

# Package ‘socialmixr’

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**Title** Social Mixing Matrices for Infectious Disease Modelling

**Version** 0.3.1

**Description** Provides methods for sampling contact matrices from diary data for use in infectious disease modelling, as discussed in Mossong et al. (2008) <[doi:10.1371/journal.pmed.0050074](https://doi.org/10.1371/journal.pmed.0050074)>.

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**NeedsCompilation** no

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**URL** <https://github.com/epiforecasts/socialmixr>,  
<https://epiforecasts.io/socialmixr/>

**BugReports** <https://github.com/epiforecasts/socialmixr/issues>

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check	<i>Check contact survey data</i>
-------	----------------------------------

---

### Description

Checks that a survey fulfills all the requirements to work with the 'contact\_matrix' function

### Usage

```
## S3 method for class 'survey'
check(
  x,
  columns,
  id.column = "part_id",
  participant.age.column = "part_age",
  country.column = "country",
  year.column = "year",
  contact.age.column = "cnt_age",
  ...
)
```

**Arguments**

<code>x</code>	A <a href="#">survey()</a> object
<code>columns</code>	deprecated argument, ignored
<code>id.column</code>	the column in both the participants and contacts data frames that links contacts to participants
<code>participant.age.column</code>	the column in the participants data frame containing participants' age
<code>country.column</code>	the column in the participants data frame containing the country in which the participant was queried
<code>year.column</code>	the column in the participants data frame containing the year in which the participant was queried
<code>contact.age.column</code>	the column in the contacts data frame containing the age of contacts; if this does not exist, at least columns "..._exact", "..._est_min" and "..._est_max" must (see the <code>estimated.contact.age</code> option in <a href="#">contact_matrix()</a> )
<code>...</code>	ignored

**Value**

invisibly returns a character vector of the relevant columns

**Examples**

```
data(polymod)
check(polymod)
```

---

<code>cite</code>	<i>Citation for a survey</i>
-------------------	------------------------------

---

**Description**

Gets a full citation for a [survey\(\)](#).

**Usage**

```
## S3 method for class 'survey'
cite(x, ...)
```

**Arguments**

<code>x</code>	a character vector of surveys to cite
<code>...</code>	ignored

**Value**

citation as bibentry

**Examples**

```
data(polymod)
cite(polymod)
```

---

clean	<i>Clean contact survey data</i>
-------	----------------------------------

---

**Description**

Cleans survey data to work with the 'contact\_matrix' function

**Usage**

```
## S3 method for class 'survey'
clean(x, country.column = "country", participant.age.column = "part_age", ...)
```

**Arguments**

x	A <code>survey()</code> object
country.column	the name of the country in which the survey participant was interviewed
participant.age.column	the column in <code>x\$participants</code> containing participants' age
...	ignored

**Value**

a cleaned survey in the correct format

**Examples**

```
data(polymod)
cleaned <- clean(polymod) # not really necessary as the 'polymod' data set has already been cleaned
```

---

contact_matrix	<i>Generate a contact matrix from diary survey data</i>
----------------	---

---

**Description**

Samples a contact survey using a bootstrap

**Usage**

```

contact_matrix(
  survey,
  countries = NULL,
  survey.pop,
  age.limits,
  filter,
  n = 1,
  bootstrap,
  counts = FALSE,
  symmetric = FALSE,
  split = FALSE,
  sample.participants = FALSE,
  estimated.participant.age = c("mean", "sample", "missing"),
  estimated.contact.age = c("mean", "sample", "missing"),
  missing.participant.age = c("remove", "keep"),
  missing.contact.age = c("remove", "sample", "keep", "ignore"),
  weights = NULL,
  weigh.dayofweek = FALSE,
  weigh.age = FALSE,
  weight.threshold = NA,
  sample.all.age.groups = FALSE,
  return.part.weights = FALSE,
  return.demography = NA,
  per.capita = FALSE,
  ...
)

```

**Arguments**

survey	a <a href="#">survey()</a> object
countries	limit to one or more countries; if not given, will use all countries in the survey; these can be given as country names or 2-letter (ISO Alpha-2) country codes
survey.pop	survey population – either a data frame with columns 'lower.age.limit' and 'population', or a character vector giving the name(s) of a country or countries from the list that can be obtained via <code>wpp_countries</code> ; if not given, will use the country populations from the chosen countries, or all countries in the survey if countries is not given
age.limits	lower limits of the age groups over which to construct the matrix
filter	any filters to apply to the data, given as list of the form (column=filter_value) - only contacts that have 'filter_value' in 'column' will be considered. If multiple filters are given, they are all applied independently and in the sequence given.
n	deprecated; number of bootstrap samples to generate
bootstrap	deprecated; whether to bootstrap contact matrices
counts	whether to return counts (instead of means)
symmetric	whether to make matrix symmetric, such that $c_{ij}N_i = c_{ji}N_j$ .

