# Package: srm (via r-universe)

**Type** Package

**Title** Structural Equation Modeling for the Social Relations Model

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**Description** Provides functionality for structural equation modeling for the social relations model (Kenny & La Voie, 1984; <doi:10.1016/S0065-2601(08)60144-6>; Warner, Kenny, & Soto, 1979, <doi:10.1037/0022-3514.37.10.1742>). Maximum likelihood estimation (Gill & Swartz, 2001, <doi:10.2307/3316080>; Nestler, 2018, <doi:10.3102/1076998617741106>) and least squares estimation is supported (Bond & Malloy, 2018, <doi:10.1016/B978-0-12-811967-9.00014-X>).

**Depends** R (>= 3.1)

**Imports** Rcpp, stats, utils

**Enhances** amen, TripleR

**LinkingTo** Rcpp, RcppArmadillo

**License** GPL (>= 2)

**URL** https://github.com/alexanderrobitzsch/srm, https://sites.google.com/site/alexanderrobitzsch2/software

**Repository** https://alexanderrobitzsch.r-universe.dev

**RemoteUrl** https://github.com/alexanderrobitzsch/srm

**RemoteRef** HEAD

**RemoteSha** 5e403a8e8ebd8387203a104930eaaec56bf3e188

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srm-package                     *Structural Equation Modeling for the Social Relations Model*

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## Description

Provides functionality for structural equation modeling for the social relations model (Kenny & La Voie, 1984; <doi:10.1016/S0065-2601(08)60144-6>; Warner, Kenny, & Soto, 1979, <doi:10.1037/0022-3514.37.10.1742>). Maximum likelihood estimation (Gill & Swartz, 2001, <doi:10.2307/3316080>; Nestler, 2018, <doi:10.3102/1076998617741106>) and least squares estimation is supported (Bond & Malloy, 2018, <doi:10.1016/B978-0-12-811967-9.00014-X>).

## Author(s)

Steffen Nestler [aut], Alexander Robitzsch [aut, cre], Oliver Luedtke [aut]

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## References

Bond, C. F., & Malloy, T. E. (2018a). Social relations analysis of dyadic data structure: The general case. In T. E. Malloy. *Social relations modeling of behavior in dyads and groups* (Ch. 14). Academic Press. doi:10.1016/B9780128119679.00014X

Gill, P. S., & Swartz, T. B. (2001). Statistical analyses for round robin interaction data. *Canadian Journal of Statistics, 29*(2), 321-331. doi:10.2307/3316080

Kenny, D. A., & La Voie, L. J. (1984). The social relations model. In L. Berkowitz (Ed.), *Advances in experimental social psychology* (Vol. 18, pp. 142-182). Orlando, FL: Academic. doi:10.1016/S00652601(08)601446

Nestler, S. (2018). Likelihood estimation of the multivariate social relations model. *Journal of Educational and Behavioral Statistics, 43*(4), 387-406. doi:10.3102/1076998617741106

Warner, R. M., Kenny, D. A., & Soto, M. (1979). A new round robin analysis of variance for social interaction data. *Journal of Personality and Social Psychology, 37*(10), 1742-1757. doi:10.1037/00223514.37.10.1742

## See Also

See also the R packages **amen** and **TripleR** for estimating the social relations model.

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data.back                    *Dataset Back et al. (2011)*

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## Description

Dataset used in Back, Schmukle and Egloff (2011).

## Usage

```
data(data.back)
```

## Format

- The dataset data.back is a round-robin desiogn with 54 units and has the following structure

  ```
  'data.frame': 2862 obs. of 8 variables:
  $ Group : num 1 1 1 1 1 1 1 1 1 1 ...
  $ Actor : int 1 1 1 1 1 1 1 1 1 1 ...
  $ Partner: int 2 3 4 5 6 7 8 9 10 11 ...
  $ Dyad : int 1 2 3 4 5 6 7 8 9 10 ...
  $ y : int 3 3 2 2 4 3 3 2 3 3 ...
  $ sex : int 1 1 1 1 1 1 1 1 1 1 ...
  $ age : int 22 22 22 22 22 22 22 22 22 22 ...
  $ n : num −1.17 −1.17 −1.17 −1.17 −1.17 −1.17 −1.17 −1.17 −1.17 −1.17 ...
  ```

## Source

https://osf.io/zd67x/

## References

Back, M. D., Schmukle, S. C., & Egloff, B. (2011). A closer look at first sight: Social relations lens model analysis of personality and interpersonal attraction at zero acquaintance. *European Journal of Personality, 25*(3), 225-238. doi:10.1002/per.790

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data.bm                           *Dataset Bond and Malloy (2018)*

---

### Description

This is the illustration dataset of Bond and Malloy (2018) for a bivariate social relations model. The round robin design contains 16 persons and some missing values for one person.

