Package: MAd (via r-universe)

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Type Package

Title Meta-Analysis with Mean Differences

Version 0.8-3

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Description A collection of functions for conducting a meta-analysis with mean differences data. It uses recommended procedures as described in The Handbook of Research Synthesis and Meta-Analysis (Cooper, Hedges, & Valentine, 2009).

Depends R (>= 2.10.1)

Suggests metafor, ggplot2

License GPL (>= 2)

Encoding UTF-8

URL https://www.acdelre.com

NeedsCompilation no

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Contents

MAd-package *Meta-Analysis with Mean Differences*

Description

The Mad package contains a variety of functions for conducting a mean differences meta-analysis using recommended procedures as described in *The Handbook of Research Synthesis and Meta-Analysis* (Cooper, Hedges, and Valentine, 2009). The goal in creating this package was to provide user-friendly functions to assist researchers in the process of conducting a meta-analysis, from the initial to final stages of their analytic endeavor. The meta-analyst can begin their project by using MAd functions to derive d (standardized mean differences) and g (unbiased d) from a variety of statistics/values reported in the primary studies (e.g., raw means and sd, t-test). Then, the analyst can aggregate all within-study effect sizes (while accounting for within-study correlations among outcome measures and eliminating any dependencies in the dataset), calculate omnibus effect sizes under a fixed and random effects model, and assess for significant moderators (categorical and continuous, single and multi-predictor models) in the dataset. Finally, the meta-analyst can use one of several user-friendly graphics functions to visually represent their data.

Details

Package:	MAd
Type:	Package
Version:	0.8-2
Date:	2014-12-23
License:	GPL-2
LazyLoad:	yes

The MAd package has integrated functions to facilitate the meta-analytic process at nearly every analytical stage. There are five broad areas of analysis that the MAd package targets:

1. Computations to Calculate Mean Differences:

There are a variety of functions to compute d (standardized mean difference) and g (unbiased d) from various designs reported in the primary studies. Most functions were derived from Borenstein's chapter in *The Handbook of Research Synthesis and Meta-Analysis* (Cooper, Hedges, & Valentine, 2009; pp. 228-234). For additional conversion formulas see the **compute.es** package: https://CRAN.R-project.org/package=compute.es

2. Within-Study Aggregation of Effect Sizes:

This fuction will simultaneously aggregate all within-study effect sizes while taking into account the correlations among the within-study outcome measures (Gleser & Olkin 2009; Gleser & Olkin 2009; Hedges & Olkin, 1985; Rosenthal et al., 2006). The default imputed correlation between within-study effect sizes is set at .50 (Wampold et al., 1997) and will compute an aggregated effect size for each study. This default of .50 is adjustable and can vary between outcome types. This MAd aggregation function implements Gleser & Olkin (1994; 2009) and Borenstein et al. (2009) procedures for aggregating dependent effect sizes. To our knowledge, this is the first statistical package/program to explicitly utilize and automate this type of aggregation procedure, which has a dual effect of saving the researcher **substantial** time while improving the accuracy of their analyses.

3. Fixed and Random Effects Omnibus Analysis:

This package contains all the relevant functions to calculate fixed and random effects omnibus effect sizes, outputting the omnibus (i.e., overall) effect size, variance, standard error, upper and lower confidence intervals, and the Q-statistic (heterogeneity test).

4. Moderator Analyses:

There are user-friendly functions to compute fixed and random effects moderator analyses. These include single and multiple predictor models for both categorical and continuous moderator data.

5. Graphics:

This package has a variety of functions visually representing data. This includes boxplots and meta-regression scatterplots.

6. Sample of Additional Functions:

Export MA output to nicely formatted Word tables.

Author(s)

AC Del Re & William T. Hoyt

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References

Borenstein (2009). Effect sizes for continuous data. In H. Cooper, L. V. Hedges, & J. C. Valentine (Eds.), *The handbook of research synthesis and meta analysis* (pp. 279-293). New York: Russell Sage Foundation.

Cooper, H., Hedges, L.V., & Valentine, J.C. (2009). *The handbook of research synthesis and meta-analysis* (2nd edition). New York: Russell Sage Foundation.

Gleser & Olkin (1994). Stochastically dependent effect sizes. In H. Cooper, & L. V. Hedges, & J. C.(Eds.), *The handbook of research synthesis* (pp. 339-356). New York: Russell Sage Foundation.

Gleser & Olkin (2009). Stochastically dependent effect sizes. In H. Cooper, L. V. Hedges, & J. C. Valentine (Eds.), *The handbook of research synthesis and meta analysis* (pp. 357-376). New York: Russell Sage Foundation.

Viechtbauer, W (2010). metafor: Meta-Analysis Package for R. R package version 1.1-0. https://CRAN.R-project.org/package=metafor

Wampold, B. E., Mondin, G. W., Moody, M., Stich, F., Benson, K., & Ahn, H. (1997). A meta-analysis of outcome studies comparing bona fide psychotherapies: Empiricially, 'all must have prizes.' *Psychological Bulletin, 122(3)*, 203-215.

See Also

compute.es package: https://CRAN.R-project.org/package=compute.es;

metafor package: https://CRAN.R-project.org/package=metafor

Examples

```
## EXAMPLES FOR EACH BROAD AREA

# SAMPLE DATA:
MA <- data.frame(id=factor(rep(1:5, 3)),
                 measure=c(rep("dep",5), rep("anx",5), rep("shy",5)),
                 es=c(rnorm(5, 0.8, .2), rnorm(5, 0.5, .1), rnorm(5, 0.4, .1)),
                 var.es=abs(rnorm(5*3,0.05, .03)),
                 nT=round(rnorm(5*3, 30, 5),0),
                 nC=round(rnorm(5*3, 30, 5),0),
                 mod1=factor(rep(c("a","b","c","d","e"),3)),
                 mod2=rep(seq(20, 60, 10), 3))

# 1. COMPUTE MEAN DIFFERENCE STATISTIC FROM
# REPORTED STATS (GENERALLY FROM A PRIMARY STUDY):

# suppose the primary study reported an log odds ratio for different
# proportions between 2 groups. Then, running:

lor_to_d(.9070,.0676)

# reported log odds ratio (lor = .9070) and variance (.0676) will output the
# standardized mean difference (d) and its variance (var.d) that can be used in
# a meta-analysis.

## 2. ACCOUNT FOR DEPENDENCIES: WITHIN-STUDY EFFECT SIZES (ES):

## 2 EXAMPLES:
# EXAMPLE 1:  AGGREGATING EFFECT SIZES FOR A DATA FRAME
# (MULTIPLE STUDIES AT LEAST SOME OF WHICH HAVE MULTIPLE DEPENDENT EFFECT SIZES)
# EXAMPLE 2:  AGGREGATING EFFECT SIZES FOR SINGLE STUDY WITH THREE OR MORE
# EFFECT SIZES WHEN PAIRS OF DVS HAVE DIFFERENT CORRELATIONS

## EXAMPLE 1:  MA IS A DATA FRAME CONTAINING MULTIPLE STUDIES (id),
## EACH WITH MULTIPLE EFFECT SIZES (CORRELATIONS BETWEEN ALL PAIRS OF DVS ARE r=.5.)


# AGGREGATION PROCEDURE:
# method="GO1"; GLESER AND OLKIN (1994) PROCEDURE WHEN d IS COMPUTED
# USING POOLED SD IN THE DENOMINATOR

MA1 <- agg(id=id, es=es, var=var.es, n.1=nT, n.2=nC, cor = .5, method="GO1", data=MA)

MA1

## EXAMPLE 2: STUDY 1 COMPARES A TREATMENT AND CONTROL GROUP ON
## THREE OUTCOME MEASURES (DEPRESSION, ANXIETY, and SHYNESS).
# THE CORRELATION AMONG THE THREE PAIRS OF DVS ARE r12=.5, r13=.2, and r23=.3.

study1 <- data.frame( id=factor(rep(1, 3)),
                      measure=c("dep", "anx", "shy"),
                      es=c(0.8, 0.5, 0.4),
```

```
                      var.es=c(0.01, 0.02, 0.1),
                      nT=rep(30, 3),
                      nC=rep(30, 3))

# ONE WOULD CONSTRUCT THE CORRELATION MATRIX AS FOLLOWS:

cors <- matrix(c(1,.5,.2,
                 .5,1,.3,
                 .2,.3,1), nrow=3)

# AGGREGATION PROCEDURE:
# method="GO1"; GLESER AND OLKIN (1994) PROCEDURE WHEN d
# IS COMPUTED USING POOLED SD IN THE DENOMINATOR

agg(id=id, es=es, var=var.es, n.1=nT, n.2=nC, cor=cors, method="GO1", mod = NULL, data=study1)


# where MA = data.frame with columns for id, es (standardized
# mean difference), var.es (variance of es), n.1 (sample size of group
# one), and n.2 (sample size of comparison group) with multiple rows per
# study. Outputs an aggregated data.frame with 1 effect size per study.

## 3.OMNIBUS ANALYSIS

# FIRST ADD MODERATORS TO THE AGGREGATED DATASET:

MODS <- data.frame(id=1:5,
                   mod1=factor(c("a","b","a","b","b")),
                   mod2=as.numeric(c(20, 30, 25, 35, 40)))

MA2 <- merge(MA1, MODS, by='id')

# Random Effects
m0 <- mareg(es1~ 1, var = var1, method = "REML", data = MA2)

# where MA = data.frame with columns for id, es (standardized
# mean difference), var.es (variance of es), n.1 (sample size of group
# one), and n.2 (sample size of comparison group).

# view output:
summary(m0)


# 4. MODERATOR ANALYSIS:

# Random Effects
m1 <- mareg(es1~ mod1 + mod2 , var = var1, method = "REML", data = MA2)

# view output:
summary(m1)

# 5. Graphics:
```

```
## Not run: plotcon(g = es1, var = var1, mod = mod1, data = MA2, method= "random",
modname= "Moderator")
## End(Not run)

# Additional Functions

# Export MA output to nicely formatted Word tables.

# install R2wd
# install.packages('R2wd', dependencies = TRUE)

# Export data to Word in formatted table

#  wd(m1, get = TRUE, new = TRUE)
```

---

agg *Aggregate Dependent Effect Sizes*

Description

This function will simultaneously aggregate all within-study effect sizes while taking into account the correlations among the within-study outcomes. The default correlation between outcome measures is set at .50 (Wampold et al., 1997), and can be adjusted as needed. An aggregate effect size and its variance is computed for each study. This MAd aggregation function implements Gleser & Olkin (1994) and Borenstein et al. (2009) procedures for aggregating dependent effect sizes..

