Package: piecepackr (via r-universe)

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Type Package

Title Board Game Graphics

Version 1.13.11

Description Functions to make board game graphics with the 'ggplot2', 'grid', 'rayrender', 'rayvertex', and 'rgl' packages. Specializes in game diagrams, animations, and ``Print & Play'' layouts for the 'piecepack' <https://www.ludism.org/ppwiki> but can make graphics for other board game systems. Includes configurations for several public domain game systems such as checkers, (double-18) dominoes, go, 'piecepack', playing cards, etc.

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URL https://trevorldavis.com/piecepackr/ (blog),
https://trevorldavis.com/R/piecepackr/ (pkgdown),
https://groups.google.com/forum/#!forum/piecepackr (forum)

BugReports https://github.com/piecepackr/piecepackr/issues

LazyData true

LazyLoad yes

Imports grid, gridGeometry, grImport2, grDevices, purrr, jpeg, png, R6, rlang, stringr, tibble, tools, utils

Suggests animation (>= 2.7), ggplot2, gifski, gridpattern, magick, pdftools, rayrender (>= 0.34.3), rayvertex (>= 0.10.4), readobj (>= 0.4.0), rgl (>= 0.106.8), scales (>= 0.5.0), systemfonts, testthat, tweenr, vdiffr, xmpdf (>= 0.1.1), XML (>= 3.99-0.9)

Roxygen list(markdown = TRUE)

RoxygenNote 7.3.1

Config/testthat/edition 3

Repository https://piecepackr.r-universe.dev

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Contents

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piecepackr-package	*piecepackr: Board Game Graphics*

Description

Functions to make board game graphics with the 'ggplot2', 'grid', 'rayrender', 'rayvertex', and 'rgl' packages. Specializes in game diagrams, animations, and "Print & Play" layouts for the 'piecepack' <https://www.ludism.org/ppwiki> but can make graphics for other board game systems. Includes configurations for several public domain game systems such as checkers, (double-18) dominoes, go, 'piecepack', playing cards, etc.

Package options

The following piecepackr function arguments may be set globally via `base::options()`:

piecepackr.at.inform If `FALSE` turns off messages when affine transformation support not detected in active graphics device.

piecepackr.cfg Sets a new default for the `cfg` argument

piecepackr.check.cairo If `FALSE` don't check the version of cairo

piecepackr.default.units Sets a new default for the `default.units` argument

piecepackr.envir Sets a new default for the `envir` argument

piecepackr.metadata.inform If `FALSE` turns off messages when support for embedding metadata not detected.

piecepackr.op_angle Sets a new default for the `op_angle` argument

piecepackr.op_scale Sets a new default for the `op_scale` argument

piecepackr.trans Sets a new default for the `trans` argument

Author(s)

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Other contributors:

- Linux Foundation (Uses some data from the "SPDX License List" <https://github.com/spdx/license-list-XML>) [data contributor]

- Delapouite <https://delapouite.com/> (Meeple shape extracted from "Meeple icon" <https://game-icons.net/1x1/delapouite/meeple.html> / "CC BY 3.0" <https://creativecommons.org/licenses/by/3.0/>) [illustrator]

- Creative Commons ('save_print_and_play()' uses "license badges" from Creative Commons to describe the generated print-and-play file's license) [illustrator]

See Also

Useful links:

- blog: <https://trevorldavis.com/piecepackr/>

- pkgdown: <https://trevorldavis.com/R/piecepackr/>

- forum: <https://groups.google.com/forum/#!forum/piecepackr>

- Report bugs: <https://github.com/piecepackr/piecepackr/issues>

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aabb_piece   *Calculate axis-aligned bounding box for set of game pieces*

Description

Calculate axis-aligned bounding box (AABB) for set of game pieces with and without an "oblique projection".

Usage

```
aabb_piece(
  df,
  cfg = getOption("piecepackr.cfg", pp_cfg()),
  envir = getOption("piecepackr.envir"),
  op_scale = getOption("piecepackr.op_scale", 0),
  op_angle = getOption("piecepackr.op_angle", 45),
  ...
)
```

Arguments

df	A data frame of game piece information with (at least) the named columns "piece_side", "x", and "y".
cfg	Piecepack configuration list or `pp_cfg` object, a list of `pp_cfg` objects, or a character vector referring to names in `envir` or a character vector referring to object names that can be retrieved by `base::dynGet()`.
envir	Environment (or named list) containing configuration list(s).
op_scale	How much to scale the depth of the piece in the oblique projection (viewed from the top of the board). `0` (the default) leads to an "orthographic" projection, `0.5` is the most common scale used in the "cabinet" projection, and `1.0` is the scale used in the "cavalier" projection.
op_angle	What is the angle of the oblique projection? Has no effect if `op_scale` is `0`.
...	Ignored

Details

The "oblique projection" of a set of (x, y, z) points onto the xy-plane is $(x + \lambda * z * cos(\alpha), y + \lambda * z * sin(\alpha))$ where λ is the scale factor and α is the angle.

Value

A named list of ranges with five named elements x, y, and z for the axis-aligned bounding cube in xyz-space plus x_op and y_op for the axis-aligned bounding box of the "oblique projection" onto the xy plane.

Examples

```
df_tiles <- data.frame(piece_side="tile_back", x=0.5+c(3,1,3,1), y=0.5+c(3,3,1,1),
                       suit=NA, angle=NA, z=NA, stringsAsFactors=FALSE)
df_coins <- data.frame(piece_side="coin_back", x=rep(4:1, 4), y=rep(4:1, each=4),
                       suit=1:16%%2+rep(c(1,3), each=8),
                       angle=rep(c(180,0), each=8), z=1/4+1/16, stringsAsFactors=FALSE)
df <- rbind(df_tiles, df_coins)

aabb_piece(df, op_scale = 0)
aabb_piece(df, op_scale = 1, op_angle = 45)
aabb_piece(df, op_scale = 1, op_angle = -90)
```

AA_to_R   *Helper functions for making geometric calculations.*

Description

to_x, to_y, to_r, to_t convert between polar coordinates (in degrees) and Cartesian coordinates. to_degrees and to_radians converts between degrees and radians. AA_to_R and R_to_AA convert back and forth between (post-multiplied) rotation matrix and axis-angle representations of 3D rotations. R_x, R_y, and R_z build (post-multiplied) rotation matrices for simple rotations around the x, y, and z axes.

Usage

```
AA_to_R(angle = 0, axis_x = 0, axis_y = 0, axis_z = NA, ...)

R_to_AA(R = diag(3))

R_x(angle = 0)

R_y(angle = 0)

R_z(angle = 0)

to_radians(t)

to_degrees(t)

to_x(t, r)

to_y(t, r)

to_r(x, y)

to_t(x, y)
```

Arguments

`angle`	Angle in degrees (counter-clockwise)
`axis_x`	First coordinate of the axis unit vector.
`axis_y`	Second coordinate of the axis unit vector.
`axis_z`	Third coordinate of the axis unit vector (usually inferred).
`...`	Ignored
`R`	3D rotation matrix (post-multiplied)
`t`	Angle in degrees (counter-clockwise)
`r`	Radial distance
`x`	Cartesian x coordinate
`y`	Cartesian y coordinate

Details

`pp_cfg` uses polar coordinates to determine where the "primary" and "directional" symbols are located on a game piece. They are also useful for drawing certain shapes and for making game diagrams on hex boards.

`piecepackr` and `grid` functions use angles in degrees but the `base` trigonometry functions usually use radians.

`piecepackr`'s 3D graphics functions `save_piece_obj`, `piece`, and `piece3d` use the axis-angle representation for 3D rotations. The axis-angle representation involves specifying a unit vector indicating the direction of an axis of rotation and an angle describing the (counter-clockwise) rotation around that axis. Because it is a unit vector one only needs to specify the first two elements, `axis_x` and `axis_y`, and we are able to infer the 3rd element `axis_z`. The default of `axis = 0`, `axis_y = 0`, and implied `axis_z = 1` corresponds to a rotation around the z-axis which is reverse-compatible with the originally 2D `angle` interpretation in `grid.piece`. In order to figure out the appropriate axis-angle representation parameters `R_to_AA`, `R_x`, `R_y`, and `R_z` allow one to first come up with an appropriate (post-multiplied) 3D rotation matrix by chaining simple rotations and then convert them to the corresponding axis-angle representation. Pieces are rotated as if their center was at the origin.

See Also

https://en.wikipedia.org/wiki/Axis-angle_representation for more details about the Axis-angle representation of 3D rotations. See `Trig` for R's built-in trigonometric functions.

Examples

```
to_x(90, 1)
to_y(180, 0.5)
to_t(0, -1)
to_r(0.5, 0)
all.equal(pi, to_radians(to_degrees(pi)))
# default axis-angle axis is equivalent to a rotation about the z-axis
all.equal(AA_to_R(angle=60), R_z(angle=60))
# axis-angle representation of 90 rotation about the x-axis
```

```
R_to_AA(R_x(90))
# find Axis-Angle representation of first rotating about x-axis 180 degrees
# and then rotating about z-axis 45 degrees
R_to_AA(R_x(180) %*% R_z(45))
```

---

animate_piece	*Animate board game pieces*

Description

animate_piece() animates board game pieces.

Usage

```
animate_piece(
  dfs,
  file = "animation.gif",
  ...,
  annotate = TRUE,
  .f = piecepackr::grid.piece,
  cfg = getOption("piecepackr.cfg", NULL),
  envir = getOption("piecepackr.envir", game_systems("sans")),
  n_transitions = 0L,
  n_pauses = 1L,
  fps = n_transitions + n_pauses,
  width = NULL,
  height = NULL,
  ppi = NULL,
  new_device = TRUE,
  annotation_scale = NULL
)
```

Arguments

dfs	A list of data frames of game data to plot.
file	Filename to save animation unless NULL in which case it uses the current graphics device.
...	Arguments to pmap_piece
annotate	If TRUE or "algebraic" annotate the plot with "algrebraic" coordinates, if FALSE or "none" don't annotate, if "cartesian" annotate the plot with "cartesian" coordinates.
.f	Low level graphics function to use e.g. grid.piece(), piece3d(), piece(), or piece_mesh().
cfg	A piecepackr configuration list
envir	Environment (or named list) of piecepackr configuration lists

n_transitions	Integer, if over zero (the default) how many transition frames to add between moves.
n_pauses	Integer, how many paused frames per completed move.
fps	Double, frames per second.
width	Width of animation (in inches). Inferred by default.
height	Height of animation (in inches). Inferred by default.
ppi	Resolution of animation in pixels per inch. By default set so image max 600 pixels wide or tall.
new_device	If file is NULL should we open up a new graphics device?
annotation_scale	

Multiplicative factor that scales (stretches) any annotation coordinates. By default uses attr(df, "scale_factor") %||% 1.

