Package 'esc'

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Title Effect Size Computation for Meta Analysis

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Description Implementation of the web-based 'Practical Meta-Analysis Effect Size Calculator' from David B. Wilson (<http://www.campbellcollaboration.org/escalc/html/EffectSizeCalculator-Home.php>) in R. Based on the input, the effect size can be returned as standardized mean difference, Cohen's f, Hedges' g, Pearson's r or Fisher's transformation z, odds ratio or log odds, or eta squared effect size.

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Depends R (>= 3.2), stats

Imports utils

URL https://strengejacke.github.io/esc

BugReports https://github.com/strengejacke/esc/issues

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R topics documented:

`esc-package` *Effect Size Computation for Meta Analysis*

Description

This is an R implementation of the web-based 'Practical Meta-Analysis Effect Size Calculator' from David B. Wilson.

Based on the input, the effect size can be returned as standardized mean difference (`d`), Hedges' `g`, correlation coefficient effect size `r` or Fisher's transformation `z`, odds ratio or log odds effect size.

Return values

The return value of all functions has the same structure:

- The effect size, whether being `d`, `g`, `r`, (Cox) odds ratios or (Cox) logits, is always named `es`.
- The standard error of the effect size, `se`.
- The variance of the effect size, `var`.
- The lower and upper confidence limits `ci.lo` and `ci.hi`.
- The weight factor, based on the inverse-variance, `w`.
- The total sample size `totaln`.
- The effect size measure, `measure`, which is typically specified via the `es.type`-argument.
- Information on the effect-size conversion, `info`.

- A string with the study name, if the `study`-argument was specified in function calls.

Correlation Effect Size

If the correlation effect size `r` is computed, the transformed Fisher's z and their confidence intervals are also returned. The variance and standard error for the correlation effect size r are always based on Fisher's transformation.

Odds Ratio Effect Size

For odds ratios, the variance and standard error are always returned on the log-scale!

Preparing an Effect Size Data Frame for Meta-Analysis

The results of the effect size calculation functions in this package are returned as list with a `esc`-class attribute. The `combine_esc`-function takes one or more of these `esc`-objects and combines them into a `data.frame` that can be used as argument for further use, for instance with the `rma`-function.

```
e1 <- esc_2x2(grp1yes = 30, grp1no = 50, grp2yes = 40,
              grp2no = 45, study = "Study 1")
e2 <- esc_2x2(grp1yes = 30, grp1no = 50, grp2yes = 40, grp2no = 45,
              es.type = "or", study = "Study 2")
e3 <- esc_t(p = 0.03, grp1n = 100, grp2n = 150, study = "Study 3")
e4 <- esc_mean_sd(grp1m = 7, grp1sd = 2, grp1n = 50, grp2m = 9, grp2sd = 3,
                  grp2n = 60, es.type = "logit", study = "Study 4")

mydat <- combine_esc(e1, e2, e3, e4)

metafor::rma(yi = es, sei = se, method = "REML", data = mydat)
```

`combine_esc` *Combine one or more 'esc' objects into a data frame*

Description

This method takes one or more objects of class `esc` (which are returned by each effect size calculation function) and returns the combined result as a single data frame. This can then be used for further computation, e.g. with the `rma`-function of the **metafor**-package.

Usage

```
combine_esc(...)
```

Arguments

`...`	One or more objects of class `esc`

Value

A data frame with all relevant information from the effect size calculation.

See Also

write_esc

Examples

```
e1 <- esc_2x2(grp1yes = 30, grp1no = 50, grp2yes = 40,
              grp2no = 45, study = "Study 1")
e2 <- esc_2x2(grp1yes = 30, grp1no = 50, grp2yes = 40, grp2no = 45,
              es.type = "or", study = "Study 2")
e3 <- esc_t(p = 0.03, grp1n = 100, grp2n = 150, study = "Study 3")
e4 <- esc_mean_sd(grp1m = 7, grp1sd = 2, grp1n = 50, grp2m = 9, grp2sd = 3,
                  grp2n = 60, es.type = "logit", study = "Study 4")

combine_esc(e1, e2, e3, e4)
```

---

convert_d2etasq *Convert effect size d into Eta Squared*

Description

Compute effect size Eta Squared from effect size d.

Usage

```
convert_d2etasq(d, se, v, grp1n, grp2n, info = NULL, study = NULL)
```

Arguments

d	The effect size d.
se	The standard error of d. One of se or v must be specified.
v	The variance of d. One of se or v must be specified.
grp1n	Treatment group sample size.
grp2n	Control group sample size.
info	String with information on the transformation. Used for the print-method. Usually, this argument can be ignored
study	Optional string with the study name. Using combine_esc or as.data.frame on esc-objects will add this as column in the returned data frame.

Value

The effect size es, the standard error se, the variance of the effect size var, the lower and upper confidence limits ci.lo and ci.hi, the weight factor w and the total sample size totaln.

References

Cohen J. 1988. Statistical Power Analysis for the Behavioral Sciences. 2nd ed. Hillsdale, NJ: Erlbaum

Examples

```
# d to eta squared
convert_d2etasq(d = 0.7, se = 0.5, grp1n = 70, grp2n = 80)
```

`convert_d2f` *Convert effect size d into f*

Description

Compute effect size `f` from effect size `d`.

Usage

```
convert_d2f(d, se, v, totaln, info = NULL, study = NULL)
```

Arguments

`d`	The effect size `d`.
`se`	The standard error of `d`. One of `se` or `v` must be specified.
`v`	The variance of `d`. One of `se` or `v` must be specified.
`totaln`	A vector of total sample size(s).
`info`	String with information on the transformation. Used for the print-method. Usually, this argument can be ignored
`study`	Optional string with the study name. Using `combine_esc` or `as.data.frame` on `esc`-objects will add this as column in the returned data frame.

Value

The effect size `es`, the standard error `se`, the variance of the effect size `var`, the lower and upper confidence limits `ci.lo` and `ci.hi`, the weight factor `w` and the total sample size `totaln`.

