

Package ‘paletteknife’

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Title Create Colour Scales and Legend from Continuous or Categorical Vectors

Version 0.4.2

Description Streamlines the steps for adding colour scales and associated legends when working with base R graphics, especially for interactive use. Popular palettes are included and pretty legends produced when mapping a large variety of vector classes to a colour scale. An additional helper for adding axes and grid lines complements the `base::plot()` work flow.

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URL <https://github.com/johnxhobbs/paletteknife>

BugReports <https://github.com/johnxhobbs/paletteknife/issues>

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autoaxis

*Auto Axis Tool***Description**

Overlay base plot with a new axis and optional gridlines. The axis spacing can be manually specified or automatically generated, including for date and time axis. A default grid is drawn if called with just the side specified.

Usage

```
autoaxis(
  side,
  major = NA,
  major_grid = FALSE,
  minor = NA,
  minor_grid = FALSE,
  format = "auto",
  spacing = TRUE,
  tck = -0.03,
  ...
)
```

Arguments

side	Side to add axis, 1 = bottom, 2 = left, 3 = top, 4 = right. If only this argument is given, a default dense grid is drawn. If this argument is given as a character, a date-time grid will be attempted, for example side='1'
major	Spacing of major axis ticks and labels (or approx. number of intervals if spacing = FALSE). If the axis is date or time, use a interval specified in ?seq.POSIXt, such as 'sec' or 'week', or character value for spacing such as '=20'
major_grid	Add grid lines corresponding to major axis ticks, TRUE to get default translucent black, otherwise colour (name or hex)
minor	Spacing (or number) of minor ticks (note, no label for minor). If given as a character string, it will pass to seq.POSIXt
minor_grid	Add gridlines for minor ticks, TRUE uses transparent black, otherwise colour string
format	Date or time format for major axis for example '%Y %b'. If left as the default 'auto' an appropriate choice between seconds and years will be used. Note, major or side must be given as a character string to trigger datetime labels.
spacing	Should major and minor be interpreted as tick spacing (default) or approximate number of ticks
tck	Size of axis tick: minor axis will always take half this value
...	Additional arguments passed to axis(), for example las=2 for perpendicular labels

Details

Major and minor tick marks can be specified in a number of ways:

- As a character string if the axis is datetime, such as 'year' or 'hour' which are passed as by to `seq()`. These can be prefixed with an integer multiplier, for example '6 hour' or '10 year', as per `seq.POSIXt`
- As a tick interval using the default spacing = TRUE
- As an approximate number of tick marks to include, using `pretty()` to find the best interval, using spacing = FALSE. Use a character number if this is a Date or Time axis, such as major = '100' and spacing will be set FALSE automatically.

Major adds labels and ticks, minor is just half-sized ticks marks. Both tick sizes can be changed (or direction changed) using `tck`.

Three different datetime axis are possible: year, day-offset, seconds-offset. Use format to specify how the label should appear, such as '%b %Y' (see `?strptime`)

- Year should be treated as a conventional numeric axis, use major=1/12 not major='month'
- day-offset is an axis of `class(x)=='Date'` and is identified if the axis range exists within +/-9e4, meaning within dates 1723 - 2216, and minimum interval is 'day'
- second-offset is an axis of `class(x)=='POSIXct'` and is identified by a range outside of +/-9e4. This will give very strange results if your entire POSIXct axis is within 24 hours of 1970-01-01

A grid can be added at the same time by setting `major_grid` or `minor_grid` to TRUE or a colour string. If TRUE, a transparent black is used by default.

Any other options can be passed through to `axis()` directly (see `?axis`), most notably `las = 2` to rotate the labels, and `cex.axis` for label size.

The function will exit with a warning if more than 1000 ticks or gridlines were generated, as this is most likely a mistake with autogenerated date / time intervals and can lead to very slow behaviour.

This does NOT work well for `barplot()` categorical axis, for this continue to use the basic `axis()` function with custom labels, see examples.