Value

Nothing, as a side effect creates an animation.

Examples

```
# Basic tic-tac-toe animation
dfs <- list()
d.frame <- function(piece_side = "bit_back", ..., rank = 1L) {
            data.frame(piece_side = piece_side, ..., rank = rank,
                       cfg = "checkers1", stringsAsFactors = FALSE)
}
df <- d.frame("board_back", suit = 2L, rank = 3L, x = 2, y = 2, id = "1")
dfs[[1L]] <- df
df <- rbind(df, d.frame(suit = 1L, x = 2, y = 2, id = "2"))
dfs[[2L]] <- df
df <- rbind(df, d.frame(suit = 2L, x = 1, y = 2, id = "3"))
dfs[[3L]] <- df
df <- rbind(df, d.frame(suit = 1L, x = 3, y = 1, id = "4"))
dfs[[4L]] <- df
df <- rbind(df, d.frame(suit = 2L, x = 1, y = 3, id = "5"))
dfs[[5L]] <- df
df <- rbind(df, d.frame(suit = 1L, x = 1, y = 1, id = "6"))
dfs[[6L]] <- df
df <- rbind(df, d.frame(suit = 2L, x = 3, y = 3, id = "7"))
dfs[[7L]] <- df
df <- rbind(df, d.frame(suit = 1L, x = 2, y = 1, id = "8"))
dfs[[8L]] <- df

## Press enter to walk through moves in a "game" in new graphics device
if (interactive()) {
    animate_piece(dfs, file = NULL)
}

## Save GIF of game with animation transitions
## Not run: # May take more than 5 seconds on CRAN servers
```

```
    if ((requireNamespace("animation", quietly = TRUE) ||
          requireNamespace("gifski", quietly = TRUE)) &&
        requireNamespace("tweenr", quietly = TRUE)) {
        file <- tempfile("tic-tac-toe", fileext = ".gif")
        animate_piece(dfs, file = file,
                       n_transitions = 5L, n_pauses = 2L, fps = 9)
    }

  ## End(Not run)
```

---

basicPieceGrobs   *Piece Grob Functions*

Description

basicPieceGrob is the most common "grob" function that grid.piece uses to create grid graphical grob objects. picturePieceGrobFn is a function that returns a "grob" function that imports graphics from files found in its directory argument.

Usage

```
basicPieceGrob(piece_side, suit, rank, cfg = pp_cfg())

picturePieceGrobFn(directory, filename_fn = find_pp_file)

pyramidTopGrob(piece_side, suit, rank, cfg = pp_cfg())

previewLayoutGrob(piece_side, suit, rank, cfg = pp_cfg())
```

Arguments

piece_side	A string with piece and side separated by a underscore e.g. "coin_face"
suit	Number of suit (starting from 1).
rank	Number of rank (starting from 1)
cfg	Piecepack configuration list or pp_cfg object.
directory	Directory that picturePieceGrobFn will look in for piece graphics.
filename_fn	Function that takes arguments directory, piece_side, suit, rank, and optionally cfg and returns the (full path) filename of the image that the function returned by picturePieceGrobFn should import.

Examples

```
if (requireNamespace("grid", quietly = TRUE) && piecepackr:::device_supports_unicode()) {
  cfg <- pp_cfg(list(grob_fn.tile=basicPieceGrob, invert_colors=TRUE))
  grid.piece("tile_face", suit=1, rank=3, cfg=cfg)
}
```

```
# May take more than 5 seconds on CRAN servers
try({
  if (requireNamespace("grid", quietly = TRUE) && capabilities(c("cairo"))) {
    cfg <- pp_cfg(list(grob_fn.tile=basicPieceGrob, invert_colors=TRUE))
    directory <- tempdir()
    save_piece_images(cfg, directory=directory, format="svg", angle=0)
    cfg2 <- pp_cfg(list(grob_fn=picturePieceGrobFn(directory)))

    grid::grid.newpage()
    grid.piece("coin_back", suit=3, rank=5, cfg=cfg2)
  }
})
```

---

font_utils   *Font utility functions*

Description

get_embedded_font() returns which font is actually embedded by cairo_pdf() for a given character. has_font() tries to determine if a given font is available on the OS.

Usage

```
get_embedded_font(font, char)

has_font(font)
```

Arguments

font	A character vector of font(s).
char	A character vector of character(s) to be embedded by grid::grid.text()

Details

get_embedded_font() depends on the suggested pdftools package being installed and R being compiled with Cairo support. has_font() depends on either the suggested systemfonts (preferred) or pdftools packages being installed.

Value

get_embedded_font() returns character vector of fonts that were actually embedded by cairo_pdf(). NA's means no embedded font detected: this either means that no font was found or that a color emoji font was found and instead of a font an image was embedded.

Examples

```
if (requireNamespace("pdftools", quietly = TRUE) &&
    capabilities("cairo") &&
    !piecepackr:::is_cairo_maybe_buggy()) {
  chars <- c("a", "\u2666")
  fonts <- c("sans", "Sans Noto", "Noto Sans", "Noto Sans Symbols2")
  try(get_embedded_font(fonts, chars))
}

if (requireNamespace("systemfonts", quietly = TRUE) ||
    (requireNamespace("pdftools", quietly = TRUE) &&
     capabilities("cairo")) && !piecepackr:::is_cairo_maybe_buggy()) {
  try(has_font("Dejavu Sans"))
}
```

---

game_systems   *Standard game systems*

Description

game_systems returns a list of pp_cfg objects representing several game systems and pieces. to_subpack and to_hexpack will attempt to generate matching (piecepack stackpack) subpack and (piecepack) hexpack pp_cfg R6 objects respectively given a piecepack configuration.

Usage

```
game_systems(style = NULL, round = FALSE, pawn = "token")

to_hexpack(cfg = getOption("piecepackr.cfg", pp_cfg()))

to_subpack(cfg = getOption("piecepackr.cfg", pp_cfg()))
```

Arguments

style	If NULL (the default) uses suit glyphs from the default "sans" font. If "dejavu" it will use suit glyphs from the "DejaVu Sans" font (must be installed on the system).
round	If TRUE the "shape" of "tiles" and "cards" will be "roundrect" instead of "rect" (the default).
pawn	If "token" (default) the piecepack pawn will be a two-sided token in a "halma" outline, if "peg-doll" the piecepack pawn will be a "peg doll" style pawn, and if "joystick" the piecepack pawn will be a "joystick" style pawn. Note for the latter two pawn styles only pawn_top will work with grid.piece.
cfg	List of configuration options

Details

Contains the following game systems:

alquerque Boards and pieces in six color schemes for Alquerque

checkers1, checkers2 Checkers and checkered boards in six color schemes. Checkers are represented by a piecepackr "bit". The "board" "face" is a checkered board and the "back" is a lined board. Color is controlled by suit and number of rows/columns by rank. checkers1 has one inch squares and checkers2 has two inch squares.

chess1, chess2 Chess pieces, boards, and dice in six color schemes. Chess pieces are represented by a "bit" (face). The "board" "face" is a checkered board and the "back" is a lined board. Color is controlled by suit and number of rows/columns by rank. chess1 has one inch squares and chess2 has two inch squares. Currently uses print-and-play style discs instead of 3D Staunton chess pieces.

dice Traditional six-sided pipped dice in six color schemes (color controlled by their suit).

dice_d4, dice_numeral, dice_d8, dice_d10, dice_d10_percentile, dice_d12, dice_d20 Polyhedral dice most commonly used to play wargames, roleplaying games, and trading card games:

dice_d4 Four-sided dice in six color schemes (color controlled by their suit). Tetrahedrons with the rank as a numeral at the top point.

dice_numeral Six-sided dice with numerals instead of pips in six color schemes (color controlled by their suit).

dice_d8 Eight-sided dice in six color schemes (color controlled by their suit). Octahedrons with the rank as a numeral at the top face.

dice_d10 Ten-sided dice in six color schemes (color controlled by their suit). Pentagonal trapezohedrons with the rank as a numeral at the top face. The rank of ten is represented by a zero.

dice_d10_percentile Ten-sided dice in six color schemes (color controlled by their suit). Pentagonal trapezohedrons with the rank as a numeral followed by a zero at the top face. The rank of ten is represented by a zero.

dice_d12 Twelve-sided dice in six color schemes (color controlled by their suit). Dodecahedrons with the rank as a numeral at the top face.

dice_d20 Twenty-sided dice in six color schemes (color controlled by their suit). Icosahedrons with the rank as a numeral at the top face.

dice_fudge "Fudge" dice in six color schemes (color controlled by their suit). "Fudge" dice have three ranks "+", " ", and "-" repeated twice.

dominoes, dominoes_black, dominoes_blue, dominoes_green, dominoes_red, dominoes_white, dominoes_yellow Traditional pipped dominoes in six color schemes (dominoes and dominoes_white are the same). In each color scheme the number of pips on the "top" of the domino is controlled by their "rank" and on the "bottom" by their "suit". Supports up to double-18 sets.

dominoes_chinese, dominoes_chinese_black dominoes_chinese has Asian-style six-sided pipped dice with white background and black and red pips. The "tile"'s are Chinese dominoes (1" x 2.5") whose number of pips are controlled by both their "rank" and their "suit". dominoes_chinese_black are like dominoes_chinese but the dice and dominoes have a black background and white and red pips.

go Go stones and lined boards in six color schemes. Go stones are represented by a "bit" and the board is a "board". Color is controlled by suit and number of rows/columns by rank.

meeples Standard 16mm x 16mm x 10mm "meeples" in six colors represented by a "bit".

morris Various morris aka mills aka merels games in six colors. Color is controlled by suit and "size" of morris board is controlled by rank e.g. "Six men's morris" corresponds to a rank of 6 and "Nine men's morris" corresponds to a rank of 9. Game pieces are represented by stones.

piecepack, dual_piecepacks_expansion, playing_cards_expansion, hexpack, subpack, piecepack_inverted
The piecepack is a public domain game system invented by James "Kyle" Droscha. See https://www.ludism.org/ppwiki for more info about the piecepack and its accessories/expansions.

piecepack A standard piecepack. The configuration also contains the following piecepack accessories:

piecepack dice cards An accessory proposed by John Braley. See https://www.ludism.org/ppwiki/PiecepackDiceCards.

piecepack matchsticks A public domain accessory developed by Dan Burkey. See https://www.ludism.org/ppwiki/PiecepackMatchsticks.