### Usage

```
data(data.bm1)
data(data.bm2)
```

### Format

- The dataset `data.bm1` contains all ratings in a wide format. The two outcomes are arranged one below the other.

  ```
  'data.frame': 32 obs. of 16 variables:
  $ a: int NA 12 13 14 15 15 14 14 13 13 ...
  $ b: int 10 NA 10 18 7 15 14 8 12 12 ...
  $ c: int 13 12 NA 14 13 14 13 13 11 12 ...
  [...]
  $ p: int 11 13 14 14 9 8 17 13 11 12 ...
  ```

- The dataset `data.bm2` is a subdataset of `data.bm1` which contains observations 9 to 16.

### Source

http://thomasemalloy.org/arbsrm-the-general-social-relations-model/

### References

Bond, C. F., & Malloy, T. E. (2018a). Social relations analysis of dyadic data structure: The general case. In T. E. Malloy. *Social relations modeling of behavior in dyads and groups* (Ch. 14). Academic Press. doi:10.1016/B9780128119679.00014X

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data.srm                     *Example Datasets for the* **srm** *Package*

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### Description

Some simulated example datasets for the **srm** package.

### Usage

```
data(data.srm01)
```

**Format**

- The dataset `data.srm01` contains three variables, 10 round robin groups with 10 members each.

    ```
    'data.frame': 900 obs. of 7 variables:
    $ Group : num 1 1 1 1 1 1 1 1 1 1 ...
    $ dyad : num 1 2 3 4 5 6 7 8 9 10 ...
    $ Actor : num 1 1 1 1 1 1 1 1 1 2 ...
    $ Partner: num 2 3 4 5 6 7 8 9 10 3 ...
    $ Wert1 : num -0.15 -0.95 0.82 1.15 -1.79 1.17 1.79 -0.57 -0.46 1.19 ...
    $ Wert2 : num -0.77 0.17 0.42 0.16 -0.44 0.89 1.67 -1.9 -0.74 2.67 ...
    $ Wert3 : num -0.49 0.08 -0.12 1.16 -2.78 -0.74 2.66 -1.28 -0.45 1.93 ...
    ```

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HallmarkKenny *Hallmark and Kenny Round Robin Data*

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**Description**

Data from Kenny et al. (1994)

**Usage**

```
data(HallmarkKenny)
```

**Format**

A data frame with 802 measurements of 30 round-robin groups on the following 7 round-robin variables (taken on unnumbered 7-point rating scales with higher numbers indicating a higher value of the trait):

`calm`: rating of dimension calm-anxious
`sociable` rating of dimension sociable-withdrawn
`liking` rating of dimension like-do not like
`careful` rating of dimension careful-careless
`relaxed` rating of dimension relaxed-tense
`talkative` rating of dimension talkative-quiet
`responsible` rating of dimension responsible-undependable

The data frame also contains participants gender (`actor.sex`; 1 = F, 2 = M) and their age in years (`actor.age`). Note that the data was assessed in two conditions: odd round robin group numbers indicate groups in which participants rated all traits for a person at a time whereas even numbers refer to groups in which participants rated all the people for each trait.

**Source**

<http://davidakenny.net/srm/srmdata.htm>

## References

Kenny, D. A., Albright, L., Malloy, T. E., & Kashy, D. A. (1994). Consensus in interpersonal perception: Acquaintance and the big five. *Psychological Bulletin, 116*(2), 245-258. doi:10.1037/00332909.116.2.245

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| Kenzer | *Zero Acquaintance Round Robin Data from Kenny* |
|--------|--------------------------------------------------|

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## Description

Data from Albright et al. (1988) Study 2

## Usage

```
data(Kenzer)
```

## Format

A data frame with 124 measurements from 7 round-robin groups on the following 5 round-robin variables (taken on unnumbered 7-point rating scales with higher numbers indicating a higher value of the trait):

sociable: rating of dimension sociable
irritable: rating of dimension good-natured
responsible: rating of dimension responsible
anxious: rating of dimension calm
intellectual: rating of dimension intellectual

The data frame also contains the gender (actor.sex; 1 = F, 2 = M) of the participants and their self-ratings on the five assessed traits (actor.sociable and so on).