References

Cohen J. 1988. Statistical Power Analysis for the Behavioral Sciences. 2nd ed. Hillsdale, NJ: Erlbaum

Examples

```
# d to f
convert_d2f(d = 0.2, se = .1, totaln = 50)
```

convert_d2logit *Convert effect size d into log odds*

Description

Compute effect size log odds from effect size d.

Usage

```
convert_d2logit(
  d,
  se,
  v,
  totaln,
  es.type = c("logit", "cox"),
  info = NULL,
  study = NULL
)
```

Arguments

d	The effect size d.
se	The standard error of d. One of se or v must be specified.
v	The variance of d. One of se or v must be specified.
totaln	A vector of total sample size(s).
es.type	Type of effect size odds ratio that should be returned. May be es.type = "logit" or es.type = "cox" (see 'Details').
info	String with information on the transformation. Used for the print-method. Usually, this argument can be ignored
study	Optional string with the study name. Using combine_esc or as.data.frame on esc-objects will add this as column in the returned data frame.

Details

Conversion from d to odds ratios can be done with two methods:

es.type = "logit" uses the Hasselblad and Hedges logit method.

es.type = "cox" uses the modified logit method as proposed by Cox. This method performs slightly better for rare or frequent events, i.e. if the success rate is close to 0 or 1.

Value

The effect size es, the standard error se, the variance of the effect size var, the lower and upper confidence limits ci.lo and ci.hi, the weight factor w and the total sample size totaln.

Note

Effect size, variance, standard error and confidence intervals are returned on the log-scale. To get the odds ratios and exponentiated confidence intervals, use convert_d2or.

References

Lipsey MW, Wilson DB. 2001. Practical meta-analysis. Thousand Oaks, Calif: Sage Publications

Wilson DB. 2016. Formulas Used by the "Practical Meta-Analysis Effect Size Calculator". Unpublished manuscript: George Mason University

Cox DR. 1970. Analysis of binary data. New York: Chapman & Hall/CRC

Hasselblad V, Hedges LV. 1995. Meta-analysis of screening and diagnostic tests. Psychological Bulletin 117(1): 167–178. doi: 10.1037/00332909.117.1.167

Examples

```
# to logits
convert_d2logit(0.7, se = 0.5)

# to Cox-logits
convert_d2logit(0.7, v = 0.25, es.type = "cox")
```

---

convert_d2or *Convert effect size d into OR*

Description

Compute effect size OR from effect size d.

Usage

```
convert_d2or(
  d,
  se,
  v,
  totaln,
  es.type = c("logit", "cox"),
  info = NULL,
  study = NULL
)
```

Arguments

d	The effect size d.
se	The standard error of d. One of se or v must be specified.
v	The variance of d. One of se or v must be specified.
totaln	A vector of total sample size(s).
es.type	Type of effect size odds ratio that should be returned. May be es.type = "logit" or es.type = "cox" (see 'Details').
info	String with information on the transformation. Used for the print-method. Usually, this argument can be ignored
study	Optional string with the study name. Using combine_esc or as.data.frame on esc-objects will add this as column in the returned data frame.

Details

Conversion from d to odds ratios can be done with two methods:

es.type = "logit" uses the Hasselblad and Hedges logit method.

es.type = "cox" uses the modified logit method as proposed by Cox. This method performs slightly better for rare or frequent events, i.e. if the success rate is close to 0 or 1.

Value

The effect size es, the standard error se, the variance of the effect size var, the lower and upper confidence limits ci.lo and ci.hi, the weight factor w and the total sample size totaln.

Note

Effect size is returned as exp(log_values) (odds ratio), confidence intervals are also exponentiated. To get the log-values, use convert_d2logit. **However**, variance and standard error of this function are returned on the log-scale!

References

Lipsey MW, Wilson DB. 2001. Practical meta-analysis. Thousand Oaks, Calif: Sage Publications

Wilson DB. 2016. Formulas Used by the "Practical Meta-Analysis Effect Size Calculator". Unpublished manuscript: George Mason University

Cox DR. 1970. Analysis of binary data. New York: Chapman & Hall/CRC

Hasselblad V, Hedges LV. 1995. Meta-analysis of screening and diagnostic tests. Psychological Bulletin 117(1): 167–178. doi: 10.1037/00332909.117.1.167

Borenstein M, Hedges LV, Higgins JPT, Rothstein HR. 2009. Introduction to Meta-Analysis. Chichester, West Sussex, UK: Wiley

Examples

```
# d to odds ratio
convert_d2or(0.7, se = 0.5)
# odds ratio to d
convert_or2d(3.56, se = 0.91)
```

`convert_d2r` *Convert effect size d into correlation*

Description

Compute effect size correlation from effect size `d`.

Usage

```
convert_d2r(d, se, v, grp1n, grp2n, info = NULL, study = NULL)
```

Arguments

`d`	The effect size `d`.
`se`	The standard error of `d`. One of `se` or `v` must be specified.
`v`	The variance of `d`. One of `se` or `v` must be specified.
`grp1n`	Treatment group sample size.
`grp2n`	Control group sample size.
`info`	String with information on the transformation. Used for the print-method. Usually, this argument can be ignored
`study`	Optional string with the study name. Using `combine_esc` or `as.data.frame` on `esc`-objects will add this as column in the returned data frame.

Value

The effect size `es`, the standard error `se`, the variance of the effect size `var`, the lower and upper confidence limits `ci.lo` and `ci.hi`, the weight factor `w` and the total sample size `totaln`. Furthermore, Fisher's z and confidence intervals are returned.

References

Lipsey MW, Wilson DB. 2001. Practical meta-analysis. Thousand Oaks, Calif: Sage Publications

Wilson DB. 2016. Formulas Used by the "Practical Meta-Analysis Effect Size Calculator". Unpublished manuscript: George Mason University

Examples

```
convert_d2r(d = 0.7, se = 0.5, grp1n = 70, grp2n = 80)
```

convert_or2d *Convert effect size OR from d*

Description

Compute effect size d from effect size OR.

