

# Package ‘ggalluvial’

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**Type** Package

**Title** Alluvial Plots in 'ggplot2'

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**Maintainer** Jason Cory Brunson <cornelioid@gmail.com>

**Description** Alluvial plots use variable-width ribbons and stacked bar plots to represent multi-dimensional or repeated-measures data with categorical or ordinal variables; see Riehmman, Hanfler, and Froehlich (2005) <doi:10.1109/INFVIS.2005.1532152> and Rosvall and Bergstrom (2010) <doi:10.1371/journal.pone.0008694>. Alluvial plots are statistical graphics in the sense of Wilkinson (2006) <doi:10.1007/0-387-28695-0>; they share elements with Sankey diagrams and parallel sets plots but are uniquely determined from the data and a small set of parameters. This package extends Wickham's (2010) <doi:10.1198/jcgs.2009.07098> layered grammar of graphics to generate alluvial plots from tidy data.

**Depends** R (>= 3.5), ggplot2 (>= 2.2)

**Imports** stats, dplyr (>= 0.7), tidyr (>= 0.7), lazyeval, rlang, tidyselect

**Suggests** grid, alluvial, testthat, knitr, rmarkdown, babynames, sessioninfo, ggrepel, shiny (>= 1.4.0.2), htmltools, sp (>= 1.4-0), ggfittext (>= 0.6), vdiff (>= 0.2)

**License** GPL-3

**LazyData** true

**URL** <http://corybrunson.github.io/ggalluvial/>

**BugReports** <https://github.com/corybrunson/ggalluvial/issues>

**VignetteBuilder** knitr

**RoxygenNote** 7.1.1

**NeedsCompilation** no

**Author** Jason Cory Brunson [aut, cre],  
Quentin D. Read [aut]

**Repository** CRAN

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alluvial-data	<i>Check for alluvial structure and convert between alluvial formats</i>
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### Description

Alluvial plots consist of multiple horizontally-distributed columns (axes) representing factor variables, vertical divisions (strata) of these axes representing these variables' values; and splines (alluvial flows) connecting vertical subdivisions (lodes) within strata of adjacent axes representing subsets or amounts of observations that take the corresponding values of the corresponding variables. This function checks a data frame for either of two types of alluvial structure:

### Usage

```
is_lodes_form(
  data,
  key,
  value,
  id,
  weight = NULL,
  site = NULL,
  logical = TRUE,
  silent = FALSE
)
```

```
is_alluvia_form(
  data,
  ...,
```

```

    axes = NULL,
    weight = NULL,
    logical = TRUE,
    silent = FALSE
  )

  to_lodes_form(
    data,
    ...,
    axes = NULL,
    key = "x",
    value = "stratum",
    id = "alluvium",
    diffuse = FALSE,
    discern = FALSE
  )

  to_alluvia_form(data, key, value, id, distill = FALSE)

```

### Arguments

<code>data</code>	A data frame.
<code>key, value, id</code>	In <code>to_lodes_form</code> , handled as in <code>tidyr::gather()</code> and used to name the new axis (key), stratum (value), and alluvium (identifying) variables. In <code>to_alluvia_form</code> , handled as in <code>tidyr::spread()</code> and used to identify the fields of data to be used as the axis (key), stratum (value), and alluvium (identifying) variables.
<code>weight</code>	Optional field of data, handled using <code>rlang::enquo()</code> , to be used as heights or depths of the alluvia or lodes.
<code>site</code>	Optional vector of fields of data, handled using <code>rlang::enquos()</code> , to be used to group rows before testing for duplicate and missing id-axis pairings. Variables intended for faceting should be passed to <code>site</code> .
<code>logical</code>	Defunct. Whether to return a logical value or a character string indicating the type of alluvial structure ("none", "lodes", or "alluvia").
<code>silent</code>	Whether to print messages.
<code>...</code>	Used in <code>is_alluvia_form</code> and <code>to_lodes_form</code> as in <code>dplyr::select()</code> to determine axis variables, as an alternative to <code>axes</code> . Ignored when <code>axes</code> is provided.
<code>axes</code>	In <code>*_alluvia_form</code> , handled as in <code>dplyr::select()</code> and used to identify the field(s) of data to be used as axes.
<code>diffuse</code>	Fields of data, handled using <code>tidyselect::vars_select()</code> , to merge into the reshape data by id. They must be a subset of the axis variables. Alternatively, a logical value indicating whether to merge all (TRUE) or none (FALSE) of the axis variables.
<code>discern</code>	Logical value indicating whether to suffix values of the variables used as axes that appear at more than one variable in order to distinguish their factor levels. This forces the levels of the combined factor variable value to be in the order of the axes.

`distill` A logical value indicating whether to include variables, other than those passed to `key` and `value`, that vary within values of `id`. Alternatively, a function (or its name) to be used to distill each such variable to a single value. In addition to existing functions, `distill` accepts the character values `"first"` (used if `distill` is `TRUE`), `"last"`, and `"most"` (which returns the first modal value).

## Details

- One row per **lode**, wherein each row encodes a subset or amount of observations having a specific profile of axis values, a key field encodes the axis, a value field encodes the value within each axis, and a `id` column identifies multiple lodes corresponding to the same subset or amount of observations. `is_lodes_form` tests for this structure.
- One row per **alluvium**, wherein each row encodes a subset or amount of observations having a specific profile of axis values and a set axes of fields encodes its values at each axis variable. `is_alluvia_form` tests for this structure.

`to_lodes_form` takes a data frame with several designated variables to be used as axes in an alluvial plot, and reshapes the data frame so that the axis variable names constitute a new factor variable and their values comprise another. Other variables' values will be repeated, and a row-grouping variable can be introduced. This function invokes `tidyr::gather()`.

`to_alluvia_form` takes a data frame with axis and axis value variables to be used in an alluvial plot, and reshape the data frame so that the axes constitute separate variables whose values are given by the value variable. This function invokes `tidyr::spread()`.

## See Also

Other alluvial data manipulation: [self-adjoin](#)

## Examples

```
# Titanic data in alluvia format
titanic_alluvia <- as.data.frame(Titanic)
head(titanic_alluvia)
is_alluvia_form(titanic_alluvia,
                weight = "Freq")
# Titanic data in lodes format
titanic_lodes <- to_lodes_form(titanic_alluvia,
                              key = "x", value = "stratum", id = "alluvium",
                              axes = 1:4)
head(titanic_lodes)
is_lodes_form(titanic_lodes,
              key = "x", value = "stratum", id = "alluvium",
              weight = "Freq")
# again in lodes format, this time diffusing the `Class` variable
titanic_lodes2 <- to_lodes_form(titanic_alluvia,
                               key = variable, value = value,
                               id = cohort,
                               1:3, diffuse = Class)
head(titanic_lodes2)
is_lodes_form(titanic_lodes2,
              key = variable, value = value, id = cohort,
```

```

      weight = Freq)
# use `site` to separate data before lode testing
is_lodes_form(titanic_lodes2,
              key = variable, value = value, id = Class,
              weight = Freq)
is_lodes_form(titanic_lodes2,
              key = variable, value = value, id = Class,
              weight = Freq, site = cohort)

# curriculum data in lodes format
data(majors)
head(majors)
is_lodes_form(majors,
              key = "semester", value = "curriculum", id = "student")
# curriculum data in alluvia format
majors_alluvia <- to_alluvia_form(majors,
                                 key = "semester", value = "curriculum",
                                 id = "student")

head(majors_alluvia)
is_alluvia_form(majors_alluvia, tidyselect::starts_with("CURR"))

# distill variables that vary within `id` values
set.seed(1)
majors$hypo_grade <- LETTERS[sample(5, size = nrow(majors), replace = TRUE)]
majors_alluvia2 <- to_alluvia_form(majors,
                                  key = "semester", value = "curriculum",
                                  id = "student",
                                  distill = "most")

head(majors_alluvia2)

# options to distinguish strata at different axes
gg <- ggplot(majors_alluvia,
             aes(axis1 = CURR1, axis2 = CURR7, axis3 = CURR13))
gg +
  geom_alluvium(aes(fill = as.factor(student)), width = 2/5, discern = TRUE) +
  geom_stratum(width = 2/5, discern = TRUE) +
  geom_text(stat = "stratum", discern = TRUE, aes(label = after_stat(stratum)))
gg +
  geom_alluvium(aes(fill = as.factor(student)), width = 2/5, discern = FALSE) +
  geom_stratum(width = 2/5, discern = FALSE) +
  geom_text(stat = "stratum", discern = FALSE, aes(label = after_stat(stratum)))
# warning when inappropriate
ggplot(majors[majors$semester %in% paste0("CURR", c(1, 7, 13)), ],
       aes(x = semester, stratum = curriculum, alluvium = student,
           label = curriculum)) +
  geom_alluvium(aes(fill = as.factor(student)), width = 2/5, discern = TRUE) +
  geom_stratum(width = 2/5, discern = TRUE) +
  geom_text(stat = "stratum", discern = TRUE)

```

## Description

geom\_alluvium receives a dataset of the horizontal (x) and vertical (y, ymin, ymax) positions of the **lodes** of an alluvial plot, the intersections of the alluvia with the strata. It plots both the lodes themselves, using `geom_lode()`, and the flows between them, using `geom_flow()`.

