Package ‘obicubes’

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**cheap_darken**

* 'light' effect helper functions

**Description**

Helper functions to generate a “light” effect for `oblicubesGrob()`, `grid.oblicubes()`, `obicuboidsGrob()`, and `grid.oblicuboids()`. `darken_face()` is the default light argument for `oblicubesGrob()`, `grid.oblicubes()`, `obicuboidsGrob()`, and `grid.oblicuboids()`. `cheap_darken()` is the default darkening function used by `darken_face()`.

**Usage**

```r
cheap_darken(col, amount)

darken_face(
  face,
  col,
  top = 0,
  west = 0.2,
  east = 0.2,
  south = 0.4,
  north = 0.4,
  darken_fn = cheap_darken
)
```

**Arguments**

- `col` Vector of colors to darken
- `amount` Fraction to darken by
- `face` Cube/cuboid face to color. One of "top", "west", "east", "south", or "north".
- `top` Amount to darken the "top" face.
- `west` Amount to darken the "west" face.
- `east` Amount to darken the "east" face.
- `south` Amount to darken the "south" face.
- `north` Amount to darken the "north" face.
- `darken_fn` Function to darken with. Should take two arguments: the first should be the colour and the second should be numeric amount to darken by. Default will be to use `cheap_darken()`. `colorspace::darken()` is a slower, “better” alternative.
Details

The light argument of `oblicubesGrob()`, `grid.oblicubes()`, `geom_oblicubes()`, `oblicuboidsGrob()`, `grid.oblicuboids()`, and `geom_oblicuboids()` needs a function that takes two arguments: the first is `face` one of its five faces: "top", "west", "east", "south", or "north" and the second is `col` the cube/cuboid’s fill color.

Value

Vector of darkened colors.

Examples

```r
demo_light <- function(light = darken_face, ...) {
  df <- data.frame(x=1, y=1, z=1)
  grid::grid.newpage()
  grid.oblicubes(df, ..., light=light, angle=45, lwd=4, vp = grid::viewport(0.25, 0.25, 0.5, 0.5))
  grid.oblicubes(df, ..., light=light, angle=135, lwd=4, vp = grid::viewport(0.75, 0.25, 0.5, 0.5))
  grid.oblicubes(df, ..., light=light, angle=-45, lwd=4, vp = grid::viewport(0.25, 0.75, 0.5, 0.5))
  grid.oblicubes(df, ..., light=light, angle=-135, lwd=4, vp = grid::viewport(0.75, 0.75, 0.5, 0.5))
}
demo_light()
demo_light(fill = "gold")
demo_light(light = function(face, col)
         darken_face(face, col, top = 0.3, west = 0.6, east = 0.6, south = 0.0, north = 0.0))
demo_light(light = function(face, col) {
  n <- length(col)
  switch(face,
         top = rep_len("grey90", n),
         west = rep_len("red", n),
         east = rep_len("green", n),
         south = rep_len("blue", n),
         north = rep_len("yellow", n))
})
```

Description

`geom_oblicubes()` creates a ggplot2 geom that draws cubes.
Usage

geom_oblicubes(
    mapping = NULL,
    data = NULL,
    stat = "identity",
    position = "identity",
    ...
    angle = 45,
    scale = 0.5,
    xoffset = 0,
    yoffset = 0,
    zoffset = 0,
    light = darken_face,
    show.legend = NA,
    inherit.aes = TRUE
)

Arguments

mapping Set of aesthetic mappings created by aes() or aes(). If specified and inherit.aes = TRUE (the default), it is combined with the default mapping at the top level of the plot. You must supply mapping if there is no plot mapping.

data The data to be displayed in this layer. There are three options:
If NULL, the default, the data is inherited from the plot data as specified in the call to ggplot().
A data.frame, or other object, will override the plot data. All objects will be fortified to produce a data frame. See fortify() for which variables will be created.
A function will be called with a single argument, the plot data. The return value must be a data.frame, and will be used as the layer data. A function can be created from a formula (e.g. ~ head(.x, 10)).

stat The statistical transformation to use on the data for this layer, as a string.

position Position adjustment, either as a string, or the result of a call to a position adjustment function.

