

# Package ‘calibrate’

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**Title** Calibration of Scatterplot and Biplot Axes

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**Depends** R (>= 1.8.0), MASS

**Description** Package for drawing calibrated scales with tick marks on (non-orthogonal) variable vectors in scatterplots and biplots.

**License** GPL-2

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calibrate

*Calibration of Biplot and Scatterplot Axis***Description**

Routine for the calibration of any axis (variable vector) in a biplot or a scatterplot

**Usage**

```
calibrate(g,y,tm,Fr,tmlab=tm,tl=0.05,dt=TRUE,dp=FALSE,
          lm=TRUE,verb=TRUE,axislab="",reverse=FALSE,
          alpha=NULL,labpos=1,weights=diag(rep(1,length(y))),
          axiscol="blue",cex.axislab=0.75,graphics=TRUE,where=3,
          laboffset=c(0,0),m=matrix(c(0,0),nrow=1),markerpos=3,
          showlabel=TRUE,lwd=1,shiftvec=c(0,0),shiftdir="none",shiftfactor=1.05)
```

**Arguments**

g	the vector to be calibrated (2 x 1).
y	the data vector corresponding to g, appropriately centred and/or standardized.
tm	the vector of tick marks, appropriately centred and/or scaled.
Fr	the coordinates of the rows markers in the biplot.
tmlab	a list or vector of tick mark labels.
tl	the tick length. By default, the tick markers have length 0.05.
dt	draw ticks. By default, ticks markers are drawn. Set dt=F in order to compute calibration results without actually drawing the calibrated scale.
dp	drop perpendiculars. With dp=T perpendicular lines will be drawn from the row markers specified by Fr onto the calibrated axis. This is a graphical aid to read off the values in the corresponding scale.
lm	label markers. By default, all tick marks are labelled. Setting lm=F turns off the labelling of the tick marks. This allows for creating tick marks without labels. It is particularly useful for creating finer scales of tickmarks without labels.
verb	verbose parameter (F=be quiet, T=show results).
axislab	a label for the calibrated axis.
reverse	puts the tick marks and tick mark labels on the other side of the axis.
alpha	a value for the calibration factor. This parameter should only be specified if a calibration is required that is different from the one that is optimal for data recovery.
labpos	position of the label for the calibrated axis (1,2,3 or 4).
laboffset	offset vector for the axis label. If specified, shifts the label by the specified amounts with respect to the current position.
weights	a matrix of weights (optional).

axiscol	color of the calibrated axis.
cex.axislab	character expansion factor for axis label and tick mark labels.
graphics	do graphics or not (F=no graphical output, T=draws calibrated scale).
where	label placement (1=beginning,2=middle,3=end).
m	vector of means.
markerpos	position specifier for the tick mark labels (1,2,3 or 4).
showlabel	show axis label in graph (T) or not (F).
lwd	line width for the calibrated axis
shiftvec	a shift vector for the calibrated axis ((0,0) by default)
shiftdir	indicates in which direction the axis should be shifted ("left", "right" or "none"). This direction is w.r.t. vector g
shiftfactor	scalar by which the shift vector is stretched (or shrunk). By default, the length of the shift vector is stretched by 5 percent (shiftfactor = 1.05)

### Details

This program calibrates variable vectors in biplots and scatterplots, by drawing tick marks along a given the vector and labelling the tick marks with specified values. The optimal calibration is found by (generalized) least squares. Non-optimal calibrations are possible by specifying a calibration factor (alpha).

### Value

Returns a list with calibration results

useralpha	calibration factor specified by the user
optalpha	optimal calibration factor
lengthoneunit	length in the plot of one unit in the scale of the calibrated variable
gof	goodness of fit (as in regression)
gos	goodness of scale
M	coordinates of the tick markers
ang	angle in degrees of the biplot axis with the positive x-axis
shiftvec	the supplied or computed shift vector
yt	fitted values for the variable according to the calibration
e	errors according to the calibration
Fpr	coordinates of the projections of the row markers onto the calibrated axis
Mn	coordinates of the tick marker end points

### Author(s)

Jan Graffelman <jan.graffelman@upc.edu>

## References

Gower, J.C. and Hand, D.J., (1996) *Biplots*. Chapman & Hall, London

Graffelman, J. and van Eeuwijk, F.A. (2005) Calibration of multivariate scatter plots for exploratory analysis of relations within and between sets of variables in genomic research *Biometrical Journal*, 47(6) pp. 863-879.

