

Package ‘ggdist’

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Title Visualizations of Distributions and Uncertainty

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Description

Provides primitives for visualizing distributions using 'ggplot2' that are particularly tuned for visualizing uncertainty in either a frequentist or Bayesian mode. Both analytical distributions (such as frequentist confidence distributions or Bayesian priors) and distributions represented as samples (such as bootstrap distributions or Bayesian posterior samples) are easily visualized. Visualization primitives include but are not limited to: points with multiple uncertainty intervals, eye plots (Spiegelhalter D., 1999) <<https://ideas.repec.org/a/bla/jorssa/v162y1999i1p45-58.html>>, density plots, gradient plots, dot plots (Wilkinson L., 1999) <[doi:10.1080/00031305.1999.10474474](https://doi.org/10.1080/00031305.1999.10474474)>, quantile dot plots (Kay M., Kola T., Hullman J., Munson S., 2016) <[doi:10.1145/2858036.2858558](https://doi.org/10.1145/2858036.2858558)>, complementary cumulative distribution function barplots (Fernandes M., Walls L., Munson S., Hullman J., Kay M., 2018) <[doi:10.1145/3173574.3173718](https://doi.org/10.1145/3173574.3173718)>, and fit curves with multiple uncertainty ribbons.

Depends R (>= 3.6.0)

Imports ggplot2 (>= 3.5.0), rlang (>= 0.3.0), cli, scales, grid, tibble, vctrs, withr, distributional (>= 0.3.2), numDeriv, glue, quadprog, gtable, Rcpp

Suggests tidyselect, dplyr (>= 1.0.0), fda, posterior, beeswarm (>= 0.4.0), rmarkdown, knitr, testthat (>= 3.0.0), vdiff (>= 1.0.0), svglite (>= 2.1.0), fontquiver, sysfonts, showtext, mvtnorm, covr, broom (>= 0.5.6), patchwork, tidyr (>= 1.0.0), ragg, pkgdown

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BugReports <https://github.com/mjskay/ggdist/issues/new>

URL <https://mjskay.github.io/ggdist/>,
<https://github.com/mjskay/ggdist/>

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Collate `ggdist-package.R` ``util.R`` `compat.R` ``rd.R`` `RcppExports.R`
 ``abstract_geom.R`` ``abstract_stat.R``
 ``abstract_stat_slabinterval.R`` ``auto_partial.R``
 ``binning_methods.R`` ``bounder.R`` ``curve_interval.R``
 ``cut_cdf_qi.R`` ``data.R`` ``density.R`` ``distributions.R``
 ``draw_key_slabinterval.R`` ``geom.R`` ``geom_slabinterval.R``
 ``geom_dotsinterval.R`` ``geom_blur_dots.R`` ``geom_interval.R``
 ``geom_lineribbon.R`` ``geom_pointinterval.R`` ``geom_slab.R``
 ``geom_spike.R`` ``geom_swarm.R`` ``guide_rampbar.R``
 ``lkjcorr_marginal.R`` ``parse_dist.R`` ``partial_colour_ramp.R``
 ``point_interval.R`` ``position_dodgejust.R`` ``pr.R``
 ``rd_dotsinterval.R`` ``rd_slabinterval.R`` ``rd_spike.R``
 ``rd_lineribbon.R`` ``scale_colour_ramp.R`` ``scale_thickness.R``
 ``scale_side_mirrored.R`` ``scale_.R`` ``smooth.R`` ``stat.R``
 ``stat_slabinterval.R`` ``stat_dotsinterval.R`` ``stat_mcse_dots.R``
 ``stat_pointinterval.R`` ``stat_interval.R`` ``stat_lineribbon.R``
 ``stat_spike.R`` ``student_t.R`` ``subguide.R`` ``testthat.R``
 ``theme_ggdist.R`` ``tidy_format_translators.R`` ``weighted_ecdf.R``
 ``weighted_hist.R`` ``weighted_quantile.R`` ``deprecated.R``

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ggdist-package	<i>Visualizations of Distributions and Uncertainty</i>
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Description

ggdist is an R package that aims to make it easy to integrate popular Bayesian modeling methods into a tidy data + ggplot workflow.

Details

ggdist is an R package that provides a flexible set of ggplot2 geoms and stats designed especially for visualizing distributions and uncertainty. It is designed for both frequentist and Bayesian uncertainty visualization, taking the view that uncertainty visualization can be unified through the perspective of distribution visualization: for frequentist models, one visualizes confidence distributions or bootstrap distributions (see vignette("freq-uncertainty-vis")); for Bayesian models, one visualizes probability distributions (see vignette("tidybayes", package = "tidybayes")).

The `geom_slabinterval()` / `stat_slabinterval()` family (see vignette("slabinterval")) makes it easy to visualize point summaries and intervals, eye plots, half-eye plots, ridge plots, CCDF bar plots, gradient plots, histograms, and more.

The `geom_dotsinterval()` / `stat_dotsinterval()` family (see vignette("dotsinterval")) makes it easy to visualize dot+interval plots, Wilkinson dotplots, beeswarm plots, and quantile dotplots.

The `geom_lineribbon()` / `stat_lineribbon()` family (see vignette("lineribbon")) makes it easy to visualize fit lines with an arbitrary number of uncertainty bands.

Author(s)

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See Also

Useful links:

- <https://mjskay.github.io/ggdist/>
- <https://github.com/mjskay/ggdist/>
- Report bugs at <https://github.com/mjskay/ggdist/issues/new>

align

Break (bin) alignment methods

Description

Methods for aligning breaks (bins) in histograms, as used in the `align` argument to `density_histogram()`.

Supports [automatic partial function application](#).

Usage

```
align_none(breaks)
```

```
align_boundary(breaks, at = 0)
```

```
align_center(breaks, at = 0)
```

Arguments

`breaks` A sorted vector of breaks (bin edges).

`at` A scalar numeric giving an alignment point.

- For `align_boundary()`: align breaks so that a bin edge lines up with `at`.
- For `align_center()`: align breaks so that the center of a bin lines up with `at`.

Details

These functions take a sorted vector of equally-spaced breaks giving bin edges and return a numeric offset which, if subtracted from `breaks`, will align them as desired:

- `align_none()` performs no alignment (it always returns `0`).
- `align_boundary()` ensures that a bin edge lines up with `at`.
- `align_center()` ensures that a bin center lines up with `at`.

For `align_boundary()` (respectively `align_center()`), if no bin edge (or center) in the range of `breaks` would line up with `at`, it ensures that `at` is an integer multiple of the bin width away from a bin edge (or center).

Value

A scalar numeric returning an offset to be subtracted from breaks.

See Also

[density_histogram\(\)](#), [breaks](#)

Examples

```
library(ggplot2)

set.seed(1234)
x = rnorm(200, 1, 2)

# If we manually specify a bin width using breaks_fixed(), the default
# alignment (align_none()) will not align bin edges to any "pretty" numbers.
# Here is a comparison of the three alignment methods on such a histogram:
ggplot(data.frame(x), aes(x)) +
  stat_slab(
    aes(y = "align_none()\nor 'none'"),
    density = "histogram",
    breaks = breaks_fixed(width = 1),
    outline_bars = TRUE,
    # no need to specify align; align_none() is the default
    color = "black",
  ) +
  stat_slab(
    aes(y = "align_center(at = 0)\nor 'center'"),
    density = "histogram",
    breaks = breaks_fixed(width = 1),
    align = align_center(at = 0), # or align = "center"
    outline_bars = TRUE,
    color = "black",
  ) +
  stat_slab(
    aes(y = "align_boundary(at = 0)\nor 'boundary'"),
    density = "histogram",
    breaks = breaks_fixed(width = 1),
    align = align_boundary(at = 0), # or align = "boundary"
    outline_bars = TRUE,
    color = "black",
  ) +
  geom_point(aes(y = 0.7), alpha = 0.5) +
  labs(
    subtitle = "ggdist::stat_slab(density = 'histogram', ...)",
    y = "align =",
    x = NULL
  ) +
  geom_vline(xintercept = 0, linetype = "22", color = "red")
```

Description

Several **ggdist** functions support *automatic partial application*: when called, if all of their required arguments have not been provided, the function returns a modified version of itself that uses the arguments passed to it so far as defaults. Technically speaking, these functions are essentially "Curried" with respect to their required arguments, but I think "automatic partial application" gets the idea across more clearly.

Functions supporting automatic partial application include:

- The `point_interval()` family, such as `median_qi()`, `mean_qi()`, `mode_hdi()`, etc.
- The `smooth_` family, such as `smooth_bounded()`, `smooth_unbounded()`, `smooth_discrete()`, and `smooth_bar()`.
- The `density_` family, such as `density_bounded()`, `density_unbounded()` and `density_histogram()`.
- The `align` family.
- The `breaks` family.
- The `bandwidth` family.
- The `blur` family.

Partial application makes it easier to supply custom parameters to these functions when using them inside other functions, such as geoms and stats. For example, smoothers for `geom_dots()` can be supplied in one of three ways:

- as a suffix: `geom_dots(smooth = "bounded")`
- as a function: `geom_dots(smooth = smooth_bounded)`
- as a partially-applied function with options: `geom_dots(smooth = smooth_bounded(kernel = "cosine"))`

Many other common arguments for **ggdist** functions work similarly; e.g. `density`, `align`, `breaks`, `bandwidth`, and `point_interval` arguments.

These function families (except `point_interval()`) also support passing `waivers` to their optional arguments: if `waiver()` is passed to any of these arguments, their default value (or the most recently-partially-applied non-waiver value) is used instead.

Use the `auto_partial()` function to create new functions that support automatic partial application.

Usage

```
auto_partial(f, name = NULL, waivable = TRUE)
```

Arguments

f	A function
name	A character string giving the name of the function, to be used when printing.
waivable	logical: if TRUE, optional arguments that get passed a <code>waiver()</code> will keep their default value (or whatever non-waiver value has been most recently partially applied for that argument).

Value

A modified version of `f` that will automatically be partially applied if all of its required arguments are not given.

Examples

```

set.seed(1234)
x = rnorm(100)

# the first required argument, `x`, of the density_ family is the vector
# to calculate a kernel density estimate from. If it is not provided, the
# function is partially applied and returned as-is
density_unbounded()

# we could create a new function that uses half the default bandwidth
density_half_bw = density_unbounded(adjust = 0.5)
density_half_bw

# we can overwrite partially-applied arguments
density_quarter_bw_trimmed = density_half_bw(adjust = 0.25, trim = TRUE)
density_quarter_bw_trimmed

# when we eventually call the function and provide the required argument
# `x`, it is applied using the arguments we have "saved up" so far
density_quarter_bw_trimmed(x)

# create a custom automatically partially applied function
f = auto_partial(function(x, y, z = 3) (x + y) * z)
f()
f(1)
g = f(y = 2)(z = 4)
g
g(1)

# pass waiver() to optional arguments to use existing values
f(z = waiver())(1, 2) # uses default z = 3
f(z = 4)(z = waiver())(1, 2) # uses z = 4

```

bandwidth	<i>Bandwidth estimators</i>
-----------	-----------------------------

Description

Bandwidth estimators for densities, used in the `bandwidth` argument to density functions (e.g. `density_bounded()`, `density_unbounded()`).

Supports [automatic partial function application](#).

Usage

```
bandwidth_nrd0(x, ...)
```

```
bandwidth_nrd(x, ...)
```

```
bandwidth_ucv(x, ...)
```

```
bandwidth_bcv(x, ...)
```

```
bandwidth_SJ(x, ...)
```

```
bandwidth_dpi(x, ...)
```

Arguments

<code>x</code>	A numeric vector giving a sample.
<code>...</code>	Arguments passed on to <code>stats::bw.SJ</code>
	<code>nb</code> number of bins to use.
	<code>lower, upper</code> range over which to minimize. The default is almost always satisfactory. <code>hmax</code> is calculated internally from a normal reference bandwidth.
	<code>method</code> either "ste" ("solve-the-equation") or "dpi" ("direct plug-in"). Can be abbreviated.
	<code>tol</code> for method "ste", the convergence tolerance for <code>uniroot</code> . The default leads to bandwidth estimates with only slightly more than one digit accuracy, which is sufficient for practical density estimation, but possibly not for theoretical simulation studies.

Details

These are loose wrappers around the corresponding `bw.`-prefixed functions in **stats**. See, for example, `bw.SJ()`.

`bandwidth_dpi()`, which is the default bandwidth estimator in **ggdist**, is the Sheather-Jones direct plug-in estimator, i.e. `bw.SJ(..., method = "dpi")`.

Value

A single number giving the bandwidth

See Also

[density_bounded\(\)](#), [density_unbounded\(\)](#).

bin_dots

Bin data values using a dotplot algorithm

Description

Bins the provided data values using one of several dotplot algorithms.

Usage

```
bin_dots(
  x,
  y,
  binwidth,
  heightratio = 1,
  stackratio = 1,
  layout = c("bin", "weave", "hex", "swarm", "bar"),
  side = c("topright", "top", "right", "bottomleft", "bottom", "left", "topleft",
           "bottomright", "both"),
  orientation = c("horizontal", "vertical", "y", "x"),
  overlaps = "nudge"
)
```

Arguments

x	numeric vector of x values
y	numeric vector of y values
binwidth	bin width
heightratio	ratio of bin width to dot height
stackratio	ratio of dot height to vertical distance between dot centers
layout	The layout method used for the dots: <ul style="list-style-type: none"> • "bin" (default): places dots on the off-axis at the midpoint of their bins as in the classic Wilkinson dotplot. This maintains the alignment of rows and columns in the dotplot. This layout is slightly different from the classic Wilkinson algorithm in that: (1) it nudges bins slightly to avoid overlapping bins and (2) if the input data are symmetrical it will return a symmetrical layout. • "weave": uses the same basic binning approach of "bin", but places dots in the off-axis at their actual positions (unless overlaps = "nudge", in which case overlaps may be nudged out of the way). This maintains the alignment of rows but does not align dots within columns.

	<ul style="list-style-type: none"> • "hex": uses the same basic binning approach of "bin", but alternates placing dots + binwidth/4 or - binwidth/4 in the off-axis from the bin center. This allows hexagonal packing by setting a stackratio less than 1 (something like 0.9 tends to work). • "swarm": uses the "compactswarm" layout from <code>beeswarm::beeswarm()</code>. Does not maintain alignment of rows or columns, but can be more compact and neat looking, especially for sample data (as opposed to quantile dotplots of theoretical distributions, which may look better with "bin", "weave", or "hex"). • "bar": for discrete distributions, lays out duplicate values in rectangular bars.
side	Which side to place the slab on. "topright", "top", and "right" are synonyms which cause the slab to be drawn on the top or the right depending on if orientation is "horizontal" or "vertical". "bottomleft", "bottom", and "left" are synonyms which cause the slab to be drawn on the bottom or the left depending on if orientation is "horizontal" or "vertical". "topleft" causes the slab to be drawn on the top or the left, and "bottomright" causes the slab to be drawn on the bottom or the right. "both" draws the slab mirrored on both sides (as in a violin plot).
orientation	Whether the dots are laid out horizontally or vertically. Follows the naming scheme of <code>geom_slabinterval()</code> : <ul style="list-style-type: none"> • "horizontal" assumes the data values for the dotplot are in the x variable and that dots will be stacked up in the y direction. • "vertical" assumes the data values for the dotplot are in the y variable and that dots will be stacked up in the x direction. For compatibility with the base ggplot naming scheme for orientation, "x" can be used as an alias for "vertical" and "y" as an alias for "horizontal".
overlaps	How to handle overlapping dots or bins in the "bin", "weave", and "hex" layouts (dots never overlap in the "swarm" or "bar" layouts). For the purposes of this argument, dots are only considered to be overlapping if they would be overlapping when <code>dotsize = 1</code> and <code>stackratio = 1</code> ; i.e. if you set those arguments to other values, overlaps may still occur. One of: <ul style="list-style-type: none"> • "keep": leave overlapping dots as they are. Dots may overlap (usually only slightly) in the "bin", "weave", and "hex" layouts. • "nudge": nudge overlapping dots out of the way. Overlaps are avoided using a constrained optimization which minimizes the squared distance of dots to their desired positions, subject to the constraint that adjacent dots do not overlap.

Value

A data frame with three columns:

- x: the x position of each dot
- y: the y position of each dot
- bin: a unique number associated with each bin (supplied but not used when `layout = "swarm"`)

See Also

[find_dotplot_binwidth\(\)](#) for an algorithm that finds good bin widths to use with this function;
[geom_dotsinterval\(\)](#) for geometries that use these algorithms to create dotplots.

Examples

```
library(dplyr)
library(ggplot2)

x = qnorm(ppoints(20))
bin_df = bin_dots(x = x, y = 0, binwidth = 0.5, heightratio = 1)
bin_df

# we can manually plot the binning above, though this is only recommended
# if you are using find_dotplot_binwidth() and bin_dots() to build your own
# grob. For practical use it is much easier to use geom_dots(), which will
# automatically select good bin widths for you (and which uses
# find_dotplot_binwidth() and bin_dots() internally)
bin_df %>%
  ggplot(aes(x = x, y = y)) +
  geom_point(size = 4) +
  coord_fixed()
```

 blur

Blur functions for blurry dot plots

Description

Methods for constructing blurs, as used in the `blur` argument to [geom_blur_dots\(\)](#) or [stat_mcse_dots\(\)](#).
 Supports [automatic partial function application](#).

Usage

```
blur_gaussian(x, r, sd)

blur_interval(x, r, sd, .width = 0.95)
```

Arguments

<code>x</code>	numeric vector of positive distances from the center of the dot (assumed to be 0) to evaluate blur function at.
<code>r</code>	radius of the dot that is being blurred.
<code>sd</code>	standard deviation of the dot that is being blurred.
<code>.width</code>	for <code>blur_interval()</code> , a probability giving the width of the interval.

Details

These functions are passed x , r , and sd when `geom_blur_dots()` draws in order to create a radial gradient representing each dot in the dotplot. They return values between 0 and 1 giving the opacity of the dot at each value of x .

`blur_gaussian()` creates a dot with radius r that has a Gaussian blur with standard deviation sd applied to it. It does this by calculating $\alpha(x; r, \sigma)$, the opacity at distance x from the center of a dot with radius r that has had a Gaussian blur with standard deviation $\sigma = sd$ applied to it:

$$\alpha(x; r, \sigma) = \Phi\left(\frac{x+r}{\sigma}\right) - \Phi\left(\frac{x-r}{\sigma}\right)$$

`blur_interval()` creates an interval-type representation around the dot at 50% opacity, where the interval is a Gaussian quantile interval with mass equal to `.width` and standard deviation `sd`.

Value

A vector of length x giving the opacity of the radial gradient representing the dot at each x value.

See Also

`geom_blur_dots()` and `stat_mcse_dots()` for geometries making use of blurs.

Examples

```
# see examples in geom_blur_dots()
```

bounder_cdf

Estimate bounds of a distribution using the CDF of its order statistics

Description

Estimate the bounds of the distribution a sample came from using the CDF of the order statistics of the sample. Use with the `bounder` argument to `density_bounded()`.

Supports [automatic partial function application](#).

Usage

```
bounder_cdf(x, p = 0.01)
```

Arguments

`x` numeric vector containing a sample to estimate the bounds of.

`p` scalar in $[0, 1]$: percentile of the order statistic distribution to use as the estimate. `p = 1` will return `range(x)`; `p = 0.5` will give the median estimate, `p = 0` will give a very wide estimate (effectively treating the distribution as unbounded when used with `density_bounded()`).

Details

`bounder_cdf()` uses the distribution of the order statistics of X to estimate where the first and last order statistics (i.e. the min and max) of this distribution would be, assuming the sample x is the distribution. Then, it adjusts the boundary outwards from $\min(x)$ (or $\max(x)$) by the distance between $\min(x)$ (or $\max(x)$) and the nearest estimated order statistic.

Taking $X = x$, the distributions of the first and last order statistics are:

$$\begin{aligned} F_{X_{(1)}}(x) &= 1 - [1 - F_X(x)]^n \\ F_{X_{(n)}}(x) &= F_X(x)^n \end{aligned}$$

Re-arranging, we can get the inverse CDFs (quantile functions) of each order statistic in terms of the quantile function of X (which we can estimate from the data), giving us an estimate for the minimum and maximum order statistic:

$$\begin{aligned} \hat{x}_1 &= F_{X_{(1)}}^{-1}(p) = F_X^{-1}[1 - (1 - p)^{1/n}] \\ \hat{x}_n &= F_{X_{(n)}}^{-1}(p) = F_X^{-1}[p^{1/n}] \end{aligned}$$

Then the estimated bounds are:

$$[2 \min(x) - \hat{x}_1, 2 \max(x) - \hat{x}_n]$$

These bounds depend on p , the percentile of the distribution of the order statistic used to form the estimate. While $p = 0.5$ (the median) might be a reasonable choice (and gives results similar to `bounder_cooke()`), this tends to be a bit too aggressive in "detecting" bounded distributions, especially in small sample sizes. Thus, we use a default of $p = 0.01$, which tends to be very conservative in small samples (in that it usually gives results roughly equivalent to an unbounded distribution), but which still performs well on bounded distributions when sample sizes are larger (in the thousands).

Value

A length-2 numeric vector giving an estimate of the minimum and maximum bounds of the distribution that x came from.

See Also

The `bounder` argument to `density_bounded()`.

Other bounds estimators: `bounder_cooke()`, `bounder_range()`

bounder_cooke

*Estimate bounds of a distribution using Cooke's method***Description**

Estimate the bounds of the distribution a sample came from using Cooke's method. Use with the `bounder` argument to `density_bounded()`.

Supports [automatic partial function application](#).

Usage

```
bounder_cooke(x)
```

Arguments

`x` numeric vector containing a sample to estimate the bounds of.

Details

Estimate the bounds of a distribution using the method from Cooke (1979); i.e. method 2.3 from Loh (1984). These bounds are:

$$\left[\begin{array}{l} 2X_{(1)} - \sum_{i=1}^n \left[\left(1 - \frac{i-1}{n}\right)^n - \left(1 - \frac{i}{n}\right)^n \right] X_{(i)} \\ 2X_{(n)} - \sum_{i=1}^n \left[\left(1 - \frac{n-i}{n}\right)^n - \left(1 - \frac{n+1-i}{n}\right)^n \right] X_{(i)} \end{array} \right]$$

Where $X_{(i)}$ is the i th order statistic of x (i.e. its i th-smallest value).

Value

A length-2 numeric vector giving an estimate of the minimum and maximum bounds of the distribution that x came from.

References

Cooke, P. (1979). Statistical inference for bounds of random variables. *Biometrika* 66(2), 367–374. [doi:10.1093/biomet/66.2.367](https://doi.org/10.1093/biomet/66.2.367).

Loh, W. Y. (1984). Estimating an endpoint of a distribution with resampling methods. *The Annals of Statistics* 12(4), 1543–1550. [doi:10.1214/aos/1176346811](https://doi.org/10.1214/aos/1176346811)

See Also

The `bounder` argument to `density_bounded()`.

Other bounds estimators: `bounder_cdf()`, `bounder_range()`

bounder_range	<i>Estimate bounds of a distribution using the range of the sample</i>
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Description

Estimate the bounds of the distribution a sample came from using the range of the sample. Use with the bounder argument to [density_bounded\(\)](#).

Supports [automatic partial function application](#).

Usage

```
bounder_range(x)
```

Arguments

x numeric vector containing a sample to estimate the bounds of.

Details

Estimate the bounds of a distribution using `range(x)`.

Value

A length-2 numeric vector giving an estimate of the minimum and maximum bounds of the distribution that x came from.

See Also

The bounder argument to [density_bounded\(\)](#).

Other bounds estimators: [bounder_cdf\(\)](#), [bounder_cooke\(\)](#)

breaks	<i>Break (bin) selection algorithms for histograms</i>
--------	--

Description

Methods for determining breaks (bins) in histograms, as used in the breaks argument to [density_histogram\(\)](#).

