

# Package ‘MSG’

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**Type** Package

**Title** Data and Functions for the Book Modern Statistical Graphics

**Version** 0.6

**Description** A companion to the Chinese book “Modern Statistical Graphics”.

**License** GPL

**Depends** R (>= 3.5.0)

**Imports** RColorBrewer (>= 1.1.2)

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**BugReports** <https://github.com/yihui/MSG/issues>

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MSG-package

*Modern Statistical Graphics*

---

### Description

Datasets and functions for the Chinese book “Modern Statistical Graphics”.

### Author(s)

Yihui Xie <<https://yihui.org>>

---

andrews\_curve

*Draw Andrew’s Curve*

---

### Description

This function evaluates the transformation of the original data matrix for  $t$  from  $-\pi$  to  $\pi$ , and uses `matplot` to draw the curves.

**Usage**

```
andrews_curve(  
  x,  
  n = 101,  
  type = "l",  
  lty = 1,  
  lwd = 1,  
  pch = NA,  
  xlab = "t",  
  ylab = "f(t)",  
  ...  
)
```

**Arguments**

x                    a data frame or matrix

n                    number of x-axis values at which f(t) is evaluated

type, lty, lwd, pch, xlab, ylab, ...  
                    passed to [matplot](#)

**Value**

a matrix of coefficients for each observation at different t values

**Author(s)**

Yihui Xie <<https://yihui.org>>

**References**

[https://en.wikipedia.org/wiki/Andrews\\_plot](https://en.wikipedia.org/wiki/Andrews_plot)

**See Also**

[matplot](#)

**Examples**

```
andrews_curve(iris[, -5], col = as.integer(iris[, 5]))
```

---

assists

*Assists between players in CLE and LAL*

---

### Description

The players in the rows assisted the ones in the columns.

### References

<http://www.basketballgeek.com/data/>

### Examples

```
data(assists)

if (require("sna")) {
  set.seed(2011)
  gplot(assists, displaylabels = TRUE, label.cex = 0.7)
}
```

---

BinormCircle

*Random numbers containing a "circle"*

---

### Description

The data was generated from two independent random variables (standard Normal distribution) and further points on a circle were added to the data. The order of the data was randomized.

### Format

A data frame with 20000 observations on the following 2 variables.

**V1** the first random variable with the x-axis coordinate of the circle

**V2** the second random variable with the y-axis coordinate of the circle

### Details

See the example section for the code to generate the data.

### Source

<https://yihui.org/en/2008/09/to-see-a-circle-in-a-pile-of-sand/>

**Examples**

```

data(BinormCircle)

## original plot: cannot see anything
plot(BinormCircle)

## transparent colors (alpha = 0.1)
plot(BinormCircle, col = rgb(0, 0, 0, 0.1))

## set axes limits
plot(BinormCircle, xlim = c(-1, 1), ylim = c(-1, 1))

## small symbols
plot(BinormCircle, pch = ".")

## subset
plot(BinormCircle[sample(nrow(BinormCircle), 1000), ],

## 2D density estimation
library(KernSmooth)
fit = bkde2D(as.matrix(BinormCircle), dpik(as.matrix(BinormCircle)))
# perspective plot by persp()
persp(fit$x1, fit$x2, fit$fhat)

if (interactive() && require("rgl")) {
  # perspective plot by OpenGL
  rgl.surface(fit$x1, fit$x2, fit$fhat)
  # animation
  M = par3d("userMatrix")
  play3d(par3dinterp(userMatrix = list(M, rotate3d(M, pi/2, 1, 0, 0), rotate3d(M,
    pi/2, 0, 1, 0), rotate3d(M, pi, 0, 0, 1))), duration = 20)
}

## data generation
x1 = rnorm(10000)
y1 = rnorm(10000)
x2 = rep(0.5 * cos(seq(0, 2 * pi, length = 500)), 20)
y2 = rep(0.5 * sin(seq(0, 2 * pi, length = 500)), 20)
x = cbind(c(x1, x2), c(y1, y2))
BinormCircle = as.data.frame(round(x[sample(20000), ], 3))

