r`	correlation between the outcome and covariate (multiple correlation when multiple covariates are included in the ANCOVA model).
`n_cov_ancova`	number of covariates in the ANCOVA model.
`n_exp`	number of participants in the experimental/exposed group.
`n_nexp`	number of participants in the non-experimental/non-exposed group.
`max_asymmetry`	A percentage indicating the tolerance before detecting asymmetry in the 95% CI bounds.
`smd_to_cor`	formula used to convert the `cohen_d` value into a coefficient correlation (see details).
`reverse_ancova_md`	a logical value indicating whether the direction of generated effect sizes should be flipped.

Details

This function converts the mean difference (MD) 95% CI into a standard error, and then relies on the calculations of the `es_from_ancova_md_se` function.

To convert the 95% CI into a standard error, the following formula is used (table 12.3 in Cooper):

$$md\_se = \frac{ancova\_md\_ci\_up - ancova\_md\_ci\_lo}{(2 * qt(0.975, n\_exp + n\_nexp - 2 - n\_cov\_ancova))}$$

Calculations of the `es_from_ancova_md_se()` are then applied.

Value

This function estimates and converts between several effect size measures.

natural effect size measure	MD + D + G
converted effect size measure	OR + R + Z
required input data	See 'Section 20. Adjusted: Mean difference and dispersion' https://metaconvert.org/input.html

Examples

```
es_from_ancova_md_ci(
  ancova_md = 4, ancova_md_ci_lo = 2,
  ancova_md_ci_up = 6,
  cov_outcome_r = 0.5, n_cov_ancova = 5,
  n_exp = 20, n_nexp = 22
)
```

es_from_ancova_md_pval

Convert an adjusted mean difference and adjusted standard deviation between two independent groups obtained from an ANCOVA model into several effect size measures

Description

Convert an adjusted mean difference and adjusted standard deviation between two independent groups obtained from an ANCOVA model into several effect size measures

Usage

```
es_from_ancova_md_pval(
  ancova_md,
  ancova_md_pval,
  cov_outcome_r,
  n_cov_ancova,
  n_exp,
  n_nexp,
  smd_to_cor = "viechtbauer",
  reverse_ancova_md
)
```

Arguments

`ancova_md`	adjusted mean difference between two independent groups
`ancova_md_pval`	p-value (two-tailed) of the adjusted mean difference
`cov_outcome_r`	correlation between the outcome and covariate (multiple correlation when multiple covariates are included in the ANCOVA model).
`n_cov_ancova`	number of covariates in the ANCOVA model.
`n_exp`	number of participants in the experimental/exposed group.
`n_nexp`	number of participants in the non-experimental/non-exposed group.
`smd_to_cor`	formula used to convert the `cohen_d` value into a coefficient correlation (see details).
`reverse_ancova_md`	a logical value indicating whether the direction of generated effect sizes should be flipped.

Details

This function converts the mean difference (MD) p-value into a standard error, and then relies on the calculations of the `es_from_ancova_md_se()` function.

To convert the p-value into a standard error, the following formula is used (table 12.3 in Cooper):

$$t = qt(p = \frac{ancova\_md\_pval}{2}, df = n\_exp + n\_nexp - 2 - n\_cov\_ancova)$$

$$ancova\_md\_se = |\frac{ancova\_md}{t}|$$

Calculations of the `es_from_ancova_md_se()` are then applied.

Value

This function estimates and converts between several effect size measures.

`natural effect size measure`	MD + D + G
`converted effect size measure`	OR + R + Z
`required input data`	See 'Section 20. Adjusted: Mean difference and dispersion' https://metaconvert.org/input.html

Examples

```
es_from_ancova_md_pval(
  ancova_md = 4, ancova_md_pval = 0.05,
  cov_outcome_r = 0.5, n_cov_ancova = 5,
  n_exp = 20, n_nexp = 22
)
```

`es_from_ancova_md_sd` *Convert an adjusted mean difference and adjusted standard deviation between two independent groups obtained from an ANCOVA model into several effect size measures*

Description

Convert an adjusted mean difference and adjusted standard deviation between two independent groups obtained from an ANCOVA model into several effect size measures

Usage

```
es_from_ancova_md_sd(
  ancova_md,
  ancova_md_sd,
  cov_outcome_r,
  n_cov_ancova,
  n_exp,
```

```
  n_nexp,
  smd_to_cor = "viechtbauer",
  reverse_ancova_md
)
```

Arguments

ancova_md	adjusted mean difference between two independent groups
ancova_md_sd	covariate-adjusted standard deviation of the mean difference
cov_outcome_r	correlation between the outcome and covariate (multiple correlation when multiple covariates are included in the ANCOVA model).
n_cov_ancova	number of covariates in the ANCOVA model.
n_exp	number of participants in the experimental/exposed group.
n_nexp	number of participants in the non-experimental/non-exposed group.
smd_to_cor	formula used to convert the `cohen_d` value into a coefficient correlation (see details).
reverse_ancova_md	a logical value indicating whether the direction of generated effect sizes should be flipped.

Details

This function first computes an "adjusted" Cohen's d (D), Hedges' g (G) from the adjusted mean difference (MD). Odds ratio (OR) and correlation coefficients (R/Z) are then converted from the Cohen's d.

To estimate the unadjusted variance of MD (table 12.3 in Cooper):

$$md\_sd = \frac{ancova\_md\_sd}{\sqrt{1 - cor\_outcome\_r^2}}$$

$$md\_se = md\_sd * \sqrt{\frac{1}{n\_exp} + \frac{1}{n\_nexp}}$$

$$md\_lo = md - md\_se * qt(.975, n\_exp + n\_nexp - 2 - n\_cov\_ancova)$$

$$md\_up = md + md\_se * qt(.975, n\_exp + n\_nexp - 2 - n\_cov\_ancova)$$

To estimate the Cohen's d (table 12.3 in Cooper):

$$d = \frac{ancova\_md}{md\_sd}$$

To estimate other effect size measures, Calculations of the `es_from_cohen_d_adj()` are applied.

Value

This function estimates and converts between several effect size measures.

natural effect size measure	MD + D + G
converted effect size measure	OR + R + Z
required input data	See 'Section 20. Adjusted: Mean difference and dispersion' https://metaconvert.org/input.html

Examples

```
es_from_ancova_md_sd(
  ancova_md = 4, ancova_md_sd = 2,
  cov_outcome_r = 0.5, n_cov_ancova = 5,
  n_exp = 20, n_nexp = 22
)
```

---

es_from_ancova_md_se *Convert an adjusted mean difference and standard error between two independent groups obtained from an ANCOVA model into several effect size measures*

Description

Convert an adjusted mean difference and standard error between two independent groups obtained from an ANCOVA model into several effect size measures

Usage

```
es_from_ancova_md_se(
  ancova_md,
  ancova_md_se,
  cov_outcome_r,
  n_cov_ancova,
  n_exp,
  n_nexp,
  smd_to_cor = "viechtbauer",
  reverse_ancova_md
)
```

Arguments

ancova_md	adjusted mean difference between two independent groups
ancova_md_se	covariate-adjusted standard error of the mean difference
cov_outcome_r	correlation between the outcome and covariate (multiple correlation when multiple covariates are included in the ANCOVA model).
n_cov_ancova	number of covariates in the ANCOVA model.

`n_exp`	number of participants in the experimental/exposed group.
`n_nexp`	number of participants in the non-experimental/non-exposed group.
`smd_to_cor`	formula used to convert the `cohen_d` value into a coefficient correlation (see details).
`reverse_ancova_md`	a logical value indicating whether the direction of generated effect sizes should be flipped.

Details

This function converts the mean difference (MD) standard error into a standard deviation, and then relies on the calculations of the `es_from_ancova_md_sd` function.

To convert the standard error into a standard deviation, the following formula is used.

$$ancova\_md\_sd = \frac{ancova\_md\_se}{\sqrt{1/n_exp + 1/n_nexp}}$$

Calculations of the `es_from_ancova_md_sd()` are then applied.

Value

This function estimates and converts between several effect size measures.

`natural effect size measure`	MD + D + G
`converted effect size measure`	OR + R + Z
`required input data`	See 'Section 20. Adjusted: Mean difference and dispersion' https://metaconvert.org/input.html

Examples

```
es_from_ancova_md_se(
  ancova_md = 4, ancova_md_se = 2,
  cov_outcome_r = 0.5, n_cov_ancova = 5,
  n_exp = 20, n_nexp = 22
)
```

`es_from_ancova_means_ci` *Convert means and 95% CIs of two independent groups obtained from an ANCOVA model into several effect size measures*

Description

Convert means and 95% CIs of two independent groups obtained from an ANCOVA model into several effect size measures

Usage

```
es_from_ancova_means_ci(
  n_exp,
  n_nexp,
  ancova_mean_exp,
  ancova_mean_ci_lo_exp,
  ancova_mean_ci_up_exp,
  ancova_mean_nexp,
  ancova_mean_ci_lo_nexp,
  ancova_mean_ci_up_nexp,
  cov_outcome_r,
  n_cov_ancova,
  max_asymmetry = 10,
  smd_to_cor = "viechtbauer",
  reverse_ancova_means
)
```

Arguments

`n_exp`	number of participants in the experimental/exposed group.
`n_nexp`	number of participants in the non-experimental/non-exposed group.
`ancova_mean_exp`	adjusted mean of participants in the experimental/exposed group.
`ancova_mean_ci_lo_exp`	lower bound of the adjusted 95% CI of the mean of the experimental/exposed group
`ancova_mean_ci_up_exp`	upper bound of the adjusted 95% CI of the mean of the experimental/exposed group
`ancova_mean_nexp`	adjusted mean of participants in the non-experimental/non-exposed group.
`ancova_mean_ci_lo_nexp`	lower bound of the adjusted 95% CI of the mean of the non-experimental/non-exposed group.
`ancova_mean_ci_up_nexp`	upper bound of the adjusted 95% CI of the mean of the non-experimental/non-exposed group.
`cov_outcome_r`	correlation between the outcome and covariate(s) (multiple correlation when multiple covariates are included in the ANCOVA model).
`n_cov_ancova`	number of covariates in the ANCOVA model.
`max_asymmetry`	A percentage indicating the tolerance before detecting asymmetry in the 95% CI bounds.

`smd_to_cor` formula used to convert the adjusted `cohen_d` value into a coefficient correlation (see details).

`reverse_ancova_means`
a logical value indicating whether the direction of the generated effect sizes should be flipped.

Details

This function converts the adjusted means 95% CI of two independent groups into a standard error, and then relies on the calculations of the `es_from_ancova_means_se()` function.

To convert the 95% CIs into standard errors, the following formula is used (table 12.3 in Cooper):

$$ancova\_mean\_se\_exp = \frac{ancova\_mean\_ci\_up\_exp - ancova\_mean\_ci\_lo\_exp}{2 * qt(0.975, df = n\_exp - 1)}$$

$$ancova\_mean\_se\_nexp = \frac{ancova\_mean\_ci\_up\_nexp - ancova\_mean\_ci\_lo\_nexp}{2 * qt(0.975, df = n\_nexp - 1)}$$

Calculations of the `es_from_ancova_means_se()` are then applied.

Value

This function estimates and converts between several effect size measures.

`natural effect size measure`	MD + D + G
`converted effect size measure`	OR + R + Z
`required input data`	See 'Section 19. Adjusted: Means and dispersion' https://metaconvert.org/input.html

References

Cooper, H., Hedges, L.V., & Valentine, J.C. (Eds.). (2019). The handbook of research synthesis and meta-analysis. Russell Sage Foundation.

Examples

```
es_from_ancova_means_ci(
  n_exp = 55, n_nexp = 55, cov_outcome_r = 0.5, n_cov_ancova = 4,
  ancova_mean_exp = 25, ancova_mean_ci_lo_exp = 15, ancova_mean_ci_up_exp = 35,
  ancova_mean_nexp = 18, ancova_mean_ci_lo_nexp = 12, ancova_mean_ci_up_nexp = 24
)
```

es_from_ancova_means_sd

Convert means and standard deviations of two independent groups obtained from an ANCOVA model into several effect size measures

Description

Convert means and standard deviations of two independent groups obtained from an ANCOVA model into several effect size measures

Usage

```
es_from_ancova_means_sd(
  n_exp,
  n_nexp,
  ancova_mean_exp,
  ancova_mean_nexp,
  ancova_mean_sd_exp,
  ancova_mean_sd_nexp,
  cov_outcome_r,
  n_cov_ancova,
  smd_to_cor = "viechtbauer",
  reverse_ancova_means
)
```

Arguments

`n_exp` number of participants in the experimental/exposed group.

`n_nexp` number of participants in the non-experimental/non-exposed group.

`ancova_mean_exp` adjusted mean of participants in the experimental/exposed group.

`ancova_mean_nexp` adjusted mean of participants in the non-experimental/non-exposed group.

`ancova_mean_sd_exp` adjusted standard deviation of participants in the experimental/exposed group.

`ancova_mean_sd_nexp` adjusted standard deviation of participants in the non-experimental/non-exposed group.

`cov_outcome_r` correlation between the outcome and covariate(s) (multiple correlation when multiple covariates are included in the ANCOVA model).

`n_cov_ancova` number of covariates in the ANCOVA model.

`smd_to_cor` formula used to convert the adjusted `cohen_d` value into a coefficient correlation (see details).

`reverse_ancova_means` a logical value indicating whether the direction of the generated effect sizes should be flipped.

Details

This function first computes an "adjusted" mean difference (MD), Cohen's d (D) and Hedges' g (G) from the adjusted means and standard deviations. Odds ratio (OR) and correlation coefficients (R/Z) are then converted from the Cohen's d.

This function start by estimating the non-adjusted standard deviation of the two groups (formula 12.24 in Cooper);

$$mean\_sd\_exp = \frac{ancova\_mean\_sd\_exp}{\sqrt{1 - cov\_outcome\_r^2}}$$

$$mean\_sd\_nexp = \frac{ancova\_mean\_sd\_nexp}{\sqrt{1 - cov\_outcome\_r^2}}$$

To obtain the mean difference, the following formulas are used (authors calculations):

$$md = ancova\_mean\_exp - ancova\_mean\_nexp$$

$$md\_se = \sqrt{\frac{mean\_sd\_exp^2}{n\_exp} + \frac{mean\_sd\_nexp^2}{n\_nexp}}$$

$$md\_ci\_lo = md - md\_se * qt(.975, n\_exp + n\_nexp - 2 - n\_cov\_ancova)$$

$$md\_ci\_up = md + md\_se * qt(.975, n\_exp + n\_nexp - 2 - n\_cov\_ancova)$$

To obtain the Cohen's d, the following formulas are used (table 12.3 in Cooper):

$$mean\_sd\_pooled = \sqrt{\frac{(n\_exp - 1) * ancova\_mean\_exp^2 + (n\_nexp - 1) * ancova\_mean\_nexp^2}{n\_exp + n\_nexp - 2}}$$

$$cohen\_d = \frac{ancova\_mean\_exp - ancova\_mean\_nexp}{mean\_sd\_pooled}$$

$$cohen\_d\_se = \frac{(n\_exp + n\_nexp) * (1 - cov\_outcome\_r^2)}{n\_exp * n\_nexp} + \frac{cohen\_d^2}{2(n\_exp + n\_nexp)}$$

$$cohen\_d\_ci\_lo = cohen\_d - cohen\_d\_se * qt(.975, n\_exp + n\_nexp - 2 - n\_cov\_ancova)$$

$$cohen\_d\_ci\_up = cohen\_d + cohen\_d\_se * qt(.975, n\_exp + n\_nexp - 2 - n\_cov\_ancova)$$

To estimate other effect size measures, Calculations of the `es_from_cohen_d_adj()` are applied.

Value

This function estimates and converts between several effect size measures.

`natural effect size measure`	MD + D + G
`converted effect size measure`	OR + R + Z
`required input data`	See 'Section 19. Adjusted: Means and dispersion' https://metaconvert.org/input.html

References

Cooper, H., Hedges, L.V., & Valentine, J.C. (Eds.). (2019). The handbook of research synthesis and meta-analysis. Russell Sage Foundation.

Examples

```
es_from_ancova_means_sd(
  n_exp = 55, n_nexp = 55,
  ancova_mean_exp = 2.3, ancova_mean_sd_exp = 1.2,
  ancova_mean_nexp = 1.9, ancova_mean_sd_nexp = 0.9,
  cov_outcome_r = 0.2, n_cov_ancova = 3
)
```

---

es_from_ancova_means_sd_pooled_adj

Convert means and adjusted pooled standard deviation of two independent groups obtained from an ANCOVA model into several effect size measures

---

Description

Convert means and adjusted pooled standard deviation of two independent groups obtained from an ANCOVA model into several effect size measures

Usage

```
es_from_ancova_means_sd_pooled_adj(
  ancova_mean_exp,
  ancova_mean_nexp,
  ancova_mean_sd_pooled,
  cov_outcome_r,
  n_cov_ancova,
  n_exp,
  n_nexp,
  smd_to_cor = "viechtbauer",
  reverse_ancova_means
)
```

Arguments

`ancova_mean_exp`
: adjusted mean of participants in the experimental/exposed group.

`ancova_mean_nexp`
: adjusted mean of participants in the non-experimental/non-exposed group.

`ancova_mean_sd_pooled`
: adjusted pooled standard deviation.

`cov_outcome_r`
: correlation between the outcome and covariate(s) (multiple correlation when multiple covariates are included in the ANCOVA model).

`n_cov_ancova`
: number of covariates in the ANCOVA model.

`n_exp`
: number of participants in the experimental/exposed group.

`n_nexp`
: number of participants in the non-experimental/non-exposed group.

`smd_to_cor`
: formula used to convert the adjusted `cohen_d` value into a coefficient correlation (see details).

`reverse_ancova_means`
: a logical value indicating whether the direction of the generated effect sizes should be flipped.

Details

This function converts the adjusted pooled standard deviations of two independent groups into a crude pooled standard deviation. and then relies on the calculations of the `es_from_ancova_means_sd_pooled_crude()` function.

To convert the adjusted pooled SD into a crude pooled SD (table 12.3 in Cooper):

$$mean\_sd\_pooled = \frac{ancova\_mean\_sd\_pooled}{\sqrt{1 - cov\_outcome\_r^2}}$$

Calculations of the `es_from_ancova_means_sd_pooled_crude()` are then applied.

Value

This function estimates and converts between several effect size measures.

natural effect size measure	MD + D + G
converted effect size measure	OR + R + Z
required input data	See 'Section 19. Adjusted: Means and dispersion' https://metaconvert.org/input.html

References

Cooper, H., Hedges, L.V., & Valentine, J.C. (Eds.). (2019). The handbook of research synthesis and meta-analysis. Russell Sage Foundation.

Examples

```
es_from_ancova_means_sd_pooled_adj(
  ancova_mean_exp = 98, ancova_mean_nexp = 87,
  ancova_mean_sd_pooled = 17, cov_outcome_r = 0.2,
  n_cov_ancova = 3, n_exp = 20, n_nexp = 20
)
```

es_from_ancova_means_sd_pooled_crude

Convert adjusted means obtained from an ANCOVA model and crude pooled standard deviation of two independent groups into several effect size measures

Description

Convert adjusted means obtained from an ANCOVA model and crude pooled standard deviation of two independent groups into several effect size measures

Usage

```
es_from_ancova_means_sd_pooled_crude(
  ancova_mean_exp,
  ancova_mean_nexp,
  mean_sd_pooled,
  cov_outcome_r,
  n_cov_ancova,
  n_exp,
  n_nexp,
  smd_to_cor = "viechtbauer",
  reverse_ancova_means
)
```

Arguments

`ancova_mean_exp`	adjusted mean of participants in the experimental/exposed group.
`ancova_mean_nexp`	adjusted mean of participants in the non-experimental/non-exposed group.
`mean_sd_pooled`	crude pooled standard deviation.
`cov_outcome_r`	correlation between the outcome and covariate(s) (multiple correlation when multiple covariates are included in the ANCOVA model).
`n_cov_ancova`	number of covariates in the ANCOVA model.
`n_exp`	number of participants in the experimental/exposed group.
`n_nexp`	number of participants in the non-experimental/non-exposed group.
`smd_to_cor`	formula used to convert the adjusted `cohen_d` value into a coefficient correlation (see details).
`reverse_ancova_means`	a logical value indicating whether the direction of the generated effect sizes should be flipped.

Details

This function first computes an "adjusted" mean difference (MD) and Cohen's d (D) from the adjusted means and crude pooled standard deviation of two independent groups. Odds ratio (OR) and correlation coefficients (R/Z) are then converted from the Cohen's d.

To estimate the Cohen's d:

$$d = \frac{ancova\_mean\_exp - ancova\_mean\_nexp\_adj}{mean\_sd\_pooled}$$

To estimate the mean difference:

$$md = ancova\_mean\_exp - ancova\_mean\_nexp\_adj$$

$$md\_se = \sqrt{\frac{n\_exp + n\_nexp}{n\_exp * n\_nexp} * (1 - cov\_outcome\_r^2) * mean\_sd\_pooled^2}$$

Then, calculations of the `es_from_ancova_means_sd()` and `es_from_cohen_d_adj()` are applied.

Value

This function estimates and converts between several effect size measures.

`natural effect size measure`	MD + D + G
`converted effect size measure`	OR + R + Z
`required input data`	See 'Section 19. Adjusted: Means and dispersion' https://metaconvert.org/input.html

References

Cooper, H., Hedges, L.V., & Valentine, J.C. (Eds.). (2019). The handbook of research synthesis and meta-analysis. Russell Sage Foundation.

Examples

```
es_from_ancova_means_sd_pooled_crude(
  ancova_mean_exp = 29, ancova_mean_nexp = 34,
  mean_sd_pooled = 7, cov_outcome_r = 0.2,
  n_cov_ancova = 3, n_exp = 20, n_nexp = 20
)
```

es_from_ancova_means_se

Convert means and standard errors of two independent groups obtained from an ANCOVA model into several effect size measures

Description

Convert means and standard errors of two independent groups obtained from an ANCOVA model into several effect size measures

Usage

```
es_from_ancova_means_se(
  n_exp,
  n_nexp,
  ancova_mean_exp,
  ancova_mean_nexp,
  ancova_mean_se_exp,
  ancova_mean_se_nexp,
  cov_outcome_r,
  n_cov_ancova,
  smd_to_cor = "viechtbauer",
  reverse_ancova_means
)
```

Arguments

`n_exp` number of participants in the experimental/exposed group.

`n_nexp` number of participants in the non-experimental/non-exposed group.

`ancova_mean_exp` adjusted mean of participants in the experimental/exposed group.

`ancova_mean_nexp` adjusted mean of participants in the non-experimental/non-exposed group.

`ancova_mean_se_exp` adjusted standard error of participants in the experimental/exposed group.

`ancova_mean_se_nexp` adjusted standard error of participants in the non-experimental/non-exposed group.

`cov_outcome_r` correlation between the outcome and covariate(s) (multiple correlation when multiple covariates are included in the ANCOVA model).

`n_cov_ancova` number of covariates in the ANCOVA model.

`smd_to_cor` formula used to convert the adjusted `cohen_d` value into a coefficient correlation (see details).

`reverse_ancova_means` a logical value indicating whether the direction of the generated effect sizes should be flipped.

Details

This function converts the adjusted means standard errors of two independent groups into standard deviations, and then relies on the calculations of the `es_from_ancova_means_sd` function.

To convert the standard errors into standard deviations, the following formula is used.

$$ancova\_mean\_sd\_exp = ancova\_mean\_se\_exp * \sqrt{n\_exp}$$

$$ancova\_mean\_sd\_nexp = ancova\_mean\_se\_nexp * \sqrt{n\_nexp}$$

Calculations of the `es_from_ancova_means_sd()` are then applied.

Value

This function estimates and converts between several effect size measures.

`natural effect size measure`	MD + D + G
`converted effect size measure`	OR + R + Z
`required input data`	See 'Section 19. Adjusted: Means and dispersion' https://metaconvert.org/input.html

References

Higgins JPT, Li T, Deeks JJ (editors). Chapter 6: Choosing effect size measures and computing estimates of effect. In: Higgins JPT, Thomas J, Chandler J, Cumpston M, Li T, Page MJ, Welch VA (editors). Cochrane Handbook for Systematic Reviews of Interventions version 6.3 (updated February 2022). Cochrane, 2022. Available from www.training.cochrane.org/handbook.

Examples

```
es_from_ancova_means_se(
  n_exp = 55, n_nexp = 55,
  ancova_mean_exp = 2.3, ancova_mean_se_exp = 1.2,
  ancova_mean_nexp = 1.9, ancova_mean_se_nexp = 0.9,
  cov_outcome_r = 0.2, n_cov_ancova = 3
)
```

`es_from_ancova_t` *Convert a t-statistic obtained from an ANCOVA model into several effect size measures.*

Description

Convert a t-statistic obtained from an ANCOVA model into several effect size measures.