## Usage

```
geom_alluvium(
  mapping = NULL,
  data = NULL,
  stat = "alluvium",
  position = "identity",
  width = 1/3,
  knot.pos = 1/4,
  knot.prop = TRUE,
  curve_type = NULL,
  curve_range = NULL,
  segments = NULL,
  na.rm = FALSE,
  show.legend = NA,
  inherit.aes = TRUE,
  ...
)
```

## Arguments

mapping	Set of aesthetic mappings created by <code>aes()</code> or <code>aes_()</code> . If specified and <code>inherit.aes = TRUE</code> (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 <code>NULL</code> , the default, the data is inherited from the plot data as specified in the call to <code>ggplot()</code> . A <code>data.frame</code> , or other object, will override the plot data. All objects will be fortified to produce a data frame. See <code>fortify()</code> for which variables will be created. A function will be called with a single argument, the plot data. The return value must be a <code>data.frame</code> , and will be used as the layer data. A function can be created from a formula (e.g. <code>~ head(.x, 10)</code> ).
stat	The statistical transformation to use on the data; override the default.
position	Position adjustment, either as a string, or the result of a call to a position adjustment function.
width	Numeric; the width of each stratum, as a proportion of the distance between axes. Defaults to 1/3.
knot.pos	The horizontal distance of x-spline knots from each stratum ( <code>width/2</code> from its axis), either (if <code>knot.prop = TRUE</code> , the default) as a proportion of the length of the x-spline, i.e. of the gap between adjacent strata, or (if <code>knot.prop = FALSE</code> ) on the scale of the x direction.

knot.prop	Logical; whether to interpret knot.pos as a proportion of the length of each flow (the default), rather than on the x scale.
curve_type	Character; the type of curve used to produce flows. Defaults to "xspline" and can be alternatively set to one of "linear", "cubic", "quintic", "sine", "arctangent", and "sigmoid". "xspline" produces approximation splines using 4 points per curve; the alternatives produce interpolation splines between points along the graphs of functions of the associated type. See the <b>Curves</b> section.
curve_range	For alternative curve_types based on asymptotic functions, the value along the asymptote at which to truncate the function to obtain the shape that will be scaled to fit between strata. See the <b>Curves</b> section.
segments	The number of segments to be used in drawing each alternative curve (each curved boundary of each flow). If less than 3, will be silently changed to 3.
na.rm	Logical: if FALSE, the default, NA lodes are not included; if TRUE, NA lodes constitute a separate category, plotted in grey (regardless of the color scheme).
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. <code>borders()</code> .
...	Additional arguments passed to <code>ggplot2::layer()</code> .

## Aesthetics

geom\_alluvium, geom\_flow, geom\_lode, and geom\_stratum understand the following aesthetics (required aesthetics are in bold):

- x
- y
- ymin
- ymax
- alpha
- colour
- fill
- linetype
- size
- group

group is used internally; arguments are ignored.

## Curves

By default, `geom_alluvium()` and `geom_flow()` render flows between nodes as filled regions between parallel x-splines. These graphical elements, generated using `grid::xsplineGrob()`, are parameterized by the relative location of the knot (`knot.pos`). They are quick to render and clear to read, but users may prefer plots that use differently-shaped ribbons.

A variety of such options are documented at, e.g., [this easing functions cheat sheet](#) and [this blog post by Jeffrey Shaffer](#). Easing functions are not (yet) used in `ggalluvial`, but several alternative curves are available. Each is encoded as a continuous, increasing, bijective function from the unit interval  $[0, 1]$  to itself, and each is rescaled so that its endpoints meet the corresponding nodes. They are rendered piecewise-linearly, by default using `segments = 48`. Summon each curve type by passing one of the following strings to `curve_type`:

- "linear":  $f(x) = x$ , the unique degree-1 polynomial that takes 0 to 0 and 1 to 1
- "cubic":  $f(x) = 3x^2 - 2x^3$ , the unique degree-3 polynomial that also is flat at both endpoints
- "quintic":  $f(x) = 10x^3 - 15x^4 + 6x^5$ , the unique degree-5 polynomial that also has zero curvature at both endpoints
- "sine": the unique sinusoidal function that is flat at both endpoints
- "arctangent": the inverse tangent function, scaled and re-centered to the unit interval from the interval centered at zero with radius `curve_range`
- "sigmoid": the sigmoid function, scaled and re-centered to the unit interval from the interval centered at zero with radius `curve_range`

Only the (default) "xspline" option uses the `knot.*` parameters, while only the alternative curves use the `segments` parameter, and only "arctangent" and "sigmoid" use the `curve_range` parameter. (Both are ignored if not needed.) Larger values of `curve_range` result in greater compression and steeper slopes. The NULL default will be changed to  $2 + \sqrt{3}$  for "arctangent" and to 6 for "sigmoid".

These package-specific options set global values for `curve_type`, `curve_range`, and `segments` that will be defaulted to when not manually set:

- `ggalluvial.curve_type`: defaults to "xspline".
- `ggalluvial.curve_range`: defaults to NA, which triggers the curve-specific default values.
- `ggalluvial.segments`: defaults to 48L.

See `base::options()` for how to use options.

## Defunct parameters

The previously defunct parameters `axis_width` and `ribbon_bend` have been discontinued. Use `width` and `knot.pos` instead.

## See Also

`ggplot2::layer()` for additional arguments and `stat_alluvium()` and `stat_flow()` for the corresponding stats.

Other alluvial geom layers: `geom_flow()`, `geom_lode()`, `geom_stratum()`

**Examples**

```

# basic
ggplot(as.data.frame(Titanic),
       aes(y = Freq,
           axis1 = Class, axis2 = Sex, axis3 = Age,
           fill = Survived)) +
  geom_alluvium() +
  scale_x_discrete(limits = c("Class", "Sex", "Age"))

gg <- ggplot(alluvial::Refugees,
             aes(y = refugees, x = year, alluvium = country))
# time series bump chart (quintic flows)
gg + geom_alluvium(aes(fill = country, colour = country),
                  width = 1/4, alpha = 2/3, decreasing = FALSE,
                  curve_type = "sigmoid")
# time series line plot of refugees data, sorted by country
gg + geom_alluvium(aes(fill = country, colour = country),
                  decreasing = NA, width = 0, knot.pos = 0)

# irregular spacing between axes of a continuous variable
refugees_sub <- subset(alluvial::Refugees, year %in% c(2003, 2005, 2010, 2013))
gg <- ggplot(data = refugees_sub,
             aes(x = year, y = refugees, alluvium = country)) +
  theme_bw() +
  scale_fill_brewer(type = "qual", palette = "Set3")
# proportional knot positioning (default)
gg +
  geom_alluvium(aes(fill = country),
               alpha = .75, decreasing = FALSE, width = 1/2) +
  geom_stratum(aes(stratum = country), decreasing = FALSE, width = 1/2)
# constant knot positioning
gg +
  geom_alluvium(aes(fill = country),
               alpha = .75, decreasing = FALSE, width = 1/2,
               knot.pos = 1, knot.prop = FALSE) +
  geom_stratum(aes(stratum = country), decreasing = FALSE, width = 1/2)
# coarsely-segmented curves
gg +
  geom_alluvium(aes(fill = country),
               alpha = .75, decreasing = FALSE, width = 1/2,
               curve_type = "arctan", segments = 6) +
  geom_stratum(aes(stratum = country), decreasing = FALSE, width = 1/2)
# custom-ranged curves
gg +
  geom_alluvium(aes(fill = country),
               alpha = .75, decreasing = FALSE, width = 1/2,
               curve_type = "arctan", curve_range = 1) +
  geom_stratum(aes(stratum = country), decreasing = FALSE, width = 1/2)

```

## Description

geom\_flow receives a dataset of the horizontal (x) and vertical (y, ymin, ymax) positions of the **lodes** of an alluvial plot, the intersections of the alluvia with the strata. It reconfigures these into alluvial segments connecting pairs of corresponding lodes in adjacent strata and plots filled x-splines between each such pair, using a provided knot position parameter knot.pos, and filled rectangles at either end, using a provided width.