split	whether to split the number of contacts and assortativity
sample.participants	whether to sample participants randomly (with replacement); done multiple times this can be used to assess uncertainty in the generated contact matrices. See the "Bootstrapping" section in the vignette for how to do this..
estimated.participant.age	if set to "mean" (default), people whose ages are given as a range (in columns named "..._est_min" and "..._est_max") but not exactly (in a column named "..._exact") will have their age set to the mid-point of the range; if set to "sample", the age will be sampled from the range; if set to "missing", age ranges will be treated as missing
estimated.contact.age	if set to "mean" (default), contacts whose ages are given as a range (in columns named "..._est_min" and "..._est_max") but not exactly (in a column named "..._exact") will have their age set to the mid-point of the range; if set to "sample", the age will be sampled from the range; if set to "missing", age ranges will be treated as missing
missing.participant.age	if set to "remove" (default), participants without age information are removed; if set to "keep", participants with missing age are kept and treated as a separate age group
missing.contact.age	if set to "remove" (default), participants that have contacts without age information are removed; if set to "sample", contacts without age information are sampled from all the contacts of participants of the same age group; if set to "keep", contacts with missing age are kept and treated as a separate age group; if set to "ignore", contact with missing age are ignored in the contact analysis
weights	column names(s) of the participant data of the <code>survey()</code> object with user-specified weights (default = empty vector)
weigh.dayofweek	whether to weigh social contacts data by the day of the week (weight $(5/7 / N_{\text{week}} / N)$ for weekdays and $(2/7 / N_{\text{weekend}} / N)$ for weekends)
weigh.age	whether to weigh social contacts data by the age of the participants (vs. the populations' age distribution)
weight.threshold	threshold value for the standardized weights before running an additional standardisation (default 'NA' = no cutoff)
sample.all.age.groups	what to do if bootstrapping fails to sample participants from one or more age groups; if FALSE (default), corresponding rows will be set to NA, if TRUE the sample will be discarded and a new one taken instead
return.part.weights	boolean to return the participant weights
return.demography	boolean to explicitly return demography data that corresponds to the survey data (default 'NA' = if demography data is requested by other function parameters)

`per.capita` whether to return a matrix with contact rates per capita (default is FALSE and not possible if 'counts=TRUE' or 'split=TRUE')

... further arguments to pass to `get_survey()`, `check()` and `pop_age()` (especially column names)

**Value**

a contact matrix, and the underlying demography of the surveyed population

**Author(s)**

Sebastian Funk

**Examples**

```
data(polymod)
contact_matrix(polymod, countries = "United Kingdom", age.limits = c(0, 1, 5, 15))
```

---

download\_survey      *Download a survey from its Zenodo repository*

---

**Description**

Downloads survey data

**Usage**

```
download_survey(survey, dir = NULL, sleep = 1)
```

**Arguments**

`survey` a URL (see `list_surveys()`)

`dir` a directory to save the files to; if not given, will save to a temporary directory

`sleep` time to sleep between requests to avoid overloading the server (passed on to `Sys.sleep`)

**Value**

a vector of filenames that can be used with `load_survey`

**Examples**

```
## Not run:
list_surveys()
peru_survey <- download_survey("https://doi.org/10.5281/zenodo.1095664")

## End(Not run)
```

---

get_citation	<i>Citation for a survey</i>
--------------	------------------------------

---

**Description**

Gets a full citation for a [survey\(\)](#).

**Usage**

```
get_citation(x)
```

**Arguments**

x a character vector of surveys to cite

**Value**

citation as bibentry

**Examples**

```
data(polymod)
citation <- get_citation(polymod)
print(citation)
print(citation, style = "bibtex")
```

---

get_survey	<i>Get a survey, either from its Zenodo repository, a set of files, or a survey variable</i>
------------	--

---

**Description**

Downloads survey data, or extracts them from files, and returns a clean data set.