Supports [automatic partial function application](#).

Usage

```
breaks_fixed(x, weights = NULL, width = 1)

breaks_Sturges(x, weights = NULL)

breaks_Scott(x, weights = NULL)

breaks_FD(x, weights = NULL, digits = 5)

breaks_quantiles(x, weights = NULL, max_n = "Scott", min_width = 0.5)
```

Arguments

x	A numeric vector giving a sample.
weights	A numeric vector of length(x) giving sample weights.
width	For breaks_fixed() , the desired bin width.
digits	For breaks_FD() , the number of significant digits to keep when rounding in the Freedman-Diaconis algorithm. For an explanation of this parameter, see the documentation of the corresponding parameter in grDevices::nclass.FD() .
max_n	For breaks_quantiles() , either a scalar numeric giving the maximum number of bins, or another breaks function (or string giving the suffix of the name of a function prefixed with "breaks_") that will return the maximum number of bins. breaks_quantiles() will construct <i>at most</i> max_n bins.
min_width	For breaks_quantiles() , a scalar numeric between 0 and 1 giving the minimum bin width as a proportion of <code>diff(range(x)) / max_n</code> .

Details

These functions take a sample and its weights and return a value suitable for the breaks argument to [density_histogram\(\)](#) that will determine the histogram breaks.

- [breaks_fixed\(\)](#) allows you to manually specify a fixed bin width.
- [breaks_Sturges\(\)](#), [breaks_Scott\(\)](#), and [breaks_FD\(\)](#) implement weighted versions of their corresponding base functions. They return a scalar numeric giving the number of bins. See [nclass.Sturges\(\)](#), [nclass.scott\(\)](#), and [nclass.FD\(\)](#).
- [breaks_quantiles\(\)](#) constructs irregularly-sized bins using max_n + 1 (possibly weighted) quantiles of x. The final number of bins is *at most* max_n, as small bins (ones whose bin width is less than half the range of the data divided by max_n times min_width) will be merged into adjacent bins.

Value

Either a single number (giving the number of bins) or a vector giving the edges between bins.

See Also

[density_histogram\(\)](#), [align](#)

Examples

```

library(ggplot2)

set.seed(1234)
x = rnorm(200, 1, 2)

# Let's compare the different break-selection algorithms on this data:
ggplot(data.frame(x), aes(x)) +
  stat_slab(
    aes(y = "breaks_fixed(width = 0.5)"),
    density = "histogram",
    breaks = breaks_fixed(width = 0.5),
    outline_bars = TRUE,
    color = "black",
  ) +
  stat_slab(
    aes(y = "breaks_Sturges()\nor 'Sturges'"),
    density = "histogram",
    breaks = "Sturges",
    outline_bars = TRUE,
    color = "black",
  ) +
  stat_slab(
    aes(y = "breaks_Scott()\nor 'Scott'"),
    density = "histogram",
    breaks = "Scott",
    outline_bars = TRUE,
    color = "black",
  ) +
  stat_slab(
    aes(y = "breaks_FD()\nor 'FD'"),
    density = "histogram",
    breaks = "FD",
    outline_bars = TRUE,
    color = "black",
  ) +
  geom_point(aes(y = 0.7), alpha = 0.5) +
  labs(
    subtitle = "ggdist::stat_slab(density = 'histogram', ...)",
    y = "breaks =",
    x = NULL
  )

```

curve_interval

Curvewise point and interval summaries for tidy data frames of draws from distributions

Description

Translates draws from distributions in a grouped data frame into a set of point and interval summaries using a curve boxplot-inspired approach.

Usage

```

curve_interval(
  .data,
  ...,
  .along = NULL,
  .width = 0.5,
  na.rm = FALSE,
  .interval = c("mhd", "mbd", "bd", "bd-mbd")
)

## S3 method for class 'matrix'
curve_interval(
  .data,
  ...,
  .along = NULL,
  .width = 0.5,
  na.rm = FALSE,
  .interval = c("mhd", "mbd", "bd", "bd-mbd")
)

## S3 method for class 'rvar'
curve_interval(
  .data,
  ...,
  .along = NULL,
  .width = 0.5,
  na.rm = FALSE,
  .interval = c("mhd", "mbd", "bd", "bd-mbd")
)

## S3 method for class 'data.frame'
curve_interval(
  .data,
  ...,
  .along = NULL,
  .width = 0.5,
  na.rm = FALSE,
  .interval = c("mhd", "mbd", "bd", "bd-mbd"),
  .simple_names = TRUE,
  .exclude = c(".chain", ".iteration", ".draw", ".row")
)

```

Arguments

- `.data` One of:
- A data frame (or grouped data frame as returned by `dplyr::group_by()`) that contains draws to summarize.
 - A `posterior::rvar` vector.

	<ul style="list-style-type: none"> • A matrix; in which case the first dimension should be draws and the second dimension values of the curve.
...	Bare column names or expressions that, when evaluated in the context of <code>.data</code> , represent draws to summarize. If this is empty, then by default all columns that are not group columns and which are not in <code>.exclude</code> (by default <code>".chain"</code> , <code>".iteration"</code> , <code>".draw"</code> , and <code>".row"</code>) will be summarized. This can be numeric columns, list columns containing numeric vectors, or <code>posterior::rvar()</code> s.
<code>.along</code>	Which columns are the input values to the function describing the curve (e.g., the "x" values). Supports <code>tidyselect</code> syntax. Intervals are calculated jointly with respect to these variables, conditional on all other grouping variables in the data frame. The default (NULL) causes <code>curve_interval()</code> to use all grouping variables in the input data frame as the value for <code>.along</code> , which will generate the most conservative intervals. However, if you want to calculate intervals for some function $y = f(x)$ conditional on some other variable(s) (say, conditional on a factor <code>g</code>), you would group by <code>g</code> , then use <code>.along = x</code> to calculate intervals jointly over <code>x</code> conditional on <code>g</code> . To avoid selecting any variables as input values to the function describing the curve, use <code>character()</code> ; this will produce conditional intervals only (the result in this case should be very similar to <code>median_qi()</code>). Currently only supported when <code>.data</code> is a data frame.
<code>.width</code>	vector of probabilities to use that determine the widths of the resulting intervals. If multiple probabilities are provided, multiple rows per group are generated, each with a different probability interval (and value of the corresponding <code>.width</code> column).
<code>na.rm</code>	logical value indicating whether NA values should be stripped before the computation proceeds. If FALSE (the default), the presence of NA values in the columns to be summarized will generally result in an error. If TRUE, NA values will be removed in the calculation of intervals so long as <code>.interval</code> is <code>"mhd"</code> ; other methods do not currently support <code>na.rm</code> . Be cautious in applying this parameter: in general, it is unclear what a joint interval should be when any of the values are missing!
<code>.interval</code>	The method used to calculate the intervals. Currently, all methods rank the curves using some measure of <i>data depth</i> , then create envelopes containing the <code>.width%</code> "deepest" curves. Available methods are: <ul style="list-style-type: none"> • <code>"mhd"</code>: mean halfspace depth (Fraiman and Muniz 2001). • <code>"mbd"</code>: modified band depth (Sun and Genton 2011): calls <code>fda::fbplot()</code> with <code>method = "MBD"</code>. • <code>"bd"</code>: band depth (Sun and Genton 2011): calls <code>fda::fbplot()</code> with <code>method = "BD2"</code>. • <code>"bd-mbd"</code>: band depth, breaking ties with modified band depth (Sun and Genton 2011): calls <code>fda::fbplot()</code> with <code>method = "Both"</code>.
<code>.simple_names</code>	When TRUE and only a single column / vector is to be summarized, use the name <code>.lower</code> for the lower end of the interval and <code>.upper</code> for the upper end. When FALSE and <code>.data</code> is a data frame, names the lower and upper intervals for each column <code>x</code> <code>x.lower</code> and <code>x.upper</code> .
<code>.exclude</code>	A character vector of names of columns to be excluded from summarization if no column names are specified to be summarized. Default ignores several meta-data column names used in <code>ggdist</code> and <code>tidybayes</code> .

Details

Intervals are calculated by ranking the curves using some measure of *data depth*, then using binary search to find a cutoff k such that an envelope containing the $k\%$ "deepest" curves also contains $.width\%$ of the curves, for each value of $.width$ (note that k and $.width$ are not necessarily the same). This is in contrast to most functional boxplot or curve boxplot approaches, which tend to simply take the $.width\%$ deepest curves, and are generally quite conservative (i.e. they may contain more than $.width\%$ of the curves).

See Mirzargar *et al.* (2014) or Juul *et al.* (2020) for an accessible introduction to data depth and curve boxplots / functional boxplots.

Value

A data frame containing point summaries and intervals, with at least one column corresponding to the point summary, one to the lower end of the interval, one to the upper end of the interval, the width of the interval ($.width$), the type of point summary ($.point$), and the type of interval ($.interval$).

Author(s)

Matthew Kay

References

- Fraiman, Ricardo and Graciela Muniz. (2001). "Trimmed means for functional data". *Test* 10: 419–440. doi:[10.1007/BF02595706](https://doi.org/10.1007/BF02595706).
- Sun, Ying and Marc G. Genton. (2011). "Functional Boxplots". *Journal of Computational and Graphical Statistics*, 20(2): 316-334. doi:[10.1198/jcgs.2011.09224](https://doi.org/10.1198/jcgs.2011.09224)
- Mirzargar, Mahsa, Ross T Whitaker, and Robert M Kirby. (2014). "Curve Boxplot: Generalization of Boxplot for Ensembles of Curves". *IEEE Transactions on Visualization and Computer Graphics*. 20(12): 2654-2663. doi:[10.1109/TVCG.2014.2346455](https://doi.org/10.1109/TVCG.2014.2346455)
- Juul Jonas, Kaare Græsbøll, Lasse Engbo Christiansen, and Sune Lehmann. (2020). "Fixed-time descriptive statistics underestimate extremes of epidemic curve ensembles". *arXiv e-print*. [arXiv:2007.05035](https://arxiv.org/abs/2007.05035)

See Also

[point_interval\(\)](#) for pointwise intervals. See `vignette("lineribbon")` for more examples and discussion of the differences between pointwise and curvewise intervals.

Examples

```
library(dplyr)
library(ggplot2)

# generate a set of curves
k = 11 # number of curves
n = 201
```

```

df = tibble(
  .draw = rep(1:k, n),
  mean = rep(seq(-5,5, length.out = k), n),
  x = rep(seq(-15,15,length.out = n), each = k),
  y = dnorm(x, mean, 3)
)

# see pointwise intervals...
df %>%
  group_by(x) %>%
  median_qi(y, .width = c(.5)) %>%
  ggplot(aes(x = x, y = y)) +
  geom_lineribbon(aes(ymin = .lower, ymax = .upper)) +
  geom_line(aes(group = .draw), alpha=0.15, data = df) +
  scale_fill_brewer() +
  ggtitle("50% pointwise intervals with point_interval()") +
  theme_ggdist()

# ... compare them to curvewise intervals
df %>%
  group_by(x) %>%
  curve_interval(y, .width = c(.5)) %>%
  ggplot(aes(x = x, y = y)) +
  geom_lineribbon(aes(ymin = .lower, ymax = .upper)) +
  geom_line(aes(group = .draw), alpha=0.15, data = df) +
  scale_fill_brewer() +
  ggtitle("50% curvewise intervals with curve_interval()") +
  theme_ggdist()

```

cut_cdf_qi

Categorize values from a CDF into quantile intervals

Description

Given a vector of probabilities from a cumulative distribution function (CDF) and a list of desired quantile intervals, return a vector categorizing each element of the input vector according to which quantile interval it falls into. **NOTE:** While this function can be used for (and was originally designed for) drawing slabs with intervals overlaid on the density, this is can now be done more easily by mapping the `.width` or `level` computed variable to slab fill or color. See **Examples**.

Usage

```
cut_cdf_qi(p, .width = c(0.66, 0.95, 1), labels = NULL)
```

Arguments

`p` A numeric vector of values from a cumulative distribution function, such as values returned by `p`-prefixed distribution functions in base R (e.g. `pnorm()`), the

`cut_cdf_qi()` uses the `cdf()` function, or values of the cdf computed aesthetic from the `stat_slabinterval()` family of stats.

`.width` vector of probabilities to use that determine the widths of the resulting intervals.

`labels` One of:

- NULL to use the default labels (`.width` converted to a character vector).
- A character vector giving labels (must be same length as `.width`)
- A function that takes numeric probabilities as input and returns labels as output (a good candidate might be `scales::percent_format()`).

Value

An `ordered` factor of the same length as `p` giving the quantile interval to which each value of `p` belongs.

See Also

See `stat_slabinterval()` and its shortcut `stats`, which generate cdf aesthetics that can be used with `cut_cdf_qi()` to draw slabs colored by their intervals.

Examples

```
library(ggplot2)
library(dplyr)
library(scales)
library(distributional)

theme_set(theme_ggdist())

# NOTE: cut_cdf_qi() used to be the recommended way to do intervals overlaid
# on densities, like this...
tibble(x = dist_normal(0, 1)) %>%
  ggplot(aes(xdist = x)) +
  stat_slab(
    aes(fill = after_stat(cut_cdf_qi(cdf)))
  ) +
  scale_fill_brewer(direction = -1)

# ... however this is now more easily and flexibly accomplished by directly
# mapping .width or level onto fill:
tibble(x = dist_normal(0, 1)) %>%
  ggplot(aes(xdist = x)) +
  stat_slab(
    aes(fill = after_stat(level)),
    .width = c(.66, .95, 1)
  ) +
  scale_fill_brewer()

# See vignette("slabinterval") for more examples. The remaining examples
# below using cut_cdf_qi() are kept for posterity.
```

```

# With a halfeye (or other geom with slab and interval), NA values will
# show up in the fill scale from the CDF function applied to the internal
# interval geometry data and can be ignored, hence na.translate = FALSE
tibble(x = dist_normal(0, 1)) %>%
  ggplot(aes(xdist = x)) +
  stat_halfeye(aes(
    fill = after_stat(cut_cdf_qi(cdf, .width = c(.5, .8, .95, 1)))
  )) +
  scale_fill_brewer(direction = -1, na.translate = FALSE)

# we could also use the labels parameter to apply nicer formatting
# and provide a better name for the legend, and omit the 100% interval
# if desired
tibble(x = dist_normal(0, 1)) %>%
  ggplot(aes(xdist = x)) +
  stat_halfeye(aes(
    fill = after_stat(cut_cdf_qi(
      cdf,
      .width = c(.5, .8, .95),
      labels = percent_format(accuracy = 1)
    ))
  )) +
  labs(fill = "Interval") +
  scale_fill_brewer(direction = -1, na.translate = FALSE)

```

density_bounded

Bounded density estimator using the reflection method

Description

Bounded density estimator using the reflection method.

Supports [automatic partial function application](#).

Usage

```

density_bounded(
  x,
  weights = NULL,
  n = 512,
  bandwidth = "dpi",
  adjust = 1,
  kernel = "gaussian",
  trim = FALSE,
  bounds = c(NA, NA),
  bounder = "cdf",
  adapt = 1,
  na.rm = FALSE,

```

```

    ...,
    range_only = FALSE
  )

```

Arguments

x	numeric vector containing a sample to compute a density estimate for.
weights	optional numeric vector of weights to apply to x.
n	numeric: the number of grid points to evaluate the density estimator at.
bandwidth	bandwidth of the density estimator. One of: <ul style="list-style-type: none"> • a numeric: the bandwidth, as the standard deviation of the kernel • a function: a function taking x (the sample) and returning the bandwidth • a string: the suffix of the name of a function starting with "bandwidth_" that will be used to determine the bandwidth. See bandwidth for a list.
adjust	numeric: the bandwidth for the density estimator is multiplied by this value. See stats::density() .
kernel	string: the smoothing kernel to be used. This must partially match one of "gaussian", "rectangular", "triangular", "epanechnikov", "biweight", "cosine", or "optcosine". See stats::density() .
trim	Should the density estimate be trimmed to the bounds of the data?
bounds	length-2 vector of min and max bounds. If a bound is NA, then that bound is estimated from the data using the method specified by <code>bounder</code> .
bounder	Method to use to find missing (NA) bounds. A function that takes a numeric vector of values and returns a length-2 vector of the estimated lower and upper bound of the distribution. Can also be a string giving the suffix of the name of such a function that starts with "bounder_". Useful values include: <ul style="list-style-type: none"> • "cdf": Use the CDF of the the minimum and maximum order statistics of the sample to estimate the bounds. See bounder_cdf(). • "cooke": Use the method from Cooke (1979); i.e. method 2.3 from Loh (1984). See bounder_cooke(). • "range": Use the range of x (i.e the min or max). See bounder_range().
adapt	(very experimental) The name and interpretation of this argument are subject to change without notice. Positive integer. If <code>adapt > 1</code> , uses an adaptive approach to calculate the density. First, uses the adaptive bandwidth algorithm of Abramson (1982) to determine local (pointwise) bandwidths, then groups these bandwidths into <code>adapt</code> groups, then calculates and sums the densities from each group. You can set this to a very large number (e.g. <code>Inf</code>) for a fully adaptive approach, but this will be very slow; typically something around 100 yields nearly identical results.
na.rm	Should missing (NA) values in x be removed?
...	Additional arguments (ignored).
range_only	If TRUE, the range of the output of this density estimator is computed and is returned in the <code>\$x</code> element of the result, and <code>c(NA, NA)</code> is returned in <code>\$y</code> . This gives a faster way to determine the range of the output than <code>density_XXX(n = 2)</code> .

Value

An object of class "density", mimicking the output format of `stats::density()`, with the following components:

- `x`: The grid of points at which the density was estimated.
- `y`: The estimated density values.
- `bw`: The bandwidth.
- `n`: The sample size of the `x` input argument.
- `call`: The call used to produce the result, as a quoted expression.
- `data.name`: The deparsed name of the `x` input argument.
- `has.na`: Always `FALSE` (for compatibility).
- `cdf`: Values of the (possibly weighted) empirical cumulative distribution function at `x`. See `weighted_ecdf()`.

This allows existing methods for density objects, like `print()` and `plot()`, to work if desired. This output format (and in particular, the `x` and `y` components) is also the format expected by the `density` argument of the `stat_slabinterval()` and the `smooth_` family of functions.

References

- Cooke, P. (1979). Statistical inference for bounds of random variables. *Biometrika* 66(2), 367–374. doi:10.1093/biomet/66.2.367.
- Loh, W. Y. (1984). Estimating an endpoint of a distribution with resampling methods. *The Annals of Statistics* 12(4), 1543–1550. doi:10.1214/aos/1176346811

See Also

Other density estimators: `density_histogram()`, `density_unbounded()`

Examples

```
library(distributional)
library(dplyr)
library(ggplot2)

# For compatibility with existing code, the return type of density_bounded()
# is the same as stats::density(), ...
set.seed(123)
x = rbeta(5000, 1, 3)
d = density_bounded(x)
d

# ... thus, while designed for use with the `density` argument of
# stat_slabinterval(), output from density_bounded() can also be used with
# base::plot():
plot(d)

# here we'll use the same data as above, but pick either density_bounded()
```

```

# or density_unbounded() (which is equivalent to stats::density()). Notice
# how the bounded density (green) is biased near the boundary of the support,
# while the unbounded density is not.
data.frame(x) %>%
  ggplot() +
  stat_slab(
    aes(xdist = dist), data = data.frame(dist = dist_beta(1, 3)),
    alpha = 0.25
  ) +
  stat_slab(aes(x), density = "bounded", fill = NA, color = "#d95f02", alpha = 0.5) +
  stat_slab(aes(x), density = "unbounded", fill = NA, color = "#1b9e77", alpha = 0.5) +
  scale_thickness_shared() +
  theme_ggdist()

# We can also supply arguments to the density estimators by using their
# full function names instead of the string suffix; e.g. we can supply
# the exact bounds of c(0,1) rather than using the bounds of the data.
data.frame(x) %>%
  ggplot() +
  stat_slab(
    aes(xdist = dist), data = data.frame(dist = dist_beta(1, 3)),
    alpha = 0.25
  ) +
  stat_slab(
    aes(x), fill = NA, color = "#d95f02", alpha = 0.5,
    density = density_bounded(bounds = c(0,1))
  ) +
  scale_thickness_shared() +
  theme_ggdist()

```

density_histogram *Histogram density estimator*

Description

Histogram density estimator.

Supports [automatic partial function application](#).

Usage

```

density_histogram(
  x,
  weights = NULL,
  breaks = "Scott",
  align = "none",
  outline_bars = FALSE,
  na.rm = FALSE,
  ...,
  range_only = FALSE
)

```

Arguments

<code>x</code>	numeric vector containing a sample to compute a density estimate for.
<code>weights</code>	optional numeric vector of weights to apply to <code>x</code> .
<code>breaks</code>	Determines the breakpoints defining bins. Defaults to "Scott". Similar to (but not exactly the same as) the <code>breaks</code> argument to <code>graphics::hist()</code> . One of: <ul style="list-style-type: none"> • A scalar (length-1) numeric giving the number of bins • A vector numeric giving the breakpoints between histogram bins • A function taking <code>x</code> and <code>weights</code> and returning either the number of bins or a vector of breakpoints • A string giving the suffix of a function that starts with "breaks_". <code>ggdist</code> provides weighted implementations of the "Sturges", "Scott", and "FD" break-finding algorithms from <code>graphics::hist()</code>, as well as <code>breaks_fixed()</code> for manually setting the bin width. See <code>breaks</code>. <p>For example, <code>breaks = "Sturges"</code> will use the <code>breaks_Sturges()</code> algorithm, <code>breaks = 9</code> will create 9 bins, and <code>breaks = breaks_fixed(width = 1)</code> will set the bin width to 1.</p>
<code>align</code>	Determines how to align the breakpoints defining bins. Default ("none") performs no alignment. One of: <ul style="list-style-type: none"> • A scalar (length-1) numeric giving an offset that is subtracted from the breaks. The offset must be between 0 and the bin width. • A function taking a sorted vector of breaks (bin edges) and returning an offset to subtract from the breaks. • A string giving the suffix of a function that starts with "align_" used to determine the alignment, such as <code>align_none()</code>, <code>align_boundary()</code>, or <code>align_center()</code>. <p>For example, <code>align = "none"</code> will provide no alignment, <code>align = align_center(at = 0)</code> will center a bin on 0, and <code>align = align_boundary(at = 0)</code> will align a bin edge on 0.</p>
<code>outline_bars</code>	Should outlines in between the bars (i.e. density values of 0) be included?
<code>na.rm</code>	Should missing (NA) values in <code>x</code> be removed?
<code>...</code>	Additional arguments (ignored).
<code>range_only</code>	If TRUE, the range of the output of this density estimator is computed and is returned in the <code>\$x</code> element of the result, and <code>c(NA, NA)</code> is returned in <code>\$y</code> . This gives a faster way to determine the range of the output than <code>density_XXX(n = 2)</code> .

Value

An object of class "density", mimicking the output format of `stats::density()`, with the following components:

- `x`: The grid of points at which the density was estimated.
- `y`: The estimated density values.
- `bw`: The bandwidth.

- `n`: The sample size of the `x` input argument.
- `call`: The call used to produce the result, as a quoted expression.
- `data.name`: The deparsed name of the `x` input argument.
- `has.na`: Always `FALSE` (for compatibility).
- `cdf`: Values of the (possibly weighted) empirical cumulative distribution function at `x`. See [weighted_ecdf\(\)](#).

This allows existing methods for density objects, like `print()` and `plot()`, to work if desired. This output format (and in particular, the `x` and `y` components) is also the format expected by the `density` argument of the `stat_slabinterval()` and the `smooth_` family of functions.