Graffelman, J. (2006) *A guide to biplot calibration*.

## See Also

[biplot](#)

## Examples

```
x <- rnorm(20,1)
y <- rnorm(20,1)
x <- x - mean(x)
y <- y - mean(y)
z <- x + y
b <- c(1,1)
plot(x,y,asp=1,pch=19)
tm<-seq(-2,2,by=0.5)
Calibrate.z <- calibrate(b,z,tm,cbind(x,y),axislab="Z",graphics=TRUE)
```

---

calves

*Delivery of Dutch Calves*

---

## Description

This data set gives a cross classification of 7275 calves born in the late nineties according to type of production and type of delivery.

## Usage

```
data(calves)
```

## Format

A data frame containing a contingency table of 7275 observations.

## Source

Holland Genetics. <http://www.hg.nl>

## References

Graffelman, J. (2005) *A guide to scatterplot and biplot calibration*.

---

canocor *Canonical correlation analysis*

---

**Description**

canocor performs canonical correlation analysis on the basis of the standardized variables and stores extensive output in a list object.

**Usage**

```
canocor(X, Y)
```

**Arguments**

X	a matrix containing the X variables
Y	a matrix containing the Y variables

**Details**

canocor computes the solution by a singular value decomposition of the transformed between set correlation matrix.

**Value**

Returns a list with the following results

ccor	the canonical correlations
A	canonical weights of the x variables
B	canonical weights of the y variables
U	canonical x variates
V	canonical y variates
Fs	biplot markers for x variables (standard coordinates)
Gs	biplot markers for y variables (standard coordinates)
Fp	biplot markers for x variables (principal coordinates)
Gp	biplot markers for y variables (principal coordinates)
fitRxy	goodness of fit of the between-set correlation matrix
fitXs	adequacy coefficients of x variables
fitXp	redundancy coefficients of x variables
fitYs	adequacy coefficients of y variables
fitYp	redundancy coefficients of y variables

**Author(s)**

Jan Graffelman <jan.graffelman@upc.edu>

**References**

- Hotelling, H. (1935) The most predictable criterion. *Journal of Educational Psychology* (26) pp. 139-142.
- Hotelling, H. (1936) Relations between two sets of variates. *Biometrika* (28) pp. 321-377.
- Johnson, R. A. and Wichern, D. W. (2002) *Applied Multivariate Statistical Analysis*. New Jersey: Prentice Hall.

**See Also**

[cancor](#)

**Examples**

```
set.seed(123)
X <- matrix(runif(75),ncol=3)
Y <- matrix(runif(75),ncol=3)
cca.results <- canocor(X,Y)
```

---

circle

*Draw a circle*

---

**Description**

circle draws a circle in an existing plot.

**Usage**

```
circle(radius,origin)
```

**Arguments**

radius	the radius of the circle
origin	the origin of the circle

**Value**

NULL

**Author(s)**

Jan Graffelman <jan.graffelman@upc.edu>

**Examples**

```
set.seed(123)
X <- matrix(rnorm(20),ncol=2)
plot(X[,1],X[,2])
circle(1,c(0,0))
```

---

dlines	<i>Connect two sets of points by lines</i>
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---

**Description**

dlines connects two sets of points by lines in a rowwise manner.

**Usage**

```
dlines(SetA, SetB, lin = "dotted")
```

**Arguments**

SetA	matrix with the first set of points
SetB	matrix with teh second set of points
lin	linestyle for the connecting lines

**Value**

NULL

**Author(s)**

Jan Graffelman (jan.graffelman@upc.edu)

**See Also**

[lines](#)

**Examples**

```
X <- matrix(runif(20),ncol=2)
Y <- matrix(runif(20),ncol=2)
plot(rbind(X,Y))
text(X[,1],X[,2],paste("X",1:10,sep=""))
text(Y[,1],Y[,2],paste("Y",1:10,sep=""))
dlines(X,Y)
```

---

goblets

*Size measurements of archeological goblets*

---

**Description**

This data set gives 6 different size measurements of 25 goblets

**Usage**

```
data(goblets)
```

**Format**

A data frame containing 25 observations.