piecepack pyramids A public domain accessory developed by Tim Schutz. See https://www.ludism.org/ppwiki/PiecepackPyramids.

piecepack saucers A public domain accessory developed by Karol M. Boyle at Mesomorph Games. See https://web.archive.org/web/20190719155827/http://www.piecepack.org/Accessories.html.

piecepack_inverted The standard piecepack with its color scheme inverted. Intended to aid in highlighting special pieces in diagrams.

dual_piecepacks_expansion A companion piecepack with a special suit scheme. See https://trevorldavis.com/piecepackr/dual-piecepacks-pnp.html.

playing_cards_expansion A piecepack with the standard "French" playing card suits. See https://www.ludism.org/ppwiki/PlayingCardsExpansion.

hexpack A hexagonal extrapolation of the piecepack designed by Nathan Morse and Daniel Wilcox. See https://boardgamegeek.com/boardgameexpansion/35424/hexpack.

subpack A mini piecepack. Designed to be used with the piecepack to make piecepack "stackpack" diagrams. See https://www.ludism.org/ppwiki/StackPack.

playing_cards, playing_cards_colored, playing_cards_tarot Poker-sized card components for various playing card decks:

playing_cards A traditional deck of playing cards with 4 suits and 13 ranks (A, 2-10, J, Q, K) plus a 14th "Joker" rank.

playing_cards_colored Like playing_cards but with five colored suits: red hearts, black spades, green clubs, blue diamonds, and yellow stars.

playing_cards_tarot A (French Bourgeois) deck of tarot playing cards: first four suits are hearts, spades, clubs, and diamonds with 14 ranks (ace through jack, knight, queen, king) plus a 15th "Joker" rank and a fifth "suit" of 22 trump cards (1-21 plus an "excuse").

reversi Boards and pieces for Reversi. "board_face" provides lined boards with colored backgrounds. "board_back" provides checkered boards. "bit_face" / "bit_back" provides circular game tokens with differently colored sides: red paired with green, black paired with white, and blue paired with yellow.

See Also

pp_cfg for information about the pp_cfg objects returned by game_systems.

Examples

```
cfgs <- game_systems(pawn = "joystick")
names(cfgs)

# May take more than 5 seconds on CRAN servers
# standard dice, meeples, and joystick pawns
if (requireNamespace("grid", quietly = TRUE) && piecepackr:::device_supports_unicode()) {
  opt <- options(piecepackr.at.inform = FALSE)
  grid::grid.newpage()
  dice <-  c("d4", "numeral", "d8", "d10", "d12", "d20")
  cfg <- paste0("dice_", dice)
  grid.piece("die_face", suit = c(1:6, 1), rank = 1:6,
             cfg = cfg, envir = cfgs, x = 1:6, y = 1,
             default.units = "in", op_scale = 0.5)
  grid.piece("die_face", rank=1:6, suit=1:6,
             x=1:6, y=2, default.units="in",
             op_scale=0.5, cfg=cfgs$dice)
  grid.piece("bit_face", suit=1:6,
             x=1:6, y=3, default.units="in",
             op_scale=0.5, cfg=cfgs$meeple)
  grid.piece("pawn_top", suit=1:6,
             x=1:6, y=4, default.units="in",
             op_scale=0.5, cfg=cfgs$piecepack)
  options(opt)
}

# dominoes
if (requireNamespace("grid", quietly = TRUE)) {
  grid::grid.newpage()
  colors <- c("black", "red", "green", "blue", "yellow", "white")
  cfg <- paste0("dominoes_", rep(colors, 2))
  grid.piece("tile_face",  suit=1:12, rank=1:12+1,
             cfg=cfg, envir=cfgs,
             x=rep(6:1, 2), y=rep(2*2:1, each=6),
             default.units="in", op_scale=0.5)
}
# piecepack "playing card expansion"
if (requireNamespace("grid", quietly = TRUE) && piecepackr:::device_supports_unicode()) {
  grid::grid.newpage()
  df_tiles <- data.frame(piece_side="tile_back",
                         x=0.5+c(3,1,3,1), y=0.5+c(3,3,1,1),
                         suit=NA, angle=NA, z=1/8,
                         stringsAsFactors=FALSE)
  df_coins <- data.frame(piece_side="coin_back",
                         x=rep(4:1, 4), y=rep(4:1, each=4),
                         suit=c(1,4,1,4,4,1,4,1,2,3,2,3,3,2,3,2),
                         angle=rep(c(180,0), each=8), z=1/4+1/16,
                         stringsAsFactors=FALSE)
  df <- rbind(df_tiles, df_coins)
  pmap_piece(df, cfg = cfgs$playing_cards_expansion, op_scale=0.5,
             default.units="in")
}
```

---

geom_piece   *Draw board game pieces with ggplot2*

Description

geom_piece() creates a ggplot2 geom. aes_piece() takes a data frame and generates an appropriate ggplot2::aes() mapping.

Usage

```
geom_piece(
  mapping = NULL,
  data = NULL,
  stat = "identity",
  position = "identity",
  ...,
  envir = getOption("piecepackr.envir", piecepackr::game_systems()),
  op_scale = getOption("piecepackr.op_scale", 0),
  op_angle = getOption("piecepackr.op_angle", 45),
  inherit.aes = TRUE
)

aes_piece(df)
```

Arguments

mapping   Set of aesthetic mappings created by [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. When using a
                 geom_*() function to construct a layer, the stat argument can be used the override the default coupling between geoms and stats. The stat argument accepts
                 the following:

                 - A Stat ggproto subclass, for example StatCount.
                 - A string naming the stat. To give the stat as a string, strip the function name
                   of the stat_ prefix. For example, to use stat_count(), give the stat as
                   "count".

- For more information and other ways to specify the stat, see the [layer stat](layer%20stat) documentation.

position   A position adjustment to use on the data for this layer. This can be used in various ways, including to prevent overplotting and improving the display. The `position` argument accepts the following:

- The result of calling a position function, such as `position_jitter()`. This method allows for passing extra arguments to the position.
- A string naming the position adjustment. To give the position as a string, strip the function name of the `position_` prefix. For example, to use `position_jitter()`, give the position as `"jitter"`.
- For more information and other ways to specify the position, see the [layer position](layer%20position) documentation.

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

envir   Environment (or named list) containing configuration list(s).

op_scale   How much to scale the depth of the piece in the oblique projection (viewed from the top of the board). `0` (the default) leads to an "orthographic" projection, `0.5` is the most common scale used in the "cabinet" projection, and `1.0` is the scale used in the "cavalier" projection.

op_angle   What is the angle of the oblique projection? Has no effect if `op_scale` is `0`.

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()`.

df   A data frame of game piece information with (at least) the named columns "piece_side", "x", and "y".

Details

`geom_piece()` requires a fixed scale coordinate system with an aspect ratio of 1 as provided by `ggplot2::coord_fixed()`. `geom_piece()` also requires that `cfg` is a character vector (and not a `pp_cfg()` object). In particular if using `op_transform()` one should set its argument `cfg_class = "character"` if intending for use with `geom_piece()`.

Aesthetics

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

- x
- y
- z
- piece_side
- rank
- suit
- cfg

- width

- height

- depth

- angle

- scale

- type

See Also

geom_piece() is a wrapper around pieceGrob(). scale_x_piece() and scale_y_piece() are
wrappers around ggplot2::scale_x_continuous() and ggplot2::scale_y_continuous() with
better defaults for board game diagrams.

Examples

```
if (require("ggplot2", quietly = TRUE) && require("tibble", quietly = TRUE)) {
  envir <- game_systems("sans")
  df_board <- tibble(piece_side = "board_face", suit = 3, rank = 8,
                x = 4.5, y = 4.5)
  df_w <- tibble(piece_side = "bit_face", suit = 6, rank = 1,
                x = rep(1:8, 2), y = rep(1:2, each=8))
  df_b <- tibble(piece_side = "bit_face", suit = 1, rank = 1,
                x = rep(1:8, 2), y = rep(7:8, each=8))
  df <- rbind(df_board, df_w, df_b)
  # 2D example
  # `cfg` must be a character vector for `geom_piece()`
  ggplot(df, aes_piece(df)) +
      geom_piece(cfg = "checkers1", envir = envir) +
      coord_fixed() +
      scale_x_piece() +
      scale_y_piece() +
      theme_minimal(28) +
      theme(panel.grid = element_blank())
}
if (require("ggplot2", quietly = TRUE) && require("tibble", quietly = TRUE)) {
  # 3D "oblique" projection example
  # `cfg_class` must be "character" when using with `geom_piece()`
  df3d <- op_transform(df, cfg = "checkers1", envir = envir,
                       op_angle = 45, cfg_class = "character")
  ggplot(df3d, aes_piece(df3d)) +
      geom_piece(cfg = "checkers1", envir = envir,
                op_angle = 45, op_scale = 0.5) +
      coord_fixed() +
      theme_void()
}
```

grid.cropmark   *Crop Mark Grob*

Description

grid.cropmark() draws "crop marks" to the active graphics device. cropmarkGrob() is its grid grob counterpart. Intended for use in adding crop marks around game pieces in print-and-play layouts.

Usage

```
cropmarkGrob(
  ...,
  piece_side = "tile_back",
  suit = NA,
  rank = NA,
  cfg = getOption("piecepackr.cfg", pp_cfg()),
  x = unit(0.5, "npc"),
  y = unit(0.5, "npc"),
  angle = 0,
  width = NA,
  height = NA,
  scale = 1,
  default.units = "npc",
  envir = getOption("piecepackr.envir"),
  name = NULL,
  gp = NULL,
  vp = NULL,
  bleed = unit(0.125, "in"),
  cm_select = "12345678",
  cm_width = unit(0.25, "mm"),
  cm_length = unit(0.125, "in")
)

grid.cropmark(..., draw = TRUE)
```

Arguments

...	cropmarkGrob() ignores; grid.cropmark() passes to cropmarkGrob().
piece_side	A string with piece and side separated by a underscore e.g. "coin_face"
suit	Number of suit (starting from 1).
rank	Number of rank (starting from 1)
cfg	Piecepack configuration list or pp_cfg object, a list of pp_cfg objects, or a character vector referring to names in envir or a character vector referring to object names that can be retrieved by base::dynGet().

x	Where to place piece on x axis of viewport
y	Where to place piece on y axis of viewport
angle	Angle (on xy plane) to draw piece at
width	Width of piece
height	Height of piece
scale	Multiplicative scaling factor to apply to width, height, and depth.
default.units	A string indicating the default units to use if 'x', 'y', 'width', and/or 'height' are only given as numeric vectors.
envir	Environment (or named list) containing configuration list(s).
name	A character identifier (for grid)
gp	An object of class "gpar".
vp	A grid viewport object (or NULL).
bleed	Bleed zone size to assume:

- If bleed is a [grid::unit()](#) simply use it
- If bleed is numeric then convert via grid::unit(bleed, default.units)
- If bleed is TRUE assume 1/8 inch bleed zone size
- If bleed is FALSE assume 0 inch bleed zone size

cm_select	A string of integers from "1" to "8" indicating which crop marks to draw. "1" represents the top right crop mark then we proceeding clockwise to "8" which represents the top left crop mark. Default "12345678" draws all eight crop marks.
cm_width	Width of crop mark.
cm_length	Length of crop mark.
draw	A logical value indicating whether graphics output should be produced.