See Also

Other density estimators: [density_bounded\(\)](#), [density_unbounded\(\)](#)

Examples

```
library(distributional)
library(dplyr)
library(ggplot2)

# For compatibility with existing code, the return type of density_unbounded()
# is the same as stats::density(), ...
set.seed(123)
x = rbeta(5000, 1, 3)
d = density_histogram(x)
d

# ... thus, while designed for use with the `density` argument of
# stat_slabinterval(), output from density_histogram() can also be used with
# base::plot():
plot(d)

# here we'll use the same data as above with stat_slab():
data.frame(x) %>%
  ggplot() +
  stat_slab(
    aes(xdist = dist), data = data.frame(dist = dist_beta(1, 3)),
    alpha = 0.25
  ) +
  stat_slab(aes(x), density = "histogram", fill = NA, color = "#d95f02", alpha = 0.5) +
  scale_thickness_shared() +
  theme_ggdist()
```

density_unbounded *Unbounded density estimator*

Description

Unbounded density estimator using `stats::density()`.

Supports [automatic partial function application](#).

Usage

```
density_unbounded(
  x,
  weights = NULL,
  n = 512,
  bandwidth = "dpi",
  adjust = 1,
  kernel = "gaussian",
  trim = FALSE,
  adapt = 1,
  na.rm = FALSE,
  ...,
  range_only = FALSE
)
```

Arguments

<code>x</code>	numeric vector containing a sample to compute a density estimate for.
<code>weights</code>	optional numeric vector of weights to apply to <code>x</code> .
<code>n</code>	numeric: the number of grid points to evaluate the density estimator at.
<code>bandwidth</code>	bandwidth of the density estimator. One of: <ul style="list-style-type: none"> • a numeric: the bandwidth, as the standard deviation of the kernel • a function: a function taking <code>x</code> (the sample) and returning the bandwidth • a string: the suffix of the name of a function starting with "bandwidth_" that will be used to determine the bandwidth. See bandwidth for a list.
<code>adjust</code>	numeric: the bandwidth for the density estimator is multiplied by this value. See stats::density() .
<code>kernel</code>	string: the smoothing kernel to be used. This must partially match one of "gaussian", "rectangular", "triangular", "epanechnikov", "biweight", "cosine", or "optcosine". See stats::density() .
<code>trim</code>	Should the density estimate be trimmed to the bounds of the data?
<code>adapt</code>	(very experimental) The name and interpretation of this argument are subject to change without notice. Positive integer. If <code>adapt > 1</code> , uses an adaptive approach to calculate the density. First, uses the adaptive bandwidth algorithm of Abramson (1982) to determine local (pointwise) bandwidths, then groups these

bandwidths into adapt groups, then calculates and sums the densities from each group. You can set this to a very large number (e.g. `Inf`) for a fully adaptive approach, but this will be very slow; typically something around 100 yields nearly identical results.

<code>na.rm</code>	Should missing (NA) values in <code>x</code> be removed?
<code>...</code>	Additional arguments (ignored).
<code>range_only</code>	If TRUE, the range of the output of this density estimator is computed and is returned in the <code>\$x</code> element of the result, and <code>c(NA, NA)</code> is returned in <code>\$y</code> . This gives a faster way to determine the range of the output than <code>density_XXX(n = 2)</code> .

Value

An object of class "density", mimicking the output format of `stats::density()`, with the following components:

- `x`: The grid of points at which the density was estimated.
- `y`: The estimated density values.
- `bw`: The bandwidth.
- `n`: The sample size of the `x` input argument.
- `call`: The call used to produce the result, as a quoted expression.
- `data.name`: The deparsed name of the `x` input argument.
- `has.na`: Always FALSE (for compatibility).
- `cdf`: Values of the (possibly weighted) empirical cumulative distribution function at `x`. See [weighted_ecdf\(\)](#).

This allows existing methods for density objects, like `print()` and `plot()`, to work if desired. This output format (and in particular, the `x` and `y` components) is also the format expected by the `density` argument of the `stat_slabinterval()` and the `smooth_` family of functions.

See Also

Other density estimators: [density_bounded\(\)](#), [density_histogram\(\)](#)

Examples

```
library(distributional)
library(dplyr)
library(ggplot2)

# For compatibility with existing code, the return type of density_unbounded()
# is the same as stats::density(), ...
set.seed(123)
x = rbeta(5000, 1, 3)
d = density_unbounded(x)
d

# ... thus, while designed for use with the `density` argument of
```

```

# stat_slabinterval(), output from density_unbounded() can also be used with
# base::plot():
plot(d)

# here we'll use the same data as above, but pick either density_bounded()
# or density_unbounded() (which is equivalent to stats::density()). Notice
# how the bounded density (green) is biased near the boundary of the support,
# while the unbounded density is not.
data.frame(x) %>%
  ggplot() +
  stat_slab(
    aes(xdist = dist), data = data.frame(dist = dist_beta(1, 3)),
    alpha = 0.25
  ) +
  stat_slab(aes(x), density = "bounded", fill = NA, color = "#d95f02", alpha = 0.5) +
  stat_slab(aes(x), density = "unbounded", fill = NA, color = "#1b9e77", alpha = 0.5) +
  scale_thickness_shared() +
  theme_ggdist()

```

find_dotplot_binwidth *Dynamically select a good bin width for a dotplot*

Description

Searches for a nice-looking bin width to use to draw a dotplot such that the height of the dotplot fits within a given space (maxheight).

Usage

```

find_dotplot_binwidth(
  x,
  maxheight,
  heightratio = 1,
  stackratio = 1,
  layout = c("bin", "weave", "hex", "swarm", "bar")
)

```

Arguments

x	numeric vector of values
maxheight	maximum height of the dotplot
heightratio	ratio of bin width to dot height
stackratio	ratio of dot height to vertical distance between dot centers
layout	The layout method used for the dots: <ul style="list-style-type: none"> • "bin" (default): places dots on the off-axis at the midpoint of their bins as in the classic Wilkinson dotplot. This maintains the alignment of rows and columns in the dotplot. This layout is slightly different from the classic

Wilkinson algorithm in that: (1) it nudges bins slightly to avoid overlapping bins and (2) if the input data are symmetrical it will return a symmetrical layout.

- "weave": uses the same basic binning approach of "bin", but places dots in the off-axis at their actual positions (unless overlaps = "nudge", in which case overlaps may be nudged out of the way). This maintains the alignment of rows but does not align dots within columns.
- "hex": uses the same basic binning approach of "bin", but alternates placing dots + binwidth/4 or - binwidth/4 in the off-axis from the bin center. This allows hexagonal packing by setting a stackratio less than 1 (something like 0.9 tends to work).
- "swarm": uses the "compactswarm" layout from `beeswarm::beeswarm()`. Does not maintain alignment of rows or columns, but can be more compact and neat looking, especially for sample data (as opposed to quantile dotplots of theoretical distributions, which may look better with "bin", "weave", or "hex").
- "bar": for discrete distributions, lays out duplicate values in rectangular bars.

Details

This dynamic bin selection algorithm uses a binary search over the number of bins to find a bin width such that if the input data (x) is binned using a Wilkinson-style dotplot algorithm the height of the tallest bin will be less than `maxheight`.

This algorithm is used by `geom_dotsinterval()` (and its variants) to automatically select bin widths. Unless you are manually implementing your own dotplot `grob` or `geom`, you probably do not need to use this function directly

Value

A suitable bin width such that a dotplot created with this bin width and `heightratio` should have its tallest bin be less than or equal to `maxheight`.

See Also

`bin_dots()` for an algorithm can bin dots using bin widths selected by this function; `geom_dotsinterval()` for geometries that use these algorithms to create dotplots.

Examples

```
library(dplyr)
library(ggplot2)

x = qnorm(ppoints(20))
binwidth = find_dotplot_binwidth(x, maxheight = 4, heightratio = 1)
binwidth

bin_df = bin_dots(x = x, y = 0, binwidth = binwidth, heightratio = 1)
```

```
bin_df

# we can manually plot the binning above, though this is only recommended
# if you are using find_dotplot_binwidth() and bin_dots() to build your own
# grob. For practical use it is much easier to use geom_dots(), which will
# automatically select good bin widths for you (and which uses
# find_dotplot_binwidth() and bin_dots() internally)
bin_df %>%
  ggplot(aes(x = x, y = y)) +
  geom_point(size = 4) +
  coord_fixed()
```

geom_blur_dots	<i>Blurry dot plot (geom)</i>
----------------	-------------------------------

Description

Variant of `geom_dots()` for creating blurry dotplots. Accepts an `sd` aesthetic that gives the standard deviation of the blur applied to the dots. Requires a graphics engine supporting radial gradients. Unlike `geom_dots()`, all dots must be circular, so this geom does not support the `shape` aesthetic.

Usage

```
geom_blur_dots(
  mapping = NULL,
  data = NULL,
  stat = "identity",
  position = "identity",
  ...,
  blur = "gaussian",
  binwidth = NA,
  dotsize = 1.07,
  stackratio = 1,
  layout = "bin",
  overlaps = "nudge",
  smooth = "none",
  overflow = "warn",
  verbose = FALSE,
  orientation = NA,
  subguide = "none",
  na.rm = FALSE,
  show.legend = NA,
  inherit.aes = TRUE
)
```

Arguments

mapping	Set of aesthetic mappings created by <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 for this layer, either as a <code>ggproto</code> <code>Geom</code> subclass or as a string naming the stat stripped of the <code>stat_</code> prefix (e.g. "count" rather than "stat_count")
position	Position adjustment, either as a string, or the result of a call to a position adjustment function. Setting this equal to "dodge" (<code>position_dodge()</code>) or "dodgejust" (<code>position_dodgejust()</code>) can be useful if you have overlapping geometries.
...	Other arguments passed to <code>layer()</code> . These are often aesthetics, used to set an aesthetic to a fixed value, like <code>colour = "red"</code> or <code>linewidth = 3</code> (see Aesthetics , below). They may also be parameters to the paired geom/stat.
blur	Blur function to apply to dots. One of: <ul style="list-style-type: none"> • A function that takes a numeric vector of distances from the dot center, the dot radius, and the standard deviation of the blur and returns a vector of opacities in $[0, 1]$, such as <code>blur_gaussian()</code> or <code>blur_interval()</code>. • A string indicating what blur function to use, as the suffix to a function name starting with <code>blur_</code>; e.g. "gaussian" (the default) applies <code>blur_gaussian()</code>.
binwidth	The bin width to use for laying out the dots. One of: <ul style="list-style-type: none"> • <code>NA</code> (the default): Dynamically select the bin width based on the size of the plot when drawn. This will pick a binwidth such that the tallest stack of dots is at most scale in height (ideally exactly scale in height, though this is not guaranteed). • A length-1 (scalar) numeric or <code>unit</code> object giving the exact bin width. • A length-2 (vector) numeric or <code>unit</code> object giving the minimum and maximum desired bin width. The bin width will be dynamically selected within these bounds.

If the value is numeric, it is assumed to be in units of data. The bin width (or its bounds) can also be specified using `unit()`, which may be useful if it is desired that the dots be a certain point size or a certain percentage of the width/height of the viewport. For example, `unit(0.1, "npc")` would make dots that are *exactly* 10% of the viewport size along whichever dimension the dotplot is drawn; `unit(c(0, 0.1), "npc")` would make dots that are *at most* 10% of the viewport size (while still ensuring the tallest stack is less than or equal to scale).

dotsize	The width of the dots relative to the binwidth. The default, 1.07, makes dots be just a bit wider than the bin width, which is a manually-tuned parameter that tends to work well with the default circular shape, preventing gaps between bins from appearing to be too large visually (as might arise from dots being <i>precisely</i> the binwidth). If it is desired to have dots be precisely the binwidth, set <code>dotsize = 1</code> .
stackratio	The distance between the center of the dots in the same stack relative to the dot height. The default, 1, makes dots in the same stack just touch each other.
layout	The layout method used for the dots: <ul style="list-style-type: none"> • "bin" (default): places dots on the off-axis at the midpoint of their bins as in the classic Wilkinson dotplot. This maintains the alignment of rows and columns in the dotplot. This layout is slightly different from the classic Wilkinson algorithm in that: (1) it nudges bins slightly to avoid overlapping bins and (2) if the input data are symmetrical it will return a symmetrical layout. • "weave": uses the same basic binning approach of "bin", but places dots in the off-axis at their actual positions (unless <code>overlaps = "nudge"</code>, in which case overlaps may be nudged out of the way). This maintains the alignment of rows but does not align dots within columns. • "hex": uses the same basic binning approach of "bin", but alternates placing dots + <code>binwidth/4</code> or - <code>binwidth/4</code> in the off-axis from the bin center. This allows hexagonal packing by setting a <code>stackratio</code> less than 1 (something like 0.9 tends to work). • "swarm": uses the "compactswarm" layout from <code>beeswarm::beeswarm()</code>. Does not maintain alignment of rows or columns, but can be more compact and neat looking, especially for sample data (as opposed to quantile dotplots of theoretical distributions, which may look better with "bin", "weave", or "hex"). • "bar": for discrete distributions, lays out duplicate values in rectangular bars.
overlaps	How to handle overlapping dots or bins in the "bin", "weave", and "hex" layouts (dots never overlap in the "swarm" or "bar" layouts). For the purposes of this argument, dots are only considered to be overlapping if they would be overlapping when <code>dotsize = 1</code> and <code>stackratio = 1</code> ; i.e. if you set those arguments to other values, overlaps may still occur. One of: <ul style="list-style-type: none"> • "keep": leave overlapping dots as they are. Dots may overlap (usually only slightly) in the "bin", "weave", and "hex" layouts. • "nudge": nudge overlapping dots out of the way. Overlaps are avoided using a constrained optimization which minimizes the squared distance of dots to their desired positions, subject to the constraint that adjacent dots do not overlap.
smooth	Smoother to apply to dot positions. One of: <ul style="list-style-type: none"> • A function that takes a numeric vector of dot positions and returns a smoothed version of that vector, such as <code>smooth_bounded()</code>, <code>smooth_unbounded()</code>, <code>smooth_discrete()</code>, or <code>smooth_bar()</code>.

- A string indicating what smoother to use, as the suffix to a function name starting with `smooth_`; e.g. "none" (the default) applies `smooth_none()`, which simply returns the given vector without applying smoothing.

Smoothing is most effective when the smoother is matched to the support of the distribution; e.g. using `smooth_bounded(bounds = ...)`.

overflow

How to handle overflow of dots beyond the extent of the geom when a minimum binwidth (or an exact binwidth) is supplied. One of:

- "keep": Keep the overflow, drawing dots outside the geom bounds.
- "warn": Keep the overflow, but produce a warning suggesting solutions, such as setting `binwidth = NA` or `overflow = "compress"`.
- "compress": Compress the layout. Reduces the binwidth to the size necessary to keep the dots within bounds, then adjusts `stackratio` and `dotsize` so that the apparent dot size is the user-specified minimum binwidth times the user-specified `dotsize`.

If you find the default layout has dots that are too small, and you are okay with dots overlapping, consider setting `overflow = "compress"` and supplying an exact or minimum dot size using `binwidth`.

verbose

If TRUE, print out the bin width of the dotplot. Can be useful if you want to start from an automatically-selected bin width and then adjust it manually. Bin width is printed both as data units and as normalized parent coordinates or "npc"s (see `unit()`). Note that if you just want to scale the selected bin width to fit within a desired area, it is probably easier to use `scale` than to copy and scale `binwidth` manually, and if you just want to provide constraints on the bin width, you can pass a length-2 vector to `binwidth`.

orientation

Whether this geom is drawn horizontally or vertically. One of:

- NA (default): automatically detect the orientation based on how the aesthetics are assigned. Automatic detection works most of the time.
- "horizontal" (or "y"): draw horizontally, using the y aesthetic to identify different groups. For each group, uses the x, `xmin`, `xmax`, and `thickness` aesthetics to draw points, intervals, and slabs.
- "vertical" (or "x"): draw vertically, using the x aesthetic to identify different groups. For each group, uses the y, `ymin`, `ymax`, and `thickness` aesthetics to draw points, intervals, and slabs.

For compatibility with the base ggplot naming scheme for orientation, "x" can be used as an alias for "vertical" and "y" as an alias for "horizontal" (`ggdist` had an `orientation` parameter before base ggplot did, hence the discrepancy).

subguide

Sub-guide used to annotate the thickness scale. One of:

- A function that takes a scale argument giving a `ggplot2::Scale` object and an orientation argument giving the orientation of the geometry and then returns a `grid::grob` that will draw the axis annotation, such as `subguide_axis()` (to draw a traditional axis) or `subguide_none()` (to draw no annotation). See `subguide_axis()` for a list of possibilities and examples.
- A string giving the name of such a function when prefixed with "subguide"; e.g. "axis" or "none".

na.rm	If FALSE, the default, missing values are removed with a warning. If TRUE, missing values are silently removed.
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> .

Details

The *dots* family of stats and geoms are similar to `geom_dotplot()` but with a number of differences:

- Dots geoms act like slabs in `geom_slabinterval()` and can be given x positions (or y positions when in a horizontal orientation).
- Given the available space to lay out dots, the dots geoms will automatically determine how many bins to use to fit the available space.
- Dots geoms use a dynamic layout algorithm that lays out dots from the center out if the input data are symmetrical, guaranteeing that symmetrical data results in a symmetrical plot. The layout algorithm also prevents dots from overlapping each other.
- The shape of the dots in these geoms can be changed using the `slab_shape` aesthetic (when using the `dotsinterval` family) or the `shape` or `slab_shape` aesthetic (when using the `dots` family)

Stats and geoms in this family include:

- `geom_dots()`: dotplots on raw data. Ensures the dotplot fits within available space by reducing the size of the dots automatically (may result in very small dots).
- `geom_swarm()` and `geom_weave()`: dotplots on raw data with defaults intended to create "beeswarm" plots. Used `side = "both"` by default, and sets the default dot size to the same size as `geom_point()` (`binwidth = unit(1.5, "mm")`), allowing dots to overlap instead of getting very small.
- `stat_dots()`: dotplots on raw data, **distributional** objects, and `posterior::rvar()`s
- `geom_dotsinterval()`: dotplot + interval plots on raw data with already-calculated intervals (rarely useful directly).
- `stat_dotsinterval()`: dotplot + interval plots on raw data, **distributional** objects, and `posterior::rvar()`s (will calculate intervals for you).
- `geom_blur_dots()`: blurry dotplots that allow the standard deviation of a blur applied to each dot to be specified using the `sd` aesthetic.
- `stat_mcse_dots()`: blurry dotplots of quantiles using the Monte Carlo Standard Error of each quantile.

`stat_dots()` and `stat_dotsinterval()`, when used with the `quantiles` argument, are particularly useful for constructing quantile dotplots, which can be an effective way to communicate uncertainty using a frequency framing that may be easier for laypeople to understand (Kay et al. 2016, Fernandes et al. 2018).

Value

A `ggplot2::Geom` representing a blurry dot geometry which can be added to a `ggplot()` object.

Aesthetics

The dots+interval stats and geoms have a wide variety of aesthetics that control the appearance of their three sub-geometries: the **dots** (aka the **slab**), the **point**, and the **interval**.

Positional aesthetics

- `x`: x position of the geometry
- `y`: y position of the geometry

Dots-specific (aka Slab-specific) aesthetics

- `sd`: The standard deviation (in data units) of the blur associated with each dot.
- `order`: The order in which data points are stacked within bins. Can be used to create the effect of "stacked" dots by ordering dots according to a discrete variable. If omitted (NULL), the value of the data points themselves are used to determine stacking order. Only applies when layout is "bin" or "hex", as the other layout methods fully determine both *x* and *y* positions.
- `side`: Which side to place the slab on. "topright", "top", and "right" are synonyms which cause the slab to be drawn on the top or the right depending on if orientation is "horizontal" or "vertical". "bottomleft", "bottom", and "left" are synonyms which cause the slab to be drawn on the bottom or the left depending on if orientation is "horizontal" or "vertical". "topleft" causes the slab to be drawn on the top or the left, and "bottomright" causes the slab to be drawn on the bottom or the right. "both" draws the slab mirrored on both sides (as in a violin plot).
- `scale`: What proportion of the region allocated to this geom to use to draw the slab. If `scale = 1`, slabs that use the maximum range will just touch each other. Default is 0.9 to leave some space between adjacent slabs. For a comprehensive discussion and examples of slab scaling and normalization, see the [thickness scale article](#).
- `justification`: Justification of the interval relative to the slab, where 0 indicates bottom/left justification and 1 indicates top/right justification (depending on orientation). If `justification` is NULL (the default), then it is set automatically based on the value of `side`: when `side` is "top"/"right" justification is set to 0, when `side` is "bottom"/"left" justification is set to 1, and when `side` is "both" justification is set to 0.5.
- `datatype`: When using composite geoms directly without a stat (e.g. `geom_slabinterval()`), `datatype` is used to indicate which part of the geom a row in the data targets: rows with `datatype = "slab"` target the slab portion of the geometry and rows with `datatype = "interval"` target the interval portion of the geometry. This is set automatically when using `ggdist` stats.

Interval-specific aesthetics

- `xmin`: Left end of the interval sub-geometry (if orientation = "horizontal").
- `xmax`: Right end of the interval sub-geometry (if orientation = "horizontal").
- `ymin`: Lower end of the interval sub-geometry (if orientation = "vertical").
- `ymax`: Upper end of the interval sub-geometry (if orientation = "vertical").

Color aesthetics

- **colour:** (or **color**) The color of the **interval** and **point** sub-geometries. Use the `slab_color`, `interval_color`, or `point_color` aesthetics (below) to set sub-geometry colors separately.
- **fill:** The fill color of the **slab** and **point** sub-geometries. Use the `slab_fill` or `point_fill` aesthetics (below) to set sub-geometry colors separately.
- **alpha:** The opacity of the **slab**, **interval**, and **point** sub-geometries. Use the `slab_alpha`, `interval_alpha`, or `point_alpha` aesthetics (below) to set sub-geometry colors separately.
- **colour_ramp:** (or **color_ramp**) A secondary scale that modifies the color scale to "ramp" to another color. See `scale_colour_ramp()` for examples.
- **fill_ramp:** A secondary scale that modifies the fill scale to "ramp" to another color. See `scale_fill_ramp()` for examples.

Line aesthetics

- **linewidth:** Width of the line used to draw the **interval** (except with `geom_slab()`: then it is the width of the **slab**). With composite geometries including an interval and slab, use `slab_linewidth` to set the line width of the **slab** (see below). For **interval**, raw linewidth values are transformed according to the `interval_size_domain` and `interval_size_range` parameters of the geom (see above).
- **size:** Determines the size of the **point**. If `linewidth` is not provided, `size` will also determine the width of the line used to draw the **interval** (this allows line width and point size to be modified together by setting only `size` and not `linewidth`). Raw `size` values are transformed according to the `interval_size_domain`, `interval_size_range`, and `fatten_point` parameters of the geom (see above). Use the `point_size` aesthetic (below) to set sub-geometry size directly without applying the effects of `interval_size_domain`, `interval_size_range`, and `fatten_point`.
- **stroke:** Width of the outline around the **point** sub-geometry.
- **linetype:** Type of line (e.g., "solid", "dashed", etc) used to draw the **interval** and the outline of the **slab** (if it is visible). Use the `slab_linetype` or `interval_linetype` aesthetics (below) to set sub-geometry line types separately.

Slab-specific color and line override aesthetics

- `slab_fill`: Override for `fill`: the fill color of the slab.
- `slab_colour`: (or `slab_color`) Override for `colour/color`: the outline color of the slab.
- `slab_alpha`: Override for `alpha`: the opacity of the slab.
- `slab_linewidth`: Override for `linewidth`: the width of the outline of the slab.
- `slab_linetype`: Override for `linetype`: the line type of the outline of the slab.
- `slab_shape`: Override for `shape`: the shape of the dots used to draw the dotplot slab.

Interval-specific color and line override aesthetics

- `interval_colour`: (or `interval_color`) Override for `colour/color`: the color of the interval.
- `interval_alpha`: Override for `alpha`: the opacity of the interval.

