

# Package ‘BayesRep’

June 29, 2023

**Version** 0.42.2

**Date** 2023-06-28

**Author** Samuel Pawel [aut, cre] (<<https://orcid.org/0000-0003-2779-320X>>)

**Maintainer** Samuel Pawel <samuel.pawel@uzh.ch>

**Title** Bayesian Analysis of Replication Studies

**Description** Provides tools for the analysis of replication studies using Bayes factors (Pawel and Held, 2022) <[doi:10.1111/rssb.12491](https://doi.org/10.1111/rssb.12491)>.

**License** GPL-3

**Encoding** UTF-8

**Imports** lamW, hypergeo

**Suggests** roxygen2, tinytest

**NeedsCompilation** no

**RoxygenNote** 7.2.3

**URL** <https://github.com/SamCH93/BayesRep>

**BugReports** <https://github.com/SamCH93/BayesRep/issues>

**Repository** CRAN

**Date/Publication** 2023-06-29 15:50:16 UTC

## R topics documented:

BayesRep	2
BFe	2
BFr	4
BFrlogOR	6
BFrSMD	7
BFs	9
BFslogOR	11
BFsSMD	13
formatBF	14
repPosterior	15
SSRPexact	17

BayesRep

*BayesRep package***Description**

The BayesRep package provides various tools for Bayesian analysis of replication studies.

`repPosterior` visualizes the posterior distribution of the effect size based on both studies. `BFs` computes the sceptical Bayes factor (Pawel and Held, 2022), `BFr` computes the replication Bayes factor (Verhagen and Wagenmakers, 2014), and `BFe` computes the equality of effect size Bayes factor (Bayarri and Mayoral, 2002).

These functions take effect estimates and their standard errors from original and replication study as inputs. Throughout, original effect estimate and standard error are denoted by `to` and `so` and replication effect estimate and standard error are denoted `tr` and `sr`. It is assumed that each effect estimate is normally distributed around its true underlying effect size with variance equal to its squared standard error

$$to | \theta_o \sim N(\theta_o, so^2) \text{ and } tr | \theta_r \sim N(\theta_r, sr^2).$$

These assumptions may be inadequate for studies with small sample size (there are special functions for data with continuous outcomes and standardized mean difference effect size, `BFsSMD` and `BFrSMD`, and binary outcomes with log odds ratio effects, `BFslogOR` and `BFrlogOR`, which are based on the exact distribution of the data). If not specified otherwise, it is assumed that the true effect sizes from both studies are the same ( $\theta_o = \theta_r$ ).

**References**

Bayarri, M. and Mayoral, A. (2002). Bayesian Design of "Successful" Replications. *The American Statistician*, 56(3): 207-214. doi:10.1198/000313002155

Verhagen, J. and Wagenmakers, E. J. (2014). Bayesian tests to quantify the result of a replication attempt. *Journal of Experimental Psychology: General*, 145:1457-1475. doi:10.1037/a0036731

Pawel, S. and Held, L. (2022). The sceptical Bayes factor for the assessment of replication success. *Journal of the Royal Statistical Society Series B: Statistical Methodology*, 84(3): 879-911. doi:10.1111/rssb.12491

BFe

*Equality of effect size Bayes factor***Description**

Computes the equality of effect size Bayes factor

**Usage**

```
BFe(to, so, tr, sr, tau, log = FALSE)
```

**Arguments**

to	Original effect estimate
so	Standard error of the original effect estimate
tr	Replication effect estimate
sr	Standard error of the replication effect estimate
tau	The heterogeneity standard deviation $\tau$ under the hypothesis of unequal effect sizes $H_1$
log	Logical indicating whether the natural logarithm of the Bayes factor should be returned. Defaults to FALSE

**Details**

The equality of effect size Bayes factor is the Bayes factor contrasting the hypothesis of equal original and replication effect sizes  $H_0 : \theta_o = \theta_r$  to the hypothesis of unequal effect sizes  $H_1 : \theta_o \neq \theta_r$ . Under the hypothesis of unequal effect sizes  $H_1$  the study specific effect sizes are assumed to be normally distributed around an overall effect size with heterogeneity standard deviation tau.

**Value**

The equality of effect size Bayes factor  $BF_{01}$ .  $BF_{01} > 1$  indicates that the data favour the hypothesis of equal effect sizes  $H_0$  (replication success), whereas  $BF_{01} < 1$  indicates that the data favour the hypothesis of unequal effect sizes  $H_1$  (replication failure).