... Aesthetics, used to set an aesthetic to a fixed value.

angle Oblique projection angle.

scale Oblique projection foreshortening factor. 0.5 corresponds to the “cabinet projection”. 1.0 corresponds to the “cavalier projection”. 0.0 corresponds to a “primary view orthographic projection”.

xoffset, yoffset, zoffset
By default the x,y,z values are assumed to be the center of the cube. Use xoffset, yoffset, and/or zoffset to shift the x,y,z values a fixed amount.

light If FALSE don’t perform a “light” effect. Otherwise a function that takes two arguments: the first face of the cube/cuboid face (one of "top", "west", "east", "south", "north"): the second col of the fill color. By default we use darken_face().
geom_oblicubes

show.legend  logical. Should this layer be included in the legends? NA, the default, includes if any aesthetics are mapped. FALSE never includes, and TRUE always includes. It can also be a named logical vector to finely select the aesthetics to display.

inherit.aes  If FALSE, overrides the default aesthetics, rather than combining with them. This is most useful for helper functions that define both data and aesthetics and shouldn’t inherit behaviour from the default plot specification, e.g. borders().

Details

geom_oblicubes() requires a fixed scale coordinate system with an aspect ratio of 1 as provided by ggplot2::coord_fixed().

Value

A ggplot2 geom.

Aesthetics

geom_oblicubes() understands the following aesthetics (required aesthetics are in bold). See oblicubesGrob() for more details.

- x
- y
- z
- fill
- colour
- linetype
- linewidth

See Also

geom_oblicubes() is a wrapper around oblicubesGrob().

Examples

if (require("ggplot2")) {
  data("volcano", package = "datasets")
  df <- xyz_heightmap(volcano, scale = 0.3, min = 1)
  g <- ggplot(df, aes(x, y, z = z, fill = raw)) +
    geom_oblicubes(light = FALSE) +
    coord_fixed() +
    scale_fill_gradientn(name = "Height (m)",
                        colours=terrain.colors(256)) +
    labs(x = "East (10m)", y = "North (10m)",
         title = "Maungawhau ('datasets::volcano')")
  plot(g)
}

if (require("ggplot2")) {

# Using `scale_fill_identity()` if using `xyz_heightmap()`'s 'fill' column

```r
df <- xyz_heightmap(volcano, scale = 0.3, min = 1,
  col = grDevices::heat.colors)
g <- ggplot(df, aes(x, y, z = z, fill = fill)) +
  geom_oblicubes() +
  coord_fixed() +
  scale_fill_identity()
plot(g)
```

if (require("ggplot2") && require("dplyr") {  
  # Note you probably should not do 3D bar charts...
  df <- as.data.frame(datasets::Titanic) |>
    filter(Age == "Child", Freq > 0) |>
    group_by(Sex, Survived, Class) |>
    summarize(Freq = seq.int(sum(Freq)), .groups = "drop")
g <- ggplot(df, aes(x = Survived, y = Freq, fill = Survived)) +
  facet_grid(cols = vars(Class, Sex)) +
  coord_fixed() +
  geom_oblicubes(yoffset = -0.5, zoffset = -0.5, angle = -45, scale = 0.7) +
  scale_fill_manual(values = c("Yes" = "lightblue", "No" = "red")) +
  scale_y_continuous(expand = expansion(), name = "") +
  scale_x_discrete(name = "", breaks = NULL) +
  labs(title = "Children on the Titanic (by ticket class)"
  plot(g)
}

---

**geom_oblicuboids**  
*Draw 2D/3D cuboids with ggplot2*

**Description**

`geom_oblicuboids()` creates a `ggplot2` geom that draws cuboids

**Usage**

```r
geom_oblicuboids(
  mapping = NULL,
  data = NULL,
  stat = "identity",
  position = "identity",
  ...,
  angle = 45,
  scale = 0.5,
  xoffset = 0,
  yoffset = 0,
  zoffset = 0,
  light = darken_face,
  show.legend = NA,
```
geom_oblicuboids

    inherit.aes = TRUE
  }

Arguments

mapping      Set of aesthetic mappings created by \texttt{aes()} or \texttt{aes()}. If specified and \texttt{inherit.aes = TRUE} (the default), it is combined with the default mapping at the top level of the plot. You must supply \texttt{mapping} if there is no plot mapping.