Value

No return value (NULL)

Examples

```
plot(sunspots) # This time series is actually given in decimal years
  autoaxis(side=3, major=50, major_grid='coral', minor=10, minor_grid=TRUE, spacing=TRUE)
  autoaxis(side=4, major=11, minor=25, spacing=FALSE, las=2, cex.axis=0.5, tck=0.02)

plot(seq(as.POSIXct('2020-01-01'),as.POSIXct('2020-01-03'),length.out=1e3),
      rnorm(1e3), xlab='POSIXct', xaxt='n')
  autoaxis(side=1, major='day', minor='3 hour', format='%x')
# Shortcut method to make a default dense grid
  autoaxis(side='3')
  autoaxis(side=2)
```

```

# You can always request a datetime axis (side='4' not 4L) but it will be nonsense
autoaxis(side='4', col='red')

plot(seq(as.Date('2013-02-01'),as.Date('2020-01-03'),length.out=1e3),
      rnorm(1e3), xlab='Date', xaxt='n')
autoaxis(side=1, major='10', minor='50', format='%Y')
autoaxis(side=3, minor='3 month', minor_grid=TRUE)

# Guessing is ambiguous with small values, depends on smallest interval
plot(1:500,runif(500), type='l', xaxt='n', xlab='Time or Date?', main=
      'For small values (<1e5), use interval to guess format\n')
autoaxis(1, major='min', minor='10 sec', format='%M:%S')
autoaxis(3, major='quarter', minor='month', format='%b %Y')

# For barplot() use base functions - remember to set width=1, space=0
# otherwise bars will not be plotted on integer x-coordinates
barplot(mtcars$mpg, width=1, space=0, ylab='mpg')
# Adjust the x-axis down by 0.5 so that the tick is in centre of each bar
axis(side=1, at=-0.5+1:length(mtcars$mpg), labels=rownames(mtcars), las=2 )
# Often prettier, label each bar inside the bar itself using text()
text(x=-1+1:length(mtcars$mpg), y=1, pos=4,
      labels=rownames(mtcars), srt=90, cex=0.7)
# autoaxis can still be used for adjusting the numeric scale
autoaxis(side=2, major=5, major_grid=TRUE, minor=1, minor_grid=TRUE)

```

autocol

Map Colours From Value

Description

Create a vector of colours and associated legend for easier base plots

Usage

```

autocol(
  x,
  set = "",
  alpha = NA,
  limits = NA,
  na_colour = NA,
  bias = 1,
  legend_len = 6
)

palette.misc

palette.viridis

palette.colorbrewer

```

Arguments

<code>x</code>	Vector to be mapped to colours
<code>set</code>	Colour set to use – see Details for full list. A default <code>sasha</code> or <code>viridis</code> is chosen if empty.
<code>alpha</code>	Transparency as a single value or as another vector (recycled to fill). If it is a vector, all values are scaled from 0: $\max(\alpha)$ meaning transparent:opaque. Single values must be in range 0-1. If NA no alpha channel is added.
<code>limits</code>	Colour scale limits as absolute range <code>c(0, 10)</code> or NA = full range
<code>na_colour</code>	Colour to represent NA-values, default NA returns a colour of NA (thus not plotted)
<code>bias</code>	Skew to apply to colour-ramp (>1 increases resolution at low end, <1 at the high end)
<code>legend_len</code>	Continuous legend target size

Format

An object of class `list` of length 1.

An object of class `list` of length 8.

An object of class `list` of length 35.

Details

Helper function for using colours in R's default `plot()` and `legend()`. Colours from built-in palettes are automatically scaled to return a vector of colours and create `options('autolegend')` which contains the correct legend mapping for `autolegend()`.

A discrete palette is used for factor and character inputs whilst a continuous palette is used for integer and numeric.

Colour sets built-in so far are held in lists starting `pals.` and can be visualized most easily with `pals_display()`. The `set` argument can be any of the colour set names listed here (such as 'magma'), or from `palette.pals()`, or finally as a custom-defined vector, such as `set = rainbow(5)`.

The current lists of palettes included with `palettetechnique` all being with `pal.`

- `pals.viridis`
All of the continuous palette forked from the `viridisLite` package maintained by Simon Garnier.
 - Contains: `cividis inferno magma mako plasma rocket turbo viridis`
- `pals.rcolorbrewer`
All of the palettes included in `RColorBrewer`
 - Categorical: `Accent Set1 Set2 Set3 Paired Pastel1 Pastel2 Dark2`
 - Continuous: `Greys Blues BuGn BuPu Greens GnBu PuBu Purples PuBuGn YlGnBu YlGn YlOrBr YlOrRd Oranges OrRd Reds RdPu PuRd`
 - Divergent: `Spectral RdYlBu RdYlGn BrBG RdBu RdGy PiYG PRGn PuOr`
- `pals.misc`

– Sasha Trubetskoy (2017): *List of 20 Simple, Distinct Colors*: sasha

Custom limits can be specified using `c(0, 10)`. This is useful if multiple plots using the same range are required for cross-comparison. Default behaviour (`limits = NA`) sets the range to exactly fit.