Usage

```
es_from_ancova_t(
  ancova_t,
  cov_outcome_r,
  n_cov_ancova,
  n_exp,
  n_nexp,
  smd_to_cor = "viechtbauer",
  reverse_ancova_t
)
```

Arguments

`ancova_t`	a t-statistic from an ANCOVA (binary predictor)
`cov_outcome_r`	correlation between the outcome and covariate(s) (multiple correlation when multiple covariates are included in the ANCOVA model).
`n_cov_ancova`	number of covariates in the ANCOVA model.
`n_exp`	number of participants in the experimental/exposed group.
`n_nexp`	number of participants in the non-experimental/non-exposed group.
`smd_to_cor`	formula used to convert the adjusted `cohen_d` value into a coefficient correlation (see details).
`reverse_ancova_t`	a logical value indicating whether the direction of the generated effect sizes should be flipped.

Details

This function first computes an "adjusted" Cohen's d (D), and Hedges' g (G) from the t-value of an ANCOVA (binary predictor). Odds ratio (OR) and correlation coefficients (R/Z) are then converted from the Cohen's d.

To estimate a Cohen's d the formula used is (table 12.3 in Cooper):

$$cohen\_d = ancova\_t * \sqrt{\frac{(n\_exp + n\_nexp)}{n\_exp * n\_nexp}} \sqrt{1 - cov\_out\_cor^2}$$

To estimate other effect size measures, Calculations of the `es_from_cohen_d_adj()` are applied.

Value

This function estimates and converts between several effect size measures.

`natural effect size measure`	D + G
`converted effect size measure`	OR + R + Z
`required input data`	See 'Section 18. Adjusted: ANCOVA statistics, eta-squared'

https://metaconvert.org/input.html

References

Cooper, H., Hedges, L. V., & Valentine, J. C. (Eds.). (2019). The handbook of research synthesis and meta-analysis. Russell Sage Foundation.

Examples

```
es_from_ancova_t(ancova_t = 2, cov_outcome_r = 0.2, n_cov_ancova = 3, n_exp = 20, n_nexp = 20)
```

---

es_from_ancova_t_pval *Convert a two-tailed p-value of an ANCOVA t-test into several effect size measures.*

Description

Convert a two-tailed p-value of an ANCOVA t-test into several effect size measures.

Usage

```
es_from_ancova_t_pval(
  ancova_t_pval,
  cov_outcome_r,
  n_cov_ancova,
  n_exp,
  n_nexp,
  smd_to_cor = "viechtbauer",
  reverse_ancova_t_pval
)
```

Arguments

ancova_t_pval	a two-tailed p-value of a t-test in an ANCOVA (binary predictor)
cov_outcome_r	correlation between the outcome and covariate(s) (multiple correlation when multiple covariates are included in the ANCOVA model).
n_cov_ancova	number of covariates in the ANCOVA model.
n_exp	number of participants in the experimental/exposed group.
n_nexp	number of participants in the non-experimental/non-exposed group.
smd_to_cor	formula used to convert the adjusted cohen_d value into a coefficient correlation (see details).
reverse_ancova_t_pval	a logical value indicating whether the direction of the generated effect sizes should be flipped.

Details

This function converts the p-value of an ANCOVA (binary predictor) into a t value, and then relies on the calculations of the `es_from_ancova_t()` function.

To convert the p-value into a t-value, the following formula is used (table 12.3 in Cooper):

$$df = n\_exp + n\_nexp + n\_exp - 2 - n\_cov\_ancova$$

$$t = |pt(ancova\_f\_pval/2, df = df)|$$

Then, calculations of the `es_from_ancova_t()` are applied.

Value

This function estimates and converts between several effect size measures.

natural effect size measure	D + G
converted effect size measure	OR + R + Z
required input data	See 'Section 18. Adjusted: ANCOVA statistics, eta-squared' https://metaconvert.org/input.html

References

Cooper, H., Hedges, L.V., & Valentine, J.C. (Eds.). (2019). The handbook of research synthesis and meta-analysis. Russell Sage Foundation.

Examples

```
es_from_ancova_t_pval(
  ancova_t_pval = 0.05, cov_outcome_r = 0.2,
  n_cov_ancova = 3, n_exp = 20, n_nexp = 20
)
```

---

es_from_anova_f — *Convert a one-way independent ANOVA F-value to several effect size measures*

Description

Convert a one-way independent ANOVA F-value to several effect size measures

Usage

```
es_from_anova_f(
  anova_f,
  n_exp,
  n_nexp,
  smd_to_cor = "viechtbauer",
  reverse_anova_f
)
```

Arguments

anova_f	ANOVA F-value (one-way, binary predictor).
n_exp	number of participants in the experimental/exposed group.
n_nexp	number of participants in the non-experimental/non-exposed group.
smd_to_cor	formula used to convert the anova_f value into a coefficient correlation (see details).
reverse_anova_f	a logical value indicating whether the direction of generated effect sizes should be flipped.

Details

This function converts the F-value (one-way, binary predictor) into a t-value, and then relies on the calculations of the es_from_student_t() function.

To convert the F-value into a t-value, the following formula is used (table 12.1 in Cooper):

$$student\_t = \sqrt{anova\_f}$$

Then, calculations of the es_from_student_t() are applied.

Value

This function estimates and converts between several effect size measures.

natural effect size measure	D + G
converted effect size measure	OR + R + Z
required input data	See 'Section 11. ANOVA statistics, Student's t-test, or point-bis correlation' https://metaconvert.org/html/input.html

References

Cooper, H., Hedges, L.V., & Valentine, J.C. (Eds.). (2019). The handbook of research synthesis and meta-analysis. Russell Sage Foundation.

Examples

```
es_from_anova_f(anova_f = 2.01, n_exp = 20, n_nexp = 22)
```

---

es_from_anova_pval — *Convert a p-value from a one-way independent ANOVA to several effect size measures*

Description

Convert a p-value from a one-way independent ANOVA to several effect size measures

Usage

```
es_from_anova_pval(
  anova_f_pval,
  n_exp,
  n_nexp,
  smd_to_cor = "viechtbauer",
  reverse_anova_f_pval
)
```

Arguments

`anova_f_pval`	p-value (two-tailed) from an ANOVA (binary predictor). If your p-value is one-tailed, simply multiply it by two.
`n_exp`	number of participants in the experimental/exposed group.
`n_nexp`	number of participants in the non-experimental/non-exposed group.
`smd_to_cor`	formula used to convert the `anova_f_pval` value into a coefficient correlation (see details).
`reverse_anova_f_pval`	a logical value indicating whether the direction of generated effect sizes should be flipped.

Details

This function converts the p-value from the F-value of an ANOVA (one-way, binary predictor) into a t-value, and then relies on the calculations of the `es_from_student_t()` function.

To convert the p-value into a t-value, the following formula is used (table 12.1 in Cooper):

$$student\_t = qt(\frac{anova\_f\_pval}{2}, df = n\_exp + n\_nexp - 2)$$

Then, calculations of the `es_from_student_t()` are applied.

Value

This function estimates and converts between several effect size measures.

`natural effect size measure`	D + G
`converted effect size measure`	OR + R + Z
`required input data`	See 'Section 11. ANOVA statistics, Student's t-test, or point-bis correlation' https://metaconvert.org/html/input.html

References

Cooper, H., Hedges, L.V., & Valentine, J.C. (Eds.). (2019). The handbook of research synthesis and meta-analysis. Russell Sage Foundation.

Examples

```
es_from_anova_pval(anova_f_pval = 0.0012, n_exp = 20, n_nexp = 22)
```

---

es_from_beta_std — *Convert a standardized regression coefficient and the standard deviation of the dependent variable into several effect size measures*

Description

Convert a standardized regression coefficient and the standard deviation of the dependent variable into several effect size measures

Usage

```
es_from_beta_std(
  beta_std,
  sd_dv,
  n_exp,
  n_nexp,
  smd_to_cor = "viechtbauer",
  reverse_beta_std
)
```

Arguments

`beta_std`	a standardized regression coefficient value (binary predictor, no other covariables in the model)
`sd_dv`	standard deviation of the dependent variable

`n_exp`	number of participants in the experimental/exposed group.
`n_nexp`	number of participants in the non-experimental/non-exposed group.
`smd_to_cor`	formula used to convert the `cohen_d` value into a coefficient correlation (see details).
`reverse_beta_std`	a logical value indicating whether the direction of the generated effect sizes should be flipped.

Details

This function converts a standardized linear regression coefficient (coming from a model with only one binary predictor), into an unstandardized linear regression coefficient.

$$sd\_dummy = \sqrt{\frac{n_exp - (n_exp^2/(n_exp + n_nexp))}{(n_exp + n_nexp - 1)}}$$

$$unstd\_beta = beta\_std * \frac{sd\_dv}{sd\_dummy}$$

Calculations of the `es_from_beta_unstd` functions are then used.

Value

This function estimates and converts between several effect size measures.

`natural effect size measure`	D + G
`converted effect size measure`	OR + R + Z
`required input data`	See 'Section 13. (Un-)Standardized regression coefficient' https://metaconvert.org/input.html

References

Lipsey, M. W., & Wilson, D. B. (2001). Practical meta-analysis. Sage Publications, Inc.

Examples

```
es_from_beta_std(beta_std = 2.1, sd_dv = 0.98, n_exp = 20, n_nexp = 22)
```

es_from_beta_unstd — *Convert an unstandardized regression coefficient and the standard deviation of the dependent variable into several effect size measures*

Description

Convert an unstandardized regression coefficient and the standard deviation of the dependent variable into several effect size measures

Usage

```
es_from_beta_unstd(
  beta_unstd,
  sd_dv,
  n_exp,
  n_nexp,
  smd_to_cor = "viechtbauer",
  reverse_beta_unstd
)
```

Arguments

`beta_unstd`	an unstandardized regression coefficient value (binary predictor, no other covariables in the model)
`sd_dv`	standard deviation of the dependent variable
`n_exp`	number of participants in the experimental/exposed group.
`n_nexp`	number of participants in the non-experimental/non-exposed group.
`smd_to_cor`	formula used to convert the `cohen_d` value into a coefficient correlation (see details).
`reverse_beta_unstd`	a logical value indicating whether the direction of the generated effect sizes should be flipped.

Details

This function estimates a Cohen's d (D) and Hedges' g (G) from an unstandardized linear regression coefficient (coming from a model with only one binary predictor), and the standard deviation of the dependent variable. Odds ratio (OR) and correlation coefficients (R/Z) are then converted from the Cohen's d.

The formula used to obtain the Cohen's d is:

$$N = n\_exp + n\_nexp$$

$$sd\_pooled = \sqrt{\frac{sd\_dv^2 * (N-1) - unstd\_beta^2 * \frac{n\_exp * n\_nexp}{N}}{N-2}}$$

$$cohen\_d = \frac{unstd\_beta}{sd\_pooled}$$

To estimate other effect size measures, calculations of the `es_from_cohen_d()` are applied.

Value

This function estimates and converts between several effect size measures.

`natural effect size measure`	D + G
`converted effect size measure`	OR + R + Z
`required input data`	See 'Section 13. (Un-)Standardized regression coefficient' https://metaconvert.org/input.html

References

Lipsey, M. W., & Wilson, D. B. (2001). Practical meta-analysis. Sage Publications, Inc.

Examples

```
es_from_beta_unstd(beta_unstd = 2.1, sd_dv = 0.98, n_exp = 20, n_nexp = 22)
```

`es_from_cases_time` *Convert the number of cases and the person-time of disease-free observation in two independent groups into an incidence rate ratio (IRR)*

Description

Convert the number of cases and the person-time of disease-free observation in two independent groups into an incidence rate ratio (IRR)

Usage

```
es_from_cases_time(n_cases_exp, n_cases_nexp, time_exp, time_nexp, reverse_irr)
```

Arguments

`n_cases_exp`	number of cases in the exposed group
`n_cases_nexp`	number of cases in the non-exposed group
`time_exp`	person-time of disease-free observation in the exposed group
`time_nexp`	person-time of disease-free observation in the non-exposed group
`reverse_irr`	a logical value indicating whether the direction of the generated effect sizes should be flipped.

Details

This function estimates the incidence rate ratio from the number of cases and the person-time of disease-free observation in two independent groups.

The formula used to obtain the IRR and its standard error are (Cochrane Handbook (section 6.7.1):

$$logirr = log(\frac{n\_cases\_exp/time\_exp}{n\_cases\_nexp/time\_nexp})$$

$$logirr\_se = \sqrt{\frac{1}{n\_cases\_exp} + \frac{1}{n\_cases\_nexp}}$$

Value

This function estimates IRR.

`natural effect size measure`	IRR
`converted effect size measure`	N/A
`required input data`	See 'Section 5. Incidence Ratio Ratio' https://metaconvert.org/input.html

References

Higgins JPT, Thomas J, Chandler J, Cumpston M, Li T, Page MJ, Welch VA (editors). Cochrane Handbook for Systematic Reviews of Interventions version 6.3 (updated February 2022). Cochrane, 2022. Available from www.training.cochrane.org/handbook.

Examples

```
es_from_cases_time(
  n_cases_exp = 241, n_cases_nexp = 554,
  time_exp = 12.764, time_nexp = 19.743
)
```

`es_from_chisq` *Convert a chi-square value to several effect size measures*

Description

Convert a chi-square value to several effect size measures

Usage

```
es_from_chisq(
  chisq,
  n_sample,
  n_cases,
  n_exp,
  yates_chisq = FALSE,
  reverse_chisq
)
```

Arguments

`chisq`	value of the chi-squared
`n_sample`	total number of participants in the sample
`n_cases`	total number of cases/events
`n_exp`	total number of participants in the exposed group
`yates_chisq`	a logical value indicating whether the Chi square has been performed using Yate's correction for continuity.
`reverse_chisq`	a logical value indicating whether the direction of generated effect sizes should be flipped.

Details

This function converts a chi-square value (with one degree of freedom) into a phi coefficient (Lipsey et al. 2001):

$$phi = \sqrt{\frac{chisq^2}{n\_sample}}$$

.

Note that if `yates_chisq = "TRUE"`, a small correction is added.

Then, the phi coefficient is converted to other effect size measures (see `es_from_phi`).

Value

This function estimates and converts between several effect size measures.

`natural effect size measure`	OR + RR + NNT
`converted effect size measure`	D + G + R + Z
`required input data`	See 'Section 8. Phi or chi-square' https://metaconvert.org/input.html

References

Lipsey, M. W., & Wilson, D. B. (2001). Practical meta-analysis. Sage Publications, Inc.

Examples

```
es_from_chisq(chisq = 4.21, n_sample = 78, n_cases = 51, n_exp = 50)
```

`es_from_chisq_pval` *Convert a p-value of a chi-square to several effect size measures*

Description

Convert a p-value of a chi-square to several effect size measures

Usage

```
es_from_chisq_pval(
  chisq_pval,
  n_sample,
  n_cases,
  n_exp,
  yates_chisq = FALSE,
  reverse_chisq_pval
)
```

Arguments

`chisq_pval`	p-value of a chi-square coefficient
`n_sample`	total number of participants in the sample
`n_cases`	total number of cases/events
`n_exp`	total number of participants in the exposed group
`yates_chisq`	a logical value indicating whether the Chi square has been performed using Yate's correction for continuity.
`reverse_chisq_pval`	a logical value indicating whether the direction of generated effect sizes should be flipped.

Details

This function converts a chi-square value (with one degree of freedom) into a chi-square coefficient (Section 3.12 in Lipsey et al., 2001):

$$chisq = qchisq(chisq\_pval, df = 1, lower.tail = FALSE)$$

Note that if `yates_chisq = "TRUE"`, a small correction is added.

Then, the chisq coefficient is converted to other effect size measures (see `es_from_chisq`).

Value

This function estimates and converts between several effect size measures.

natural effect size measure	OR + RR + NNT
converted effect size measure	D + G + R + Z
required input data	See 'Section 8. Phi or chi-square' https://metaconvert.org/input.html

References

Lipsey, M. W., & Wilson, D. B. (2001). Practical meta-analysis. Sage Publications, Inc.

Examples

```
es_from_chisq_pval(chisq_pval = 0.2, n_sample = 42, n_exp = 25, n_cases = 13)
```

---

es_from_cohen_d *Convert a Cohen's d value to several effect size measures*

Description

Convert a Cohen's d value to several effect size measures

Usage

```
es_from_cohen_d(cohen_d, n_exp, n_nexp, smd_to_cor = "viechtbauer", reverse_d)
```

Arguments

`cohen_d`	Cohen's d (i.e., standardized mean difference) value.
`n_exp`	number of participants in the experimental/exposed group.
`n_nexp`	number of participants in the non-experimental/non-exposed group.
`smd_to_cor`	formula used to convert the `cohen_d` value into a coefficient correlation (see details).
`reverse_d`	a logical value indicating whether the direction of generated effect sizes should be flipped.

Details

This function estimates the standard error of a Cohen's d value and computes a Hedges' g (G). Odds ratio (OR) and correlation coefficients (R/Z) are then converted from the Cohen's d.

To estimate the standard error of Cohen's d, the following formula is used (formula 12.13 in Cooper):

$$cohen\_d\_se = \sqrt{\frac{n\_exp + n\_nexp}{n\_exp * n\_nexp} + \frac{cohen\_d^2}{2 * (n\_exp + n\_nexp)}}$$

$$cohen\_d\_ci\_lo = cohen\_d - cohen\_d\_se * qt(.975, df = n\_exp + n\_nexp - 2)$$

$$cohen\_d\_ci\_up = cohen\_d + cohen\_d\_se * qt(.975, df = n\_exp + n\_nexp - 2)$$

To estimate the Hedges' g and its standard error, the following formulas are used (Hedges, 1981):

$$df = n\_exp + n\_nexp - 2$$

$$J = exp(\log_{gamma}(\frac{df}{2}) - 0.5 * \log(\frac{df}{2}) - \log_{gamma}(\frac{df - 1}{2}))$$

$$hedges\_g = cohen\_d * J$$

$$hedges\_g\_se = \sqrt{cohen\_d\_se^2 * J^2}$$

$$hedges\_g\_ci\_lo = hedges\_g - hedges\_g\_se * qt(.975, df = n\_exp + n\_nexp - 2)$$

$$hedges\_g\_ci\_up = hedges\_g + hedges\_g\_se * qt(.975, df = n\_exp + n\_nexp - 2)$$

To estimate the log odds ratio and its standard error, the following formulas are used (formulas 12.34-12.35 in Cooper):

$$logor = \frac{cohen\_d * \pi}{\sqrt{3}}$$

$$logor\_se = \sqrt{\frac{cohen\_d\_se^2 * \pi^2}{3}}$$

$$logor\_lo = logor - logor\_se * qnorm(.975)$$

$$logor\_up = logor + logor\_se * qnorm(.975)$$

Note that this conversion assumes that responses within the two groups follow logistic distributions.

To estimate the correlation coefficient and its standard error, various formulas can be used.

A. To estimate the 'biserial' correlation (`smd_to_cor="viechtbauer"`), the following formulas are used (formulas 5, 8, 13, 17, 18, 19 in Viechtbauer):

$$h = \frac{n\_exp + n\_nexp}{n\_exp} + \frac{n\_exp + n\_nexp}{n\_nexp}$$

$$r.pb = \frac{cohen\_d}{\sqrt{cohen\_d^2 + h}}$$

$$p = \frac{n\_exp}{n\_exp + n\_nexp}$$

$$q = 1 - p$$

$$R = \frac{\sqrt{p * q}}{dnorm(qnorm(1-p)) * r.pb}$$

$$R\_var = \frac{1}{n\_exp + n\_nexp - 1} * (\frac{\sqrt{p * q}}{dnorm(qnorm(1-p))} - R^2)^2$$

$$R\_se = \sqrt{R\_var}$$

$$a = \frac{\sqrt{dnorm(qnorm(1-p))}}{(p * q)^{\frac{1}{4}}}$$

$$Z = \frac{a}{2} * \log(\frac{1 + a * R}{1 - a * R})$$

$$Z\_var = \frac{1}{n-1}$$

$$Z\_se = \sqrt{Z\_var}$$

$$Z\_ci\_lo = Z - qnorm(.975) * Z\_se$$

$$Z\_ci\_up = Z + qnorm(.975) * Z\_se$$

$$R\_ci\_lo = tanh(Z\_lo)$$

$$R\_ci\_up = tanh(Z\_up)$$

B. To estimate the correlation coefficient according to Cooper et al. (2019) (formulas 12.40-42) and Borenstein et al. (2009) (formulas 54-56), the following formulas are used (`smd_to_cor="lipsey_cooper"`):

$$p = \frac{n\_exp}{n\_exp + n\_nexp}$$

$$R = \frac{cohen\_d}{\sqrt{cohen\_d^2 + 1/(p * (1-p))}}$$

$$a = \frac{(n\_exp + n\_nexp)^2}{(n\_exp * n\_nexp)}$$

$$var\_R = \frac{a^2 * cohen\_d\_se^2}{(cohen\_d^2 + a)^3}$$

$$R\_se = \sqrt{R\_var}$$

$$R\_ci\_lo = R - qt(.975, n\_exp + n\_nexp - 2) * R\_se$$

$$R\_ci\_up = R + qt(.975, n\_exp + n\_nexp - 2) * R\_se$$

$$Z = atanh(R)$$

$$Z\_var = \frac{cohen\_d\_se^2}{cohen\_d\_se^2 + (1/p * (1-p))}$$

$$Z\_se = \sqrt{Z\_var}$$

$$Z\_ci\_lo = Z - qnorm(.975) * Z\_se$$

$$Z\_ci\_up = Z + qnorm(.975) * Z\_se$$

Value

This function estimates and converts between several effect size measures.

`natural effect size measure`	D + G
`converted effect size measure`	OR + R + Z
`required input data`	See 'Section 1. Cohen's d or Hedges' g' https://metaconvert.org/input.html

References

Cooper, H., Hedges, L.V., & Valentine, J.C. (Eds.). (2019). The handbook of research synthesis and meta-analysis. Russell Sage Foundation.

Borenstein, M., Hedges, L. V., Higgins, J. P., & Rothstein, H. R. (2021). Introduction to meta-analysis. John Wiley & Sons.

Hedges LV (1981): Distribution theory for Glass's estimator of effect size and related estimators. Journal of Educational and Behavioral Statistics, 6, 107–28

Jacobs, P., & Viechtbauer, W. (2017). Estimation of the biserial correlation and its sampling variance for use in meta-analysis. Research synthesis methods, 8(2), 161–180.

Examples

```
es_from_cohen_d(cohen_d = 1, n_exp = 20, n_nexp = 20)
```

`es_from_cohen_d_adj` *Convert an adjusted Cohen's d value to several effect size measures*

Description

Convert an adjusted Cohen's d value to several effect size measures

Usage

```
es_from_cohen_d_adj(
  cohen_d_adj,
  n_cov_ancova,
  cov_outcome_r,
  n_exp,
  n_nexp,
  smd_to_cor = "viechtbauer",
  reverse_d
)
```

Arguments

`cohen_d_adj`	Adjusted Cohen's d (i.e., standardized mean difference) value.
`n_cov_ancova`	number of covariates
`cov_outcome_r`	covariate-outcome correlation (in case of multiple covariates, the multiple correlation)
`n_exp`	number of participants in the experimental/exposed group.
`n_nexp`	number of participants in the non-experimental/non-exposed group.
`smd_to_cor`	formula used to convert the `cohen_d` value into a coefficient correlation (see details).
`reverse_d`	a logical value indicating whether the direction of generated effect sizes should be flipped.

Details

This function estimates the standard error of an adjusted Cohen's d value and Hedges' g (G), and converts an odds ratio (OR) and correlation coefficients (R/Z).

To estimate the standard error of Cohen's d, the following formula is used (table 12.3 in Cooper):

$$d\_se = \sqrt{\frac{n\_exp + n\_nexp}{n\_exp * n\_nexp} * (1 - cov\_outcome\_r^2) + \frac{cohen\_d\_adj^2}{2 * (n\_exp + n\_nexp)}}$$

To estimate other effect size measures, calculations of the `es_from_cohen_d()` function are used (with the exception of the degree of freedom that is estimated as `df = n_exp + n_nexp - 2 - n_cov_ancova`).

Value

This function estimates and converts between several effect size measures.

`natural effect size measure`	D + G
`converted effect size measure`	OR + R + Z
`required input data`	See 'Section 1. Cohen's d or Hedges' g' https://metaconvert.org/input.html

References

Cooper, H., Hedges, L.V., & Valentine, J.C. (Eds.). (2019). The handbook of research synthesis and meta-analysis. Russell Sage Foundation.