**Author(s)**

Samuel Pawel

**References**

- Bayarri, M. and Mayoral, A. (2002). Bayesian Design of "Successful" Replications. *The American Statistician*, 56(3): 207-214. doi:[10.1198/000313002155](https://doi.org/10.1198/000313002155)
- Verhagen, J. and Wagenmakers, E. J. (2014). Bayesian tests to quantify the result of a replication attempt. *Journal of Experimental Psychology: General*, 145:1457-1475. doi:[10.1037/a0036731](https://doi.org/10.1037/a0036731)

**Examples**

```
## strong evidence for unequal effect sizes
BFe(to = 1, tr = 0.5, so = sqrt(1/100), sr = sqrt(1/100), tau = 0.3)

## some evidence for equal effect sizes
BFe(to = 1, tr = 1, so = sqrt(1/200), sr = sqrt(1/200), tau = 0.3)
```

BFr

*Generalized replication Bayes factor***Description**

Computes the generalized replication Bayes factor

**Usage**

```
BFr(
  to,
  so,
  tr,
  sr,
  ss = 0,
  truncate = FALSE,
  log = FALSE,
  zo = NULL,
  zr = NULL,
  c = NULL,
  g = 0
)
```

**Arguments**

to	Original effect estimate
so	Standard error of the original effect estimate
tr	Replication effect estimate
sr	Standard error of the replication effect estimate
ss	Standard deviation of the sceptical prior under $H_S$ . Defaults to 0
truncate	Logical indicating whether advocacy prior should be truncated to direction of the original effect estimate (i.e., a one-sided test). Defaults to FALSE
log	Logical indicating whether the natural logarithm of the Bayes factor should be returned. Defaults to FALSE
zo	Original $z$ -value $zo = to/so$ (alternative parametrization for to and so)
zr	Replication $z$ -value $zr = tr/sr$ (alternative parametrization for tr and sr)
c	Relative variance $c = so^2/sr^2$ (alternative parametrization for so and sr)
g	Relative prior variance $g = ss^2/so^2$ . Defaults to 0 (alternative parametrization for ss)

## Details

The generalized replication Bayes factor is the Bayes factor contrasting the sceptic's hypothesis that the effect size is about zero

$$H_S : \theta \sim N(0, ss^2)$$

to the advocate's hypothesis that the effect size is compatible with its posterior distribution based on the original study and a uniform prior

$$H_A : \theta \sim f(\theta | \text{original study}).$$

The standard replication Bayes factor from Verhagen and Wagenmakers (2014) is obtained by specifying a point-null hypothesis  $ss = 0$  (the default).

The function can be used with two input parametrizations, either on the absolute effect scale (to, so, tr, sr, ss) or alternatively on the relative  $z$ -scale (zo, zr, c, g). If an argument on the effect scale is missing, the  $z$ -scale is automatically used and the other non-missing arguments on the effect scale ignored.

## Value

The generalized replication Bayes factor  $BF_{SA}$ .  $BF_{SA} < 1$  indicates that the data favour the advocate's hypothesis  $H_A$  (replication success), whereas  $BF_{SA} > 1$  indicates that the data favour the sceptic's hypothesis  $H_S$  (replication failure).

## Author(s)

Samuel Pawel

## References

- Verhagen, J. and Wagenmakers, E. J. (2014). Bayesian tests to quantify the result of a replication attempt. *Journal of Experimental Psychology: General*, 145:1457-1475. [doi:10.1037/a0036731](https://doi.org/10.1037/a0036731)
- Ly, A., Etz, A., Marsman, M., Wagenmakers, E. J. (2019). Replication Bayes factors from evidence updating. *Behavior Research Methods*, 51(6):2498-2508. [doi:10.3758/s134280181092x](https://doi.org/10.3758/s134280181092x)
- Pawel, S. and Held, L. (2022). The sceptical Bayes factor for the assessment of replication success. *Journal of the Royal Statistical Society Series B: Statistical Methodology*, 84(3): 879-911. [doi:10.1111/rssb.12491](https://doi.org/10.1111/rssb.12491)

## See Also

[BFRSMD](#), [BFRlogOR](#)

## Examples

```
to <- 2
tr <- 2.5
so <- 1
sr <- 1
BFR(to = to, so = so, tr = tr, sr = sr)
BFR(zo = to/so, zr = tr/sr, c = so^2/sr^2)
```