- `interval_linetype`: Override for `linetype`: the line type of the interval.

Point-specific color and line override aesthetics

- `point_fill`: Override for `fill`: the fill color of the point.
- `point_colour`: (or `point_color`) Override for `colour/color`: the outline color of the point.
- `point_alpha`: Override for `alpha`: the opacity of the point.
- `point_size`: Override for `size`: the size of the point.

Deprecated aesthetics

- `slab_size`: Use `slab_linewidth`.
- `interval_size`: Use `interval_linewidth`.

Other aesthetics (these work as in standard geoms)

- `width`
- `height`
- `group`

See examples of some of these aesthetics in action in `vignette("dotsinterval")`. Learn more about the sub-geom override aesthetics (like `interval_color`) in the [scales](#) documentation. Learn more about basic ggplot aesthetics in `vignette("ggplot2-specs")`.

References

Kay, M., Kola, T., Hullman, J. R., & Munson, S. A. (2016). When (ish) is My Bus? User-centered Visualizations of Uncertainty in Everyday, Mobile Predictive Systems. *Conference on Human Factors in Computing Systems - CHI '16*, 5092–5103. doi:10.1145/2858036.2858558.

Fernandes, M., Walls, L., Munson, S., Hullman, J., & Kay, M. (2018). Uncertainty Displays Using Quantile Dotplots or CDFs Improve Transit Decision-Making. *Conference on Human Factors in Computing Systems - CHI '18*. doi:10.1145/3173574.3173718.

See Also

See `geom_dotsinterval()` for the geometry this shortcut is based on.

See `vignette("dotsinterval")` for a variety of examples of use.

Other `dotsinterval` geoms: `geom_dots()`, `geom_dotsinterval()`, `geom_swarm()`, `geom_weave()`

Examples

```
library(dplyr)
library(ggplot2)

theme_set(theme_ggdist())

set.seed(1234)
```

```

x = rnorm(1000)

# manually calculate quantiles and their MCSE
# this could also be done more succinctly with stat_mcse_dots()
p = ppoints(100)
df = data.frame(
  q = quantile(x, p),
  se = posterior::mcse_quantile(x, p)
)

df %>%
  ggplot(aes(x = q, sd = se)) +
  geom_blur_dots()

df %>%
  ggplot(aes(x = q, sd = se)) +
  # or blur = blur_interval(.width = .95) to set the interval width
  geom_blur_dots(blur = "interval")

```

geom_dots

Dot plot (shortcut geom)

Description

Shortcut version of `geom_dotsinterval()` for creating dot plots. Geoms based on `geom_dotsinterval()` create dotplots that automatically ensure the plot fits within the available space.

Roughly equivalent to:

```

geom_dotsinterval(
  show_point = FALSE,
  show_interval = FALSE
)

```

Usage

```

geom_dots(
  mapping = NULL,
  data = NULL,
  stat = "identity",
  position = "identity",
  ...,
  binwidth = NA,
  dotsize = 1.07,
  stackratio = 1,
  layout = "bin",
  overlaps = "nudge",
  smooth = "none",

```

```

overflow = "warn",
verbose = FALSE,
orientation = NA,
subguide = "none",
na.rm = FALSE,
show.legend = NA,
inherit.aes = TRUE
)

```

Arguments

mapping	Set of aesthetic mappings created by <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>
stat	The statistical transformation to use on the data for this layer, either as a <code>ggproto</code> <code>Geom</code> subclass or as a string naming the stat stripped of the <code>stat_</code> prefix (e.g. "count" rather than "stat_count")
position	Position adjustment, either as a string, or the result of a call to a position adjustment function. Setting this equal to "dodge" (<code>position_dodge()</code>) or "dodgejust" (<code>position_dodgejust()</code>) can be useful if you have overlapping geometries.
...	Other arguments passed to <code>layer()</code> . These are often aesthetics, used to set an aesthetic to a fixed value, like <code>colour = "red"</code> or <code>linewidth = 3</code> (see Aesthetics , below). They may also be parameters to the paired <code>geom/stat</code> .
binwidth	<p>The bin width to use for laying out the dots. One of:</p> <ul style="list-style-type: none"> • <code>NA</code> (the default): Dynamically select the bin width based on the size of the plot when drawn. This will pick a <code>binwidth</code> such that the tallest stack of dots is at most scale in height (ideally exactly scale in height, though this is not guaranteed). • A length-1 (scalar) numeric or <code>unit</code> object giving the exact bin width. • A length-2 (vector) numeric or <code>unit</code> object giving the minimum and maximum desired bin width. The bin width will be dynamically selected within these bounds. <p>If the value is numeric, it is assumed to be in units of data. The bin width (or its bounds) can also be specified using <code>unit()</code>, which may be useful if it is desired that the dots be a certain point size or a certain percentage of the width/height of the viewport. For example, <code>unit(0.1, "npc")</code> would make dots that are <i>exactly</i> 10% of the viewport size along whichever dimension the</p>

	dotplot is drawn; <code>unit(c(0, 0.1), "npc")</code> would make dots that are <i>at most</i> 10% of the viewport size (while still ensuring the tallest stack is less than or equal to scale).
dotsize	The width of the dots relative to the binwidth. The default, 1.07, makes dots be just a bit wider than the bin width, which is a manually-tuned parameter that tends to work well with the default circular shape, preventing gaps between bins from appearing to be too large visually (as might arise from dots being <i>precisely</i> the binwidth). If it is desired to have dots be precisely the binwidth, set <code>dotsize = 1</code> .
stackratio	The distance between the center of the dots in the same stack relative to the dot height. The default, 1, makes dots in the same stack just touch each other.
layout	The layout method used for the dots: <ul style="list-style-type: none"> • "bin" (default): places dots on the off-axis at the midpoint of their bins as in the classic Wilkinson dotplot. This maintains the alignment of rows and columns in the dotplot. This layout is slightly different from the classic Wilkinson algorithm in that: (1) it nudges bins slightly to avoid overlapping bins and (2) if the input data are symmetrical it will return a symmetrical layout. • "weave": uses the same basic binning approach of "bin", but places dots in the off-axis at their actual positions (unless <code>overlaps = "nudge"</code>, in which case overlaps may be nudged out of the way). This maintains the alignment of rows but does not align dots within columns. • "hex": uses the same basic binning approach of "bin", but alternates placing dots $+ \text{binwidth}/4$ or $- \text{binwidth}/4$ in the off-axis from the bin center. This allows hexagonal packing by setting a <code>stackratio</code> less than 1 (something like 0.9 tends to work). • "swarm": uses the "compactswarm" layout from <code>beeswarm::beeswarm()</code>. Does not maintain alignment of rows or columns, but can be more compact and neat looking, especially for sample data (as opposed to quantile dotplots of theoretical distributions, which may look better with "bin", "weave", or "hex"). • "bar": for discrete distributions, lays out duplicate values in rectangular bars.
overlaps	How to handle overlapping dots or bins in the "bin", "weave", and "hex" layouts (dots never overlap in the "swarm" or "bar" layouts). For the purposes of this argument, dots are only considered to be overlapping if they would be overlapping when <code>dotsize = 1</code> and <code>stackratio = 1</code> ; i.e. if you set those arguments to other values, overlaps may still occur. One of: <ul style="list-style-type: none"> • "keep": leave overlapping dots as they are. Dots may overlap (usually only slightly) in the "bin", "weave", and "hex" layouts. • "nudge": nudge overlapping dots out of the way. Overlaps are avoided using a constrained optimization which minimizes the squared distance of dots to their desired positions, subject to the constraint that adjacent dots do not overlap.
smooth	Smoother to apply to dot positions. One of:

- A function that takes a numeric vector of dot positions and returns a smoothed version of that vector, such as `smooth_bounded()`, `smooth_unbounded()`, `smooth_discrete()`, or `smooth_bar()`.
- A string indicating what smoother to use, as the suffix to a function name starting with `smooth_`; e.g. "none" (the default) applies `smooth_none()`, which simply returns the given vector without applying smoothing.

Smoothing is most effective when the smoother is matched to the support of the distribution; e.g. using `smooth_bounded(bounds = . . .)`.

overflow

How to handle overflow of dots beyond the extent of the geom when a minimum binwidth (or an exact binwidth) is supplied. One of:

- "keep": Keep the overflow, drawing dots outside the geom bounds.
- "warn": Keep the overflow, but produce a warning suggesting solutions, such as setting `binwidth = NA` or `overflow = "compress"`.
- "compress": Compress the layout. Reduces the binwidth to the size necessary to keep the dots within bounds, then adjusts `stackratio` and `dotsize` so that the apparent dot size is the user-specified minimum binwidth times the user-specified `dotsize`.

If you find the default layout has dots that are too small, and you are okay with dots overlapping, consider setting `overflow = "compress"` and supplying an exact or minimum dot size using `binwidth`.

verbose

If TRUE, print out the bin width of the dotplot. Can be useful if you want to start from an automatically-selected bin width and then adjust it manually. Bin width is printed both as data units and as normalized parent coordinates or "npc"s (see `unit()`). Note that if you just want to scale the selected bin width to fit within a desired area, it is probably easier to use `scale` than to copy and scale `binwidth` manually, and if you just want to provide constraints on the bin width, you can pass a length-2 vector to `binwidth`.

orientation

Whether this geom is drawn horizontally or vertically. One of:

- NA (default): automatically detect the orientation based on how the aesthetics are assigned. Automatic detection works most of the time.
- "horizontal" (or "y"): draw horizontally, using the y aesthetic to identify different groups. For each group, uses the x, xmin, xmax, and thickness aesthetics to draw points, intervals, and slabs.
- "vertical" (or "x"): draw vertically, using the x aesthetic to identify different groups. For each group, uses the y, ymin, ymax, and thickness aesthetics to draw points, intervals, and slabs.

For compatibility with the base ggplot naming scheme for orientation, "x" can be used as an alias for "vertical" and "y" as an alias for "horizontal" (`ggdist` had an orientation parameter before base ggplot did, hence the discrepancy).

subguide

Sub-guide used to annotate the thickness scale. One of:

- A function that takes a scale argument giving a `ggplot2::Scale` object and an orientation argument giving the orientation of the geometry and then returns a `grid::grob` that will draw the axis annotation, such as `subguide_axis()` (to draw a traditional axis) or `subguide_none()` (to draw no annotation). See `subguide_axis()` for a list of possibilities and examples.

	<ul style="list-style-type: none"> • A string giving the name of such a function when prefixed with "subguide"; e.g. "axis" or "none".
na.rm	If FALSE, the default, missing values are removed with a warning. If TRUE, missing values are silently removed.
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> .

Details

The *dots* family of stats and geoms are similar to `geom_dotplot()` but with a number of differences:

- Dots geoms act like slabs in `geom_slabinterval()` and can be given x positions (or y positions when in a horizontal orientation).
- Given the available space to lay out dots, the dots geoms will automatically determine how many bins to use to fit the available space.
- Dots geoms use a dynamic layout algorithm that lays out dots from the center out if the input data are symmetrical, guaranteeing that symmetrical data results in a symmetrical plot. The layout algorithm also prevents dots from overlapping each other.
- The shape of the dots in these geoms can be changed using the `slab_shape` aesthetic (when using the `dotsinterval` family) or the `shape` or `slab_shape` aesthetic (when using the `dots` family)

Stats and geoms in this family include:

- `geom_dots()`: dotplots on raw data. Ensures the dotplot fits within available space by reducing the size of the dots automatically (may result in very small dots).
- `geom_swarm()` and `geom_weave()`: dotplots on raw data with defaults intended to create "beeswarm" plots. Used `side = "both"` by default, and sets the default dot size to the same size as `geom_point()` (`binwidth = unit(1.5, "mm")`), allowing dots to overlap instead of getting very small.
- `stat_dots()`: dotplots on raw data, **distributional** objects, and `posterior::rvar()`s
- `geom_dotsinterval()`: dotplot + interval plots on raw data with already-calculated intervals (rarely useful directly).
- `stat_dotsinterval()`: dotplot + interval plots on raw data, **distributional** objects, and `posterior::rvar()`s (will calculate intervals for you).
- `geom_blur_dots()`: blurry dotplots that allow the standard deviation of a blur applied to each dot to be specified using the `sd` aesthetic.
- `stat_mcse_dots()`: blurry dotplots of quantiles using the Monte Carlo Standard Error of each quantile.

`stat_dots()` and `stat_dotsinterval()`, when used with the `quantiles` argument, are particularly useful for constructing quantile dotplots, which can be an effective way to communicate uncertainty using a frequency framing that may be easier for laypeople to understand (Kay et al. 2016, Fernandes et al. 2018).

Value

A `ggplot2::Geom` representing a dot geometry which can be added to a `ggplot()` object.

Aesthetics

The dots+interval stats and geoms have a wide variety of aesthetics that control the appearance of their three sub-geometries: the **dots** (aka the **slab**), the **point**, and the **interval**.

Positional aesthetics

- `x`: x position of the geometry
- `y`: y position of the geometry

Dots-specific (aka Slab-specific) aesthetics

- `family`: The font family used to draw the dots.
- `order`: The order in which data points are stacked within bins. Can be used to create the effect of "stacked" dots by ordering dots according to a discrete variable. If omitted (NULL), the value of the data points themselves are used to determine stacking order. Only applies when layout is "bin" or "hex", as the other layout methods fully determine both *x* and *y* positions.
- `side`: Which side to place the slab on. "topright", "top", and "right" are synonyms which cause the slab to be drawn on the top or the right depending on if orientation is "horizontal" or "vertical". "bottomleft", "bottom", and "left" are synonyms which cause the slab to be drawn on the bottom or the left depending on if orientation is "horizontal" or "vertical". "topleft" causes the slab to be drawn on the top or the left, and "bottomright" causes the slab to be drawn on the bottom or the right. "both" draws the slab mirrored on both sides (as in a violin plot).
- `scale`: What proportion of the region allocated to this geom to use to draw the slab. If `scale = 1`, slabs that use the maximum range will just touch each other. Default is 0.9 to leave some space between adjacent slabs. For a comprehensive discussion and examples of slab scaling and normalization, see the [thickness scale article](#).
- `justification`: Justification of the interval relative to the slab, where 0 indicates bottom/left justification and 1 indicates top/right justification (depending on orientation). If `justification` is NULL (the default), then it is set automatically based on the value of `side`: when `side` is "top"/"right" justification is set to 0, when `side` is "bottom"/"left" justification is set to 1, and when `side` is "both" justification is set to 0.5.
- `datatype`: When using composite geoms directly without a stat (e.g. `geom_slabinterval()`), `datatype` is used to indicate which part of the geom a row in the data targets: rows with `datatype = "slab"` target the slab portion of the geometry and rows with `datatype = "interval"` target the interval portion of the geometry. This is set automatically when using `ggdist` stats.

Interval-specific aesthetics

- `xmin`: Left end of the interval sub-geometry (if orientation = "horizontal").
- `xmax`: Right end of the interval sub-geometry (if orientation = "horizontal").
- `ymin`: Lower end of the interval sub-geometry (if orientation = "vertical").
- `ymax`: Upper end of the interval sub-geometry (if orientation = "vertical").

Point-specific aesthetics

- **shape**: Shape type used to draw the **point** sub-geometry.

Color aesthetics

- **colour**: (or **color**) The color of the **interval** and **point** sub-geometries. Use the `slab_color`, `interval_color`, or `point_color` aesthetics (below) to set sub-geometry colors separately.
- **fill**: The fill color of the **slab** and **point** sub-geometries. Use the `slab_fill` or `point_fill` aesthetics (below) to set sub-geometry colors separately.
- **alpha**: The opacity of the **slab**, **interval**, and **point** sub-geometries. Use the `slab_alpha`, `interval_alpha`, or `point_alpha` aesthetics (below) to set sub-geometry colors separately.
- **colour_ramp**: (or **color_ramp**) A secondary scale that modifies the color scale to "ramp" to another color. See `scale_colour_ramp()` for examples.
- **fill_ramp**: A secondary scale that modifies the fill scale to "ramp" to another color. See `scale_fill_ramp()` for examples.

Line aesthetics

- **linewidth**: Width of the line used to draw the **interval** (except with `geom_slab()`: then it is the width of the **slab**). With composite geometries including an interval and slab, use `slab_linewidth` to set the line width of the **slab** (see below). For **interval**, raw `linewidth` values are transformed according to the `interval_size_domain` and `interval_size_range` parameters of the geom (see above).
- **size**: Determines the size of the **point**. If `linewidth` is not provided, `size` will also determine the width of the line used to draw the **interval** (this allows line width and point size to be modified together by setting only `size` and not `linewidth`). Raw `size` values are transformed according to the `interval_size_domain`, `interval_size_range`, and `fatten_point` parameters of the geom (see above). Use the `point_size` aesthetic (below) to set sub-geometry size directly without applying the effects of `interval_size_domain`, `interval_size_range`, and `fatten_point`.
- **stroke**: Width of the outline around the **point** sub-geometry.
- **linetype**: Type of line (e.g., "solid", "dashed", etc) used to draw the **interval** and the outline of the **slab** (if it is visible). Use the `slab_linetype` or `interval_linetype` aesthetics (below) to set sub-geometry line types separately.

Slab-specific color and line override aesthetics

- `slab_fill`: Override for `fill`: the fill color of the slab.
- `slab_colour`: (or `slab_color`) Override for `colour/color`: the outline color of the slab.
- `slab_alpha`: Override for `alpha`: the opacity of the slab.
- `slab_linewidth`: Override for `linewidth`: the width of the outline of the slab.
- `slab_linetype`: Override for `linetype`: the line type of the outline of the slab.
- `slab_shape`: Override for `shape`: the shape of the dots used to draw the dotplot slab.

Interval-specific color and line override aesthetics

- `interval_colour`: (or `interval_color`) Override for `colour/color`: the color of the interval.
- `interval_alpha`: Override for `alpha`: the opacity of the interval.
- `interval_linetype`: Override for `linetype`: the line type of the interval.

Point-specific color and line override aesthetics

- `point_fill`: Override for `fill`: the fill color of the point.
- `point_colour`: (or `point_color`) Override for `colour/color`: the outline color of the point.
- `point_alpha`: Override for `alpha`: the opacity of the point.
- `point_size`: Override for `size`: the size of the point.

Deprecated aesthetics

- `slab_size`: Use `slab_linewidth`.
- `interval_size`: Use `interval_linewidth`.

Other aesthetics (these work as in standard geoms)

- `width`
- `height`
- `group`

See examples of some of these aesthetics in action in `vignette("dotsinterval")`. Learn more about the sub-geom override aesthetics (like `interval_color`) in the [scales](#) documentation. Learn more about basic ggplot aesthetics in `vignette("ggplot2-specs")`.

References

Kay, M., Kola, T., Hullman, J. R., & Munson, S. A. (2016). When (ish) is My Bus? User-centered Visualizations of Uncertainty in Everyday, Mobile Predictive Systems. *Conference on Human Factors in Computing Systems - CHI '16*, 5092–5103. doi:10.1145/2858036.2858558.

Fernandes, M., Walls, L., Munson, S., Hullman, J., & Kay, M. (2018). Uncertainty Displays Using Quantile Dotplots or CDFs Improve Transit Decision-Making. *Conference on Human Factors in Computing Systems - CHI '18*. doi:10.1145/3173574.3173718.

See Also

See `stat_dots()` for the stat version, intended for use on sample data or analytical distributions.

See `geom_dotsinterval()` for the geometry this shortcut is based on.

See `vignette("dotsinterval")` for a variety of examples of use.

Other `dotsinterval` geoms: `geom_blur_dots()`, `geom_dotsinterval()`, `geom_swarm()`, `geom_weave()`

Examples

```

library(dplyr)
library(ggplot2)

theme_set(theme_ggdist())

set.seed(12345)
df = tibble(
  g = rep(c("a", "b"), 200),
  value = rnorm(400, c(0, 3), c(0.75, 1))
)

# orientation is detected automatically based on
# which axis is discrete

df %>%
  ggplot(aes(x = value, y = g)) +
  geom_dots()

df %>%
  ggplot(aes(y = value, x = g)) +
  geom_dots()

```

geom_dotsinterval *Automatic dotplot + point + interval meta-geom*

Description

This meta-geom supports drawing combinations of dotplots, points, and intervals. Geoms and stats based on `geom_dotsinterval()` create dotplots that automatically determine a bin width that ensures the plot fits within the available space. They also ensure dots do not overlap, and allow the generation of quantile dotplots using the `quantiles` argument to `stat_dotsinterval()/stat_dots()`. Generally follows the naming scheme and arguments of the `geom_slabinterval()` and `stat_slabinterval()` family of geoms and stats.

Usage

```

geom_dotsinterval(
  mapping = NULL,
  data = NULL,
  stat = "identity",
  position = "identity",
  ...,
  binwidth = NA,
  dotsize = 1.07,
  stackratio = 1,
  layout = "bin",
  overlaps = "nudge",

```

```

smooth = "none",
overflow = "warn",
verbose = FALSE,
orientation = NA,
interval_size_domain = c(1, 6),
interval_size_range = c(0.6, 1.4),
fatten_point = 1.8,
arrow = NULL,
show_slab = TRUE,
show_point = TRUE,
show_interval = TRUE,
subguide = "none",
na.rm = FALSE,
show.legend = NA,
inherit.aes = TRUE
)

```

Arguments

mapping	Set of aesthetic mappings created by <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>
stat	The statistical transformation to use on the data for this layer, either as a <code>ggproto</code> <code>Geom</code> subclass or as a string naming the stat stripped of the <code>stat_</code> prefix (e.g. "count" rather than "stat_count")
position	Position adjustment, either as a string, or the result of a call to a position adjustment function. Setting this equal to "dodge" (<code>position_dodge()</code>) or "dodgejust" (<code>position_dodgejust()</code>) can be useful if you have overlapping geometries.
...	Other arguments passed to <code>layer()</code> . These are often aesthetics, used to set an aesthetic to a fixed value, like <code>colour = "red"</code> or <code>linewidth = 3</code> (see Aesthetics , below). They may also be parameters to the paired <code>geom/stat</code> .
binwidth	<p>The bin width to use for laying out the dots. One of:</p> <ul style="list-style-type: none"> • <code>NA</code> (the default): Dynamically select the bin width based on the size of the plot when drawn. This will pick a binwidth such that the tallest stack of dots is at most scale in height (ideally exactly scale in height, though this is not guaranteed). • A length-1 (scalar) numeric or <code>unit</code> object giving the exact bin width.

- A length-2 (vector) numeric or `unit` object giving the minimum and maximum desired bin width. The bin width will be dynamically selected within these bounds.