Usage

```
agg(id, es, var, n.1=NULL, n.2=NULL, method = "BHHR", cor = .50,  mod=NULL, data)
```

Arguments

id	Study id with multiple rows of same id.
es	Effect size. Use Cohen's d for GO1 and GO2 method and use Hedges g for BHHR method.
var	Variance of g.
n.1	Sample size of group one. Only required if using method='GO1' or 'GO2'.
n.2	Sample size of group two. Only required if using method='GO1' or 'GO2'.
method	'BHHR'= Borenstein, et al. (2009) procedure.'GO1'= Gleser and Olkin (1994) procedure using pooled standard deviation (SD). 'GO2'= Gleser and Olkin (1994) procedure using group 2 SD (typically control group SD). Default is 'BHHR'.
cor	Estimated correlation among within-study outcome variables. Input should either be a fixed correlation (default is r=.5) or a correlation matrix to allow different correlations between outcome types (in which case aggregation should typically be on one study at a time rather than the entire dataset–see examples below).

mod
: To aggregate by id and one moderator. If there are multiple levels of a categorical moderator within study and one can in derive seperate effect size estimates for each level within and between studies. Default is NULL.

data
: `data.frame` with above values.

Value

Outputs a `data.frame` with aggregated effect sizes and variances of effect sizes where each study is reduced to one row per study (unless aggregated by a moderator) by a weighted average formula.

Author(s)

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References

Borenstein (2009). Effect sizes for continuous data. In H. Cooper, L. V. Hedges, & J. C. Valentine (Eds.), *The handbook of research synthesis and meta analysis* (pp. 279-293). New York: Russell Sage Foundation.

Cooper, H., Hedges, L.V., & Valentine, J.C. (2009). *The handbook of research synthesis and meta-analysis* (2nd edition). New York: Russell Sage Foundation.

Gleser & Olkin (1994). Stochastically dependent effect sizes. In H. Cooper, & L. V. Hedges, & J. C.(Eds.), *The handbook of research synthesis*(pp. 339-356). New York: Russell Sage Foundation.

Gleser & Olkin (2009). Stochastically dependent effect sizes. In H. Cooper, L. V. Hedges, & J. C. Valentine (Eds.), *The handbook of research synthesis and meta analysis* (pp. 357-377). New York: Russell Sage Foundation.

Shadish & Haddock (2009). Analyzing effect sizes: Fixed-effects models. In H. Cooper, L. V. Hedges, & J. C. Valentine (Eds.), *The handbook of research synthesis and meta analysis* (pp. 257-278). New York: Russell Sage Foundation.

Examples

```
## 2 EXAMPLES:

# EXAMPLE 1:  Aggregating effect sizes for a data frame
# (multiple studies at least some of which have multiple
# effect sizes), assuming equal correlations (r=.5) between
# pairs of DVs.
# EXAMPLE 2:  Aggregating effect sizes for a single study
# with 3 or more effect sizes when pairs of DVs have
# different correlations.

# LOAD DATA (EXAMPLE DATA FROM HOYT & DEL RE, 2015 SIMULATION):
data(dat.hoyt)

## EXAMPLE 1:  dat.hoyt is a data frame with multiple studies identified
## by variable 'id'.  Each study has multiple effect sizes based on
## multiple DVs.  Correlations between all pairs of DVs are r=.5.
```

```
# NOTE: Based on a simulation study by Hoyt & Del Re (2015), it is
# recommended that methods "G01" and "G02" (Gleser and Olkin)
# should aggregate Cohen's d, without using Hedges & Olkin's
# recommended bias correction.  (Studies providing only a single
# effect size should still be corrected for bias, after aggregation.)

# Method "BHHR" should aggregate Hedges' g, after bias correction.


# Option 1: method="BHHR"; Borenstein et al. (2009) procedure.
# Use with Hedges' g; can also be used with any other effect
# size (e.g., z', LOR).

agg(id=id, es=g, var=vg,  cor=.5,
    method="BHHR", mod=NULL, data=dat.hoyt)

#  Option 2: method="GO1"; Gleser & Olkin (1994) procedure when
#  d is computed using pooled sd in denominator.

agg(id=id, es=d, var=vd, n.1=n.T, n.2=n.C, cor = .5,
    method="GO1", mod = NULL, data=dat.hoyt)

# Option 3: method="GO2"; Gleser & Olkin (1994) procedure when
# d is computed using sd.2 (typically control group sd)
# in denominator

agg(id=id, es=d, var=vd, n.1=n.T, n.2=n.C, cor = .5,
    method="GO2", mod = NULL, data=dat.hoyt)


## EXAMPLE 2: Single study comparing T and C group
## on three DVs:  depression, anxiety, and shyness
## r12=.5; r13=.2; r23=.3

data <- dat.hoyt[20:22,]

# Step 1:  Create the correlation matrix, based on r12, r13, and r23:

cors <- matrix(c(1,.5,.2,
                 .5,1,.3,
                 .2,.3,1), nrow=3)

# Step 2:  Aggregate using agg() function.

# Option 1: method="BHHR"; Borenstein et al. (2009) procedure.
# Use with Hedges' g; can also be used with any other effect
# size (e.g., z', LOR).

agg(id=id, es=g, var=vg,  cor=cors,
    method="BHHR", mod=NULL, data=data)

#  Option 2: method="GO1"; Gleser & Olkin (1994) procedure when
```

```
#  d is computed using pooled sd in denominator.

agg(id=id, es=d, var=vd, n.1=n.T, n.2=n.C, cor = cors,
    method="GO1", mod = NULL, data=data)

# Option 3: method="GO2"; Gleser & Olkin (1994) procedure when
# d is computed using sd.2 (typically control group sd)
# in denominator

agg(id=id, es=d, var=vd, n.1=n.T, n.2=n.C, cor = cors,
    method="GO2", mod = NULL, data=data)


## Citation ##
# Hoyt, W. T., & Del Re, A. C. (2013).  Comparison of methods for
# aggregating dependent effect sizes in meta-analysis.
# Manuscript submitted for publication.
```

---

ancova_to_d1 *ANCOVA F-statistic to d*

Description

Converts an ANCOVA F-statistic to d (standardized mean difference)

Usage

```
ancova_to_d1(m.1.adj, m.2.adj, sd.adj, n.1, n.2, R, q)
```

Arguments

m.1.adj	Adjusted mean of treatment group from ANCOVA.
m.2.adj	Adjusted mean of comparison group from ANCOVA.
sd.adj	Adjusted standard deviation.
n.1	Treatment group sample size.
n.2	Comparison group sample size.
R	Covariate outcome correlation or multiple correlation.
q	Number of covariates.

Value

d	Standardized mean difference (d).
var_d	Variance of d.

Author(s)

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References

Borenstein (2009). Effect sizes for continuous data. In H. Cooper, L. V. Hedges, & J. C. Valentine (Eds.), *The handbook of research synthesis and meta analysis* (pp. 279-293). New York: Russell Sage Foundation.

See Also

d_to_g, mean_to_d, mean_to_d2, t_to_d, f_to_d, p_to_d1, p_to_d2, ancova_to_d1, ancova_to_d2, tt.ancova_to_d, f.ancova_to_d, r_to_d, p.ancova_to_d1, p.ancova_to_d2, lor_to_d, prop_to_or, prop_to_d, r_from_chi, r_from_d, r_from_d1, r_from_t

---

ancova_to_d2 *ANCOVA F-statistic to d II*

Description

Converts an ANCOVA F-statistic with pooled standard deviation to d (standardized mean difference)

Usage

```
ancova_to_d2(m.1.adj, m.2.adj, s.pooled, n.1, n.2, R, q)
```

Arguments

m.1.adj	Adjusted mean of treatment group from ANCOVA.
m.2.adj	Adjusted mean of comparison group from ANCOVA.
s.pooled	Pooled standard deviation.
n.1	Treatment group sample size.
n.2	Comparison group sample size.
R	Covariate outcome correlation or multiple correlation.
q	number of covariates.

Value

d	Standardized mean difference (d).
var_d	Variance of d.

Author(s)

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References

Borenstein (2009). Effect sizes for continuous data. In H. Cooper, L. V. Hedges, & J. C. Valentine (Eds.), *The handbook of research synthesis and meta analysis* (pp. 279-293). New York: Russell Sage Foundation.

See Also

`d_to_g`, `mean_to_d`, `mean_to_d2`, `t_to_d`, `f_to_d`, `p_to_d1`, `p_to_d2`, `ancova_to_d1`, `ancova_to_d2`, `tt.ancova_to_d`, `f.ancova_to_d`, `r_to_d`, `p.ancova_to_d1`, `p.ancova_to_d2`, `lor_to_d`, `prop_to_or`, `prop_to_d`, `r_from_chi`, `r_from_d`, `r_from_d1`, `r_from_t`

`atten` *Correction for Attenuation*

Description

Used to correct for attenuated effect sizes due to measurement unreliability.