## Usage

```
geom_flow(
  mapping = NULL,
  data = NULL,
  stat = "flow",
  position = "identity",
  width = 1/3,
  knot.pos = 1/4,
  knot.prop = TRUE,
  curve_type = NULL,
  curve_range = NULL,
  segments = NULL,
  aes.flow = "forward",
  na.rm = FALSE,
  show.legend = NA,
  inherit.aes = TRUE,
  ...
)
```

## Arguments

mapping	Set of aesthetic mappings created by <a href="#">aes()</a> or <a href="#">aes_()</a> . 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 <a href="#">ggplot()</a> . A data.frame, or other object, will override the plot data. All objects will be fortified to produce a data frame. See <a href="#">fortify()</a> 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. <code>~ head(.x, 10)</code> ).
stat	The statistical transformation to use on the data; override the default.
position	Position adjustment, either as a string, or the result of a call to a position adjustment function.
width	Numeric; the width of each stratum, as a proportion of the distance between axes. Defaults to 1/3.

knot.pos	The horizontal distance of x-spline knots from each stratum (width/2 from its axis), either (if knot.prop = TRUE, the default) as a proportion of the length of the x-spline, i.e. of the gap between adjacent strata, or (if knot.prop = FALSE) on the scale of the x direction.
knot.prop	Logical; whether to interpret knot.pos as a proportion of the length of each flow (the default), rather than on the x scale.
curve_type	Character; the type of curve used to produce flows. Defaults to "xspline" and can be alternatively set to one of "linear", "cubic", "quintic", "sine", "arctangent", and "sigmoid". "xspline" produces approximation splines using 4 points per curve; the alternatives produce interpolation splines between points along the graphs of functions of the associated type. See the <b>Curves</b> section.
curve_range	For alternative curve_types based on asymptotic functions, the value along the asymptote at which to truncate the function to obtain the shape that will be scaled to fit between strata. See the <b>Curves</b> section.
segments	The number of segments to be used in drawing each alternative curve (each curved boundary of each flow). If less than 3, will be silently changed to 3.
aes.flow	Character; how inter-lode flows assume aesthetics from lodes. Options are "forward" and "backward".
na.rm	Logical: if FALSE, the default, NA lodes are not included; if TRUE, NA lodes constitute a separate category, plotted in grey (regardless of the color scheme).
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. <code>borders()</code> .
...	Additional arguments passed to <code>ggplot2::layer()</code> .

### Aesthetics

`geom_alluvium`, `geom_flow`, `geom_lode`, and `geom_stratum` understand the following aesthetics (required aesthetics are in bold):

- x
- y
- ymin
- ymax
- alpha
- colour
- fill
- linetype
- size
- group

group is used internally; arguments are ignored.

## Curves

By default, `geom_alluvium()` and `geom_flow()` render flows between nodes as filled regions between parallel x-splines. These graphical elements, generated using `grid::xsplineGrob()`, are parameterized by the relative location of the knot (`knot.pos`). They are quick to render and clear to read, but users may prefer plots that use differently-shaped ribbons.

A variety of such options are documented at, e.g., [this easing functions cheat sheet](#) and [this blog post by Jeffrey Shaffer](#). Easing functions are not (yet) used in `ggalluvial`, but several alternative curves are available. Each is encoded as a continuous, increasing, bijective function from the unit interval  $[0, 1]$  to itself, and each is rescaled so that its endpoints meet the corresponding nodes. They are rendered piecewise-linearly, by default using `segments = 48`. Summon each curve type by passing one of the following strings to `curve_type`:

- "linear":  $f(x) = x$ , the unique degree-1 polynomial that takes 0 to 0 and 1 to 1
- "cubic":  $f(x) = 3x^2 - 2x^3$ , the unique degree-3 polynomial that also is flat at both endpoints
- "quintic":  $f(x) = 10x^3 - 15x^4 + 6x^5$ , the unique degree-5 polynomial that also has zero curvature at both endpoints
- "sine": the unique sinusoidal function that is flat at both endpoints
- "arctangent": the inverse tangent function, scaled and re-centered to the unit interval from the interval centered at zero with radius `curve_range`
- "sigmoid": the sigmoid function, scaled and re-centered to the unit interval from the interval centered at zero with radius `curve_range`

Only the (default) "xspline" option uses the `knot.*` parameters, while only the alternative curves use the `segments` parameter, and only "arctangent" and "sigmoid" use the `curve_range` parameter. (Both are ignored if not needed.) Larger values of `curve_range` result in greater compression and steeper slopes. The NULL default will be changed to  $2 + \sqrt{3}$  for "arctangent" and to 6 for "sigmoid".

These package-specific options set global values for `curve_type`, `curve_range`, and `segments` that will be defaulted to when not manually set:

- `ggalluvial.curve_type`: defaults to "xspline".
- `ggalluvial.curve_range`: defaults to NA, which triggers the curve-specific default values.
- `ggalluvial.segments`: defaults to 48L.

See `base::options()` for how to use options.

## Defunct parameters

The previously defunct parameters `axis_width` and `ribbon_bend` have been discontinued. Use `width` and `knot.pos` instead.

## See Also

`ggplot2::layer()` for additional arguments and `stat_alluvium()` and `stat_flow()` for the corresponding stats.

Other alluvial geom layers: `geom_alluvium()`, `geom_lode()`, `geom_stratum()`

**Examples**

```

# use of strata and labels
ggplot(as.data.frame(Titanic),
       aes(y = Freq,
           axis1 = Class, axis2 = Sex, axis3 = Age)) +
  geom_flow() +
  scale_x_discrete(limits = c("Class", "Sex", "Age")) +
  geom_stratum() +
  geom_text(stat = "stratum", aes(label = after_stat(stratum))) +
  ggtitle("Alluvial plot of Titanic passenger demographic data")

# use of facets, with sigmoid flows
ggplot(as.data.frame(Titanic),
       aes(y = Freq,
           axis1 = Class, axis2 = Sex)) +
  geom_flow(aes(fill = Age), width = .4, curve_type = "quintic") +
  geom_stratum(width = .4) +
  geom_text(stat = "stratum", aes(label = after_stat(stratum)), size = 3) +
  scale_x_discrete(limits = c("Class", "Sex")) +
  facet_wrap(~ Survived, scales = "fixed")

# time series alluvia of WorldPhones data
wph <- as.data.frame(as.table(WorldPhones))
names(wph) <- c("Year", "Region", "Telephones")
ggplot(wph,
       aes(x = Year, alluvium = Region, y = Telephones)) +
  geom_flow(aes(fill = Region, colour = Region), width = 0)
# treat 'Year' as a number rather than as a factor
wph$Year <- as.integer(as.character(wph$Year))
ggplot(wph,
       aes(x = Year, alluvium = Region, y = Telephones)) +
  geom_flow(aes(fill = Region, colour = Region), width = 0)
# hold the knot positions fixed
ggplot(wph,
       aes(x = Year, alluvium = Region, y = Telephones)) +
  geom_flow(aes(fill = Region, colour = Region), width = 0, knot.prop = FALSE)

# rightward flow aesthetics for vaccine survey data, with cubic flows
data(vaccinations)
vaccinations$response <- factor(vaccinations$response,
                               rev(levels(vaccinations$response)))
# annotate with proportional counts
ggplot(vaccinations,
       aes(x = survey, stratum = response, alluvium = subject,
           y = freq, fill = response)) +
  geom_lode() + geom_flow(curve_type = "cubic") +
  geom_stratum(alpha = 0) +
  geom_text(stat = "stratum", aes(label = round(after_stat(prop), 3)))
# annotate fixed-width ribbons with counts
ggplot(vaccinations,
       aes(x = survey, stratum = response, alluvium = subject,
           weight = freq, fill = response)) +

```

```
geom_lode() + geom_flow(curve_type = "cubic") +
geom_stratum(alpha = 0) +
geom_text(stat = "flow",
          aes(label = after_stat(n),
              hjust = (after_stat(flow) == "to"))))
```

---

geom\_lode

*Lodes at intersections of alluvia and strata*


---

## Description

geom\_alluvium receives a dataset of the horizontal (x) and vertical (y, ymin, ymax) positions of the **lodes** of an alluvial plot, the intersections of the alluvia with the strata. It plots rectangles for these lodes of a provided width.