If the value is numeric, it is assumed to be in units of data. The bin width (or its bounds) can also be specified using `unit()`, which may be useful if it is desired that the dots be a certain point size or a certain percentage of the width/height of the viewport. For example, `unit(0.1, "npc")` would make dots that are *exactly* 10% of the viewport size along whichever dimension the dotplot is drawn; `unit(c(0, 0.1), "npc")` would make dots that are *at most* 10% of the viewport size (while still ensuring the tallest stack is less than or equal to scale).

dotsize	The width of the dots relative to the binwidth. The default, 1.07, makes dots be just a bit wider than the bin width, which is a manually-tuned parameter that tends to work well with the default circular shape, preventing gaps between bins from appearing to be too large visually (as might arise from dots being <i>precisely</i> the binwidth). If it is desired to have dots be precisely the binwidth, set <code>dotsize = 1</code> .
stackratio	The distance between the center of the dots in the same stack relative to the dot height. The default, 1, makes dots in the same stack just touch each other.
layout	<p>The layout method used for the dots:</p> <ul style="list-style-type: none"> • "bin" (default): places dots on the off-axis at the midpoint of their bins as in the classic Wilkinson dotplot. This maintains the alignment of rows and columns in the dotplot. This layout is slightly different from the classic Wilkinson algorithm in that: (1) it nudges bins slightly to avoid overlapping bins and (2) if the input data are symmetrical it will return a symmetrical layout. • "weave": uses the same basic binning approach of "bin", but places dots in the off-axis at their actual positions (unless <code>overlaps = "nudge"</code>, in which case overlaps may be nudged out of the way). This maintains the alignment of rows but does not align dots within columns. • "hex": uses the same basic binning approach of "bin", but alternates placing dots $+ \text{binwidth}/4$ or $- \text{binwidth}/4$ in the off-axis from the bin center. This allows hexagonal packing by setting a <code>stackratio</code> less than 1 (something like 0.9 tends to work). • "swarm": uses the "compactswarm" layout from <code>beeswarm::beeswarm()</code>. Does not maintain alignment of rows or columns, but can be more compact and neat looking, especially for sample data (as opposed to quantile dotplots of theoretical distributions, which may look better with "bin", "weave", or "hex"). • "bar": for discrete distributions, lays out duplicate values in rectangular bars.
overlaps	How to handle overlapping dots or bins in the "bin", "weave", and "hex" layouts (dots never overlap in the "swarm" or "bar" layouts). For the purposes of this argument, dots are only considered to be overlapping if they would be overlapping when <code>dotsize = 1</code> and <code>stackratio = 1</code> ; i.e. if you set those arguments to other values, overlaps may still occur. One of:

- "keep": leave overlapping dots as they are. Dots may overlap (usually only slightly) in the "bin", "weave", and "hex" layouts.
- "nudge": nudge overlapping dots out of the way. Overlaps are avoided using a constrained optimization which minimizes the squared distance of dots to their desired positions, subject to the constraint that adjacent dots do not overlap.

smooth

Smoother to apply to dot positions. One of:

- A function that takes a numeric vector of dot positions and returns a smoothed version of that vector, such as `smooth_bounded()`, `smooth_unbounded()`, `smooth_discrete()`, or `smooth_bar()`.
- A string indicating what smoother to use, as the suffix to a function name starting with `smooth_`; e.g. "none" (the default) applies `smooth_none()`, which simply returns the given vector without applying smoothing.

Smoothing is most effective when the smoother is matched to the support of the distribution; e.g. using `smooth_bounded(bounds = ...)`.

overflow

How to handle overflow of dots beyond the extent of the geom when a minimum binwidth (or an exact binwidth) is supplied. One of:

- "keep": Keep the overflow, drawing dots outside the geom bounds.
- "warn": Keep the overflow, but produce a warning suggesting solutions, such as setting `binwidth = NA` or `overflow = "compress"`.
- "compress": Compress the layout. Reduces the binwidth to the size necessary to keep the dots within bounds, then adjusts `stackratio` and `dotsize` so that the apparent dot size is the user-specified minimum binwidth times the user-specified `dotsize`.

If you find the default layout has dots that are too small, and you are okay with dots overlapping, consider setting `overflow = "compress"` and supplying an exact or minimum dot size using `binwidth`.

verbose

If TRUE, print out the bin width of the dotplot. Can be useful if you want to start from an automatically-selected bin width and then adjust it manually. Bin width is printed both as data units and as normalized parent coordinates or "npc"s (see `unit()`). Note that if you just want to scale the selected bin width to fit within a desired area, it is probably easier to use `scale` than to copy and scale `binwidth` manually, and if you just want to provide constraints on the bin width, you can pass a length-2 vector to `binwidth`.

orientation

Whether this geom is drawn horizontally or vertically. One of:

- NA (default): automatically detect the orientation based on how the aesthetics are assigned. Automatic detection works most of the time.
- "horizontal" (or "y"): draw horizontally, using the y aesthetic to identify different groups. For each group, uses the x, `xmin`, `xmax`, and thickness aesthetics to draw points, intervals, and slabs.
- "vertical" (or "x"): draw vertically, using the x aesthetic to identify different groups. For each group, uses the y, `ymin`, `ymax`, and thickness aesthetics to draw points, intervals, and slabs.

For compatibility with the base ggplot naming scheme for orientation, "x" can be used as an alias for "vertical" and "y" as an alias for "horizontal"

(**ggdist** had an orientation parameter before base **ggplot** did, hence the discrepancy).

interval_size_domain	A length-2 numeric vector giving the minimum and maximum of the values of the size and linewidth aesthetics that will be translated into actual sizes for intervals drawn according to interval_size_range (see the documentation for that argument.)
interval_size_range	A length-2 numeric vector. This geom scales the raw size aesthetic values when drawing interval and point sizes, as they tend to be too thick when using the default settings of <code>scale_size_continuous()</code> , which give sizes with a range of <code>c(1, 6)</code> . The <code>interval_size_domain</code> value indicates the input domain of raw size values (typically this should be equal to the value of the range argument of the <code>scale_size_continuous()</code> function), and <code>interval_size_range</code> indicates the desired output range of the size values (the min and max of the actual sizes used to draw intervals). Most of the time it is not recommended to change the value of this argument, as it may result in strange scaling of legends; this argument is a holdover from earlier versions that did not have size aesthetics targeting the point and interval separately. If you want to adjust the size of the interval or points separately, you can also use the <code>linewidth</code> or <code>point_size</code> aesthetics; see sub-geometry-scales .
fatten_point	A multiplicative factor used to adjust the size of the point relative to the size of the thickest interval line. If you wish to specify point sizes directly, you can also use the <code>point_size</code> aesthetic and <code>scale_point_size_continuous()</code> or <code>scale_point_size_discrete()</code> ; sizes specified with that aesthetic will not be adjusted using <code>fatten_point</code> .
arrow	<code>grid::arrow()</code> giving the arrow heads to use on the interval, or NULL for no arrows.
show_slab	Should the slab portion of the geom be drawn?
show_point	Should the point portion of the geom be drawn?
show_interval	Should the interval portion of the geom be drawn?
subguide	Sub-guide used to annotate the thickness scale. One of: <ul style="list-style-type: none"> • A function that takes a scale argument giving a <code>ggplot2::Scale</code> object and an orientation argument giving the orientation of the geometry and then returns a <code>grid::grob</code> that will draw the axis annotation, such as <code>subguide_axis()</code> (to draw a traditional axis) or <code>subguide_none()</code> (to draw no annotation). See <code>subguide_axis()</code> for a list of possibilities and examples. • A string giving the name of such a function when prefixed with "subguide"; e.g. "axis" or "none".
na.rm	If FALSE, the default, missing values are removed with a warning. If TRUE, missing values are silently removed.
show.legend	logical. Should this layer be included in the legends? NA, the default, includes if any aesthetics are mapped. FALSE never includes, and TRUE always includes. It can also be a named logical vector to finely select the aesthetics to display.

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

Details

The *dots* family of stats and geoms are similar to `geom_dotplot()` but with a number of differences:

- Dots geoms act like slabs in `geom_slabinterval()` and can be given x positions (or y positions when in a horizontal orientation).
- Given the available space to lay out dots, the dots geoms will automatically determine how many bins to use to fit the available space.
- Dots geoms use a dynamic layout algorithm that lays out dots from the center out if the input data are symmetrical, guaranteeing that symmetrical data results in a symmetrical plot. The layout algorithm also prevents dots from overlapping each other.
- The shape of the dots in these geoms can be changed using the `slab_shape` aesthetic (when using the *dotsinterval* family) or the `shape` or `slab_shape` aesthetic (when using the *dots* family)

Stats and geoms in this family include:

- `geom_dots()`: dotplots on raw data. Ensures the dotplot fits within available space by reducing the size of the dots automatically (may result in very small dots).
- `geom_swarm()` and `geom_weave()`: dotplots on raw data with defaults intended to create "beeswarm" plots. Used `side = "both"` by default, and sets the default dot size to the same size as `geom_point()` (`binwidth = unit(1.5, "mm")`), allowing dots to overlap instead of getting very small.
- `stat_dots()`: dotplots on raw data, **distributional** objects, and `posterior::rvar()`s
- `geom_dotsinterval()`: dotplot + interval plots on raw data with already-calculated intervals (rarely useful directly).
- `stat_dotsinterval()`: dotplot + interval plots on raw data, **distributional** objects, and `posterior::rvar()`s (will calculate intervals for you).
- `geom_blur_dots()`: blurry dotplots that allow the standard deviation of a blur applied to each dot to be specified using the `sd` aesthetic.
- `stat_mcse_dots()`: blurry dotplots of quantiles using the Monte Carlo Standard Error of each quantile.

`stat_dots()` and `stat_dotsinterval()`, when used with the `quantiles` argument, are particularly useful for constructing quantile dotplots, which can be an effective way to communicate uncertainty using a frequency framing that may be easier for laypeople to understand (Kay et al. 2016, Fernandes et al. 2018).

To visualize sample data, such as a data distribution, samples from a bootstrap distribution, or a Bayesian posterior, you can supply samples to the `x` or `y` aesthetic.

To visualize analytical distributions, you can use the `xdist` or `ydist` aesthetic. For historical reasons, you can also use `dist` to specify the distribution, though this is not recommended as it does not work as well with orientation detection. These aesthetics can be used as follows:

- `xdist`, `ydist`, and `dist` can be any distribution object from the `distributional` package (`dist_normal()`, `dist_beta()`, etc) or can be a `posterior::rvar()` object. Since these functions are vectorized, other columns can be passed directly to them in an `aes()` specification; e.g. `aes(dist = dist_normal(mu, sigma))` will work if `mu` and `sigma` are columns in the input data frame.
- `dist` can be a character vector giving the distribution name. Then the `arg1`, ... `arg9` aesthetics (or `args` as a list column) specify distribution arguments. Distribution names should correspond to R functions that have "p", "q", and "d" functions; e.g. "norm" is a valid distribution name because R defines the `pnorm()`, `qnorm()`, and `dnorm()` functions for Normal distributions.

See the `parse_dist()` function for a useful way to generate `dist` and `args` values from human-readable distribution specs (like "normal(0,1)"). Such specs are also produced by other packages (like the `brms::get_prior` function in `brms`); thus, `parse_dist()` combined with the stats described here can help you visualize the output of those functions.

Value

A `ggplot2::Geom` or `ggplot2::Stat` representing a dotplot or combined dotplot+interval geometry which can be added to a `ggplot()` object.

Aesthetics

The dots+interval stats and geoms have a wide variety of aesthetics that control the appearance of their three sub-geometries: the **dots** (aka the **slab**), the **point**, and the **interval**.

Positional aesthetics

- `x`: x position of the geometry
- `y`: y position of the geometry

Dots-specific (aka Slab-specific) aesthetics

- `family`: The font family used to draw the dots.
- `order`: The order in which data points are stacked within bins. Can be used to create the effect of "stacked" dots by ordering dots according to a discrete variable. If omitted (NULL), the value of the data points themselves are used to determine stacking order. Only applies when layout is "bin" or "hex", as the other layout methods fully determine both `x` and `y` positions.
- `side`: Which side to place the slab on. "topright", "top", and "right" are synonyms which cause the slab to be drawn on the top or the right depending on if orientation is "horizontal" or "vertical". "bottomleft", "bottom", and "left" are synonyms which cause the slab to be drawn on the bottom or the left depending on if orientation is "horizontal" or "vertical". "topleft" causes the slab to be drawn on the top or the left, and "bottomright" causes the slab to be drawn on the bottom or the right. "both" draws the slab mirrored on both sides (as in a violin plot).
- `scale`: What proportion of the region allocated to this geom to use to draw the slab. If `scale = 1`, slabs that use the maximum range will just touch each other. Default is 0.9 to leave some space between adjacent slabs. For a comprehensive discussion and examples of slab scaling and normalization, see the [thickness scale article](#).

- **justification**: Justification of the interval relative to the slab, where 0 indicates bottom/left justification and 1 indicates top/right justification (depending on orientation). If justification is NULL (the default), then it is set automatically based on the value of side: when side is "top"/"right" justification is set to 0, when side is "bottom"/"left" justification is set to 1, and when side is "both" justification is set to 0.5.
- **datatype**: When using composite geoms directly without a stat (e.g. `geom_slabinterval()`), datatype is used to indicate which part of the geom a row in the data targets: rows with datatype = "slab" target the slab portion of the geometry and rows with datatype = "interval" target the interval portion of the geometry. This is set automatically when using ggdist stats.

Interval-specific aesthetics

- **xmin**: Left end of the interval sub-geometry (if orientation = "horizontal").
- **xmax**: Right end of the interval sub-geometry (if orientation = "horizontal").
- **ymin**: Lower end of the interval sub-geometry (if orientation = "vertical").
- **ymax**: Upper end of the interval sub-geometry (if orientation = "vertical").

Point-specific aesthetics

- **shape**: Shape type used to draw the **point** sub-geometry.

Color aesthetics

- **colour**: (or **color**) The color of the **interval** and **point** sub-geometries. Use the `slab_color`, `interval_color`, or `point_color` aesthetics (below) to set sub-geometry colors separately.
- **fill**: The fill color of the **slab** and **point** sub-geometries. Use the `slab_fill` or `point_fill` aesthetics (below) to set sub-geometry colors separately.
- **alpha**: The opacity of the **slab**, **interval**, and **point** sub-geometries. Use the `slab_alpha`, `interval_alpha`, or `point_alpha` aesthetics (below) to set sub-geometry colors separately.
- **colour_ramp**: (or **color_ramp**) A secondary scale that modifies the color scale to "ramp" to another color. See `scale_colour_ramp()` for examples.
- **fill_ramp**: A secondary scale that modifies the fill scale to "ramp" to another color. See `scale_fill_ramp()` for examples.

Line aesthetics

- **linewidth**: Width of the line used to draw the **interval** (except with `geom_slab()`: then it is the width of the **slab**). With composite geometries including an interval and slab, use `slab_linewidth` to set the line width of the **slab** (see below). For **interval**, raw linewidth values are transformed according to the `interval_size_domain` and `interval_size_range` parameters of the geom (see above).
- **size**: Determines the size of the **point**. If linewidth is not provided, size will also determine the width of the line used to draw the **interval** (this allows line width and point size to be modified together by setting only size and not linewidth). Raw size values are transformed according to the `interval_size_domain`, `interval_size_range`, and `fatten_point` parameters of the geom (see above). Use the `point_size` aesthetic (below) to set sub-geometry size directly without applying the effects of `interval_size_domain`, `interval_size_range`, and `fatten_point`.

- **stroke**: Width of the outline around the **point** sub-geometry.
- **linetype**: Type of line (e.g., "solid", "dashed", etc) used to draw the **interval** and the outline of the **slab** (if it is visible). Use the `slab_linetype` or `interval_linetype` aesthetics (below) to set sub-geometry line types separately.

Slab-specific color and line override aesthetics

- `slab_fill`: Override for `fill`: the fill color of the slab.
- `slab_colour`: (or `slab_color`) Override for `colour/color`: the outline color of the slab.
- `slab_alpha`: Override for `alpha`: the opacity of the slab.
- `slab_linewidth`: Override for `linewidth`: the width of the outline of the slab.
- `slab_linetype`: Override for `linetype`: the line type of the outline of the slab.
- `slab_shape`: Override for `shape`: the shape of the dots used to draw the dotplot slab.

Interval-specific color and line override aesthetics

- `interval_colour`: (or `interval_color`) Override for `colour/color`: the color of the interval.
- `interval_alpha`: Override for `alpha`: the opacity of the interval.
- `interval_linetype`: Override for `linetype`: the line type of the interval.

Point-specific color and line override aesthetics

- `point_fill`: Override for `fill`: the fill color of the point.
- `point_colour`: (or `point_color`) Override for `colour/color`: the outline color of the point.
- `point_alpha`: Override for `alpha`: the opacity of the point.
- `point_size`: Override for `size`: the size of the point.

Deprecated aesthetics

- `slab_size`: Use `slab_linewidth`.
- `interval_size`: Use `interval_linewidth`.

Other aesthetics (these work as in standard geoms)

- `width`
- `height`
- `group`

See examples of some of these aesthetics in action in `vignette("dotsinterval")`. Learn more about the sub-geom override aesthetics (like `interval_color`) in the [scales](#) documentation. Learn more about basic ggplot aesthetics in `vignette("ggplot2-specs")`.

Author(s)

Matthew Kay

References

Kay, M., Kola, T., Hullman, J. R., & Munson, S. A. (2016). When (ish) is My Bus? User-centered Visualizations of Uncertainty in Everyday, Mobile Predictive Systems. *Conference on Human Factors in Computing Systems - CHI '16*, 5092–5103. doi:10.1145/2858036.2858558.

Fernandes, M., Walls, L., Munson, S., Hullman, J., & Kay, M. (2018). Uncertainty Displays Using Quantile Dotplots or CDFs Improve Transit Decision-Making. *Conference on Human Factors in Computing Systems - CHI '18*. doi:10.1145/3173574.3173718.

See Also

See the `stat_slabinterval()` family for other stats built on top of `geom_slabinterval()`. See `vignette("dotsinterval")` for a variety of examples of use.

Other dotsinterval geoms: `geom_blur_dots()`, `geom_dots()`, `geom_swarm()`, `geom_weave()`

Examples

```
library(dplyr)
library(ggplot2)

theme_set(theme_ggdist())

set.seed(12345)
df = tibble(
  g = rep(c("a", "b"), 200),
  value = rnorm(400, c(0, 3), c(0.75, 1))
)

# orientation is detected automatically based on
# which axis is discrete

df %>%
  ggplot(aes(x = value, y = g)) +
  geom_dotsinterval()

df %>%
  ggplot(aes(y = value, x = g)) +
  geom_dotsinterval()

# stat_dots can summarize quantiles, creating quantile dotplots

data(RankCorr_u_tau, package = "ggdist")

RankCorr_u_tau %>%
  ggplot(aes(x = u_tau, y = factor(i))) +
  stat_dots(quantiles = 100)

# color and fill aesthetics can be mapped within the geom
# dotsinterval adds an interval
```

```
RankCorr_u_tau %>%
  ggplot(aes(x = u_tau, y = factor(i), fill = after_stat(x > 6))) +
  stat_dotsinterval(quantiles = 100)
```

geom_interval	<i>Multiple-interval plot (shortcut geom)</i>
---------------	---

Description

Shortcut version of `geom_slabinterval()` for creating multiple-interval plots.

Roughly equivalent to:

```
geom_slabinterval(
  aes(
    datatype = "interval",
    side = "both"
  ),
  interval_size_range = c(1, 6),
  show_slab = FALSE,
  show_point = FALSE
)
```

Usage

```
geom_interval(
  mapping = NULL,
  data = NULL,
  stat = "identity",
  position = "identity",
  ...,
  orientation = NA,
  interval_size_range = c(1, 6),
  interval_size_domain = c(1, 6),
  arrow = NULL,
  na.rm = FALSE,
  show.legend = NA,
  inherit.aes = TRUE
)
```

Arguments

mapping	Set of aesthetic mappings created by <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>
stat	<p>The statistical transformation to use on the data for this layer, either as a <code>ggproto</code> <code>Geom</code> subclass or as a string naming the stat stripped of the <code>stat_</code> prefix (e.g. "count" rather than "stat_count")</p>
position	<p>Position adjustment, either as a string, or the result of a call to a position adjustment function. Setting this equal to "dodge" (<code>position_dodge()</code>) or "dodgejust" (<code>position_dodgejust()</code>) can be useful if you have overlapping geometries.</p>
...	<p>Other arguments passed to <code>layer()</code>. These are often aesthetics, used to set an aesthetic to a fixed value, like <code>colour = "red"</code> or <code>linewidth = 3</code> (see Aesthetics, below). They may also be parameters to the paired geom/stat.</p>
orientation	<p>Whether this geom is drawn horizontally or vertically. One of:</p> <ul style="list-style-type: none"> • <code>NA</code> (default): automatically detect the orientation based on how the aesthetics are assigned. Automatic detection works most of the time. • "horizontal" (or "y"): draw horizontally, using the <code>y</code> aesthetic to identify different groups. For each group, uses the <code>x</code>, <code>xmin</code>, <code>xmax</code>, and <code>thickness</code> aesthetics to draw points, intervals, and slabs. • "vertical" (or "x"): draw vertically, using the <code>x</code> aesthetic to identify different groups. For each group, uses the <code>y</code>, <code>ymin</code>, <code>ymax</code>, and <code>thickness</code> aesthetics to draw points, intervals, and slabs. <p>For compatibility with the base <code>ggplot</code> naming scheme for orientation, "x" can be used as an alias for "vertical" and "y" as an alias for "horizontal" (<code>ggdist</code> had an orientation parameter before base <code>ggplot</code> did, hence the discrepancy).</p>
interval_size_range	<p>A length-2 numeric vector. This geom scales the raw size aesthetic values when drawing interval and point sizes, as they tend to be too thick when using the default settings of <code>scale_size_continuous()</code>, which give sizes with a range of <code>c(1, 6)</code>. The <code>interval_size_domain</code> value indicates the input domain of raw size values (typically this should be equal to the value of the range argument of the <code>scale_size_continuous()</code> function), and <code>interval_size_range</code> indicates the desired output range of the size values (the min and max of the actual sizes used to draw intervals). Most of the time it is not recommended to change the value of this argument, as it may result in strange scaling of legends; this argument is a holdover from earlier versions that did not have size aesthetics targeting the point and interval separately. If you want to adjust the size of the interval or points separately, you can also use the <code>linewidth</code> or <code>point_size</code> aesthetics; see sub-geometry-scales.</p>

<code>interval_size_domain</code>	A length-2 numeric vector giving the minimum and maximum of the values of the <code>size</code> and <code>linewidth</code> aesthetics that will be translated into actual sizes for intervals drawn according to <code>interval_size_range</code> (see the documentation for that argument.)
<code>arrow</code>	<code>grid::arrow()</code> giving the arrow heads to use on the interval, or <code>NULL</code> for no arrows.
<code>na.rm</code>	If <code>FALSE</code> , the default, missing values are removed with a warning. If <code>TRUE</code> , missing values are silently removed.
<code>show.legend</code>	logical. Should this layer be included in the legends? <code>NA</code> , 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> .

Details

This geom wraps `geom_slabinterval()` with defaults designed to produce multiple-interval plots. Default aesthetic mappings are applied if the `.width` column is present in the input data (e.g., as generated by the `point_interval()` family of functions), making this geom often more convenient than vanilla `ggplot2` geometries when used with functions like `median_qi()`, `mean_qi()`, `mode_hdi()`, etc.

Specifically, if `.width` is present in the input, `geom_interval()` acts as if its default aesthetics are `aes(colour = forcats::fct_rev(ordered(.width)))`

Value

A `ggplot2::Geom` representing a multiple-interval geometry which can be added to a `ggplot()` object.

Aesthetics

The slab+interval stats and geoms have a wide variety of aesthetics that control the appearance of their three sub-geometries: the **slab**, the **point**, and the **interval**.

Positional aesthetics

- `x`: x position of the geometry
- `y`: y position of the geometry

Interval-specific aesthetics

- `xmin`: Left end of the interval sub-geometry (if `orientation = "horizontal"`).
- `xmax`: Right end of the interval sub-geometry (if `orientation = "horizontal"`).
- `ymin`: Lower end of the interval sub-geometry (if `orientation = "vertical"`).
- `ymax`: Upper end of the interval sub-geometry (if `orientation = "vertical"`).

Color aesthetics

- **colour:** (or **color**) The color of the **interval** and **point** sub-geometries. Use the `slab_color`, `interval_color`, or `point_color` aesthetics (below) to set sub-geometry colors separately.
- **fill:** The fill color of the **slab** and **point** sub-geometries. Use the `slab_fill` or `point_fill` aesthetics (below) to set sub-geometry colors separately.
- **alpha:** The opacity of the **slab**, **interval**, and **point** sub-geometries. Use the `slab_alpha`, `interval_alpha`, or `point_alpha` aesthetics (below) to set sub-geometry colors separately.
- **colour_ramp:** (or **color_ramp**) A secondary scale that modifies the color scale to "ramp" to another color. See `scale_colour_ramp()` for examples.
- **fill_ramp:** A secondary scale that modifies the fill scale to "ramp" to another color. See `scale_fill_ramp()` for examples.