Usage

```
atten(g, xx, yy, data)
```

Arguments

`g`	Hedges g (unbiased estimate of d) effect size.
`xx`	Column for reliability of predictor variable ("independent variable").
`yy`	Column for reliability of outcome variable ("dependent variable").
`data`	`data.frame` with the above values.

Value

A new column for g corrected for attenuation (`g.corrected`) will be added to the data, for those xx & yy columns with complete data.

Author(s)

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References

Hunter, J. E., Schmidt, F. L. (2004). *Methods of meta-analysis* (2nd edition). Thousand Oaks, CA: Sage.

Examples

```
# Sample data:

id<-c(1, 1:19)
n<-c(10,20,13,22,28,12,12,36,19,12,36,75,33,121,37,14,40,16,14,20)
g<-c(.68,.56,.23,.64,.49,-.04,.49,.33,.58,.18,-.11,.27,.26,.40,.49,
 .51,.40,.34,.42,.16)
var.g <- c(.08,.06,.03,.04,.09,.04,.009,.033,.0058,.018,.011,.027,.026,.0040,
  .049,.0051,.040,.034,.0042,.016)
xx<-c(.88,.86,.83,.64,.89,.84,.89,.83,.99,.88,.81,.77,.86,.70,.79,
 .71,.80,.74,.82,.86)  # Reliability of "independent variable"
yy<-c(.99,.86,.83,.94,.89,.94,.89,.93,.99,.88,.81,.77,.86,.70,.79,
 .71,.80,.94,.92,.96)  # Reliability of "dependent variable"

df<-data.frame(id,n,g, var.g, xx,yy)

# Example
atten(g= g, xx = xx, yy = yy, data= df)
```

---

compute_dgs — *Computes Vector of Standardized Mean Differences*

Description

Adds d & g (standardized mean difference) to a `data.frame`. Required inputs are: n.1 (sample size of group one), m.1 (raw post-mean value of group one), sd.1 (standard deviation of group one), n.2 (sample size of group two), m.2 (raw post-mean value of group two), sd.2 (standard deviation of group two).

Usage

```
compute_dgs(n.1, m.1, sd.1 , n.2, m.2, sd.2, data, denom = "pooled.sd")
```

Arguments

`n.1`	sample size of group one.
`m.1`	raw post-mean value of group one.
`sd.1`	standard deviation of group one.
`n.2`	sample size of group two.
`m.2`	raw post-mean value of group two.
`sd.2`	standard deviation of group two.

data	data.frame with above values
denom	Value in the denominator to standardize the means by. pooled.sd will pool together both groups in deriving d. control.sd uses the standard deviation of group two (typically the control condition) to calculate d.

Value

d	Standardized mean difference.
var.d	Variance of d.
se.d	Standard error of d.

Author(s)

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References

Borenstein (2009). Effect sizes for continuous data. In H. Cooper, L. V. Hedges, & J. C. Valentine (Eds.), *The handbook of research synthesis and meta analysis* (pp. 279-293). New York: Russell Sage Foundation.

See Also

compute_ds, compute_gs

Examples

```
id <- c(1:20)
n.1 <- c(10,20,13,22,28,12,12,36,19,12,36,75,33,121,37,14,40,16,14,20)
n.2 <- c(11,22,10,20,25,12,12,36,19,11,34,75,33,120,37,14,40,16,10,21)
m.1 <- c(.68,.56,.23,.64,.49,.4,1.49,.53,.58,1.18,.11,1.27,.26,.40,.49,
         .51,.40,.34,.42,.66)
m.2 <- c(.38,.36,.23,.34,.29,.4,1.9,.33,.28,1.1,.111,.27,.21,.140,.149,
         .51,.140,.134,.42,.16)
sd.1 <- c(.28,.26,.23,.44,.49,.34,.39,.33,.58,.38,.31,.27,.26,.40,
          .49,.51,.140,.134,.42,.46)
sd.2 <- c(.28,.26,.23,.44,.49,.44,.39,.33,.58,.38,.51,.27,.26,.40,
          .49,.51,.140,.134,.142,.36)
mod1 <- c(1,2,3,4,1,2,8,7,5,3,9,7,5,4,3,2,3,5,7,1)
mod2 <- factor(c(rep(c(1,2,3,4),5)))
dfs <- data.frame(id, n.1,m.1, sd.1, n.2, m.2, sd.2, mod1, mod2)

# Example
compute_dgs(n.1, m.1, sd.1, n.2, m.2, sd.2, data = dfs)
```

compute_ds *Computes Vector of Standardized Mean Differences*

Description

Adds d (standardized mean difference) to a `data.frame`. Required inputs are: n.1 (sample size of group one), m.1 (raw post-mean value of group one), sd.1 (standard deviation of group one), n.2 (sample size of group two), m.2 (raw post-mean value of group two), sd.2 (standard deviation of group two).

Usage

```
compute_ds(n.1, m.1, sd.1 , n.2, m.2, sd.2 , data, denom = "pooled.sd")
```

Arguments

`n.1`	sample size of group one.
`m.1`	raw post-mean value of group one.
`sd.1`	standard deviation of group one.
`n.2`	sample size of group two.
`m.2`	raw post-mean value of group two.
`sd.2`	standard deviation of group two.
`data`	`data.frame` with values above.
`denom`	Value in the denominator to standardize the means by. `pooled.sd` will pool together both groups in deriving d. `control.sd` uses the standard deviation of group two (typically the control condition) to calculate d.

Value

`d`	Standardized mean difference.
`var.d`	Variance of d.
`se.d`	Standard error of d.

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References

Borenstein (2009). Effect sizes for continuous data. In H. Cooper, L. V. Hedges, & J. C. Valentine (Eds.), *The handbook of research synthesis and meta analysis* (pp. 279-293). New York: Russell Sage Foundation.

See Also

compute_ds, compute_dgs

Examples

```
id <- c(1:20)
n.1 <- c(10,20,13,22,28,12,12,36,19,12,36,75,33,121,37,14,40,16,14,20)
n.2 <- c(11,22,10,20,25,12,12,36,19,11,34,75,33,120,37,14,40,16,10,21)
m.1 <- c(.68,.56,.23,.64,.49,.4,1.49,.53,.58,1.18,.11,1.27,.26,.40,.49,
         .51,.40,.34,.42,.66)
m.2 <- c(.38,.36,.23,.34,.29,.4,1.9,.33,.28,1.1,.111,.27,.21,.140,.149,
         .51,.140,.134,.42,.16)
sd.1 <- c(.28,.26,.23,.44,.49,.34,.39,.33,.58,.38,.31,.27,.26,.40,
          .49,.51,.140,.134,.42,.46)
sd.2 <- c(.28,.26,.23,.44,.49,.44,.39,.33,.58,.38,.51,.27,.26,.40,
          .49,.51,.140,.134,.142,.36)
mod1 <- c(1,2,3,4,1,2,8,7,5,3,9,7,5,4,3,2,3,5,7,1)
mod2 <- factor(c(rep(c(1,2,3,4),5)))
dfs <- data.frame(id, n.1,m.1, sd.1, n.2, m.2, sd.2, mod1, mod2)

# Example
compute_ds(n.1, m.1, sd.1, n.2, m.2, sd.2, data = dfs)
```

---

compute_gs — *Converts Vector of Standardized Mean Differences*

Description

Adds g (unbiassed standardized mean difference) to a `data.frame`. Required inputs are: n.1 (sample size of group one), sd.1 (standard deviation of group one), n.2 (sample size of group two).

Usage

```
compute_gs(d , var.d , n.1, n.2, data)
```

Arguments

`d`	Standardized mean difference (biased).
`var.d`	Variance of d.
`n.1`	sample size of group one.
`n.2`	sample size of group two.
`data`	`data.frame` with standardized mean difference, variance of d, sample size of group one, sample size of group two.

Value

`g`	Unbiased standardized mean difference.
`var.g`	Variance of g.
`se.g`	Standard error of g.

Author(s)

AC Del Re & William T. Hoyt

Maintainer: AC Del Re <acdelre@gmail.com>

References

Borenstein (2009). Effect sizes for continuous data. In H. Cooper, L. V. Hedges, & J. C. Valentine (Eds.), *The handbook of research synthesis and meta analysis* (pp. 279-293). New York: Russell Sage Foundation.

See Also

`compute_ds`, `compute_dgs`

Examples

```
id <- c(1:20)
n.1 <- c(10,20,13,22,28,12,12,36,19,12,36,75,33,121,37,14,40,16,14,20)
n.2 <- c(11,22,10,20,25,12,12,36,19,11,34,75,33,120,37,14,40,16,10,21)
m.1 <- c(.68,.56,.23,.64,.49,.4,1.49,.53,.58,1.18,.11,1.27,.26,.40,.49,
         .51,.40,.34,.42,.66)
m.2 <- c(.38,.36,.23,.34,.29,.4,1.9,.33,.28,1.1,.111,.27,.21,.140,.149,
         .51,.140,.134,.42,.16)
sd.1 <- c(.28,.26,.23,.44,.49,.34,.39,.33,.58,.38,.31,.27,.26,.40,
          .49,.51,.140,.134,.42,.46)
sd.2 <- c(.28,.26,.23,.44,.49,.44,.39,.33,.58,.38,.51,.27,.26,.40,
          .49,.51,.140,.134,.142,.36)
mod1 <- c(1,2,3,4,1,2,8,7,5,3,9,7,5,4,3,2,3,5,7,1)
mod2 <- factor(c(rep(c(1,2,3,4),5)))
dfs <- data.frame(id, n.1,m.1, sd.1, n.2, m.2, sd.2, mod1, mod2)

# Example

# first compute d
dfs2 <- compute_ds(n.1, m.1, sd.1, n.2, m.2, sd.2, data = dfs)

# now, compute g
compute_gs(d, var.d, n.1, n.2, dfs2)
```

`dat.cooper15.3` *Data from Table 15.3 in The Handbook for Research Synthesis and Meta-Analysis (Cooper et al., 2009)*

Description

Data from Table 15.3 in The Handbook for Research Synthesis and Meta-Analysis (Cooper et al., 2009)

`dat.cooperA2` *Data from Table A2 in The Handbook for Research Synthesis and Meta-Analysis (Cooper et al., 2009)*

Description

Data from Table A2 in The Handbook for Research Synthesis and Meta-Analysis (Cooper et al., 2009)

`dat.hoyt` *Subset of simulated data to demonstrate aggregation for dependent effect sizes*

Description

Subset of simulated data to demonstrate aggregation for dependent effect sizes. This data comes from: Hoyt, W. T., & Del Re, A. C. (2013). Comparison of methods for aggregating dependent effect sizes in meta-analysis. Manuscript submitted for publication.