---

 BFrlogOR

*Generalized replication Bayes factor for logOR effect sizes*


---

**Description**

Computes the generalized replication Bayes factor for log odds ratio (logOR) effect sizes

**Usage**

```
BFrlogOR(
  ao,
  bo,
  nTo = ao + bo,
  co,
  do,
  nCo = co + do,
  ar,
  br,
  nTr = ar + br,
  cr,
  dr,
  nCr = cr + dr,
  ss,
  method = c("integration", "hypergeo")
)
```

**Arguments**

ao	Number of cases in original study treatment group
bo	Number of non-cases in original study treatment group
nTo	Number of participants in original study treatment group (specify alternatively to b)
co	Number of cases in original study control group
do	Number of non-cases in original study control group
nCo	Number of participants in original study control group (specify alternatively to d)
ar	Number of cases in replication study treatment group
br	Number of non-cases in replication study treatment group
nTr	Number of participants in replication study treatment group (specify alternatively to b)
cr	Number of cases in replication study control group
dr	Number of non-cases in replication study control group
nCr	Number of participants in replication study control group (specify alternatively to d)

ss	Standard deviation of the sceptical prior under $H_S$ . Defaults to 0
method	Method to compute posterior density. Either "integration" (default) or "hypergeo"

### Details

This function computes the generalized replication Bayes factor for log odds ratio (logOR) effect sizes using an exact binomial likelihood for the data instead of the normal approximation used in [BFR](#) (for details, see Section 4 in Pawel and Held, 2022).

### Value

The generalized replication Bayes factor  $BF_{SA}$ .  $BF_{SA} < 1$  indicates that the data favour the advocate's hypothesis  $H_A$  (replication success), whereas  $BF_{SA} > 1$  indicates that the data favour the sceptic's hypothesis  $H_S$  (replication failure).

### Author(s)

Samuel Pawel

### References

- Verhagen, J. and Wagenmakers, E. J. (2014). Bayesian tests to quantify the result of a replication attempt. *Journal of Experimental Psychology: General*, 145:1457-1475. [doi:10.1037/a0036731](https://doi.org/10.1037/a0036731)
- Pawel, S. and Held, L. (2022). The sceptical Bayes factor for the assessment of replication success. *Journal of the Royal Statistical Society Series B: Statistical Methodology*, 84(3): 879-911. [doi:10.1111/rssb.12491](https://doi.org/10.1111/rssb.12491)

### Examples

```
data("SSRPexact")
balafoutas2012 <- subset(SSRPexact, study == "Balafoutas and Sutter (2012), Science")
with(balafoutas2012,
     BFRlogOR(ao = ao, bo = bo, co = co, do = do, ar = ar, br = br, cr = cr, dr = dr,
              ss = 0))
```

---

BFRSMD

*Generalized replication Bayes factor for SMD effect sizes*

---

### Description

Computes the generalized replication Bayes factor for standardized mean difference (SMD) effect sizes

**Usage**

```
BFrSMD(
  to,
  no,
  n1o = no,
  n2o = no,
  tr,
  nr,
  n1r = nr,
  n2r = nr,
  ss,
  type = c("two.sample", "one.sample", "paired")
)
```

**Arguments**

<code>to</code>	<i>t</i> -statistic from the original study
<code>no</code>	Sample size of the original study (per group)
<code>n1o</code>	Sample size in group 1 of the original study (only required for two-sample <i>t</i> -test with unequal group sizes)
<code>n2o</code>	Sample size in group 2 of the original study (only specify if unequal group sizes)
<code>tr</code>	<i>t</i> -statistic from the replication study
<code>nr</code>	Sample size of the replication study (per group)
<code>n1r</code>	Sample size in group 1 of the replication study (only required for two-sample <i>t</i> -test with unequal group sizes)
<code>n2r</code>	Sample size in group 2 of the replication study (only required for two-sample <i>t</i> -test with unequal group sizes)
<code>ss</code>	Standard deviation of the sceptical prior under $H_S$ . Defaults to $\emptyset$
<code>type</code>	Type of <i>t</i> -test associated with <i>t</i> -statistic. Can be "two.sample", "one.sample", "paired". Defaults to "two.sample"

**Details**

This function computes the generalized replication Bayes factor for standardized mean difference (SMD) effect sizes using an exact *t*-likelihood for the data instead of the normal approximation used in [BFr](#) (for details, see Section 4 in Pawel and Held, 2022). Data from both studies are summarized by *t*-statistics and sample sizes. The following types of *t*-tests are accepted:

- Two-sample *t*-test where the SMD represents the standardized mean difference between two group means (assuming equal variances in both groups).
- One-sample *t*-test where the SMD represents the standardized mean difference to the null value.
- Paired *t*-test where the SMD represents the standardized mean difference score.