**Source**

Manly, 1989

**References**

Manly, B. F. J. (1989) *Multivariate statistical methods: a primer*. London: Chapman and Hall, London

---

heads

*Dimensions of heads of first and second sons for 25 families*

---

**Description**

Variables X1 and X2 are the head length and head breadth of the first son and Y1 and Y2 are the same variables for the second son.

**Usage**

```
data(heads)
```

**Format**

A data frame containing 25 observations.

**Source**

Mardia, 1979, p. 121



**References**

- Frets, G. P. (1921) *Heredity of head form in man*, *Genetica* 3, pp. 193-384.
- Mardia, K. V. and Kent, J. T. and Bibby, J. M. (1979) *Multivariate Analysis*. Academic Press London.
- Anderson, T. W. (1984) *An Introduction to Multivariate Statistical Analysis*. New York: John Wiley, Second edition.

---

linnerud

*Linnerud's exercise and body measurements*

---

**Description**

The data set consist of 3 exercise variables (Tractions a la barre fixe, Flexions, Sauts) and 3 body measurements (Poids, Tour de taille, Pouls) of 20 individuals.

**Usage**

```
data(linnerud)
```

**Format**

A data frame containing 20 observations.

**Source**

Tenenhaus, 1998, table 1, page 15

**References**

- Tenenhaus, M. (1998) *La Regression PLS*. Paris: Editions Technip.

---

ones

*Generates a matrix of ones*

---

**Description**

ones generates a matrix of ones.

**Usage**

```
ones(n, p = n)
```

**Arguments**

n                    number of rows  
p                    number of columns

**Details**

if only n is specified, the resulting matrix will be square.

**Value**

a matrix filled with ones.

**Author(s)**

Jan Graffelman (jan.graffelman@upc.edu)

**See Also**

[matrix](#)

**Examples**

```
Id <- ones(3)
print(Id)
```

---

origin

*Origin*

---

**Description**

Draws coordinate axes in a plot.

**Usage**

```
origin(m=c(0,0), ...)
```

**Arguments**

m	the coordinates of the means (2 x 1).
...	other arguments passed on to the lines function

**Author(s)**

Jan Graffelman (jan.graffelman@upc.edu)

**See Also**

[lines](#)

**Examples**

```
X <- matrix(runif(40),ncol=2)
plot(X[,1],X[,2])
origin(m=c(mean(X[,1]),mean(X[,2])))
```

---

rad2degree	<i>Convert radians to degrees.</i>
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---

**Description**

rad2degree converts radians to degrees.

**Usage**

```
rad2degree(x)
```

**Arguments**

x	an angle in radians
---	---------------------

**Value**

the angle with the positive x-axis in degrees.

**Author(s)**

Jan Graffelman (jan.graffelman@upc.edu)

**Examples**

```
x <- pi/2
a <- rad2degree(x)
cat("angle is",a,"degrees\n")
```

---

rda	<i>Redundancy analysis</i>
-----	----------------------------

---

**Description**

rda performs redundancy analysis and stores extensive output in a list object.

**Usage**

```
rda(X, Y, scaling = 1)
```

**Arguments**

X	a matrix of x variables
Y	a matrix of y variables
scaling	scaling used for x and y variables. 0: x and y only centered. 1: x and y standardized

**Details**

Results are computed by doing a principal component analysis of the fitted values of the regression of y on x.

Plotting the first two columns of Gxs and Gyp, or of Gxp and Gys provides a biplots of the matrix of regression coefficients.

Plotting the first two columns of Fs and Gp or of Fp and Gs provides a biplot of the matrix of fitted values.

**Value**

Returns a list with the following results

Yh	fitted values of the regression of y on x
B	regression coefficients of the regression of y on x
decom	variance decomposition/goodness of fit of the fitted values AND of the regression coefficients
Fs	biplot markers of the rows of Yh (standard coordinates)
Fp	biplot markers of the rows of Yh (principal coordinates)
Gys	biplot markers for the y variables (standard coordinates)
Gyp	biplot markers for the y variables (principal coordinates)
Gxs	biplot markers for the x variables (standard coordinates)
Gxp	biplot markers for the x variables (principal coordinates)

**Author(s)**

Jan Graffelman (jan.graffelman@upc.edu)

**References**

Van den Wollenberg, A.L. (1977) Redundancy Analysis, an alternative for canonical correlation analysis. *Psychometrika* 42(2): pp. 207-219.