**Usage**

```
get_survey(survey, ...)
```

**Arguments**

survey a DOI or url to get the survey from, or a [survey\(\)](#) object (in which case only cleaning is done).

... options for [clean\(\)](#), which is called at the end of this

**Value**

a survey in the correct format



**Examples**

```
## Not run:  
list_surveys()  
peru_survey <- get_survey("https://doi.org/10.5281/zenodo.1095664")  
  
## End(Not run)
```

---

limits\_to\_agegroups     *Convert lower age limits to age groups.*

---

**Description**

Mostly used for plot labelling

**Usage**

```
limits_to_agegroups(x, limits = sort(unique(x)))
```

**Arguments**

x	age limits to transform
limits	lower age limits; if not given, will use all limits in x

**Value**

Age groups (limits separated by dashes)

**Examples**

```
limits_to_agegroups(c(0, 5, 10))
```

---

list\_surveys     *List all surveys available for download*

---

**Description**

List all surveys available for download

**Usage**

```
list_surveys()
```

**Value**

character vector of surveys

## Examples

```
## Not run:  
list_surveys()  
  
## End(Not run)
```

---

load_survey	<i>Load a survey from local files</i>
-------------	---------------------------------------

---

## Description

Loads a survey from a local file system. Tables are expected as csv files, and a reference (if present) as JSON.

## Usage

```
load_survey(files, ...)
```

## Arguments

`files` a vector of file names as returned by [download\\_survey\(\)](#)  
`...` options for [clean\(\)](#), which is called at the end of this

## Value

a survey in the correct format

## Examples

```
## Not run:  
list_surveys()  
peru_files <- download_survey("https://doi.org/10.5281/zenodo.1095664")  
peru_survey <- load_survey(peru_files)  
  
## End(Not run)
```

---

matrix_plot	<i>Draws an image plot of a contact matrix with a legend strip and the numeric values in the cells.</i>
-------------	---

---

### Description

This function combines the R `image.plot` function with numeric contact rates in the matrix cells.

### Usage

```
matrix_plot(  
  mij,  
  min.legend = 0,  
  max.legend = NA,  
  num.digits = 2,  
  num.colors = 50,  
  main,  
  xlab,  
  ylab,  
  legend.width,  
  cex.lab,  
  cex.axis,  
  cex.text,  
  color.palette = heat.colors,  
  ...  
)
```

### Arguments

<code>mij</code>	a contact matrix containing contact rates between participants of age <i>i</i> (rows) with contacts of age <i>j</i> (columns). This is the default matrix format of <code>contact_matrix()</code> .
<code>min.legend</code>	the color scale minimum (default = 0). Set to NA to use the minimum value of <code>mij</code> .
<code>max.legend</code>	the color scale maximum (default = NA). Set to NA to use the maximum value of <code>mij</code> .
<code>num.digits</code>	the number of digits when rounding the contact rates (default = 2). Use NA to disable this.
<code>num.colors</code>	the number of color breaks (default = 50)
<code>main</code>	the figure title
<code>xlab</code>	a title for the x axis (default: "Age group (years)")
<code>ylab</code>	a title for the y axis (default: "Contact age group (years)")
<code>legend.width</code>	width of the legend strip in characters. Default is 1.
<code>cex.lab</code>	size of the x and y labels (default: 1.2)
<code>cex.axis</code>	size of the axis labels (default: 0.8)

`cex.text` size of the numeric values in the matrix (default: 1)  
`color.palette` the color palette to use (default: `heat.colors()`). Other examples are `topo.colors()`, `terrain.colors()` and `hcl.colors()`. User-defined functions are also possible if they take the number of colors to be in the palette as function argument.  
`...` further arguments to pass to `image.plot()`

### Details

This is a function using the basic R graphics to make it easier for users of `socialmixr` to visualise social contact matrices.

### Author(s)

Lander Willem

### Examples

```
## Not run:
data(polymod)
mij <- contact_matrix(polymod, countries = "United Kingdom", age.limits = c(0, 18, 65))$matrix
matrix_plot(mij)

## End(Not run)
```

---

polymod

*Social contact data from 8 European countries*

---

### Description

A dataset containing social mixing diary data from 8 European countries: Belgium, Germany, Finland, Great Britain, Italy, Luxembourg, The Netherlands and Poland. The Data are fully described in Mossong J, Hens N, Jit M, Beutels P, Auranen K, Mikolajczyk R, et al. (2008) Social Contacts and Mixing Patterns Relevant to the Spread of Infectious Diseases. *PLoS Med* 5(3): e74.