Usage

```
convert_or2d(
  or,
  se,
  v,
  totaln,
  es.type = c("d", "cox.d", "g", "f", "eta"),
  info = NULL,
  study = NULL
)
```

Arguments

or	The effect size as odds ratio.
se	The standard error of d. One of se or v must be specified.
v	The variance of d. One of se or v must be specified.
totaln	A vector of total sample size(s).
es.type	Type of effect size that should be returned. "d" returns effect size d "cox.d" returns effect size d, based on Cox method "g" returns effect size Hedges' g (see hedges_g)
info	String with information on the transformation. Used for the print-method. Usually, this argument can be ignored
study	Optional string with the study name. Using combine_esc or as.data.frame on esc-objects will add this as column in the returned data frame.

Value

The effect size es, the standard error se, the variance of the effect size var, the lower and upper confidence limits ci.lo and ci.hi, the weight factor w and the total sample size totaln.

Note

While or is the exponentiated log odds, the variance or standard error need to be on the log-scale!

References

Lipsey MW, Wilson DB. 2001. Practical meta-analysis. Thousand Oaks, Calif: Sage Publications

Wilson DB. 2016. Formulas Used by the "Practical Meta-Analysis Effect Size Calculator". Unpublished manuscript: George Mason University

Examples

```
convert_or2d(3.56, se = 0.91)
convert_d2or(0.7, se = 0.5)
```

`convert_r2z` *Convert correlation coefficient r into Fisher's z*

Description

Convert correlation coefficient r into Fisher's z.

Usage

```
convert_r2z(r)
```

Arguments

`r`	The correlation coefficient.

Value

The transformed Fisher's z.

References

Lipsey MW, Wilson DB. 2001. Practical meta-analysis. Thousand Oaks, Calif: Sage Publications

Wilson DB. 2016. Formulas Used by the "Practical Meta-Analysis Effect Size Calculator". Unpublished manuscript: George Mason University

Examples

```
convert_r2z(.03)
```

convert_z2r *Convert Fisher's z into correlation coefficient r*

Description

Convert Fisher's z into correlation coefficient r.

Usage

```
convert_z2r(z)
```

Arguments

z	Fisher's z-value.

Value

The back-transformed correlation coefficient r.

References

Lipsey MW, Wilson DB. 2001. Practical meta-analysis. Thousand Oaks, Calif: Sage Publications

Wilson DB. 2016. Formulas Used by the "Practical Meta-Analysis Effect Size Calculator". Unpublished manuscript: George Mason University

Examples

```
convert_z2r(.03)
```

effect_sizes *Generate effect size data frame from other data*

Description

This method computes any effect size from raw values from a data frame. Convenient method to compute multiple effect sizes at once, when the required information to calculate effects sizes are stored in a table (i.e. data frame).

Usage

```
effect_sizes(
  data,
  ...,
  fun,
  es.type = c("d", "g", "or", "logit", "r", "f", "eta", "cox.or", "cox.log")
)
```

Arguments

data	A data frame with columns that contain the values that are passed to one of the **esc**-functions.
...	Named arguments. The name (left-hand side) is the name of one of **esc** functions' argument, the argument (right-hand side) is the name of the column in data that holds the data values. See 'Examples'.
fun	Name of one of the **esc**-functions, as string, where arguments in ... are passed to. May either be the full function name (like "esc_t" or "esc_2x2") or the funcion name *without* the suffix "esc_" (like "t" or "2x2").
es.type	Type of effect size that should be returned. "d" returns standardized mean difference effect size d "f" returns effect size Cohen's f "g" returns adjusted standardized mean difference effect size Hedges' g "or" returns effect size as odds ratio "cox.or" returns effect size as Cox-odds ratio (see convert_d2or for details) "logit" returns effect size as log odds "cox.log" returns effect size as Cox-log odds (see convert_d2logit for details) "r" returns correlation effect size r "eta" returns effect size eta squared

Details

This function rowwise iterates data and calls the function named in fun for the values taken from each row of data. The column names in data that contain the necessary values to compute the effect sizes should be passed as unquoted value for the arguments. The argument names should match those arguments for the esc-function that should be called from within effect_sizes().

Example:
If you want to compute effect sizes from chi-squared values, you would call esc_chisq(). This function name is used for the fun-argument: fun = "esc_chisq". esc_chisq() requires one of chisq or p as arguments, and totaln. Now data must have columns with values for either chisq or p, and effect_sizes() automatically selects the first non-missing value from data (see 'Examples').

Value

A data frame with the effect sizes computed for all data from data.

Examples

```
tmp <- data.frame(
  tvalue = c(3.3, 2.9, 2.3),
  n = c(250, 200, 210),
  studyname = c("Study 1", "Study 2", "Study 3")
)
effect_sizes(tmp, t = tvalue, totaln = n, study = studyname, fun = "esc_t")
```

```
# missing effect size results are dropped,
# shorter function name, calls "esc_t()"
tmp <- data.frame(
  tvalue = c(3.3, 2.9, NA, 2.3),
  n = c(250, 200, 210, 210),
  studyname = c("Study 1", "Study 2", NA, "Study 4")
)
effect_sizes(tmp, t = tvalue, totaln = n, study = studyname, fun = "t")


tmp <- data.frame(
  coefficient = c(0.4, 0.2, 0.6),
  se = c(.15, .1, .2),
  treat = c(50, 60, 50),
  cntrl = c(45, 70, 40),
  author = c("Smith 2000", "Smith 2010 2", "Smith 2012")
)
effect_sizes(tmp, beta = coefficient, sdy = se, grp1n = treat, grp2n = cntrl,
    study = author, fun = "esc_beta", es.type = "or")

# the "esc_chisq" function requires *either* the chisq-argument *or*
# the pval-argument. If at least one of these values is present,
# effect size can be calculated. You can specify both arguments,
# and the first non-missing required value from "data" is taken.
tmp <- data.frame(
  chisqquared = c(NA, NA, 3.3, NA, 2.9),
  pval = c(.003, .05, NA, .12, NA),
  n = c(250, 200, 210, 150, 180),
  studyname = c("Study 1", "Study 2", "Study 3", "Study 4", "Study 5")
)
effect_sizes(tmp, chisq = chisqquared, p = pval, totaln = n,
             study = studyname, fun = "esc_chisq")

# if all required information are missing, data will be removed
tmp <- data.frame(
  chisqquared = c(NA, NA, 3.3, NA, NA),
  pval = c(.003, .05, NA, .12, NA),
  n = c(250, 200, 210, 150, 180),
  studyname = c("Study 1", "Study 2", "Study 3", "Study 4", "Study 5")
)
effect_sizes(tmp, chisq = chisqquared, p = pval, totaln = n,
             study = studyname, fun = "chisq")
```

---

esc_2x2 *Compute effect size from 2 by 2 Contingency Table*

Description

Compute effect size from a 2 by 2 frequency table.