## Source

http://davidakenny.net/srm/srmdata.htm

## References

Albright, L., Kenny, D. A., & Malloy, T. E. (1988). Consensus in personality judgments at zero acquaintance. *Journal of Personality and Social Psychology, 55*(3), 387-395. doi:10.1037/0022-3514.55.3.387

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| Malzer | *Zero Acquaintance Round Robin Data from Malloy* |
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### Description

Data from Albright et al. (1988) Study 1

### Usage

```
data(Malzer)
```

### Format

A data frame with 216 measurements from 12 round-robin groups on the following 5 round-robin variables (assessed on numbered 7-point rating scales with higher numbers indicating a higher value of the trait with the exception for good and calm):

`sociable`: rating of dimension sociable
`irritable`: rating of dimension good-natured
`responsible`: rating of dimension responsible
`anxious`: rating of dimension calm
`intellectual`: rating of dimension intellectual

The data frame also contains the gender (`actor.sex`; 1 = F, 2 = M) of the participants and their self-ratings on the five assessed traits (`actor.sociable` and so on).

### Source

http://davidakenny.net/srm/srmdata.htm

### References

Albright, L., Kenny, D. A., & Malloy, T. E. (1988). Consensus in personality judgments at zero acquaintance. *Journal of Personality and Social Psychology, 55*(3), 387-395. doi:10.1037/0022-3514.55.3.387

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| srm | *Structural Equation Model for the Social Relations Model* |
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### Description

Provides an estimation routine for a multiple group structural equation model for the social relations model (SRM; Kenny & La Voie, 1984; Warner, Kenny, & Soto, 1979). The model is estimated by maximum likelihood (Gill & Swartz, 2001; Nestler, 2018).

**Usage**

```
srm(model.syntax = NULL, data = NULL, group.var = NULL, rrgroup_name = NULL,
  person_names = c("Actor", "Partner"), fixed.groups = FALSE, var_positive = -1,
  optimizer = "srm", maxiter = 300, conv_dev = 1e-08, conv_par = 1e-06,
  do_line_search = TRUE, line_search_iter_max = 6, verbose = TRUE, use_rcpp = TRUE,
  shortcut = TRUE, use_woodbury = TRUE)

## S3 method for class 'srm'
coef(object, ...)
## S3 method for class 'srm'
vcov(object, ...)
## S3 method for class 'srm'
summary(object, digits=3, file=NULL, layout=1, ...)
## S3 method for class 'srm'
logLik(object, ...)
```

**Arguments**

| | |
|---|---|
| model.syntax | Syntax similar to **lavaan** language, see Examples. |
| data | Data frame containing round robin identifier variables and variables in the round robin design |
| group.var | Name of grouping variable |
| rrgroup_name | Name of variable indicating round robin group |
| person_names | Names for identifier variables for actors and partners |
| fixed.groups | Logical indicating whether groups should be handled with fixed effects |
| var_positive | Nonnegative value if variances are constrained to be positive |
| optimizer | Optimizer to be used: "srm" for internal optimization using Fisher scoring and "nlminb" for L-FBGS optimization. |
| maxiter | Maximum number of iterations |
| conv_dev | Convergence criterion for change relative deviance |
| conv_par | Convergence criterion for change in parameters |
| do_line_search | Logical indicating whether line search should be performed |
| line_search_iter_max | |
| | Number of iterations during line search algorithm |
| verbose | Logical indicating whether convergence progress should be displayed |
| use_rcpp | Logical indicating whether **Rcpp** package should be used |
| shortcut | Logical indicating whether shortcuts for round robin groups with same structure should be used |
| use_woodbury | Logical indicating whether matrix inversion should be simplified by Woodbury identity |
| object | Object of class srm |
| file | Optional file name for summary output |
| digits | Number of digits after decimal in summary output |
| layout | Different layouts (1 or 2) for layout of summary |
| ... | Further arguments to be passed |

## Value

List with following entries (selection)

| | |
|---|---|
| parm.table | Parameter table with estimated values |
| coef | Vector of parameter estimates |
| vcov | Covariance matrix of parameter estimates |
| parm_list | List of model matrices |
| sigma | Model implied covariance matrices |
| ... | Further values |

## References

Gill, P. S., & Swartz, T. B. (2001). Statistical analyses for round robin interaction data. *Canadian Journal of Statistics, 29*(2), 321-331. doi:10.2307/3316080