Value

A grid grob.

Examples

```
if (requireNamespace("grid", quietly = TRUE) && piecepackr:::device_supports_unicode()) {
  cfg <- pp_cfg(list(mat_color = "pink", mat_width=0.05, border_color=NA))
  grid::grid.newpage()
  df <- data.frame(piece_side = "tile_face", suit = 2, rank = 2,
                   x = 2, y = 2, angle = 0,
                   stringsAsFactors = FALSE)
  pmap_piece(df, grid.cropmark, cfg = cfg, default.units = "in")
  pmap_piece(df, grid.piece, cfg = cfg, default.units = "in", bleed=TRUE)
}
if (requireNamespace("grid", quietly = TRUE) && piecepackr:::device_supports_unicode()) {
  grid::grid.newpage()
  df <- data.frame(piece_side = "coin_back", suit = 2, rank = 2,
                   x = 2, y = 2, angle = 0,
                   stringsAsFactors = FALSE)
```

```
    pmap_piece(df, grid.cropmark, cfg = cfg, default.units = "in", bleed=TRUE)
    pmap_piece(df, grid.piece, cfg = cfg, default.units = "in", bleed=TRUE)
  }
```

| grid.piece | *Draw board game pieces with grid* |

Description

grid.piece() draws board game pieces onto the graphics device. pieceGrob() is its grid "grob" counterpart.

Usage

```
pieceGrob(
  piece_side = "tile_back",
  suit = NA,
  rank = NA,
  cfg = getOption("piecepackr.cfg", pp_cfg()),
  x = unit(0.5, "npc"),
  y = unit(0.5, "npc"),
  z = NA,
  angle = 0,
  ...,
  width = NA,
  height = NA,
  depth = NA,
  op_scale = getOption("piecepackr.op_scale", 0),
  op_angle = getOption("piecepackr.op_angle", 45),
  default.units = getOption("piecepackr.default.units", "npc"),
  envir = getOption("piecepackr.envir"),
  name = NULL,
  gp = NULL,
  vp = NULL,
  scale = 1,
  alpha = 1,
  type = "normal",
  bleed = FALSE
)

grid.piece(
  piece_side = "tile_back",
  suit = NA,
  rank = NA,
  cfg = getOption("piecepackr.cfg", pp_cfg()),
  x = unit(0.5, "npc"),
  y = unit(0.5, "npc"),
```

```
    z = NA,
    angle = 0,
    ...,
    width = NA,
    height = NA,
    depth = NA,
    op_scale = getOption("piecepackr.op_scale", 0),
    op_angle = getOption("piecepackr.op_angle", 45),
    default.units = getOption("piecepackr.default.units", "npc"),
    envir = getOption("piecepackr.envir"),
    name = NULL,
    gp = NULL,
    draw = TRUE,
    vp = NULL,
    scale = 1,
    alpha = 1,
    type = "normal",
    bleed = FALSE
)
```

Arguments

piece_side	A string with piece and side separated by a underscore e.g. "coin_face"
suit	Number of suit (starting from 1).
rank	Number of rank (starting from 1)
cfg	Piecepack configuration list or pp_cfg object, a list of pp_cfg objects, or a character vector referring to names in envir or a character vector referring to object names that can be retrieved by base::dynGet().
x	Where to place piece on x axis of viewport
y	Where to place piece on y axis of viewport
z	z-coordinate of the piece. Has no effect if op_scale is 0.
angle	Angle (on xy plane) to draw piece at
...	Ignored.
width	Width of piece
height	Height of piece
depth	Depth (thickness) of piece. Has no effect if op_scale is 0.
op_scale	How much to scale the depth of the piece in the oblique projection (viewed from the top of the board). 0 (the default) leads to an "orthographic" projection, 0.5 is the most common scale used in the "cabinet" projection, and 1.0 is the scale used in the "cavalier" projection.
op_angle	What is the angle of the oblique projection? Has no effect if op_scale is 0.
default.units	A string indicating the default units to use if 'x', 'y', 'width', and/or 'height' are only given as numeric vectors.
envir	Environment (or named list) containing configuration list(s).

name	A character identifier (for grid)
gp	An object of class "gpar".
vp	A grid viewport object (or NULL).
scale	Multiplicative scaling factor to apply to width, height, and depth.
alpha	Alpha channel for transparency.
type	Type of grid grob to use. Either "normal" (default), "picture", "raster", or "transformation". "picture" exports to (temporary) svg and re-imports as a grImport2::pictureGrob. "raster" exports to (temporary) png and re-imports as a grid::rasterGrob. "transformation" uses the affine transformation feature only supported in R 4.2+ within select graphic devices. The latter three can be useful if drawing pieces really big or small and don't want to mess with re-configuring fontsizes and linewidths.
bleed	If FALSE do not add a "bleed" zone around the piece, otherwise add a "bleed" zone around the piece:

- If bleed is TRUE we will add 1/8 inch bleeds
- If bleed is a grid::unit() we will use it as bleed size
- If bleed is numeric we will convert to grid::unit() via grid::unit(bleed, default.units)

A non-FALSE bleed is incompatible with op_scale > 0 (drawing in an "oblique projection").

draw	A logical value indicating whether graphics output should be produced.

Value

A grid grob object. If draw is TRUE then as a side effect grid.piece() will also draw it to the graphics device.

See Also

pmap_piece() which applies pieceGrob() over rows of a data frame.

Examples

```
if (requireNamespace("grid", quietly = TRUE) && piecepackr:::device_supports_unicode()) {
   opt <- options(piecepackr.at.inform = FALSE)
   on.exit(options(opt))

   draw_pp_diagram <- function(cfg=pp_cfg(), op_scale=0) {
       g.p <- function(...) {
           grid.piece(..., op_scale=op_scale, cfg=cfg, default.units="in")
       }
       g.p("tile_back", x=0.5+c(3,1,3,1), y=0.5+c(3,3,1,1))
       g.p("tile_back", x=0.5+3, y=0.5+1, z=1/4+1/8)
       g.p("tile_back", x=0.5+3, y=0.5+1, z=2/4+1/8)
       g.p("die_face", suit=3, rank=5, x=1, y=1, z=1/4+1/4)
       g.p("pawn_face", x=1, y=4, z=1/4+1/2, angle=90)
       g.p("coin_back", x=3, y=4, z=1/4+1/16, angle=180)
```

```
        g.p("coin_back", suit=4, x=3, y=4, z=1/4+1/8+1/16, angle=180)
        g.p("coin_back", suit=2, x=3, y=1, z=3/4+1/8, angle=90)
    }

    # default piecepack, orthogonal projection
    draw_pp_diagram(cfg=pp_cfg())
 }
 if (requireNamespace("grid", quietly = TRUE) && piecepackr:::device_supports_unicode()) {
    # custom configuration, orthogonal projection
    grid::grid.newpage()
    dark_colorscheme <- list(suit_color="darkred,black,darkgreen,darkblue,black",
                        invert_colors.suited=TRUE, border_color="black", border_lex=2)
    traditional_ranks <- list(use_suit_as_ace=TRUE, rank_text=",a,2,3,4,5")
    cfg <- c(dark_colorscheme, traditional_ranks)
    draw_pp_diagram(cfg=pp_cfg(cfg))
 }
 if (requireNamespace("grid", quietly = TRUE) && piecepackr:::device_supports_unicode()) {
    # custom configuration, oblique projection
    grid::grid.newpage()
    cfg3d <- list(width.pawn=0.75, height.pawn=0.75, depth.pawn=1,
                     dm_text.pawn="", shape.pawn="convex6", invert_colors.pawn=TRUE,
                     edge_color.coin="tan", edge_color.tile="tan")
    cfg <- pp_cfg(c(cfg, cfg3d))
    draw_pp_diagram(cfg=pp_cfg(cfg), op_scale=0.5)
 }
```

| op_transform | *Oblique projection helper function* |

Description

Guesses z coordinates and sorting order to more easily make 3D graphics with `pmap_piece`.

Usage

```
op_transform(
  df,
  ...,
  cfg = getOption("piecepackr.cfg", pp_cfg()),
  envir = getOption("piecepackr.envir"),
  op_angle = getOption("piecepackr.op_angle", 45),
  pt_thickness = 0.01,
  as_top = character(0),
  cfg_class = "list"
)
```

Arguments

df	A data frame with coordinates and dimensions in inches

...	Ignored
cfg	Piecepack configuration list or pp_cfg object, a list of pp_cfg objects, or a character vector of pp_cfg objects
envir	Environment (or named list) containing configuration list(s).
op_angle	Intended oblique projection angle (used for re-sorting)
pt_thickness	Thickness of pyramid tip i.e. value to add to the z-value of a pyramid top if it is a (weakly) smaller ranked pyramid (top) placed on top of a larger ranked pyramid (top).
as_top	Character vector of components whose "side" should be converted to "top" e.g. c("pawn_face").
cfg_class	Either "list" (default) or "character". Desired class of the cfg column in the returned tibble. "list" is more efficient for use with pmap_piece() but geom_piece() needs "character".

Details

The heuristics used to generate guesses for z coordinates and sorting order aren't guaranteed to work in every case. In some cases you may get better sorting results by changing the op_angle or the dimensions of pieces.

Value

A tibble with extra columns added and re-sorted rows

See Also

https://trevorldavis.com/piecepackr/3d-projections.html for more details and examples of oblique projections in piecepackr.

Examples

```
df <- tibble::tibble(piece_side="tile_back",
                     x=c(2,2,2,4,6,6,4,2,5),
                     y=c(4,4,4,4,4,2,2,2,3))
cfg <- game_systems()$piecepack
pmap_piece(df, op_angle=135, trans=op_transform,
           op_scale=0.5, default.units="in", cfg=cfg)
```

---

piece   *Create rayrender board game piece objects*

Description

piece creates 3d board game piece objects for use with the rayrender package.