```

---

canabalt

*The scores of the game Canabalt from Twitter*


---

**Description**

The scores of the game Canabalt from Twitter

## References

'<http://www.neilkodner.com/2011/02/visualizations-of-canabalt-scores-scraped-from-twitter/>'  
(the URL is not longer accessible)

## Examples

```
library(ggplot2)
data(canabalt)
print(qplot(device, score, data = canabalt))
print(qplot(reorder(death, score, median), score, data = canabalt, geom = "boxplot") +
  coord_flip())
```

---

char_gen	<i>Generate a matrix of similar characters</i>
----------	--

---

## Description

This function prints a matrix of characters which are very similar to each other.

## Usage

```
char_gen(x = c("V", "W"), n = 300, nrow = 10)
```

## Arguments

x	a character vector of length 2 (usually two similar characters)
n	the total number of characters in the matrix
nrow	the number of rows

## Value

a character matrix on the screen

## Author(s)

Yihui Xie <<https://yihui.org>>

## Examples

```
char_gen()
char_gen(c("O", "Q"))
```

---

ChinaLifeEdu	<i>Life Expectancy and the Number of People with Higher Education in China (2005)</i>
--------------	---

---

**Description**

This data contains the life expectancy and number of people with higher education in the 31 provinces and districts in China (2005).

**Format**

A data frame with 31 observations on the following 2 variables.

**Life.Expectancy** Life expectancy

**High.Edu.NO** Number of people with higher education

**Source**

China Statistical Yearbook 2005. National Bureau of Statistics.

**Examples**

```
data(ChinaLifeEdu)
x = ChinaLifeEdu
plot(x, type = "n", xlim = range(x[, 1]), ylim = range(x[, 2]))
u = par("usr")
rect(u[1], u[3], u[2], u[4], col = "antiquewhite", border = "red")
library(KernSmooth)
est = bkde2D(x, apply(x, 2, dpik))
contour(est$x1, est$x2, est$fhat, nlevels = 15, col = "darkgreen", add = TRUE,
        vfont = c("sans serif", "plain"))
```

---

cn_vs_us	<i>Country power indicators of China vs America</i>
----------	---

---

**Description**

Country power indicators of China vs America

**References**

<https://www.theguardian.com/news/datablog/2011/jan/19/china-social-media>

**Examples**

```
data(cn_vs_us)
```

---

`cut_plot`*Cut the points in a scatter plot into groups according to x-axis*

---

**Description**

This function can categorize the variable on the x-axis into groups and plot the mean values of y. The purpose is to show the arbitrariness of the discretization of data.

**Usage**

```
cut_plot(x, y, breaks, ..., pch.cut = 20)
```

**Arguments**

<code>x</code>	the x variable
<code>y</code>	the y variable
<code>breaks</code>	the breaks to cut the x variable
<code>...</code>	other arguments to be passed to <code>plot.default</code>
<code>pch.cut</code>	the point symbol to denote the mean values of y

**Author(s)**

Yihui Xie <<https://yihui.org>>

**Examples**

```
x = rnorm(100)
y = rnorm(100)
cut_plot(x, y, seq(min(x), max(x), length = 5))
```

---

`eq2010`*Longitude and latitude of earthquakes in the Sichuan Province*

---

**Description**

Longitude and latitude of earthquakes in the Sichuan Province

**Examples**

```
data(eq2010)
plot(lat ~ long, data = eq2010)
```



---

 Export.USCN

*Export of US and China from 1999 to 2004 in US dollars*


---

**Description**

Export of US and China from 1999 to 2004 in US dollars

**Format**

A data frame with 13 observations on the following 3 variables.