## Usage

```
geom_lode(
  mapping = NULL,
  data = NULL,
  stat = "alluvium",
  position = "identity",
  width = 1/3,
  na.rm = FALSE,
  show.legend = NA,
  inherit.aes = TRUE,
  ...
)
```

## Arguments

mapping	Set of aesthetic mappings created by <code>aes()</code> or <code>aes_()</code> . If specified and <code>inherit.aes = TRUE</code> (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 <code>NULL</code> , the default, the data is inherited from the plot data as specified in the call to <code>ggplot()</code> . A <code>data.frame</code> , or other object, will override the plot data. All objects will be fortified to produce a data frame. See <code>fortify()</code> for which variables will be created. A function will be called with a single argument, the plot data. The return value must be a <code>data.frame</code> , and will be used as the layer data. A function can be created from a formula (e.g. <code>~ head(.x, 10)</code> ).
stat	The statistical transformation to use on the data; override the default.
position	Position adjustment, either as a string, or the result of a call to a position adjustment function.

width	Numeric; the width of each stratum, as a proportion of the distance between axes. Defaults to 1/3.
na.rm	Logical: if FALSE, the default, NA lodes are not included; if TRUE, NA lodes constitute a separate category, plotted in grey (regardless of the color scheme).
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. <code>borders()</code> .
...	Additional arguments passed to <code>ggplot2::layer()</code> .

### Aesthetics

`geom_alluvium`, `geom_flow`, `geom_lode`, and `geom_stratum` understand the following aesthetics (required aesthetics are in bold):

- x
- y
- ymin
- ymax
- alpha
- colour
- fill
- linetype
- size
- group

group is used internally; arguments are ignored.

### Defunct parameters

The previously defunct parameters `axis_width` and `ribbon_bend` have been discontinued. Use `width` and `knot.pos` instead.

### See Also

`ggplot2::layer()` for additional arguments and `stat_alluvium()` and `stat_stratum()` for the corresponding stats.

Other alluvial geom layers: `geom_alluvium()`, `geom_flow()`, `geom_stratum()`

## Examples

```
# one axis
ggplot(as.data.frame(Titanic),
       aes(y = Freq,
           axis = Class)) +
  geom_lode(aes(fill = Class, alpha = Survived)) +
  scale_x_discrete(limits = c("Class")) +
  scale_alpha_manual(values = c(.25, .75))

gg <- ggplot(as.data.frame(Titanic),
            aes(y = Freq,
                axis1 = Class, axis2 = Sex, axis3 = Age,
                fill = Survived))
# alluvia and lodes
gg + geom_alluvium() + geom_lode()
# lodes as strata
gg + geom_alluvium() +
  geom_stratum(stat = "alluvium")
```

---

geom\_stratum

*Strata at axes*

---

## Description

geom\_stratum receives a dataset of the horizontal (x) and vertical (y, ymin, ymax) positions of the strata of an alluvial plot. It plots rectangles for these strata of a provided width.

## Usage

```
geom_stratum(
  mapping = NULL,
  data = NULL,
  stat = "stratum",
  position = "identity",
  show.legend = NA,
  inherit.aes = TRUE,
  width = 1/3,
  na.rm = FALSE,
  ...
)
```

## 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	<p>The data to be displayed in this layer. There are three options:</p> <p>If NULL, the default, the data is inherited from the plot data as specified in the call to <code>ggplot()</code>.</p> <p>A <code>data.frame</code>, or other object, will override the plot data. All objects will be fortified to produce a data frame. See <code>fortify()</code> for which variables will be created.</p> <p>A function will be called with a single argument, the plot data. The return value must be a <code>data.frame</code>, and will be used as the layer data. A function can be created from a formula (e.g. <code>~ head(.x, 10)</code>).</p>
stat	The statistical transformation to use on the data; override the default.
position	Position adjustment, either as a string, or the result of a call to a position adjustment function.
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. <code>borders()</code> .
width	Numeric; the width of each stratum, as a proportion of the distance between axes. Defaults to 1/3.
na.rm	Logical: if FALSE, the default, NA lodes are not included; if TRUE, NA lodes constitute a separate category, plotted in grey (regardless of the color scheme).
...	Additional arguments passed to <code>ggplot2::layer()</code> .

### Aesthetics

`geom_alluvium`, `geom_flow`, `geom_lode`, and `geom_stratum` understand the following aesthetics (required aesthetics are in bold):

- x
- y
- ymin
- ymax
- alpha
- colour
- fill
- linetype
- size
- group

group is used internally; arguments are ignored.

### Defunct parameters

The previously defunct parameters `axis_width` and `ribbon_bend` have been discontinued. Use `width` and `knot.pos` instead.

**See Also**

[ggplot2::layer\(\)](#) for additional arguments and [stat\\_stratum\(\)](#) for the corresponding stat.

Other alluvial geom layers: [geom\\_alluvium\(\)](#), [geom\\_flow\(\)](#), [geom\\_lode\(\)](#)

**Examples**

```
# full axis width
ggplot(as.data.frame(Titanic),
       aes(y = Freq,
           axis1 = Class, axis2 = Sex, axis3 = Age, axis4 = Survived)) +
  geom_stratum(width = 1) +
  geom_text(stat = "stratum", aes(label = after_stat(stratum))) +
  scale_x_discrete(limits = c("Class", "Sex", "Age", "Survived"))

# use of facets
ggplot(as.data.frame(Titanic),
       aes(y = Freq,
           axis1 = Class, axis2 = Sex)) +
  geom_flow(aes(fill = Survived)) +
  geom_stratum() +
  geom_text(stat = "stratum", aes(label = after_stat(stratum))) +
  scale_x_discrete(limits = c("Class", "Sex")) +
  facet_wrap(~ Age, scales = "free_y")
```

---

lode-guidance-functions

*Lode guidance functions*

---

**Description**

These functions control the order of lodes within strata in an alluvial diagram. They are invoked by [stat\\_alluvium\(\)](#) and can be passed to the `lode.guidance` parameter.

**Usage**

```
lode_zigzag(n, i)
lode_zagzig(n, i)
lode_forward(n, i)
lode_rightward(n, i)
lode_backward(n, i)
lode_leftward(n, i)
lode_frontback(n, i)
```

```
lode_rightleft(n, i)
```

```
lode_backfront(n, i)
```

```
lode_leftright(n, i)
```

### Arguments

n	Numeric, a positive integer
i	Numeric, a positive integer at most n

### Details

Each function orders the numbers 1 through n, starting at index i. The choice of function made in `stat_alluvium()` determines the order in which the other axes contribute to the sorting of lodes within each index axis. After starting at i, the functions order the remaining axes as follows:

- zigzag: Zigzag outward from i, starting in the outward direction
- zigzag: Zigzag outward from i, starting in the inward direction
- forward: Increasing order (alias rightward)
- backward: Decreasing order (alias leftward)
- frontback: Proceed forward from i to n, then backward to 1 (alias rightleft)
- backfront: Proceed backward from i to 1, then forward to n (alias leftright)

---

majors

*Students' declared majors across several semesters*

---

### Description

This data set follows the major curricula of 10 students across 8 academic semesters. Missing values indicate undeclared majors. The data were kindly contributed by Dario Bonaretti.

### Format

A data frame with 80 rows and 3 variables:

student student identifier

semester character tag for odd-numbered semesters

curriculum declared major program

self-adjoin

*Adjoin a dataset to itself***Description**

This function binds a dataset to itself along adjacent pairs of a key variable. It is invoked by [geom\\_flow\(\)](#) to convert data in lodes form to something similar to alluvia form.

**Usage**

```
self_adjoin(
  data,
  key,
  by = NULL,
  link = NULL,
  keep.x = NULL,
  keep.y = NULL,
  suffix = c(".x", ".y")
)
```

**Arguments**

data	A data frame in lodes form (repeated measures data; see <a href="#">alluvial-data</a> ).
key	Column of data indicating sequential collection; handled as in <a href="#">tidyr::spread()</a> .
by	Character vector of variables to self-adjoin by; passed to <a href="#">dplyr::mutate-joins</a> functions.
link	Character vector of variables to adjoin. Will be replaced by pairs of variables suffixed by <code>suffix</code> .
keep.x, keep.y	Character vector of variables to associate with the first (respectively, second) copy of data after adjoining. These variables can overlap with each other but cannot overlap with <code>by</code> or <code>link</code> .
suffix	Suffixes to add to the adjoined link variables; passed to <a href="#">dplyr::mutate-joins</a> functions.

**Details**

`self_adjoin` invokes [dplyr::mutate-joins](#) functions in order to convert a dataset with measures along a discrete key variable into a dataset consisting of column bindings of these measures (by any by variables) along adjacent values of key.

**See Also**

Other alluvial data manipulation: [alluvial-data](#)

**Examples**

```

# self-adjoin `majors` data
data(majors)
major_changes <- self_adjoin(majors, key = semester,
                             by = "student", link = c("semester", "curriculum"))
major_changes$change <- major_changes$curriculum.x == major_changes$curriculum.y
head(major_changes)

# self-adjoin `vaccinations` data
data(vaccinations)
vaccination_steps <- self_adjoin(vaccinations, key = survey, by = "subject",
                                 link = c("survey", "response"),
                                 keep.x = c("freq"))

head(vaccination_steps)
vaccination_steps <- self_adjoin(vaccinations, key = survey, by = "subject",
                                 link = c("survey", "response"),
                                 keep.x = c("freq"),
                                 keep.y = c("start_date", "end_date"))

head(vaccination_steps)

```

---

stat\_alluvium

*Alluvial positions*


---

**Description**

Given a dataset with alluvial structure, `stat_alluvium` calculates the centroids (x and y) and heights (ymin and ymax) of the lodes, the intersections of the alluvia with the strata. It leverages the group aesthetic for plotting purposes (for now).