`dat.sim.es` *Subset of simulated psychotherapy treatment studies (k=8) with dependent effect sizes*

Description

This data set includes effect sizes for treatment vs control groups for a random subset of 8 simulated psychotherapy treatment studies (total population k = 1000). The known population standardized mean difference for outcome one is g = 0.50 and for outcome two g = 0.80. The data set also includes two correlated study-level variables (i.e., moderators): treatment duration (`dose`) and average participant distress (`stress`).

This data accompanies a tutorial for meta-analysis:

Del Re, A. C. (2015). A Practical Tutorial on Conducting Meta-Analysis in R. *The Quantitative Methods for Psychology*.

`dat.sim.final` *Final aggregated dataset of simulated psychotherapy treatment studies (k=8)*

Description

This data set includes aggregated effect sizes for treatment vs control groups for a random subset of 8 simulated psychotherapy treatment studies (total population k = 1000). The known population standardized mean difference for outcome one is g = 0.50 and for outcome two g = 0.80. The data set also includes two correlated study-level variables (i.e., moderators): treatment duration (`dose`) and average participant distress (`stress`).

This data accompanies a tutorial for meta-analysis:

Del Re, A. C. (2015). A Practical Tutorial on Conducting Meta-Analysis in R. *The Quantitative Methods for Psychology*.

`dat.sim.raw` *Subset of simulated psychotherapy treatment studies (k=8) with means and SD*

Description

This data set includes means and standard deviations for treatment and control groups for a subset of k = 8 simulated psychotherapy treatment studies from a population of k = 1000 (see dat.sim1 and dat.sim2 for the k = 1000 studies for outcome 1 and 2, respectfully). Although effect sizes are not calculated in this dataset, the known population standardized mean difference for outcome one is d=0.50 and for outcome two g=0.80. The data set also includes two correlated study-level variables (i.e., moderators): treatment duration (`dose`) and average participant distress (`stress`).

This data accompanies a tutorial for meta-analysis:

Del Re, A. C. (2015). A Practical Tutorial on Conducting Meta-Analysis in R. *The Quantitative Methods for Psychology*.

`dat.sim1` *Simulated psychotherapy treatment studies for 'outcome one'*

Description

This data set includes 1000 simulated psychotherapy treatment studies. The population standardized mean difference for outcome one is d=0.50. The data set also includes two correlated study-level variables (i.e., moderators): treatment duration (`dose`) and average participant distress (`stress`).

This data accompanies a tutorial for meta-analysis:

Del Re, A. C. (2015). A Practical Tutorial on Conducting Meta-Analysis in R. *The Quantitative Methods for Psychology*.

dat.sim2	*Simulated psychotherapy treatment studies for 'outcome two'*

Description

This data set includes 1000 simulated psychotherapy treatment studies. The population standardized mean difference for outcome two is d=0.80. The data set also includes two correlated study-level variables (i.e., moderators): treatment duration (`dose`) and average participant distress (`stress`).

This data accompanies a tutorial for meta-analysis:

Del Re, A. C. (2015). A Practical Tutorial on Conducting Meta-Analysis in R. *The Quantitative Methods for Psychology*.

d_to_g	*Standardized Mean Difference (d) Statistic to Unbiased Standardized Mean Difference (g)*

Description

Eliminates the small upward bias of d to provide an unbiased estimate of the population effect size parameter (g). This procedure will compute g for a single value of d.

Usage

```
d_to_g(d, var.d, n.1, n.2)
```

Arguments

`d`	Standardized mean difference statistic (d has a slight bias).
`var.d`	Variance of d.
`n.1`	Sample size of treatment group.
`n.2`	Sample size of comparison group.

Value

`g`	Unbiased Standardized mean difference statistic.
`var.g`	Variance of g.

Author(s)

AC Del Re & William T. Hoyt

Maintainer: AC Del Re `<acdelre@gmail.com>`

References

Borenstein (2009). Effect sizes for continuous data. In H. Cooper, L. V. Hedges, & J. C. Valentine (Eds.), *The handbook of research synthesis and meta analysis* (pp. 279-293). New York: Russell Sage Foundation.

---

f.ancova_to_d *ANCOVA F-statistic to Standardized Mean Difference (d)*

Description

Converts an ANCOVA F-statistic to d (standardized mean difference).

Usage

```
f.ancova_to_d(f, n.1, n.2, R, q)
```

Arguments

`f`	F-test value from ANCOVA.
`n.1`	Treatment group sample size.
`n.2`	Comparison group sample size.
`R`	Covariate outcome correlation or multiple correlation.
`q`	number of covariates.

Value

`d`	Standardized mean difference (d).
`var_d`	Variance of d.

Author(s)

AC Del Re & William T. Hoyt

Maintainer: AC Del Re <acdelre@gmail.com>

References

Borenstein (2009). Effect sizes for continuous data. In H. Cooper, L. V. Hedges, & J. C. Valentine (Eds.), *The handbook of research synthesis and meta analysis* (pp. 279-293). New York: Russell Sage Foundation.

See Also

`d_to_g`, `mean_to_d`, `mean_to_d2`, `t_to_d`, `f_to_d`, `p_to_d1`, `p_to_d2`, `ancova_to_d1`, `ancova_to_d2`, `tt.ancova_to_d`, `r_to_d`, `p.ancova_to_d1`, `p.ancova_to_d2`, `lor_to_d`, `prop_to_or`, `prop_to_d`, `r_from_chi`, `r_from_d`, `r_from_d1`, `r_from_t` `fail_to_d` *Failure groups to Standardized Mean Difference (d)*

Description

Converts number of 'failure' groups reported in the primary study to standardized mean difference (d).

Usage

```
fail_to_d(B, D, n.1, n.0)
```

Arguments

B	Treatment failure.
D	Non-treatment failure.
n.1	Treatment sample size.
n.0	Control/comparison sample size.

Value

d	Standardized mean difference (d).
var_d	Variance of d.

Author(s)

AC Del Re & William T. Hoyt

Maintainer: AC Del Re <acdelre@gmail.com>

References

Borenstein (2009). Effect sizes for continuous data. In H. Cooper, L. V. Hedges, & J. C. Valentine (Eds.), *The handbook of research synthesis and meta analysis* (pp. 279-293). New York: Russell Sage Foundation.

See Also

`d_to_g`, `mean_to_d`, `mean_to_d2`, `t_to_d`, `f_to_d`, `p_to_d1`, `p_to_d2`, `ancova_to_d1`, `ancova_to_d2`, `tt.ancova_to_d`, `f.ancova_to_d`, `r_to_d`, `p.ancova_to_d1`, `p.ancova_to_d2`, `lor_to_d`, `prop_to_or`, `r_from_chi`, `r_from_d`, `r_from_d1`, `r_from_t` f_to_d *F-test to Standardized Mean Difference (d)*

Description

Converts F-test value to standardized mean difference (d).

Usage

```
f_to_d(f, n.1, n.2)
```

Arguments

f	F-value reported in primary study.
n.1	Sample size of treatment group.
n.2	Sample size of comparison group.

Value

d	Standardized mean difference (d).
var_d	Variance of d.

Author(s)

AC Del Re & William T. Hoyt

Maintainer: AC Del Re <acdelre@gmail.com>

References

Borenstein, M. (2009). Effect sizes for continuous data. In H. Cooper, L. V. Hedges, & J. C. Valentine (Eds.), *The handbook of research synthesis and meta analysis* (pp. 279-293). New York: Russell Sage Foundation.

See Also

d_to_g, mean_to_d, mean_to_d2, t_to_d, p_to_d1, p_to_d2, ancova_to_d1, ancova_to_d2, tt.ancova_to_d, f.ancova_to_d, r_to_d, p.ancova_to_d1, p.ancova_to_d2, lor_to_d, prop_to_or, prop_to_d, r_from_chi, r_from_d, r_from_d1, r_from_t icc *Intraclass correlation coefficient (ICC) for oneway and twoway models*

Description

Computes single score or average score ICCs as an index of interrater reliability of quantitative data. Additionally, F-test and confidence interval are computed.

Usage

```
icc(ratings, model = c("oneway", "twoway"),
    type = c("consistency", "agreement"),
    unit = c("single", "average"), r0 = 0, conf.level = 0.95)
```

Arguments

`ratings`	n*m matrix or dataframe, n subjects m raters.
`model`	a character string specifying if a `oneway` model (default) with row effects random, or a `twoway` model with column and row effects random should be applied. You can specify just the initial letter.
`type`	a character string specifying if '"consistency"' (default) or '"agreement"' between raters should be estimated. If a '"oneway"' model is used, only '"consistency"' could be computed. You can specify just the initial letter.
`unit`	a character string specifying the unit of analysis: Must be one of `single` (default) or `average`. You can specify just the initial letter.
`r0`	specification of the null hypothesis r = r0. Note that a one sided test (H1: r > r0) is performed.
`conf.level`	confidence level of the interval.