Usage

```
esc_2x2(
  grp1yes,
  grp1no,
  grp2yes,
  grp2no,
  es.type = c("logit", "d", "g", "or", "r", "f", "eta", "cox.d"),
  study = NULL,
  ...
)
```

Arguments

grp1yes	Size of treatment group with successes (outcome = yes).
grp1no	Size of treatment group with non-successes (outcome = no).
grp2yes	Size of control group with successes (outcome = yes).
grp2no	Size of control group with non-successes (outcome = no).
es.type	Type of effect size that should be returned. "d" returns standardized mean difference effect size d "f" returns effect size Cohen's f "g" returns adjusted standardized mean difference effect size Hedges' g "or" returns effect size as odds ratio "cox.or" returns effect size as Cox-odds ratio (see convert_d2or for details) "logit" returns effect size as log odds "cox.log" returns effect size as Cox-log odds (see convert_d2logit for details) "r" returns correlation effect size r "eta" returns effect size eta squared
study	Optional string with the study name. Using combine_esc or as.data.frame on esc-objects will add this as column in the returned data frame.
...	Other parameters, passed down to further functions. For internal use only, can be ignored.

Value

The effect size es, the standard error se, the variance of the effect size var, the lower and upper confidence limits ci.lo and ci.hi, the weight factor w and the total sample size totaln.

Note

If es.type = "r", Fisher's transformation for the effect size r and their confidence intervals are also returned.

References

Lipsey MW, Wilson DB. 2001. Practical meta-analysis. Thousand Oaks, Calif: Sage Publications

Wilson DB. 2016. Formulas Used by the "Practical Meta-Analysis Effect Size Calculator". Unpublished manuscript: George Mason University

Examples

```
# effect size log odds
esc_2x2(grp1yes = 30, grp1no = 50, grp2yes = 40, grp2no = 45)

# effect size odds ratio
esc_2x2(grp1yes = 30, grp1no = 50, grp2yes = 40, grp2no = 45, es.type = "or")
```

---

esc_B *Compute effect size from Unstandardized Regression Coefficient*

Description

Compute effect size from Unstandardized Regression Coefficient.

Usage

```
esc_B(
  b,
  sdy,
  grp1n,
  grp2n,
  es.type = c("d", "g", "or", "logit", "r", "f", "eta", "cox.or", "cox.log"),
  study = NULL
)
```

Arguments

b	The unstandardized coefficient B.
sdy	The standard deviation of the dependent variable.
grp1n	Treatment group sample size.
grp2n	Control group sample size.
es.type	Type of effect size that should be returned. "d" returns standardized mean difference effect size d "f" returns effect size Cohen's f "g" returns adjusted standardized mean difference effect size Hedges' g "or" returns effect size as odds ratio "cox.or" returns effect size as Cox-odds ratio (see convert_d2or for details)

"logit" returns effect size as log odds

"cox.log" returns effect size as Cox-log odds (see convert_d2logit for details)

"r" returns correlation effect size r

"eta" returns effect size eta squared

study — Optional string with the study name. Using combine_esc or as.data.frame on esc-objects will add this as column in the returned data frame.

Value

The effect size es, the standard error se, the variance of the effect size var, the lower and upper confidence limits ci.lo and ci.hi, the weight factor w and the total sample size totaln.

Note

If es.type = "r", Fisher's transformation for the effect size r and their confidence intervals are also returned.

References

Lipsey MW, Wilson DB. 2001. Practical meta-analysis. Thousand Oaks, Calif: Sage Publications

Wilson DB. 2016. Formulas Used by the "Practical Meta-Analysis Effect Size Calculator". Unpublished manuscript: George Mason University

Examples

```
esc_B(3.3, 5, 100, 150)
```

---

esc_beta *Compute effect size from Standardized Regression Coefficient*

Description

Compute effect size from Standardized Regression Coefficient.

Usage

```
esc_beta(
  beta,
  sdy,
  grp1n,
  grp2n,
  es.type = c("d", "g", "or", "logit", "r", "f", "eta", "cox.or", "cox.log"),
  study = NULL
)
```

Arguments

beta	The standardized beta coefficient.
sdy	The standard deviation of the dependent variable.
grp1n	Treatment group sample size.
grp2n	Control group sample size.
es.type	Type of effect size that should be returned. "d" returns standardized mean difference effect size d "f" returns effect size Cohen's f "g" returns adjusted standardized mean difference effect size Hedges' g "or" returns effect size as odds ratio "cox.or" returns effect size as Cox-odds ratio (see convert_d2or for details) "logit" returns effect size as log odds "cox.log" returns effect size as Cox-log odds (see convert_d2logit for details) "r" returns correlation effect size r "eta" returns effect size eta squared
study	Optional string with the study name. Using combine_esc or as.data.frame on esc-objects will add this as column in the returned data frame.

Value

The effect size es, the standard error se, the variance of the effect size var, the lower and upper confidence limits ci.lo and ci.hi, the weight factor w and the total sample size totaln.

Note

If es.type = "r", Fisher's transformation for the effect size r and their confidence intervals are also returned.