Examples

```
es_from_cohen_d_adj(cohen_d_adj = 1, n_cov_ancova = 4, cov_outcome_r = .30, n_exp = 20, n_nexp = 20)
```

es_from_etasq — *Convert an eta-squared value to various effect size measures*

Description

Convert an eta-squared value to various effect size measures

Usage

```
es_from_etasq(etasq, n_exp, n_nexp, smd_to_cor = "viechtbauer", reverse_etasq)
```

Arguments

`etasq`	an eta-squared value (binary predictor, ANOVA model))
`n_exp`	number of participants in the experimental/exposed group.
`n_nexp`	number of participants in the non-experimental/non-exposed group.
`smd_to_cor`	formula used to convert the `cohen_d` value into a coefficient correlation.
`reverse_etasq`	a logical value indicating whether the direction of generated effect sizes should be flipped.

Details

This function first computes a Cohen's d (D) and Hedges' g (G) from the eta squared of a binary predictor (ANOVA model). Odds ratio (OR) and correlation coefficients (R/Z) are then converted from the Cohen's d.

To estimate a Cohen's d the following formula is used (Cohen, 1988):

$$d = 2 * \sqrt{\frac{etasq}{1 - etasq}}$$

To estimate other effect size measures, calculations of the `es_from_cohen_d()` are applied.

Value

This function estimates and converts between several effect size measures.

`natural effect size measure`	D + G
`converted effect size measure`	OR + R + Z
`required input data`	See 'Section 11. ANOVA statistics, Student's t-test, or point-bis correlation' https://metaconvert.org/input.html

References

Cohen, J. (1988). Statistical power analysis for the behavioral sciences. Routledge.

Examples

```
es_from_etasq(etasq = 0.28, n_exp = 20, n_nexp = 22)
```

---

es_from_etasq_adj *Convert an adjusted eta-squared value (i.e., from an ANCOVA) to various effect size measures*

Description

Convert an adjusted eta-squared value (i.e., from an ANCOVA) to various effect size measures

Usage

```
es_from_etasq_adj(
  etasq_adj,
  n_exp,
  n_nexp,
  n_cov_ancova,
  cov_outcome_r,
  smd_to_cor = "viechtbauer",
  reverse_etasq
)
```

Arguments

etasq_adj	an adjusted eta-squared value (i.e., obtained from an ANCOVA model)
n_exp	number of participants in the experimental/exposed group.
n_nexp	number of participants in the non-experimental/non-exposed group.
n_cov_ancova	number of covariates in the ANCOVA model.
cov_outcome_r	correlation between the outcome and covariate (multiple correlation when multiple covariates are included in the ANCOVA model).
smd_to_cor	formula used to convert the cohen_d value into a coefficient correlation (see details).
reverse_etasq	a logical value indicating whether the direction of generated effect sizes should be flipped.

Details

This function first computes an adjusted Cohen's d (D) and Hedges' g (G) from the adjusted eta squared of a binary predictor (ANCOVA model). Odds ratio (OR) and correlation coefficients (R/Z) are then converted from the Cohen's d.

To estimate a Cohen's d the following formula is used (Cohen, 1988):

$$d\_adj = 2 * \sqrt{\frac{etasq\_adj}{1 - etasq\_adj}}$$

To estimate other effect size measures, calculations of the `es_from_cohen_d_adj()` are applied.

Value

This function estimates and converts between several effect size measures.

`natural effect size measure`	D + G
`converted effect size measure`	OR + R + Z
`required input data`	See 'Section 18. Adjusted: ANCOVA statistics, eta-squared' https://metaconvert.org/input.html

References

Cohen, J. (1988). Statistical power analysis for the behavioral sciences. Routledge.

Examples

```
es_from_etasq_adj(etasq = 0.28, n_cov_ancova = 3, cov_outcome_r = 0.2, n_exp = 20, n_nexp = 22)
```

`es_from_fisher_z` *Convert a Fisher's z (r-to-z transformation) to several effect size measures*

Description

Convert a Fisher's z (r-to-z transformation) to several effect size measures

Usage

```
es_from_fisher_z(
  fisher_z,
  n_sample,
  unit_type = "raw_scale",
  n_exp,
  n_nexp,
  cor_to_smd = "viechtbauer",
  sd_iv,
  unit_increase_iv,
  reverse_fisher_z
)
```

Arguments

`fisher_z`	a Fisher's r-to-z transformed correlation coefficient
`n_sample`	the total number of participants
`unit_type`	the type of unit for the `unit_increase_iv` argument. Must be either "sd" or "value"
`n_exp`	number of the experimental/exposed group
`n_nexp`	number of the non-experimental/non-exposed group
`cor_to_smd`	formula used to convert a `pearson_r` or `fisher_z` value into a SMD.
`sd_iv`	the standard deviation of the independent variable
`unit_increase_iv`	a value of the independent variable that will be used to estimate the Cohen's d (see details).
`reverse_fisher_z`	a logical value indicating whether the direction of the generated effect sizes should be flipped.

Details

This function converts estimates the standard error of the Fisher's z and performs the z-to-r Fisher's transformation.

Last, it converts this r value into a Cohen's d and OR (see details in `es_from_pearson_r()`).

Value

This function estimates and converts between several effect size measures.

natural effect size measure	R + Z
converted effect size measure	D + G + OR
required input data	See 'Section 4. Pearson's r or Fisher's z' https://metaconvert.org/input.html

References

Cooper, H., Hedges, L.V., & Valentine, J.C. (Eds.). (2019). The handbook of research synthesis and meta-analysis. Russell Sage Foundation.

Mathur, M. B., & VanderWeele, T. J. (2020). A Simple, Interpretable Conversion from Pearson's Correlation to Cohen's for d Continuous Exposures. Epidemiology (Cambridge, Mass.), 31(2), e16–e18. https://doi.org/10.1097/EDE.0000000000001105

Viechtbauer W (2010). "Conducting meta-analyses in R with the metafor package." Journal of Statistical Software, 36(3), 1–48. doi:10.18637/jss.v036.i03.

Examples

```
es_from_fisher_z(
  fisher_z = .21, n_sample = 44,
)
```

---

es_from_hedges_g   *Convert a Hedges' g value to other effect size measures (G, OR, COR)*

Description

Convert a Hedges' g value to other effect size measures (G, OR, COR)

Usage

```
es_from_hedges_g(
  hedges_g,
  n_exp,
  n_nexp,
  smd_to_cor = "viechtbauer",
  reverse_g
)
```

Arguments

hedges_g	Hedges' g value
n_exp	number of participants in the experimental/exposed group.
n_nexp	number of participants in the non-experimental/non-exposed group.
smd_to_cor	formula used to convert the hedges_g value into a coefficient correlation (see details).
reverse_g	a logical value indicating whether the direction of the hedges_g value should be flipped.

Details

This function estimates the standard error of the Hedges' g and the Cohen's d (D). Odds ratio (OR) and correlation coefficients (R/Z) are then converted from the Cohen's d.

To estimate standard error of Hedges'g, the following formula is used (Hedges, 1981):

$$df = n\_exp + n\_nexp - 2$$

$$hedges\_g\_se = \sqrt{cohen\_d\_se^2 * J^2}$$

$$hedges\_g\_ci\_lo = hedges\_g - hedges\_g\_se * qt(.975, df = n\_exp + n\_nexp - 2)$$

$$hedges\_g\_ci\_up = hedges\_g + hedges\_g\_se * qt(.975, df = n\_exp + n\_nexp - 2)$$

To estimate the Cohen's d value, the following formula is used (Hedges, 1981):

$$J = exp(\log_{gamma}(\frac{df}{2}) - 0.5 * \log(\frac{df}{2}) - \log_{gamma}(\frac{df - 1}{2}))$$

$$cohen\_d = \frac{hedges\_g}{J}$$

$$cohen\_d\_se = \sqrt{(\frac{n\_exp + n\_nexp}{n\_exp * n\_nexp} + \frac{cohen\_d^2}{2 * (n\_exp + n\_nexp)})}$$

To estimate other effect size measures, calculations of the `es_from_cohen_d()` are applied.

Value

This function estimates and converts between several effect size measures.

`natural effect size measure`	D + G
`converted effect size measure`	OR + R + Z
`required input data`	See 'Section 1. Cohen's d or Hedges' g' https://metaconvert.org/input.html

References

Hedges LV (1981): Distribution theory for Glass's estimator of effect size and related estimators. Journal of Educational and Behavioral Statistics, 6, 107–28

Examples

```
es_from_hedges_g(hedges_g = 0.243, n_exp = 20, n_nexp = 20)
```

`es_from_md_ci` *Convert a mean difference between two independent groups and 95% CI into several effect size measures*

Description

Convert a mean difference between two independent groups and 95% CI into several effect size measures

Usage

```
es_from_md_ci(
  md,
  md_ci_lo,
  md_ci_up,
  n_exp,
  n_nexp,
  smd_to_cor = "viechtbauer",
  max_asymmetry = 10,
  reverse_md
)
```

Arguments

`md`	mean difference between two independent groups
`md_ci_lo`	lower bound of the 95% CI of the mean difference
`md_ci_up`	upper bound of the 95% CI of the mean difference
`n_exp`	number of participants in the experimental/exposed group.
`n_nexp`	number of participants in the non-experimental/non-exposed group.
`smd_to_cor`	formula used to convert the `cohen_d` value into a coefficient correlation (see details).
`max_asymmetry`	A percentage indicating the tolerance before detecting asymmetry in the 95% CI bounds.
`reverse_md`	a logical value indicating whether the direction of generated effect sizes should be flipped.

Details

This function converts 95% CI of a mean difference into a standard error (Cochrane Handbook section 6.5.2.3):

$$md\_se = \frac{md\_ci\_up - md\_ci\_lo}{2 * qt(0.975, df = n\_exp + n\_nexp - 2)}$$

Calculations of the `es_from_md_se()` function are then used to estimate the Cohen's d and other effect size measures.

Value

This function estimates and converts between several effect size measures.

`natural effect size measure`	MD + D + G
`converted effect size measure`	OR + R + Z
`required input data`	See 'Section 10. Mean difference and dispersion (crude)' https://metaconvert.org/input.html

References

Higgins JPT, Li T, Deeks JJ (editors). Chapter 6: Choosing effect size measures and computing estimates of effect. In: Higgins JPT, Thomas J, Chandler J, Cumpston M, Li T, Page MJ, Welch VA (editors). Cochrane Handbook for Systematic Reviews of Interventions version 6.3 (updated February 2022). Cochrane, 2022. Available from www.training.cochrane.org/handbook.

Examples

```
es_from_md_ci(md = 4, md_ci_lo = 2, md_ci_up = 6, n_exp = 20, n_nexp = 22)
```

`es_from_md_pval` *Convert a mean difference between two independent groups and its p-value into several effect size measures*

Description

Convert a mean difference between two independent groups and its p-value into several effect size measures

Usage

```
es_from_md_pval(
  md,
  md_pval,
  n_exp,
  n_nexp,
  smd_to_cor = "viechtbauer",
  reverse_md
)
```

Arguments

md	mean difference between two independent groups
md_pval	p-value of the mean difference
n_exp	number of participants in the experimental/exposed group.
n_nexp	number of participants in the non-experimental/non-exposed group.
smd_to_cor	formula used to convert the cohen_d value into a coefficient correlation (see details).
reverse_md	a logical value indicating whether the direction of generated effect sizes should be flipped.

Details

This function converts the p-value of a mean difference into a standard error (Cochrane Handbook section 6.5.2.3):

$$t = qt(\frac{md\_pval}{2}, df = n\_exp + n\_nexp - 2)$$

$$md\_se = |\frac{md}{t}|$$

Calculations of the es_from_md_se function are then used to estimate the Cohen's d and other effect size measures.

Value

This function estimates and converts between several effect size measures.

natural effect size measure	MD + D + G
converted effect size measure	OR + R + Z
required input data	See 'Section 10. Mean difference and dispersion (crude)' https://metaconvert.org/input.html

References

Higgins JPT, Thomas J, Chandler J, Cumpston M, Li T, Page MJ, Welch VA (editors). Cochrane Handbook for Systematic Reviews of Interventions version 6.3 (updated February 2022). Cochrane, 2022. Available from www.training.cochrane.org/handbook.

Examples

```
es_from_md_pval(md = 4, md_pval = 0.024, n_exp = 20, n_nexp = 22)
```

es_from_md_sd — *Convert a mean difference between two independent groups and standard deviation into several effect size measures*

Description

Convert a mean difference between two independent groups and standard deviation into several effect size measures

Usage

```
es_from_md_sd(md, md_sd, n_exp, n_nexp, smd_to_cor = "viechtbauer", reverse_md)
```

Arguments

md	mean difference between two independent groups
md_sd	standard deviation of the mean difference
n_exp	number of participants in the experimental/exposed group.
n_nexp	number of participants in the non-experimental/non-exposed group.
smd_to_cor	formula used to convert the cohen_d value into a coefficient correlation (see details).
reverse_md	a logical value indicating whether the direction of generated effect sizes should be flipped.

Details

This function converts the mean difference and 95% CI into a Cohen's d (D) and Hedges' g (G). Odds ratio (OR) and correlation coefficients (R/Z) are then converted from the Cohen's d.

The formula used to obtain the Cohen's d is:

$$d = \frac{md}{md\_sd}$$

Note that this formula is perfectly accurate only if the md_sd has been estimated by assuming that the variance of the two groups is equal.

To estimate other effect size measures, calculations of the es_from_cohen_d() are applied.

Value

This function estimates and converts between several effect size measures.

natural effect size measure	MD + D + G
converted effect size measure	OR + R + Z
required input data	See 'Section 10. Mean difference and dispersion (crude)'

https://metaconvert.org/input.html

Examples

```
es_from_md_sd(md = 4, md_sd = 2, n_exp = 20, n_nexp = 22)
```

---

es_from_md_se — *Convert a mean difference between two independent groups and its standard error into several effect size measures*

Description

Convert a mean difference between two independent groups and its standard error into several effect size measures

Usage

```
es_from_md_se(md, md_se, n_exp, n_nexp, smd_to_cor = "viechtbauer", reverse_md)
```

Arguments

`md`	mean difference between two independent groups
`md_se`	standard error of the mean difference
`n_exp`	number of participants in the experimental/exposed group.
`n_nexp`	number of participants in the non-experimental/non-exposed group.
`smd_to_cor`	formula used to convert the `cohen_d` value into a coefficient correlation (see details).
`reverse_md`	a logical value indicating whether the direction of generated effect sizes should be flipped.

Details

This function the standard error of a mean difference into a standard deviation:

$$inv\_n = \frac{1}{n\_exp} + \frac{1}{n\_nexp}$$

$$md\_sd = \frac{md\_se}{\sqrt{inv\_n}}$$

Calculations of the `es_from_md_sd` function are then used to estimate the Cohen's d and other effect size measures.

Value

This function estimates and converts between several effect size measures.

`natural effect size measure`	MD + D + G
`converted effect size measure`	OR + R + Z
`required input data`	See 'Section 10. Mean difference and dispersion (crude)' https://metaconvert.org/input.html

References

Higgins JPT, Li T, Deeks JJ (editors). Chapter 6: Choosing effect size measures and computing estimates of effect. In: Higgins JPT, Thomas J, Chandler J, Cumpston M, Li T, Page MJ, Welch VA (editors). Cochrane Handbook for Systematic Reviews of Interventions version 6.3 (updated February 2022). Cochrane, 2022. Available from www.training.cochrane.org/handbook.

Examples

```
es_from_md_se(md = 4, md_se = 2, n_exp = 20, n_nexp = 22)
```

`es_from_means_ci` *Convert means and 95% CI of two independent groups several effect size measures*

Description

Convert means and 95% CI of two independent groups several effect size measures

Usage

```
es_from_means_ci(
  mean_exp,
  mean_ci_lo_exp,
  mean_ci_up_exp,
  mean_nexp,
  mean_ci_lo_nexp,
  mean_ci_up_nexp,
  n_exp,
  n_nexp,
  smd_to_cor = "viechtbauer",
  max_asymmetry = 10,
  reverse_means
)
```

Arguments

`mean_exp`	mean of participants in the experimental/exposed group.
`mean_ci_lo_exp`	lower bound of the 95% CI of the mean of the experimental/exposed group
`mean_ci_up_exp`	upper bound of the 95% CI of the mean of the experimental/exposed group
`mean_nexp`	mean of participants in the non-experimental/non-exposed group.
`mean_ci_lo_nexp`	lower bound of the 95% CI of the mean of the non-experimental/non-exposed group.
`mean_ci_up_nexp`	upper bound of the 95% CI of the mean of the non-experimental/non-exposed group.
`n_exp`	number of participants in the experimental/exposed group.
`n_nexp`	number of participants in the non-experimental/non-exposed group.
`smd_to_cor`	formula used to convert the `cohen_d` value into a coefficient correlation (see details).
`max_asymmetry`	A percentage indicating the tolerance before detecting asymmetry in the 95% CI bounds.
`reverse_means`	a logical value indicating whether the direction of the generated effect sizes should be flipped.

Details

This function converts the 95% CI of two independent groups into a standard error, and then relies on the calculations of the `es_from_means_se()` function.

To convert the 95% CIs into standard errors, the following formula is used (table 12.3 in Cooper):

$$mean\_se\_exp = \frac{mean\_ci\_up\_exp - mean\_ci\_lo\_exp}{2 * qt(0.975, df = n\_exp - 1)}$$

$$mean\_se\_nexp = \frac{mean\_ci\_up\_nexp - mean\_ci\_lo\_nexp}{2 * qt(0.975, df = n\_nexp - 1)}$$

Calculations of the `es_from_means_se()` are then applied.

Value

This function estimates and converts between several effect size measures.

`natural effect size measure`	MD + D + G
`converted effect size measure`	OR + R + Z
`required input data`	See 'Section 9. Means and dispersion (crude)' https://metaconvert.org/input.html

References

Higgins JPT, Li T, Deeks JJ (editors). Chapter 6: Choosing effect size measures and computing estimates of effect. In: Higgins JPT, Thomas J, Chandler J, Cumpston M, Li T, Page MJ, Welch VA (editors). Cochrane Handbook for Systematic Reviews of Interventions version 6.3 (updated February 2022). Cochrane, 2022. Available from www.training.cochrane.org/handbook.

Examples

```
es_from_means_ci(
  n_exp = 55, n_nexp = 55,
  mean_exp = 25, mean_ci_lo_exp = 15, mean_ci_up_exp = 35,
  mean_nexp = 18, mean_ci_lo_nexp = 12, mean_ci_up_nexp = 24
)
```

`es_from_means_ci_pre_post` *Convert pre-post means of two independent groups into various effect size measures*

Description

Convert pre-post means of two independent groups into various effect size measures

Usage

```
es_from_means_ci_pre_post(
  mean_pre_exp,
  mean_exp,
  mean_pre_ci_lo_exp,
  mean_pre_ci_up_exp,
  mean_ci_lo_exp,
  mean_ci_up_exp,
  mean_pre_nexp,
  mean_nexp,
  mean_pre_ci_lo_nexp,
  mean_pre_ci_up_nexp,
  mean_ci_lo_nexp,
  mean_ci_up_nexp,
  n_exp,
  n_nexp,
  r_pre_post_exp,
  r_pre_post_nexp,
  smd_to_cor = "viechtbauer",
  pre_post_to_smd = "bonett",
  max_asymmetry = 10,
  reverse_means_pre_post
)
```

Arguments

mean_pre_exp
: mean of the experimental/exposed group at baseline

mean_exp
: mean of the experimental/exposed group at follow up

mean_pre_ci_lo_exp
: lower bound of the 95% CI of the mean of the experimental/exposed group at baseline

mean_pre_ci_up_exp
: upper bound of the 95% CI of the mean of the experimental/exposed group at baseline

mean_ci_lo_exp
: lower bound of the 95% CI of the mean of the experimental/exposed group at follow up

mean_ci_up_exp
: upper bound of the 95% CI of the mean of the experimental/exposed group at follow up

mean_pre_nexp
: mean of the non-experimental/non-exposed group at baseline

mean_nexp
: mean of the non-experimental/non-exposed group at follow up

mean_pre_ci_lo_nexp
: lower bound of the 95% CI of the mean of the non-experimental/non-exposed group at baseline

mean_pre_ci_up_nexp
: upper bound of the 95% CI of the mean of the non-experimental/non-exposed group at baseline

mean_ci_lo_nexp
: lower bound of the 95% CI of the mean of the non-experimental/non-exposed group at follow up

mean_ci_up_nexp
: upper bound of the 95% CI of the mean of the non-experimental/non-exposed group at follow up

n_exp
: number of the experimental/exposed group

n_nexp
: number of the non-experimental/non-exposed group

r_pre_post_exp
: pre-post correlation in the experimental/exposed group

r_pre_post_nexp
: pre-post correlation in the non-experimental/non-exposed group

smd_to_cor
: formula used to convert the `cohen_d` value into a coefficient correlation (see details).

pre_post_to_smd
: formula used to convert the pre and post means/SD into a SMD (see details).

max_asymmetry
: A percentage indicating the tolerance before detecting asymmetry in the 95% CI bounds.

reverse_means_pre_post
: a logical value indicating whether the direction of generated effect sizes should be flipped.

Details

This function converts the bounds of the 95% CI of the pre/post means of two independent groups into standard errors (Section 6.3.1 in the Cochrane Handbook).

$$mean\_pre\_se\_exp = \frac{mean\_pre\_ci\_up\_exp - mean\_pre\_ci\_lo\_exp}{2 * qt(0.975, df = n\_exp - 1)}$$

$$mean\_pre\_se\_nexp = \frac{mean\_pre\_ci\_up\_nexp - mean\_pre\_ci\_lo\_nexp}{2 * qt(0.975, df = n\_nexp - 1)}$$

$$mean\_se\_exp = \frac{mean\_ci\_up\_exp - mean\_ci\_lo\_exp}{2 * qt(0.975, df = n\_exp - 1)}$$

$$mean\_se\_nexp = \frac{mean\_ci\_up\_nexp - mean\_ci\_lo\_nexp}{2 * qt(0.975, df = n\_nexp - 1)}$$

Then, calculations of the `es_from_means_se_pre_post` are applied.

Value

This function estimates and converts between several effect size measures.

`natural effect size measure`	MD + D + G
`converted effect size measure`	OR + R + Z
`required input data`	See 'Section 15. Paired: pre-post means and dispersion' https://metaconvert.org/input.html

References

Higgins JPT, Li T, Deeks JJ (editors). Chapter 6: Choosing effect size measures and computing estimates of effect. In: Higgins JPT, Thomas J, Chandler J, Cumpston M, Li T, Page MJ, Welch VA (editors). Cochrane Handbook for Systematic Reviews of Interventions version 6.3 (updated February 2022). Cochrane, 2022. Available from www.training.cochrane.org/handbook.

Examples

```
es_from_means_ci_pre_post(
  n_exp = 36, n_nexp = 35,
  mean_pre_exp = 98,
  mean_pre_ci_lo_exp = 88,
  mean_pre_ci_up_exp = 108,
  mean_exp = 102,
  mean_ci_lo_exp = 92,
  mean_ci_up_exp = 112,
  mean_pre_nexp = 96,
  mean_pre_ci_lo_nexp = 86,
  mean_pre_ci_up_nexp = 106,
```

```
    mean_nexp = 102,
    mean_ci_lo_nexp = 92,
    mean_ci_up_nexp = 112,
    r_pre_post_exp = 0.8, r_pre_post_nexp = 0.8
  )
```

`es_from_means_sd` *Convert means and standard deviations of two independent groups into several effect size measures*

Description

Convert means and standard deviations of two independent groups into several effect size measures

Usage

```
es_from_means_sd(
  mean_exp,
  mean_sd_exp,
  mean_nexp,
  mean_sd_nexp,
  n_exp,
  n_nexp,
  smd_to_cor = "viechtbauer",
  reverse_means
)
```

Arguments

`mean_exp`	mean of participants in the experimental/exposed group.
`mean_sd_exp`	standard deviation of participants in the experimental/exposed group.
`mean_nexp`	mean of participants in the non-experimental/non-exposed group.
`mean_sd_nexp`	standard deviation of participants in the non-experimental/non-exposed group.
`n_exp`	number of participants in the experimental/exposed group.
`n_nexp`	number of participants in the non-experimental/non-exposed group.
`smd_to_cor`	formula used to convert the generated `cohen_d` value into a coefficient correlation (see details).
`reverse_means`	a logical value indicating whether the direction of the generated effect sizes should be flipped.

Details

This function first computes a Cohen's d (D), Hedges' g (G) and mean difference (MD) from the means and standard deviations of two independent groups. Odds ratio (OR) and correlation coefficients (R/Z) are then converted from the Cohen's d.