Usage

```
piece(
  piece_side = "tile_back",
  suit = NA,
  rank = NA,
  cfg = getOption("piecepackr.cfg", pp_cfg()),
  x = 0,
  y = 0,
  z = NA,
  angle = 0,
  axis_x = 0,
  axis_y = 0,
  width = NA,
  height = NA,
  depth = NA,
  envir = getOption("piecepackr.envir"),
  ...,
  scale = 1,
  res = 72
)
```

Arguments

piece_side	A string with piece and side separated by a underscore e.g. "coin_face"
suit	Number of suit (starting from 1).
rank	Number of rank (starting from 1)
cfg	Piecepack configuration list or pp_cfg object, a list of pp_cfg objects, or a character vector referring to names in envir or a character vector referring to object names that can be retrieved by base::dynGet().
x	Where to place piece on x axis of viewport
y	Where to place piece on y axis of viewport
z	z-coordinate of the piece. Has no effect if op_scale is 0.
angle	Angle (on xy plane) to draw piece at
axis_x	First coordinate of the axis unit vector.
axis_y	Second coordinate of the axis unit vector.
width	Width of piece
height	Height of piece
depth	Depth (thickness) of piece. Has no effect if op_scale is 0.
envir	Environment (or named list) containing configuration list(s).
...	Ignored.
scale	Multiplicative scaling factor to apply to width, height, and depth.
res	Resolution of the faces.

Value

A rayrender object.

See Also

See https://www.rayrender.net for more information about the rayrender package. See geometry_utils
for a discussion of the 3D rotation parameterization.

Examples

```
# May take more than 5 seconds on CRAN servers
opt <- options(cores = getOption("Ncpus"))
cfg <- game_systems("sans3d")$piecepack
if (requireNamespace("rayrender", quietly = TRUE) && all(capabilities(c("cairo", "png")))) {
    rayrender::render_scene(piece("tile_face", suit = 3, rank = 3, cfg = cfg))
}
if (requireNamespace("rayrender", quietly = TRUE) && all(capabilities(c("cairo", "png")))) {
    rayrender::render_scene(piece("coin_back", suit = 4, rank = 2, cfg = cfg))
}
if (requireNamespace("rayrender", quietly = TRUE) && all(capabilities(c("cairo", "png")))) {
    rayrender::render_scene(piece("pawn_face", suit = 2, cfg = cfg))
}
options(opt)
```

---

piece3d   *Render board game pieces with rgl*

Description

piece3d draws board games pieces using the rgl package.

Usage

```
piece3d(
  piece_side = "tile_back",
  suit = NA,
  rank = NA,
  cfg = getOption("piecepackr.cfg", pp_cfg()),
  x = 0,
  y = 0,
  z = NA,
  angle = 0,
  axis_x = 0,
  axis_y = 0,
  width = NA,
  height = NA,
  depth = NA,
```

```
  envir = getOption("piecepackr.envir"),
  ...,
  scale = 1,
  res = 72,
  alpha = 1,
  lit = FALSE,
  shininess = 50,
  textype = NA
)
```

Arguments

piece_side	A string with piece and side separated by a underscore e.g. "coin_face"
suit	Number of suit (starting from 1).
rank	Number of rank (starting from 1)
cfg	Piecepack configuration list or `pp_cfg` object, a list of `pp_cfg` objects, or a character vector referring to names in `envir` or a character vector referring to object names that can be retrieved by `base::dynGet()`.
x	Where to place piece on x axis of viewport
y	Where to place piece on y axis of viewport
z	z-coordinate of the piece. Has no effect if `op_scale` is `0`.
angle	Angle (on xy plane) to draw piece at
axis_x	First coordinate of the axis unit vector.
axis_y	Second coordinate of the axis unit vector.
width	Width of piece
height	Height of piece
depth	Depth (thickness) of piece. Has no effect if `op_scale` is `0`.
envir	Environment (or named list) containing configuration list(s).
...	Ignored.
scale	Multiplicative scaling factor to apply to width, height, and depth.
res	Resolution of the faces.
alpha	Alpha channel for transparency.
lit	logical, specifying if rgl lighting calculation should take place.
shininess	Properties for rgl lighting calculation.
textype	Use `"rgba"` when sure texture will have alpha transparency. Use `"rgb"` when sure texture will not have alpha transparency (in particular `rgl`'s WebGL export will likely work better). If `NA` we will read the texture and figure out a reasonable value.

Value

A numeric vector of rgl object IDs.

See Also

See [rgl-package](#) for more information about the rgl package. See [rgl::material3d()](#) for more info about setting rgl material properties. See [geometry_utils](#) for a discussion of the 3D rotation parameterization.

Examples

```
if (requireNamespace("rgl", quietly = TRUE) && all(capabilities(c("cairo", "png")))) {
  rgl::open3d()
  cfg <- game_systems("sans3d")$piecepack
  piece3d("tile_back", suit = 3, rank = 3, cfg = cfg, x = 0, y = 0, z = 0)
  piece3d("coin_back", suit = 4, rank = 2, cfg = cfg, x = 0.5, y = 0.5, z = 0.25)
  piece3d("pawn_top", suit = 1, cfg = cfg, x = -0.5, y = 0.5, z = 0.6)
  piece3d("die_face", suit = 3, cfg = cfg, x = -0.5, y = -0.5, z = 0.375)
  piece3d("pyramid_top", suit = 2, rank = 3, cfg = cfg, x = 1.5, y = 0.0, z = 0.31875)
  invisible(NULL)
}
```

---

piecepackr-defunct   *Defunct functions*

Description

These functions are Defunct and have been removed from piecepackr.

Usage

```
halmaGrob(...)

kiteGrob(...)

pyramidGrob(...)

convexGrobFn(...)

concaveGrobFn(...)

gridlinesGrob(...)

matGrob(...)

checkersGrob(...)

hexlinesGrob(...)

get_shape_grob_fn(...)
```

Arguments

... Ignored

Details

1. For `get_shape_grob_fn` use `pp_shape()$shape` instead.
2. For `gridlinesGrob()` use `pp_shape()$gridlines()` instead.
3. For `matGrob()` use `pp_shape()$mat()` instead.
4. For `checkersGrob()()` use `pp_shape()$checkers()` instead.
5. For `hexlinesGrob()` use `pp_shape()$hexlines()` instead.
6. For `halmaGrob()` use `pp_shape("halma")$shape()` instead.
7. For `kiteGrob()` use `pp_shape("kite")$shape()` instead.
8. For `pyramidGrob()` use `pp_shape("pyramid")$shape()` instead.
9. For `convexGrobFn(n, t)` use `pp_shape(paste0("convex", n), t)$shape` instead.
10. For `concaveGrobFn(n, t, r)` use `pp_shape(paste0("concave", n), t, r)$shape` instead.

---

piece_mesh *Create rayvertex board game piece objects*

Description

`piece_mesh()` creates 3d board game piece objects for use with the rayvertex package.

Usage

```
piece_mesh(
  piece_side = "tile_back",
  suit = NA,
  rank = NA,
  cfg = pp_cfg(),
  x = 0,
  y = 0,
  z = NA,
  angle = 0,
  axis_x = 0,
  axis_y = 0,
  width = NA,
  height = NA,
  depth = NA,
  envir = NULL,
  ...,
  scale = 1,
  res = 72
)
```

Arguments

`piece_side`	A string with piece and side separated by a underscore e.g. "coin_face"
`suit`	Number of suit (starting from 1).
`rank`	Number of rank (starting from 1)
`cfg`	Piecepack configuration list or `pp_cfg` object, a list of `pp_cfg` objects, or a character vector referring to names in `envir` or a character vector referring to object names that can be retrieved by `base::dynGet()`.
`x`	Where to place piece on x axis of viewport
`y`	Where to place piece on y axis of viewport
`z`	z-coordinate of the piece. Has no effect if `op_scale` is `0`.
`angle`	Angle (on xy plane) to draw piece at
`axis_x`	First coordinate of the axis unit vector.
`axis_y`	Second coordinate of the axis unit vector.
`width`	Width of piece
`height`	Height of piece
`depth`	Depth (thickness) of piece. Has no effect if `op_scale` is `0`.
`envir`	Environment (or named list) containing configuration list(s).
`...`	Ignored.
`scale`	Multiplicative scaling factor to apply to width, height, and depth.
`res`	Resolution of the faces.

Value

A rayvertex object.

See Also

See https://www.rayvertex.com for more information about the rayvertex package. See geometry_utils for a discussion of the 3D rotation parameterization.

Examples

```
 # May take more than 5 seconds on CRAN servers
if (requireNamespace("rayvertex", quietly = TRUE) && all(capabilities(c("cairo", "png")))) {
    cfg <- game_systems("sans3d")$piecepack
    rs <- function(shape) {
        opt <- options(cores = getOption("Ncpus"))
        light <- rayvertex::directional_light(c(0, 0, 1))
        rayvertex::rasterize_scene(shape, light_info = light)
        options(opt)
    }
    rs(piece_mesh("tile_face", suit = 3, rank = 3, cfg = cfg))
 }
 if (requireNamespace("rayvertex", quietly = TRUE) && all(capabilities(c("cairo", "png")))) {
    rs(piece_mesh("coin_back", suit = 4, rank = 2, cfg = cfg))
```

```
    }
  if (requireNamespace("rayvertex", quietly = TRUE) && all(capabilities(c("cairo", "png")))) {
      rs(piece_mesh("pawn_face", suit = 1, cfg = cfg))
  }
```

---

pmap_piece   *Create graphics using data frame input*

Description

pmap_piece() operates on the rows of a data frame applying .f to each row (usually grid.piece).

Usage

```
pmap_piece(
  .l,
  .f = pieceGrob,
  ...,
  cfg = getOption("piecepackr.cfg"),
  envir = getOption("piecepackr.envir"),
  trans = getOption("piecepackr.trans"),
  draw = TRUE,
  name = NULL,
  gp = NULL,
  vp = NULL
)
```

Arguments

.l	A list of vectors, such as a data frame. The length of .l determines the number of arguments that .f will be called with. List names will be used if present.
.f	Function to be applied to .l after adjustments to cfg and envir and the application of trans. Usually [grid.piece()](), [pieceGrob()](), [piece3d()](), or [piece()]().
...	Extra arguments to pass to .f.
cfg	Piecepack configuration list or pp_cfg object, a list of pp_cfg objects, or a character vector referring to names in envir or a character vector referring to object names that can be retrieved by base::dynGet().
envir	Environment (or named list) containing configuration list(s).
trans	Function to modify .l before drawing. Default (NULL) is to not modify .l. op_transform can help with using an oblique projection (i.e. op_scale over 0).
draw	A logical value indicating whether graphics output should be produced.
name	A character identifier (for grid)
gp	An object of class "gpar".
vp	A grid viewport object (or NULL).