data         The data to be displayed in this layer. There are three options:
If \texttt{NULL}, the default, the data is inherited from the plot data as specified in the call to \texttt{ggplot()}. A \texttt{data.frame}, or other object, will override the plot data. All objects will be fortified to produce a data frame. See \texttt{fortify()} for which variables will be created.
A function will be called with a single argument, the plot data. The return value must be a \texttt{data.frame}, and will be used as the layer data. A function can be created from a formula (e.g. \texttt{~ head(.x, 10)}).

stat         The statistical transformation to use on the data for this layer, as a string.
position     Position adjustment, either as a string, or the result of a call to a position adjustment function.
...          Aesthetics, used to set an aesthetic to a fixed value.
angle        Oblique projection angle.
scale        Oblique projection foreshortening factor. 0.5 corresponds to the “cabinet projection”. 1.0 corresponds to the “cavalier projection”. 0.0 corresponds to a “primary view orthographic projection”.
xoffset, yoffset, zoffset
By default the x,y values are assumed to be the \texttt{center} of the cuboid and the z value is assumed to be the \texttt{top} of the cuboid. Use \texttt{xoffset}, \texttt{yoffset}, and/or \texttt{zoffset} to shift the x,y,z values a fixed amount.
light        If \texttt{FALSE} don’t perform a “light” effect. Otherwise a function that takes two arguments: the first face of the cube/cuboid face (one of “top”, “west”, “east”, “south”, “north”). the second \texttt{col} of the fill color. By default we use \texttt{darken_face()}. show.legend   logical. Should this layer be included in the legends? \texttt{NA}, the default, includes if any aesthetics are mapped. \texttt{FALSE} never includes, and \texttt{TRUE} always includes. It can also be a named logical vector to finely select the aesthetics to display.

Details

\texttt{geom_oblicuboids()} requires a fixed scale coordinate system with an aspect ratio of 1 as provided by \texttt{ggplot2::coord_fixed()}. Value

A ggplot2 geom.
Aesthetics

geom_oblicuboids() understands the following aesthetics (required aesthetics are in bold). See `oblicuboidsGrob()` for more details.

- x
- y
- z
- fill
- colour
- linetype
- linewidth

See Also

 geom_oblicuboids() is a wrapper around oblicuboidsGrob().