Ter Braak, C. J. F. and Looman, C. W. N. (1994) Biplots in Reduced-Rank Regression. *Biometrical Journal* 36(8): pp. 983-1003.

**See Also**

[princomp](#), [canocor](#), [biplot](#)

**Examples**

```
X <- matrix(rnorm(75),ncol=3)
Y <- matrix(rnorm(75),ncol=3)
rda.results <- rda(X,Y)
```

---

shiftvector                      *Compute a shift vector for a calibrated axis.*

---

### Description

shiftvector computes two shift vectors perpendicular to the supplied biplot or scatterplot axis g. The vector norm is computed from the two most extreme data points.

### Usage

```
shiftvector(g, X, x = c(1, 0), verbose = FALSE)
```

### Arguments

g	a biplot or scatterplot axis
X	a n by 2 matrix of scatterplot or biplot coordinates
x	reference axis, (1,0) by default
verbose	print information or not

### Details

shiftvector locates the two most extreme datapoints in the direction perpendicular to axis g.

### Value

dr	the right (w.r.t. the direction of g) shift vector
dl	the left (w.r.t. the direction of g) shift vector

### Author(s)

Jan Graffelman (jan.graffelman@upc.edu)

### References

Graffelman, J. and van Eeuwijk, F.A. (2005) Calibration of multivariate scatter plots for exploratory analysis of relations within and between sets of variables in genomic research *Biometrical Journal*, 47(6) pp. 863-879.

Graffelman, J. (2006) A guide to biplot calibration.

### See Also

[calibrate](#)

**Examples**

```

X <- matrix(rnorm(100),ncol=2)
Xs <- scale(X)

g <- c(1,1)

plot(Xs[,1],Xs[,2],asp=1,pch=19)
textxy(Xs[,1],Xs[,2],1:nrow(X))

arrows(0,0,g[1],g[2])
text(g[1],g[2],"g",pos=1)

out <- shiftvector(g,X,verbose=TRUE)
dr <- out$dr
dl <- out$dl

arrows(0,0,dl[1],dl[2])
text(dl[1],dl[2],"dl",pos=1)

arrows(0,0,dr[1],dr[2])
text(dr[1],dr[2],"dr",pos=1)

```

---

storks

*Frequencies of nesting storks in Denmark*


---

**Description**

Danish data from 1953-1977 giving the frequency of nesting storks, the human birth rate and the per capita electricity consumption.

**Usage**

```
data(storks)
```

**Format**

A data frame containing 25 observations.

**Source**

Gabriel and Odoroff, Table 1.

**References**

Gabriel, K. R. and Odoroff, C. L. (1990) Biplots in biomedical research. *Statistics in Medicine* 9(5): pp. 469-485.

---

textxy *Nice placement of labels in a plot*

---

### Description

Function `textxy` calls function `text` in order to add text to points in a graph. `textxy` chooses a different position for the text depending on the quadrant. This tends to produce better readable plots, with labels fanning away from the origin.

### Usage

```
textxy(X, Y, labs, m = c(0, 0), cex = 0.5, offset = 0.8, ...)
```

### Arguments

<code>X</code>	x coordinates of a set of points
<code>Y</code>	y coordinates of a set of points
<code>labs</code>	labels to be placed next to the points
<code>m</code>	coordinates of the origin of the plot (default (0,0))
<code>cex</code>	character expansion factor
<code>offset</code>	controls the distance between the label and the point. A value of 0 will plot labels on top of the point. Larger values give larger separation between point and label. The default value is 0.8
<code>...</code>	additional arguments for function <code>text</code> .

### Value

NULL

### Author(s)

Jan Graffelman (jan.graffelman@upc.edu)

### References

Graffelman, J. (2006) A guide to biplot calibration.

### See Also

[text](#)

### Examples

```
x <- rnorm(50)
y <- rnorm(50)
plot(x,y,asp=1)
textxy(x,y,1:50,m=c(mean(x),mean(y)))
```

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