Details

pmap_piece() differs from purrr::pmap() in a few ways:

1. If cfg and/or envir are missing attempts to set reasonable defaults.

2. If not NULL will first apply function trans to .l.

3. If the output of .f is a grid grob object then pmap_piece will return a gTree object with specified name, gp, and vp values and if draw is true draw it.

4. If .l lacks a name column or if name column is non-unique attempts to generate a reasonable new default name column and use that to name the return gTree children or list values.

See Also

[render_piece()](#) is a higher-level function that wraps this function.

Examples

```
if (requireNamespace("grid", quietly = TRUE) && piecepackr:::device_supports_unicode()) {
    dark_colorscheme <- list(suit_color="darkred,black,darkgreen,darkblue,black",
                         invert_colors.suited=TRUE, border_color="black", border_lex=2)
    traditional_ranks <- list(use_suit_as_ace=TRUE, rank_text=",a,2,3,4,5")
    cfg3d <- list(width.pawn=0.75, height.pawn=0.75, depth.pawn=1,
                      dm_text.pawn="", shape.pawn="convex6", invert_colors.pawn=TRUE,
                      edge_color.coin="tan", edge_color.tile="tan")
    cfg <- pp_cfg(c(dark_colorscheme, traditional_ranks, cfg3d))
    grid::grid.newpage()
   df_tiles <- data.frame(piece_side="tile_back", x=0.5+c(3,1,3,1), y=0.5+c(3,3,1,1),
                             suit=NA, angle=NA, z=NA, stringsAsFactors=FALSE)
    df_coins <- data.frame(piece_side="coin_back", x=rep(4:1, 4), y=rep(4:1, each=4),
                             suit=1:16%%2+rep(c(1,3), each=8),
                         angle=rep(c(180,0), each=8), z=1/4+1/16, stringsAsFactors=FALSE)
    df <- rbind(df_tiles, df_coins)
    pmap_piece(df, cfg=cfg, op_scale=0.5, default.units="in")
}
```

---

pp_cfg	*Configuration list R6 object*

Description

pp_cfg() and as_pp_cfg() create piecepack configuration list R6 objects. is_pp_cfg() returns TRUE if object is a piecepack configuration list R6 object. as.list() will convert it into a list.

Usage

```
pp_cfg(cfg = list())

is_pp_cfg(cfg)

as_pp_cfg(cfg = list())
```

Arguments

cfg   List of configuration options

Details

pp_cfg R6 class objects serve the following purposes:

- Customize the appearance of pieces drawn by grid.piece().
- Speed up the drawing of graphics through use of caching.
- Allow the setting and querying of information about the board game components that maybe of use to developers:
    - Number of suits
    - Number of ranks
    - Suit colors
    - Which types of components are included and/or properly supported
    - What would be a good color to use when adding annotations on top of these components.
    - Title, Description, Copyright, License, and Credit metadata

pp_cfg R6 Class Method Arguments

piece_side A string with piece and side separated by a underscore e.g. "coin_face".

suit Number of suit (starting from 1).

rank Number of rank (starting from 1).

type Which type of grob to return, either "normal", "picture", "raster", or "transformation".

scale "scale" factor

alpha "alpha" value

pp_cfg R6 Class Methods

get_grob() Returns a grid "grob" for drawing the piece.

get_piece_opt() Returns a list with info useful for drawing the piece.

get_suit_color() Returns the suit colors.

get_width(), get_height(), get_depth() Dimensions (of the bounding cube) of the piece in inches

pp_cfg R6 Class Fields and Active Bindings

annotation_color Suggestion of a good color to annotate with

cache Cache object which stores intermediate graphical calculations. Default is a memory-cache that does not prune. This can be replaced by another cache that implements the cache API used by the cachem package

cache_grob Whether we should cache (2D) grobs

cache_grob_with_bleed_fn Whether we should cache the grob with bleed functions

cache_piece_opt Whether we should cache piece opt information

`cache_op_fn` Whether we should cache the oblique projection functions

`cache_obj_fn` Whether we should cache any 3D rendering functions

`copyright` Design copyright information

`credit` Design credits

`description` Design description

`fontfamily` Main font family

`has_bits` Whether we should assume this supports "bit" pieces

`has_boards` Whether we should assume this supports "board" pieces

`has_cards` Whether we should assume this supports "card" pieces

`has_coins` Whether we should assume this supports "coin" pieces

`has_dice` Whether we should assume this supports "die" pieces

`has_matchsticks` Whether we should assume this supports "matchstick" pieces

`has_pawns` Whether we should assume this supports "pawn" pieces

`has_piecepack` Binding which simultaneously checks/sets `has_coins`, `has_tiles`, `has_pawns`, `has_dice`

`has_pyramids` Whether we should assume this supports "pyramid" pieces

`has_saucers` Whether we should assume this supports "saucer" pieces

`has_tiles` Whether we should assume this supports "tile" pieces

`spdx_id` SPDX Identifier for graphical design license. See https://spdx.org/licenses/ for full list.

`title` Design title

Defunct `pp_cfg` **R6 Class attributes which have been removed**

`cache_shadow` Use `cache_op_fn` instead

`i_unsuit` Instead add `1L` to `n_suits`

`get_pictureGrob()` Use `get_grob(..., type = "picture")` instead

`get_shadow_fn` `get_op_grob()` returns complete oblique projection grob

See Also

game_systems() for functions that return configuration list objects for several game systems. https://trevorldavis.com/piecepackr/configuration-lists.html for more details about piecepackr configuration lists.

Examples

```
cfg <- pp_cfg(list(invert_colors=TRUE))
as.list(cfg)
is_pp_cfg(cfg)
as_pp_cfg(list(suit_color="darkred,black,darkgreen,darkblue,grey"))
cfg$get_suit_color(suit=3)
cfg$annotation_color
```

```
cfg$has_matchsticks
cfg$has_matchsticks <- TRUE
cfg$has_matchsticks
cfg$get_width("tile_back")
cfg$get_height("die_face")
cfg$get_depth("coin_face")
# May take more than 5 seconds on CRAN servers
# `pp_cfg()` objects use a cache to speed up repeated drawing
pdf(tempfile(fileext = ".pdf"))
cfg <- list()
system.time(replicate(100, grid.piece("tile_back", 4, 4, cfg)))
cfg <- pp_cfg(list())
system.time(replicate(100, grid.piece("tile_back", 4, 4, cfg)))
invisible(dev.off())
```

---

pp_shape   *Shape object for generating various grobs*

Description

pp_shape() creates an R6 object with methods for creating various shape based grobs.

Usage

```
pp_shape(label = "rect", theta = 90, radius = 0.2, back = FALSE)
```

Arguments

label   Label of the shape. One of

    "circle" Circle.

    "convexN" An N-sided convex polygon. theta controls which direction the first vertex is drawn.

    "concaveN" A "star" (concave) polygon with N "points". theta controls which direction the first point is drawn. radius controls the distance of the "inner" vertices from the center.

    "halma" A 2D outline of a "Halma pawn".

    "kite" "Kite" quadrilateral shape.

    "meeple" A 2D outline of a "meeple".

    "oval" Oval.

    "pyramid" An "Isosceles" triangle whose base is the bottom of the viewport. Typically used to help draw the face of the "pyramid" piece.

    "rect" Rectangle.

    "roundrect" "Rounded" rectangle. radius controls curvature of corners.

theta   convex and concave polygon shapes use this to determine where the first point is drawn.

| radius | concave polygon and `roundrect` use this to control appearance of the shape. |
| back | Whether the shape should be reflected across a vertical line in the middle of the viewport. |

Details

pp_shape objects serve the following purposes:

1. Make it easier for developers to customize game piece appearances either through a "grob_fn" or "op_grob_fn" styles in `pp_cfg()` or manipulate a piece post drawing via functions like `grid::grid.edit()`.
2. Used internally to generate `piecepackr`'s built-in game piece grobs.

pp_shape **R6 Class Method Arguments**

mat_width Numeric vector of mat widths.

clip "clip grob" to perform polyclip operation with. See [gridGeometry::grid.polyclip()](#) for more info.

op Polyclip operation to perform. See [gridGeometry::grid.polyclip()](#) for more info.

pattern Pattern to fill in shape with. See [gridpattern::patternGrob()](#) for more info.

... Passed to gridpattern::patternGrob().

name Grid grob name value.

gp Grid gpar list. See [grid::gpar()](#) for more info.

vp Grid viewport or NULL.

pp_shape **R6 Class Methods**

checkers(name = NULL, gp = gpar(), vp = NULL) Returns a grob of checkers for that shape.

gridlines(name = NULL, gp = gpar(), vp = NULL) Returns a grob of gridlines for that shape.

hexlines(name = NULL, gp = gpar(), vp = NULL) Returns a grob of hexlines for that shape.

mat(mat_width = 0, name = NULL, gp = gpar(), vp = NULL) Returns a grob for a matting "mat" for that shape.

pattern(pattern = "stripe", ..., name = NULL, gp = gpar(), vp = NULL) Fills in the shape's npc_coords with a pattern. See [gridpattern::patternGrob()](#) for more information.

polyclip(clip, op = "intersection", name = NULL, gp = gpar(), vp = NULL) Returns a grob that is an "intersection", "minus", "union", or "xor" of another grob. Note unlike gridGeometry::polyclipGrob it can directly work with a pieceGrob "clip grob" argument.

shape(name = NULL, gp = gpar(), vp = NULL) Returns a grob of the shape.

pp_shape **R6 Class Active Bindings**

label The shape's label.

theta The shape's theta.

radius The shape's radius.

back A boolean of whether this is the shape's "back" side.

npc_coords A named list of "npc" coordinates along the perimeter of the shape.