**Export** amount of export

**Year** year from 1999 to 2004

**Country** country: US or China

**Source**

[https://www.wto.org/english/res\\_e/statis\\_e/statis\\_e.htm](https://www.wto.org/english/res_e/statis_e/statis_e.htm)

**Examples**

```
data(Export.USCN)
par(mar = c(4, 4.5, 1, 4.5))
plot(1:13, Export.USCN$Export, xlab = "Year / Country", ylab = "US Dollars ( $10^{16}$ )",
     axes = FALSE, type = "h", lwd = 10, col = c(rep(2, 6), NA, rep(4, 6)), lend = 1,
     panel.first = grid())
xlabel = paste(Export.USCN$Year, "\n", Export.USCN$Country)
xlabel[7] = ""
xlabel
abline(v = 7, lty = 2)
axis(1, at = 1:13, labels = xlabel, tick = FALSE, cex.axis = 0.75)
axis(2)
(ylab = pretty(Export.USCN$Export * 8.27))
axis(4, at = ylab/8.27, labels = ylab)
mtext("Chinese RMB", side = 4, line = 2)
box()
```

---

 gov.cn.pct

*Percentage data in Chinese government websites*


---

**Description**

This data was collected from Google by searching for percentages in Chinese government websites.

**Format**

A data frame with 10000 observations on the following 4 variables.

**percentage** a numeric vector: the percentages

**count** a numeric vector: the number of webpages corresponding to a certain percentage

**round0** a logical vector: rounded to integers?

**round1** a logical vector: rounded to the 1st decimal place?

**Details**

We can specify the domain when searching in Google. For this data, we used 'site:gov.cn', e.g. to search for '87.53% site:gov.cn'.

**Source**

Google (date: 2009/12/17)

**Examples**

```
data(gov.cn.pct)
pct.lowess = function(cond) {
  with(gov.cn.pct, {
    plot(count ~ percentage, pch = ifelse(cond, 4, 20), col = rgb(0:1,
      0, 0, c(0.04, 0.5))[cond + 1], log = "y")
    lines(lowess(gov.cn.pct[cond, 1:2], f = 1/3), col = 2, lwd = 2)
    lines(lowess(gov.cn.pct[!cond, 1:2], f = 1/3), col = 1, lwd = 2)
  })
}
par(mar = c(3.5, 3.5, 1, 0.2), mfrow = c(2, 2))
with(gov.cn.pct, {
  plot(percentage, count, type = "l", panel.first = grid())
  plot(percentage, count, type = "l", xlim = c(10, 11), panel.first = grid())
  pct.lowess(round0)
  pct.lowess(round1)
})
if (interactive()) {
  devAskNewPage(ask = TRUE)

  with(gov.cn.pct, {
    plot(count ~ percentage, type = "l")
    grid()

    devAskNewPage(ask = FALSE)

    for (i in 0:99) {
      plot(count ~ percentage, type = "l", xlim = i + c(0, 1),
        panel.first = grid())
    }

    devAskNewPage(ask = TRUE)
  })
}
```

```
plot(count ~ percentage, pch = 20, col = rgb(0:1, 0, 0, c(0.07,
  1))[round0 + 1], log = "y")
lines(lowess(gov.cn.pct[round0, 1:2], f = 1/3), col = "red",
  lwd = 2)
lines(lowess(gov.cn.pct[!round0, 1:2], f = 1/3), col = "black",
  lwd = 2)

plot(count ~ percentage, pch = 20, col = rgb(0:1, 0, 0, c(0.07,
  1))[round1 + 1], log = "y")
lines(lowess(gov.cn.pct[round1, 1:2], f = 1/3), col = "red",
  lwd = 2)
lines(lowess(gov.cn.pct[!round1, 1:2], f = 1/3), col = "black",
  lwd = 2)
  })
}
```

---

heart\_curve

*Draw a heart curve*

---

### Description

Calculate the coordinates of a heart shape and draw it with a polygon.

### Usage

```
heart_curve(n = 101, ...)
```

### Arguments

n	the number of points to use when calculating the coordinates of the heart shape
...	other arguments to be passed to <code>polygon</code> , e.g. the color of the polygon (usually red)

### Author(s)

Yihui Xie <<https://yihui.org>>

### Examples

```
heart_curve()
heart_curve(col = "red")
heart_curve(col = "pink", border = "red")
```

---

`msg`*Plot a graph with a pre-installed R script*

---

**Description**

Plot a graph with a pre-installed R script

**Usage**

```
msg(fig = "3.6", show_code = TRUE, print_plot = TRUE, filter = 0)
```

**Arguments**

<code>fig</code>	Character. The figure number or the R script name, which is given in the book.
<code>show_code</code>	Logical. TRUE means the codes are shown in the console.
<code>print_plot</code>	Logical. TRUE means the graph is printed.
<code>filter</code>	Integer. The line numbers indicating which lines in the code are displayed (when positive) or hidden (when negative).