Details

This function was created by Matthias Gamer for the `irr` package. For more details, see:

http://rss.acs.unt.edu/Rdoc/library/irr/html/icc.html

Details for the function:

Missing data are omitted in a listwise way. When considering which form of ICC is appropriate for an actual set of data, one has take several decisions (Shrout & Fleiss, 1979):

1. Should only the subjects be considered as random effects (`oneway` model) or are subjects and raters randomly chosen from a bigger pool of persons (`twoway` model).

2. If differences in judges' mean ratings are of interest, interrater `agreement` instead of `consistency` should be computed.

3. If the unit of analysis is a mean of several ratings, unit should be changed to `average`. In most cases, however, single values (`unit` = `single`) are regarded.

Value

A list with class `icclist` containing the following components:

`subjects`	the number of subjects examined.
`raters`	the number of raters.
`model`	a character string describing the selected model for the analysis.
`type`	a character string describing the selected type of interrater reliability.
`unit`	a character string describing the unit of analysis.
`icc.name`	a character string specifying the name of ICC according to McGraw & Wong (1996).
`value`	the intraclass correlation coefficient.
`r0`	the specified null hypothesis.
`Fvalue`	the value of the F-statistic.
`df1`	the numerator degrees of freedom.
`df2`	the denominator degrees of freedom.
`p.value`	the p-value for a two-sided test.
`conf.level`	the confidence level for the interval.
`lbound`	the lower bound of the confidence interval.
`ubound`	the upper bound of the confidence interval.

Author(s)

Matthias Gamer

References

Bartko, J.J. (1966). The intraclass correlation coefficient as a measure of reliability. Psychological Reports, 19, 3-11.

McGraw, K.O., & Wong, S.P. (1996), Forming inferences about some intraclass correlation coefficients. Psychological Methods, 1, 30-46.

Shrout, P.E., & Fleiss, J.L. (1979), Intraclass correlation: uses in assessing rater reliability. Psychological Bulletin, 86, 420-428.

Examples

```
# sample data

study <- c(1,1,2,2,3,3)
rater <- c(rep(1:2,3))
mod1 <- round(rnorm(6, 10, 1))
mod2 <- c(5,5, 9, 9, 8, 8)
mod3 <- c(10,10, 9, 9, 8, 8)
w <-data.frame(study, rater, mod1, mod2, mod3)
w
```

```
# if data is in this format:

# study rater mod1 mod2 mod3
#     1     1    9    9   10
#     1     2   11    8   10
#     2     1    9   10   11
#     2     2    9   10   11
#     3     1    9    9    8
#     3     2   12    9    8
#
# the data will need to be reshaped to be processed by the
# icc function:

long <- reshape(w, varying=colnames(w)[3:5], v.names="Code",
            idvar=c('study', 'rater'), timevar="mods", direction='long')
wide <- reshape(long, idvar=c('mods', 'study'), timevar='rater')

# icc function (created by Matthias Gamer for the 'irr' package)

icc(cbind(wide$Code.1, wide$Code.2), type= "consistency")
```

Kappa *Inter-Rater Agreement*

Description

Kappa coefficients for assessing inter-rater agreement between two coders (for categorical variables/moderators).

Usage

```
Kappa(rater1, rater2)
```

Arguments

rater1	First rater of categorical variable to be analyzed. This vector needs to be in a separate column if in a `data.frame`.
rater2	Second rater on same categorical variable to be analyzed. This vector needs to be in a separate column if in a `data.frame`.

Value

Kappa coefficients for inter-rater reliability (categorical variables).

Author(s)

AC Del Re & William T. Hoyt

Maintainer: AC Del Re <acdelre@gmail.com>

Examples

```
# sample data

study <- c(1,1,2,2,3,3) # study coded
rater <- rep(1:2, 3)  # 2 raters
mod1 <- as.factor(round(rnorm(6, 10, 1))) # values coded for mod 1
mod2 <- as.factor(round(rnorm(6, 10, 1)))
mod3 <- as.factor(round(rnorm(6, 10, 1)))
mod4 <- as.factor(round(rnorm(6, 10, 1)))
mod5 <- as.factor(round(rnorm(6, 10, 1)))
mod6 <- as.factor(round(rnorm(6, 10, 1)))
w <-data.frame(study, rater,mod1, mod2, mod3, mod4, mod5, mod6)
w

# if data is in this format:
# study rater mod1 mod2 mod3 mod4 mod5 mod6
#     1     1    8   10    9    9   10   10
#     1     2   10   11   10   10   13   12
#     2     1   11   10   11   11   10   12
#     2     2   13   10   10   11   12    9
#     3     1   11   10   11   10   10    9
#     3     2   10   10   11    9   10   11
#
# the data will need to be reshaped to be processed by the
# Kappa function:

long <- reshape(w, varying=colnames(w)[3:8], v.names="code",
            idvar=c('study', 'rater'), timevar= 'mods', direction='long')
wide <- reshape(long, idvar=c('mods', 'study'), timevar='rater')
wide

# running the function:

Kappa(wide$code.1, wide$code.2)
```

---

lor_to_d *Log Odds Ratio to Standardized Mean Difference (d)*

Description

Converts a log odds ratio reported in the primary study to a standardized mean difference (d).

Usage

```
lor_to_d(lor, var.lor)
```

Arguments

lor	Log odds ratio reported in the primary study.
var.lor	Variance of the log odds ratio.

Value

d	Standardized mean difference (d).
var_d	Variance of d.

Author(s)

AC Del Re & William T. Hoyt

Maintainer: AC Del Re <acdelre@gmail.com>

References

Borenstein (2009). Effect sizes for continuous data. In H. Cooper, L. V. Hedges, & J. C. Valentine (Eds.), *The handbook of research synthesis and meta analysis* (pp. 279-293). New York: Russell Sage Foundation.

See Also

d_to_g, mean_to_d, mean_to_d2, t_to_d, f_to_d, p_to_d1, p_to_d2, ancova_to_d1, ancova_to_d2, tt.ancova_to_d, f.ancova_to_d, r_to_d, p.ancova_to_d1, p.ancova_to_d2, prop_to_or, prop_to_d, r_from_chi, r_from_d, r_from_d1, r_from_t

---

macat *Categorical Moderator Analysis*

Description

Computes single predictor categorical moderator analysis under a fixed or random effects model.

Usage

```
macat(g, var, mod, data, method= "random")
```

Arguments

g	Hedges g (unbiased estimate of d) effect size.
var	Vaiance of g.
mod	Categorical moderator variable used for moderator analysis.
method	Default is random. For fixed effects, use fixed.
data	data.frame with values above.

Details

See Konstantopoulos & Hedges (2009; pp. 280-288) for the computations used in this function.

Value

`mod`	Level of the categorical moderator.
`k`	Number of studies for each level of the moderator.
`estimate`	Mean effect size of each level of the moderator.
`ci.l`	Lower 95% confidence interval.
`ci.u`	Upper 95% confidence interval.
`z`	z-score (standardized value).
`p`	Significance level.
`var`	Variance of effect size.
`se`	Square root of variance.
`Q`	Q-statistic (measure of homogeneity).
`df`	Degrees of freedom for Q-statistic.
`p.h`	p-value for homogeneity within that level of the moderator.
`I2`	Proportion of total variation in effect size that is due to heterogeneity rather than chance (see Shadish & Haddock, 2009; pp. 263).
`Q`	Q-statistic overall. Note: Whether fixed or random effects analyses are conducted, the Q statistic reported is for the fixed effect model. Therefore, Qb + Qw != Q in the random effects output.
`Qw`	Q-within (or error). Measure of within-group heterogeneity.
`Qw.df`	Degrees of freedom for Q-within.
`Qw.p`	Q-within p-value (for homogeneity).
`Qb`	Q-between (or model). Measure of model fit.
`Qb.df`	Degrees of freedom for Q-between.
`Qb.p`	Q-between p-value (for homogeneity). Qb and Qb.p provide the test of whether the moderator variable(s) account for significant variance among effect sizes.

Author(s)

AC Del Re & William T. Hoyt

Maintainer: AC Del Re <acdelre@gmail.com>

References

Konstantopoulos & Hedges (2009). Analyzing effect sizes: Fixed-effects models. In H. Cooper, L. V. Hedges, & J. C. Valentine (Eds.), *The handbook of research synthesis and meta analysis* (pp. 279-293). New York: Russell Sage Foundation.

Shadish & Haddock (2009). Analyzing effect sizes: Fixed-effects models. In H. Cooper, L. V. Hedges, & J. C. Valentine (Eds.), *The handbook of research synthesis and meta analysis* (pp. 257-278). New York: Russell Sage Foundation.

See Also

`plotcat`

Examples

```
id<-c(1:20)
n.1<-c(10,20,13,22,28,12,12,36,19,12,36,75,33,121,37,14,40,16,14,20)
n.2 <- c(11,22,10,20,25,12,12,36,19,11,34,75,33,120,37,14,40,16,10,21)
g <- c(.68,.56,.23,.64,.49,-.04,1.49,1.33,.58,1.18,-.11,1.27,.26,.40,.49,
.51,.40,.34,.42,1.16)
var.g <- c(.08,.06,.03,.04,.09,.04,.009,.033,.0058,.018,.011,.027,.026,.0040,
.049,.0051,.040,.034,.0042,.016)
mod<-factor(c(rep(c(1,1,2,3),5)))
df<-data.frame(id, n.1,n.2, g, var.g,mod)

# Example

# Random effects
macat(g = g, var= var.g, mod = mod, data = df, method= "random")
```

---

macatC *Direct Categorical Moderator Comparison*

Description

Function for a planned comparison between two levels of a moderator under a fixed or random effects model.