**Usage**

```

stat_alluvium(
  mapping = NULL,
  data = NULL,
  geom = "alluvium",
  position = "identity",
  decreasing = NULL,
  reverse = NULL,
  absolute = NULL,
  discern = FALSE,
  negate.strata = NULL,
  aggregate.y = NULL,
  cement.alluvia = NULL,
  lode.guidance = NULL,
  lode.ordering = NULL,
  aes.bind = NULL,
  infer.label = FALSE,
  min.y = NULL,

```

```

    max.y = NULL,
    na.rm = FALSE,
    show.legend = NA,
    inherit.aes = TRUE,
    ...
  )

```

## Arguments

mapping	Set of aesthetic mappings created by <code>aes()</code> or <code>aes_()</code> . If specified and <code>inherit.aes = TRUE</code> (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 <code>NULL</code> , the default, the data is inherited from the plot data as specified in the call to <code>ggplot()</code> . A <code>data.frame</code> , or other object, will override the plot data. All objects will be fortified to produce a data frame. See <code>fortify()</code> for which variables will be created. A function will be called with a single argument, the plot data. The return value must be a <code>data.frame</code> , and will be used as the layer data. A function can be created from a formula (e.g. <code>~ head(.x, 10)</code> ).
geom	The geometric object to use display the data; override the default.
position	Position adjustment, either as a string, or the result of a call to a position adjustment function.
decreasing	Logical; whether to arrange the strata at each axis in the order of the variable values ( <code>NA</code> , the default), in ascending order of totals (largest on top, <code>FALSE</code> ), or in descending order of totals (largest on bottom, <code>TRUE</code> ).
reverse	Logical; if <code>decreasing</code> is <code>NA</code> , whether to arrange the strata at each axis in the reverse order of the variable values, so that they match the order of the values in the legend. Ignored if <code>decreasing</code> is not <code>NA</code> . Defaults to <code>TRUE</code> .
absolute	Logical; if some cases or strata are negative, whether to arrange them (respecting <code>decreasing</code> and <code>reverse</code> ) using negative or absolute values of <code>y</code> .
discern	Passed to <code>to_lodes_form()</code> if data is in alluvia format.
negate.strata	A vector of values of the <code>stratum</code> aesthetic to be treated as negative (will ignore missing values with a warning).
aggregate.y	Deprecated alias for <code>cement.alluvia</code> .
cement.alluvia	Logical value indicating whether to aggregate <code>y</code> values over equivalent alluvia before computing lode and flow positions.
lode.guidance	The function to prioritize the axis variables for ordering the lodes within each stratum, or else a character string identifying the function. Character options are "zigzag", "frontback", "backfront", "forward", and "backward" (see <a href="#">lode-guidance-functions</a> ).
lode.ordering	<b>Deprecated in favor of the order aesthetic.</b> A list (of length the number of axes) of integer vectors (each of length the number of rows of data) or <code>NULL</code> entries (indicating no imposed ordering), or else a numeric matrix of corresponding dimensions, giving the preferred ordering of alluvia at each axis. This will

be used to order the lodes within each stratum by sorting the lodes first by stratum, then by the provided vectors, and lastly by remaining factors (if the vectors contain duplicate entries and therefore do not completely determine the lode orderings).

aes.bind	At what grouping level, if any, to prioritize differentiation aesthetics when ordering the lodes within each stratum. Defaults to "none" (no aesthetic binding) with intermediate option "flows" to bind aesthetics after stratifying by axes linked to the index axis (the one adjacent axis in <code>stat_flow()</code> ; all remaining axes in <code>stat_alluvium()</code> ) and strongest option "alluvia" to bind aesthetics after stratifying by the index axis but before stratifying by linked axes (only available for <code>stat_alluvium()</code> ). Stratification by any axis is done with respect to the strata at that axis, after separating positive and negative strata, consistent with the values of decreasing, reverse, and absolute. Thus, if "none", then lode orderings will not depend on aesthetic variables. All aesthetic variables are used, in the order in which they are specified in <code>aes()</code> .
infer.label	Logical; whether to assign the stratum or alluvium variable to the label aesthetic. Defaults to FALSE, and requires that no label aesthetic is assigned. This parameter is intended for use only with data in alluvia form, which are converted to lode form before the statistical transformation. Deprecated; use <code>ggplot2::after_stat()</code> instead.
min.y	Numeric; bounds on the heights of the strata to be rendered. Use these bounds to exclude strata outside a certain range, for example when labeling strata using <code>ggplot2::geom_text()</code> .
max.y	Numeric; bounds on the heights of the strata to be rendered. Use these bounds to exclude strata outside a certain range, for example when labeling strata using <code>ggplot2::geom_text()</code> .
na.rm	Logical: if FALSE, the default, NA lodes are not included; if TRUE, NA lodes constitute a separate category, plotted in grey (regardless of the color scheme).
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. <code>borders()</code> .
...	Additional arguments passed to <code>ggplot2::layer()</code> .

## Aesthetics

`stat_alluvium`, `stat_flow`, and `stat_stratum` require one of two sets of aesthetics:

- x and at least one of alluvium and stratum
- any number of axis[0-9]\* (axis1, axis2, etc.)

Use x, alluvium, and/or stratum for data in lodes format and axis[0-9]\* for data in alluvia format (see [alluvial-data](#)). Arguments to parameters inconsistent with the format will be ignored. Additionally, each `stat_*()` accepts the following optional aesthetics:

- y
- weight
- order
- group
- label

y controls the heights of the alluvia, and may be aggregated across equivalent observations. weight applies to the computed variables (see that section below) but does not affect the positional aesthetics. order, recognized by stat\_alluvium() and stat\_flow(), is used to arrange the lodes within each stratum. It tolerates duplicates and takes precedence over the differentiation aesthetics (when aes.bind is not "none") and lode guidance with respect to the remaining axes. (It replaces the deprecated parameter lode.ordering.) group is used internally; arguments are ignored. label is used to label the strata or lodes and must take a unique value across the observations within each stratum or lode.

These and any other aesthetics are aggregated as follows: Numeric aesthetics, including y, are summed. Character and factor aesthetics, including label, are assigned to strata or lodes provided they take unique values across the observations within each (and are otherwise assigned NA).

### Computed variables

These can be used with `ggplot2::after_stat()` to **control aesthetic evaluation**.

n number of cases in lode

count cumulative weight of lode

prop weighted proportion of lode

stratum value of variable used to define strata

deposit order in which (signed) strata are deposited

lode lode label distilled from alluvia (stat\_alluvium() and stat\_flow() only)

flow direction of flow "to" or "from" from its axis (stat\_flow() only)

The numerical variables n, count, and prop are calculated after the data are grouped by x and weighted by weight (in addition to y). The integer variable deposit is used internally to sort the data before calculating heights. The character variable lode is obtained from alluvium according to distill.

### Package options

stat\_stratum, stat\_alluvium, and stat\_flow order strata and lodes according to the values of several parameters, which must be held fixed across every layer in an alluvial plot. These package-specific options set global values for these parameters that will be defaulted to when not manually set:

- ggalluvial.decreasing (each stat\_\*): defaults to NA.
- ggalluvial.reverse (each stat\_\*): defaults to TRUE.
- ggalluvial.absolute (each stat\_\*): defaults to TRUE.
- ggalluvial.cement.alluvia (stat\_alluvium): defaults to FALSE.

- `ggalluvial.lode.guidance` (`stat_alluvium`): defaults to "zigzag".
- `ggalluvial.aes.bind` (`stat_alluvium` and `stat_flow`): defaults to "none".

See `base::options()` for how to use options.

### Defunct parameters

The previously defunct parameters `weight` and `aggregate.wts` have been discontinued. Use `y` and `cement.alluvia` instead.

### See Also

`ggplot2::layer()` for additional arguments and `geom_alluvium()`, `geom_lode()`, and `geom_flow()` for the corresponding geoms.