References

Lipsey MW, Wilson DB. 2001. Practical meta-analysis. Thousand Oaks, Calif: Sage Publications

Wilson DB. 2016. Formulas Used by the "Practical Meta-Analysis Effect Size Calculator". Unpublished manuscript: George Mason University

Examples

```
esc_beta(.7, 3, 100, 150)
esc_beta(.7, 3, 100, 150, es.type = "cox.log")
```

esc_bin_prop *Compute effect size from binary proportions*

Description

Compute effect size from binary proportions

Usage

```
esc_bin_prop(
  prop1event,
  grp1n,
  prop2event,
  grp2n,
  es.type = c("logit", "d", "g", "or", "r", "f", "eta", "cox.d"),
  study = NULL
)
```

Arguments

prop1event	Proportion of successes in treatment group (proportion of outcome = yes).
grp1n	Treatment group sample size.
prop2event	Proportion of successes in control group (proportion of outcome = yes).
grp2n	Control group sample size.
es.type	Type of effect size that should be returned. "d" returns standardized mean difference effect size d "f" returns effect size Cohen's f "g" returns adjusted standardized mean difference effect size Hedges' g "or" returns effect size as odds ratio "cox.or" returns effect size as Cox-odds ratio (see convert_d2or for details) "logit" returns effect size as log odds "cox.log" returns effect size as Cox-log odds (see convert_d2logit for details) "r" returns correlation effect size r "eta" returns effect size eta squared
study	Optional string with the study name. Using combine_esc or as.data.frame on esc-objects will add this as column in the returned data frame.

Value

The effect size es, the standard error se, the variance of the effect size var, the lower and upper confidence limits ci.lo and ci.hi, the weight factor w and the total sample size totaln.

Note

If `es.type = "r"`, Fisher's transformation for the effect size `r` and their confidence intervals are also returned.

References

Lipsey MW, Wilson DB. 2001. Practical meta-analysis. Thousand Oaks, Calif: Sage Publications

Wilson DB. 2016. Formulas Used by the "Practical Meta-Analysis Effect Size Calculator". Unpublished manuscript: George Mason University

Examples

```
# effect size log odds
esc_bin_prop(prop1event = .375, grp1n = 80, prop2event = .47, grp2n = 85)

# effect size odds ratio
esc_bin_prop(prop1event = .375, grp1n = 80, prop2event = .47, grp2n = 85,
             es.type = "or")
```

`esc_chisq` *Compute effect size from Chi-Square coefficient*

Description

Compute effect size from Chi-Square coefficient

Usage

```
esc_chisq(
  chisq,
  p,
  totaln,
  es.type = c("d", "g", "or", "logit", "r", "f", "eta", "cox.or", "cox.log"),
  study = NULL
)
```

Arguments

`chisq`	The chi-squared value. One of `chisq` or `p` must be reported.
`p`	The p-value of the chi-squared or phi-value.
`totaln`	A vector of total sample size(s).

`es.type`	Type of effect size that should be returned.
	`"d"` returns standardized mean difference effect size `d`
	`"f"` returns effect size Cohen's `f`

"g" returns adjusted standardized mean difference effect size Hedges' g

"or" returns effect size as odds ratio

"cox.or" returns effect size as Cox-odds ratio (see convert_d2or for details)

"logit" returns effect size as log odds

"cox.log" returns effect size as Cox-log odds (see convert_d2logit for details)

"r" returns correlation effect size r

"eta" returns effect size eta squared

study — Optional string with the study name. Using combine_esc or as.data.frame on esc-objects will add this as column in the returned data frame.

Value

The effect size es, the standard error se, the variance of the effect size var, the lower and upper confidence limits ci.lo and ci.hi, the weight factor w and the total sample size totaln.

Note

This effect size should only be used for data from 2x2 frequency tables. Furthermore, use this approximation for the effect size only, if information about the 2x2 frequencies or proportions are not available. Else, esc_2x2 or esc_bin_prop provide better estimates for the effect size.

References

Lipsey MW, Wilson DB. 2001. Practical meta-analysis. Thousand Oaks, Calif: Sage Publications

Wilson DB. 2016. Formulas Used by the "Practical Meta-Analysis Effect Size Calculator". Unpublished manuscript: George Mason University

Examples

```
# Effect size based on chi-squared value
esc_chisq(chisq = 9.9, totaln = 100)

# Effect size based on p-value of chi-squared
esc_chisq(p = .04, totaln = 100)
```

---

esc_f *Compute effect size from One-way Anova*

Description

Compute effect size from One-way Anova with two independent groups.

Usage

```
esc_f(
  f,
  totaln,
  grp1n,
  grp2n,
  es.type = c("d", "g", "or", "logit", "r", "f", "eta", "cox.or", "cox.log"),
  study = NULL
)
```

Arguments

f	The F-value of the F-test.
totaln	Total sample size. Either totaln, or grp1n and grp2n must be specified.
grp1n	Treatment group sample size.
grp2n	Control group sample size.
es.type	Type of effect size that should be returned. "d" returns standardized mean difference effect size d "f" returns effect size Cohen's f "g" returns adjusted standardized mean difference effect size Hedges' g "or" returns effect size as odds ratio "cox.or" returns effect size as Cox-odds ratio (see convert_d2or for details) "logit" returns effect size as log odds "cox.log" returns effect size as Cox-log odds (see convert_d2logit for details) "r" returns correlation effect size r "eta" returns effect size eta squared
study	Optional string with the study name. Using combine_esc or as.data.frame on esc-objects will add this as column in the returned data frame.

Value

The effect size es, the standard error se, the variance of the effect size var, the lower and upper confidence limits ci.lo and ci.hi, the weight factor w and the total sample size totaln.

Note

This function only applies to *one-way Anova* F-tests with *two independent groups*, either equal or unequal sample sizes.

If es.type = "r", Fisher's transformation for the effect size r and their confidence intervals are also returned.

References

Lipsey MW, Wilson DB. 2001. Practical meta-analysis. Thousand Oaks, Calif: Sage Publications

Wilson DB. 2016. Formulas Used by the "Practical Meta-Analysis Effect Size Calculator". Unpublished manuscript: George Mason University

Examples

```
# unequal sample size
esc_f(f = 5.5, grp1n = 100, grp2n = 150)

# equal sample size
esc_f(f = 5.5, totaln = 200)
```

`esc_mean_gain` *Compute effect size from Mean Gain Scores and Standard Deviations*

Description

Compute effect size from Mean Gain Scores and Standard Deviations for pre-post tests.