Examples

```r
if (require("ggplot2")) {
  df <- xyz_heightmap(volcano, scale = 0.3, min = 1)
  g <- ggplot(df, aes(x, y, z = z, fill = raw)) +
      geom_oblicuboids(light = FALSE) +
      coord_fixed() +
      scale_fill_gradientn(name = "Height (m)",
                           values = terrain.colors(256)) +
      labs(x = "East (10m)", y = "North (10m)",
           title = "Maungawhau (datasets::volcano)")
  plot(g)
}
if (require("ggplot2")) {
  # Using `scale_fill_identity()` if using `xyz_heightmap()`'s `fill` column
  df <- xyz_heightmap(volcano, scale = 0.3, min = 1,
                      col = grDevices::heat.colors)
  g <- ggplot(df, aes(x, y, z = z, fill = fill)) +
      geom_oblicuboids() +
      coord_fixed() +
      scale_fill_identity()
  plot(g)
}
if (require("ggplot2") & require("dplyr")) {
  # Note you probably should not do 3D bar charts...
  df <- as.data.frame(datasets::Titanic) |>
        filter(Age == "Child", Freq > 0) |>
        group_by(Sex, Survived, Class) |>
        summarize(Freq = seq.int(sum(Freq)), .groups = "drop")
  g <- ggplot(df, aes(x = Survived, y = Freq, fill = Survived)) +
      facet_grid(cols = vars(Class, Sex)) +
      coord_fixed() +
      geom_oblicuboids(yoffset = -0.5, scale = 0.7, angle = -45) +
      geom_bar(stat = "identity", fill = "black", width = 0.5)
  plot(g)
  ```
```
oblicubesGrob

Render 2D/3D cubes via an oblique projection

Description

oblicubesGrob() / grid.oblicubes() renders cubes using a 3D oblique projection. oblicubesGrob() returns a grid grob object while grid.oblicubes() also draws the grob to the graphic device. As a special case may also render a 2D primary view orthographic projection.

Usage

oblicubesGrob(
  x,
  y = NULL,
  z = NULL,
  ...,
  fill = NULL,
  light = darken_face,
  scale = 0.5,
  angle = 45,
  xo = NULL,
  yo = NULL,
  width = NULL,
  default.units = "snpc",
  name = NULL,
  gp = gpar(),
  vp = NULL
)

grid.oblicubes(
  x,
  y = NULL,
  z = NULL,
  ...,
  fill = NULL,
  light = darken_face,
  scale = 0.5,
  angle = 45,
  xo = NULL,
  yo = NULL,
width = NULL,
default.units = "snpc",
name = NULL,
gp = gpar(),
vp = NULL)
)

Arguments

x Integer vector of x coordinates (if necessary will be rounded to integers). May be a data frame of x,y,z coordinates (and maybe fill color).
y Integer vector of y coordinates (if necessary will be rounded to integers). If NULL and x is a data frame with a y column then we use that instead.
z Integer vector of z coordinates (if necessary will be rounded to integers). If NULL and x is a data frame with a z column then we use that instead.
... Passed to grid::gpar(). Will override any values set in gp.
fill Fill color(s) for the cubes. If NULL and x is a data frame with a fill or col column then we use that column; if no such column but gp has a fill value we use that; otherwise we fall back to "grey90".
light If FALSE don’t perform a "light" effect. Otherwise a function that takes two arguments: the first face of the cube/cuboid face (one of "top", "west", "east", "south", "north"). the second col of the fill color. By default we use darken_face().
scale Oblique projection foreshortening factor. 0.5 corresponds to the “cabinet projection”. 1.0 corresponds to the “cavalier projection”. 0.0 corresponds to a “primary view orthographic projection”.
angle Oblique projection angle.
xo, yo The origin of the oblique projection coordinate system in grid units. The default is to try to guess a “good” value.
width Width of the cube’s (non-foreshortened) sides. The default will be to try to guess a “good” value.
default.units Default units for the xo, yo, and width arguments.
name A character identifier (for grid).
gp A ‘grid’ gpar object. See grid::gpar(). Will be merged with the values in ... and the value of fill.
vp A ‘grid’ viewport object. See grid::viewport().

Value

A grid grob. As a side effect grid.oblicubes() also draws to the active graphics device.

Examples

if (require("grid")) {
  # we support arbitrary oblique projection angles
  mat <- matrix(c(1, 2, 1, 2, 3, 2, 1, 2, 1), nrow = 3, ncol = 3, byrow = TRUE)
coords <- xyz_heightmap(mat, col = c("red", "yellow", "green"))

angles <- c(135, 90, 45, 180, 0, -135, -90, -45)
scales <- c(0.5, 0.5, 0.5, 0.0, 0.5, 0.5, 0.5, 0.5)
vp_x <- rep(1:3/3 - 1/6, 3)
vp_y <- rep(3:1/3 - 1/6, each = 3)
grid.newpage()
for (i in 1:9) {
  pushViewport(viewport(x=vp_x[i], y=vp_y[i], width=1/3, height=1/3))
  grid.rect(gp = gpar(lty = "dashed"))
  grid.oblicubes(coords, width = 0.15, xo = 0.25, yo = 0.15,
                  angle = angles[i], scale = scales[i],
                  gp = gpar(lwd=4))
  if(i != 5)
    grid.text(paste("angle =", angles[i]), y=0.92, gp = gpar(cex = 1.2))
  else
    grid.text(paste("scale = 0"), y=0.92, gp = gpar(cex = 1.2))
  popViewport()
}
# volcano example
mat <- datasets::volcano
mat <- 0.3 * (mat - min(mat)) + 1.0
coords <- xyz_heightmap(mat, col = grDevices::terrain.colors)
grid.newpage()
grid.oblicubes(coords)

oblucidbonsGrob Render 2D/3D cuboids via an oblique projection

Description
oblucidbonsGrob() / grid.oblicuboids() renders cuboids using a 3D oblique projection. oblidbonsGrob() returns a grid grob object while grid.oblicuboids() also draws the grob to the graphic device. As a special case may also render a 2D primary view orthographic projection.

Usage
oblucidbonsGrob(
x,
y = NULL,
z = NULL,
...
fill = NULL,
light = darken_face,
scale = 0.5,
angle = 45,
xo = NULL,
ypo = NULL,
width = NULL,
default.units = "snpc",
name = NULL,
gp = gpar(),
vp = NULL
)

grid.oblicuboids(
x,
y = NULL,
z = NULL,
..., fill = NULL,
width = NULL,
default.units = "snpc",
name = NULL,
gp = gpar(),
vp = NULL
)

Arguments

x Integer vector of x coordinates (if necessary will be rounded to integers). May
be a data.frame of x,y,z coordinates (and maybe fill color). This will be the
x-value at the center of the cuboid.

y Integer vector of y coordinates (if necessary will be rounded to integers). If NULL
and x is a data frame with a y column then we use that instead. This will be the
x-value at the center of the cuboid.

z Integer vector of z coordinates (if necessary will be rounded to integers). If NULL
and x is a data frame with a z column then we use that instead. This will be the
z-value at the top of the cuboid.

... Passed to grid::gpar(). Will override any values set in gp.

fill Fill color(s) for the cuboids. If NULL and x is a data frame with a fill or col
column then we use that column; if no such column but gp has a fill value we
use that; otherwise we fall back to "grey90".

light If FALSE don’t perform a "light" effect. Otherwise a function that takes two
arguments: the first face of the cube/cuboid face (one of "top", "west", "east",
"south", "north"). the second col of the fill color. By default we use darken_face().

scale Oblique projection foreshortening factor. 0.5 corresponds to the “cabinet pro-
jection”. 1.0 corresponds to the “cavalier projection”. 0.0 corresponds to a
“primary view orthographic projection”.

angle Oblique projection angle.
xo, yo  
The origin of the oblique projection coordinate system in grid units. The default is to try to guess a "good" value.

width  
Width of the cuboids's (non-foreshortened) side. The default will be to try to guess a "good" value.

default.units  
Default units for the xo, yo, and width arguments.

name  
A character identifier (for grid).

gp  
A 'grid' gpar object. See grid::gpar(). Will be merged with the values in ... and the value of fill.

vp  
A 'grid' viewport object. See grid::viewport().

Value  
A grid grob. As a side effect grid.oblicubes() also draws to the active graphics device.

Examples

if (require("grid")) {
  # we support arbitrary oblique projection angles
  mat <- matrix(c(1, 2, 1, 2, 3, 2, 1, 2, 1), nrow = 3, ncol = 3, byrow = TRUE)
  coords <- xyz_heightmap(mat, col = c("red", "yellow", "green"),
                          solid = FALSE)
  angles <- c(135, 90, 45, 180, 45, 0, -135, -90, -45)
  scales <- c(0.5, 0.5, 0.5, 0.0, 0.5, 0.5, 0.5, 0.5, 0.5)
  vp_x <- rep(1:3/3 - 1/6, 3)
  vp_y <- rep(3:1/3 - 1/6, each = 3)
  grid.newpage()
  for (i in 1:9) {
    pushViewport(viewport(x=vp_x[i], y=vp_y[i], width=1/3, height=1/3))
    grid.rect(gp = gpar(lty = "dashed"))
    grid.oblicuboids(coords, width = 0.15, xo = 0.25, yo = 0.15,
                     angle = angles[i], scale = scales[i],
                     gp = gpar(lwd=4))
    if(i != 5)
      grid.text(paste("angle = ", angles[i]), y=0.92, gp = gpar(cex = 1.2))
    else
      grid.text(paste("scale = 0"), y=0.92, gp = gpar(cex = 1.2))
    popViewport()
  }
  # volcano example
  mat <- datasets::volcano
  mat <- 0.3 * (mat - min(mat)) + 1.0
  coords <- xyz_heightmap(mat, col = grDevices::terrain.colors,
                           solid = FALSE)
  grid::grid.newpage()
  grid.oblicuboids(coords)
xyz_heightmap  

Calculate x,y,z coordinates from a height matrix

Description

Calculate x,y,z coordinates from a height matrix

Usage