Other alluvial stat layers: `stat_flow()`, `stat_stratum()`

### Examples

```
# illustrate positioning
ggplot(as.data.frame(Titanic),
       aes(y = Freq,
           axis1 = Class, axis2 = Sex, axis3 = Age,
           color = Survived)) +
  stat_stratum(geom = "errorbar") +
  geom_line(stat = "alluvium") +
  stat_alluvium(geom = "pointrange") +
  geom_text(stat = "stratum", aes(label = after_stat(stratum))) +
  scale_x_discrete(limits = c("Class", "Sex", "Age"))

# lode ordering examples
gg <- ggplot(as.data.frame(Titanic),
            aes(y = Freq,
                axis1 = Class, axis2 = Sex, axis3 = Age)) +
  geom_stratum() +
  geom_text(stat = "stratum", aes(label = after_stat(stratum))) +
  scale_x_discrete(limits = c("Class", "Sex", "Age"))

# use of lode controls
gg + geom_flow(aes(fill = Survived, alpha = Sex), stat = "alluvium",
              lode.guidance = "forward")

# prioritize aesthetic binding
gg + geom_flow(aes(fill = Survived, alpha = Sex), stat = "alluvium",
              aes.bind = "alluvia", lode.guidance = "forward")

# use of custom lode order
gg + geom_flow(aes(fill = Survived, alpha = Sex, order = sample(x = 32)),
              stat = "alluvium")

# use of custom lode guidance function
lode_custom <- function(n, i) {
  stopifnot(n == 3)
  switch(
    i,
    `1` = 1:3,
    `2` = c(2, 3, 1),
```

```

    `3` = 3:1
  )
}
gg + geom_flow(aes(fill = Survived, alpha = Sex), stat = "alluvium",
              aes.bind = "flow", lode.guidance = lode_custom)

# omit missing elements & reverse the `y` axis
ggplot(ggalluvial::majors,
       aes(x = semester, stratum = curriculum, alluvium = student, y = 1)) +
  geom_alluvium(fill = "darkgrey", na.rm = TRUE) +
  geom_stratum(aes(fill = curriculum), color = NA, na.rm = TRUE) +
  theme_bw() +
  scale_y_reverse()

# alluvium cementation examples
gg <- ggplot(ggalluvial::majors,
            aes(x = semester, stratum = curriculum, alluvium = student,
               fill = curriculum)) +
  geom_stratum()
# diagram with outlined alluvia and labels
gg + geom_flow(stat = "alluvium", color = "black") +
  geom_text(aes(label = after_stat(lode)), stat = "alluvium")
# cemented diagram with default distillation (first most common alluvium)
gg +
  geom_flow(stat = "alluvium", color = "black", cement.alluvia = TRUE) +
  geom_text(aes(label = after_stat(lode)), stat = "alluvium",
            cement.alluvia = TRUE)
# cemented diagram with custom label distillation
gg +
  geom_flow(stat = "alluvium", color = "black", cement.alluvia = TRUE) +
  geom_text(aes(label = after_stat(lode)), stat = "alluvium",
            cement.alluvia = TRUE,
            distill = function(x) paste(x, collapse = "; "))

## Not run:
data(babynames, package = "babynames")
# a discontinuous alluvium
bn <- subset(babynames, prop >= .01 & sex == "F" & year > 1962 & year < 1968)
ggplot(data = bn,
       aes(x = year, alluvium = name, y = prop)) +
  geom_alluvium(aes(fill = name, color = name == "Tammy"),
               decreasing = TRUE, show.legend = FALSE) +
  scale_color_manual(values = c("#00000000", "#000000"))
# filling in missing zeros
bn2 <- merge(bn,
            expand.grid(year = unique(bn$year), name = unique(bn$name)),
            all = TRUE)
bn2$prop[is.na(bn2$prop)] <- 0
ggplot(data = bn2,
       aes(x = year, alluvium = name, y = prop)) +
  geom_alluvium(aes(fill = name, color = name == "Tammy"),
               decreasing = TRUE, show.legend = FALSE) +
  scale_color_manual(values = c("#00000000", "#000000"))

```

```
## End(Not run)

# use negative y values to encode deaths versus survivals
titanic <- as.data.frame(Titanic)
titanic <- transform(titanic, Lives = Freq * (-1) ^ (Survived == "No"))
ggplot(subset(titanic, Class != "Crew"),
  aes(axis1 = Class, axis2 = Sex, axis3 = Age, y = Lives)) +
  geom_alluvium(aes(alpha = Survived, fill = Class), absolute = FALSE) +
  geom_stratum(absolute = FALSE) +
  geom_text(stat = "stratum", aes(label = after_stat(stratum)),
    absolute = FALSE) +
  scale_x_discrete(limits = c("Class", "Sex", "Age"), expand = c(.1, .05)) +
  scale_alpha_discrete(range = c(.25, .75), guide = FALSE)

# faceting with common alluvia
ggplot(titanic, aes(y = Freq, axis1 = Class, axis2 = Sex, axis3 = Age)) +
  facet_wrap(~ Survived) +
  geom_alluvium() +
  geom_stratum() +
  geom_text(stat = "stratum", aes(label = after_stat(stratum)))
ggplot(transform(alluvial::Refugees, id = 1),
  aes(y = refugees, x = year, alluvium = id)) +
  facet_wrap(~ country) +
  geom_alluvium()
```

---

stat\_flow

*Flow positions*


---

## Description

Given a dataset with alluvial structure, `stat_flow` calculates the centroids (x and y) and heights (ymin and ymax) of the flows between each pair of adjacent axes.

## Usage

```
stat_flow(
  mapping = NULL,
  data = NULL,
  geom = "flow",
  position = "identity",
  decreasing = NULL,
  reverse = NULL,
  absolute = NULL,
  discern = FALSE,
  negate.strata = NULL,
  aes.bind = NULL,
  infer.label = FALSE,
  min.y = NULL,
```

```

    max.y = NULL,
    na.rm = FALSE,
    show.legend = NA,
    inherit.aes = TRUE,
    ...
  )

```

## Arguments

mapping	Set of aesthetic mappings created by <code>aes()</code> or <code>aes_()</code> . If specified and <code>inherit.aes = TRUE</code> (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	<p>The data to be displayed in this layer. There are three options:</p> <p>If <code>NULL</code>, the default, the data is inherited from the plot data as specified in the call to <code>ggplot()</code>.</p> <p>A <code>data.frame</code>, or other object, will override the plot data. All objects will be fortified to produce a data frame. See <code>fortify()</code> for which variables will be created.</p> <p>A function will be called with a single argument, the plot data. The return value must be a <code>data.frame</code>, and will be used as the layer data. A function can be created from a formula (e.g. <code>~ head(.x, 10)</code>).</p>
geom	The geometric object to use display the data; override the default.
position	Position adjustment, either as a string, or the result of a call to a position adjustment function.
decreasing	Logical; whether to arrange the strata at each axis in the order of the variable values ( <code>NA</code> , the default), in ascending order of totals (largest on top, <code>FALSE</code> ), or in descending order of totals (largest on bottom, <code>TRUE</code> ).
reverse	Logical; if <code>decreasing</code> is <code>NA</code> , whether to arrange the strata at each axis in the reverse order of the variable values, so that they match the order of the values in the legend. Ignored if <code>decreasing</code> is not <code>NA</code> . Defaults to <code>TRUE</code> .
absolute	Logical; if some cases or strata are negative, whether to arrange them (respecting <code>decreasing</code> and <code>reverse</code> ) using negative or absolute values of <code>y</code> .
discern	Passed to <code>to_lodes_form()</code> if data is in alluvia format.
negate.strata	A vector of values of the stratum aesthetic to be treated as negative (will ignore missing values with a warning).
aes.bind	At what grouping level, if any, to prioritize differentiation aesthetics when ordering the lodes within each stratum. Defaults to "none" (no aesthetic binding) with intermediate option "flows" to bind aesthetics after stratifying by axes linked to the index axis (the one adjacent axis in <code>stat_flow()</code> ; all remaining axes in <code>stat_alluvium()</code> ) and strongest option "alluvia" to bind aesthetics after stratifying by the index axis but before stratifying by linked axes (only available for <code>stat_alluvium()</code> ). Stratification by any axis is done with respect to the strata at that axis, after separating positive and negative strata, consistent with the values of <code>decreasing</code> , <code>reverse</code> , and <code>absolute</code> . Thus, if "none", then lode orderings will not depend on aesthetic variables. All aesthetic variables are used, in the order in which they are specified in <code>aes()</code> .

<code>infer.label</code>	Logical; whether to assign the stratum or alluvium variable to the <code>label</code> aesthetic. Defaults to <code>FALSE</code> , and requires that no <code>label</code> aesthetic is assigned. This parameter is intended for use only with data in alluvia form, which are converted to lode form before the statistical transformation. Deprecated; use <code>ggplot2::after_stat()</code> instead.
<code>min.y</code>	Numeric; bounds on the heights of the strata to be rendered. Use these bounds to exclude strata outside a certain range, for example when labeling strata using <code>ggplot2::geom_text()</code> .
<code>max.y</code>	Numeric; bounds on the heights of the strata to be rendered. Use these bounds to exclude strata outside a certain range, for example when labeling strata using <code>ggplot2::geom_text()</code> .
<code>na.rm</code>	Logical: if <code>FALSE</code> , the default, NA lodes are not included; if <code>TRUE</code> , NA lodes constitute a separate category, plotted in grey (regardless of the color scheme).
<code>show.legend</code>	logical. Should this layer be included in the legends? NA, the default, includes if any aesthetics are mapped. <code>FALSE</code> never includes, and <code>TRUE</code> always includes. It can also be a named logical vector to finely select the aesthetics to display.
<code>inherit.aes</code>	If <code>FALSE</code> , 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. <code>borders()</code> .
<code>...</code>	Additional arguments passed to <code>ggplot2::layer()</code> .