**Value**

The generalized replication Bayes factor  $BF_{SA}$ .  $BF_{SA} < 1$  indicates that the data favour the advocate's hypothesis  $H_A$  (replication success), whereas  $BF_{SA} > 1$  indicates that the data favour the sceptic's hypothesis  $H_S$  (replication failure).

**Author(s)**

Samuel Pawel

**References**

Verhagen, J. and Wagenmakers, E. J. (2014). Bayesian tests to quantify the result of a replication attempt. *Journal of Experimental Psychology: General*, 145:1457-1475. doi:[10.1037/a0036731](https://doi.org/10.1037/a0036731)

Pawel, S. and Held, L. (2022). The sceptical Bayes factor for the assessment of replication success. *Journal of the Royal Statistical Society Series B: Statistical Methodology*, 84(3): 879-911. doi:[10.1111/rssb.12491](https://doi.org/10.1111/rssb.12491)

**See Also**

[BFr](#), [BFrlogOR](#)

**Examples**

```
data("SSRPexact")
morewedge2010 <- subset(SSRPexact, study == "Morewedge et al. (2010), Science")
with(morewedge2010,
     BFrSMD(to = to, n1o = n1o, n2o = n2o, tr = tr, n1r = n1r, n2r = n2r, ss = 0))
```

---

BFs

*Sceptical Bayes factor*

---

**Description**

Computes the sceptical Bayes factor

**Usage**

```
BFs(to, so, tr, sr, truncate = FALSE, zo = NULL, zr = NULL, c = NULL)
```

**Arguments**

to	Original effect estimate
so	Standard error of the original effect estimate
tr	Replication effect estimate
sr	Standard error of the replication effect estimate

truncate	Logical indicating whether advocacy prior should be truncated to direction of the original effect estimate (i.e., a one-sided test). Defaults to FALSE
zo	Original $z$ -value $zo = to/so$ (alternative parametrization for $to$ and $so$ )
zr	Replication $z$ -value $zr = tr/sr$ (alternative parametrization for $tr$ and $sr$ )
c	Relative variance $c = so^2/sr^2$ (alternative parametrization for $so$ and $sr$ )

## Details

The sceptical Bayes factor is a summary measure of the following two-step reverse-Bayes procedure for assessing replication success:

1. Use the data from the original study to determine the standard deviation  $\tau_\gamma$  of a sceptical normal prior  $\theta \sim N(0, \tau_\gamma^2)$  such that the Bayes factor contrasting the null hypothesis  $H_0 : \theta = 0$  to the sceptic's hypothesis  $H_S : \theta \sim N(0, \tau_\gamma^2)$  equals a specified level  $\gamma \in (0, 1]$ . This prior represents a sceptic who remains unconvinced about the presence of an effect at level  $\gamma$ .
2. Use the data from the replication study to compare the sceptic's hypothesis  $H_S : \theta \sim N(0, \tau_\gamma^2)$  to the advocate's hypothesis  $H_A : \theta \sim f(\theta | \text{original study})$ . The prior of the effect size under  $H_A$  is its posterior based on the original study and a uniform prior, thereby representing the position of an advocate of the original study. Replication success at level  $\gamma$  is achieved if the Bayes factor contrasting  $H_S$  to  $H_A$  is smaller than  $\gamma$ , which means that the replication data favour the advocate over the sceptic at a higher level than the sceptic's initial objection. The sceptical Bayes factor  $BF_S$  is the smallest level  $\gamma$  at which replication success can be established.

The function can be used with two input parametrizations, either on the absolute effect scale ( $to$ ,  $so$ ,  $tr$ ,  $sr$ ) or alternatively on the relative  $z$ -scale ( $zo$ ,  $zr$ ,  $c$ ). If an argument on the effect scale is missing, the  $z$ -scale is automatically used and the other non-missing arguments on the effect scale ignored.