To estimate a mean difference (formulas 12.1-12.6 in Cooper):

$$md = mean\_exp - mean\_nexp$$

$$md\_se = \sqrt{\frac{mean\_sd\_exp^2}{n\_exp} + \frac{mean\_sd\_nexp^2}{n\_nexp}}$$

$$md\_ci\_lo = md - md\_se * qt(.975, df = n\_exp + n\_nexp - 2)$$

$$md\_ci\_up = md + md\_se * qt(.975, df = n\_exp + n\_nexp - 2)$$

To estimate a Cohen's d the following formulas are used (formulas 12.10-12.18 in Cooper):

$$mean\_sd\_pooled = \sqrt{\frac{(n\_exp - 1) * sd\_exp^2 + (n\_nexp - 1) * sd\_nexp^2}{n\_exp + n\_nexp - 2}}$$

$$cohen\_d = \frac{mean\_exp - mean\_nexp}{mean\_sd\_pooled}$$

$$cohen\_d\_se = \frac{(n\_exp + n\_nexp)}{n\_exp * n\_nexp} + \frac{cohen\_d^2}{2(n\_exp + n\_nexp)}$$

$$cohen\_d\_ci\_lo = cohen\_d - cohen\_d\_se * qt(.975, df = n\_exp + n\_nexp - 2)$$

$$cohen\_d\_ci\_up = cohen\_d + cohen\_d\_se * qt(.975, df = n\_exp + n\_nexp - 2)$$

To estimate other effect size measures, calculations of the `es_from_cohen_d()` are applied.

Value

This function estimates and converts between several effect size measures.

`natural effect size measure`	MD + D + G
`converted effect size measure`	OR + R + Z
`required input data`	See 'Section 9. Means and dispersion (crude)' https://metaconvert.org/input.html

References

Cooper, H., Hedges, L.V., & Valentine, J.C. (Eds.). (2019). The handbook of research synthesis and meta-analysis. Russell Sage Foundation.

Examples

```
es_from_means_sd(
  n_exp = 55, n_nexp = 55,
  mean_exp = 2.3, mean_sd_exp = 1.2,
  mean_nexp = 1.9, mean_sd_nexp = 0.9
)
```

---

es_from_means_sd_pooled

Convert means of two groups and the pooled standard deviation into several effect size measures

---

Description

Convert means of two groups and the pooled standard deviation into several effect size measures

Usage

```
es_from_means_sd_pooled(
  mean_exp,
  mean_nexp,
  mean_sd_pooled,
  n_exp,
  n_nexp,
  smd_to_cor = "viechtbauer",
  reverse_means
)
```

Arguments

mean_exp	mean of participants in the experimental/exposed group.
mean_nexp	mean of participants in the non-experimental/non-exposed group.
mean_sd_pooled	pooled standard deviation across both groups.
n_exp	number of participants in the experimental/exposed group.
n_nexp	number of participants in the non-experimental/non-exposed group.
smd_to_cor	formula used to convert the cohen_d value into a coefficient correlation (see details).
reverse_means	a logical value indicating whether the direction of the generated effect sizes should be flipped.

Details

This function first computes a Cohen's d (D), Hedges' g (G) and mean difference (MD) from the means of two independent groups and the pooled standard deviation across the groups. Odds ratio (OR) and correlation coefficients (R/Z) are then converted from the Cohen's d.

To estimate a mean difference (formulas 12.1-12.6 in Cooper):

$$md = mean\_exp - mean\_nexp$$

$$md\_se = \sqrt{\frac{n_exp + n_nexp}{n_exp * n_nexp} * mean_sd_pooled^2}$$

$$md\_ci\_lo = md - md\_se * qt(.975, df = n\_exp + n\_nexp - 2)$$

$$md\_ci\_up = md + md\_se * qt(.975, df = n\_exp + n\_nexp - 2)$$

To estimate a Cohen's d the following formulas are used (formulas 12.10-12.18 in Cooper):

$$cohen\_d = \frac{mean\_exp - mean\_nexp}{means\_sd\_pooled}$$

$$cohen\_d\_se = \frac{(n\_exp + n\_nexp)}{n\_exp * n\_nexp} + \frac{cohen\_d^2}{2(n\_exp + n\_nexp)}$$

$$cohen\_d\_ci\_lo = cohen\_d - cohen\_d\_se * qt(.975, df = n\_exp + n\_nexp - 2)$$

$$cohen\_d\_ci\_up = cohen\_d + cohen\_d\_se * qt(.975, df = n\_exp + n\_nexp - 2)$$

To estimate other effect size measures, calculations of the `es_from_cohen_d()` are applied.

Value

This function estimates and converts between several effect size measures.

`natural effect size measure`	MD + D + G
`converted effect size measure`	OR + R + Z
`required input data`	See 'Section 9. Means and dispersion (crude)' https://metaconvert.org/input.html

References

Cooper, H., Hedges, L.V., & Valentine, J.C. (Eds.). (2019). The handbook of research synthesis and meta-analysis. Russell Sage Foundation.

Examples

```
es_from_means_sd_pooled(
  n_exp = 55, n_nexp = 55,
  mean_exp = 2.3, mean_nexp = 1.9,
  mean_sd_pooled = 0.9
)
```

es_from_means_sd_pre_post

Convert pre-post means of two independent groups into various effect size measures

Description

Convert pre-post means of two independent groups into various effect size measures

Usage

```
es_from_means_sd_pre_post(
  mean_pre_exp,
  mean_exp,
  mean_pre_sd_exp,
  mean_sd_exp,
  mean_pre_nexp,
  mean_nexp,
  mean_pre_sd_nexp,
  mean_sd_nexp,
  n_exp,
  n_nexp,
  r_pre_post_exp,
  r_pre_post_nexp,
  smd_to_cor = "viechtbauer",
  pre_post_to_smd = "bonett",
  reverse_means_pre_post
)
```

Arguments

`mean_pre_exp`	mean of the experimental/exposed group at baseline
`mean_exp`	mean of the experimental/exposed group at follow up
`mean_pre_sd_exp`	standard deviation of the experimental/exposed group at baseline
`mean_sd_exp`	standard deviation of the experimental/exposed group at follow up
`mean_pre_nexp`	mean of the non-experimental/non-exposed group at baseline
`mean_nexp`	mean of the non-experimental/non-exposed group at follow up
`mean_pre_sd_nexp`	standard deviation of the non-experimental/non-exposed group at baseline
`mean_sd_nexp`	standard deviation of the non-experimental/non-exposed group at follow up
`n_exp`	number of the experimental/exposed group
`n_nexp`	number of the non-experimental/non-exposed group
`r_pre_post_exp`	pre-post correlation in the experimental/exposed group

r_pre_post_nexp
pre-post correlation in the non-experimental/non-exposed group

smd_to_cor
formula used to convert the cohen_d value into a coefficient correlation (see details).

pre_post_to_smd
formula used to convert the pre and post means/SD into a SMD (see details).

reverse_means_pre_post
a logical value indicating whether the direction of generated effect sizes should be flipped.

Details

This function converts pre-post means of two independent groups into a Cohen's d (D) and Hedges' g (G). Odds ratio (OR) and correlation coefficients (R/Z) are then converted from the Cohen's d.

Two approaches can be used to compute the Cohen's d.

In these two approaches, the standard deviation of the difference within each group first needs to be obtained:

$$adj\_exp = 2 * r\_pre\_post\_exp * mean\_pre\_sd\_exp * mean\_sd\_exp$$

$$sd\_change\_exp = \sqrt{mean\_pre\_sd\_exp^2 + mean\_sd\_exp^2 - adj\_exp}$$

$$adj\_nexp = 2 * r\_pre\_post\_nexp * mean\_pre\_sd\_nexp * mean\_sd\_nexp$$

$$sd\_change\_nexp = \sqrt{mean\_pre\_sd\_nexp^2 + mean\_sd\_nexp^2 - adj\_nexp}$$

1. In the approach described by Bonett (pre_post_to_smd = "bonett"), one Cohen's d per group is obtained by standardizing the pre-post mean difference by the standard deviation at baseline (Bonett, 2008):

$$cohen\_d\_exp = \frac{mean\_pre\_exp - mean\_exp}{mean\_pre\_sd\_exp}$$

$$cohen\_d\_nexp = \frac{mean\_pre\_nexp - mean\_nexp}{mean\_pre\_sd\_nexp}$$

$$cohen\_d\_se\_exp = \sqrt{\frac{sd\_change\_exp^2}{mean\_pre\_sd\_exp^2 * (n\_exp - 1) + g\_exp^2/(2 * (n\_exp - 1))}}$$

$$cohen\_d\_se\_nexp = \sqrt{\frac{sd\_change\_nexp^2}{mean\_pre\_sd\_nexp^2 * (n\_nexp - 1) + g\_nexp^2/(2 * (n\_nexp - 1))}}$$

2. In the approach described by Cooper (pre_post_to_smd = "cooper"), the following formulas are used:

$$cohen\_d\_exp = \frac{mean\_pre\_exp - mean\_exp}{sd\_change\_exp} * \sqrt{2 * (1 - r\_pre\_post\_exp)}$$

$$cohen\_d\_nexp = \frac{mean\_pre\_nexp - mean\_nexp}{sd\_change\_nexp} * \sqrt{2 * (1 - r\_pre\_post\_nexp)}$$

$$cohen\_d\_se\_exp = \frac{2 * (1 - r\_pre\_post\_exp)}{n\_exp} + \frac{cohen\_d\_exp^2}{2 * n\_exp}$$

$$cohen\_d\_se\_nexp = \frac{2 * (1 - r\_pre\_post\_nexp)}{n\_nexp} + \frac{cohen\_d\_nexp^2}{2 * n\_nexp}$$

Last, the Cohen's d reflecting the within-group change from baseline to follow-up are combined into one Cohen's d:

$$cohen\_d = d\_exp - d\_nexp$$

$$cohen\_d\_se = \sqrt{cohen\_d\_se\_exp^2 + cohen\_d\_se\_nexp^2}$$

To estimate other effect size measures, calculations of the `es_from_cohen_d()` are applied.

Value

This function estimates and converts between several effect size measures.

`natural effect size measure`	MD + D + G
`converted effect size measure`	OR + R + Z
`required input data`	See 'Section 15. Paired: pre-post means and dispersion' https://metaconvert.org/input.html

References

Bonett, S. B. (2008). Estimating effect sizes from pretest-posttest-control group designs. Organizational Research Methods, 11(2), 364–386. https://doi.org/10.1177/1094428106291059

Cooper, H., Hedges, L.V., & Valentine, J.C. (Eds.). (2019). The handbook of research synthesis and meta-analysis. Russell Sage Foundation.

Examples

```
es_from_means_sd_pre_post(
  n_exp = 36, n_nexp = 35,
  mean_pre_exp = 98, mean_exp = 102,
  mean_pre_sd_exp = 16, mean_sd_exp = 17,
  mean_pre_nexp = 96, mean_nexp = 102,
  mean_pre_sd_nexp = 14, mean_sd_nexp = 15,
  r_pre_post_exp = 0.8, r_pre_post_nexp = 0.8
)
```

`es_from_means_se` *Convert means and standard errors of two independent groups several effect size measures*

Description

Convert means and standard errors of two independent groups several effect size measures

Usage

```
es_from_means_se(
  mean_exp,
  mean_se_exp,
  mean_nexp,
  mean_se_nexp,
  n_exp,
  n_nexp,
  smd_to_cor = "viechtbauer",
  reverse_means
)
```

Arguments

`mean_exp`	mean of participants in the experimental/exposed group.
`mean_se_exp`	standard error of participants in the experimental/exposed group.
`mean_nexp`	mean of participants in the non-experimental/non-exposed group.
`mean_se_nexp`	standard error of participants in the non-experimental/non-exposed group.
`n_exp`	number of participants in the experimental/exposed group.
`n_nexp`	number of participants in the non-experimental/non-exposed group.
`smd_to_cor`	formula used to convert the `cohen_d` value into a coefficient correlation (see details).
`reverse_means`	a logical value indicating whether the direction of the generated effect sizes should be flipped.

Details

This function converts the standard errors of two independent groups into standard deviations, and then relies on the calculations of the `es_from_means_sd()` function.

To convert the standard errors into standard deviations, the following formula is used.

$$mean\_sd\_exp = mean\_se\_exp * \sqrt{n\_exp}$$

$$mean\_sd\_nexp = mean\_se\_nexp * \sqrt{n\_nexp}$$

Then, calculations of the `es_from_means_sd()` are applied.

To estimate other effect size measures, calculations of the `es_from_cohen_d()` are applied.

Value

This function estimates and converts between several effect size measures.

`natural effect size measure`	MD + D + G
`converted effect size measure`	OR + R + Z
`required input data`	See 'Section 9. Means and dispersion (crude)'

https://metaconvert.org/input.html

References

Higgins JPT, Li T, Deeks JJ (editors). Chapter 6: Choosing effect size measures and computing estimates of effect. In: Higgins JPT, Thomas J, Chandler J, Cumpston M, Li T, Page MJ, Welch VA (editors). Cochrane Handbook for Systematic Reviews of Interventions version 6.3 (updated February 2022). Cochrane, 2022. Available from www.training.cochrane.org/handbook.

Examples

```
es_from_means_se(
  mean_exp = 42, mean_se_exp = 11,
  mean_nexp = 42, mean_se_nexp = 15,
  n_exp = 43, n_nexp = 34
)
```

---

es_from_means_se_pre_post *Convert pre-post means of two independent groups into various effect size measures*

Description

Convert pre-post means of two independent groups into various effect size measures

Usage

```
es_from_means_se_pre_post(
  mean_pre_exp,
  mean_exp,
  mean_pre_se_exp,
  mean_se_exp,
  mean_pre_nexp,
  mean_nexp,
  mean_pre_se_nexp,
  mean_se_nexp,
  n_exp,
  n_nexp,
  r_pre_post_exp,
  r_pre_post_nexp,
  smd_to_cor = "viechtbauer",
  pre_post_to_smd = "bonett",
  reverse_means_pre_post
)
```

Arguments

mean_pre_exp — mean of the experimental/exposed group at baseline

mean_exp — mean of the experimental/exposed group at follow up

mean_pre_se_exp — standard error of the experimental/exposed group at baseline

mean_se_exp — standard error of the experimental/exposed group at follow up

mean_pre_nexp — mean of the non-experimental/non-exposed group at baseline

mean_nexp — mean of the non-experimental/non-exposed group at follow up

mean_pre_se_nexp — standard error of the non-experimental/non-exposed group at baseline

mean_se_nexp — standard error of the non-experimental/non-exposed group at follow up

n_exp — number of the experimental/exposed group

n_nexp — number of the non-experimental/non-exposed group

r_pre_post_exp — pre-post correlation in the experimental/exposed group

r_pre_post_nexp — pre-post correlation in the non-experimental/non-exposed group

smd_to_cor — formula used to convert the cohen_d value into a coefficient correlation (see details).

pre_post_to_smd — formula used to convert the pre and post means/SD into a SMD (see details).

reverse_means_pre_post — a logical value indicating whether the direction of generated effect sizes should be flipped.

Details

This function converts the pre/post standard errors of two independent groups into standard deviations (Section 6.5.2.2 in the Cochrane Handbook).

$$mean\_pre\_sd\_exp = mean\_pre\_se\_exp * \sqrt{n\_exp}$$

$$mean\_pre\_sd\_nexp = mean\_pre\_se\_nexp * \sqrt{n\_nexp}$$

$$mean\_sd\_exp = mean\_se\_exp * \sqrt{n\_exp}$$

$$mean\_sd\_nexp = mean\_se\_nexp * \sqrt{n\_nexp}$$

Then, calculations of the es_from_means_sd_pre_post() are applied.

Value

This function estimates and converts between several effect size measures.

natural effect size measure	MD + D + G
converted effect size measure	OR + R + Z

`required input data`	See 'Section 15. Paired: pre-post means and dispersion' https://metaconvert.org/input.html

References

Higgins JPT, Li T, Deeks JJ (editors). Chapter 6: Choosing effect size measures and computing estimates of effect. In: Higgins JPT, Thomas J, Chandler J, Cumpston M, Li T, Page MJ, Welch VA (editors). Cochrane Handbook for Systematic Reviews of Interventions version 6.3 (updated February 2022). Cochrane, 2022. Available from www.training.cochrane.org/handbook.

Examples

```
es_from_means_sd_pre_post(
  n_exp = 36, n_nexp = 35,
  mean_pre_exp = 98, mean_exp = 102,
  mean_pre_sd_exp = 16, mean_sd_exp = 17,
  mean_pre_nexp = 96, mean_nexp = 102,
  mean_pre_sd_nexp = 14, mean_sd_nexp = 15,
  r_pre_post_exp = 0.8, r_pre_post_nexp = 0.8
)
```

---

es_from_mean_change_ci

Convert mean changes and standard deviations of two independent groups into standard effect size measures

---

Description

Convert mean changes and standard deviations of two independent groups into standard effect size measures

Usage

```
es_from_mean_change_ci(
  mean_change_exp,
  mean_change_ci_lo_exp,
  mean_change_ci_up_exp,
  mean_change_nexp,
  mean_change_ci_lo_nexp,
  mean_change_ci_up_nexp,
  r_pre_post_exp,
  r_pre_post_nexp,
  n_exp,
  n_nexp,
  max_asymmetry = 10,
```

```
  smd_to_cor = "viechtbauer",
  reverse_mean_change
)
```

Arguments

`mean_change_exp`
: mean change of participants in the experimental/exposed group.

`mean_change_ci_lo_exp`
: lower bound of the 95% CI around the mean change of the experimental/exposed group.

`mean_change_ci_up_exp`
: upper bound of the 95% CI around the mean change of the experimental/exposed group.

`mean_change_nexp`
: mean change of participants in the non-experimental/non-exposed group.

`mean_change_ci_lo_nexp`
: lower bound of the 95% CI around the mean change of the non-experimental/non-exposed group.

`mean_change_ci_up_nexp`
: upper bound of the 95% CI around the mean change of the non-experimental/non-exposed group.

`r_pre_post_exp`
: pre-post correlation in the experimental/exposed group

`r_pre_post_nexp`
: pre-post correlation in the non-experimental/non-exposed group

`n_exp`
: number of participants in the experimental/exposed group.

`n_nexp`
: number of participants in the non-experimental/non-exposed group.

`max_asymmetry`
: A percentage indicating the tolerance before detecting asymmetry in the 95% CI bounds.

`smd_to_cor`
: formula used to convert the `cohen_d` value into a coefficient correlation (see details).

`reverse_mean_change`
: a logical value indicating whether the direction of generated effect sizes should be flipped.

Details

This function converts the mean change and 95% CI of two independent groups into a Cohen's d. The Cohen's d is then converted to other effect size measures.

This function simply internally calls the `es_from_means_ci_pre_post` function but setting:

$$mean\_pre\_exp = mean\_change\_exp$$

$$mean\_pre\_ci\_lo\_exp = mean\_change\_ci\_lo\_exp$$

$$mean\_pre\_ci\_up\_exp = mean\_change\_ci\_up\_exp$$

$$mean\_exp = 0$$
$$mean\_ci\_lo\_exp = 0$$
$$mean\_ci\_up\_exp = 0$$

$$mean\_pre\_nexp = mean\_change\_nexp$$
$$mean\_pre\_ci\_lo\_nexp = mean\_change\_ci\_lo\_nexp$$
$$mean\_pre\_ci\_up\_nexp = mean\_change\_ci\_up\_nexp$$

$$mean\_nexp = 0$$
$$mean\_ci\_lo\_nexp = 0$$
$$mean\_ci\_up\_nexp = 0$$

To know more about the calculations, see `es_from_means_sd_pre_post` function.

Value

This function estimates and converts between several effect size measures.

`natural effect size measure`	MD + D + G
`converted effect size measure`	OR + R + Z
`required input data`	See 'Section 14. Paired: mean change, and dispersion' https://metaconvert.org/input.html

References

Bonett, S. B. (2008). Estimating effect sizes from pretest-posttest-control group designs. Organizational Research Methods, 11(2), 364–386. https://doi.org/10.1177/1094428106291059

Cooper, H., Hedges, L.V., & Valentine, J.C. (Eds.). (2019). The handbook of research synthesis and meta-analysis. Russell Sage Foundation.

Examples

```
es_from_mean_change_ci(
  n_exp = 36, n_nexp = 35,
  mean_change_exp = 8.4,
  mean_change_ci_lo_exp = 6.4, mean_change_ci_up_exp = 10.4,
  mean_change_nexp = 2.43,
  mean_change_ci_lo_nexp = 1.43, mean_change_ci_up_nexp = 3.43,
  r_pre_post_exp = 0.2, r_pre_post_nexp = 0.2
)
```

es_from_mean_change_pval
Convert mean changes and standard deviations of two independent groups into standard effect size measures

Description

Convert mean changes and standard deviations of two independent groups into standard effect size measures

Usage

```
es_from_mean_change_pval(
  mean_change_exp,
  mean_change_pval_exp,
  mean_change_nexp,
  mean_change_pval_nexp,
  r_pre_post_exp,
  r_pre_post_nexp,
  n_exp,
  n_nexp,
  smd_to_cor = "viechtbauer",
  reverse_mean_change
)
```

Arguments

`mean_change_exp`
mean change of participants in the experimental/exposed group.

`mean_change_pval_exp`
p-value of the mean change for participants in the experimental/exposed group.

`mean_change_nexp`
mean change of participants in the non-experimental/non-exposed group.

`mean_change_pval_nexp`
p-value of the mean change for participants in the non-experimental/non-exposed group.

`r_pre_post_exp` pre-post correlation in the experimental/exposed group

`r_pre_post_nexp`
pre-post correlation in the non-experimental/non-exposed group

`n_exp` number of participants in the experimental/exposed group.

`n_nexp` number of participants in the non-experimental/non-exposed group.

`smd_to_cor` formula used to convert the `cohen_d` value into a coefficient correlation (see details).

`reverse_mean_change`
a logical value indicating whether the direction of generated effect sizes should be flipped.

Details

This function converts the mean change and associated p-values of two independent groups into a Cohen's d. The Cohen's d is then converted to other effect size measures.

To start, this function estimates the mean change standard errors from the p-values:

$$t\_exp < -qt(p = mean\_change\_pval\_exp/2, df = n\_exp - 1, lower.tail = FALSE)$$

$$t\_nexp < -qt(p = mean\_change\_pval\_nexp/2, df = n\_nexp - 1, lower.tail = FALSE)$$

$$mean\_change\_se\_exp < -|\frac{mean\_change\_exp}{t\_exp}|$$

$$mean\_change\_se\_nexp < -|\frac{mean\_change\_nexp}{t\_nexp}|$$

Then, this function simply internally calls the `es_from_means_se_pre_post` function but setting:

$$mean\_pre\_exp = mean\_change\_exp$$

$$mean\_pre\_se\_exp = mean\_change\_se\_exp$$

$$mean\_exp = 0$$

$$mean\_se\_exp = 0$$

$$mean\_pre\_nexp = mean\_change\_nexp$$

$$mean\_pre\_se\_nexp = mean\_change\_se\_nexp$$

$$mean\_nexp = 0$$

$$mean\_se\_nexp = 0$$

To know more about other calculations, see `es_from_means_sd_pre_post` function.

Value

This function estimates and converts between several effect size measures.

`natural effect size measure`	MD + D + G
`converted effect size measure`	OR + R + Z
`required input data`	See 'Section 14. Paired: mean change, and dispersion' https://metaconvert.org/input.html

References

Bonett, S. B. (2008). Estimating effect sizes from pretest-posttest-control group designs. Organizational Research Methods, 11(2), 364–386. https://doi.org/10.1177/1094428106291059

Cooper, H., Hedges, L.V., & Valentine, J.C. (Eds.). (2019). The handbook of research synthesis and meta-analysis. Russell Sage Foundation.

Examples

```
es_from_mean_change_pval(
  n_exp = 36, n_nexp = 35,
  mean_change_exp = 8.4, mean_change_pval_exp = 0.13,
  mean_change_nexp = 2.43, mean_change_pval_nexp = 0.61,
  r_pre_post_exp = 0.8, r_pre_post_nexp = 0.8
)
```

---

es_from_mean_change_sd

Convert mean changes and standard deviations of two independent groups into standard effect size measures

---

Description

Convert mean changes and standard deviations of two independent groups into standard effect size measures

Usage

```
es_from_mean_change_sd(
  mean_change_exp,
  mean_change_sd_exp,
  mean_change_nexp,
  mean_change_sd_nexp,
  r_pre_post_exp,
  r_pre_post_nexp,
  n_exp,
  n_nexp,
  smd_to_cor = "viechtbauer",
  reverse_mean_change
)
```

Arguments

`mean_change_exp`
: mean change of participants in the experimental/exposed group.

`mean_change_sd_exp`
: standard deviation of the mean change for participants in the experimental/exposed group.

`mean_change_nexp`
: mean change of participants in the non-experimental/non-exposed group.

`mean_change_sd_nexp`
: standard deviation of the mean change for participants in the non-experimental/non-exposed group.

`r_pre_post_exp`
: pre-post correlation in the experimental/exposed group

`r_pre_post_nexp`
: pre-post correlation in the non-experimental/non-exposed group

`n_exp`
: number of participants in the experimental/exposed group.

`n_nexp`
: number of participants in the non-experimental/non-exposed group.