Examples

```
if (require("grid", quietly = TRUE)) {
    gp <- gpar(col="black", fill="yellow")
    rect <- pp_shape(label="rect")
    convex6 <- pp_shape(label="convex6")
    circle <- pp_shape(label="circle")

    pushViewport(viewport(x=0.25, y=0.75, width=1/2, height=1/2))
    grid.draw(rect$shape(gp=gp))
    grid.draw(rect$gridlines(gp=gpar(col="blue", lex=4)))
    grid.draw(rect$hexlines(gp=gpar(col="green")))
    popViewport()

    pushViewport(viewport(x=0.75, y=0.75, width=1/2, height=1/2))
    grid.draw(convex6$shape(gp=gp))
    grid.draw(convex6$checkers(gp=gpar(fill="blue")))
    popViewport()

    pushViewport(viewport(x=0.25, y=0.25, width=1/2, height=1/2))
    grid.draw(circle$shape(gp=gp))
    grid.draw(circle$mat(mat_width=0.2, gp=gpar(fill="blue")))
    popViewport()

    pushViewport(viewport(x=0.75, y=0.25, width=1/2, height=1/2))
    grid.draw(rect$shape(gp=gp))
    grid.draw(rect$mat(mat_width=c(0.2, 0.1, 0.3, 0.4), gp=gpar(fill="blue")))
    popViewport()
}
if (require("grid", quietly = TRUE)) {
    grid.newpage()
    gp <- gpar(col="black", fill="yellow")

    vp <- viewport(x=1/4, y=1/4, width=1/2, height=1/2)
    grid.draw(pp_shape("halma")$shape(gp=gp, vp=vp))
    vp <- viewport(x=3/4, y=1/4, width=1/2, height=1/2)
    grid.draw(pp_shape("pyramid")$shape(gp=gp, vp=vp))
    vp <- viewport(x=3/4, y=3/4, width=1/2, height=1/2)
    grid.draw(pp_shape("kite")$shape(gp=gp, vp=vp))
    vp <- viewport(x=1/4, y=3/4, width=1/2, height=1/2)
    grid.draw(pp_shape("meeple")$shape(gp=gp, vp=vp))
}
if (require("grid", quietly = TRUE)) {
    grid.newpage()
    vp <- viewport(x=1/4, y=1/4, width=1/2, height=1/2)
    grid.draw(pp_shape("convex3", 0)$shape(gp=gp, vp=vp))
    vp <- viewport(x=3/4, y=1/4, width=1/2, height=1/2)
    grid.draw(pp_shape("convex4", 90)$shape(gp=gp, vp=vp))
    vp <- viewport(x=3/4, y=3/4, width=1/2, height=1/2)
    grid.draw(pp_shape("convex5", 180)$shape(gp=gp, vp=vp))
    vp <- viewport(x=1/4, y=3/4, width=1/2, height=1/2)
    grid.draw(pp_shape("convex6", 270)$shape(gp=gp, vp=vp))
}
```

```
if (require("grid", quietly = TRUE)) {
    grid.newpage()
    vp <- viewport(x=1/4, y=1/4, width=1/2, height=1/2)
    grid.draw(pp_shape("concave3", 0, 0.1)$shape(gp=gp, vp=vp))
    vp <- viewport(x=3/4, y=1/4, width=1/2, height=1/2)
    grid.draw(pp_shape("concave4", 90, 0.2)$shape(gp=gp, vp=vp))
    vp <- viewport(x=3/4, y=3/4, width=1/2, height=1/2)
    grid.draw(pp_shape("concave5", 180, 0.3)$shape(gp=gp, vp=vp))
    vp <- viewport(x=1/4, y=3/4, width=1/2, height=1/2)
    grid.draw(pp_shape("concave6", 270)$shape(gp=gp, vp=vp))
}
if (require("grid", quietly = TRUE) &&
    requireNamespace("gridpattern", quietly = TRUE)) {
    grid.newpage()
    hex <- pp_shape("convex6")
    gp <- gpar(fill = c("blue", "yellow", "red"), col = "black")
    grid.draw(hex$pattern("polygon_tiling", gp = gp, spacing = 0.1,
                          type = "truncated_trihexagonal"))
    gp <- gpar(fill = "black", col = NA)
    grid.draw(hex$mat(mat_width = 0.025, gp = gp))
}
```

| pp_utils | *Miscellaneous* piecepackr *utility functions* |

Description

cleave converts a delimiter separated string into a vector. inch(x) is equivalent to unit(x, "in").
is_color_invisible tells whether the color is transparent (and hence need not be drawn).

Usage

```
is_color_invisible(col)

inch(inches)

cleave(s, sep = ",", float = FALSE, color = FALSE)

file2grob(file, distort = TRUE)
```

Arguments

col	Color
inches	Number representing number of inches
s	String to convert
sep	Delimiter (defaults to ",")
float	If TRUE cast to numeric

color	if TRUE convert empty strings to `"transparent"`
file	Filename of image
distort	Logical value of whether one should preserve the aspect ratio or distort to fit the area it is drawn in

Examples

```
cleave("0.5,0.2,0.4,0.5", float=TRUE)
cleave("black,darkred,#050EAA,,", color=TRUE)

is_color_invisible("transparent")
is_color_invisible(NA)
is_color_invisible("blue")
is_color_invisible("#05AE9C")

if (requireNamespace("grid", quietly = TRUE)) {
    identical(inch(1), grid::unit(1, "inch"))
}
```

---

render_piece	*Render image of game pieces*

Description

`render_piece()` renders an image of game pieces to a file or graphics device. It is a wrapper around `pmap_piece()` that can auto-size files and graphic devices, apply axes offsets, annotate coordinates, and set up `rayrender` / `rayvertex` scenes.

Usage

```
render_piece(
  df,
  file = NULL,
  ...,
  .f = piecepackr::grid.piece,
  cfg = getOption("piecepackr.cfg", NULL),
  envir = getOption("piecepackr.envir", game_systems("sans")),
  width = NULL,
  height = NULL,
  ppi = 72,
  bg = "white",
  xoffset = NULL,
  yoffset = NULL,
  new_device = TRUE,
  dev = NULL,
  dev.args = list(res = ppi, bg = bg, units = "in"),
```

```
  annotate = FALSE,
  annotation_scale = NULL
)
```

Arguments

df	A data frame of game piece information with (at least) the named columns "piece_side", "x", and "y".
file	Filename to save image unless NULL in which case it either uses the current graphics device or opens a new device (depending on new_device argument).
...	Arguments to pmap_piece()
.f	Low level graphics function to use e.g. grid.piece(), piece3d(), piece_mesh(), or piece().
cfg	A piecepackr configuration list
envir	Environment (or named list) of piecepackr configuration lists
width	Width of image (in inches). Inferred by default.
height	Height of image (in inches). Inferred by default.
ppi	Resolution of image in pixels per inch.
bg	Background color (use "transparent" for transparent)
xoffset	Number to add to the x column in df. Inferred by default.
yoffset	Number to add to the y column in df. Inferred by default.
new_device	If file is NULL should we open up a new graphics device?
dev	Graphics device function to use. If NULL infer a reasonable choice.
dev.args	Additional arguments to pass to dev (besides filename, width, and height). Will filter out any names that aren't in formals(dev).
annotate	If TRUE or "algebraic" annotate the plot with "algrebraic" coordinates, if FALSE or "none" don't annotate, if "cartesian" annotate the plot with "cartesian" coordinates.
annotation_scale	
	Multiplicative factor that scales (stretches) any annotation coordinates. By default uses attr(df, "scale_factor") %||% 1.

Value

An invisible list of the dimensions of the image, as a side effect saves a graphic

See Also

This function is a wrapper around pmap_piece().

Examples

```
df_board <- data.frame(piece_side = "board_face", suit = 3, rank = 5,
                       x = 3.0, y = 3.0, stringsAsFactors = FALSE)
df_w <- data.frame(piece_side = "bit_face", suit = 6, rank = 1,
                   x = rep(1:5, 2), y = rep(1:2, each=5),
                   stringsAsFactors = FALSE)
df_b <- data.frame(piece_side = "bit_face", suit = 1, rank = 1,
                   x = rep(1:5, 2), y = rep(4:5, each=5),
                   stringsAsFactors = FALSE)
df <- rbind(df_board, df_w, df_b)
df$cfg <- "checkers1"

if (requireNamespace("grid", quietly = TRUE)) {
  render_piece(df, new_device = FALSE)
}
if (requireNamespace("grid", quietly = TRUE)) {
  grid::grid.newpage()
  render_piece(df, new_device = FALSE,
               op_scale = 0.5, trans = op_transform,
               annotate = "algrebraic")
}
## Not run: # May take more than 5 seconds on CRAN servers
if (require(rayvertex)) {
  envir3d <- game_systems("sans3d")
  render_piece(df, .f = piece_mesh, envir = envir3d,
               op_scale = 0.5, trans = op_transform)
}

## End(Not run)
```

---

save_ellipsoid_obj   *Alternative Wavefront OBJ file generators*

Description

These are alternative Wavefront OBJ generators intended to be used as a `obj_fn` attribute in a `pp_cfg()` "configuration list". `save_ellipsoid_obj` saves an ellipsoid with a color equal to that piece's `background_color`. `save_peg_doll_obj` saves a "peg doll" style doll with a color equal to that piece's `edge_color` with a "pawn belt" around it's waste from that suit's and rank's `belt_face`.

Usage

```
save_ellipsoid_obj(
  piece_side = "bit_face",
  suit = 1,
  rank = 1,
  cfg = getOption("piecepackr.cfg", pp_cfg()),
  ...,
  x = 0,
```

```
  y = 0,
  z = 0,
  angle = 0,
  axis_x = 0,
  axis_y = 0,
  width = NA,
  height = NA,
  depth = NA,
  filename = tempfile(fileext = ".obj"),
  subdivide = 3
)

save_peg_doll_obj(
  piece_side = "pawn_top",
  suit = 1,
  rank = 1,
  cfg = getOption("piecepackr.cfg", pp_cfg()),
  ...,
  x = 0,
  y = 0,
  z = 0,
  angle = 0,
  axis_x = 0,
  axis_y = 0,
  width = NA,
  height = NA,
  depth = NA,
  filename = tempfile(fileext = ".obj"),
  res = 72
)
```

Arguments

piece_side	A string with piece and side separated by a underscore e.g. "coin_face"
suit	Number of suit (starting from 1).
rank	Number of rank (starting from 1)
cfg	Piecepack configuration list or pp_cfg object, a list of pp_cfg objects, or a character vector referring to names in envir or a character vector referring to object names that can be retrieved by base::dynGet().
...	Ignored.
x	Where to place piece on x axis of viewport
y	Where to place piece on y axis of viewport
z	z-coordinate of the piece. Has no effect if op_scale is 0.
angle	Angle (on xy plane) to draw piece at
axis_x	First coordinate of the axis unit vector.
axis_y	Second coordinate of the axis unit vector.

width	Width of piece
height	Height of piece
depth	Depth (thickness) of piece. Has no effect if op_scale is 0.
filename	Name of Wavefront OBJ object.
subdivide	Increasing this value makes for a smoother ellipsoid (and larger OBJ file and slower render). See ellipse3d.
res	Resolution of the faces.