## Value

The sceptical Bayes factor  $BF_S$ .  $BF_S < 1$  indicates replication success, the smaller the value of  $BF_S$  the higher the degree of replication success. It is possible that the result of the replication is so inconclusive that replication success cannot be established at any level. In this case, the sceptical Bayes factor does not exist and the function returns NaN.

## Author(s)

Samuel Pawel

## References

Pawel, S. and Held, L. (2022). The sceptical Bayes factor for the assessment of replication success. *Journal of the Royal Statistical Society Series B: Statistical Methodology*, 84(3): 879-911. [doi:10.1111/rssb.12491](https://doi.org/10.1111/rssb.12491)

## See Also

[BFsSMD](#), [BFslogOR](#)

**Examples**

```

to <- 2
tr <- 2.5
so <- 1
sr <- 1
BFs(to = to, so = so, tr = tr, sr = sr)
BFs(zo = to/so, zr = tr/sr, c = so^2/sr^2)

```

---

BFslogOR

*Sceptical Bayes factor for logOR effect sizes*


---

**Description**

Computes the sceptical Bayes factor for logOR effect sizes

**Usage**

```

BFslogOR(
  ao,
  bo,
  nTo = ao + bo,
  co,
  do,
  nCo = co + do,
  ar,
  br,
  nTr = ar + br,
  cr,
  dr,
  nCr = cr + dr,
  method = c("integration", "hypergeo")
)

```

**Arguments**

ao	Number of cases in original study treatment group
bo	Number of non-cases in original study treatment group
nTo	Number of participants in original study treatment group (specify alternatively to b)
co	Number of cases in original study control group
do	Number of non-cases in original study control group
nCo	Number of participants in original study control group (specify alternatively to d)
ar	Number of cases in replication study treatment group

br	Number of non-cases in replication study treatment group
nTr	Number of participants in replication study treatment group (specify alternatively to b)
cr	Number of cases in replication study control group
dr	Number of non-cases in replication study control group
nCr	Number of participants in replication study control group (specify alternatively to d)
method	Method to compute posterior density. Either "integration" (default) or "hypergeo"

### Details

This function computes the sceptical Bayes factor for log odds ratio (logOR) effect sizes using an exact binomial likelihood for the data instead of the normal approximation used in [BFs](#) (for details, see Section 4 in Pawel and Held, 2022).

### Value

The sceptical Bayes factor  $BF_S$ .  $BF_S < 1$  indicates replication success, the smaller the value of  $BF_S$  the higher the degree of replication success. It is possible that the result of the replication is so inconclusive that replication success cannot be established at any level. In this case, the sceptical Bayes factor does not exist and the function returns NaN.

### Author(s)

Samuel Pawel

### References

Pawel, S. and Held, L. (2022). The sceptical Bayes factor for the assessment of replication success. *Journal of the Royal Statistical Society Series B: Statistical Methodology*, 84(3): 879-911. [doi:10.1111/rssb.12491](https://doi.org/10.1111/rssb.12491)

### See Also

[BFs](#), [BFslogOR](#)

### Examples

```
data("SSRPexact")
balafoutas2012 <- subset(SSRPexact, study == "Balafoutas and Sutter (2012), Science")
with(balafoutas2012,
     BFslogOR(ao = ao, bo = bo, co = co, do = do, ar = ar, br = br, cr = cr, dr = dr))
```

BFsSMD

*Sceptical Bayes factor for SMD effect sizes***Description**

Computes the sceptical Bayes factor for standardized mean difference (SMD) effect sizes

**Usage**

```
BFsSMD(
  to,
  no,
  n1o = no,
  n2o = no,
  tr,
  nr,
  n1r = nr,
  n2r = nr,
  type = c("two.sample", "one.sample", "paired")
)
```

**Arguments**

<code>to</code>	<i>t</i> -statistic from the original study
<code>no</code>	Sample size of the original study (per group)
<code>n1o</code>	Sample size in group 1 of the original study (only required for two-sample <i>t</i> -test with unequal group sizes)
<code>n2o</code>	Sample size in group 2 of the original study (only specify if unequal group sizes)
<code>tr</code>	<i>t</i> -statistic from the replication study
<code>nr</code>	Sample size of the replication study (per group)
<code>n1r</code>	Sample size in group 1 of the replication study (only required for two-sample <i>t</i> -test with unequal group sizes)
<code>n2r</code>	Sample size in group 2 of the replication study (only required for two-sample <i>t</i> -test with unequal group sizes)
<code>type</code>	Type of <i>t</i> -test associated with <i>t</i> -statistic. Can be "two.sample", "one.sample", "paired". Defaults to "two.sample".