`smd_to_cor`
: formula used to convert the `cohen_d` value into a coefficient correlation (see details).

`reverse_mean_change`
: a logical value indicating whether the direction of generated effect sizes should be flipped.

Details

This function first computes a Cohen's d (D), Hedges' g (G) from the mean change (MC) and standard deviations of two independent groups. Odds ratio (OR) and correlation coefficients (R/Z) are then converted from the Cohen's d.

This function simply internally calls the `es_from_means_sd_pre_post` function but setting:

$$mean\_pre\_exp = mean\_change\_exp$$

$$mean\_pre\_sd\_exp = mean\_change\_sd\_exp$$

$$mean\_exp = 0$$

$$mean\_sd\_exp = 0$$

$$mean\_pre\_nexp = mean\_change\_nexp$$

$$mean\_pre\_sd\_nexp = mean\_change\_sd\_nexp$$

$$mean\_nexp = 0$$

$$mean\_sd\_nexp = 0$$

To know more about the calculations, see `es_from_means_sd_pre_post` function.

Value

This function estimates and converts between several effect size measures.

`natural effect size measure`	MD + D + G
`converted effect size measure`	OR + R + Z
`required input data`	See 'Section 14. Paired: mean change, and dispersion' https://metaconvert.org/input.html

References

Bonett, S. B. (2008). Estimating effect sizes from pretest-posttest-control group designs. Organizational Research Methods, 11(2), 364–386. https://doi.org/10.1177/1094428106291059

Cooper, H., Hedges, L.V., & Valentine, J.C. (Eds.). (2019). The handbook of research synthesis and meta-analysis. Russell Sage Foundation.

Examples

```
es_from_mean_change_sd(
  n_exp = 36, n_nexp = 35,
  mean_change_exp = 8.4, mean_change_sd_exp = 9.13,
  mean_change_nexp = 2.43, mean_change_sd_nexp = 6.61,
  r_pre_post_exp = 0.2, r_pre_post_nexp = 0.2
)
```

---

es_from_mean_change_se

Convert mean changes and standard errors of two independent groups into standard effect size measures

---

Description

Convert mean changes and standard errors of two independent groups into standard effect size measures

Usage

```
es_from_mean_change_se(
  mean_change_exp,
  mean_change_se_exp,
  mean_change_nexp,
  mean_change_se_nexp,
  r_pre_post_exp,
  r_pre_post_nexp,
  n_exp,
  n_nexp,
  smd_to_cor = "viechtbauer",
  reverse_mean_change
)
```

Arguments

`mean_change_exp`
: mean change of participants in the experimental/exposed group.

`mean_change_se_exp`
: standard error of the mean change for participants in the experimental/exposed group.

`mean_change_nexp`
: mean change of participants in the non-experimental/non-exposed group.

`mean_change_se_nexp`
: standard error of the mean change for participants in the non-experimental/non-exposed group.

`r_pre_post_exp`
: pre-post correlation in the experimental/exposed group

`r_pre_post_nexp`
: pre-post correlation in the non-experimental/non-exposed group

`n_exp`
: number of participants in the experimental/exposed group.

`n_nexp`
: number of participants in the non-experimental/non-exposed group.

`smd_to_cor`
: formula used to convert the `cohen_d` value into a coefficient correlation (see details).

`reverse_mean_change`
: a logical value indicating whether the direction of generated effect sizes should be flipped.

Details

This function converts the mean change and standard errors of two independent groups into a Cohen's d. The Cohen's d is then converted to other effect size measures.

This function simply internally calls the `es_from_means_se_pre_post` function but setting:

$$mean\_pre\_exp = mean\_change\_exp$$

$$mean\_pre\_se\_exp = mean\_change\_se\_exp$$

$$mean\_exp = 0$$

$$mean\_se\_exp = 0$$

$$mean\_pre\_nexp = mean\_change\_nexp$$

$$mean\_pre\_se\_nexp = mean\_change\_se\_nexp$$

$$mean\_nexp = 0$$

$$mean\_se\_nexp = 0$$

To know more about the calculations, see `es_from_means_se_pre_post` function.

Value

This function estimates and converts between several effect size measures.

`natural effect size measure`	MD + D + G
`converted effect size measure`	OR + R + Z
`required input data`	See 'Section 14. Paired: mean change, and dispersion' https://metaconvert.org/input.html

References

Bonett, S. B. (2008). Estimating effect sizes from pretest-posttest-control group designs. Organizational Research Methods, 11(2), 364–386. https://doi.org/10.1177/1094428106291059

Cooper, H., Hedges, L.V., & Valentine, J.C. (Eds.). (2019). The handbook of research synthesis and meta-analysis. Russell Sage Foundation.

Examples

```
es_from_mean_change_se(
  n_exp = 36, n_nexp = 35,
  mean_change_exp = 8.4, mean_change_se_exp = 9.13,
  mean_change_nexp = 2.43, mean_change_se_nexp = 6.61,
  r_pre_post_exp = 0.2, r_pre_post_nexp = 0.2
)
```

---

es_from_med_min_max — *Convert median, quartiles, and range of two independent groups into several effect size measures*

Description

Convert median, quartiles, and range of two independent groups into several effect size measures

Usage

```
es_from_med_min_max(
  min_exp,
  med_exp,
  max_exp,
  n_exp,
  min_nexp,
  med_nexp,
  max_nexp,
  n_nexp,
  smd_to_cor = "viechtbauer",
  reverse_med
)
```

Arguments

`min_exp`	minimum value of the experimental/exposed group.
`med_exp`	median value of the experimental/exposed group.
`max_exp`	maximum value of the experimental/exposed group.
`n_exp`	number of participants in the experimental/exposed group.
`min_nexp`	minimum value of the non-experimental/non-exposed group.
`med_nexp`	median value of the non-experimental/non-exposed group.
`max_nexp`	maximum value of the non-experimental/non-exposed group.
`n_nexp`	number of participants in the non-experimental/non-exposed group.
`smd_to_cor`	formula used to convert the generated `cohen_d` value into a coefficient correlation (see details).
`reverse_med`	a logical value indicating whether the direction of generated effect sizes should be flipped.

Details

This function first converts a Cohen's d (D), Hedges' g (G) and mean difference (MD) from the medians and ranges of two independent groups. Odds ratio (OR) and correlation coefficients (R/Z) are then converted from the Cohen's d.

This function recreates means+SD of the two groups (Wan et al., 2014):

$$mean\_exp = \frac{min\_exp + 2 * med\_exp + max\_exp}{4}$$

$$mean\_nexp = \frac{min\_nexp + 2 * med\_nexp + max\_nexp}{4}$$

$$mean\_sd\_exp = \frac{max\_exp - min\_exp}{2 * qnorm((n\_exp - 0.375)/(n\_exp + 0.25))}$$

$$mean\_sd\_nexp = \frac{max\_nexp - min\_nexp}{2 * qnorm((n\_nexp - 0.375)/(n\_nexp + 0.25))}$$

Note that if the group sample size is inferior to 50, a correction is applied to estimate the standard deviation.

From these means+SD, the function computes MD, D and G using formulas described in `es_from_means_sd()`.

To estimate other effect size measures, calculations of the `es_from_cohen_d()` are applied.

Importantly,, authors of the Cochrane Handbook stated "As a general rule, we recommend that ranges should not be used to estimate SDs." (see section 6.5.2.6). It is thus a good practice to explore the consequences of the use of this conversion in sensitivity analyses.

Value

This function estimates and converts between several effect size measures.

`natural effect size measure`	
`converted effect size measure`	MD + D + G OR + R + Z
`required input data`	See 'Section 12. Median, range and/or interquartile range' https://metaconvert.org/input.html

This function estimates and converts between several effect size measures.

`natural effect size measure`	
`converted effect size measure`	MD + D + G OR + R + Z
`required input data`	See 'Section 12. Median, range and/or interquartile range' https://metaconvert.org/input.html

References

Wan, X., Wang, W., Liu, J. et al. Estimating the sample mean and standard deviation from the sample size, median, range and/or interquartile range. BMC Med Res Methodol 14, 135 (2014). https://doi.org/10.1186/1471-2288-14-135

Higgins JPT, Li T, Deeks JJ (editors). Chapter 6: Choosing effect size measures and computing estimates of effect. In: Higgins JPT, Thomas J, Chandler J, Cumpston M, Li T, Page MJ, Welch VA (editors). Cochrane Handbook for Systematic Reviews of Interventions version 6.3 (updated February 2022). Cochrane, 2022. Available from www.training.cochrane.org/handbook.

Examples

```
es_from_med_min_max(
  min_exp = 1335, med_exp = 1400,
  max_nexp = 1765, n_exp = 40,
  min_nexp = 1481, med_nexp = 1625,
  max_exp = 1800, n_nexp = 40
)
```

`es_from_med_min_max_quarts` *Convert median, range and interquartile range of two independent groups into several effect size measures*

Description

Convert median, range and interquartile range of two independent groups into several effect size measures

Usage

```
es_from_med_min_max_quarts(
  q1_exp,
  med_exp,
  q3_exp,
  min_exp,
  max_exp,
  n_exp,
  q1_nexp,
  med_nexp,
  q3_nexp,
  min_nexp,
  max_nexp,
  n_nexp,
  smd_to_cor = "viechtbauer",
  reverse_med
)
```

Arguments

`q1_exp`	first quartile of the experimental/exposed group.
`med_exp`	median value of the experimental/exposed group.
`q3_exp`	third quartile of the experimental/exposed group.
`min_exp`	minimum value of the experimental/exposed group.
`max_exp`	maximum value of the experimental/exposed group.
`n_exp`	number of participants in the experimental/exposed group.
`q1_nexp`	first quartile of the non-experimental/non-exposed group.
`med_nexp`	median value of the non-experimental/non-exposed group.
`q3_nexp`	third quartile of the non-experimental/non-exposed group.
`min_nexp`	minimum value of the non-experimental/non-exposed group.
`max_nexp`	maximum value of the non-experimental/non-exposed group.
`n_nexp`	number of participants in the non-experimental/non-exposed group.
`smd_to_cor`	formula used to convert the generated `cohen_d` value into a coefficient correlation (see details).
`reverse_med`	a logical value indicating whether the direction of generated effect sizes should be flipped.

Details

This function first converts a Cohen's d (D), Hedges' g (G) and mean difference (MD) from the medians, ranges, and interquartile ranges of two independent groups. Odds ratio (OR) and correlation coefficients (R/Z) are then converted from the Cohen's d.

This function recreates means+SD of the two groups (Wan et al., 2014):

$$mean\_exp = \frac{min\_exp + 2 * q1\_exp + 2 * med\_exp + 2 * q3\_exp + max\_exp}{8}$$

$$mean\_nexp = \frac{min\_nexp + 2 * q1\_nexp + 2 * med\_nexp + 2 * q3\_nexp + max\_nexp}{8}$$

$$mean\_sd\_exp = \frac{max\_exp - min\_exp}{4 * qnorm(\frac{n\_exp - 0.375}{n\_exp + 0.25})} + \frac{q3\_exp - q1\_exp}{4 * qnorm(\frac{0.75 * n\_exp - 0.125}{n\_exp + 0.25})}$$

$$mean\_sd\_nexp = \frac{max\_nexp - min\_nexp}{4 * qnorm(\frac{n\_nexp - 0.375}{n\_nexp + 0.25})} + \frac{q3\_nexp - q1\_nexp}{4 * qnorm(\frac{0.75 * n\_nexp - 0.125}{n\_nexp + 0.25})}$$

Note that if the group sample size is inferior to 50, a correction is applied to estimate the standard deviation.

From these means+SD, the function computes MD, D and G using formulas described in `es_from_means_sd()`.

To estimate other effect size measures, calculations of the `es_from_cohen_d()` are applied.

Value

This function estimates and converts between several effect size measures.

`natural effect size measure`

`converted effect size measure`	MD + D + G OR + R + Z
`required input data`	See 'Section 12. Median, range and/or interquartile range' https://metaconvert.org/input.html

References

Wan, X., Wang, W., Liu, J. et al. Estimating the sample mean and standard deviation from the sample size, median, range and/or interquartile range. BMC Med Res Methodol 14, 135 (2014). https://doi.org/10.1186/1471-2288-14-135

Examples

```
es_from_med_min_max_quarts(
  min_exp = 1102, q1_exp = 1335,
  med_exp = 1400, q3_exp = 1765,
  max_exp = 1899, n_exp = 40,
  min_nexp = 1181, q1_nexp = 1481,
  med_nexp = 1625, q3_nexp = 1800,
  max_nexp = 1910, n_nexp = 40
)
```

`es_from_med_quarts` *Convert median and interquartile range of two independent groups into several effect size measures*

Description

Convert median and interquartile range of two independent groups into several effect size measures

Usage

```
es_from_med_quarts(
  q1_exp,
  med_exp,
  q3_exp,
  n_exp,
  q1_nexp,
  med_nexp,
  q3_nexp,
```

```
  n_nexp,
  smd_to_cor = "viechtbauer",
  reverse_med
)
```

Arguments

q1_exp	first quartile of the experimental/exposed group.
med_exp	median value of the experimental/exposed group.
q3_exp	third quartile of the experimental/exposed group.
n_exp	number of participants in the experimental/exposed group.
q1_nexp	first quartile of the non-experimental/non-exposed group.
med_nexp	median value of the non-experimental/non-exposed group.
q3_nexp	third quartile of the non-experimental/non-exposed group.
n_nexp	number of participants in the non-experimental/non-exposed group.
smd_to_cor	formula used to convert the generated cohen_d value into a coefficient correlation (see details).
reverse_med	a logical value indicating whether the direction of generated effect sizes should be flipped.

Details

This function first converts a Cohen's d (D), Hedges' g (G) and mean difference (MD) from the medians and interquartile ranges of two independent groups. Odds ratio (OR) and correlation coefficients (R/Z) are then converted from the Cohen's d.

This function recreates means+SD of the two groups (Wan et al., 2014):

$$mean\_exp = \frac{q1\_exp + med\_exp + q3\_exp}{3}$$

$$mean\_nexp = \frac{q1\_nexp + med\_nexp + q3\_nexp}{3}$$

$$mean\_sd\_exp = \frac{q3\_exp - q1\_exp}{2 * qnorm(\frac{0.75*n\_exp-0.125}{n\_exp+0.25})}$$

$$mean\_sd\_nexp = \frac{q3\_nexp - q1\_nexp}{2 * qnorm(\frac{0.75*n\_nexp-0.125}{n\_nexp+0.25})}$$

Note that if the group sample size is inferior to 50, a correction is applied to estimate the standard deviation.

From these means+SD, the function computes MD, D and G using formulas described in es_from_means_sd().

To estimate other effect size measures, calculations of the es_from_cohen_d() are applied.

Value

This function estimates and converts between several effect size measures.

References

Wan, X., Wang, W., Liu, J. et al. Estimating the sample mean and standard deviation from the sample size, median, range and/or interquartile range. BMC Med Res Methodol 14, 135 (2014). https://doi.org/10.1186/1471-2288-14-135

Examples

```
es_from_med_quarts(
  q1_exp = 1335, med_exp = 1400,
  q3_exp = 1765, n_exp = 40,
  q1_nexp = 1481, med_nexp = 1625,
  q3_nexp = 1800, n_nexp = 40
)
```

---

es_from_or — *Convert an odds ratio value to several effect size measures*

Description

Convert an odds ratio value to several effect size measures

Usage

```
es_from_or(
  or,
  logor,
  n_cases,
  n_controls,
  n_sample,
  small_margin_prop,
  baseline_risk,
  n_exp,
  n_nexp,
  or_to_cor = "bonett",
  or_to_rr = "metaumbrella_cases",
  reverse_or
)
```

Arguments

`or`	odds ratio value
`logor`	log odds ratio value
`n_cases`	number of cases/events
`n_controls`	number of controls/no-event
`n_sample`	total number of participants in the sample

`small_margin_prop`	smallest margin proportion of the underlying 2x2 table
`baseline_risk`	proportion of cases in the non-exposed group
`n_exp`	number of participants in the exposed group
`n_nexp`	number of participants in the non-exposed group
`or_to_cor`	formula used to convert the `or` value into a correlation coefficient (see details).
`or_to_rr`	formula used to convert the `or` value into a risk ratio (see details).
`reverse_or`	a logical value indicating whether the direction of the generated effect sizes should be flipped.

Details

This function computes the standard error of the log odds ratio. Risk ratio (RR), Cohen's d (D), Hedges' g (G) and correlation coefficients (R/Z), are converted from the odds ratio value.

Estimation of the standard error of the log OR. This function generates the standard error of an odds ratio (OR) based on the OR value and the number of cases and controls. More precisely, this function simulates all combinations of the possible number of cases and controls in the exposed and non-exposed groups compatible with the reported OR value and with the overall number of cases and controls. Then, our function assumes that the variance of the OR is equal to the mean of the standard error of all possible situations. This estimation thus necessarily comes with some imprecision and should not be used before having requested the value (or raw data) to authors of the original report.

Conversion of other effect size measures. Calculations of `es_from_or_se()` are then applied to estimate the other effect size measures

Value

This function estimates and converts between several effect size measures.

`natural effect size measure`	N/A
`converted effect size measure`	OR + RR + NNT D + G + R + Z
`required input data`	See 'Section 2. Odds Ratio' https://metaconvert.org/input.html

References

Gosling, C. J., Solanes, A., Fusar-Poli, P., & Radua, J. (2023). metaumbrella: the first comprehensive suite to perform data analysis in umbrella reviews with stratification of the evidence. BMJ mental health, 26(1), e300534. https://doi.org/10.1136/bmjment-2022-300534

Examples

```
es_or_guess <- es_from_or(or = 0.5, n_cases = 210, n_controls = 220)
es_or <- es_from_or_se(or = 0.5, logor_se = 0.4, n_cases = 210, n_controls = 220)
round(es_or_guess$logor_se, 0.10) == round(es_or$logor_se, 0.10)
```

`es_from_or_ci` *Convert an odds ratio value and its 95% confidence interval to several effect size measures*

Description

Convert an odds ratio value and its 95% confidence interval to several effect size measures

Usage

```
es_from_or_ci(
  or,
  or_ci_lo,
  or_ci_up,
  logor,
  logor_ci_lo,
  logor_ci_up,
  baseline_risk,
  small_margin_prop,
  n_exp,
  n_nexp,
  n_cases,
  n_controls,
  n_sample,
  max_asymmetry = 10,
  or_to_cor = "bonett",
  or_to_rr = "metaumbrella_cases",
  reverse_or
)
```

Arguments

`or`	odds ratio value
`or_ci_lo`	lower bound of the 95% CI around the odds ratio value
`or_ci_up`	upper bound of the 95% CI around the odds ratio value
`logor`	log odds ratio value
`logor_ci_lo`	lower bound of the 95% CI around the log odds ratio value
`logor_ci_up`	upper bound of the 95% CI around the log odds ratio value
`baseline_risk`	proportion of cases in the non-exposed group (only required for the `or_to_rr = "grant"` argument).

small_margin_prop	smallest margin proportion of the underlying 2x2 table
n_exp	number of participants in the exposed group (only required for the or_to_rr = "grant", and or_to_rr = "metaumbrella_exp" arguments)
n_nexp	number of participants in the non-exposed group (only required for the or_to_rr = "grant", and or_to_rr = "metaumbrella_exp" arguments)
n_cases	number of cases/events
n_controls	number of controls/no-event
n_sample	total number of participants in the sample
max_asymmetry	A percentage indicating the tolerance before detecting asymmetry in the 95% CI bounds.
or_to_cor	formula used to convert the or value into a correlation coefficient (see details).
or_to_rr	formula used to convert the or value into a risk ratio (see details).
reverse_or	a logical value indicating whether the direction of the generated effect sizes should be flipped.

Details

This function computes the standard error of the (log) odds ratio into a standard error (Section 6.5.2.2 in the Cochrane Handbook).

$$logor\_se = \frac{\log or\_ci\_up - \log or\_ci\_lo}{2 * qnorm(.975)}$$

Then, calculations of es_from_or_se are applied.

Value

This function estimates and converts between several effect size measures.

natural effect size measure	OR
converted effect size measure	RR + NNT D + G + R + Z
required input data	See 'Section 2. Odds Ratio' https://metaconvert.org/input.html

References

Higgins JPT, Li T, Deeks JJ (editors). Chapter 6: Choosing effect size measures and computing estimates of effect. In: Higgins JPT, Thomas J, Chandler J, Cumpston M, Li T, Page MJ, Welch VA (editors). Cochrane Handbook for Systematic Reviews of Interventions version 6.3 (updated February 2022). Cochrane, 2022. Available from www.training.cochrane.org/handbook.

Examples

```
es_or <- es_from_or_ci(
  or = 1, or_ci_lo = 0.5, or_ci_up = 2,
  n_cases = 42, n_controls = 38, baseline_risk = 0.08,
  or_to_rr = "grant"
)
```

---

es_from_or_pval — *Convert an odds ratio value and its standard error to several effect size measures*

Description

Convert an odds ratio value and its standard error to several effect size measures

Usage

```
es_from_or_pval(
  or,
  logor,
  or_pval,
  baseline_risk,
  small_margin_prop,
  n_exp,
  n_nexp,
  n_cases,
  n_controls,
  n_sample,
  or_to_rr = "metaumbrella_cases",
  or_to_cor = "bonett",
  reverse_or_pval
)
```

Arguments

`or`	odds ratio value
`logor`	log odds ratio value
`or_pval`	p-value of the (log) odds ratio
`baseline_risk`	proportion of cases in the non-exposed group (only required for the `or_to_rr` = `"grant"` argument).
`small_margin_prop`	smallest margin proportion of the underlying 2x2 table
`n_exp`	number of participants in the exposed group (only required for the `or_to_rr` = `"grant"`, and `or_to_rr` = `"metaumbrella_exp"` arguments)
`n_nexp`	number of participants in the non-exposed group (only required for the `or_to_rr` = `"grant"`, and `or_to_rr` = `"metaumbrella_exp"` arguments)

`n_cases` number of cases/events

`n_controls` number of controls/no-event

`n_sample` total number of participants in the sample

`or_to_rr` formula used to convert the `or` value into a risk ratio (see details).

`or_to_cor` formula used to convert the `or` value into a correlation coefficient (see details).

`reverse_or_pval` a logical value indicating whether the direction of the generated effect sizes should be flipped.

Details

This function computes the standard error of the (log) odds ratio into from a p-value (Section 6.3.2 in the Cochrane Handbook).

$$logor\_z = qnorm(or_pval/2, lower.tail = FALSE)$$

$$logor\_se = |\frac{\log(or)}{logor\_z}|$$

Then, calculations of `es_from_or_se()` are applied.

Value

This function estimates and converts between several effect size measures.

`natural effect size measure`	OR
`converted effect size measure`	RR + NNT D + G + R + Z
`required input data`	See 'Section 2. Odds Ratio' https://metaconvert.org/input.html

References

Higgins, J. P., Thomas, J., Chandler, J., Cumpston, M., Li, T., Page, M. J., & Welch, V. A. (Eds.). (2019). Cochrane handbook for systematic reviews of interventions. John Wiley & Sons.

Examples

```
es_or <- es_from_or_pval(
  or = 3.51, or_pval = 0.001,
  n_cases = 12, n_controls = 68
)
```

`es_from_or_se` *Convert an odds ratio value and its standard error into several effect size measures*

Description

Convert an odds ratio value and its standard error into several effect size measures

Usage

```
es_from_or_se(
  or,
  logor,
  logor_se,
  baseline_risk,
  small_margin_prop,
  n_exp,
  n_nexp,
  n_cases,
  n_controls,
  n_sample,
  or_to_rr = "metaumbrella_cases",
  or_to_cor = "pearson",
  reverse_or
)
```

Arguments

`or`	odds ratio value
`logor`	log odds ratio value
`logor_se`	the standard error of the log odds ratio
`baseline_risk`	proportion of cases in the non-exposed group
`small_margin_prop`	smallest margin proportion of cases/events in the underlying 2x2 table
`n_exp`	number of participants in the exposed group
`n_nexp`	number of participants in the non-exposed group
`n_cases`	number of cases/events across exposed/non-exposed groups
`n_controls`	number of controls/no-event across exposed/non-exposed groups
`n_sample`	total number of participants in the sample
`or_to_rr`	formula used to convert the `or` value into a risk ratio (see details).
`or_to_cor`	formula used to convert the `or` value into a correlation coefficient (see details).
`reverse_or`	a logical value indicating whether the direction of the generated effect sizes should be flipped.

Details

This function converts the log odds ratio into a Risk ratio (RR), Cohen's d (D), Hedges' g (G) and correlation coefficients (R/Z).

To estimate the Cohen's d value and its standard error The following formulas are used (Cooper et al., 2019):

$$d = \log(or) * \frac{\sqrt{3}}{\pi}$$

$$d\_se = \sqrt{\frac{logor\_se^2 * 3}{\pi^2}}$$

To estimate the risk ratio and its standard error, various formulas can be used.