Kenny, D. A., & La Voie, L. J. (1984). The social relations model. In L. Berkowitz (Ed.), *Advances in experimental social psychology* (Vol. 18, pp. 142-182). Orlando, FL: Academic. doi:10.1016/S00652601(08)601446

Nestler, S. (2018). Likelihood estimation of the multivariate social relations model. *Journal of Educational and Behavioral Statistics, 43*(4), 387-406. doi:10.3102/1076998617741106

Warner, R. M., Kenny, D. A., & Soto, M. (1979). A new round robin analysis of variance for social interaction data. *Journal of Personality and Social Psychology, 37*(10), 1742-1757. doi:10.1037/00223514.37.10.1742

## See Also

See also **TripleR** and **amen** packages for alternative estimation routines for the SRM.

## Examples

```
##########################################################################
# EXAMPLE 1: Univariate SRM
##########################################################################

data(data.srm01, package="srm")
dat <- data.srm01

#-- define model
mf <- '
%Person
F1@A =~ 1*Wert1@A
F1@P =~ 1*Wert1@P
Wert1@A ~~ 0*Wert1@A + 0*Wert1@P
Wert1@P ~~ 0*Wert1@P

%Dyad
F1@AP =~ 1*Wert1@AP
F1@PA =~ 1*Wert1@PA
Wert1@AP ~~ 0*Wert1@AP + 0*Wert1@PA
```

```
Wert1@PA ~~ 0*Wert1@PA
'

#-- estimate model
mod1 <- srm::srm(mf, data = dat, rrgroup_name="Group", conv_par=1e-4, maxiter=20)
summary(mod1)
round(coef(mod1),3)


##########################################################################
# EXAMPLE 2: Bivariate SRM
##########################################################################

data(data.srm01, package="srm")
dat <- data.srm01

#-- define model
mf <- '
%Person
F1@A =~ 1*Wert1@A
F1@P =~ 1*Wert1@P
F2@A =~ 1*Wert2@A
F2@P =~ 1*Wert2@P
Wert1@A ~~ 0*Wert1@A + 0*Wert1@P
Wert1@P ~~ 0*Wert1@P
Wert2@A ~~ 0*Wert2@A + 0*Wert2@P
Wert2@P ~~ 0*Wert2@P

%Dyad
F1@AP =~ 1*Wert1@AP
F1@PA =~ 1*Wert1@PA
F2@AP =~ 1*Wert2@AP
F2@PA =~ 1*Wert2@PA
Wert1@AP ~~ 0*Wert1@AP + 0*Wert1@PA
Wert1@PA ~~ 0*Wert1@PA
Wert2@AP ~~ 0*Wert2@AP + 0*Wert2@PA
Wert2@PA ~~ 0*Wert2@PA
'

#-- estimate model
mod1 <- srm::srm(mf, data = dat, rrgroup_name="Group", conv_par=1e-4, maxiter=20)
summary(mod1)

##########################################################################
# EXAMPLE 3: One-factor model
##########################################################################

data(data.srm01, package="srm")
dat <- data.srm01

#-- define model
mf <- '
# definition of factor for persons and dyad
```

```
%Person
f1@A=~Wert1@A+Wert2@A+Wert3@A
f1@P=~Wert1@P+Wert2@P+Wert3@P

%Dyad
f1@AP=~Wert1@AP+Wert2@AP+Wert3@AP

# define some constraints
Wert1@AP ~~ 0*Wert1@PA
Wert3@AP ~~ 0*Wert3@PA
'
#-- estimate model
mod1 <- srm::srm(mf, data = dat, rrgroup_name="Group", conv_par=1e-4)
summary(mod1)
coef(mod1)

#- use stats::nlminb() optimizer
mod1 <- srm::srm(mf, data = dat, rrgroup_name="Group", optimizer="nlminb", conv_par=1e-4)
summary(mod1)
```

---

| srm_arbsrm | *Least Squares Estimation of the Social Relations Model (Bond & Malloy, 2018)* |
|---|---|

---

### Description

Provides least squares estimation of the bivariate social relations model with missing completely at random data (Bond & Malloy, 2018a). The code is basically taken from Bond and Malloy (2018b) and rewritten for reasons of computation time reduction.