**Details**

This function computes the sceptical Bayes factor for standardized mean difference (SMD) effect sizes using an exact *t*-likelihood for the data instead of the normal approximation used in [BFs](#) (for details, see Section 4 in Pawel and Held, 2022). Data from both studies are summarized by *t*-statistics and sample sizes. The following types of *t*-tests are accepted:

- Two-sample *t*-test where the SMD represents the standardized mean difference between two group means (assuming equal variances in both groups).

- One-sample  $t$ -test where the SMD represents the standardized mean difference to the null value.
- Paired  $t$ -test where the SMD represents the standardized mean difference score.

### Value

The sceptical Bayes factor  $BF_S$ .  $BF_S < 1$  indicates replication success, the smaller the value of  $BF_S$  the higher the degree of replication success. It is possible that the result of the replication is so inconclusive that replication success cannot be established at any level. In this case, the sceptical Bayes factor does not exist and the function returns NaN.

### Author(s)

Samuel Pawel

### References

Pawel, S. and Held, L. (2022). The sceptical Bayes factor for the assessment of replication success. *Journal of the Royal Statistical Society Series B: Statistical Methodology*, 84(3): 879-911. [doi:10.1111/rssb.12491](https://doi.org/10.1111/rssb.12491)

### See Also

[BFs](#), [BFslogOR](#)

### Examples

```
data("SSRPexact")
morewedge2010 <- subset(SSRPexact, study == "Morewedge et al. (2010), Science")
with(morewedge2010,
     BFsSMD(to = to, n1o = n1o, n2o = n2o, tr = tr, n1r = n1r, n2r = n2r))
```

---

formatBF

*Formatting of Bayes factors*

---

### Description

Formats Bayes factors such that Bayes factors smaller than 1 are represented as ratios  $1/x$ , where  $x$  is rounded to the specified number of digits, while Bayes factors larger than 1 are only rounded to the specified number of digits.

### Usage

```
formatBF(BF, digits = "default")
```

**Arguments**

BF	Bayes factor
digits	either "default" (see Details) or a positive integer specifying the number of decimal places to round the Bayes factor (for Bayes factors $\geq 1$ ) or its inverse (for Bayes factors $< 1$ )

**Details**

The default formatting, which is recommended in Held and Ott (2018), is as follows: For very small Bayes factors  $BF < 1/1000$ , " $< 1/1000$ " is returned. Bayes factors  $BF$  with  $1/1000 \leq BF \leq 1/10$  are formatted as  $1/x$  where  $x$  is an integer and Bayes factors  $BF$  with  $1/10 < BF < 1$  as  $1/x$ , where  $x$  is rounded to one decimal place. Accordingly, Bayes factors  $\leq BF < 10$  are rounded to one decimal place, Bayes factors  $10 \leq BF \leq 1000$  are rounded to the next integer and for larger Bayes factors, " $> 1000$ " is returned.

If digits is specified, the Bayes factor (if it is  $\geq 1$ ) or its inverse (if the Bayes factor is  $< 1$ ) is rounded to the number of decimal places specified and returned as a ratio if the Bayes factor is  $< 1$ .

**Value**

A character vector of ratios (for inputs  $< 1$ ) or rounded numeric values (for inputs  $\geq 1$ ).

**Author(s)**

Manuela Ott (creator of package pCalibrate), Leonhard Held (contributor of package pCalibrate), Samuel Pawel (made small changes to pCalibrate::formatBF)

**References**

Held, L. and Ott, M. (2018). On  $p$ -values and Bayes factors. *Annual Review of Statistics and Its Application*, 5, 393-419. doi:[10.1146/annurevstatistics031017100307](https://doi.org/10.1146/annurevstatistics031017100307)

**Examples**

```
(bf <- BFr(to = 2, so = 0.5, tr = 2.5, sr = 0.9))
formatBF(BF = bf)
```

---

 repPosterior

*Effect size posterior distribution*


---

**Description**

Computes the posterior distribution of the effect size based on the original and replication effect estimates and their standard errors, assuming a common underlying effect size and an initial flat prior.