Line aesthetics

- **linewidth:** Width of the line used to draw the **interval** (except with `geom_slab()`: then it is the width of the **slab**). With composite geometries including an interval and slab, use `slab_linewidth` to set the line width of the **slab** (see below). For **interval**, raw linewidth values are transformed according to the `interval_size_domain` and `interval_size_range` parameters of the geom (see above).
- **size:** Determines the size of the **point**. If `linewidth` is not provided, `size` will also determine the width of the line used to draw the **interval** (this allows line width and point size to be modified together by setting only `size` and not `linewidth`). Raw `size` values are transformed according to the `interval_size_domain`, `interval_size_range`, and `fatten_point` parameters of the geom (see above). Use the `point_size` aesthetic (below) to set sub-geometry size directly without applying the effects of `interval_size_domain`, `interval_size_range`, and `fatten_point`.
- **stroke:** Width of the outline around the **point** sub-geometry.
- **linetype:** Type of line (e.g., "solid", "dashed", etc) used to draw the **interval** and the outline of the **slab** (if it is visible). Use the `slab_linetype` or `interval_linetype` aesthetics (below) to set sub-geometry line types separately.

Interval-specific color and line override aesthetics

- **interval_colour:** (or **interval_color**) Override for `colour/color`: the color of the interval.
- **interval_alpha:** Override for `alpha`: the opacity of the interval.
- **interval_linetype:** Override for `linetype`: the line type of the interval.

Deprecated aesthetics

- **interval_size:** Use `interval_linewidth`.

Other aesthetics (these work as in standard geoms)

- `width`
- `height`

- group

See examples of some of these aesthetics in action in `vignette("slabinterval")`. Learn more about the sub-geom override aesthetics (like `interval_color`) in the [scales](#) documentation. Learn more about basic ggplot aesthetics in `vignette("ggplot2-specs")`.

See Also

See `stat_interval()` for the stat version, intended for use on sample data or analytical distributions. See `geom_slabinterval()` for the geometry this shortcut is based on.

Other slabinterval geoms: `geom_pointinterval()`, `geom_slab()`, `geom_spike()`

Examples

```
library(dplyr)
library(ggplot2)

theme_set(theme_ggdist())

data(RankCorr_u_tau, package = "ggdist")

# orientation is detected automatically based on
# use of xmin/xmax or ymin/ymax

RankCorr_u_tau %>%
  group_by(i) %>%
  median_qi(.width = c(.5, .8, .95, .99)) %>%
  ggplot(aes(y = i, x = u_tau, xmin = .lower, xmax = .upper)) +
  geom_interval() +
  scale_color_brewer()

RankCorr_u_tau %>%
  group_by(i) %>%
  median_qi(.width = c(.5, .8, .95, .99)) %>%
  ggplot(aes(x = i, y = u_tau, ymin = .lower, ymax = .upper)) +
  geom_interval() +
  scale_color_brewer()
```

geom_lineribbon

Line + multiple-ribbon plots (ggplot geom)

Description

A combination of `geom_line()` and `geom_ribbon()` with default aesthetics designed for use with output from `point_interval()`.

Usage

```
geom_lineribbon(
  mapping = NULL,
  data = NULL,
  stat = "identity",
  position = "identity",
  ...,
  step = FALSE,
  orientation = NA,
  na.rm = FALSE,
  show.legend = NA,
  inherit.aes = TRUE
)
```

Arguments

mapping	Set of aesthetic mappings created by <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 data frame, 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 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>).</p>
stat	The statistical transformation to use on the data for this layer, either as a ggproto Geom subclass or as a string naming the stat stripped of the <code>stat_</code> prefix (e.g. "count" rather than "stat_count")
position	Position adjustment, either as a string naming the adjustment (e.g. "jitter" to use <code>position_jitter</code>), or the result of a call to a position adjustment function. Use the latter if you need to change the settings of the adjustment.
...	Other arguments passed to <code>layer()</code> . These are often aesthetics, used to set an aesthetic to a fixed value, like <code>colour = "red"</code> or <code>linewidth = 3</code> (see Aesthetics , below). They may also be parameters to the paired geom/stat.
step	<p>Should the line/ribbon be drawn as a step function? One of:</p> <ul style="list-style-type: none"> • <code>FALSE</code> (default): do not draw as a step function. • <code>"mid"</code> (or <code>TRUE</code>): draw steps midway between adjacent x values. • <code>"hv"</code>: draw horizontal-then-vertical steps. • <code>"vh"</code>: draw as vertical-then-horizontal steps. <p><code>TRUE</code> is an alias for <code>"mid"</code> because for a step function with ribbons, <code>"mid"</code> is probably what you want (for the other two step approaches the ribbons at either the very first or very last x value will not be visible).</p>

orientation	<p>Whether this geom is drawn horizontally or vertically. One of:</p> <ul style="list-style-type: none"> • NA (default): automatically detect the orientation based on how the aesthetics are assigned. Automatic detection works most of the time. • "horizontal" (or "y"): draw horizontally, using the y aesthetic to identify different groups. For each group, uses the x, xmin, xmax, and thickness aesthetics to draw points, intervals, and slabs. • "vertical" (or "x"): draw vertically, using the x aesthetic to identify different groups. For each group, uses the y, ymin, ymax, and thickness aesthetics to draw points, intervals, and slabs. <p>For compatibility with the base ggplot naming scheme for orientation, "x" can be used as an alias for "vertical" and "y" as an alias for "horizontal" (ggdist had an orientation parameter before base ggplot did, hence the discrepancy).</p>
na.rm	If FALSE, the default, missing values are removed with a warning. If TRUE, missing values are silently removed.
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> .

Details

`geom_lineribbon()` is a combination of a `geom_line()` and `geom_ribbon()` designed for use with output from `point_interval()`. This geom sets some default aesthetics equal to the `.width` column generated by the `point_interval()` family of functions, making them often more convenient than a vanilla `geom_ribbon() + geom_line()`.

Specifically, `geom_lineribbon()` acts as if its default aesthetics are `aes(fill = forcats::fct_rev(ordered(.width)))`.

Value

A `ggplot2::Geom` representing a combined line + multiple-ribbon geometry which can be added to a `ggplot()` object.

Aesthetics

The line+ribbon stats and geoms have a wide variety of aesthetics that control the appearance of their two sub-geometries: the **line** and the **ribbon**.

Positional aesthetics

- x: x position of the geometry
- y: y position of the geometry

Ribbon-specific aesthetics

- xmin: Left edge of the ribbon sub-geometry (if orientation = "horizontal").

- `xmax`: Right edge of the ribbon sub-geometry (if `orientation = "horizontal"`).
- `ymin`: Lower edge of the ribbon sub-geometry (if `orientation = "vertical"`).
- `ymax`: Upper edge of the ribbon sub-geometry (if `orientation = "vertical"`).
- `order`: The order in which ribbons are drawn. Ribbons with the smallest mean value of `order` are drawn first (i.e., will be drawn below ribbons with larger mean values of `order`). If `order` is not supplied to `geom_lineribbon()`, `-abs(xmax - xmin)` or `-abs(ymax - ymin)` (depending on orientation) is used, having the effect of drawing the widest (on average) ribbons on the bottom. `stat_lineribbon()` uses `order = after_stat(level)` by default, causing the ribbons generated from the largest `.width` to be drawn on the bottom.

Color aesthetics

- `colour`: (or `color`) The color of the **line** sub-geometry.
- `fill`: The fill color of the **ribbon** sub-geometry.
- `alpha`: The opacity of the **line** and **ribbon** sub-geometries.
- `fill_ramp`: A secondary scale that modifies the `fill` scale to "ramp" to another color. See `scale_fill_ramp()` for examples.

Line aesthetics

- `linewidth`: Width of **line**. In `ggplot2 < 3.4`, was called `size`.
- `linetype`: Type of **line** (e.g., "solid", "dashed", etc)

Other aesthetics (these work as in standard geoms)

- `group`

See examples of some of these aesthetics in action in `vignette("lineribbon")`. Learn more about the sub-geom override aesthetics (like `interval_color`) in the `scales` documentation. Learn more about basic ggplot aesthetics in `vignette("ggplot2-specs")`.

Author(s)

Matthew Kay

See Also

See `stat_lineribbon()` for a version that does summarizing of samples into points and intervals within ggplot. See `geom_pointinterval()` for a similar geom intended for point summaries and intervals. See `geom_ribbon()` and `geom_line()` for the geoms this is based on.

Examples

```
library(dplyr)
library(ggplot2)

theme_set(theme_ggdist())
```

```

set.seed(12345)
tibble(
  x = rep(1:10, 100),
  y = rnorm(1000, x)
) %>%
  group_by(x) %>%
  median_qi(.width = c(.5, .8, .95)) %>%
  ggplot(aes(x = x, y = y, ymin = .lower, ymax = .upper)) +
  # automatically uses aes(fill = forcats::fct_rev(ordered(.width)))
  geom_lineribbon() +
  scale_fill_brewer()

```

geom_pointinterval *Point + multiple-interval plot (shortcut geom)*

Description

Shortcut version of `geom_slabinterval()` for creating point + multiple-interval plots.

Roughly equivalent to:

```

geom_slabinterval(
  aes(
    datatype = "interval",
    side = "both"
  ),
  show_slab = FALSE,
  show.legend = c(size = FALSE)
)

```

Usage

```

geom_pointinterval(
  mapping = NULL,
  data = NULL,
  stat = "identity",
  position = "identity",
  ...,
  orientation = NA,
  interval_size_domain = c(1, 6),
  interval_size_range = c(0.6, 1.4),
  fatten_point = 1.8,
  arrow = NULL,
  na.rm = FALSE,
  show.legend = c(size = FALSE),
  inherit.aes = TRUE
)

```

Arguments

mapping	Set of aesthetic mappings created by <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 for this layer, either as a <code>ggproto</code> <code>Geom</code> subclass or as a string naming the stat stripped of the <code>stat_</code> prefix (e.g. "count" rather than "stat_count")
position	Position adjustment, either as a string, or the result of a call to a position adjustment function. Setting this equal to "dodge" (<code>position_dodge()</code>) or "dodgejust" (<code>position_dodgejust()</code>) can be useful if you have overlapping geometries.
...	Other arguments passed to <code>layer()</code> . These are often aesthetics, used to set an aesthetic to a fixed value, like <code>colour = "red"</code> or <code>linewidth = 3</code> (see Aesthetics , below). They may also be parameters to the paired <code>geom/stat</code> .
orientation	Whether this geom is drawn horizontally or vertically. One of: <ul style="list-style-type: none"> • <code>NA</code> (default): automatically detect the orientation based on how the aesthetics are assigned. Automatic detection works most of the time. • "horizontal" (or "y"): draw horizontally, using the y aesthetic to identify different groups. For each group, uses the x, <code>xmin</code>, <code>xmax</code>, and thickness aesthetics to draw points, intervals, and slabs. • "vertical" (or "x"): draw vertically, using the x aesthetic to identify different groups. For each group, uses the y, <code>ymin</code>, <code>ymax</code>, and thickness aesthetics to draw points, intervals, and slabs. <p>For compatibility with the base <code>ggplot</code> naming scheme for orientation, "x" can be used as an alias for "vertical" and "y" as an alias for "horizontal" (<code>ggdist</code> had an orientation parameter before base <code>ggplot</code> did, hence the discrepancy).</p>
interval_size_domain	A length-2 numeric vector giving the minimum and maximum of the values of the size and linewidth aesthetics that will be translated into actual sizes for intervals drawn according to <code>interval_size_range</code> (see the documentation for that argument.)
interval_size_range	A length-2 numeric vector. This geom scales the raw size aesthetic values when drawing interval and point sizes, as they tend to be too thick when using the default settings of <code>scale_size_continuous()</code> , which give sizes with a range of <code>c(1, 6)</code> . The <code>interval_size_domain</code> value indicates the input domain of

raw size values (typically this should be equal to the value of the range argument of the `scale_size_continuous()` function), and `interval_size_range` indicates the desired output range of the size values (the min and max of the actual sizes used to draw intervals). Most of the time it is not recommended to change the value of this argument, as it may result in strange scaling of legends; this argument is a holdover from earlier versions that did not have size aesthetics targeting the point and interval separately. If you want to adjust the size of the interval or points separately, you can also use the `linewidth` or `point_size` aesthetics; see [sub-geometry-scales](#).

<code>fatten_point</code>	A multiplicative factor used to adjust the size of the point relative to the size of the thickest interval line. If you wish to specify point sizes directly, you can also use the <code>point_size</code> aesthetic and <code>scale_point_size_continuous()</code> or <code>scale_point_size_discrete()</code> ; sizes specified with that aesthetic will not be adjusted using <code>fatten_point</code> .
<code>arrow</code>	<code>grid::arrow()</code> giving the arrow heads to use on the interval, or NULL for no arrows.
<code>na.rm</code>	If FALSE, the default, missing values are removed with a warning. If TRUE, missing values are silently removed.
<code>show.legend</code>	Should this layer be included in the legends? Default is <code>c(size = FALSE)</code> , unlike most geoms, to match its common use cases. FALSE hides all legends, TRUE shows all legends, and NA shows only those that are mapped (the default for most geoms).
<code>inherit.aes</code>	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> .

Details

This geom wraps `geom_slabinterval()` with defaults designed to produce point + multiple-interval plots. Default aesthetic mappings are applied if the `.width` column is present in the input data (e.g., as generated by the `point_interval()` family of functions), making this geom often more convenient than vanilla `ggplot2` geometries when used with functions like `median_qi()`, `mean_qi()`, `mode_hdi()`, etc.

Specifically, if `.width` is present in the input, `geom_pointinterval()` acts as if its default aesthetics are `aes(size = .width)`

Value

A `ggplot2::Geom` representing a point + multiple-interval geometry which can be added to a `ggplot()` object.

Aesthetics

The slab+interval stats and geoms have a wide variety of aesthetics that control the appearance of their three sub-geometries: the **slab**, the **point**, and the **interval**.

Positional aesthetics

- x: x position of the geometry
- y: y position of the geometry

Interval-specific aesthetics

- xmin: Left end of the interval sub-geometry (if orientation = "horizontal").
- xmax: Right end of the interval sub-geometry (if orientation = "horizontal").
- ymin: Lower end of the interval sub-geometry (if orientation = "vertical").
- ymax: Upper end of the interval sub-geometry (if orientation = "vertical").

Point-specific aesthetics

- shape: Shape type used to draw the **point** sub-geometry.

Color aesthetics

- colour: (or color) The color of the **interval** and **point** sub-geometries. Use the slab_color, interval_color, or point_color aesthetics (below) to set sub-geometry colors separately.
- fill: The fill color of the **slab** and **point** sub-geometries. Use the slab_fill or point_fill aesthetics (below) to set sub-geometry colors separately.
- alpha: The opacity of the **slab**, **interval**, and **point** sub-geometries. Use the slab_alpha, interval_alpha, or point_alpha aesthetics (below) to set sub-geometry colors separately.
- colour_ramp: (or color_ramp) A secondary scale that modifies the color scale to "ramp" to another color. See [scale_colour_ramp\(\)](#) for examples.
- fill_ramp: A secondary scale that modifies the fill scale to "ramp" to another color. See [scale_fill_ramp\(\)](#) for examples.

Line aesthetics

- linewidth: Width of the line used to draw the **interval** (except with [geom_slab\(\)](#): then it is the width of the **slab**). With composite geometries including an interval and slab, use slab_linewidth to set the line width of the **slab** (see below). For **interval**, raw linewidth values are transformed according to the interval_size_domain and interval_size_range parameters of the geom (see above).
- size: Determines the size of the **point**. If linewidth is not provided, size will also determine the width of the line used to draw the **interval** (this allows line width and point size to be modified together by setting only size and not linewidth). Raw size values are transformed according to the interval_size_domain, interval_size_range, and fatten_point parameters of the geom (see above). Use the point_size aesthetic (below) to set sub-geometry size directly without applying the effects of interval_size_domain, interval_size_range, and fatten_point.
- stroke: Width of the outline around the **point** sub-geometry.
- linetype: Type of line (e.g., "solid", "dashed", etc) used to draw the **interval** and the outline of the **slab** (if it is visible). Use the slab_linetype or interval_linetype aesthetics (below) to set sub-geometry line types separately.

Interval-specific color and line override aesthetics

- `interval_colour`: (or `interval_color`) Override for `colour/color`: the color of the interval.
- `interval_alpha`: Override for `alpha`: the opacity of the interval.
- `interval_linetype`: Override for `linetype`: the line type of the interval.

Point-specific color and line override aesthetics

- `point_fill`: Override for `fill`: the fill color of the point.
- `point_colour`: (or `point_color`) Override for `colour/color`: the outline color of the point.
- `point_alpha`: Override for `alpha`: the opacity of the point.
- `point_size`: Override for `size`: the size of the point.

Deprecated aesthetics

- `interval_size`: Use `interval_linewidth`.

Other aesthetics (these work as in standard geoms)

- `width`
- `height`
- `group`

See examples of some of these aesthetics in action in `vignette("slabinterval")`. Learn more about the sub-geom override aesthetics (like `interval_color`) in the [scales](#) documentation. Learn more about basic ggplot aesthetics in `vignette("ggplot2-specs")`.

See Also

See `stat_pointinterval()` for the stat version, intended for use on sample data or analytical distributions. See `geom_slabinterval()` for the geometry this shortcut is based on.

Other slabinterval geoms: `geom_interval()`, `geom_slab()`, `geom_spike()`

Examples

```
library(dplyr)
library(ggplot2)

data(RankCorr_u_tau, package = "ggdist")

# orientation is detected automatically based on
# use of xmin/xmax or ymin/ymax

RankCorr_u_tau %>%
  group_by(i) %>%
  median_qi(.width = c(.8, .95)) %>%
  ggplot(aes(y = i, x = u_tau, xmin = .lower, xmax = .upper)) +
  geom_pointinterval()
```

```

RankCorr_u_tau %>%
  group_by(i) %>%
  median_qi(.width = c(.8, .95)) %>%
  ggplot(aes(x = i, y = u_tau, ymin = .lower, ymax = .upper)) +
  geom_pointinterval()

```

geom_slab	<i>Slab (ridge) plot (shortcut geom)</i>
-----------	--

Description

Shortcut version of `geom_slabinterval()` for creating slab (ridge) plots.

Roughly equivalent to:

```

geom_slabinterval(
  show_point = FALSE,
  show_interval = FALSE
)

```

Usage

```

geom_slab(
  mapping = NULL,
  data = NULL,
  stat = "identity",
  position = "identity",
  ...,
  orientation = NA,
  normalize = "all",
  fill_type = "segments",
  subguide = "none",
  na.rm = FALSE,
  show.legend = NA,
  inherit.aes = TRUE
)

```

Arguments

mapping	Set of aesthetic mappings created by <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> .

	<p>A data.frame, 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 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>).</p>
stat	The statistical transformation to use on the data for this layer, either as a ggproto Geom subclass or as a string naming the stat stripped of the <code>stat_</code> prefix (e.g. "count" rather than "stat_count")
position	Position adjustment, either as a string, or the result of a call to a position adjustment function. Setting this equal to "dodge" (<code>position_dodge()</code>) or "dodgejust" (<code>position_dodgejust()</code>) can be useful if you have overlapping geometries.
...	Other arguments passed to <code>layer()</code> . These are often aesthetics, used to set an aesthetic to a fixed value, like <code>colour = "red"</code> or <code>linewidth = 3</code> (see Aesthetics , below). They may also be parameters to the paired geom/stat.
orientation	<p>Whether this geom is drawn horizontally or vertically. One of:</p> <ul style="list-style-type: none"> • NA (default): automatically detect the orientation based on how the aesthetics are assigned. Automatic detection works most of the time. • "horizontal" (or "y"): draw horizontally, using the y aesthetic to identify different groups. For each group, uses the x, xmin, xmax, and thickness aesthetics to draw points, intervals, and slabs. • "vertical" (or "x"): draw vertically, using the x aesthetic to identify different groups. For each group, uses the y, ymin, ymax, and thickness aesthetics to draw points, intervals, and slabs. <p>For compatibility with the base ggplot naming scheme for orientation, "x" can be used as an alias for "vertical" and "y" as an alias for "horizontal" (<code>ggdist</code> had an orientation parameter before base ggplot did, hence the discrepancy).</p>
normalize	<p>How to normalize heights of functions input to the thickness aesthetic. One of:</p> <ul style="list-style-type: none"> • "all": normalize so that the maximum height across all data is 1. • "panels": normalize within panels so that the maximum height in each panel is 1. • "xy": normalize within the x/y axis opposite the orientation of this geom so that the maximum height at each value of the opposite axis is 1. • "groups": normalize within values of the opposite axis and within each group so that the maximum height in each group is 1. • "none": values are taken as is with no normalization (this should probably only be used with functions whose values are in [0,1], such as CDFs). <p>For a comprehensive discussion and examples of slab scaling and normalization, see the thickness scale article.</p>
fill_type	<p>What type of fill to use when the fill color or alpha varies within a slab. One of:</p> <ul style="list-style-type: none"> • "segments": breaks up the slab geometry into segments for each unique combination of fill color and alpha value. This approach is supported by all

graphics devices and works well for sharp cutoff values, but can give ugly results if a large number of unique fill colors are being used (as in gradients, like in [stat_gradientinterval\(\)](#)).

- "gradient": a `grid::linearGradient()` is used to create a smooth gradient fill. This works well for large numbers of unique fill colors, but requires R \geq 4.1 and is not yet supported on all graphics devices. As of this writing, the `png()` graphics device with `type = "cairo"`, the `svg()` device, the `pdf()` device, and the `ragg::agg_png()` devices are known to support this option. On R $<$ 4.1, this option will fall back to `fill_type = "segments"` with a message.
- "auto": attempts to use `fill_type = "gradient"` if support for it can be auto-detected. On R \geq 4.2, support for gradients can be auto-detected on some graphics devices; if support is not detected, this option will fall back to `fill_type = "segments"` (in case of a false negative, `fill_type = "gradient"` can be set explicitly). On R $<$ 4.2, support for gradients cannot be auto-detected, so this will always fall back to `fill_type = "segments"`, in which case you can set `fill_type = "gradient"` explicitly if you are using a graphics device that support gradients.

subguide	Sub-guide used to annotate the thickness scale. One of: <ul style="list-style-type: none"> • A function that takes a scale argument giving a <code>ggplot2::Scale</code> object and an orientation argument giving the orientation of the geometry and then returns a <code>grid::grob</code> that will draw the axis annotation, such as <code>subguide_axis()</code> (to draw a traditional axis) or <code>subguide_none()</code> (to draw no annotation). See <code>subguide_axis()</code> for a list of possibilities and examples. • A string giving the name of such a function when prefixed with "subguide"; e.g. "axis" or "none".
na.rm	If FALSE, the default, missing values are removed with a warning. If TRUE, missing values are silently removed.
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> .

Value

A `ggplot2::Geom` representing a slab (ridge) geometry which can be added to a `ggplot()` object.

Aesthetics

The slab+interval stats and geoms have a wide variety of aesthetics that control the appearance of their three sub-geometries: the **slab**, the **point**, and the **interval**.