### Usage

`polymod`

### Format

A list of two data frames:

**participants** the study participant, with age, country, year and day of the week (starting with 1 = Monday)

**contacts** reported contacts of the study participants. The variable `phys_contact` has two levels (1 denotes physical contact while 2 denotes non-physical contact), `duration_multi` has five levels (1 is less than 5 minutes while 5 is more than 4 hours, increasing in the order found in Figure 1 in Mossong et al.), and `frequency_multi` has five levels (1 is daily, 2 is weekly, 3 is monthly, 4 is less often, and 5 is first time) All other variables are described on the Zenodo repository of the data, available at [doi:10.5281/zenodo.1043437](https://doi.org/10.5281/zenodo.1043437)

**Source**

[doi:10.1371/journal.pmed.0050074](https://doi.org/10.1371/journal.pmed.0050074)

---

pop\_age

*Change age groups in population data*

---

**Description**

This changes population data to have age groups with the given age.limits, extrapolating linearly between age groups (if more are requested than available) and summing populations (if fewer are requested than available)

**Usage**

```
pop_age(
  pop,
  age.limits,
  pop.age.column = "lower.age.limit",
  pop.column = "population",
  ...
)
```

**Arguments**

pop	a data frame with columns indicating lower age limits and population sizes (see 'age.column' and 'pop.column')
age.limits	lower age limits of age groups to extract
pop.age.column	column in the 'pop' data frame indicating the lower age group limit
pop.column	column in the 'pop' data frame indicating the population size
...	ignored

**Value**

data frame of age-specific population data

**Examples**

```
ages_it_2015 <- wpp_age("Italy", 2015)

# Modify the age data.frame to get age groups of 10 years instead of 5
pop_age(ages_it_2015, age.limit = seq(0, 100, by = 10))

# The function will also automatically interpolate if necessary
pop_age(ages_it_2015, age.limit = c(0, 18, 40, 65))
```

---

reduce_agegroups	<i>Reduce the number of age groups given a broader set of limits</i>
------------------	--

---

**Description**

Operates on lower limits

**Usage**

```
reduce_agegroups(x, limits)
```

**Arguments**

x	vector of limits
limits	new limits

**Value**

vector with the new age groups

**Examples**

```
reduce_agegroups(seq_len(20), c(0, 5, 10))
```

---

survey	<i>Contact survey</i>
--------	-----------------------

---

**Description**

A survey object contains the results of a contact survey. In particular, it contains two data frames called participants and contacts that are linked by a column specified as `id.column`

**Usage**

```
survey(participants, contacts, reference = NULL)
```

**Arguments**

participants	a data.frame containing information on participants
contacts	a data.frame containing information on contacts
reference	a list containing information needed to reference the survey, in particular it can contain a "title", "bibtype", "author", "doi", "publisher", "note", "year"

**Value**

a new survey object

**Author(s)**

Sebastian Funk

**Examples**

```
data(polymod)
new_survey <- survey(polymod$participants, polymod$contacts)
```

---

survey_countries	<i>List all countries contained in a survey</i>
------------------	---

---

**Description**

List all countries contained in a survey

**Usage**

```
survey_countries(survey, country.column = "country", ...)
```

**Arguments**

survey	a DOI or url to get the survey from, or a <a href="#">survey()</a> object (in which case only cleaning is done).
country.column	column in the survey indicating the country
...	further arguments for <a href="#">get_survey()</a>

**Value**

list of countries

**Examples**

```
data(polymod)
survey_countries(polymod)
```

---

wpp_age	<i>Get age-specific population data according to the World Population Prospects 2017 edition</i>
---------	--

---

**Description**

This uses data from the wpp2017 package but combines male and female, and converts age groups to lower age limits. If the requested year is not present in the historical data, wpp projections are used.

**Usage**

```
wpp_age(countries, years)
```

**Arguments**

countries	countries, will return all if not given
years	years, will return all if not given

**Value**

data frame of age-specific population data

**Examples**

```
wpp_age("Italy", c(1990, 2000))
```

---

wpp_countries	<i>List all countries and regions for which socialmixr has population data</i>
---------------	--

---

**Description**

Uses the World Population Prospects data from the wpp2017 package

**Usage**

```
wpp_countries()
```

**Value**

list of countries

**Examples**

```
wpp_countries()
```



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