Usage

```
esc_mean_gain(
  pre1mean,
  pre1sd,
  post1mean,
  post1sd,
  grp1n,
  gain1mean,
  gain1sd,
  grp1r,
  pre2mean,
  pre2sd,
  post2mean,
  post2sd,
  grp2n,
  gain2mean,
  gain2sd,
  grp2r,
  r,
  es.type = c("d", "g", "or", "logit", "r", "f", "eta", "cox.or", "cox.log"),
  study = NULL
)
```

Arguments

pre1mean	The mean of the first group at pre-test.
pre1sd	The standard deviation of the first group at pre-test.
post1mean	The mean of the first group at post-test.
post1sd	The standard deviation of the first group at post-test.
grp1n	The sample size of the first group.
gain1mean	The mean gain between pre and post of the first group.
gain1sd	The standard deviation gain between pre and post of the first group.
grp1r	The (estimated) correlation of pre-post scores for the first group.
pre2mean	The mean of the second group at pre-test.
pre2sd	The standard deviation of the second group at pre-test.
post2mean	The mean of the second group at post-test.
post2sd	The standard deviation of the second group at post-test.
grp2n	The sample size of the second group.
gain2mean	The mean gain between pre and post of the second group.
gain2sd	The standard deviation gain between pre and post of the second group.
grp2r	The (estimated) correlation of pre-post scores for the second group.
r	Correlation for within-subject designs (paired samples, repeated measures).
es.type	Type of effect size that should be returned. "d" returns standardized mean difference effect size d "f" returns effect size Cohen's f "g" returns adjusted standardized mean difference effect size Hedges' g "or" returns effect size as odds ratio "cox.or" returns effect size as Cox-odds ratio (see convert_d2or for details) "logit" returns effect size as log odds "cox.log" returns effect size as Cox-log odds (see convert_d2logit for details) "r" returns correlation effect size r "eta" returns effect size eta squared
study	Optional string with the study name. Using combine_esc or as.data.frame on esc-objects will add this as column in the returned data frame.

Details

For this function, either the gain scores of mean and sd (gain1mean and gain1sd for the first group and gain2mean and gain2sd for the second group) must be specified, or the pre-post values (pre1mean, post1mean, pre1sd and post1sd and the counterpart arguments for the second group).

If the pre-post standard deviations are available, no correlation value grp1r resp. grp2r needs to be specified, because these can then be computed based on t-value computation. However, if grp1r is specified, this value will be used (and no t-test performed).

Value

The effect size `es`, the standard error `se`, the variance of the effect size `var`, the lower and upper confidence limits `ci.lo` and `ci.hi`, the weight factor `w` and the total sample size `totaln`.

Note

If `es.type = "r"`, Fisher's transformation for the effect size `r` and their confidence intervals are also returned.

References

Lipsey MW, Wilson DB. 2001. Practical meta-analysis. Thousand Oaks, Calif: Sage Publications

Wilson DB. 2016. Formulas Used by the "Practical Meta-Analysis Effect Size Calculator". Unpublished manuscript: George Mason University

Examples

```
# effect size of mean gain scores, with available pre-post values
esc_mean_gain(pre1mean = 13.07, pre1sd = 11.95, post1mean = 6.1,
              post1sd = 8.33, grp1n = 78, pre2mean = 10.77, pre2sd = 10.73,
              post2mean = 8.83, post2sd = 9.67, grp2n = 83)

# same as above, but with assumed correlation of .5
# Note that effect size is the same, but variance differs
esc_mean_gain(pre1mean = 13.07, pre1sd = 11.95, post1mean = 6.1, grp1r = .5,
              post1sd = 8.33, grp1n = 78, pre2mean = 10.77, pre2sd = 10.73,
              post2mean = 8.83, post2sd = 9.67, grp2n = 83, grp2r = .5)

# effect size based on gain scores for mean and sd. note that the
# pre-post correlations must be given
esc_mean_gain(gain1mean = 1.5, gain1sd = 1, grp1n = 40, grp1r = .5,
              gain2mean = .7, gain2sd = .8, grp2n = 50, grp2r = .5)
```

---

esc_mean_sd *Compute effect size from Mean and Standard Deviation*

Description

Compute effect size from mean and either group-based standard deviations or full sample standard deviation.

Usage

```
esc_mean_sd(
  grp1m,
  grp1sd,
```

```
  grp1n,
  grp2m,
  grp2sd,
  grp2n,
  totalsd,
  r,
  es.type = c("d", "g", "or", "logit", "r", "cox.or", "cox.log"),
  study = NULL
)
```

Arguments

grp1m	The mean of the first group.
grp1sd	The standard deviation of the first group.
grp1n	The sample size of the first group.
grp2m	The mean of the second group.
grp2sd	The standard deviation of the second group.
grp2n	The sample size of the second group.
totalsd	The full sample standard deviation. Either grp1sd and grp2sd, or totalsd must be specified.
r	Correlation for within-subject designs (paired samples, repeated measures).
es.type	Type of effect size that should be returned. "d" returns standardized mean difference effect size d "f" returns effect size Cohen's f "g" returns adjusted standardized mean difference effect size Hedges' g "or" returns effect size as odds ratio "cox.or" returns effect size as Cox-odds ratio (see convert_d2or for details) "logit" returns effect size as log odds "cox.log" returns effect size as Cox-log odds (see convert_d2logit for details) "r" returns correlation effect size r "eta" returns effect size eta squared
study	Optional string with the study name. Using combine_esc or as.data.frame on esc-objects will add this as column in the returned data frame.

Value

The effect size es, the standard error se, the variance of the effect size var, the lower and upper confidence limits ci.lo and ci.hi, the weight factor w and the total sample size totaln.

Note

If es.type = "r", Fisher's transformation for the effect size r and their confidence intervals are also returned.