Positional aesthetics

- x: x position of the geometry
- y: y position of the geometry

Slab-specific aesthetics

- **thickness**: The thickness of the slab at each x value (if orientation = "horizontal") or y value (if orientation = "vertical") of the slab.
- **side**: Which side to place the slab on. "topright", "top", and "right" are synonyms which cause the slab to be drawn on the top or the right depending on if orientation is "horizontal" or "vertical". "bottomleft", "bottom", and "left" are synonyms which cause the slab to be drawn on the bottom or the left depending on if orientation is "horizontal" or "vertical". "topleft" causes the slab to be drawn on the top or the left, and "bottomright" causes the slab to be drawn on the bottom or the right. "both" draws the slab mirrored on both sides (as in a violin plot).
- **scale**: What proportion of the region allocated to this geom to use to draw the slab. If scale = 1, slabs that use the maximum range will just touch each other. Default is 0.9 to leave some space between adjacent slabs. For a comprehensive discussion and examples of slab scaling and normalization, see the [thickness scale article](#).
- **justification**: Justification of the interval relative to the slab, where 0 indicates bottom/left justification and 1 indicates top/right justification (depending on orientation). If justification is NULL (the default), then it is set automatically based on the value of side: when side is "top"/"right" justification is set to 0, when side is "bottom"/"left" justification is set to 1, and when side is "both" justification is set to 0.5.

Color aesthetics

- **colour**: (or color) The color of the **interval** and **point** sub-geometries. Use the slab_color, interval_color, or point_color aesthetics (below) to set sub-geometry colors separately.
- **fill**: The fill color of the **slab** and **point** sub-geometries. Use the slab_fill or point_fill aesthetics (below) to set sub-geometry colors separately.
- **alpha**: The opacity of the **slab**, **interval**, and **point** sub-geometries. Use the slab_alpha, interval_alpha, or point_alpha aesthetics (below) to set sub-geometry colors separately.
- **colour_ramp**: (or color_ramp) A secondary scale that modifies the color scale to "ramp" to another color. See [scale_colour_ramp\(\)](#) for examples.
- **fill_ramp**: A secondary scale that modifies the fill scale to "ramp" to another color. See [scale_fill_ramp\(\)](#) for examples.

Line aesthetics

- **linewidth**: Width of the line used to draw the **interval** (except with [geom_slab\(\)](#): then it is the width of the **slab**). With composite geometries including an interval and slab, use slab_linewidth to set the line width of the **slab** (see below). For **interval**, raw linewidth values are transformed according to the interval_size_domain and interval_size_range parameters of the geom (see above).
- **size**: Determines the size of the **point**. If linewidth is not provided, size will also determine the width of the line used to draw the **interval** (this allows line width and point size to be modified together by setting only size and not linewidth). Raw size values are transformed according to the interval_size_domain, interval_size_range, and fatten_point parameters of the geom (see above). Use the point_size aesthetic (below) to set sub-geometry size directly without applying the effects of interval_size_domain, interval_size_range, and fatten_point.

- **stroke**: Width of the outline around the **point** sub-geometry.
- **linetype**: Type of line (e.g., "solid", "dashed", etc) used to draw the **interval** and the outline of the **slab** (if it is visible). Use the `slab_linetype` or `interval_linetype` aesthetics (below) to set sub-geometry line types separately.

Slab-specific color and line override aesthetics

- `slab_fill`: Override for fill: the fill color of the slab.
- `slab_colour`: (or `slab_color`) Override for colour/color: the outline color of the slab.
- `slab_alpha`: Override for alpha: the opacity of the slab.
- `slab_linewidth`: Override for linewidth: the width of the outline of the slab.
- `slab_linetype`: Override for linetype: the line type of the outline of the slab.

Deprecated aesthetics

- `slab_size`: Use `slab_linewidth`.

Other aesthetics (these work as in standard geoms)

- `width`
- `height`
- `group`

See examples of some of these aesthetics in action in `vignette("slabinterval")`. Learn more about the sub-geom override aesthetics (like `interval_color`) in the [scales](#) documentation. Learn more about basic ggplot aesthetics in `vignette("ggplot2-specs")`.

See Also

See `stat_slab()` for the stat version, intended for use on sample data or analytical distributions. See `geom_slabinterval()` for the geometry this shortcut is based on.

Other slabinterval geoms: `geom_interval()`, `geom_pointinterval()`, `geom_spike()`

Examples

```
library(dplyr)
library(ggplot2)

theme_set(theme_ggdist())

# we will manually demonstrate plotting a density with geom_slab(),
# though generally speaking this is easier to do using stat_slab(), which
# will determine sensible limits automatically and correctly adjust
# densities when using scale transformations
df = expand.grid(
  mean = 1:3,
  input = seq(-2, 6, length.out = 100)
) %>%
```

```

mutate(
  group = letters[4 - mean],
  density = dnorm(input, mean, 1)
)

# orientation is detected automatically based on
# use of x or y
df %>%
  ggplot(aes(y = group, x = input, thickness = density)) +
  geom_slab()

df %>%
  ggplot(aes(x = group, y = input, thickness = density)) +
  geom_slab()

# RIDGE PLOTS
# "ridge" plots can be created by increasing the slab height and
# setting the slab color
df %>%
  ggplot(aes(y = group, x = input, thickness = density)) +
  geom_slab(height = 2, color = "black")

```

geom_slabinterval *Slab + point + interval meta-geom*

Description

This meta-geom supports drawing combinations of functions (as slabs, aka ridge plots or joy plots), points, and intervals. It acts as a meta-geom for many other **ggdist** geoms that are wrappers around this geom, including eye plots, half-eye plots, CCDF barplots, and point+multiple interval plots, and supports both horizontal and vertical orientations, dodging (via the `position` argument), and relative justification of slabs with their corresponding intervals.

Usage

```

geom_slabinterval(
  mapping = NULL,
  data = NULL,
  stat = "identity",
  position = "identity",
  ...,
  orientation = NA,
  normalize = "all",
  fill_type = "segments",
  interval_size_domain = c(1, 6),
  interval_size_range = c(0.6, 1.4),
  fatten_point = 1.8,
  arrow = NULL,

```

```

  show_slab = TRUE,
  show_point = TRUE,
  show_interval = TRUE,
  subguide = "none",
  na.rm = FALSE,
  show.legend = NA,
  inherit.aes = TRUE
)

```

Arguments

mapping	Set of aesthetic mappings created by <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>
stat	The statistical transformation to use on the data for this layer, either as a ggproto Geom subclass or as a string naming the stat stripped of the <code>stat_</code> prefix (e.g. "count" rather than "stat_count")
position	Position adjustment, either as a string, or the result of a call to a position adjustment function. Setting this equal to "dodge" (<code>position_dodge()</code>) or "dodgejust" (<code>position_dodgejust()</code>) can be useful if you have overlapping geometries.
...	Other arguments passed to <code>layer()</code> . These are often aesthetics, used to set an aesthetic to a fixed value, like <code>colour = "red"</code> or <code>linewidth = 3</code> (see Aesthetics , below). They may also be parameters to the paired geom/stat.
orientation	<p>Whether this geom is drawn horizontally or vertically. One of:</p> <ul style="list-style-type: none"> • <code>NA</code> (default): automatically detect the orientation based on how the aesthetics are assigned. Automatic detection works most of the time. • "horizontal" (or "y"): draw horizontally, using the y aesthetic to identify different groups. For each group, uses the x, <code>xmin</code>, <code>xmax</code>, and thickness aesthetics to draw points, intervals, and slabs. • "vertical" (or "x"): draw vertically, using the x aesthetic to identify different groups. For each group, uses the y, <code>ymin</code>, <code>ymax</code>, and thickness aesthetics to draw points, intervals, and slabs.

For compatibility with the base `ggplot` naming scheme for orientation, "x" can be used as an alias for "vertical" and "y" as an alias for "horizontal" (`ggdist` had an orientation parameter before base `ggplot` did, hence the discrepancy).

normalize	<p>How to normalize heights of functions input to the thickness aesthetic. One of:</p> <ul style="list-style-type: none"> • "all": normalize so that the maximum height across all data is 1. • "panels": normalize within panels so that the maximum height in each panel is 1. • "xy": normalize within the x/y axis opposite the orientation of this geom so that the maximum height at each value of the opposite axis is 1. • "groups": normalize within values of the opposite axis and within each group so that the maximum height in each group is 1. • "none": values are taken as is with no normalization (this should probably only be used with functions whose values are in [0,1], such as CDFs). <p>For a comprehensive discussion and examples of slab scaling and normalization, see the thickness scale article.</p>
fill_type	<p>What type of fill to use when the fill color or alpha varies within a slab. One of:</p> <ul style="list-style-type: none"> • "segments": breaks up the slab geometry into segments for each unique combination of fill color and alpha value. This approach is supported by all graphics devices and works well for sharp cutoff values, but can give ugly results if a large number of unique fill colors are being used (as in gradients, like in stat_gradientinterval()). • "gradient": a <code>grid::linearGradient()</code> is used to create a smooth gradient fill. This works well for large numbers of unique fill colors, but requires R \geq 4.1 and is not yet supported on all graphics devices. As of this writing, the <code>png()</code> graphics device with <code>type = "cairo"</code>, the <code>svg()</code> device, the <code>pdf()</code> device, and the <code>ragg::agg_png()</code> devices are known to support this option. On R $<$ 4.1, this option will fall back to <code>fill_type = "segments"</code> with a message. • "auto": attempts to use <code>fill_type = "gradient"</code> if support for it can be auto-detected. On R \geq 4.2, support for gradients can be auto-detected on some graphics devices; if support is not detected, this option will fall back to <code>fill_type = "segments"</code> (in case of a false negative, <code>fill_type = "gradient"</code> can be set explicitly). On R $<$ 4.2, support for gradients cannot be auto-detected, so this will always fall back to <code>fill_type = "segments"</code>, in which case you can set <code>fill_type = "gradient"</code> explicitly if you are using a graphics device that support gradients.
interval_size_domain	<p>A length-2 numeric vector giving the minimum and maximum of the values of the size and linewidth aesthetics that will be translated into actual sizes for intervals drawn according to <code>interval_size_range</code> (see the documentation for that argument.)</p>
interval_size_range	<p>A length-2 numeric vector. This geom scales the raw size aesthetic values when drawing interval and point sizes, as they tend to be too thick when using the default settings of scale_size_continuous(), which give sizes with a range of <code>c(1, 6)</code>. The <code>interval_size_domain</code> value indicates the input domain of raw size values (typically this should be equal to the value of the range argument of the scale_size_continuous() function), and <code>interval_size_range</code></p>

indicates the desired output range of the size values (the min and max of the actual sizes used to draw intervals). Most of the time it is not recommended to change the value of this argument, as it may result in strange scaling of legends; this argument is a holdover from earlier versions that did not have size aesthetics targeting the point and interval separately. If you want to adjust the size of the interval or points separately, you can also use the `linewidth` or `point_size` aesthetics; see [sub-geometry-scales](#).

fatten_point	A multiplicative factor used to adjust the size of the point relative to the size of the thickest interval line. If you wish to specify point sizes directly, you can also use the <code>point_size</code> aesthetic and scale_point_size_continuous() or scale_point_size_discrete() ; sizes specified with that aesthetic will not be adjusted using <code>fatten_point</code> .
arrow	grid::arrow() giving the arrow heads to use on the interval, or NULL for no arrows.
show_slab	Should the slab portion of the geom be drawn?
show_point	Should the point portion of the geom be drawn?
show_interval	Should the interval portion of the geom be drawn?
subguide	Sub-guide used to annotate the thickness scale. One of: <ul style="list-style-type: none"> • A function that takes a scale argument giving a ggplot2::Scale object and an orientation argument giving the orientation of the geometry and then returns a grid::grob that will draw the axis annotation, such as subguide_axis() (to draw a traditional axis) or subguide_none() (to draw no annotation). See subguide_axis() for a list of possibilities and examples. • A string giving the name of such a function when prefixed with "subguide"; e.g. "axis" or "none".
na.rm	If FALSE, the default, missing values are removed with a warning. If TRUE, missing values are silently removed.
show.legend	logical. Should this layer be included in the legends? NA, the default, includes if any aesthetics are mapped. FALSE never includes, and TRUE always includes. It can also be a named logical vector to finely select the aesthetics to display.
inherit.aes	If FALSE, overrides the default aesthetics, rather than combining with them. This is most useful for helper functions that define both data and aesthetics and shouldn't inherit behaviour from the default plot specification, e.g. borders() .

Details

[geom_slabinterval\(\)](#) is a flexible meta-geom that you can use directly or through a variety of "shortcut" geoms that represent useful combinations of the various parameters of this geom. In many cases you will want to use the shortcut geoms instead as they create more useful mnemonic primitives, such as eye plots, half-eye plots, point+interval plots, or CCDF barplots.

The *slab* portion of the geom is much like a ridge or "joy" plot: it represents the value of a function scaled to fit between values on the x or y axis (depending on the value of `orientation`). Values of the functions are specified using the `thickness` aesthetic and are scaled to fit into `scale` times the distance between points on the relevant axis. E.g., if `orientation` is "horizontal", `scale` is 0.9, and `y` is a discrete variable, then the `thickness` aesthetic specifies the value of some function of `x`

that is drawn for every y value and scaled to fit into 0.9 times the distance between points on the y axis.

For the *interval* portion of the geom, x and y aesthetics specify the location of the point, and ymin/ymax or xmin/xmax (depending on the value of orientation) specify the endpoints of the interval. A scaling factor for interval line width and point size is applied through the interval_size_domain, interval_size_range, and fatten_point parameters. These scaling factors are designed to give multiple uncertainty intervals reasonable scaling at the default settings for [scale_size_continuous\(\)](#).

As a combination geom, this geom expects a datatype aesthetic specifying which part of the geom a given row in the input data corresponds to: "slab" or "interval". However, specifying this aesthetic manually is typically only necessary if you use this geom directly; the numerous wrapper geoms will usually set this aesthetic for you as needed, and their use is recommended unless you have a very custom use case.

Wrapper geoms include:

- [geom_pointinterval\(\)](#)
- [geom_interval\(\)](#)
- [geom_slab\(\)](#)

In addition, the [stat_slabinterval\(\)](#) family of stats uses geoms from the [geom_slabinterval\(\)](#) family, and is often easier to use than using these geoms directly. Typically, the geom_* versions are meant for use with already-summarized data (such as intervals) and the stat_* versions are summarize the data themselves (usually draws from a distribution) to produce the geom.

Value

A [ggplot2::Geom](#) representing a slab or combined slab+interval geometry which can be added to a [ggplot\(\)](#) object.

Aesthetics

The slab+interval stats and geoms have a wide variety of aesthetics that control the appearance of their three sub-geometries: the **slab**, the **point**, and the **interval**.

Positional aesthetics

- x: x position of the geometry
- y: y position of the geometry

Slab-specific aesthetics

- thickness: The thickness of the slab at each x value (if orientation = "horizontal") or y value (if orientation = "vertical") of the slab.
- side: Which side to place the slab on. "topright", "top", and "right" are synonyms which cause the slab to be drawn on the top or the right depending on if orientation is "horizontal" or "vertical". "bottomleft", "bottom", and "left" are synonyms which cause the slab to be drawn on the bottom or the left depending on if orientation is "horizontal" or "vertical". "topleft" causes the slab to be drawn on the top or the left, and "bottomright" causes the slab to be drawn on the bottom or the right. "both" draws the slab mirrored on both sides (as in a violin plot).

- **scale**: What proportion of the region allocated to this geom to use to draw the slab. If `scale = 1`, slabs that use the maximum range will just touch each other. Default is `0.9` to leave some space between adjacent slabs. For a comprehensive discussion and examples of slab scaling and normalization, see the [thickness scale article](#).
- **justification**: Justification of the interval relative to the slab, where `0` indicates bottom/left justification and `1` indicates top/right justification (depending on orientation). If justification is `NULL` (the default), then it is set automatically based on the value of `side`: when `side` is `"top"/"right"` justification is set to `0`, when `side` is `"bottom"/"left"` justification is set to `1`, and when `side` is `"both"` justification is set to `0.5`.
- **datatype**: When using composite geoms directly without a stat (e.g. `geom_slabinterval()`), `datatype` is used to indicate which part of the geom a row in the data targets: rows with `datatype = "slab"` target the slab portion of the geometry and rows with `datatype = "interval"` target the interval portion of the geometry. This is set automatically when using ggdist stats.

Interval-specific aesthetics

- **xmin**: Left end of the interval sub-geometry (if `orientation = "horizontal"`).
- **xmax**: Right end of the interval sub-geometry (if `orientation = "horizontal"`).
- **ymin**: Lower end of the interval sub-geometry (if `orientation = "vertical"`).
- **ymax**: Upper end of the interval sub-geometry (if `orientation = "vertical"`).

Point-specific aesthetics

- **shape**: Shape type used to draw the **point** sub-geometry.

Color aesthetics

- **colour**: (or `color`) The color of the **interval** and **point** sub-geometries. Use the `slab_color`, `interval_color`, or `point_color` aesthetics (below) to set sub-geometry colors separately.
- **fill**: The fill color of the **slab** and **point** sub-geometries. Use the `slab_fill` or `point_fill` aesthetics (below) to set sub-geometry colors separately.
- **alpha**: The opacity of the **slab**, **interval**, and **point** sub-geometries. Use the `slab_alpha`, `interval_alpha`, or `point_alpha` aesthetics (below) to set sub-geometry colors separately.
- **colour_ramp**: (or `color_ramp`) A secondary scale that modifies the color scale to "ramp" to another color. See [scale_colour_ramp\(\)](#) for examples.
- **fill_ramp**: A secondary scale that modifies the fill scale to "ramp" to another color. See [scale_fill_ramp\(\)](#) for examples.

Line aesthetics

- **linewidth**: Width of the line used to draw the **interval** (except with `geom_slab()`: then it is the width of the **slab**). With composite geometries including an interval and slab, use `slab_linewidth` to set the line width of the **slab** (see below). For **interval**, raw `linewidth` values are transformed according to the `interval_size_domain` and `interval_size_range` parameters of the geom (see above).

- **size**: Determines the size of the **point**. If **linewidth** is not provided, **size** will also determine the width of the line used to draw the **interval** (this allows line width and point size to be modified together by setting only **size** and not **linewidth**). Raw size values are transformed according to the **interval_size_domain**, **interval_size_range**, and **fatten_point** parameters of the geom (see above). Use the **point_size** aesthetic (below) to set sub-geometry size directly without applying the effects of **interval_size_domain**, **interval_size_range**, and **fatten_point**.
- **stroke**: Width of the outline around the **point** sub-geometry.
- **linetype**: Type of line (e.g., "solid", "dashed", etc) used to draw the **interval** and the outline of the **slab** (if it is visible). Use the **slab_linetype** or **interval_linetype** aesthetics (below) to set sub-geometry line types separately.

Slab-specific color and line override aesthetics

- **slab_fill**: Override for **fill**: the fill color of the slab.
- **slab_colour**: (or **slab_color**) Override for **colour/color**: the outline color of the slab.
- **slab_alpha**: Override for **alpha**: the opacity of the slab.
- **slab_linewidth**: Override for **linewidth**: the width of the outline of the slab.
- **slab_linetype**: Override for **linetype**: the line type of the outline of the slab.

Interval-specific color and line override aesthetics

- **interval_colour**: (or **interval_color**) Override for **colour/color**: the color of the interval.
- **interval_alpha**: Override for **alpha**: the opacity of the interval.
- **interval_linetype**: Override for **linetype**: the line type of the interval.

Point-specific color and line override aesthetics

- **point_fill**: Override for **fill**: the fill color of the point.
- **point_colour**: (or **point_color**) Override for **colour/color**: the outline color of the point.
- **point_alpha**: Override for **alpha**: the opacity of the point.
- **point_size**: Override for **size**: the size of the point.

Deprecated aesthetics

- **slab_size**: Use **slab_linewidth**.
- **interval_size**: Use **interval_linewidth**.

Other aesthetics (these work as in standard geoms)

- **width**
- **height**
- **group**

See examples of some of these aesthetics in action in `vignette("slabinterval")`. Learn more about the sub-geom override aesthetics (like `interval_color`) in the [scales](#) documentation. Learn more about basic ggplot aesthetics in `vignette("ggplot2-specs")`.

Author(s)

Matthew Kay

See Also

See [geom_lineribbon\(\)](#) for a combination geom designed for fit curves plus probability bands.
See [geom_dotsinterval\(\)](#) for a combination geom designed for plotting dotplots with intervals.
See [stat_slabinterval\(\)](#) for families of stats built on top of this geom for common use cases (like [stat_halfeye\(\)](#)). See [vignette\("slabinterval"\)](#) for a variety of examples of use.

Examples

```
# geom_slabinterval() is typically not that useful on its own.  
# See vignette("slabinterval") for a variety of examples of the use of its  
# shortcut geoms and stats, which are more useful than using  
# geom_slabinterval() directly.
```

geom_spike

Spike plot (ggplot2 geom)

Description

Geometry for drawing "spikes" (optionally with points on them) on top of [geom_slabinterval\(\)](#) geometries: this geometry understands the scaling and positioning of the thickness aesthetic from [geom_slabinterval\(\)](#), which allows you to position spikes and points along a slab.

Usage

```
geom_spike(  
  mapping = NULL,  
  data = NULL,  
  stat = "identity",  
  position = "identity",  
  ...,  
  orientation = NA,  
  normalize = "all",  
  arrow = NULL,  
  subguide = "none",  
  na.rm = FALSE,  
  show.legend = NA,  
  inherit.aes = TRUE  
)
```

Arguments

mapping	Set of aesthetic mappings created by <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>
stat	The statistical transformation to use on the data for this layer, either as a <code>ggproto</code> <code>Geom</code> subclass or as a string naming the stat stripped of the <code>stat_</code> prefix (e.g. "count" rather than "stat_count")
position	Position adjustment, either as a string, or the result of a call to a position adjustment function. Setting this equal to "dodge" (<code>position_dodge()</code>) or "dodgejust" (<code>position_dodgejust()</code>) can be useful if you have overlapping geometries.
...	Other arguments passed to <code>layer()</code> . These are often aesthetics, used to set an aesthetic to a fixed value, like <code>colour = "red"</code> or <code>linewidth = 3</code> (see Aesthetics , below). They may also be parameters to the paired <code>geom/stat</code> .
orientation	<p>Whether this geom is drawn horizontally or vertically. One of:</p> <ul style="list-style-type: none"> • <code>NA</code> (default): automatically detect the orientation based on how the aesthetics are assigned. Automatic detection works most of the time. • "horizontal" (or "y"): draw horizontally, using the y aesthetic to identify different groups. For each group, uses the x, <code>xmin</code>, <code>xmax</code>, and thickness aesthetics to draw points, intervals, and slabs. • "vertical" (or "x"): draw vertically, using the x aesthetic to identify different groups. For each group, uses the y, <code>ymin</code>, <code>ymax</code>, and thickness aesthetics to draw points, intervals, and slabs. <p>For compatibility with the base <code>ggplot</code> naming scheme for orientation, "x" can be used as an alias for "vertical" and "y" as an alias for "horizontal" (<code>ggdist</code> had an orientation parameter before base <code>ggplot</code> did, hence the discrepancy).</p>
normalize	<p>How to normalize heights of functions input to the thickness aesthetic. One of:</p> <ul style="list-style-type: none"> • "all": normalize so that the maximum height across all data is 1. • "panels": normalize within panels so that the maximum height in each panel is 1. • "xy": normalize within the x/y axis opposite the orientation of this geom so that the maximum height at each value of the opposite axis is 1. • "groups": normalize within values of the opposite axis and within each group so that the maximum height in each group is 1.

- "none": values are taken as is with no normalization (this should probably only be used with functions whose values are in [0,1], such as CDFs).

For a comprehensive discussion and examples of slab scaling and normalization, see the [thickness scale article](#).

arrow	<code>grid::arrow()</code> giving the arrow heads to use on the spike, or NULL for no arrows.
subguide	Sub-guide used to annotate the thickness scale. One of: <ul style="list-style-type: none"> • A function that takes a scale argument giving a <code>ggplot2::Scale</code> object and an orientation argument giving the orientation of the geometry and then returns a <code>grid::grob</code> that will draw the axis annotation, such as <code>subguide_axis()</code> (to draw a traditional axis) or <code>subguide_none()</code> (to draw no annotation). See <code>subguide_axis()</code> for a list of possibilities and examples. • A string giving the name of such a function when prefixed with "subguide"; e.g. "axis" or "none".
na.rm	If FALSE, the default, missing values are removed with a warning. If TRUE, missing values are silently removed.
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> .