The skew of the colourscale can be adjusted with `bias`, for example if `x` has an exponential distribution, a bias value > 1 will bring out contrast at the low end.

Value

A character vector of colours of equal length to input `x`, sampled from the chosen set. This allows it to be used for plotting directly. Information for a legend (containing every level for categorical data, or approximately length `legend_len` for continuous) is stored in `options('autolegend')` and not returned explicitly.

Examples

```
plot(iris$Sepal.Length, iris$Petal.Length, cex=3, pch=16,
     col=autocol(iris$Petal.Width, set='PuBuGn', alpha=0.8, legend_len=12) )
autolegend('topleft', title='Petal.Width', ncol=3)
# Also try simplest "autolegend()" for click-to-draw

# Try scales which include NA in both colour and alpha channel
with(airquality, plot(Temp, col=autocol(x=Solar.R, set='YlOrRd', alpha=Ozone,
na_colour='cyan'), pch=16, cex=sqrt(Wind) ))
# Note inset=1 draws on opposite side ie above not below plot area
autolegend('bottom', inset=1, bty='n', horiz=TRUE)

# Here we want a summary plot ordered by level, so need to create a colour vector to match
# 'Alphabet' is a built-in colour set, see "palette.pals()"
mixedbag = as.factor(sample(letters,1000,replace=TRUE))
plot(x=mixedbag, y=rnorm(1000), col=autocol(levels(mixedbag), set='Alphabet'))
autolegend('bottom', ncol=9, cex=0.7)

# Maintain the order of strings
barplot(1:8, col=autocol(LETTERS[8:1]))
autolegend('topleft')

# Any unusual formats are coerced to numeric and the legend converted back
mydates = as.Date('2000-01-01')+0:100
plot(mydates, pch=16, col=autocol(mydates, set=rainbow(10), bias=2) )
autolegend(x=0, y=mydates[100], title='My Dates')

# Timeseries objects plot as a line, but can overlay with points()
plot(airmiles)
points(airmiles, pch=15, col=autocol(airmiles, set='Reds'))

# Use the limits to clip or augment the colour-scale
layout(matrix(1:2))
plot(runif(10), col=autocol(1:10, limits=c(0,20)), pch=16,
     main='Data split over two plots with same scale')
plot(runif(10), col=autocol(c(100,20:12), limits=c(0,20)), pch=16)
```

```

    text(1, 0.5, pos=4, xpd=NA,
    'This point has a
    value of 100 but
    clipped to max
    colour == 20')
    autolegend('bottom', inset=1, horiz=TRUE) # Draws above!
    layout(1)

```

autolegend

Add Auto-Generated Legend

Description

Add a legend for the last `autocol()` set generated

Usage

```
autolegend(...)
```

Arguments

... Arguments passed directly to `legend` – legend text and colours are taken automatically from `options('autolegend')`. See examples for useful parameters, including `pch` and `pt.cex`

Details

If no location (such as 'top', 'above', or an x,y coordinate) is given, then it calls the `locator()` crosshairs so the position of the legend can be picked interactively. All arguments are passed to `legend()`, see `?legend` for a full list.

Positions 'above' and 'below' are allowed which shorthand for `inset` and `horizontal` (see example).

Legend labels and fill are generated by either `autopal()` or `autocol()` and stored in the global `options('autolegend')` where they can be manipulated if needs be.

See more examples in `?autocol` for a `plot()` and `autolegend()` work flow.

Value

No return value (NULL)

Examples

```

# Simplest version: click-to-draw with locator()
plot(1:10, pch=16, col=autocol(1:10, 'Blues', legend_len=5))
# autolegend() # Try me! And click on plot to add legend

# Other neat versions -- note ?legend
autolegend('above', title='Above plot')