### Usage

```
srm_arbsrm(data, serror = TRUE, use_srm = TRUE)

## S3 method for class 'srm_arbsrm'
coef(object, ...)
## S3 method for class 'srm_arbsrm'
summary(object, digits=3, file=NULL, ...)
```

### Arguments

| | |
|---|---|
| data | Rectangular dataset currently containing only one round robin group. Bivariate observations are stacked one below the other (see example dataset data.bm1). |
| serror | Logical indicating whether standard errors should be calculated. |
| use_srm | Logical indicating whether the rewritten code (TRUE) or the original code of Bond and Malloy (2018b) should be used. |
| object | Object of class srm_arbsrm |

| | |
|---|---|
| file | Optional file name for summary output |
| digits | Number of digits after decimal in summary output |
| ... | Further arguments to be passed |

## Value

List containing entries

| | |
|---|---|
| par_summary | Parameter summary table |
| est | Estimated parameters (as in Bond & Malloy, 2018b) |
| se | Estimated standard errors (as in Bond & Malloy, 2018b) |

## Note

If you use this function, please also cite Bond and Malloy (2018a).

## Author(s)

Rewritten code of Bond and Malloy (2018b). See http://thomasemalloy.org/arbsrm-the-general-social-relations
and http://thomasemalloy.org/wp-content/uploads/2017/09/arbcodeR.pdf.

## References

Bond, C. F., & Malloy, T. E. (2018a). Social relations analysis of dyadic data structure: The general case. In T. E. Malloy. *Social relations modeling of behavior in dyads and groups* (Ch. 14). Academic Press. doi:10.1016/B9780128119679.00014X

Bond, C. F., & Malloy, T. E. (2018b). *ARBSRM - The general social relations model*. http://thomasemalloy.org/arbsrm-the-general-social-relations-model/.

## See Also

Without missing data, ANOVA estimation can be conducted with the **TripleR** package.

## Examples

```
#############################################################################
# EXAMPLE 1: Bond and Malloy (2018) illustration dataset
#############################################################################

data(data.bm2, package="srm")
dat <- data.bm2

#- estimation
mod1 <- srm::srm_arbsrm(dat)
mod1$par_summary
coef(mod1)
summary(mod1)


#-- estimation with original Bond and Malloy code
```

```
mod1a <- srm::srm_arbsrm(dat, use_srm=FALSE)
summary(mod1a)
```

---

| Warner | *Round Robin Data Reported in Warner et al.* |
| --- | --- |

---

## Description

Data from Warner et al. (1979)

## Usage

```
data(Warner)
```

## Format

A data frame with 56 measurements of a single round-robin group on a single round-robin variable that was measured at three consecutive time points. The variable reflects the proportion of time an actor spent when speaking to a partner.

prop.T1: proportion of time spent in the first interaction
prop.T2: proportion of time spent in the second interaction
prop.T3: proportion of time spent in the third interaction

## Source

See Table 7 (p. 1752) of the Warner et al. (1979).

## References

Warner, R. M., Kenny, D. A., & Soto, M. (1979). A new round robin analysis of variance for social interaction data. *Journal of Personality and Social Psychology, 37*(10), 1742-1757. doi:10.1037/00223514.37.10.1742

---

| Zero | *Zero Acquaintance Round Robin Data From Albirght, Kenny, and Malloy* |

---

### Description

Data from Study 3 of Albright et al. (1988)

### Usage

```
data(Zero)
```

### Format

A data frame with 636 measurements of 36 round robin groups on the following 15 round-robin variables (taken on 7-point rating scales with higher values indicating more of the trait):

`sociable`: rating of dimension sociable-reclusive
`good`: rating of dimension good-natured-irritable
`responsible`: rating of dimension responsible-undependable
`calm`: rating of dimension calm-anxious
`intellectual`: rating of dimension intellectual-unintellectual
`imaginative`: rating of dimension imaginative-unimaginative
`talkative`: rating of dimension talkative-silent
`fussy`: rating of dimension fussy-careless
`composed`: rating of dimension composed-excitable
`cooperative`: rating of dimension cooperative-negativistic
`physically_attractive`: rating of dimension physically attractive-unattractive
`formal_dress`: rating of dimension formal dress-casual dress
`neatly_dressed`: rating of dimension neatly dressed-sloppy dress
`athletic`: rating of dimension athletic-not athletic
`young`: rating of dimension young-old

The data frame also contains the gender (`actor.sex`; 1 = F, 2 = M) of the participants and their self-ratings on the five assessed traits (`actor.sociable` and so on).

### Source

http://davidakenny.net/srm/srmdata.htm

### References

Albright, L., Kenny, D. A., & Malloy, T. E. (1988). Consensus in personality judgments at zero acquaintance. *Journal of Personality and Social Psychology, 55*(3), 387-395. doi:10.1037/0022-3514.55.3.387

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