See Also

See pp_cfg() for a discussion of "configuration lists". Wavefront OBJ file generators are used by save_piece_obj() and (by default) piece3d() (rgl wrapper), piece() (rayrender wrapper), and piece_mesh() (rayvertex wrapper).

---

save_piece_images   *Save piecepack images*

Description

Saves images of all individual piecepack pieces.

Usage

```
save_piece_images(
  cfg = getOption("piecepackr.cfg", pp_cfg()),
  directory = tempdir(),
  format = "svg",
  angle = 0
)
```

Arguments

cfg	Piecepack configuration list
directory	Directory where to place images
format	Character vector of formats to save images in
angle	Numeric vector of angles to rotate images (in degrees)

Examples

```
# May take more than 5 seconds on CRAN server
if (all(capabilities(c("cairo", "png")))) {
    cfg <- pp_cfg(list(suit_color="darkred,black,darkgreen,darkblue,grey"))
    save_piece_images(cfg, directory=tempdir(), format="svg", angle=0)
    save_piece_images(cfg, directory=tempdir(), format="png", angle=90)
}
```

---

save_piece_obj   *Save Wavefront OBJ files of board game pieces*

Description

save_piece_obj saves Wavefront OBJ files (including associated MTL and texture image) of board game pieces.

Usage

```
save_piece_obj(
  piece_side = "tile_face",
  suit = 1,
  rank = 1,
  cfg = getOption("piecepackr.cfg", pp_cfg()),
  ...,
  x = 0,
  y = 0,
  z = 0,
  angle = 0,
  axis_x = 0,
  axis_y = 0,
  width = NA,
  height = NA,
  depth = NA,
  filename = tempfile(fileext = ".obj"),
  scale = 1,
  res = 72
)
```

Arguments

piece_side	A string with piece and side separated by a underscore e.g. "coin_face"
suit	Number of suit (starting from 1).
rank	Number of rank (starting from 1)
cfg	Piecepack configuration list or pp_cfg object, a list of pp_cfg objects, or a character vector referring to names in envir or a character vector referring to object names that can be retrieved by base::dynGet().
...	Ignored.
x	Where to place piece on x axis of viewport
y	Where to place piece on y axis of viewport
z	z-coordinate of the piece. Has no effect if op_scale is 0.
angle	Angle (on xy plane) to draw piece at
axis_x	First coordinate of the axis unit vector.

axis_y	Second coordinate of the axis unit vector.
width	Width of piece
height	Height of piece
depth	Depth (thickness) of piece. Has no effect if `op_scale` is `0`.
filename	Name of Wavefront OBJ object.
scale	Multiplicative scaling factor to apply to width, height, and depth.
res	Resolution of the faces.

Value

A list with named elements "obj", "mtl", "png" with the created filenames.

See Also

See `geometry_utils` for a discussion of the 3D rotation parameterization.

Examples

```
if (all(capabilities(c("cairo", "png")))) {
  cfg <- game_systems("sans3d")$dominoes
  files <- save_piece_obj("tile_face", suit = 3+1, rank=6+1, cfg = cfg)
  print(files)
}
```

---

save_print_and_play   *Save piecepack print-and-play (PnP) file*

Description

Save piecepack print-and-play (PnP) file

Usage

```
save_print_and_play(
  cfg = getOption("piecepackr.cfg", pp_cfg()),
  output_filename = "piecepack.pdf",
  size = c("letter", "A4", "A5", "4x6"),
  pieces = NULL,
  arrangement = c("single-sided", "double-sided"),
  dev = NULL,
 dev.args = list(family = cfg$fontfamily, onefile = TRUE, units = "in", bg = "white",
    res = 300),
  quietly = FALSE,
  ...,
  bleed = FALSE,
  size_bleed = NULL
)
```

Arguments

`cfg`	Piecepack configuration list or `pp_cfg` object
`output_filename`	
	Filename for print-and-play file
`size`	PnP output size (currently supports either "letter", "A4", "A5", or "4x6"). This is the targeted "trim" size of the print-and-play file (`size_bleed` can be used to make the print-and-play file larger than this). Size "4x6" currently only supports `pieces = "piecepack"` and doesn't support `bleed = TRUE`. "A5" is in "portrait" mode whereas the other sizes are in "landscape" mode.
`pieces`	Character vector of desired PnP pieces. Supports "piecepack", "matchsticks", "pyramids", "subpack", or "all". If NULL and combination of `size` / `bleed` values supports "matchsticks" and "pyramids" then defaults to `c("piecepack", "pyramids", "matchsticks")` else just "piecepack".
`arrangement`	Either "single-sided" or "double-sided". Ignored if `size = "4x6"`.
`dev`	Graphics device function to use. If NULL infer a reasonable choice.
`dev.args`	Additional arguments to pass to `dev` (besides `filename`, `width`, and `height`). Will filter out any names that aren't in `formals(dev)`.
`quietly`	Whether to hide messages about missing metadata in the provided configuration.
`...`	Currently ignored.
`bleed`	If `TRUE` produce a variant print-and-play file with "bleed" zones and "crop marks" around game pieces. Currently only supports `pieces = "piecepack"` and doesn't support `size = "4x6"`.
`size_bleed`	A list with names "top", "right", "bottom", "left" containing numeric values indicating the inches "bleed" to add to the `size` of the print-and-play layout. The default NULL means no such bleed added to "letter", "A4", "A5" layouts and a small bleed added to "4x6" layouts (1/16" to top/bottom and 3/32" to left/right). NB. multiply millimeters by `0.0393700787` to convert to inches. We currently don't support an asymmetric left/right bleed combined with `arrangement = "double-sided"`.

Examples

```
# May take more than 5 seconds on CRAN servers
if (capabilities("cairo")) {
  cfg <- pp_cfg(list(invert_colors.suited=TRUE))
  cfg$description <- 'Piecepack with an "inverted" color scheme.'
  cfg$title <- '"Inverted" piecepack'
  cfg$copyright <- "\u00a9 2022 Trevor L Davis.  Some Right Reserved."
  cfg$spdx_id <- "CC-BY-4.0"
  cfg$credit <- ""

  file <- tempfile("my_pnp_file", fileext = ".pdf")
  file_ds <- tempfile("my_pnp_file_ds", fileext = ".pdf")
  file_a4 <- tempfile("my_pnp_file_a4", fileext = ".pdf")
  file_a5 <- tempfile("my_pnp_file_a5", fileext = ".pdf")
```

```
  save_print_and_play(cfg, file)
  save_print_and_play(cfg, file_ds, arrangement="double-sided")
  save_print_and_play(cfg, file_a4, size="A4", pieces="all")
  save_print_and_play(cfg, file_a5, size="A5")
}
```

---

scale_x_piece   *ggplot2 game diagram scales*

Description

scale_x_piece() and scale_y_piece() are wrappers around `ggplot2::scale_x_continuous()` and `ggplot2::scale_y_continuous()` with "better" defaults for board game diagrams. label_letter() labels breaks with letters and label_counting() labels breaks with positive integers to more easily generate (i.e. chess) algebraic notation coordinates. breaks_counting() generates breaks of just the positive integers within the limits.

Usage

```
scale_x_piece(
  ...,
  name = NULL,
  breaks = breaks_counting(),
  minor_breaks = NULL,
  labels = label_letter()
)

scale_y_piece(
  ...,
  name = NULL,
  breaks = breaks_counting(),
  minor_breaks = NULL,
  labels = label_counting()
)

label_letter()

label_counting()

breaks_counting()
```

Arguments

...	Passed to `ggplot2::scale_x_continuous()` or `ggplot2::scale_y_continuous()`.
name	The name of the scale. Used as the axis or legend title. If waiver(), the default, the name of the scale is taken from the first mapping used for that aesthetic. If NULL, the legend title will be omitted.

breaks   One of:

          • NULL for no breaks

          • waiver() for the default breaks computed by the transformation object

          • A numeric vector of positions

          • A function that takes the limits as input and returns breaks as output (e.g.,
            a function returned by scales::extended_breaks()). Note that for po-
            sition scales, limits are provided after scale expansion. Also accepts rlang
            lambda function notation.

minor_breaks   One of:

          • NULL for no minor breaks

          • waiver() for the default breaks (one minor break between each major
            break)

          • A numeric vector of positions

          • A function that given the limits returns a vector of minor breaks. Also
            accepts rlang lambda function notation. When the function has two argu-
            ments, it will be given the limits and major breaks.

labels   One of:

          • NULL for no labels

          • waiver() for the default labels computed by the transformation object

          • A character vector giving labels (must be same length as breaks)

          • An expression vector (must be the same length as breaks). See ?plotmath
            for details.

          • A function that takes the breaks as input and returns labels as output. Also
            accepts rlang lambda function notation.

Value

scale_x_piece() and scale_y_piece() return ggplot2 scale objects. label_letter() and label_counting()
return functions suitable for use with the labels scale argument. breaks_counting() returns a
function suitable for use with the breaks scale argument.

Examples

```
if (require("ggplot2", quietly = TRUE) && require("tibble", quietly = TRUE)) {
  envir <- game_systems("sans")
  df_board <- tibble(piece_side = "board_face", suit = 3, rank = 8,
                x = 4.5, y = 4.5)
  df_w <- tibble(piece_side = "bit_face", suit = 6, rank = 1,
                x = rep(1:8, 2), y = rep(1:2, each=8))
  df_b <- tibble(piece_side = "bit_face", suit = 1, rank = 1,
                x = rep(1:8, 2), y = rep(7:8, each=8))
  df <- rbind(df_board, df_w, df_b)

  # `cfg` must be a character vector for `geom_piece()`
  ggplot(df, aes_piece(df)) +
      geom_piece(cfg = "checkers1", envir = envir) +
      coord_fixed() +
```

```
        scale_x_piece() +
        scale_y_piece() +
        theme_minimal(28) +
        theme(panel.grid = element_blank())
    }
```

spdx_license_list   *SPDX License List data*

Description

spdx_license_list is a data frame of SPDX License List data.

Usage

```
spdx_license_list
```

Format

a data frame with eight variables:

id SPDX Identifier.

name Full name of license. For Creative Commons licenses these have been tweaked from the SPDX version to more closely match the full name used by Creative Commons Foundation.

url URL for copy of license located at spdx.org

fsf Is this license considered Free/Libre by the FSF?

osi Is this license OSI approved?

deprecated Has this SPDFX Identifier been deprecated by SPDX?

badge Filename of appropriate "button mark" badge (if any) located in system.file("extdata/badges", package = "piecepackr").

url_alt Alternative URL for license. Manually created for a subset of Creative Commons licenses. Others taken from https://github.com/sindresorhus/spdx-license-list.

See Also

See https://spdx.org/licenses/ for more information.

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