```

```

# Exactly equivalent to...
autolegend('bottom', inset=1, horiz=TRUE, bty='n')
autolegend(x=6, y=4, ncol=2, title='Draw at (6,4)')
autolegend('topleft', title='\"topleft\"', ncol=2, bty='n')

# Use pch (and optionally pt.cex) in legend -- these get recycled
autolegend('bottom', horiz=TRUE, pch=16, pt.cex=3, title='pch=16, pt.cex=3')
autolegend('right', pch=1:10, pt.cex=2, title='pch=1:10')

# Manipulate the legend text, for example with format(), this is a bit long-winded!
heatmap(as.matrix(eurodist), col=autopal('turbo', limits=range(eurodist)) )
current_legend = options('autolegend')[[1]]
options(autolegend = list(format(current_legend[[1]], big.mark=','), current_legend[[2]]))
autolegend('bottom', inset=1, horiz=TRUE, title='Misleading miles between cities')

# No helper exists yet for creating size or shape legends -- follow this idea...
with(airquality, plot(Temp, pch=16, cex=Solar.R/100, col=autocol(Ozone, set='Reds')))
cex_legend = pretty(airquality$Solar.R)
legend('bottom', pt.cex=cex_legend/100, legend=cex_legend, pch=1,
       horiz=TRUE, title='Solar.R', bty='n' )
autolegend('above', title='Ozone')

```

autopal

Auto-Palette

Description

Return a palette vector from one of the built-in sets

Usage

```
autopal(set = "", n = 30, limits = NA, bias = 1, legend_len = 6)
```

Arguments

set	Colour set to use – see ?autocol for full list. A default sasha or viridis is chosen if empty.
n	Length of colour vector to return, must be at least 2
limits	Colour scale limits to pass to legend eg $c(0, 10)$ – if left as NA no autolegend will be generated
bias	Skew to apply to colour-ramp (>1 increases resolution at low end, <1 at the high end)
legend_len	Continuous legend target size

Details

This can be used where a palette is provided rather than a mapped colour vector, for example `image()`. The limits must be specified for `autolegend()` information to be updated. Custom colour limits can be set using `breaks` or `levels` (see examples) if the same colour range is needed across several plots.

See `?autocol` for list of all available colour sets.

Value

A character vector of colours of length `n` giving a continuous colour palette sampled from `set`. If `limits` are specified, information for a colour legend is produced of approximate length `legend_len`. This is stored in `options('autolegend')` and not returned explicitly.

Examples

```
image(volcano, col=autopal('RdYlGn', n=100, limits=c(50,200), bias=1.5),
      breaks=seq(50,200,length.out=101) )
autolegend('bottom', inset=1, ncol=5)

# Or using the slightly smarter filled.contour
filled.contour(volcano, col=autopal('RdYlGn', n=20, limits=c(100,150)),
              levels=seq(50,200,length.out=21) )
```

 autozoom

Auto Zoom to Create a Dynamic Plot

Description

Replaces `plot()` with an interactive loop which allows user to click twice on the plot window to redraw with new limits. Press ESCAPE to finish.

Usage

```
autozoom(x, ..., after = NULL)
```

Arguments

<code>x</code>	Passed directly to <code>plot()</code>
<code>...</code>	Passed directly to <code>plot()</code>
<code>after</code>	An expression to be executed after each plot is drawn

Details

Click twice to set the new plot extents. If both clicks are on one of the axis (outside of the plot area) then only this axis is zoomed. Click twice on the same spot to reset the zoom to the entire plot.

Extras such as axes or legends are added using the `after` argument.

Examples

```
## Not run:
autozoom(airmiles)

autozoom(faithful, cex=runif(272), after={autoaxis(3); autoaxis(4)})

autozoom(faithful, col=autocol(runif(272)), pch=16,
  after=autolegend('above') )

## End(Not run)
```

palette.display

Built-in Paletteknife Palettes

Description

Plot a list of palettes for comparison

Usage

```
palette.display(palette = palette.colorbrewer)
```

Arguments

palette Character vector of palette names or a named list of colour vectors

Value

No return value (NULL)

Examples

```
palette.display(c(palette.misc,palette.colorbrewer,palette.viridis))

palette.display(c(list(rainbow=rainbow(10), default=palette()),
  palette.misc, palette.colorbrewer[c('Paired','Set1','Set2')] ))

palette.display(list(rainbow=rainbow(45)[30:1], turbo=palette.viridis$turbo ))

# Call by vector of names - here it gets 'Paired' from palette.colorbrewer
palette.display(palette.pals() )

# Bit of fun ordering a list of palettes (MUST be same palette size)
mat_cols = do.call(rbind, lapply(palette.colorbrewer[9:26],
  function(hex) as.vector(rgb2hsv(col2rgb(hex)))))
palette.display(palette.colorbrewer[9:26][hclust(dist(mat_cols))$order])
```

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