**Value**

A graph and the source code

**Examples**

```
# msg('3.6') msg('ChinaPop')
```

---

`murcia`*Composition of Soil from Murcia Province, Spain*

---

**Description**

The proportions of sand, silt and clay in soil samples are given for 8 contiguous sites. The sites extended over the crest and flank of a low rise in a valley underlain by marl near Albudeite in the province of Murcia, Spain. The sites were small areas of ground surface of uniform shape internally and delimited by relative discontinuities externally. Soil samples were obtained for each site at 11 random points within a 10m by 10m area centred on the mid-point of the site. All samples were taken from the same depth. The data give the sand, silt and clay content of each sample, expressed as a percentage of the total sand, silt and clay content.

**References**

<http://www.statsci.org/data/general/murcia.html>

**Examples**

```
data(murcia)
boxplot(sand ~ site, data = murcia)
```

---

music

*Attributes of some music clips*


---

**Description**

Attributes of some music clips

**References**

Cook D, Swayne DF (2007). Interactive and Dynamic Graphics for Data Analysis With R and GGobi. Springer. ISBN 978-0-387-71761-6.

**Examples**

```
data(music)
```

---

PlantCounts

*Number of plants corresponding to altitude*


---

**Description**

For each altitude, the number of plants is recorded.

**Format**

A data frame with 600 observations on the following 2 variables.

**altitude** altitude of the area

**counts** number of plants

**Source**

<https://cosx.org/2008/11/lowess-to-explore-bivariate-correlation-by-yihui>

**Examples**

```
## different span for LOWESS
data(PlantCounts)
par(las = 1, mar = c(4, 4, 0.1, 0.1), mgp = c(2.2, 0.9, 0))
with(PlantCounts, {
  plot(altitude, counts, pch = 20, col = rgb(0, 0, 0, 0.5), panel.first = grid())
  for (i in seq(0.01, 1, length = 70)) {
    lines(lowess(altitude, counts, f = i), col = rgb(0, i, 0), lwd = 1.5)
  }
})
```

---

quake6

*Earth quakes from 1973 to 2010*

---

### Description

The time, location and magnitude of all the earth quakes with magnitude being greater than 6 since 1973.

### References

<https://d.cosx.org/d/101510>

### Examples

```
data(quake6)
library(ggplot2)
qplot(year, month, data = quake6) + stat_sum(aes(size = ..n..)) +
  scale_size(range = c(1, 10))
```

---

t.diff

*The differences of P-values in t test assuming equal or unequal variances*

---

### Description

Given that the variances of two groups are unequal, we compute the difference of P-values assuming equal or unequal variances respectively by simulation.

### Format

A data frame with 1000 rows and 99 columns.

### Details

See the Examples section for the generation of this data.

### Source

By simulation.

### References

Welch B (1947). "The generalization of Student's problem when several different population variances are involved." *Biometrika*, 34(1/2), 28–35.

**Examples**

```

data(t.diff)
boxplot(t.diff, axes = FALSE, xlab = expression(n[1]))
axis(1)
axis(2)
box()

## reproducing the data
if (interactive()) {
  set.seed(123)
  t.diff = NULL
  for (n1 in 2:100) {
    t.diff = rbind(t.diff, replicate(1000, {
      x1 = rnorm(n1, mean = 0, sd = runif(1, 0.5, 1))
      x2 = rnorm(30, mean = 1, sd = runif(1, 2, 5))
      t.test(x1, x2, var.equal = TRUE)$p.value - t.test(x1, x2,
        var.equal = FALSE)$p.value
    })))
  }
  t.diff = as.data.frame(t(t.diff))
  colnames(t.diff) = 2:100
}

```

---

tukeyCount

*Results of a Simulation to Tukey's Fast Test*


---

**Description**

For the test of means of two samples, we calculated the P-values and recorded the counts of Tukey's rule of thumb.