```r
xyz_heightmap(
  mat,
  col = NULL,
  scale = 1,
  min = NULL,
  flipx = FALSE,
  flipy = TRUE,
  ground = "xy",
  solid = TRUE,
  verbose = FALSE
)
```

Arguments

- **mat**: integer matrix. The matrix will be interpreted as cubes (or cuboids) flat on the page, with the value in the matrix interpreted as the height above the page.
- **col**: matrix, vector, or (palette) function of colours. If a matrix it must be the same dimensions as the `mat` argument; each cube/cuboid corresponding to that x,y value will have that color. If a vector then if the max of z values is less than equal to the number of colors we will use the z integers as indices else we will use `base::cut()` to assign z values to colors. If a function we will call it with the argument `max(z)` to create a vector of colors and then use the z values as indices. If `col` is not NULL then a fill column will be included in the final returned coordinates.
- **scale**: scale factor for values in matrix. Default = 1
- **min**: Minimum target z value. If NULL ignore else we "translate" the z-values so the minimum z-value is equal to this value.
- **flipx, flipy**: Should the matrix be flipped in the horizontal/vertical directions (respectively)? Note: flipy defaults to TRUE as matrices are indexed from the top-down, but the coordinate space is increasing from the bottom up. Flipping the matrix vertically is usually what you want.
- **ground**: Orientation of the ground plane. Default: "xy". Possible values "xy", "xz", "zy"
- **solid**: Should the heightmap be made 'solid' i.e. without holes? This can be an expensive operation in terms of both memory and CPU, but should be OK for simple examples. Set to FALSE if things take too long or you will be rendering cuboids. This operation works by extruding cubes down from the top of the height map to the floor to ensure gaps do not appear when the slope is too great.
verbose

Be verbose? default: FALSE

Value

A data frame of x, y, z, raw, and possibly fill columns. The "raw" column is the (original) "z" column before any scale, min, and ground transformations have been performed (it may be repeated "down" if solid = TRUE). The "raw" column can be useful as the fill value in ggplot2 plots especially when adding a legend.

Examples