Usage

```
macatC(x1, x2, g, var, mod, data, method= "random", type= "post.hoc")
```

Arguments

`x1`	One level of categorical moderator.
`x2`	Comparison level of same categorical moderator.
`g`	Hedges g (unbiased estimate of d) effect size.
`var`	Vaiance of g.
`mod`	Categorical moderator variable used for moderator analysis.
`method`	Default is `random`. For fixed effects, use `fixed`.
`type`	`post.hoc` assumes the comparison was not planned prior to conducting the meta analysis. The a priori option, `planned`, assumes the researcher planned to conduct the analysis a priori. Default is `post.hoc` using the Scheffe post hoc statistical method.
`data`	`data.frame` with values above.

Details

See Konstantopoulos & Hedges (2009; pp. 280-288) for the computations used in this function.

Value

diff	Mean difference between the two levels.
var.diff	Variance of diff.
p	Significance level.

Author(s)

AC Del Re & William T. Hoyt

Maintainer: AC Del Re <acdelre@gmail.com>

References

Konstantopoulos & Hedges (2009). Analyzing effect sizes: Fixed-effects models. In H. Cooper, L. V. Hedges, & J. C. Valentine (Eds.), *The handbook of research synthesis and meta analysis* (pp. 279-293). New York: Russell Sage Foundation.

Shadish & Haddock (2009). Analyzing effect sizes: Fixed-effects models. In H. Cooper, L. V. Hedges, & J. C. Valentine (Eds.), *The handbook of research synthesis and meta analysis* (pp. 257-278). New York: Russell Sage Foundation.

See Also

macat,

Examples

```
id<-c(1:20)
n.1<-c(10,20,13,22,28,12,12,36,19,12,36,75,33,121,37,14,40,16,14,20)
n.2 <- c(11,22,10,20,25,12,12,36,19,11,34,75,33,120,37,14,40,16,10,21)
g <- c(.68,.56,.23,.64,.49,-.04,1.49,1.33,.58,1.18,-.11,1.27,.26,.40,.49,
.51,.40,.34,.42,1.16)
var.g <- c(.08,.06,.03,.04,.09,.04,.009,.033,.0058,.018,.011,.027,.026,.0040,
.049,.0051,.040,.034,.0042,.016)
mod<-factor(c(rep(c(1,1,2,3),5)))
df<-data.frame(id, n.1,n.2, g, var.g,mod)

# Example
macatC(1, 2, g=g, var=var.g, mod=mod, data=df,  method= "random",
  type= "post.hoc")
```

`mareg` *Meta-Regression*

Description

Meta-regression function for a single or multiple predictor model. This function is a wrapper for the `rma()` function in the metafor package (Viechtbauer, W, 2010). Please see http://CRAN.R-project.org/package=metafor for details or for more advanced functionality with the `rma()` function.

Usage

```
mareg(formula, var, data, method = "REML", subset,  digits = 3, ...)
```

Arguments

`formula`	This is a formula based function, similar to other functions in R (e.g., lm), where the criterion variable (e.g., Hedges g in this case) is dependent on ('~') the predictor variables (e.g., moderators). The formula for two moderators would take this form: mareg(g ~ mod1 + mod2, var.g, data), where g is the criterion variable predicted by mod1 and mod2. The variance (var) of each g is var.g in this case.
`var`	Variance of g.
`data`	Aggregated `data.frame` (see agg function for setting up the dataset for these analyses) with id, g (unbiased standardized mean difference), var.g (variance of g) for each study.
`method`	Default is `REML` (Restricted-Maximal Likelihood), which is the standard random effects method. For fixed effects, use `FE`. Other options are specified in the `metafor` package manual ('rma' function).
`subset`	an optional vector specifying a subset of observations to be used in the fitting process.
`digits`	Number of digits to output. Default is 3.
`...`	Additional arguments to be passed to rma().

Details

See Wolfgang Viechtbauer (2010). metafor: Meta-Analysis Package for R. R package version 1.1-0. for the details of the `rma()` function. http://CRAN.R-project.org/package=metafor

Value

`estimate`	Meta-regression coefficient estimate.
`se`	Standard error of the estimate coefficient.
`z`	z-value.
`ci.l`	Lower 95% confidence interval.
`ci.u`	Upper 95% confidence interval.

p	p-value (significance level).
QE	Q-error. Measure of error in the model.
QE.df	Degrees of freedom for Q-error.
QEp	Q-error p-value (for homogeneity).
QM	Q-model. Measure of model fit.
QM.df	Degrees of freedom for Q-model.
QMp	Q-between p-value (for homogeneity). QM and QMp provide the test of whether the moderator variable(s) account for significant variance among effect sizes.

References

Wolfgang Viechtbauer (2010). metafor: Meta-Analysis Package for R. R package version 1.1-0. http://CRAN.R-project.org/package=metafor

See Also

plotcon

Examples

```
# install metafor
# install.packages('metafor', dependencies = TRUE)

# Sample data
data(dat.sim.final)


# Examples

# OMNIBUS
m0 <- mareg(es~1, var=var, data=dat.sim.final)
summary(m0)

# META-REGRESSION
m1 <- mareg(es~dose, var=var, data=dat.sim.final)
summary(m1)  # SINGLE MODERATOR

m2 <- mareg(es~stress, var=var, data=dat.sim.final)
summary(m2)  # SINGLE MODERATOR

m3 <- mareg(es~dose + stress, var=var, data=dat.sim.final)
summary(m3)  # MULTIPLE MODERATOR
```

mean_to_d *Means to Standardized Mean Difference*

Description

Converts raw mean scores reported in the primary study to a standardized mean difference (d).

Usage

```
mean_to_d(m.1, m.2, sd.1, sd.2, n.1, n.2)
```

Arguments

m.1	Mean of group one.
m.2	Mean of group two.
sd.1	Standard deviation of group one.
sd.2	Standard deviation of group two.
n.1	Sample size of group one.
n.2	Sample size of group two.

Value

d	Standardized mean difference (d).
var.d	Variance of d.

Author(s)

AC Del Re & William T. Hoyt

Maintainer: AC Del Re <acdelre@gmail.com>

References

Borenstein (2009). Effect sizes for continuous data. In H. Cooper, L. V. Hedges, & J. C. Valentine (Eds.), *The handbook of research synthesis and meta analysis* (pp. 279-293). New York: Russell Sage Foundation.

See Also

d_to_g, mean_to_d2, t_to_d, f_to_d, p_to_d1, p_to_d2, ancova_to_d1, ancova_to_d2, tt.ancova_to_d, f.ancova_to_d, r_to_d, p.ancova_to_d1, p.ancova_to_d2, lor_to_d, prop_to_or, prop_to_d, r_from_chi, r_from_d, r_from_d1, r_from_t mean_to_d2 *Means with Pooled SD to Standardized Mean Difference*

Description

Converts raw mean scores with pooled standard deviation from the primary study to a standardized mean difference (d).

Usage

```
mean_to_d2(m.1, m.2, s.pooled, n.1, n.2)
```

Arguments

m.1	Mean of group one.
m.2	Mean of group two.
s.pooled	Pooled standard deviation.
n.1	Sample size of group one.
n.2	Sample size of group two.

Value

d	Standardized mean difference (d).
var.d	Variance of d.

Author(s)

AC Del Re & William T. Hoyt

Maintainer: AC Del Re <acdelre@gmail.com>

References

Borenstein (2009). Effect sizes for continuous data. In H. Cooper, L. V. Hedges, & J. C. Valentine (Eds.), *The handbook of research synthesis and meta analysis* (pp. 279-293). New York: Russell Sage Foundation.

See Also

d_to_g, mean_to_d, t_to_d, f_to_d, p_to_d1, p_to_d2, ancova_to_d1, ancova_to_d2, tt.ancova_to_d, f.ancova_to_d, r_to_d, p.ancova_to_d1, p.ancova_to_d2, lor_to_d, prop_to_or, prop_to_d, r_from_chi, r_from_d, r_from_d1, r_from_t

or_to_d *Odds Ratio to Standardized Mean Difference (d)*

Description

Converts odds ratio reported in the primary study to standardized mean difference (d).

Usage

```
or_to_d(or)
```

Arguments

or	Odds ratio.

Value

d	Standardized mean difference (d).

Author(s)

AC Del Re & William T. Hoyt

Maintainer: AC Del Re <acdelre@gmail.com>

References

Borenstein (2009). Effect sizes for continuous data. In H. Cooper, L. V. Hedges, & J. C. Valentine (Eds.), *The handbook of research synthesis and meta analysis* (pp. 279-293). New York: Russell Sage Foundation.

See Also

d_to_g, mean_to_d, mean_to_d2, t_to_d, f_to_d, p_to_d1, p_to_d2, ancova_to_d1, ancova_to_d2, tt.ancova_to_d, f.ancova_to_d, r_to_d, p.ancova_to_d1, p.ancova_to_d2, lor_to_d, prop_to_or, r_from_chi, r_from_d, r_from_d1, r_from_t `p.ancova_to_d1` *One-tailed p-value from ANCOVA to Standardized Mean Difference (d)*

Description

Converts a one-tailed p-value from ANCOVA reported in the primary study to a standardized mean difference (d)

Usage

```
p.ancova_to_d1(p, n.1, n.2, R, q)
```

Arguments

`p`	One-tailed p-value reported in primary study.
`n.1`	Treatment group sample size.
`n.2`	Comparison group sample size.
`R`	Covariate outcome correlation or multiple correlation.
`q`	number of covariates.

Value

`d`	Standardized mean difference (d).
`var_d`	Variance of d.

Author(s)

AC Del Re & William T. Hoyt

Maintainer: AC Del Re <acdelre@gmail.com>

References

Borenstein (2009). Effect sizes for continuous data. In H. Cooper, L. V. Hedges, & J. C. Valentine (Eds.), *The handbook of research synthesis and meta analysis* (pp. 279-293). New York: Russell Sage Foundation.