**Format**

A data frame with 10000 observations on the following 3 variables.

**pvalue.t** P-values of t test

**pvalue.w** P-values of Wilcoxon test

**count** Tukey's counts

**Details**

See the reference for details.

**Source**

Simulation; see the Examples section below.

## References

D. Daryl Basler and Robert B. Smawley. Tukey's Compact versus Classic Tests. *The Journal of Experimental Education*, Vol. 36, No. 3 (Spring, 1968), pp. 86-88

## Examples

```
data(tukeyCount)

## does Tukey's rule of thumb agree with t test and Wilcoxon test?
with(tukeyCount, {
  ucount = unique(count)
  stripchart(pvalue.t ~ count, method = "jitter", jitter = 0.2, pch = 19,
    cex = 0.7, vertical = TRUE, at = ucount - 0.2, col = rgb(1, 0, 0, 0.2),
    xlim = c(min(count) - 1, max(count) + 1), xaxt = "n", xlab = "Tukey Count",
    ylab = "P-values")
  stripchart(pvalue.w ~ count, method = "jitter", jitter = 0.2, pch = 21,
    cex = 0.7, vertical = TRUE, at = ucount + 0.2, add = TRUE, col = rgb(0,
    0, 1, 0.2), xaxt = "n")
  axis(1, unique(count))
  lines(sort(ucount), tapply(pvalue.t, count, median), type = "o", pch = 19,
    cex = 1.3, col = "red")
  lines(sort(ucount), tapply(pvalue.w, count, median), type = "o", pch = 21,
    cex = 1.3, col = "blue", lty = 2)
  legend("topright", c("t test", "Wilcoxon test"), col = c("red", "blue"),
    pch = c(19, 21), lty = 1:2, bty = "n", cex = 0.8)
})

if (interactive()) {

  ## this is how the data was generated
  set.seed(402)
  n = 30
  tukeyCount = data.frame(t(replicate(10000, {
    x1 = rweibull(n, runif(1, 0.5, 4))
    x2 = rweibull(n, runif(1, 1, 5))
    c(t.test(x1, x2)$p.value, wilcox.test(x1, x2)$p.value, with(rle(rep(0:1,
      each = n)[order(c(x1, x2)])), ifelse(head(values, 1) == tail(values,
      1), 0, sum(lengths[c(1, length(lengths))]))))
  })))
  colnames(tukeyCount) = c("pvalue.t", "pvalue.w", "count")

}
```

---

 tvearn

*Top TV earners*


---

## Description

The pay per episode for actors as well as other information.



## References

<https://flowingdata.com/2011/02/15/visualize-this-tvs-top-earners/>

## Examples

```
data(tvearn)
plot(pay ~ rating, data = tvearn)
library(ggplot2)
qplot(pay, data = tvearn, geom = "histogram", facets = gender ~ ., binwidth = 20000)
qplot(rating, pay, data = tvearn, geom = c("jitter", "smooth"), color = type)
```

---

vec2col	<i>Generate colors from a vector</i>
---------	--------------------------------------

---

## Description

This functions generates a color vector from an input vector, which can be of the class numeric or factor.

## Usage

```
vec2col(vec, n, name)

## Default S3 method:
vec2col(vec, n, name)

## S3 method for class 'factor'
vec2col(vec, n, name)
```

## Arguments

vec	the numeric or factor vector
n	the number of colors to be generated from the palette
name	the name of the palette

## Value

a vector of colors corresponding to the input vector

## Author(s)

Yihui Xie <<https://yihui.org>>

**Examples**

```
## convert factor to colors
with(iris, plot(Petal.Length, Petal.Width, col = vec2col(Species), pch = 19))

# another palette
with(iris, plot(Petal.Length, Petal.Width, col = vec2col(Species, name = "Dark2"),
               pch = 19))

## turn numeric values to colors
with(iris, plot(Petal.Length, Petal.Width, col = vec2col(Petal.Width), pch = 19))
```

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