```r
if (require("grDevices") && require("grid")) {
  mat <- datasets::volcano
  mat <- 0.3 * (mat - min(mat)) + 1.0

  grid.newpage()
  grid.rect(gp=gpar(col=NA, fill="grey5"))
  width <- convertWidth(unit(0.007, "snpc"), "cm")

  # Top view
  pushViewport(viewport(width = 0.7, height = 0.7, x = 0.65, y = 0.65))
  coords <- xyz_heightmap(mat, col = terrain.colors, solid = FALSE)
  grid.oblicubes(coords, scale = 0, width = width, gp = gpar(col=NA))
  popViewport()

  # South view
  pushViewport(viewport(width = 0.7, height = 0.3, x = 0.65, y = 0.15))
  coords <- xyz_heightmap(mat, col = terrain.colors, ground = "xz")
  grid.oblicubes(coords, scale = 0, width = width, gp = gpar(col=NA))
  popViewport()

  # West view
  pushViewport(viewport(width = 0.3, height = 0.7, x = 0.15, y = 0.65))
  coords <- xyz_heightmap(mat, col = terrain.colors, ground = "zy")
  grid.oblicubes(coords, scale = 0, width = width, gp = gpar(col=NA))
  popViewport()
}

if (require("grDevices") && require("ggplot2")) {
  data("volcano", package = "datasets")
  df <- xyz_heightmap(volcano, scale = 0.3, min = 1, solid = FALSE)
  g <- ggplot(df, aes(x, y, z = z, fill = raw)) +
      geom_oblicuboids(light = FALSE) +
      coord_fixed() +
      scale_fill_gradientn(name = "Height (m)", colours=terrain.colors(256)) +
      labs(x = "East (10m)", y = "North (10m)", title = "Maungawhau (datasets::volcano)")
  plot(g)
}
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