**Usage**

```
repPosterior(
  to,
  so,
  tr,
  sr,
  lower = min(c(to, tr)) - 4/sqrt(1/so^2 + 1/sr^2),
  upper = max(c(to, tr)) + 4/sqrt(1/so^2 + 1/sr^2),
  nGrid = 1000,
  plot = TRUE,
  CI = TRUE,
  ...
)
```

**Arguments**

to	Original effect estimate
so	Standard error of the original effect estimate
tr	Replication effect estimate
sr	Standard error of the replication effect estimate
lower	Lower bound of range for which distribution should computed. Defaults to minimum of to and tr minus four times the pooled standard error
upper	Upper bound of range for which distribution should computed. Defaults to maximum of to and tr plus four times the pooled standard error
nGrid	Number of grid points. Defaults to 1000
plot	Logical indicating whether posterior distribution should be plotted. If FALSE, only data used for plotting are returned. Defaults to TRUE
CI	Logical indicating whether 95% highest posterior credible interval should be plotted. Defaults to TRUE
...	Additional arguments passed to matplot

**Value**

Plots posterior distribution of the effect size, invisibly returns a list with the data for the plot

**Author(s)**

Samuel Pawel

**Examples**

```
## Example from Reproducibility Project Cancer Biology
## Aird: Data from https://elifesciences.org/articles/21253 Fig4B
hro <- 25.93
lhro <- log(hro)
hroCI <- c(5.48, 122.58)
```



```

se_lhro <- diff(log(hroCI))/(2*qnorm(0.975))
hrr <- 3.75
lhrr <- log(hrr)
hrrCI <- c(1.19, 11.81)
se_lhrr <- diff(log(hrrCI))/(2*qnorm(0.975))
repPosterior(to = lhro, so = se_lhro, tr = lhrr, sr = se_lhrr)

```

---

SSRPexact

*Data from the Social Sciences Replication Project*


---

### Description

Data from the Social Sciences Replication Project. The variables are as follows:

study Authors, year, and journal of the original study

type Type of effect size. Either "logOR" for log odds ratio effect size, "SMD1" for standardized mean difference from one-sample or paired *t*-test, or "SMD2" for standardized mean difference from two-sample *t*-test

to *t*-statistic from the original study (only available for "SMD1" and "SMD2")

n1o Sample size in group 1 of the original study (only available for "SMD1" and "SMD2")

n2o Sample size in group 2 of the original study (only available for "SMD2")

tr *t*-statistic from the replication study (only available for "SMD1" and "SMD2")

n1r Sample size in group 1 of the replication study (only available for "SMD1" and "SMD2")

n2r Sample size in group 2 of the replication study (only available for "SMD2")

ao Number of cases in original study treatment group (only available for "logOR")

bo Number of non-cases in original study treatment group (only available for "logOR")

co Number of cases in original study control group (only available for "logOR")

do Number of non-cases in original study control group (only available for "logOR")

ar Number of cases in replication study treatment group (only available for "logOR")

br Number of cases in replication study control group (only available for "logOR")

cr Number of cases in replication study control group (only available for "logOR")

dr Number of non-cases in replication study control group (only available for "logOR")

### Usage

```
data(SSRPexact)
```

### Format

A data frame with 21 rows and 16 variables

**Author(s)**

Samuel Pawel

**Source**

The data were manually extracted from the Bayesian supplement of the SSRP (<https://osf.io/nsxgj/>). The data are licensed under CC0 1.0 Universal.

**References**

Camerer, C. F., Dreber, A., Holzmeister, F., Ho, T.-H., Huber, J., Johannesson, M., ... Wu, H. (2018). Evaluating the replicability of social science experiments in Nature and Science between 2010 and 2015. *Nature Human Behaviour*, 2, 637-644. [doi:10.1038/s415620180399z](https://doi.org/10.1038/s415620180399z)

# Index

## \* **data**

SSRPexact, [17](#)

BayesRep, [2](#)

BFe, [2](#), [2](#)

BFr, [2](#), [4](#), [7–9](#)

BFrlogOR, [2](#), [5](#), [6](#), [9](#)

BFrSMD, [2](#), [5](#), [7](#)

BFs, [2](#), [9](#), [12–14](#)

BFslogOR, [2](#), [10](#), [11](#), [12](#), [14](#)

BFsSMD, [2](#), [10](#), [13](#)

formatBF, [14](#)

repPosterior, [2](#), [15](#)

SSRPexact, [17](#)