A. First, the approach described in Grant (2014) can be used. However, in the paper, only the formula to convert an OR value to a RR value is described. To derive the variance, we used this formula to convert the bounds of the 95% CI, which were then used to obtain the variance.

This argument requires (or + baseline_risk + or_ci_lo + or_ci_up) to generate a RR. The following formulas are used (br = baseline_risk):

$$rr = \frac{or}{1 - br + br * or}$$

$$rr\_ci\_lo = \frac{or\_ci\_lo}{1 - br + br * or\_ci\_lo}$$

$$rr\_ci\_up = \frac{or\_ci\_up}{1 - br + br * or\_ci\_up}$$

$$logrr\_se = \frac{log(rr\_ci\_up) - log(rr\_ci\_lo)}{2 * qnorm(.975)}$$

B. Second, the formulas implemented in the metaumbrella package can be used (`or_to_rr = "metaumbrella_cases"` or `or_to_rr = "metaumbrella_exp"`). This argument requires (or + logor_se + n_cases + n_controls) or (or + logor_se + n_exp + n_nexp) to generate a RR. More precisely, when the OR value and its standard error, plus either (i) the number of cases and controls or (ii) the number of participants in the exposed and non-exposed groups, are available, we previously developed functions that simulate all combinations of the possible number of cases and controls in the exposed and non-exposed groups compatible with the actual value of the OR. Then, the functions select the contingency table whose standard error coincides best with the standard error reported. The RR value and its standard are obtained from this estimated contingency table.

C. Third, it is possible to transpose the RR to a OR (`or_to_rr = "transpose"`). This argument requires (or + logor_se) to generate a OR. It is known that OR and RR are similar when the baseline risk is small. Therefore, users can request to simply transpose the OR value & standard error into a RR value & standard error.

$$rr = or$$

$$logrr\_se = logor\_se$$

D. Fourth, it is possible to recreate the 2x2 table using the dipietrantonj's formulas (`or_to_rr = "dipietrantonj"`). This argument requires (or + logor_ci_lo + logor_ci_lo) to generate a RR. Information on this approach can be retrieved in Di Pietrantonj (2006).

To estimate the NNT, the formulas used are :

$$\frac{(1 - br * (1 - or))}{(1 - br) * (br * (1 - or))}$$

To estimate a correlation coefficient, various formulas can be used.

A. First, the approach described in Pearson (1900) can be used (`or_to_cor = "pearson"`). This argument requires (or + logor_se) to generate a R/Z. It converts the OR value and its standard error to a tetrachoric correlation. Note that the formula assumes that each cell of the 2x2 used to estimate the OR has been added 1/2 before estimating the OR value and its standard error. If it is not the case, formulas can produce slightly less accurate results.

$$c = \frac{1}{2}$$

$$r = \cos\frac{\pi}{1 + or^c}$$

$$r\_se = logor\_se * ((\pi * c * or^c) * \frac{\sin(\pi/(1 + or^c))}{1 + or^c})^2$$

$$or\_ci\_lo = exp(log(or) - qnorm(.975) * logor\_se)$$

$$or\_ci\_up = exp(log(or) + qnorm(.975) * logor\_se)$$

$$r\_ci\_lo = cos(\frac{\pi}{1 + or\_ci\_lo^c})$$

$$r\_ci\_up = cos(\frac{\pi}{1 + or\_ci\_up^c})$$

$$z = atanh(r)$$

$$z\_se = \sqrt{\frac{r\_se^2}{(1 - r^2)^2}}$$

$$z\_ci\_lo = atanh(r\_lo)$$

$$z\_ci\_up = atanh(r\_up)$$

B. Second, the approach described in Digby (1983) can be used (`or_to_cor = "digby"`). This argument requires (or + logor_se) to generate a R/Z. It converts the OR value and its standard error to a tetrachoric correlation. Note that the formula assumes that each cell of the 2x2 used to estimate the OR has been added 1/2 before estimating the OR value and its standard error. If it is not the case, formulas can produce slightly less accurate results.

$$c = \frac{3}{4}$$

$$r = \frac{or^c - 1}{or^c + 1}$$

$$r\_se = \sqrt{\frac{c^2}{4} * (1 - r^2)^2 * logor\_se}$$

$$z = atanh(r)$$

$$z\_se = \sqrt{\frac{r\_se^2}{(1-r^2)^2}}$$

$$z\_ci\_lo = z - qnorm(.975) * \sqrt{\frac{c^2}{4} * logor\_se}$$

$$z\_ci\_up = z + qnorm(.975) * \sqrt{\frac{c^2}{4} * logor\_se}$$

$$r\_ci\_lo = tanh(z\_lo)$$

$$r\_ci\_up = tanh(z\_up)$$

C. Third, the approach described in Bonett (2005) can be used (`or_to_cor = "bonett"`). This argument requires (or + logor_se + n_cases + n_exp + small_margin_prop) to generate a R/Z. Note that the formula assumes that each cell of the 2x2 used to estimate the OR has been added 1/2 before estimating the OR value and its standard error. If it is not the case, formulas can produce slightly less accurate results.

$$c = \frac{\frac{1-|n\_exp-n\_cases|}{5} - (0.5 - small\_margin\_prop)^2}{2}$$

$$r = \cos\frac{\pi}{1 + or^c}$$

$$r\_se = logor\_se * ((\pi * c * or^c) * \frac{\sin(\frac{\pi}{1+or^c})}{1 + or^c})^2$$

$$or\_ci\_lo = exp(log(or) - qnorm(.975) * logor\_se)$$

$$or\_ci\_up = exp(log(or) + qnorm(.975) * logor\_se)$$

$$r\_ci\_lo = cos(\frac{\pi}{1 + or\_ci\_lo^c})$$

$$r\_ci\_up = cos(\frac{\pi}{1 + or\_ci\_up^c})$$

$$z = atanh(r)$$

$$z\_se = \sqrt{\frac{r\_se^2}{(1-r^2)^2}}$$

$$z\_ci\_lo = atanh(r\_lo)$$

$$z\_ci\_up = atanh(r\_up)$$

D. Last, the approach described in Cooper et al. (2019) can be used (`or_to_cor = "lipsey_cooper"`). This argument requires (or + logor_se + n_exp + n_nexp) to generate a R/Z. As shown above, the function starts to estimate a SMD from the OR. Then, as described in `es_from_cohen_d`, it converts this Cohen's d value into a correlation coefficient using the `"lipsey_cooper"` formulas.

Value

This function estimates and converts between several effect size measures.

natural effect size measure	OR
converted effect size measure	RR + NNT D + G + R + Z
required input data	See 'Section 2. Odds Ratio' https://metaconvert.org/input.html

References

Bonett, Douglas G. and Robert M. Price. (2005). Inferential Methods for the Tetrachoric Correlation Coefficient. Journal of Educational and Behavioral Statistics 30:213-25.

Bonett, D. G., & Price, R. M. (2007). Statistical inference for generalized Yule coefficients in 2× 2 contingency tables. Sociological methods & research, 35(3), 429-446.

Cooper, H., Hedges, L. V., & Valentine, J. C. (Eds.). (2019). The handbook of research synthesis and meta-analysis. Russell Sage Foundation.

Di Pietrantonj C. (2006). Four-fold table cell frequencies imputation in meta analysis. Statistics in medicine, 25(13), 2299–2322. https://doi.org/10.1002/sim.2287

Digby, Peter G. N. (1983). Approximating the Tetrachoric Correlation Coefficient. Biometrics 39:753-7.

Gosling, C. J., Solanes, A., Fusar-Poli, P., & Radua, J. (2023). metaumbrella: the first comprehensive suite to perform data analysis in umbrella reviews with stratification of the evidence. BMJ mental health, 26(1), e300534. https://doi.org/10.1136/bmjment-2022-300534

Grant R. L. (2014). Converting an odds ratio to a range of plausible relative risks for better communication of research findings. BMJ (Clinical research ed.), 348, f7450. https://doi.org/10.1136/bmj.f7450

Pearson, K. (1900). Mathematical Contributions to the Theory of Evolution. VII: On the Correlation of Characters Not Quantitatively Measurable. Philosophical Transactions of the Royal Statistical Society of London, Series A 19:1-47

Veroniki, A. A., Pavlides, M., Patsopoulos, N. A., & Salanti, G. (2013). Reconstructing 2x2 contingency tables from odds ratios using the Di Pietrantonj method: difficulties, constraints and impact in meta-analysis results. Research synthesis methods, 4(1), 78–94. https://doi.org/10.1002/jrsm.1061

Examples

```
es_from_or_se(or = 2.12, logor_se = 0.242, n_exp = 120, n_nexp = 44)
```

`es_from_paired_f` *Convert two paired ANOVA f value of two independent groups into several effect size measures*

Description

Convert two paired ANOVA f value of two independent groups into several effect size measures

Usage

```
es_from_paired_f(
  paired_f_exp,
  paired_f_nexp,
  n_exp,
  n_nexp,
  r_pre_post_exp,
  r_pre_post_nexp,
  smd_to_cor = "viechtbauer",
  reverse_paired_f
)
```

Arguments

`paired_f_exp`	Paired ANOVA F value of the experimental/exposed group.
`paired_f_nexp`	Paired ANOVA F value of the non-experimental/non-exposed group.
`n_exp`	number of participants in the experimental/exposed group.
`n_nexp`	number of participants in the non-experimental/non-exposed group.
`r_pre_post_exp`	pre-post correlation in the experimental/exposed group
`r_pre_post_nexp`	pre-post correlation in the non-experimental/non-exposed group
`smd_to_cor`	formula used to convert the `cohen_d` value into a coefficient correlation (see details).
`reverse_paired_f`	a logical value indicating whether the direction of generated effect sizes should be flipped.

Details

This function converts the paired F-test obtained from two independent groups value into a Cohen's d (D) and Hedges' g (G) (table 12.2 in Cooper). Odds ratio (OR) and correlation coefficients (R/Z) are then converted from the Cohen's d.

To estimate the Cohen's d, the following formulas are used (Cooper et al., 2019): This function converts a Student's t-test value into a Cohen's d (table 12.2 in Cooper).

$$paired\_t\_exp = \sqrt{paired\_f\_exp}$$

$$paired\_t\_nexp = \sqrt{paired\_f\_nexp}$$

To estimate other effect size measures, calculations of the `es_from_paired_t()` are applied.

Value

This function estimates and converts between several effect size measures.

`natural effect size measure`	D + G

`converted effect size measure`	OR + R + Z
`required input data`	See 'Section 16. Paired: Paired F- or t-test' https://metaconvert.org/input.html

References

Cooper, H., Hedges, L.V., & Valentine, J.C. (Eds.). (2019). The handbook of research synthesis and meta-analysis. Russell Sage Foundation.

Examples

```
es_from_paired_f(paired_f_exp = 2.1, paired_f_nexp = 4.2, n_exp = 20, n_nexp = 22)
```

`es_from_paired_f_pval` *Convert two paired ANOVA f p-value of two independent groups into several effect size measures*

Description

Convert two paired ANOVA f p-value of two independent groups into several effect size measures

Usage

```
es_from_paired_f_pval(
  paired_f_pval_exp,
  paired_f_pval_nexp,
  n_exp,
  n_nexp,
  r_pre_post_exp,
  r_pre_post_nexp,
  smd_to_cor = "viechtbauer",
  reverse_paired_f_pval
)
```

Arguments

`paired_f_pval_exp`
: P-value of the paired ANOVA F of the experimental/exposed group.

`paired_f_pval_nexp`
: P-value of the paired ANOVA F of the non-experimental/non-exposed group.

`n_exp`
: number of participants in the experimental/exposed group.

`n_nexp`
: number of participants in the non-experimental/non-exposed group.

`r_pre_post_exp`
: pre-post correlation in the experimental/exposed group

`r_pre_post_nexp`
: pre-post correlation in the non-experimental/non-exposed group

`smd_to_cor`
: formula used to convert the `cohen_d` value into a coefficient correlation (see details).

`reverse_paired_f_pval`
: a logical value indicating whether the direction of generated effect sizes should be flipped.

Details

This function converts the p-values of two paired F-test obtained from two independent groups value into a Cohen's d (D) and Hedges' g (G) (table 12.2 in Cooper). Odds ratio (OR) and correlation coefficients (R/Z) are then converted from the Cohen's d.

To estimate the Cohen's d, the following formulas are used (Cooper et al., 2019): This function converts a Student's t-test value into a Cohen's d (table 12.2 in Cooper).

$$paired\_t\_exp = qt(\frac{paired\_f\_pval\_exp}{2}, df = n\_exp - 1) * \sqrt{\frac{2 * (1 - r_p re_p ost_e xp)}{n_e xp}}$$

$$paired\_t\_nexp = qt(\frac{paired\_f\_pval\_nexp}{2}, df = n\_nexp - 1) * \sqrt{\frac{2 * (1 - r_p re_p ost_n exp)}{n_n exp}}$$

To estimate other effect size measures, calculations of the `es_from_paired_t()` are applied.

Value

This function estimates and converts between several effect size measures.

`natural effect size measure`	D + G
`converted effect size measure`	OR + R + Z
`required input data`	See 'Section 16. Paired: Paired F- or t-test' https://metaconvert.org/input.html

References

Cooper, H., Hedges, L.V., & Valentine, J.C. (Eds.). (2019). The handbook of research synthesis and meta-analysis. Russell Sage Foundation.

Examples

```
es_from_paired_f_pval(paired_f_pval_exp = 0.4, paired_f_pval_nexp = 0.01, n_exp = 19, n_nexp = 22)
```

`es_from_paired_t` *Convert two paired t-test value of two independent groups into several effect size measures*

Description

Convert two paired t-test value of two independent groups into several effect size measures

Usage

```
es_from_paired_t(
  paired_t_exp,
  paired_t_nexp,
  n_exp,
  n_nexp,
  r_pre_post_exp,
  r_pre_post_nexp,
  smd_to_cor = "viechtbauer",
  reverse_paired_t
)
```

Arguments

`paired_t_exp`	Paired t-test value of the experimental/exposed group.
`paired_t_nexp`	Paired t-test value of the non-experimental/non-exposed group.
`n_exp`	number of participants in the experimental/exposed group.
`n_nexp`	number of participants in the non-experimental/non-exposed group.
`r_pre_post_exp`	pre-post correlation in the experimental/exposed group
`r_pre_post_nexp`	pre-post correlation in the non-experimental/non-exposed group
`smd_to_cor`	formula used to convert the `cohen_d` value into a coefficient correlation (see details).
`reverse_paired_t`	a logical value indicating whether the direction of generated effect sizes should be flipped.

Details

This function converts paired t-tests of two independent groups value into a Cohen's d (D) and Hedges' g (G) (table 12.2 in Cooper). Odds ratio (OR) and correlation coefficients (R/Z) are then converted from the Cohen's d.

To estimate the Cohen's d, the following formulas are used (Cooper et al., 2019):

$$cohen\_d\_exp = paired\_t\_exp * \sqrt{\frac{2 * (1 - r\_pre\_post\_exp)}{n\_exp}}$$

$$cohen\_d\_nexp = paired\_t\_nexp * \sqrt{\frac{2 * (1 - r\_pre\_post\_nexp)}{n\_nexp}}$$

$$cohen\_d\_se\_exp = \sqrt{\frac{2 * (1 - r\_pre\_post\_exp)}{n\_exp} + \frac{d\_exp^2}{2 * n\_exp}}$$

$$cohen\_d\_se\_nexp = \sqrt{\frac{2 * (1 - r\_pre\_post\_nexp)}{n\_nexp} + \frac{d\_nexp^2}{2 * n\_nexp}}$$

$$cohen\_d = d\_exp - d\_nexp$$

$$d\_se = \sqrt{cohen\_d\_se\_exp^2 + cohen\_d\_se\_nexp^2}$$

To estimate other effect size measures, calculations of the `es_from_cohen_d()` are applied.

Value

This function estimates and converts between several effect size measures.

`natural effect size measure`	D + G
`converted effect size measure`	OR + R + Z
`required input data`	See 'Section 16. Paired: Paired F- or t-test' https://metaconvert.org/input.html

References

Cooper, H., Hedges, L.V., & Valentine, J.C. (Eds.). (2019). The handbook of research synthesis and meta-analysis. Russell Sage Foundation.

Examples

```
es_from_paired_t(paired_t_exp = 2.1, paired_t_nexp = 4.2, n_exp = 20, n_nexp = 22)
```

`es_from_paired_t_pval` *Convert two paired t-test p-value obtained from two independent groups into several effect size measures*

Description

Convert two paired t-test p-value obtained from two independent groups into several effect size measures

Usage

```
es_from_paired_t_pval(
  paired_t_pval_exp,
  paired_t_pval_nexp,
  n_exp,
  n_nexp,
  r_pre_post_exp,
  r_pre_post_nexp,
  smd_to_cor = "viechtbauer",
  reverse_paired_t_pval
)
```

Arguments

`paired_t_pval_exp`
: P-value of the paired t-test value of the experimental/exposed group.

`paired_t_pval_nexp`
: P-value of the paired t-test value of the non-experimental/non-exposed group.

`n_exp`
: number of participants in the experimental/exposed group.

`n_nexp`
: number of participants in the non-experimental/non-exposed group.

`r_pre_post_exp`
: pre-post correlation in the experimental/exposed group

`r_pre_post_nexp`
: pre-post correlation in the non-experimental/non-exposed group

`smd_to_cor`
: formula used to convert the `cohen_d` value into a coefficient correlation (see details).

`reverse_paired_t_pval`
: a logical value indicating whether the direction of generated effect sizes should be flipped.

Details

This function converts the p-values of two paired t-test obtained from two independent groups value into a Cohen's d (D) and Hedges' g (G) (table 12.2 in Cooper). Odds ratio (OR) and correlation coefficients (R/Z) are then converted from the Cohen's d.

To estimate the Cohen's d, the following formulas are used (Cooper et al., 2019): This function converts a Student's t-test value into a Cohen's d (table 12.2 in Cooper).

$$paired\_t\_exp = qt(\frac{paired\_t\_pval\_exp}{2}, df = n\_exp - 1) * \sqrt{\frac{2 * (1 - r\_pre\_post\_exp)}{n\_exp}}$$

$$paired\_t\_nexp = qt(\frac{paired\_t\_pval\_nexp}{2}, df = n\_nexp - 1) * \sqrt{\frac{2 * (1 - r\_pre\_post\_nexp)}{n\_nexp}}$$

To estimate other effect size measures, calculations of the `es_from_cohen_d()` are applied.

Value

This function estimates and converts between several effect size measures.

natural effect size measure	D + G
converted effect size measure	OR + R + Z
required input data	See 'Section 16. Paired: Paired F- or t-test' https://metaconvert.org/input.html

References

Cooper, H., Hedges, L.V., & Valentine, J.C. (Eds.). (2019). The handbook of research synthesis and meta-analysis. Russell Sage Foundation.

Examples

```
es_from_paired_t_pval(paired_t_pval_exp = 0.4, paired_t_pval_nexp = 0.01, n_exp = 19, n_nexp = 22)
```

`es_from_pearson_r` *Convert a Pearson's correlation coefficient to several effect size measures*

Description

Convert a Pearson's correlation coefficient to several effect size measures

Usage

```
es_from_pearson_r(
  pearson_r,
  sd_iv,
  n_sample,
  n_exp,
  n_nexp,
  cor_to_smd = "viechtbauer",
  unit_increase_iv,
  unit_type = "raw_scale",
  reverse_pearson_r
)
```

Arguments

pearson_r — a Pearson's correlation coefficient value

sd_iv — the standard deviation of the independent variable

n_sample — the total number of participants

n_exp — number of the experimental/exposed group

n_nexp — number of the non-experimental/non-exposed group

cor_to_smd — formula used to convert a `pearson_r` or `fisher_z` value into a SMD.

unit_increase_iv — a value of the independent variable that will be used to estimate the Cohen's d (see details).

unit_type — the type of unit for the `unit_increase_iv` argument. Must be either "sd" or "value"

reverse_pearson_r — a logical value indicating whether the direction of the generated effect sizes should be flipped.

Details

This function estimates the variance of a Pearson's correlation coefficient, and computes the Fisher's r-to-z transformation. Cohen's d (D), Hedges' g (G) are converted from the Pearson's r, and odds ratio (OR) are converted from the Cohen's d.

1. **The formula used to estimate the standard error of the Pearson's correlation coefficient** and 95% CI are (Formula 12.27 in Cooper):

$$R\_se = \sqrt{\frac{(1 - pearson\_r^2)^2}{n\_sample - 1}}$$

$$R\_lo = pearson\_r - qt(.975, n\_sample - 2) * R\_se$$

$$R\_up = pearson\_r + qt(.975, n\_sample - 2) * R\_se$$

2. **The formula used to estimate the Fisher's z** are (Formula 12.28 & 12.29 in Cooper):

$$Z = atanh(r)$$

$$Z\_se = \frac{1}{n\_sample - 3}$$

$$Z\_ci\_lo = Z - qnorm(.975) * Z\_se$$

$$Z\_ci\_up = Z + qnorm(.975) * Z\_se$$

3. Several approaches can be used to convert a correlation coefficient to a SMD.

A. Mathur proposes to use this formula (Formula 1.2 in Mathur, `cor_to_smd = "mathur"`):

$$increase = ifelse(unit_type == "sd", unit\_increase\_iv * sd\_dv, unit\_increase\_iv)$$

$$d = \frac{r * increase}{sd_iv * \sqrt{1 - r^2}}$$

$$d\_se = abs(d) * \sqrt{\frac{1}{r^2 * (n\_sample - 3)} + \frac{1}{2 * (n\_sample - 1))}}$$

The resulting Cohen's d is the average increase in the dependent variable associated with an increase of x units in the independent variable (with x = `unit_increase_iv`).

B. Viechtbauer proposes to use the delta method to derive a Cohen's d from a correlation coefficient (Viechtbauer, 2023, `cor_to_smd = "viechtbauer"`)

C. Cooper proposes to use this formula (Formula 12.38 & 12.39 in Cooper, `cor_to_smd = cooper`):

$$increase = ifelse(unit_type == "sd", unit\_increase\_iv * sd\_dv, unit\_increase\_iv)$$

$$d = \frac{r * increase}{sd\_iv * \sqrt{1 - r^2}}$$

$$d\_se = abs(d) * \sqrt{\frac{1}{r^2 * (n\_sample - 3)} + \frac{1}{2 * (n\_sample - 1))}}$$

Note that this formula was initially proposed for converting a point-biserial correlation to Cohen's d. It will thus produce similar results to the `cor_to_smd = "mathur"` option only when `unit_type = "sd"` and `unit_increase_iv = 2`.

To know how the Cohen's d value is converted to other effect measures (G/OR), see details of the `es_from_cohen_d` function.

Value

This function estimates and converts between several effect size measures.

`natural effect size measure`	R + Z
`converted effect size measure`	D + G + OR
`required input data`	See 'Section 4. Pearson's r or Fisher's z' https://metaconvert.org/input.html

References

Cooper, H., Hedges, L.V., & Valentine, J.C. (Eds.). (2019). The handbook of research synthesis and meta-analysis. Russell Sage Foundation.

Mathur, M. B., & VanderWeele, T. J. (2020). A Simple, Interpretable Conversion from Pearson's Correlation to Cohen's for d Continuous Exposures. Epidemiology (Cambridge, Mass.), 31(2), e16–e18. https://doi.org/10.1097/EDE.0000000000001105

Viechtbauer W (2010). "Conducting meta-analyses in R with the metafor package." Journal of Statistical Software, 36(3), 1–48. doi:10.18637/jss.v036.i03.

Examples

```
es_from_pearson_r(
  pearson_r = .51, sd_iv = 0.24, n_sample = 214,
  unit_increase_iv = 1, unit_type = "sd"
)
```

---

es_from_phi — *Convert a phi value to several effect size measures*

Description

Convert a phi value to several effect size measures

Usage

```
es_from_phi(phi, n_cases, n_exp, n_sample, reverse_phi)
```

Arguments

phi	phi value
n_cases	total number of cases/events
n_exp	total number of participants in the exposed group
n_sample	total number of participants in the sample
reverse_phi	a logical value indicating whether the direction of generated effect sizes should be flipped.

Details

The functions computes an odds ratio (OR), risk ratio (RR), and number needed to treat (NNT) from the the phi coefficient, the total number of participants, the total number of cases and the total number of people exposed. Cohen's d (D) and Hedges' g (G) are tried to be obtained from the OR, or are converted using the approach by Lipsey et al. (2001). The correlation coefficients (R/Z) are converted by assuming that the phi coefficient is equal to a R, and the variances of R and Z are obtained using the approach proposed by Lipsey et al. (2001) as well as by our own calculations.

To estimate the OR, RR, NNT,, this function reconstructs a 2x2 table (using the approach proposed by Viechtbauer, 2023).

Then, the calculations of the `es_from_2x2()` function are applied.