References

Lipsey MW, Wilson DB. 2001. Practical meta-analysis. Thousand Oaks, Calif: Sage Publications

Wilson DB. 2016. Formulas Used by the "Practical Meta-Analysis Effect Size Calculator". Unpublished manuscript: George Mason University

Examples

```
# with standard deviations for each group
esc_mean_sd(
  grp1m = 7, grp1sd = 2, grp1n = 50,
  grp2m = 9, grp2sd = 3, grp2n = 60,
  es.type = "logit"
)

# effect-size d, within-subjects design
esc_mean_sd(
  grp1m = 7, grp1sd = 2, grp1n = 50,
  grp2m = 9, grp2sd = 3, grp2n = 60, r = .7
)

# with full sample standard deviations
esc_mean_sd(grp1m = 7, grp1n = 50, grp2m = 9, grp2n = 60, totalsd = 4)
```

---

esc_mean_se *Compute effect size from Mean and Standard Error*

Description

Compute effect size from Mean and Standard Error.

Usage

```
esc_mean_se(
  grp1m,
  grp1se,
  grp1n,
  grp2m,
  grp2se,
  grp2n,
  r,
  es.type = c("d", "g", "or", "logit", "r", "f", "eta", "cox.or", "cox.log"),
  study = NULL
)
```

Arguments

grp1m	The mean of the first group.
grp1se	The standard error of the first group.
grp1n	The sample size of the first group.
grp2m	The mean of the second group.
grp2se	The standard error of the second group.
grp2n	The sample size of the second group.
r	Correlation for within-subject designs (paired samples, repeated measures).
es.type	Type of effect size that should be returned. "d" returns standardized mean difference effect size d "f" returns effect size Cohen's f "g" returns adjusted standardized mean difference effect size Hedges' g "or" returns effect size as odds ratio "cox.or" returns effect size as Cox-odds ratio (see convert_d2or for details) "logit" returns effect size as log odds "cox.log" returns effect size as Cox-log odds (see convert_d2logit for details) "r" returns correlation effect size r "eta" returns effect size eta squared
study	Optional string with the study name. Using combine_esc or as.data.frame on esc-objects will add this as column in the returned data frame.

Value

The effect size es, the standard error se, the variance of the effect size var, the lower and upper confidence limits ci.lo and ci.hi, the weight factor w and the total sample size totaln.

Note

If es.type = "r", Fisher's transformation for the effect size r and their confidence intervals are also returned.

References

Lipsey MW, Wilson DB. 2001. Practical meta-analysis. Thousand Oaks, Calif: Sage Publications

Wilson DB. 2016. Formulas Used by the "Practical Meta-Analysis Effect Size Calculator". Unpublished manuscript: George Mason University

Examples

```
esc_mean_se(grp1m = 7, grp1se = 1.5, grp1n = 50,
            grp2m = 9, grp2se = 1.8, grp2n = 60, es.type = "or")
```

esc_phi *Compute effect size from Phi coefficient*

Description

Compute effect size from phi coefficient

Usage

```
esc_phi(
  phi,
  p,
  totaln,
  es.type = c("d", "g", "or", "logit", "r", "f", "eta", "cox.or", "cox.log"),
  study = NULL
)
```

Arguments

phi	The phi value. One of phi or p must be reported.
p	The p-value of the chi-squared or phi-value.
totaln	A vector of total sample size(s).
es.type	Type of effect size that should be returned. "d" returns standardized mean difference effect size d "f" returns effect size Cohen's f "g" returns adjusted standardized mean difference effect size Hedges' g "or" returns effect size as odds ratio "cox.or" returns effect size as Cox-odds ratio (see convert_d2or for details) "logit" returns effect size as log odds "cox.log" returns effect size as Cox-log odds (see convert_d2logit for details) "r" returns correlation effect size r "eta" returns effect size eta squared
study	Optional string with the study name. Using combine_esc or as.data.frame on esc-objects will add this as column in the returned data frame.

Value

The effect size es, the standard error se, the variance of the effect size var, the lower and upper confidence limits ci.lo and ci.hi, the weight factor w and the total sample size totaln.

Note

This effect size should only be used for data from 2x2 frequency tables. Furthermore, use this approximation for the effect size only, if information about the 2x2 frequencies or proportions are not available. Else, esc_2x2 or esc_bin_prop provide better estimates for the effect size.

References

Lipsey MW, Wilson DB. 2001. Practical meta-analysis. Thousand Oaks, Calif: Sage Publications

Wilson DB. 2016. Formulas Used by the "Practical Meta-Analysis Effect Size Calculator". Unpublished manuscript: George Mason University

Examples

```
# Effect size based on chi-squared value
esc_phi(phi = .67, totaln = 100)

# Effect size based on p-value of chi-squared
esc_phi(p = .003, totaln = 100)
```

`esc_rpb` *Compute effect size from Point-Biserial Correlation*

Description

Compute effect size from Point-Biserial Correlation.

Usage

```
esc_rpb(
  r,
  p,
  totaln,
  grp1n,
  grp2n,
  es.type = c("d", "g", "or", "logit", "f", "eta", "cox.or", "cox.log"),
  study = NULL
)
```

Arguments

`r`	The point-biserial r-value. One of `r` or `p` must be specified.
`p`	The p-value of the point-biserial correlation. One of `r` or `p` must be specified.
`totaln`	Total sample size. Either `totaln`, or `grp1n` and `grp2n` must be specified.
`grp1n`	Treatment group sample size.
`grp2n`	Control group sample size.

`es.type`	Type of effect size that should be returned.
	`"d"` returns standardized mean difference effect size `d`
	`"f"` returns effect size Cohen's `f`
	`"g"` returns adjusted standardized mean difference effect size Hedges' `g`

"or" returns effect size as odds ratio

"cox.or" returns effect size as Cox-odds ratio (see convert_d2or for details)

"logit" returns effect size as log odds

"cox.log" returns effect size as Cox-log odds (see convert_d2logit for details)

"r" returns correlation effect size r

"eta" returns effect size eta squared

study — Optional string with the study name. Using combine_esc or as.data.frame on esc-objects will add this as column in the returned data frame.

Value

The effect size es, the standard error se, the variance of the effect size var, the lower and upper confidence limits ci.lo and ci.hi, the weight factor w and the total sample size totaln.