See Also

`d_to_g`, `mean_to_d`, `mean_to_d2`, `t_to_d`, `f_to_d`, `p_to_d1`, `p_to_d2`, `ancova_to_d1`, `ancova_to_d2`, `tt.ancova_to_d`, `f.ancova_to_d`, `r_to_d`, `p.ancova_to_d2`, `lor_to_d`, `prop_to_or`, `prop_to_d`, `r_from_chi`, `r_from_d`, `r_from_d1`, `r_from_t` `p.ancova_to_d2` *Two-tailed p-value from ANCOVA to Standardized Mean Difference (d)*

Description

Converts a two-tailed p-value from ANCOVA reported in the primary study to a standardized mean difference (d)

Usage

```
p.ancova_to_d2(p, n.1, n.2, R, q)
```

Arguments

p	Two-tailed p-value reported in primary study.
n.1	Treatment group sample size.
n.2	Comparison group sample size.
R	Covariate outcome correlation or multiple correlation.
q	number of covariates.

Value

d	Standardized mean difference (d).
var_d	Variance of d.

Author(s)

AC Del Re & William T. Hoyt

Maintainer: AC Del Re <acdelre@gmail.com>

References

Borenstein (2009). Effect sizes for continuous data. In H. Cooper, L. V. Hedges, & J. C. Valentine (Eds.), *The handbook of research synthesis and meta analysis* (pp. 279-293). New York: Russell Sage Foundation.

See Also

d_to_g, mean_to_d, t_to_d, f_to_d, p_to_d1, p_to_d2, ancova_to_d1, ancova_to_d2, tt.ancova_to_d, f.ancova_to_d, r_to_d, p.ancova_to_d1, p.ancova_to_d2, lor_to_d, prop_to_or, prop_to_d, r_from_chi, r_from_d, r_from_d1, r_from_t plotcat *Categorical Moderator Graph*

Description

Outputs boxplot graphic for each level of the specified moderator.

Usage

```
plotcat(g, var, mod, data, modname=NULL,  title=NULL, ...)
```

Arguments

`g`	Hedges g (unbiased estimate of d) effect size.
`var`	Vaiance of g.
`mod`	Categorical moderator variable used for moderator analysis.
`data`	`data.frame` with values above.
`modname`	Name of moderator to appear on x axis of plot. Default is NULL.
`title`	Plot title. Default is NULL.
`...`	Additional arguments to be passed to ggplot.

Value

Boxplot graph with median, max, min, and outliers from a fixed or random effects categorical moderator analysis. Places jitter points (for each study) on the boxplots. The size of each point (representing a study in the analysis) are based on study weights where more precise studies have larger points. The ggplot2 package outputs the graphics.

Author(s)

AC Del Re & William T. Hoyt

Maintainer: AC Del Re `<acdelre@gmail.com>`

References

Cooper, H., Hedges, L.V., & Valentine, J.C. (2009). *The handbook of research synthesis and meta-analysis* (2nd edition). New York: Russell Sage Foundation.

See Also

`macat`, `plotcon`

Examples

```
id<-c(1, 1:19)
n.1<-c(10,20,13,22,28,12,12,36,19,12,36,75,33,121,37,14,40,16,14,20)
n.2 <- c(11,22,10,20,25,12,12,36,19,11,34,75,33,120,37,14,40,16,10,21)
g <- c(.68,.56,.23,.64,.49,-.04,1.49,1.33,.58,1.18,-.11,1.27,.26,.40,.49,
.51,.40,.34,.42,1.16)
var.g <- c(.08,.06,.03,.04,.09,.04,.009,.033,.0058,.018,.011,.027,.026,.0040,
.049,.0051,.040,.034,.0042,.016)
mod<-factor(c(rep(c(1,1,2,3),5)))
df<-data.frame(id, n.1,n.2, g, var.g,mod)

# Example

## Not run: plotcat(g = g, var = var.g, mod = mod, data = df, method= "random",
 modname= "Moderator")
## End(Not run)
```

---

plotcon *Meta Regression Scatterplot*

Description

Outputs a scatterplot from a fixed or random effects meta regression (continuous and/or categorical).

Usage

```
plotcon(g, var, mod, data, method= "random", modname=NULL,
  title=NULL, ...)
```

Arguments

`g`	Hedges g (unbiased estimate of d) effect size.
`var`	Vaiance of g.
`mod`	Categorical moderator variable used for moderator analysis.
`method`	Default is `random` (Restricted-Maximal Likelihood), which is the standard random effects method. For fixed effects, use `fixed`.
`data`	`data.frame` with values above.
`modname`	Name of moderator to appear on x axis of plot. Default is NULL.
`title`	Plot title. Default is NULL.
`...`	Additional arguments to be passed to ggplot.

Value

Scatterplot with fixed or random effects regression line with size of visual points based on study weights, where the more precise studies have larger points. The ggplot2 package outputs the rich graphics.

Author(s)

AC Del Re & William T. Hoyt

Maintainer: AC Del Re <acdelre@gmail.com>

References

Cooper, H., Hedges, L.V., & Valentine, J.C. (2009). *The handbook of research synthesis and meta analysis* (2nd edition). New York: Russell Sage Foundation.

See Also

mareg, plotcat

Examples

```
# SAMPLE DATA
MA2 <-read.table(textConnection("
id       es1       var1 n.1 n.2 mod1 mod2
1    1 0.5695938 0.04906967  26  30    a   20
2    2 0.4123667 0.04362541  28  34    b   30
3    3 0.4084333 0.04458363  34  28    a   25
4    4 0.5014756 0.04186354  37  29    b   35
5    5 0.5540745 0.04339382  31  32    b   40
6    1 0.5695938 0.04906967  26  30    a   20
7    2 0.4123667 0.04362541  28  34    b   30
8    3 0.4084333 0.04458363  34  28    a   25
9    4 0.5014756 0.04186354  37  29    b   35
10   5 0.5540745 0.04339382  31  32    b   40"))


# EXAMPLE
plotcon(es1, var1, mod2, data=MA2, method= "fixed", modname="NULL",title="NULL")
```

PubBias *Assess for Publication Bias*

Description

Assess for publication bias in the meta-analytic data

Usage

```
PubBias(data)
```

Arguments

data	data.frame having been analyzed by the weights function with id and z.score (standardized z-value).

Value

k	Number of studies.
Z	Overall z-value for data set.
k0	Number of studies needed to include with effect size = 0 (null) in order for the p > .05 (null hypothesis retained).
k.per	Number of missing studies for every observed study for the overall effect to be nullified.

Author(s)

AC Del Re & William T. Hoyt

Maintainer: AC Del Re <acdelre@gmail.com>

References

Sutton, A. J. (2009). Publication bias. In H. Cooper, L. V. Hedges, & J. C. Valentine (Eds.), *The handbook of research synthesis and meta analysis* (pp. 435-452). New York: Russell Sage Foundation.

See Also

weights

---

p_to_d1 — *One-tailed p-value to Standardized Mean Difference (d)*

Description

One-tailed p-value reported in the primary study to Standardized Mean Difference (d)

Usage

```
p_to_d1(p, n.1, n.2)
```

Arguments

p	One-tailed p-value reported in primary study.
n.1	Sample size of treatment group.
n.2	Sample size of comparison group.

Value

d	Standardized mean difference (d).
var_d	Variance of d.

Author(s)

AC Del Re & William T. Hoyt

Maintainer: AC Del Re <acdelre@gmail.com>

References

Borenstein (2009). Effect sizes for continuous data. In H. Cooper, L. V. Hedges, & J. C. Valentine (Eds.), *The handbook of research synthesis and meta analysis* (pp. 279-293). New York: Russell Sage Foundation.

See Also

d_to_g, mean_to_d, mean_to_d2, t_to_d, f_to_d, p_to_d2, ancova_to_d1, ancova_to_d2, tt.ancova_to_d, f.ancova_to_d, r_to_d, p.ancova_to_d1, p.ancova_to_d2, lor_to_d, prop_to_or, prop_to_d, r_from_chi, r_from_d, r_from_d1, r_from_t

---

p_to_d2 *Two-tailed p-value to Standardized Mean Difference (d)*

Description

One-tailed p-value reported in primary study to Standardized Mean Difference (d)

Usage

```
p_to_d2(p, n.1, n.2)
```

Arguments

p	Two-tailed p-value reported in primary study.
n.1	Sample size of treatment group.
n.2	Sample size of comparison group.

Value

d	Standardized mean difference (d).
var_d	Variance of d.

Author(s)

AC Del Re & William T. Hoyt

Maintainer: AC Del Re <acdelre@gmail.com>

References

Borenstein (2009). Effect sizes for continuous data. In H. Cooper, L. V. Hedges, & J. C. Valentine (Eds.), *The handbook of research synthesis and meta analysis* (pp. 279-293). New York: Russell Sage Foundation.

See Also

d_to_g, mean_to_d, mean_to_d2, t_to_d, f_to_d, p_to_d1, ancova_to_d1, ancova_to_d2, tt.ancova_to_d, f.ancova_to_d, r_to_d, p.ancova_to_d1, p.ancova_to_d2, lor_to_d, prop_to_or, prop_to_d, r_from_chi, r_from_d, r_from_d1, r_from_t

---

robustSE *Robust standard error*

Description

When the correlation between dependent effect sizes are unknown, one approach is to conduct the meta-analysis by assuming that the effect sizes are independent. Then, Hedges et al. (2010) robust standard error procedure can be calculated to adjust for dependence.

Usage

```
robustSE(model, cluster=NULL, CI=.95, digits=3)
```

Arguments

model	omnibus or moderator model object fitted from mareg() function.
cluster	Name of variable where the dependencies are present. This will typically be the variable for *study id* where `length(unique(study_id))>1`.
CI	Confidence interval. Defaults to .95.
digits	Number of digits to output. Defaults to 3.