To estimate the Cohen's d (D) and Hedges' g (G), the function first tries to convert it from the OR obtained using the approach described above. If not possible (e.g., the number of cases and exposed are missing) the function converts the Cohen's d from the Phi coefficient using the approach proposed by Lipsey et al. (2001):

$$d = \frac{2 * phi}{\sqrt{1 - phi^2}}$$

$$d\_se = \sqrt{\frac{d}{phi^2 * n\_sample}}$$

To estimate the correlation coefficients (R/Z), this function assumes that the phi coefficient is equal to a correlation coefficient, and then obtains the variance using the formula proposed by Lipsey et al. (2001):

$$r = phi$$

$$z = atanh(r)$$

$$z\_se = \frac{z^2}{phi^2 * n\_sample}$$

$$effective\_n = \frac{1}{z\_se + 3}$$

$$r\_se = \sqrt{\frac{(1 - r^2)^2}{effective\_n - 1}}$$

Note that the approach to determine the standard error of R was developed by our team.

Value

This function estimates and converts between several effect size measures.

`natural effect size measure`	OR + RR + NNT
`converted effect size measure`	D + G + R + Z
`required input data`	See 'Section 8. Phi or chi-square' https://metaconvert.org/input.html

References

Viechtbauer (2023). Accessed at https://wviechtb.github.io/metafor/reference/conv.2x2.html. Lipsey, M. W., & Wilson, D. B. (2001). Practical meta-analysis. Sage Publications, Inc.

Examples

```
es_from_phi(phi = 0.3, n_sample = 120, n_cases = 20, n_exp = 40)
```

`es_from_plot_ancova_means` *Converts the means and bounds of an error bar (generally extracted from a plot) into four effect measures (SMD, MD, OR, COR)*

Description

Converts the means and bounds of an error bar (generally extracted from a plot) into four effect measures (SMD, MD, OR, COR)

Usage

```
es_from_plot_ancova_means(
  n_exp,
  n_nexp,
  plot_ancova_mean_exp,
  plot_ancova_mean_nexp,
  plot_ancova_mean_sd_lo_exp,
  plot_ancova_mean_sd_lo_nexp,
  plot_ancova_mean_sd_up_exp,
  plot_ancova_mean_sd_up_nexp,
  plot_ancova_mean_se_lo_exp,
  plot_ancova_mean_se_lo_nexp,
  plot_ancova_mean_se_up_exp,
  plot_ancova_mean_se_up_nexp,
  plot_ancova_mean_ci_lo_exp,
  plot_ancova_mean_ci_lo_nexp,
  plot_ancova_mean_ci_up_exp,
  plot_ancova_mean_ci_up_nexp,
  cov_outcome_r,
  n_cov_ancova,
  smd_to_cor = "viechtbauer",
  reverse_plot_ancova_means
)
```

Arguments

`n_exp` number of participants in the experimental/exposed group.

`n_nexp` number of participants in the non-experimental/non-exposed group.

`plot_ancova_mean_exp`
ancova_mean of participants in the experimental/exposed group (extracted from a plot).

`plot_ancova_mean_nexp`
ancova_mean of participants in the non-experimental/non-exposed group (extracted from a plot).

`plot_ancova_mean_sd_lo_exp`
: lower bound of an error bar depicting -1 SD from the ancova_mean of the experimental/exposed group (extracted from a plot).

`plot_ancova_mean_sd_lo_nexp`
: lower bound of an error bar depicting -1 SD from the ancova_mean of the non-experimental/non-exposed group (extracted from a plot).

`plot_ancova_mean_sd_up_exp`
: upper bound of an error bar depicting +1 SD from the ancova_mean of the experimental/exposed group (extracted from a plot).

`plot_ancova_mean_sd_up_nexp`
: upper bound of an error bar depicting +1 SD from the ancova_mean of the non-experimental/non-exposed group (extracted from a plot).

`plot_ancova_mean_se_lo_exp`
: lower bound of an error bar depicting -1 SE from the ancova_mean of the experimental/exposed group (extracted from a plot).

`plot_ancova_mean_se_lo_nexp`
: lower bound of an error bar depicting -1 SE from the ancova_mean of the non-experimental/non-exposed group (extracted from a plot).

`plot_ancova_mean_se_up_exp`
: upper bound of an error bar depicting +1 SE from the ancova_mean of the experimental/exposed group (extracted from a plot).

`plot_ancova_mean_se_up_nexp`
: upper bound of an error bar depicting +1 SE from the ancova_mean of the non-experimental/non-exposed group (extracted from a plot).

`plot_ancova_mean_ci_lo_exp`
: lower bound of an error bar depicting the 95% CI of the ancova_mean of the experimental/exposed group (extracted from a plot).

`plot_ancova_mean_ci_lo_nexp`
: lower bound of an error bar depicting the 95% CI of the ancova_mean of the non-experimental/non-exposed group (extracted from a plot).

`plot_ancova_mean_ci_up_exp`
: upper bound of an error bar depicting the 95% CI of the ancova_mean of the experimental/exposed group (extracted from a plot).

`plot_ancova_mean_ci_up_nexp`
: upper bound of an error bar depicting the 95% CI of the ancova_mean of the non-experimental/non-exposed group (extracted from a plot).

`cov_outcome_r`
: correlation between the outcome and covariate (multiple correlation when multiple covariates are included in the ANCOVA model).

`n_cov_ancova`
: number of covariates in the ANCOVA model.

`smd_to_cor`
: formula used to convert the `cohen_d` value into a coefficient correlation (see details).

`reverse_plot_ancova_means`
: a logical value indicating whether the direction of the generated effect sizes should be flipped.

Details

This function uses the bounds of an error bar of a mean obtained from a plot into a standard deviation. Then, a mean difference (MD), Cohen's d (D), and Hedges' g (G) are estimated. Odds ratio (OR), risk ratio (RR) and correlation coefficients (R/Z) are converted from the Cohen's d value.

To convert the bound of an error bar into a standard deviation, this function always prioritizes information from the `plot_ancova_mean_sd_*` arguments, then those from the `plot_ancova_mean_se_*` arguments, then those from the `plot_ancova_mean_ci_*` arguments.

1. If the bounds of the standard deviations are provided, the following formulas are used:

$$ancova\_mean\_sd\_lo\_exp = plot\_ancova\_mean\_exp - plot\_ancova\_mean\_sd\_lo\_exp$$

$$ancova\_mean\_sd\_up\_exp = plot\_ancova\_mean\_sd\_up\_exp - plot\_ancova\_mean\_exp$$

$$ancova\_mean\_sd\_exp = \frac{ancova\_mean\_sd\_lo\_exp + ancova\_mean\_sd\_up\_exp}{2}$$

$$mean\_sd\_lo\_nexp = plot\_ancova\_mean\_nexp - plot\_ancova\_mean\_sd\_lo\_nexp$$

$$mean\_sd\_up\_nexp = plot\_ancova\_mean\_sd\_up\_nexp - plot\_ancova\_mean\_nexp$$

$$mean\_sd\_nexp = \frac{mean\_sd\_lo\_nexp + mean\_sd\_up\_nexp}{2}$$

Then, calculations of the `es_from_ancova_means_sd` are used.

1. If the bounds of the standard errors are provided, the following formulas are used:

$$ancova\_mean\_se\_lo\_exp = plot\_ancova\_mean\_exp - plot\_ancova\_mean\_se\_lo\_exp$$

$$ancova\_mean\_se\_up\_exp = plot\_ancova\_mean\_se\_up\_exp - plot\_ancova\_mean\_exp$$

$$ancova\_mean\_se\_exp = \frac{ancova\_mean\_se\_lo\_exp + ancova\_mean\_se\_up\_exp}{2}$$

$$mean\_se\_lo\_nexp = plot\_ancova\_mean\_nexp - plot\_ancova\_mean\_se\_lo\_nexp$$

$$mean\_se\_up\_nexp = plot\_ancova\_mean\_se\_up\_nexp - plot\_ancova\_mean\_nexp$$

$$mean\_se\_nexp = \frac{mean\_se\_lo\_nexp + mean\_se\_up\_nexp}{2}$$

Then, calculations of the `es_from_ancova_means_se` are used.

1. If the bounds of the 95% confidence intervals are provided, the calculations of the `es_from_ancova_means_ci()` are used.

Value

This function estimates and converts between several effect size measures.

natural effect size measure	MD + D + G
converted effect size measure	OR + R + Z
required input data	See 'Section 22. From plot: adjusted means and dispersion (adjusted)' https://metaconvert.org/input.html

Examples

```
es_from_plot_ancova_means(
  n_exp = 35, n_nexp = 35,
  cov_outcome_r = 0.2, n_cov_ancova = 4,
  plot_ancova_mean_exp = 89, plot_ancova_mean_nexp = 104,
  plot_ancova_mean_sd_lo_exp = 69, plot_ancova_mean_sd_lo_nexp = 83,
  plot_ancova_mean_sd_up_exp = 109, plot_ancova_mean_sd_up_nexp = 125
)
```

---

es_from_plot_means *Converts the means and bounds of an error bar (generally extracted from a plot) into four effect measures (SMD, MD, OR, COR)*

Description

Converts the means and bounds of an error bar (generally extracted from a plot) into four effect measures (SMD, MD, OR, COR)

Usage

```
es_from_plot_means(
  n_exp,
  n_nexp,
  plot_mean_exp,
  plot_mean_nexp,
  plot_mean_sd_lo_exp,
  plot_mean_sd_lo_nexp,
  plot_mean_sd_up_exp,
  plot_mean_sd_up_nexp,
  plot_mean_se_lo_exp,
  plot_mean_se_lo_nexp,
  plot_mean_se_up_exp,
  plot_mean_se_up_nexp,
  plot_mean_ci_lo_exp,
```

```
  plot_mean_ci_lo_nexp,
  plot_mean_ci_up_exp,
  plot_mean_ci_up_nexp,
  smd_to_cor = "viechtbauer",
  reverse_plot_means
)
```

Arguments

`n_exp` number of participants in the experimental/exposed group.

`n_nexp` number of participants in the non-experimental/non-exposed group.

`plot_mean_exp` mean of participants in the experimental/exposed group (extracted from a plot).

`plot_mean_nexp` mean of participants in the non-experimental/non-exposed group (extracted from a plot).

`plot_mean_sd_lo_exp`
lower bound of an error bar depicting -1 SD from the mean of the experimental/exposed group (extracted from a plot).

`plot_mean_sd_lo_nexp`
lower bound of an error bar depicting -1 SD from the mean of the non-experimental/non-exposed group (extracted from a plot).

`plot_mean_sd_up_exp`
upper bound of an error bar depicting +1 SD from the mean of the experimental/exposed group (extracted from a plot).

`plot_mean_sd_up_nexp`
upper bound of an error bar depicting +1 SD from the mean of the non-experimental/non-exposed group (extracted from a plot).

`plot_mean_se_lo_exp`
lower bound of an error bar depicting -1 SE from the mean of the experimental/exposed group (extracted from a plot).

`plot_mean_se_lo_nexp`
lower bound of an error bar depicting -1 SE from the mean of the non-experimental/non-exposed group (extracted from a plot).

`plot_mean_se_up_exp`
upper bound of an error bar depicting +1 SE from the mean of the experimental/exposed group (extracted from a plot).

`plot_mean_se_up_nexp`
upper bound of an error bar depicting +1 SE from the mean of the non-experimental/non-exposed group (extracted from a plot).

`plot_mean_ci_lo_exp`
lower bound of an error bar depicting the 95% CI of the mean of the experimental/exposed group (extracted from a plot).

`plot_mean_ci_lo_nexp`
lower bound of an error bar depicting the 95% CI of the mean of the non-experimental/non-exposed group (extracted from a plot).

`plot_mean_ci_up_exp`
upper bound of an error bar depicting the 95% CI of the mean of the experimental/exposed group (extracted from a plot).

plot_mean_ci_up_nexp
: upper bound of an error bar depicting the 95% CI of the mean of the non-experimental/non-exposed group (extracted from a plot).

smd_to_cor
: formula used to convert the cohen_d value into a coefficient correlation (see details).

reverse_plot_means
: a logical value indicating whether the direction of the generated effect sizes should be flipped.

Details

This function uses the bounds of an error bar of a mean obtained from a plot into a standard deviation. Then, a mean difference (MD), Cohen's d (D), and Hedges' g (G) are estimated. Odds ratio (OR), risk ratio (RR) and correlation coefficients (R/Z) are converted from the Cohen's d value.

To convert the bound of an error bar into a standard deviation, this function always prioritizes information from the plot_mean_sd_* arguments, then those from the plot_mean_se_* arguments, then those from the plot_mean_ci_* arguments.

1. If the bounds of the standard deviations are provided, the following formulas are used:

$$mean\_sd\_lo\_exp = plot\_mean\_exp - plot\_mean\_sd\_lo\_exp$$

$$mean\_sd\_up\_exp = plot\_mean\_sd\_up\_exp - plot\_mean\_exp$$

$$mean\_sd\_exp = \frac{mean\_sd\_lo\_exp + mean\_sd\_up\_exp}{2}$$

$$mean\_sd\_lo\_nexp = plot\_mean\_nexp - plot\_mean\_sd\_lo\_nexp$$

$$mean\_sd\_up\_nexp = plot\_mean\_sd\_up\_nexp - plot\_mean\_nexp$$

$$mean\_sd\_nexp = \frac{mean\_sd\_lo\_nexp + mean\_sd\_up\_nexp}{2}$$

Note that if only one bound (e.g., the upper bound) is provided, it will be the only information used to estimate the standard deviation value.

Then, calculations of the es_from_means_sd are used.

1. If the bounds of the standard errors are provided, the following formulas are used:

$$mean\_se\_lo\_exp = plot\_mean\_exp - plot\_mean\_se\_lo\_exp$$

$$mean\_se\_up\_exp = plot\_mean\_se\_up\_exp - plot\_mean\_exp$$

$$mean\_se\_exp = \frac{mean\_se\_lo\_exp + mean\_se\_up\_exp}{2}$$

$$mean\_se\_lo\_nexp = plot\_mean\_nexp - plot\_mean\_se\_lo\_nexp$$

$$mean\_se\_up\_nexp = plot\_mean\_se\_up\_nexp - plot\_mean\_nexp$$

$$mean\_se\_nexp = \frac{mean\_se\_lo\_nexp + mean\_se\_up\_nexp}{2}$$

Note that if only one bound (e.g., the upper bound) is provided, it will be the only information used to estimate the standard error value.

Then, calculations of the es_from_means_se() are used.

1. If the bounds of the 95% confidence intervals are provided, the calculations of the es_from_means_ci are used.

Value

This function estimates and converts between several effect size measures.

natural effect size measure	MD + D + G
converted effect size measure	OR + R + Z
required input data	See 'Section 21. From plot: means and dispersion (crude)' https://metaconvert.org/input.html

Examples

```
es_from_plot_means(
  n_exp = 35, n_nexp = 35,
  plot_mean_exp = 89, plot_mean_nexp = 104,
  plot_mean_sd_lo_exp = 69, plot_mean_sd_lo_nexp = 83,
  plot_mean_sd_up_exp = 109, plot_mean_sd_up_nexp = 125
)
```

---

es_from_pt_bis_r   *Convert a point-biserial correlation coefficient into several effect size measures*

Description

Convert a point-biserial correlation coefficient into several effect size measures

Usage

```
es_from_pt_bis_r(
  pt_bis_r,
  n_exp,
  n_nexp,
  smd_to_cor = "viechtbauer",
  reverse_pt_bis_r
)
```

Arguments

pt_bis_r	value of a point-biserial correlation coefficient
n_exp	total number of participants in the exposed group
n_nexp	total number of participants in the non exposed group
smd_to_cor	formula used to convert the pt_bis_r value into a coefficient correlation.
reverse_pt_bis_r	a logical value indicating whether the direction of the generated effect sizes should be flipped.

Details

This function uses a point-biserial correlation coefficient to estimate a Cohen's d (D) and Hedges' g (G). Odds ratio (OR) and correlation coefficients (R/Z) are then converted from the Cohen's d.

The formula used to obtain the Cohen's d are (Viechtbauer, 2021):

$$m = n\_exp + n\_nexp - 2$$

$$h = \frac{m}{n\_exp} + \frac{m}{n\_nexp}$$

$$d = \frac{pt\_bis\_r * \sqrt{h}}{\sqrt{1 - pt\_bis\_r^2}}$$

To estimate other effect size measures, calculations of the es_from_cohen_d() are applied.

Value

This function estimates and converts between several effect size measures.

natural effect size measure	D + G
converted effect size measure	OR + R + Z
required input data	See 'Section 11. ANOVA statistics, Student's t-test, or point-bis correlation' https://metaconvert.org/input.html

References

Viechtbauer (2021). Accessed at: https://stats.stackexchange.com/questions/526789/convert-correlation-r-to-cohens-d-unequal-groups-of-known-size

Examples

```
es_from_pt_bis_r(pt_bis_r = 0.2, n_exp = 121, n_nexp = 121)
```

es_from_pt_bis_r_pval *Convert a p-value of a point-biserial correlation coefficient into several effect size measures*

Description

Convert a p-value of a point-biserial correlation coefficient into several effect size measures

Usage

```
es_from_pt_bis_r_pval(
  pt_bis_r_pval,
  n_exp,
  n_nexp,
  smd_to_cor = "viechtbauer",
  reverse_pt_bis_r_pval
)
```

Arguments

`pt_bis_r_pval`	p-value of a point-biserial correlation coefficient
`n_exp`	total number of participants in the exposed group
`n_nexp`	total number of participants in the non exposed group
`smd_to_cor`	formula used to convert the `pt_bis_r_pval` value into a coefficient correlation.
`reverse_pt_bis_r_pval`	a logical value indicating whether the direction of the generated effect sizes should be flipped.

Details

This function converts the p-value of a point biserial correlation into a Student's t-value.

The formula used to obtain this Student's t-value is:

$$t = pt(\frac{pt\_bis\_r\_pval}{2}, df = n\_exp + n\_nexp - 2)$$

Calculations of the `es_from_student_t` function are then applied.

Value

This function estimates and converts between several effect size measures.

natural effect size measure	D + G
converted effect size measure	OR + R + Z

`required input data` See 'Section 11. ANOVA statistics, Student's t-test, or point-bis correlation' https://metaconvert.org/input.html

References

Lipsey, M. W., & Wilson, D. B. (2001). Practical meta-analysis. Sage Publications, Inc.

Examples

```
es_from_pt_bis_r_pval(pt_bis_r_pval = 0.2, n_exp = 121, n_nexp = 121)
```

---

es_from_rr_ci — *Convert a risk ratio value and 95% confidence interval to various effect size measures*

Description

Convert a risk ratio value and 95% confidence interval to various effect size measures

Usage

```
es_from_rr_ci(
  rr,
  rr_ci_lo,
  rr_ci_up,
  logrr,
  logrr_ci_lo,
  logrr_ci_up,
  baseline_risk,
  n_exp,
  n_nexp,
  n_cases,
  n_controls,
  rr_to_or = "metaumbrella",
  smd_to_cor = "viechtbauer",
  max_asymmetry = 10,
  reverse_rr
)
```

Arguments

`rr`	risk ratio value
`rr_ci_lo`	lower bound of the 95% CI around the risk ratio value
`rr_ci_up`	upper bound of the 95% CI around the risk ratio value

logrr	log risk ratio value
logrr_ci_lo	lower bound of the 95% CI around the log risk ratio value
logrr_ci_up	upper bound of the 95% CI around the log risk ratio value
baseline_risk	proportion of cases in the non-exposed group (only required for the rr_to_or = "grant_CI" and rr_to_or = "grant_2x2" arguments).
n_exp	number of participants in the exposed group (only required for the rr_to_or = "grant_CI", rr_to_or = "grant_2x2" arguments).
n_nexp	number of participants in the non-exposed group (only required for the rr_to_or = "grant_CI", rr_to_or = "grant_2x2" arguments).
n_cases	number of cases/events
n_controls	number of controls/no-event
rr_to_or	formula used to convert the rr value into an odds ratio (see details).
smd_to_cor	formula used to convert the SMD value (converted from RR) into a coefficient correlation (see es_from_cohen_d).
max_asymmetry	A percentage indicating the tolerance before detecting asymmetry in the 95% CI bounds.
reverse_rr	a logical value indicating whether the direction of the generated effect sizes should be flipped.

Details

This function uses the 95% CI of the (log) risk ratio to obtain the standard error (Section 6.5.2.2 in the Cochrane Handbook).

$$logrr\_se = \frac{\log rr\_ci\_up - \log rr\_ci\_lo}{2 * qnorm(.975)}$$

Then, calculations of the es_from_rr_se() are applied.

Value

This function estimates and converts between several effect size measures.

natural effect size measure	RR
converted effect size measure	OR + NNT
required input data	See 'Section 3. Risk Ratio' https://metaconvert.org/input.html

References

Higgins JPT, Li T, Deeks JJ (editors). Chapter 6: Choosing effect size measures and computing estimates of effect. In: Higgins JPT, Thomas J, Chandler J, Cumpston M, Li T, Page MJ, Welch VA (editors). Cochrane Handbook for Systematic Reviews of Interventions version 6.3 (updated February 2022). Cochrane, 2022. Available from www.training.cochrane.org/handbook.

Examples

```
es_from_rr_ci(
  rr = 1, rr_ci_lo = 0.5, rr_ci_up = 2,
  n_cases = 42, n_controls = 38, baseline_risk = 0.08
)
```

`es_from_rr_pval` *Convert a risk ratio value and its p-value to various effect size measures*

Description

Convert a risk ratio value and its p-value to various effect size measures

Usage

```
es_from_rr_pval(
  rr,
  logrr,
  rr_pval,
  baseline_risk,
  n_exp,
  n_nexp,
  n_cases,
  n_controls,
  rr_to_or = "metaumbrella",
  smd_to_cor = "viechtbauer",
  reverse_rr_pval
)
```

Arguments

`rr`	risk ratio value
`logrr`	log risk ratio value
`rr_pval`	p-value of the risk ratio
`baseline_risk`	proportion of cases in the non-exposed group (only required for the `rr_to_or = "grant_CI"` and `rr_to_or = "grant_2x2"` arguments).
`n_exp`	number of participants in the exposed group (only required for the `rr_to_or = "grant_CI"`, `rr_to_or = "grant_2x2"` arguments).
`n_nexp`	number of participants in the non-exposed group (only required for the `rr_to_or = "grant_CI"`, `rr_to_or = "grant_2x2"` arguments).
`n_cases`	number of cases/events
`n_controls`	number of controls/no-event
`rr_to_or`	formula used to convert the `rr` value into an odds ratio (see details).

`smd_to_cor` formula used to convert the SMD value (converted from RR) into a coefficient correlation (see `es_from_cohen_d`).

`reverse_rr_pval` a logical value indicating whether the direction of the generated effect sizes should be flipped.

Details

This function uses the p-value of the (log) risk ratio to obtain the standard error (Section 6.3.2 in the Cochrane Handbook).

$$logrr\_z = qnorm(rr_pval/2, lower.tail = FALSE)$$

$$logrr\_se = |\frac{\log(rr)}{logrr\_z}|$$

Then, calculations of `es_from_rr_se` are applied.

Value

This function estimates and converts between several effect size measures.

natural effect size measure	RR
converted effect size measure	OR + NNT
required input data	See 'Section 3. Risk Ratio' https://metaconvert.org/input.html

References

Higgins, J. P., Thomas, J., Chandler, J., Cumpston, M., Li, T., Page, M. J., & Welch, V. A. (Eds.). (2019). Cochrane handbook for systematic reviews of interventions. John Wiley & Sons.

Examples

```
es_rr <- es_from_rr_pval(
  rr = 3.51, rr_pval = 0.001,
  n_cases = 12, n_controls = 68
)
```

es_from_rr_se *Convert a risk ratio value and standard error to various effect size measures*

Description

Convert a risk ratio value and standard error to various effect size measures

Usage

```
es_from_rr_se(
  rr,
  logrr,
  logrr_se,
  baseline_risk,
  n_exp,
  n_nexp,
  n_cases,
  n_controls,
  smd_to_cor = "viechtbauer",
  rr_to_or = "metaumbrella",
  reverse_rr
)
```

Arguments

rr	risk ratio value
logrr	log risk ratio value
logrr_se	standard error of the log risk ratio
baseline_risk	proportion of cases in the non-exposed group
n_exp	number of participants in the exposed group
n_nexp	number of participants in the non-exposed group
n_cases	number of cases/events
n_controls	number of controls/no-event
smd_to_cor	formula used to convert the SMD value (converted from RR) into a coefficient correlation (see es_from_cohen_d).
rr_to_or	formula used to convert the rr value into an odds ratio (see details).
reverse_rr	a logical value indicating whether the direction of the generated effect sizes should be flipped.

Details

This function converts the (log) risk ratio (RR) value and its standard error to odds ratio (OR) and number needed to treat.

To estimate the odds ratio and its standard error, various formulas can be used.