References

Lipsey MW, Wilson DB. 2001. Practical meta-analysis. Thousand Oaks, Calif: Sage Publications

Wilson DB. 2016. Formulas Used by the "Practical Meta-Analysis Effect Size Calculator". Unpublished manuscript: George Mason University

Examples

```
# unequal sample size
esc_rpb(r = .3, grp1n = 100, grp2n = 150)

# equal sample size
esc_rpb(r = .3, totaln = 200)

# unequal sample size, with p-value
esc_rpb(p = 0.03, grp1n = 100, grp2n = 150)

# equal sample size, with p-value
esc_rpb(p = 0.03, totaln = 200)
```

---

esc_t *Compute effect size from Student's t-test*

Description

Compute effect size from Student's t-test for *independent samples*.

Usage

```
esc_t(
  t,
  p,
  totaln,
  grp1n,
  grp2n,
  es.type = c("d", "g", "or", "logit", "r", "f", "eta", "cox.or", "cox.log"),
  study = NULL,
  ...
)
```

Arguments

t	The t-value of the t-test. One of t or p must be specified.
p	The p-value of the t-test. One of t or p must be specified.
totaln	Total sample size. Either totaln, or grp1n and grp2n must be specified.
grp1n	Treatment group sample size.
grp2n	Control group sample size.
es.type	Type of effect size that should be returned. "d" returns standardized mean difference effect size d "f" returns effect size Cohen's f "g" returns adjusted standardized mean difference effect size Hedges' g "or" returns effect size as odds ratio "cox.or" returns effect size as Cox-odds ratio (see convert_d2or for details) "logit" returns effect size as log odds "cox.log" returns effect size as Cox-log odds (see convert_d2logit for details) "r" returns correlation effect size r "eta" returns effect size eta squared
study	Optional string with the study name. Using combine_esc or as.data.frame on esc-objects will add this as column in the returned data frame.
...	Other parameters, passed down to further functions. For internal use only, can be ignored.

Value

The effect size es, the standard error se, the variance of the effect size var, the lower and upper confidence limits ci.lo and ci.hi, the weight factor w and the total sample size totaln.

Note

This function only applies to *independent sample* t-tests, either equal or unequal sample sizes. It can't be used for t-values from dependent or paired t-tests, or t-values from other statistical procedures (like regressions).

If `es.type = "r"`, Fisher's transformation for the effect size `r` and their confidence intervals are also returned.

References

Lipsey MW, Wilson DB. 2001. Practical meta-analysis. Thousand Oaks, Calif: Sage Publications

Wilson DB. 2016. Formulas Used by the "Practical Meta-Analysis Effect Size Calculator". Unpublished manuscript: George Mason University

Examples

```
# unequal sample size
esc_t(t = 3.3, grp1n = 100, grp2n = 150)

# equal sample size
esc_t(t = 3.3, totaln = 200)

# unequal sample size, with p-value
esc_t(p = 0.03, grp1n = 100, grp2n = 150)

# equal sample size, with p-value
esc_t(p = 0.03, totaln = 200)
```

`hedges_g` *Convert effect sizes*

Description

Convert between different effect sized.

Usage

```
hedges_g(d, totaln)

eta_squared(d, r, f, or, logit)

cohens_f(d, r, eta, or, logit)

cohens_d(f, r, eta, or, logit)

pearsons_r(d, eta, f, or, logit)

log_odds(d, eta, f, or, r)

odds_ratio(d, eta, f, logit, r)
```

Arguments

d, r, f, eta, or, logit	A scalar or vector with effect size(s).
totaln	A vector of total sample size(s).

Value

The requested effect size.

References

Lipsey MW, Wilson DB. 2001. Practical meta-analysis. Thousand Oaks, Calif: Sage Publications

Wilson DB. 2016. Formulas Used by the "Practical Meta-Analysis Effect Size Calculator". Unpublished manuscript: George Mason University

Hedges LV. 1981. Distribution theory for Glass's estimator of effect size and related estimators. Journal of Educational Statistics 6: 107–128.

Borenstein M, Hedges LV, Higgins JPT, Rothstein HR. 2009. Introduction to Meta-Analysis. Chichester, West Sussex, UK: Wiley

Cohen J. 1988. Statistical Power Analysis for the Behavioral Sciences. 2nd ed. Hillsdale, NJ: Erlbaum

Examples

```
# convert from d to Hedges' g or odds ratio
hedges_g(d = 0.75, totaln = 50)
odds_ratio(d = .3)

# convert from odds ratio to eta_squared
eta_squared(or = 2.3)

# convert from f or r to d
cohens_d(f = .3)
cohens_d(r = .25)

# functions are vectorized
hedges_g(c(0.75, .3), c(50, 70))
cohens_f(r = c(.1, .2, .3))
```

---

write_esc *Write one or more 'esc' objects into an Excel csv-file*

Description

This method is a small wrapper to write csv-files. It writes the results from combine_esc into an Excel csv-file.

Usage

```
write_esc(..., path, sep = ",")
```

Arguments

...	One or more objects of class esc
path	Path to write to, or just file name (to write to working directory).
sep	The field separator string. In some Western European locales, Excel uses a semicolon by default, while in other locales the field separator string in Excel is a comma.

Value

Invisibly returns the combined data frame that is written to the csv-file (see combine_esc).

Note

For Western European locales, the sep-argument probably needs to be set to semicolon (sep = ";"), so Excel reads the csv-file properly. If sep = ";", write.csv2 is used to write the file. Else, write.csv is used.

See Also

combine_esc

Examples

```
e1 <- esc_2x2(grp1yes = 30, grp1no = 50, grp2yes = 40,
              grp2no = 45, study = "Study 1")
e2 <- esc_2x2(grp1yes = 30, grp1no = 50, grp2yes = 40, grp2no = 45,
              es.type = "or", study = "Study 2")
e3 <- esc_t(p = 0.03, grp1n = 100, grp2n = 150, study = "Study 3")
e4 <- esc_mean_sd(grp1m = 7, grp1sd = 2, grp1n = 50, grp2m = 9, grp2sd = 3,
                  grp2n = 60, es.type = "logit", study = "Study 4")

# write to current working directory,
# file extension ".csv" is automatically added
## Not run:
write_esc(e1, e2, e3, e4, path = "EffSizes")
## End(Not run)
```

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