## Aesthetics

`stat_alluvium`, `stat_flow`, and `stat_stratum` require one of two sets of aesthetics:

- `x` and at least one of `alluvium` and `stratum`
- any number of `axis[0-9]*` (`axis1`, `axis2`, etc.)

Use `x`, `alluvium`, and/or `stratum` for data in lodes format and `axis[0-9]*` for data in alluvia format (see [alluvial-data](#)). Arguments to parameters inconsistent with the format will be ignored. Additionally, each `stat_*()` accepts the following optional aesthetics:

- `y`
- `weight`
- `order`
- `group`
- `label`

`y` controls the heights of the alluvia, and may be aggregated across equivalent observations. `weight` applies to the computed variables (see that section below) but does not affect the positional aesthetics. `order`, recognized by `stat_alluvium()` and `stat_flow()`, is used to arrange the lodes within each stratum. It tolerates duplicates and takes precedence over the differentiation aesthetics (when `aes.bind` is not "none") and lode guidance with respect to the remaining axes. (It replaces the deprecated parameter `lode.ordering`.) `group` is used internally; arguments are ignored. `label` is used to label the strata or lodes and must take a unique value across the observations within each stratum or lode.

These and any other aesthetics are aggregated as follows: Numeric aesthetics, including `y`, are summed. Character and factor aesthetics, including `label`, are assigned to strata or lodes provided they take unique values across the observations within each (and are otherwise assigned NA).

### Computed variables

These can be used with `ggplot2::after_stat()` to control aesthetic evaluation.

`n` number of cases in lode

`count` cumulative weight of lode

`prop` weighted proportion of lode

`stratum` value of variable used to define strata

`deposit` order in which (signed) strata are deposited

`lode` lode label distilled from `alluvia` (`stat_alluvium()` and `stat_flow()` only)

`flow` direction of flow "to" or "from" from its axis (`stat_flow()` only)

The numerical variables `n`, `count`, and `prop` are calculated after the data are grouped by `x` and weighted by `weight` (in addition to `y`). The integer variable `deposit` is used internally to sort the data before calculating heights. The character variable `lode` is obtained from `alluvium` according to `distill`.

### Package options

`stat_stratum`, `stat_alluvium`, and `stat_flow` order strata and lodes according to the values of several parameters, which must be held fixed across every layer in an alluvial plot. These package-specific options set global values for these parameters that will be defaulted to when not manually set:

- `ggalluvial.decreasing` (each `stat_*`): defaults to NA.
- `ggalluvial.reverse` (each `stat_*`): defaults to TRUE.
- `ggalluvial.absolute` (each `stat_*`): defaults to TRUE.
- `ggalluvial.cement.alluvia` (`stat_alluvium`): defaults to FALSE.
- `ggalluvial.lode.guidance` (`stat_alluvium`): defaults to "zigzag".
- `ggalluvial.aes.bind` (`stat_alluvium` and `stat_flow`): defaults to "none".

See `base::options()` for how to use options.

### Defunct parameters

The previously defunct parameters `weight` and `aggregate.wts` have been discontinued. Use `y` and `cement.alluvia` instead.

### See Also

`ggplot2::layer()` for additional arguments and `geom_alluvium()` and `geom_flow()` for the corresponding geoms.

Other alluvial stat layers: `stat_alluvium()`, `stat_stratum()`

**Examples**

```

# illustrate positioning
ggplot(as.data.frame(Titanic),
       aes(y = Freq,
           axis1 = Class, axis2 = Sex, axis3 = Age,
           color = Survived)) +
  stat_stratum(geom = "errorbar") +
  geom_line(stat = "flow") +
  stat_flow(geom = "pointrange") +
  geom_text(stat = "stratum", aes(label = after_stat(stratum))) +
  scale_x_discrete(limits = c("Class", "Sex", "Age"))

# alluvium--flow comparison
data(vaccinations)
gg <- ggplot(vaccinations,
            aes(x = survey, stratum = response, alluvium = subject,
                y = freq, fill = response)) +
  geom_stratum(alpha = .5) +
  geom_text(aes(label = response), stat = "stratum")
# rightward alluvial aesthetics for vaccine survey data
gg + geom_flow(stat = "alluvium", lode.guidance = "forward")
# memoryless flows for vaccine survey data
gg + geom_flow()

# size filter examples
gg <- ggplot(vaccinations,
            aes(y = freq,
                x = survey, stratum = response, alluvium = subject,
                fill = response, label = response)) +
  stat_stratum(alpha = .5) +
  geom_text(stat = "stratum")
# omit small flows
gg + geom_flow(min.y = 50)
# omit large flows
gg + geom_flow(max.y = 100)

# negate missing entries
ggplot(vaccinations,
       aes(y = freq,
           x = survey, stratum = response, alluvium = subject,
           fill = response, label = response,
           alpha = response != "Missing")) +
  stat_stratum(negate.strata = "Missing") +
  geom_flow(negate.strata = "Missing") +
  geom_text(stat = "stratum", alpha = 1, negate.strata = "Missing") +
  scale_alpha_discrete(range = c(.2, .6)) +
  guides(alpha = FALSE)

# aesthetics that vary between and within strata
data(vaccinations)
vaccinations$subgroup <- LETTERS[1:2][rbinom(
  n = length(unique(vaccinations$subject)), size = 1, prob = .5

```

```

) + 1][vaccinations$subject]
ggplot(vaccinations,
       aes(x = survey, stratum = response, alluvium = subject,
          y = freq, fill = response, label = response)) +
  geom_flow(aes(alpha = subgroup)) +
  scale_alpha_discrete(range = c(1/3, 2/3)) +
  geom_stratum(alpha = .5) +
  geom_text(stat = "stratum")
# can even set aesthetics that vary both ways
ggplot(vaccinations,
       aes(x = survey, stratum = response, alluvium = subject,
          y = freq, label = response)) +
  geom_flow(aes(fill = interaction(response, subgroup)), aes.bind = "flows") +
  scale_alpha_discrete(range = c(1/3, 2/3)) +
  geom_stratum(alpha = .5) +
  geom_text(stat = "stratum")

```

---

stat\_stratum

*Stratum positions*


---

### Description

Given a dataset with alluvial structure, `stat_stratum` calculates the centroids (x and y) and heights (ymin and ymax) of the strata at each axis.

### Usage

```

stat_stratum(
  mapping = NULL,
  data = NULL,
  geom = "stratum",
  position = "identity",
  decreasing = NULL,
  reverse = NULL,
  absolute = NULL,
  discern = FALSE,
  distill = first,
  negate.strata = NULL,
  infer.label = FALSE,
  label.strata = NULL,
  min.y = NULL,
  max.y = NULL,
  min.height = NULL,
  max.height = NULL,
  na.rm = FALSE,
  show.legend = NA,
  inherit.aes = TRUE,
  ...
)