A. First, the approach described in Grant (2014) can be used. However, in the paper, only the formula to convert an RR value to a OR value is described. To derive the variance, we used this formula to convert the bounds of the 95% CI, which were then used to obtain the variance.

This argument requires (rr + baseline_risk + rr_ci_lo + rr_ci_up) to generate a RR. The following formulas are used (br = baseline_risk):

$$or = \frac{rr * (1 - br)}{1 - rr * br}$$

$$or\_ci\_lo = \frac{rr\_ci\_lo}{1 - br + br * rr\_ci\_lo}$$

$$or\_ci\_up = \frac{rr\_ci\_up}{1 - br + br * rr\_ci\_up}$$

$$logor\_se = \frac{log(or\_ci\_up) - log(or\_ci\_lo)}{2 * qnorm(.975)}$$

B. Second, the formulas implemented in the metaumbrella package can be used (`or_to_rr = "metaumbrella_exp"`). This argument requires (rr + logrr_se + n_exp + n_nexp) to generate a OR. More precisely, we previously developed functions that simulate all combinations of the possible number of cases and controls in the exposed and non-exposed groups compatible with the actual value of the RR. Then, the functions select the contingency table whose standard error coincides best with the standard error reported. The RR value and its standard are obtained from this estimated contingency table.

C. Third, it is possible to transpose the RR to a OR (`rr_to_or = "transpose"`). This argument requires (rr + logrr_se) to generate a OR. It is known that OR and RR are similar when the baseline risk is small. Therefore, users can request to simply transpose the RR value & standard error into a OR value & standard error.

$$or = rr$$

$$logor\_se = logrr\_se$$

D. Fourth, it is possible to recreate the 2x2 table using the dipietrantonj's formulas (`rr_to_or = "dipietrantonj"`). This argument requires (rr + logrr_ci_lo + logrr_ci_lo) to generate a OR. Information on this approach can be retrieved in Di Pietrantonj (2006).

To estimate the NNT, the formulas used are :

$$nnt = \frac{1}{br * (1 - rr)}$$

Value

This function estimates and converts between several effect size measures.

`natural effect size measure`	RR

`converted effect size measure`	OR + NNT
`required input data`	See 'Section 3. Risk Ratio' https://metaconvert.org/input.html

References

Di Pietrantonj C. (2006). Four-fold table cell frequencies imputation in meta analysis. Statistics in medicine, 25(13), 2299–2322. https://doi.org/10.1002/sim.2287

Gosling, C. J., Solanes, A., Fusar-Poli, P., & Radua, J. (2023). metaumbrella: the first comprehensive suite to perform data analysis in umbrella reviews with stratification of the evidence. BMJ mental health, 26(1), e300534. https://doi.org/10.1136/bmjment-2022-300534

Grant R. L. (2014). Converting an odds ratio to a range of plausible relative risks for better communication of research findings. BMJ (Clinical research ed.), 348, f7450. https://doi.org/10.1136/bmj.f7450

Veroniki, A. A., Pavlides, M., Patsopoulos, N. A., & Salanti, G. (2013). Reconstructing 2x2 contingency tables from odds ratios using the Di Pietrantonj method: difficulties, constraints and impact in meta-analysis results. Research synthesis methods, 4(1), 78–94. https://doi.org/10.1002/jrsm.1061

Examples

```
es_from_rr_se(rr = 2.12, logrr_se = 0.242, n_exp = 120, n_nexp = 44)
```

`es_from_student_t` *Convert a Student's t-test value to several effect size measures*

Description

Convert a Student's t-test value to several effect size measures

Usage

```
es_from_student_t(
  student_t,
  n_exp,
  n_nexp,
  smd_to_cor = "viechtbauer",
  reverse_student_t
)
```

Arguments

student_t	Student's t-test value.
n_exp	number of participants in the experimental/exposed group.
n_nexp	number of participants in the non-experimental/non-exposed group.
smd_to_cor	formula used to convert the student_t value into a coefficient correlation (see details).
reverse_student_t	a logical value indicating whether the direction of generated effect sizes should be flipped.

Details

This function converts the Student's t-test value into a Cohen's d (D) and Hedges' g (G), Odds ratio (OR) and correlation coefficients (R/Z) are then converted from the Cohen's d.

To estimate a Cohen's d the formula used is (table 12.1 in Cooper):

$$cohen\_d = student\_t * \sqrt{\frac{(n\_exp + n\_nexp)}{n\_exp * n\_nexp}}$$

To estimate other effect size measures, calculations of the es_from_cohen_d() are applied.

Value

This function estimates and converts between several effect size measures.

natural effect size measure	D + G
converted effect size measure	OR + R + Z
required input data	See 'Section 11. ANOVA statistics, Student's t-test, or point-bis correlation' https://metaconvert.org/html/input.html

References

Cooper, H., Hedges, L.V., & Valentine, J.C. (Eds.). (2019). The handbook of research synthesis and meta-analysis. Russell Sage Foundation.

Examples

```
es_from_student_t(student_t = 2.1, n_exp = 20, n_nexp = 22)
```

`es_from_student_t_pval` *Convert a Student's t-test p-value to several effect size measures*

Description

Convert a Student's t-test p-value to several effect size measures

Usage

```
es_from_student_t_pval(
  student_t_pval,
  n_exp,
  n_nexp,
  smd_to_cor = "viechtbauer",
  reverse_student_t_pval
)
```

Arguments

`student_t_pval`	p-value (two-tailed) from a Student's t-test. If your p-value is one-tailed, simply multiply it by two.
`n_exp`	number of participants in the experimental/exposed group.
`n_nexp`	number of participants in the non-experimental/non-exposed group.
`smd_to_cor`	formula used to convert the `student_t_pval` value into a coefficient correlation (see details).
`reverse_student_t_pval`	a logical value indicating whether the direction of generated effect sizes should be flipped.

Details

This function converts the Student's t-test p-value into a t-value, and then relies on the calculations of the `es_from_student_t()` function.

To convert the p-value into a t-value, the following formula is used (table 12.1 in Cooper):

$$student\_t = qt(\frac{student\_t\_pval}{2}, df = n\_exp + n\_nexp - 2)$$

Then, calculations of the `es_from_student_t()` are applied.

Value

This function estimates and converts between several effect size measures.

`natural effect size measure` D + G

converted effect size measure	OR + R + Z
required input data	See 'Section 11. ANOVA statistics, Student's t-test, or point-bis correlation' https://metaconvert.org/html/input.html

References

Cooper, H., Hedges, L.V., & Valentine, J.C. (Eds.). (2019). The handbook of research synthesis and meta-analysis. Russell Sage Foundation.

Examples

```
es_from_student_t_pval(student_t_pval = 0.24, n_exp = 20, n_nexp = 22)
```

---

es_from_user_adj *Directly input an adjusted value + variance of an effect size measure*

Description

Directly input an adjusted value + variance of an effect size measure

Usage

```
es_from_user_adj(
  measure,
  user_es_measure_adj,
  user_es_adj,
  user_se_adj,
  user_ci_lo_adj,
  user_ci_up_adj,
  max_asymmetry = 10
)
```

Arguments

measure	the effect size measure used in calculations (must be one of the 11 effect size measures available in metaConvert)
user_es_measure_adj	the name of the effect size measure that will appear when this function is called by the convert_df function (can be any character string)
user_es_adj	adjusted effect size value
user_se_adj	adjusted standard error of the effect size
user_ci_lo_adj	adjusted lower bound of the 95% CI around the effect size value

`user_ci_up_adj` adjusted upper bound of the 95% CI around the effect size value

`max_asymmetry` A percentage indicating the tolerance before detecting asymmetry in the 95% CI bounds.

Details

This function is a generic function allowing to include any adjusted effect size measure value + variance. Importantly, with this function, no conversions are performed (i.e., the effect size value + variance you enter is the value + variance exported by this function).

Value

This function allows to directly input any of the 11 effect size measures

`natural effect size measure`	Any of the 11 available measures
`converted effect size measure`	No conversion performed
`required input data`	See 'Section 24. User's input (adjusted)' https://metaconvert.org/input.html

Examples

```
dat = data.frame(measure = "OR", user_es_measure_adj = "adjusted OR",
                 user_es_adj = -0.04, user_se_adj = 0.2)
summary(convert_df(dat, measure="logor"))
```

`es_from_user_crude` *Directly input a value + variance of an effect size measure*

Description

Directly input a value + variance of an effect size measure

Usage

```
es_from_user_crude(
  measure,
  user_es_measure_crude,
  user_es_crude,
  user_se_crude,
  user_ci_lo_crude,
  user_ci_up_crude,
  max_asymmetry = 10
)
```

Arguments

`measure`	the effect size measure used in calculations (must be one of the 11 effect size measures available in metaConvert)
`user_es_measure_crude`	the name of the effect size measure that will appear when this function is called by the convert_df function (can be any character string)
`user_es_crude`	effect size value
`user_se_crude`	standard error of the effect size
`user_ci_lo_crude`	lower bound of the 95% CI around the effect size value
`user_ci_up_crude`	upper bound of the 95% CI around the effect size value
`max_asymmetry`	A percentage indicating the tolerance before detecting asymmetry in the 95% CI bounds.

Details

This function is a generic function allowing to include any crude effect size measure value + variance. Importantly, with this function, no conversions are performed (i.e., the effect size value + variance you enter is the value + variance exported by this function).

Value

This function allows to directly input any of the 11 effect size measures

`natural effect size measure`	Any of the 11 available measures
`converted effect size measure`	No conversion performed
`required input data`	See 'Section 23. User's input (crude)' https://metaconvert.org/input.html

Examples

```
dat = data.frame(measure = "OR", user_es_measure_crude = "mortality rate ratio",
                 user_es_crude = -0.04, user_se_crude = 0.2)
summary(convert_df(dat, measure="logor"))
```

es_variab_from_means_ci *Title*

Description

Title

Usage

```
es_variab_from_means_ci(
  mean_exp,
  mean_nexp,
  mean_ci_lo_exp,
  mean_ci_up_exp,
  mean_ci_lo_nexp,
  mean_ci_up_nexp,
  n_exp,
  n_nexp,
  reverse_means_variability
)
```

Arguments

`mean_exp`	mean of participants in the experimental/exposed group.
`mean_nexp`	mean of participants in the non-experimental/non-exposed group.
`mean_ci_lo_exp`	lower bound of the 95% CI of the mean of the experimental/exposed group
`mean_ci_up_exp`	upper bound of the 95% CI of the mean of the experimental/exposed group
`mean_ci_lo_nexp`	lower bound of the 95% CI of the mean of the non-experimental/non-exposed group.
`mean_ci_up_nexp`	upper bound of the 95% CI of the mean of the non-experimental/non-exposed group.
`n_exp`	number of participants in the experimental/exposed group.
`n_nexp`	number of participants in the non-experimental/non-exposed group.
`reverse_means_variability`	a logical value indicating whether the direction of the generated effect sizes should be flipped.

Details

This function converts the bounds of the 95% CI of the means of two independent groups into standard errors.

$$mean\_se\_exp = \frac{mean\_ci\_up\_exp - mean\_ci\_lo\_exp}{2 * qt(0.975, df = n\_exp - 1)}$$

$$mean\_se\_nexp = \frac{mean\_ci\_up\_nexp - mean\_ci\_lo\_nexp}{2 * qt(0.975, df = n\_nexp - 1)}$$

Then, calculations of the es_variab_from_means_se are applied.

Value

This function estimates VR and CVR

natural effect size measure	VR + CVR
converted effect size measure	No conversion performed
required input data	See 'Section 23. User's input (crude)' https://metaconvert.org/html/input.html

References

Senior, A. M., Viechtbauer, W., & Nakagawa, S. (2020). Revisiting and expanding the meta-analysis of variation: The log coefficient of variation ratio. Research Synthesis Methods, 11(4), 553-567. https://doi.org/10.1002/jrsm.1423

Examples

```
es_variab_from_means_ci(
  mean_exp = 42, mean_ci_lo_exp = 32, mean_ci_up_exp = 52,
  mean_nexp = 42, mean_ci_lo_nexp = 37, mean_ci_up_nexp = 47,
  n_exp = 43, n_nexp = 34
)
```

---

es_variab_from_means_sd *Convert means and/or standard deviations of two independent groups into two effect measures (VR/CVR)*

Description

Convert means and/or standard deviations of two independent groups into two effect measures (VR/CVR)

Usage

```
es_variab_from_means_sd(
  mean_exp,
  mean_nexp,
  mean_sd_exp,
```

```
    mean_sd_nexp,
    n_exp,
    n_nexp,
    reverse_means_variability
  )
```

Arguments

`mean_exp` mean of participants in the experimental/exposed group.

`mean_nexp` mean of participants in the non-experimental/non-exposed group.

`mean_sd_exp` standard deviation of participants in the experimental/exposed group.

`mean_sd_nexp` standard deviation of participants in the non-experimental/non-exposed group.

`n_exp` number of participants in the experimental/exposed group.

`n_nexp` number of participants in the non-experimental/non-exposed group.

`reverse_means_variability`
a logical value indicating whether the direction of the generated effect sizes should be flipped.

Details

This function converts the means and standard deviations of two independent groups into a log variability ratio (VR) and a log coefficient of variation ratio (CVR).

The formulas used to obtain the log VR are (formulas 5 and 15, Senior et al. 2020):

$$logvr = log(\frac{mean\_sd\_exp}{mean\_sd\_nexp}) + \frac{1}{2*(n\_exp-1)} - \frac{1}{2*(n\_nexp-1)}$$

$$logvr\_se = \sqrt{\frac{1}{2}*(\frac{n\_nexp}{(n\_nexp-1)^2} + \frac{n\_exp}{(n\_exp-1)^2})}$$

$$logvr\_ci\_lo = logvr - qnorm(.975) * logvr\_se$$

$$logvr\_ci\_up = logvr + qnorm(.975) * logvr\_se$$

The formulas used to obtain the log CVR are (formulas 6 and 16, Senior et al. 2020):

$$cvt = mean\_sd\_exp/mean\_exp$$

$$cvc = mean\_sd\_nexp/mean\_nexp$$

$$logcvr = log(\frac{cvt}{cvc}) + \frac{1}{2}*(\frac{1}{n\_exp-1} - \frac{1}{n\_nexp-1}) + \frac{1}{2}*(\frac{mean\_sd\_nexp^2}{n\_nexp*mean\_nexp^2} - \frac{mean\_sd\_exp^2}{n\_exp*mean\_exp^2})$$

$$vt\_exp = \frac{mean\_sd\_exp^2}{n\_exp*mean\_exp^2} + \frac{mean\_sd\_exp^4}{2*n\_exp^2*mean\_exp^4} + \frac{n\_exp}{(n\_exp-1)^2}$$

$$vt\_nexp = \frac{mean\_sd\_nexp^2}{n\_nexp*mean\_nexp^2} + \frac{mean\_sd\_nexp^4}{2*n\_nexp^2*mean\_nexp^4} + \frac{n\_nexp}{(n\_nexp-1)^2}$$

$$logcvr\_se = \sqrt{vt\_exp + vt\_nexp}$$

$$logcvr\_ci\_lo = logcvr - qnorm(.975) * logcvr\_se$$

$$logcvr\_ci\_up = logcvr + qnorm(.975) * logcvr\_se$$

Value

This function estimates VR and CVR

`natural effect size measure`	VR + CVR
`converted effect size measure`	No conversion performed
`required input data`	See 'Section 23. User's input (crude)' https://metaconvert.org/html/input.html

References

Senior, A. M., Viechtbauer, W., & Nakagawa, S. (2020). Revisiting and expanding the meta-analysis of variation: The log coefficient of variation ratio. Research Synthesis Methods, 11(4), 553-567. https://doi.org/10.1002/jrsm.1423

Examples

```
es_variab_from_means_sd(
  n_exp = 55, n_nexp = 55,
  mean_exp = 2.3, mean_sd_exp = 1.2,
  mean_nexp = 1.9, mean_sd_nexp = 0.9
)
```

`es_variab_from_means_se` *Convert means and/or standard errors of two independent groups into two effect measures (VR/CVR)*

Description

Convert means and/or standard errors of two independent groups into two effect measures (VR/CVR)

Usage

```
es_variab_from_means_se(
  mean_exp,
  mean_nexp,
  mean_se_exp,
  mean_se_nexp,
  n_exp,
  n_nexp,
  reverse_means_variability
)
```

Arguments

`mean_exp`	mean of participants in the experimental/exposed group.
`mean_nexp`	mean of participants in the non-experimental/non-exposed group.
`mean_se_exp`	standard error of participants in the experimental/exposed group.
`mean_se_nexp`	standard error of participants in the non-experimental/non-exposed group.
`n_exp`	number of participants in the experimental/exposed group.
`n_nexp`	number of participants in the non-experimental/non-exposed group.
`reverse_means_variability`	a logical value indicating whether the direction of the generated effect sizes should be flipped.

Details

This function converts the standard errors into standard deviations.

$$mean\_sd\_exp = mean\_se\_exp * \sqrt{n\_exp - 1}$$

$$mean\_sd\_nexp = mean\_se\_nexp * \sqrt{n\_nexp - 1}$$

Then, calculations of the `es_variab_from_means_sd` are applied.

Value

This function estimates VR and CVR

`natural effect size measure`	VR + CVR
`converted effect size measure`	No conversion performed
`required input data`	See 'Section 23. User's input (crude)' https://metaconvert.org/html/input.html

References

Senior, A. M., Viechtbauer, W., & Nakagawa, S. (2020). Revisiting and expanding the meta-analysis of variation: The log coefficient of variation ratio. Research Synthesis Methods, 11(4), 553-567. https://doi.org/10.1002/jrsm.1423

Examples

```
es_variab_from_means_se(
  mean_exp = 42, mean_se_exp = 11,
  mean_nexp = 42, mean_se_nexp = 15,
  n_exp = 43, n_nexp = 34
)
```

print.metaConvert — *Print a summary of an object of class "metaConvert"*

Description

Print a summary of an object of class "metaConvert"

Usage

```
## S3 method for class 'metaConvert'
print(x, ...)
```

Arguments

x	an object of class "metaConvert"
...	other arguments that can be passed to the function

Details

Summary method for objects of class "metaConvert".

Value

Implicitly calls the `summary.metaConvert` function.

See Also

`summary.metaConvert`

Examples

```
### print the results of an object of class metaConvert
convert_df(df.haza, measure = "g")
```

see_input_data — *Overview of effect size measures generated from each type of input data*

Description

Overview of effect size measures generated from each type of input data

Usage

```
see_input_data(
  measure = c("all", "d", "g", "md", "or", "rr", "nnt", "r", "z", "logvr", "logcvr",
    "irr"),
  type_of_measure = c("natural+converted", "natural"),
  name = "mcv_input_data",
  extension = c("data.frame", ".txt", ".csv", ".xlsx"),
  verbose = TRUE
)
```

Arguments

`measure`	Target effect size measure (one of the 11 available in metaConvert). Default is "all".
`type_of_measure`	One of "natural+converted" or "natural" (see details).
`name`	Name of the file created
`extension`	Extension of the file created. Most common are ".xlsx", ".csv" or ".txt". It is also possible to generate an R dataframe object by using the "data.frame" extension.
`verbose`	logical variable indicating whether some information should be printed (e.g., the location where the sheet is created when using ".xlsx", ".csv" or ".txt" extensions)

Details

This function generates, on your computer on in the console, a dataset showing each effect size measure computed from each type of input data. The exact combination and names of input data required are available in the links.

The `measure` argument allows to filter the dataset created. Only the input data allowing to estimate the selected effect size measure will be shown. Default is "all". The `type_of_measure` argument allows to filter the dataset created.

- If "natural+converted" is selected, the dataset will contain all input data allowing to naturally estimate and to convert the selected effect size measure
- If "natural" is selected, the dataset will contain all input data allowing to naturally estimate the selected effect size measure

Extension:

You can export a file in various formats outside R (by indicating, for example, ".txt", ".xlsx", or ".csv") in the `extension` argument. You can also visualise this dataset directly in R by setting `extension = "R"`.

This table is designed to be used in combination with tables showing the combination of input data leading to estimate each of the effect size measures (https://metaconvert.org/html/input.html)

Value

This function returns a table dataset presenting the input data enabling to compute each effect size measure.

Examples

```
see_input_data(measure = "md", extension = "data.frame")
```

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summary.metaConvert — *Synthesize information of an object of class "metaConvert" into a dataframe*

Description

Synthesize information of an object of class "metaConvert" into a dataframe

Usage

```
## S3 method for class 'metaConvert'
summary(object, digits = 3, ...)
```

Arguments

`object`	an object of class "metaConvert"
`digits`	an integer value specifying the number of decimal places for the rounding of numeric values. Default is 3.
`...`	other arguments that can be passed to the function

Details

Summary method for objects of class "metaConvert" produced by the `convert_df` function. This function automatically:

1. computes all effect sizes from all available input data
2. selects, if requested, a main effect size for each association/comparison using the information passed by the user in the `es_selected` argument of the `convert_df` function
3. identifies the smallest and largest effect size for each association/comparison
4. estimates the absolute difference between the smallest and largest effect size for each association/comparison
5. estimates the percentage of overlap between the 95% confidence intervals of the smallest and largest effect size for each association/comparison

Value

This function returns a dataframe with many columns. We present below the information stored in each column of the returned dataframe

1. Raw user information. The first columns placed at the left of the returned dataset are simply information provided by the users to facilitate the identification of each row. If the following columns are missing in the original dataset, these columns will not appear in the returned dataset.

`row_id`	Row number in the original dataset.
`study_id`	Identifier of the study.
`author`	Name of the author of the study.
`year`	Year of publication of the study.
`predictor`	Name of the predictor (intervention, risk factor, etc.).
`outcome`	Name of the outcome.
`info_expected`	Types of input data users expect to be used to estimate their effect size measure.

2. Information on generated effect sizes. Then, the function returns information on calculations. For example, users can retrieve the effect size measure estimated, the number and type(s) of input data allowing to estimate the chosen effect size measure, and the method used to obtain a unique effect size if overlapping input data were available. These columns could have several suffix.

- If users requested to separate crude and adjusted estimates, then the following columns will be presented with both a "_crude" suffix and a "_adjusted" suffix.
- If users did not request to separate the presentation of crude and adjusted estimates, the following columns will have no suffix.

For example, let's take column "all_info". It can be "all_info_crude" (all input data used to estimate any crude effect size), "all_info_adjusted" (all input data leading to estimate any adjusted effect size), or "all_info" (all input data leading to estimate any crude or adjusted effect sizes).

To facilitate the presentation, we thus refer to these columns as `name_of_the_column*`, the `*` meaning that it could end by _crude, _adjusted or "".

`all_info*`	list of input data available in the dataset that was used to estimate any effect size measure.
`measure*`	effect size measure requested by the user.
`info_measure*`	input data available to estimate the requested effect size measure.
`n_estimations*`	number of input data available to estimate the requested effect size measure.
`es_selected*`	method chosen by users to estimate the main effect size when overlapping data are present.
`info_used*`	type of input data used to estimate the main effect size.

3. Main effect size. The following columns contain the key information, namely, the main effect size + standard error + 95% CI.

Again, the suffix of these columns can vary depending on the separation of effect sizes estimated from crude and adjusted input data.

es*	main effect size value.
se*	standard error of the effect size.
es_ci_lo*	lower bound of the 95% CI around the effect size.
es_ci_up*	upper bound of the 95% CI around the effect size.

4. Overlapping effect sizes These columns are useful ONLY if a given comparison (i.e., row) has multiple input data enabling to compute the requested effect size measure.

These columns identify the smallest/largest effect size per comparison, and some indicators of consistency.

Again, the suffix of these columns can vary depending on the separation of effect sizes estimated from crude and adjusted input data.

min_info*	type of input data leading to the smallest effect size for the comparison.
min_es_value*	smallest effect size value for the comparison.
min_es_se*	standard error of the smallest effect size for the comparison.
min_es_ci_lo*	lower bound of the 95% CI of the smallest effect size for the comparison.
min_es_ci_up*	upper bound of the 95% CI of the smallest effect size for the comparison.

max_info*	type of input data leading to the largest effect size for the comparison.
max_es_value*	largest effect size value for the comparison.
max_es_se*	standard error of the largest effect size for the comparison.
max_es_ci_lo*	lower bound of the 95% CI of the largest effect size for the comparison.
max_es_ci_up*	upper bound of the 95% CI of the largest effect size for the comparison.

diff_min_max*	difference between the smallest and largest effect size for the comparison.

overlap_min_max*	% of overlap between the 95% CIs of the largest/smallest effect sizes for the comparison.
dispersion_es*	standard deviation of all effect sizes for the comparison.

See Also

metaConvert-package for the formatting of well-formatted datasets
convert_df for estimating effect sizes from a dataset

Examples

```
### generate a summary of the results of an umbrella object
summary(
  convert_df(df.haza, measure = "g"),
  digits = 5)
```

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