Value

estimate	Meta-regression coefficient estimate.
se	Adjusted Standard error of the estimate coefficient.
t	t-value.
ci.l	Adjusted Lower 95% confidence interval.
ci.u	Adjusted Upper 95% confidence interval.
p	p-value.

Author(s)

Mike Cheung with modifications by AC Del Re

References

Hedges, L. V., Tipton, E., & Johnson, M. C. (2010). Robust variance estimation in meta-regression with dependent effect size estimates. Research Synthesis Methods, 1(1), 39-65. doi:10.1002/jrsm.5

Cheung, M.W.L. (2012). metaSEM: An R package for meta-analysis using structural equation modeling. Manuscript submitted for publication.

See Also

mareg,

Examples

```
# install metafor
# install.packages('metafor', dependencies = TRUE)

# Sample data
id<-c(1:20)
n.1<-c(10,20,13,22,28,12,12,36,19,12,36,75,33,121,37,14,40,16,14,20)
n.2 <- c(11,22,10,20,25,12,12,36,19,11,34,75,33,120,37,14,40,16,10,21)
g <- c(.68,.56,.23,.64,.49,-.04,1.49,1.33,.58,1.18,-.11,1.27,.26,.40,.49,
.51,.40,.34,.42,1.16)
var.g <- c(.08,.06,.03,.04,.09,.04,.009,.033,.0058,.018,.011,.027,.026,.0040,
.049,.0051,.040,.034,.0042,.016)
mod<-factor(c(rep(c(1,1,2,3),5)))
mods2<-c(rep(1:5,4))
df<-data.frame(id, n.1,n.2, g, var.g,mod, mods2)


# Examples

# Adjusted SE
robustSE(mareg(g~ mod + mods2, var = var.g, method = "REML", data = df))
```

---

r_from_chi *Chi-Squared to Correlation*

Description

Converting Chi-squared statistic (with 1 degree of freedom) reported in primary study to r

Usage

```
r_from_chi(chi.sq, n)
```

Arguments

chi.sq	Chi squared statistic from primary study.
n	Sample size in primary study.

Value

Computes correlation coefficient (r).

Author(s)

AC Del Re & William T. Hoyt

Maintainer: AC Del Re <acdelre@gmail.com>

See Also

d_to_g, mean_to_d, mean_to_d2, t_to_d, f_to_d, p_to_d1, p_to_d2, ancova_to_d1, ancova_to_d2, tt.ancova_to_d, f.ancova_to_d, r_to_d, p.ancova_to_d1, p.ancova_to_d2, lor_to_d, prop_to_or, prop_to_d, r_from_d, r_from_d1, r_from_t

---

r_from_d *Correlation from Mean Difference*

Description

Converts d (mean difference) to r where n.tmt = n.comparison (see section 12.5.4, Borenstein, 2009; pp. 234).

Usage

```
r_from_d(d, var.d, a = 4)
```

Arguments

d	Mean difference statistic (d) reported in primary study.
var.d	Variance of d reported in primary study.
a	Used to compute correlation. Default is 4.

Value

Outputs a correlation coefficient (r).

Author(s)

AC Del Re & William T. Hoyt

Maintainer: AC Del Re <acdelre@gmail.com>

References

Borenstein (2009). Effect sizes for continuous data. In H. Cooper, L. V. Hedges, & J. C. Valentine (Eds.), *The handbook of research synthesis and meta analysis* (pp. 279-293). New York: Russell Sage Foundation.

See Also

d_to_g, mean_to_d, mean_to_d2, t_to_d, f_to_d, p_to_d1, p_to_d2, ancova_to_d1, ancova_to_d2, tt.ancova_to_d, f.ancova_to_d, r_to_d, p.ancova_to_d1, p.ancova_to_d2, lor_to_d, prop_to_or, prop_to_d, r_from_chi, r_from_d1, r_from_t

---

r_from_d1 *Correlation from Mean Difference II*

Description

Converts d (mean difference) reported in primary study to r (correlation coefficient) where sample size of the treatment group is not equal to the sample size of the comparison group (see section 12.5.4, Borenstein, 2009; pp. 234).

Usage

```
r_from_d1(d, n.1, n.2, var.d)
```

Arguments

d	Mean difference statistic (d) reported in primary study.
n.1	sample size of group one reported in primary study.
n.2	sample size of group two reported in primary study.
var.d	variance of d reported in primary study.

Value

Computes a correlation coefficient (r).

Author(s)

AC Del Re & William T. Hoyt

Maintainer: AC Del Re <acdelre@gmail.com>

References

Borenstein (2009). Effect sizes for continuous data. In H. Cooper, L. V. Hedges, & J. C. Valentine (Eds.), *The handbook of research synthesis and meta analysis* (pp. 279-293). New York: Russell Sage Foundation.

See Also

d_to_g, mean_to_d, mean_to_d2, t_to_d, f_to_d, p_to_d1, p_to_d2, ancova_to_d1, ancova_to_d2, tt.ancova_to_d, f.ancova_to_d, r_to_d, p.ancova_to_d1, p.ancova_to_d2, lor_to_d, prop_to_or, prop_to_d, r_from_chi, r_from_d, r_from_t

---

r_from_t *Correlation from t-test*

Description

Compute correlation from t-value reported in the primary study (see section 12.5.4, Borenstein, 2009; pp. 234).

Usage

```
r_from_t(t, n)
```

Arguments

t	t-statistic value reported in primary study.
n	Sample size reported in primary study.

Value

Outputs the correlation coefficient (r).

Author(s)

AC Del Re & William T. Hoyt

Maintainer: AC Del Re <acdelre@gmail.com>

References

Borenstein (2009). Effect sizes for continuous data. In H. Cooper, L. V. Hedges, & J. C. Valentine (Eds.), *The handbook of research synthesis and meta analysis* (pp. 279-293). New York: Russell Sage Foundation.

See Also

d_to_g, mean_to_d, mean_to_d2, t_to_d, f_to_d, p_to_d1, p_to_d2, ancova_to_d1, ancova_to_d2, tt.ancova_to_d, f.ancova_to_d, r_to_d, p.ancova_to_d1, p.ancova_to_d2, lor_to_d, prop_to_or, prop_to_d, r_from_chi, r_from_d, r_from_d1,

r_to_d — *Correlation (r) to Standardized Mean Difference (d)*

Description

Converts a correlation (r) to standardized mean difference (d).

Usage

```
r_to_d(r, N)
```

Arguments

r	Correlation coefficient.
N	Total sample size.

Value

d	Standardized mean difference (d).

Author(s)

AC Del Re & William T. Hoyt

Maintainer: AC Del Re <acdelre@gmail.com>

References

Borenstein (2009). Effect sizes for continuous data. In H. Cooper, L. V. Hedges, & J. C. Valentine (Eds.), *The handbook of research synthesis and meta analysis* (pp. 279-293). New York: Russell Sage Foundation.

See Also

d_to_g, mean_to_d, mean_to_d2, t_to_d, f_to_d, p_to_d1, p_to_d2, ancova_to_d1, ancova_to_d2, tt.ancova_to_d, f.ancova_to_d, p.ancova_to_d1, p.ancova_to_d2, lor_to_d, prop_to_or, prop_to_d, r_from_chi, r_from_d, r_from_d1, r_from_t

tt.ancova_to_d *t-test Value from ANCOVA to Standardized Mean Difference (d)*

Description

Converts a t-test value from ANCOVA to a standardized mean difference (d)

Usage

```
tt.ancova_to_d(t, n.1, n.2, R, q)
```

Arguments

t	t-test value reported in primary study.
n.1	Treatment group sample size.
n.2	Comparison group sample size.
R	Covariate outcome correlation or multiple correlation.
q	number of covariates.

Value

d	Standardized mean difference (d)
var_d	Variance of d

Author(s)

AC Del Re & William T. Hoyt

Maintainer: AC Del Re <acdelre@gmail.com>

References

Borenstein (2009). Effect sizes for continuous data. In H. Cooper, L. V. Hedges, & J. C. Valentine (Eds.), *The handbook of research synthesis and meta analysis* (pp. 279-293). New York: Russell Sage Foundation.

See Also

d_to_g, mean_to_d, mean_to_d2, t_to_d, f_to_d, p_to_d1, p_to_d2, ancova_to_d1, ancova_to_d2, f.ancova_to_d, r_to_d, p.ancova_to_d1, p.ancova_to_d2, lor_to_d, prop_to_or, prop_to_d, r_from_chi, r_from_d, r_from_d1, r_from_t t_to_d *t-test Value to Standardized Mean Difference (d)*

Description

Converts a t-test value reported in the primary study to a standardized mean difference (d).

Usage

```
t_to_d(t, n.1, n.2)
```

Arguments

t	t-test value reported in primary study.
n.1	Sample size of treatment group.
n.2	Sample size of comparison group.

Value

d	Standardized mean difference (d).
var_d	Variance of d.

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References

Borenstein (2009). Effect sizes for continuous data. In H. Cooper, L. V. Hedges, & J. C. Valentine (Eds.), *The handbook of research synthesis and meta analysis* (pp. 279-293). New York: Russell Sage Foundation.

See Also

d_to_g, mean_to_d, mean_to_d2, f_to_d, p_to_d1, p_to_d2, ancova_to_d1, ancova_to_d2, tt.ancova_to_d, f.ancova_to_d, r_to_d, p.ancova_to_d1, p.ancova_to_d2, lor_to_d, prop_to_or, prop_to_d, r_from_chi, r_from_d, r_from_d1, r_from_t `wgts` *Weights added to Meta Data*

Description

Adds weights to the meta-analysis data set.

Usage

```
wgts(g, var.g, data)
```

Arguments

`g`	Hedges g (unbiased standardized mean difference estimate).
`var.g`	Variance of g.
`data`	`data.frame` with values above.

Value

Adds fixed and random-effects weights and confidence intervals to meta data set.

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