```

**Arguments**

mapping	Set of aesthetic mappings created by <code>aes()</code> or <code>aes_()</code> . If specified and <code>inherit.aes = TRUE</code> (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 <code>NULL</code> , the default, the data is inherited from the plot data as specified in the call to <code>ggplot()</code> . A <code>data.frame</code> , or other object, will override the plot data. All objects will be fortified to produce a data frame. See <code>fortify()</code> for which variables will be created. A function will be called with a single argument, the plot data. The return value must be a <code>data.frame</code> , and will be used as the layer data. A function can be created from a formula (e.g. <code>~ head(.x, 10)</code> ).
geom	The geometric object to use display the data; override the default.
position	Position adjustment, either as a string, or the result of a call to a position adjustment function.
decreasing	Logical; whether to arrange the strata at each axis in the order of the variable values ( <code>NA</code> , the default), in ascending order of totals (largest on top, <code>FALSE</code> ), or in descending order of totals (largest on bottom, <code>TRUE</code> ).
reverse	Logical; if <code>decreasing</code> is <code>NA</code> , whether to arrange the strata at each axis in the reverse order of the variable values, so that they match the order of the values in the legend. Ignored if <code>decreasing</code> is not <code>NA</code> . Defaults to <code>TRUE</code> .
absolute	Logical; if some cases or strata are negative, whether to arrange them (respecting <code>decreasing</code> and <code>reverse</code> ) using negative or absolute values of <code>y</code> .
discern	Passed to <code>to_lodes_form()</code> if data is in alluvia format.
distill	A function (or its name) to be used to distill alluvium values to a single lode label, accessible via <code>ggplot2::after_stat()</code> (similar to its behavior in <code>to_alluvia_form()</code> ). In addition to existing functions, accepts the character values "first" (the default), "last", and "most" (which returns the first modal value).
negate.strata	A vector of values of the <code>stratum</code> aesthetic to be treated as negative (will ignore missing values with a warning).
infer.label	Logical; whether to assign the <code>stratum</code> or <code>alluvium</code> variable to the <code>label</code> aesthetic. Defaults to <code>FALSE</code> , and requires that no <code>label</code> aesthetic is assigned. This parameter is intended for use only with data in alluvia form, which are converted to lode form before the statistical transformation. Deprecated; use <code>ggplot2::after_stat()</code> instead.
label.strata	Defunct; alias for <code>infer.label</code> .
min.y, max.y	Numeric; bounds on the heights of the strata to be rendered. Use these bounds to exclude strata outside a certain range, for example when labeling strata using <code>ggplot2::geom_text()</code> .
min.height, max.height	Deprecated aliases for <code>min.y</code> and <code>max.y</code> .
na.rm	Logical: if <code>FALSE</code> , the default, <code>NA</code> lodes are not included; if <code>TRUE</code> , <code>NA</code> lodes constitute a separate category, plotted in grey (regardless of the color scheme).

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. <code>borders()</code> .
...	Additional arguments passed to <code>ggplot2::layer()</code> .

## Aesthetics

stat\_alluvium, stat\_flow, and stat\_stratum require one of two sets of aesthetics:

- x and at least one of alluvium and stratum
- any number of axis[0-9]\* (axis1, axis2, etc.)

Use x, alluvium, and/or stratum for data in lodes format and axis[0-9]\* for data in alluvia format (see [alluvial-data](#)). Arguments to parameters inconsistent with the format will be ignored. Additionally, each stat\_\*() accepts the following optional aesthetics:

- y
- weight
- order
- group
- label

y controls the heights of the alluvia, and may be aggregated across equivalent observations. weight applies to the computed variables (see that section below) but does not affect the positional aesthetics. order, recognized by stat\_alluvium() and stat\_flow(), is used to arrange the lodes within each stratum. It tolerates duplicates and takes precedence over the differentiation aesthetics (when aes.bind is not "none") and lode guidance with respect to the remaining axes. (It replaces the deprecated parameter lode.ordering.) group is used internally; arguments are ignored. label is used to label the strata or lodes and must take a unique value across the observations within each stratum or lode.

These and any other aesthetics are aggregated as follows: Numeric aesthetics, including y, are summed. Character and factor aesthetics, including label, are assigned to strata or lodes provided they take unique values across the observations within each (and are otherwise assigned NA).

## Computed variables

These can be used with `ggplot2::after_stat()` to control aesthetic evaluation.

n number of cases in lode

count cumulative weight of lode

prop weighted proportion of lode

stratum value of variable used to define strata

deposit order in which (signed) strata are deposited

lode lode label distilled from alluvia (stat\_alluvium() and stat\_flow() only)

flow direction of flow "to" or "from" from its axis (stat\_flow() only)

The numerical variables n, count, and prop are calculated after the data are grouped by x and weighted by weight (in addition to y). The integer variable deposit is used internally to sort the data before calculating heights. The character variable lode is obtained from alluvium according to distill.

### Package options

stat\_stratum, stat\_alluvium, and stat\_flow order strata and lodes according to the values of several parameters, which must be held fixed across every layer in an alluvial plot. These package-specific options set global values for these parameters that will be defaulted to when not manually set:

- ggalluvial.decreasing (each stat\_\*): defaults to NA.
- ggalluvial.reverse (each stat\_\*): defaults to TRUE.
- ggalluvial.absolute (each stat\_\*): defaults to TRUE.
- ggalluvial.cement.alluvia (stat\_alluvium): defaults to FALSE.
- ggalluvial.lode.guidance (stat\_alluvium): defaults to "zigzag".
- ggalluvial.aes.bind (stat\_alluvium and stat\_flow): defaults to "none".

See [base::options\(\)](#) for how to use options.

### Defunct parameters

The previously defunct parameters weight and aggregate.wts have been discontinued. Use y and cement.alluvia instead.

### See Also

[ggplot2::layer\(\)](#) for additional arguments and [geom\\_stratum\(\)](#) for the corresponding geom.

Other alluvial stat layers: [stat\\_alluvium\(\)](#), [stat\\_flow\(\)](#)

### Examples

```
data(vaccinations)
# only `stratum` assignment is necessary to generate strata
ggplot(vaccinations,
       aes(y = freq,
           x = survey, stratum = response,
           fill = response)) +
  stat_stratum(width = .5)

# lode data, positioning with y labels
ggplot(vaccinations,
       aes(y = freq,
           x = survey, stratum = response, alluvium = subject,
           label = after_stat(count))) +
  stat_stratum(geom = "errorbar") +
  geom_text(stat = "stratum")
```

```

# alluvium data, positioning with stratum labels
ggplot(as.data.frame(Titanic),
       aes(y = Freq,
           axis1 = Class, axis2 = Sex, axis3 = Age, axis4 = Survived)) +
  geom_text(stat = "stratum", aes(label = after_stat(stratum))) +
  stat_stratum(geom = "errorbar") +
  scale_x_discrete(limits = c("Class", "Sex", "Age", "Survived"))

# omit labels for strata outside a y range
ggplot(vaccinations,
       aes(y = freq,
           x = survey, stratum = response,
           fill = response, label = response)) +
  stat_stratum(width = .5) +
  geom_text(stat = "stratum", min.y = 100)

# date-valued axis variables
ggplot(vaccinations,
       aes(x = end_date, y = freq, stratum = response, alluvium = subject,
           fill = response)) +
  stat_alluvium(geom = "flow", lode.guidance = "forward",
               width = 30) +
  stat_stratum(width = 30) +
  labs(x = "Survey date", y = "Number of respondents")

admissions <- as.data.frame(UCBAdmissions)
admissions <- transform(admissions, Count = Freq * (-1) ^ (Admit == "Rejected"))
# use negative y values to encode rejection versus acceptance
ggplot(admissions,
       aes(y = Count, axis1 = Dept, axis2 = Gender)) +
  geom_alluvium(aes(fill = Dept), width = 1/12) +
  geom_stratum(width = 1/12, fill = "black", color = "grey") +
  geom_label(stat = "stratum", aes(label = after_stat(stratum)), min.y = 200) +
  scale_x_discrete(limits = c("Department", "Gender"), expand = c(.05, .05))
# computed variable 'deposit' indicates order of each signed stratum
ggplot(admissions,
       aes(y = Count, axis1 = Dept, axis2 = Gender)) +
  geom_alluvium(aes(fill = Dept), width = 1/12) +
  geom_stratum(width = 1/12, fill = "black", color = "grey") +
  geom_text(stat = "stratum", aes(label = after_stat(deposit),
                                  color = "white")) +
  scale_x_discrete(limits = c("Department", "Gender"), expand = c(.05, .05))
# fixed-width strata with acceptance and rejection totals
ggplot(admissions,
       aes(y = sign(Count), weight = Count, axis1 = Dept, axis2 = Gender)) +
  geom_alluvium(aes(fill = Dept), width = 1/8) +
  geom_stratum(width = 1/8, fill = "black", color = "grey") +
  geom_text(stat = "stratum",
           aes(label = paste0(stratum,
                               ifelse(nchar(as.character(stratum)) == 1L,
                                     ":", "\n"),
                               after_stat(n))),
           color = "white", size = 3) +

```

```
scale_x_discrete(limits = c("Department", "Gender"), expand = c(.05, .05))
```

---

vaccinations

*Influenza vaccination survey responses*

---

### Description

This data set is aggregated from three RAND American Life Panel (ALP) surveys that asked respondents their probability of vaccinating for influenza. Their responses were discretized to "Never" (0%), "Always" (100%), or "Sometimes" (any other value). After merging, missing responses were coded as "Missing" and respondents were grouped and counted by all three coded responses. The pre-processed data were kindly contributed by Raffaele Vardavas, and the complete surveys are freely available at the ALP website.

### Usage

vaccinations

### Format

A data frame with 117 rows and 5 variables:

freq number of respondents represented in each row

subject identifier linking respondents across surveys

survey survey designation from the ALP website

start\_date start date of survey

end\_date end date of survey

response discretized probability of vaccinating for influenza

### Source

<https://alpdata.rand.org/>

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