Details

This geometry consists of a "spike" (vertical/horizontal line segment) and a "point" (at the end of the line segment). It uses the thickness aesthetic to determine where the endpoint of the line is, which allows it to be used with `geom_slabinterval()` geometries for labeling specific values of the thickness function.

Value

A `ggplot2::Geom` representing a spike geometry which can be added to a `ggplot()` object. `rd_slabinterval_aesthetics(geom_r`

Aesthetics

The spike geom has a wide variety of aesthetics that control the appearance of its two sub-geometries: the **spike** and the **point**.

Positional aesthetics

- x: x position of the geometry
- y: y position of the geometry

Spike-specific (aka Slab-specific) aesthetics

- thickness: The thickness of the slab at each x value (if orientation = "horizontal") or y value (if orientation = "vertical") of the slab.

- **side**: Which side to place the slab on. "topright", "top", and "right" are synonyms which cause the slab to be drawn on the top or the right depending on if orientation is "horizontal" or "vertical". "bottomleft", "bottom", and "left" are synonyms which cause the slab to be drawn on the bottom or the left depending on if orientation is "horizontal" or "vertical". "topleft" causes the slab to be drawn on the top or the left, and "bottomright" causes the slab to be drawn on the bottom or the right. "both" draws the slab mirrored on both sides (as in a violin plot).
- **scale**: What proportion of the region allocated to this geom to use to draw the slab. If scale = 1, slabs that use the maximum range will just touch each other. Default is 0.9 to leave some space between adjacent slabs. For a comprehensive discussion and examples of slab scaling and normalization, see the [thickness scale article](#).

Color aesthetics

- **colour**: (or color) The color of the **spike** and **point** sub-geometries.
- **fill**: The fill color of the **point** sub-geometry.
- **alpha**: The opacity of the **spike** and **point** sub-geometries.
- **colour_ramp**: (or color_ramp) A secondary scale that modifies the color scale to "ramp" to another color. See [scale_colour_ramp\(\)](#) for examples.
- **fill_ramp**: A secondary scale that modifies the fill scale to "ramp" to another color. See [scale_fill_ramp\(\)](#) for examples.

Line aesthetics

- **linewidth**: Width of the line used to draw the **spike** sub-geometry.
- **size**: Size of the **point** sub-geometry.
- **stroke**: Width of the outline around the **point** sub-geometry.
- **linetype**: Type of line (e.g., "solid", "dashed", etc) used to draw the **spike**.

Other aesthetics (these work as in standard geoms)

- width
- height
- group

See examples of some of these aesthetics in action in `vignette("slabinterval")`. Learn more about the sub-geom override aesthetics (like `interval_color`) in the [scales](#) documentation. Learn more about basic ggplot aesthetics in `vignette("ggplot2-specs")`.

See Also

See [stat_spike\(\)](#) for the stat version, intended for use on sample data or analytical distributions.

Other `slabinterval` geoms: [geom_interval\(\)](#), [geom_pointinterval\(\)](#), [geom_slab\(\)](#)

Examples

```

library(ggplot2)
library(distributional)
library(dplyr)

# geom_spike is easiest to use with distributional or
# posterior::rvar objects
df = tibble(
  d = dist_normal(1:2, 1:2), g = c("a", "b")
)

# annotate the density at the mean of a distribution
df %>% mutate(
  mean = mean(d),
  density(d, list(density_at_mean = mean))
) %>%
  ggplot(aes(y = g)) +
  stat_slab(aes(xdist = d)) +
  geom_spike(aes(x = mean, thickness = density_at_mean)) +
  # need shared thickness scale so that stat_slab and geom_spike line up
  scale_thickness_shared()

# annotate the endpoints of intervals of a distribution
# here we'll use an arrow instead of a point by setting size = 0
arrow_spec = arrow(angle = 45, type = "closed", length = unit(4, "pt"))
df %>% mutate(
  median_qi(d, .width = 0.9),
  density(d, list(density_lower = .lower, density_upper = .upper))
) %>%
  ggplot(aes(y = g)) +
  stat_halfeye(aes(xdist = d), .width = 0.9, color = "gray35") +
  geom_spike(
    aes(x = .lower, thickness = density_lower),
    size = 0, arrow = arrow_spec, color = "blue", linewidth = 0.75
  ) +
  geom_spike(
    aes(x = .upper, thickness = density_upper),
    size = 0, arrow = arrow_spec, color = "red", linewidth = 0.75
  ) +
  scale_thickness_shared()

```

geom_swarm

Beeswarm plot (shortcut geom)

Description

Shortcut version of `geom_dotsinterval()` for creating beeswarm plots. Geoms based on `geom_dotsinterval()` create dotplots that automatically ensure the plot fits within the available space.

Roughly equivalent to:

```
geom_dots(
  aes(side = "both"),
  overflow = "compress",
  binwidth = unit(1.5, "mm"),
  layout = "swarm"
)
```

Usage

```
geom_swarm(
  mapping = NULL,
  data = NULL,
  stat = "identity",
  position = "identity",
  ...,
  overflow = "compress",
  binwidth = unit(1.5, "mm"),
  layout = "swarm",
  dotsize = 1.07,
  stackratio = 1,
  overlaps = "nudge",
  smooth = "none",
  verbose = FALSE,
  orientation = NA,
  subguide = "none",
  na.rm = FALSE,
  show.legend = NA,
  inherit.aes = TRUE
)
```

Arguments

mapping	Set of aesthetic mappings created by aes() . 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 ggplot().</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 fortify() 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 for this layer, either as a <code>ggproto</code> <code>Geom</code> subclass or as a string naming the stat stripped of the <code>stat_</code> prefix (e.g. "count" rather than "stat_count")

position	Position adjustment, either as a string, or the result of a call to a position adjustment function. Setting this equal to "dodge" (<code>position_dodge()</code>) or "dodgejust" (<code>position_dodgejust()</code>) can be useful if you have overlapping geometries.
...	Other arguments passed to <code>layer()</code> . These are often aesthetics, used to set an aesthetic to a fixed value, like <code>colour = "red"</code> or <code>linewidth = 3</code> (see Aesthetics , below). They may also be parameters to the paired geom/stat.
overflow	<p>How to handle overflow of dots beyond the extent of the geom when a minimum binwidth (or an exact binwidth) is supplied. One of:</p> <ul style="list-style-type: none"> • "keep": Keep the overflow, drawing dots outside the geom bounds. • "warn": Keep the overflow, but produce a warning suggesting solutions, such as setting <code>binwidth = NA</code> or <code>overflow = "compress"</code>. • "compress": Compress the layout. Reduces the binwidth to the size necessary to keep the dots within bounds, then adjusts <code>stackratio</code> and <code>dotsize</code> so that the apparent dot size is the user-specified minimum binwidth times the user-specified <code>dotsize</code>. <p>If you find the default layout has dots that are too small, and you are okay with dots overlapping, consider setting <code>overflow = "compress"</code> and supplying an exact or minimum dot size using <code>binwidth</code>.</p>
binwidth	<p>The bin width to use for laying out the dots. One of:</p> <ul style="list-style-type: none"> • NA (the default): Dynamically select the bin width based on the size of the plot when drawn. This will pick a binwidth such that the tallest stack of dots is at most scale in height (ideally exactly scale in height, though this is not guaranteed). • A length-1 (scalar) numeric or <code>unit</code> object giving the exact bin width. • A length-2 (vector) numeric or <code>unit</code> object giving the minimum and maximum desired bin width. The bin width will be dynamically selected within these bounds. <p>If the value is numeric, it is assumed to be in units of data. The bin width (or its bounds) can also be specified using <code>unit()</code>, which may be useful if it is desired that the dots be a certain point size or a certain percentage of the width/height of the viewport. For example, <code>unit(0.1, "npc")</code> would make dots that are <i>exactly</i> 10% of the viewport size along whichever dimension the dotplot is drawn; <code>unit(c(0, 0.1), "npc")</code> would make dots that are <i>at most</i> 10% of the viewport size (while still ensuring the tallest stack is less than or equal to scale).</p>
layout	<p>The layout method used for the dots:</p> <ul style="list-style-type: none"> • "bin" (default): places dots on the off-axis at the midpoint of their bins as in the classic Wilkinson dotplot. This maintains the alignment of rows and columns in the dotplot. This layout is slightly different from the classic Wilkinson algorithm in that: (1) it nudges bins slightly to avoid overlapping bins and (2) if the input data are symmetrical it will return a symmetrical layout. • "weave": uses the same basic binning approach of "bin", but places dots in the off-axis at their actual positions (unless <code>overlaps = "nudge"</code>, in which case overlaps may be nudged out of the way). This maintains the alignment of rows but does not align dots within columns.

	<ul style="list-style-type: none"> • "hex": uses the same basic binning approach of "bin", but alternates placing dots + binwidth/4 or - binwidth/4 in the off-axis from the bin center. This allows hexagonal packing by setting a stackratio less than 1 (something like 0.9 tends to work). • "swarm": uses the "compactswarm" layout from <code>beeswarm::beeswarm()</code>. Does not maintain alignment of rows or columns, but can be more compact and neat looking, especially for sample data (as opposed to quantile dotplots of theoretical distributions, which may look better with "bin", "weave", or "hex"). • "bar": for discrete distributions, lays out duplicate values in rectangular bars.
dotsize	The width of the dots relative to the binwidth. The default, 1.07, makes dots be just a bit wider than the bin width, which is a manually-tuned parameter that tends to work well with the default circular shape, preventing gaps between bins from appearing to be too large visually (as might arise from dots being <i>precisely</i> the binwidth). If it is desired to have dots be precisely the binwidth, set <code>dotsize = 1</code> .
stackratio	The distance between the center of the dots in the same stack relative to the dot height. The default, 1, makes dots in the same stack just touch each other.
overlaps	How to handle overlapping dots or bins in the "bin", "weave", and "hex" layouts (dots never overlap in the "swarm" or "bar" layouts). For the purposes of this argument, dots are only considered to be overlapping if they would be overlapping when <code>dotsize = 1</code> and <code>stackratio = 1</code> ; i.e. if you set those arguments to other values, overlaps may still occur. One of: <ul style="list-style-type: none"> • "keep": leave overlapping dots as they are. Dots may overlap (usually only slightly) in the "bin", "weave", and "hex" layouts. • "nudge": nudge overlapping dots out of the way. Overlaps are avoided using a constrained optimization which minimizes the squared distance of dots to their desired positions, subject to the constraint that adjacent dots do not overlap.
smooth	<p>Smoother to apply to dot positions. One of:</p> <ul style="list-style-type: none"> • A function that takes a numeric vector of dot positions and returns a smoothed version of that vector, such as <code>smooth_bounded()</code>, <code>smooth_unbounded()</code>, <code>smooth_discrete()</code>, or <code>smooth_bar()</code>. • A string indicating what smoother to use, as the suffix to a function name starting with <code>smooth_</code>; e.g. "none" (the default) applies <code>smooth_none()</code>, which simply returns the given vector without applying smoothing. <p>Smoothing is most effective when the smoother is matched to the support of the distribution; e.g. using <code>smooth_bounded(bounds = . . .)</code>.</p>
verbose	If TRUE, print out the bin width of the dotplot. Can be useful if you want to start from an automatically-selected bin width and then adjust it manually. Bin width is printed both as data units and as normalized parent coordinates or "npc"s (see <code>unit()</code>). Note that if you just want to scale the selected bin width to fit within a desired area, it is probably easier to use <code>scale</code> than to copy and scale <code>binwidth</code> manually, and if you just want to provide constraints on the bin width, you can pass a length-2 vector to <code>binwidth</code> .

orientation	<p>Whether this geom is drawn horizontally or vertically. One of:</p> <ul style="list-style-type: none"> • NA (default): automatically detect the orientation based on how the aesthetics are assigned. Automatic detection works most of the time. • "horizontal" (or "y"): draw horizontally, using the y aesthetic to identify different groups. For each group, uses the x, xmin, xmax, and thickness aesthetics to draw points, intervals, and slabs. • "vertical" (or "x"): draw vertically, using the x aesthetic to identify different groups. For each group, uses the y, ymin, ymax, and thickness aesthetics to draw points, intervals, and slabs. <p>For compatibility with the base ggplot naming scheme for orientation, "x" can be used as an alias for "vertical" and "y" as an alias for "horizontal" (ggdist had an orientation parameter before base ggplot did, hence the discrepancy).</p>
subguide	<p>Sub-guide used to annotate the thickness scale. One of:</p> <ul style="list-style-type: none"> • A function that takes a scale argument giving a <code>ggplot2::Scale</code> object and an orientation argument giving the orientation of the geometry and then returns a <code>grid::grob</code> that will draw the axis annotation, such as <code>subguide_axis()</code> (to draw a traditional axis) or <code>subguide_none()</code> (to draw no annotation). See <code>subguide_axis()</code> for a list of possibilities and examples. • A string giving the name of such a function when prefixed with "subguide"; e.g. "axis" or "none".
na.rm	<p>If FALSE, the default, missing values are removed with a warning. If TRUE, missing values are silently removed.</p>
show.legend	<p>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.</p>
inherit.aes	<p>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>.</p>

Details

The *dots* family of stats and geoms are similar to `geom_dotplot()` but with a number of differences:

- Dots geoms act like slabs in `geom_slabinterval()` and can be given x positions (or y positions when in a horizontal orientation).
- Given the available space to lay out dots, the dots geoms will automatically determine how many bins to use to fit the available space.
- Dots geoms use a dynamic layout algorithm that lays out dots from the center out if the input data are symmetrical, guaranteeing that symmetrical data results in a symmetrical plot. The layout algorithm also prevents dots from overlapping each other.
- The shape of the dots in these geoms can be changed using the `slab_shape` aesthetic (when using the `dotsinterval` family) or the `shape` or `slab_shape` aesthetic (when using the `dots` family)

Stats and geoms in this family include:

- `geom_dots()`: dotplots on raw data. Ensures the dotplot fits within available space by reducing the size of the dots automatically (may result in very small dots).
- `geom_swarm()` and `geom_weave()`: dotplots on raw data with defaults intended to create "beeswarm" plots. Used `side = "both"` by default, and sets the default dot size to the same size as `geom_point()` (`binwidth = unit(1.5, "mm")`), allowing dots to overlap instead of getting very small.
- `stat_dots()`: dotplots on raw data, **distributional** objects, and `posterior::rvar()`s
- `geom_dotsinterval()`: dotplot + interval plots on raw data with already-calculated intervals (rarely useful directly).
- `stat_dotsinterval()`: dotplot + interval plots on raw data, **distributional** objects, and `posterior::rvar()`s (will calculate intervals for you).
- `geom_blur_dots()`: blurry dotplots that allow the standard deviation of a blur applied to each dot to be specified using the `sd` aesthetic.
- `stat_mcse_dots()`: blurry dotplots of quantiles using the Monte Carlo Standard Error of each quantile.

`stat_dots()` and `stat_dotsinterval()`, when used with the `quantiles` argument, are particularly useful for constructing quantile dotplots, which can be an effective way to communicate uncertainty using a frequency framing that may be easier for laypeople to understand (Kay et al. 2016, Fernandes et al. 2018).

Value

A `ggplot2::Geom` representing a beeswarm geometry which can be added to a `ggplot()` object.

Aesthetics

The dots+interval stats and geoms have a wide variety of aesthetics that control the appearance of their three sub-geometries: the **dots** (aka the **slab**), the **point**, and the **interval**.

Positional aesthetics

- `x`: x position of the geometry
- `y`: y position of the geometry

Dots-specific (aka Slab-specific) aesthetics

- `family`: The font family used to draw the dots.
- `order`: The order in which data points are stacked within bins. Can be used to create the effect of "stacked" dots by ordering dots according to a discrete variable. If omitted (NULL), the value of the data points themselves are used to determine stacking order. Only applies when layout is "bin" or "hex", as the other layout methods fully determine both *x* and *y* positions.
- `side`: Which side to place the slab on. "topright", "top", and "right" are synonyms which cause the slab to be drawn on the top or the right depending on if orientation is "horizontal" or "vertical". "bottomleft", "bottom", and "left" are synonyms which cause the slab to be drawn on the bottom or the left depending on if orientation is "horizontal" or "vertical". "topleft" causes the slab to be drawn on the top or the left, and "bottomright" causes the slab to be drawn on the bottom or the right. "both" draws the slab mirrored on both sides (as in a violin plot).

- **scale**: What proportion of the region allocated to this geom to use to draw the slab. If `scale = 1`, slabs that use the maximum range will just touch each other. Default is `0.9` to leave some space between adjacent slabs. For a comprehensive discussion and examples of slab scaling and normalization, see the [thickness scale article](#).
- **justification**: Justification of the interval relative to the slab, where `0` indicates bottom/left justification and `1` indicates top/right justification (depending on orientation). If justification is `NULL` (the default), then it is set automatically based on the value of `side`: when `side` is `"top"/"right"` justification is set to `0`, when `side` is `"bottom"/"left"` justification is set to `1`, and when `side` is `"both"` justification is set to `0.5`.
- **datatype**: When using composite geoms directly without a stat (e.g. `geom_slabinterval()`), `datatype` is used to indicate which part of the geom a row in the data targets: rows with `datatype = "slab"` target the slab portion of the geometry and rows with `datatype = "interval"` target the interval portion of the geometry. This is set automatically when using ggdist stats.

Interval-specific aesthetics

- **xmin**: Left end of the interval sub-geometry (if `orientation = "horizontal"`).
- **xmax**: Right end of the interval sub-geometry (if `orientation = "horizontal"`).
- **ymin**: Lower end of the interval sub-geometry (if `orientation = "vertical"`).
- **ymax**: Upper end of the interval sub-geometry (if `orientation = "vertical"`).

Point-specific aesthetics

- **shape**: Shape type used to draw the **point** sub-geometry.

Color aesthetics

- **colour**: (or `color`) The color of the **interval** and **point** sub-geometries. Use the `slab_color`, `interval_color`, or `point_color` aesthetics (below) to set sub-geometry colors separately.
- **fill**: The fill color of the **slab** and **point** sub-geometries. Use the `slab_fill` or `point_fill` aesthetics (below) to set sub-geometry colors separately.
- **alpha**: The opacity of the **slab**, **interval**, and **point** sub-geometries. Use the `slab_alpha`, `interval_alpha`, or `point_alpha` aesthetics (below) to set sub-geometry colors separately.
- **colour_ramp**: (or `color_ramp`) A secondary scale that modifies the color scale to "ramp" to another color. See [scale_colour_ramp\(\)](#) for examples.
- **fill_ramp**: A secondary scale that modifies the fill scale to "ramp" to another color. See [scale_fill_ramp\(\)](#) for examples.

Line aesthetics

- **linewidth**: Width of the line used to draw the **interval** (except with `geom_slab()`: then it is the width of the **slab**). With composite geometries including an interval and slab, use `slab_linewidth` to set the line width of the **slab** (see below). For **interval**, raw `linewidth` values are transformed according to the `interval_size_domain` and `interval_size_range` parameters of the geom (see above).

- **size**: Determines the size of the **point**. If **linewidth** is not provided, **size** will also determine the width of the line used to draw the **interval** (this allows line width and point size to be modified together by setting only **size** and not **linewidth**). Raw size values are transformed according to the **interval_size_domain**, **interval_size_range**, and **fatten_point** parameters of the geom (see above). Use the **point_size** aesthetic (below) to set sub-geometry size directly without applying the effects of **interval_size_domain**, **interval_size_range**, and **fatten_point**.
- **stroke**: Width of the outline around the **point** sub-geometry.
- **linetype**: Type of line (e.g., "solid", "dashed", etc) used to draw the **interval** and the outline of the **slab** (if it is visible). Use the **slab_linetype** or **interval_linetype** aesthetics (below) to set sub-geometry line types separately.

Slab-specific color and line override aesthetics

- **slab_fill**: Override for **fill**: the fill color of the slab.
- **slab_colour**: (or **slab_color**) Override for **colour/color**: the outline color of the slab.
- **slab_alpha**: Override for **alpha**: the opacity of the slab.
- **slab_linewidth**: Override for **linewidth**: the width of the outline of the slab.
- **slab_linetype**: Override for **linetype**: the line type of the outline of the slab.
- **slab_shape**: Override for **shape**: the shape of the dots used to draw the dotplot slab.

Interval-specific color and line override aesthetics

- **interval_colour**: (or **interval_color**) Override for **colour/color**: the color of the interval.
- **interval_alpha**: Override for **alpha**: the opacity of the interval.
- **interval_linetype**: Override for **linetype**: the line type of the interval.

Point-specific color and line override aesthetics

- **point_fill**: Override for **fill**: the fill color of the point.
- **point_colour**: (or **point_color**) Override for **colour/color**: the outline color of the point.
- **point_alpha**: Override for **alpha**: the opacity of the point.
- **point_size**: Override for **size**: the size of the point.

Deprecated aesthetics

- **slab_size**: Use **slab_linewidth**.
- **interval_size**: Use **interval_linewidth**.

Other aesthetics (these work as in standard geoms)

- **width**
- **height**
- **group**

See examples of some of these aesthetics in action in `vignette("dotsinterval")`. Learn more about the sub-geom override aesthetics (like **interval_color**) in the [scales](#) documentation. Learn more about basic ggplot aesthetics in `vignette("ggplot2-specs")`.

References

Kay, M., Kola, T., Hullman, J. R., & Munson, S. A. (2016). When (ish) is My Bus? User-centered Visualizations of Uncertainty in Everyday, Mobile Predictive Systems. *Conference on Human Factors in Computing Systems - CHI '16*, 5092–5103. doi:10.1145/2858036.2858558.

Fernandes, M., Walls, L., Munson, S., Hullman, J., & Kay, M. (2018). Uncertainty Displays Using Quantile Dotplots or CDFs Improve Transit Decision-Making. *Conference on Human Factors in Computing Systems - CHI '18*. doi:10.1145/3173574.3173718.

See Also

See [geom_dotsinterval\(\)](#) for the geometry this shortcut is based on.

See `vignette("dotsinterval")` for a variety of examples of use.

Other dotsinterval geoms: [geom_blur_dots\(\)](#), [geom_dots\(\)](#), [geom_dotsinterval\(\)](#), [geom_weave\(\)](#)

Examples

```
library(dplyr)
library(ggplot2)

theme_set(theme_ggdist())

set.seed(12345)
df = tibble(
  g = rep(c("a", "b"), 200),
  value = rnorm(400, c(0, 3), c(0.75, 1))
)

# orientation is detected automatically based on
# which axis is discrete

df %>%
  ggplot(aes(x = value, y = g)) +
  geom_swarm()

df %>%
  ggplot(aes(y = value, x = g)) +
  geom_swarm()
```

geom_weave

Dot-weave plot (shortcut geom)

Description

Shortcut version of [geom_dotsinterval\(\)](#) for creating dot-weave plots. Geoms based on [geom_dotsinterval\(\)](#) create dotplots that automatically ensure the plot fits within the available space.

Roughly equivalent to:

```
geom_dots(
  aes(side = "both"),
  layout = "weave",
  overflow = "compress",
  binwidth = unit(1.5, "mm")
)
```

Usage

```
geom_weave(
  mapping = NULL,
  data = NULL,
  stat = "identity",
  position = "identity",
  ...,
  layout = "weave",
  overflow = "compress",
  binwidth = unit(1.5, "mm"),
  dotsize = 1.07,
  stackratio = 1,
  overlaps = "nudge",
  smooth = "none",
  verbose = FALSE,
  orientation = NA,
  subguide = "none",
  na.rm = FALSE,
  show.legend = NA,
  inherit.aes = TRUE
)
```

Arguments

mapping	Set of aesthetic mappings created by aes() . 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 ggplot().</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 fortify() 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 for this layer, either as a <code>ggproto</code> <code>Geom</code> subclass or as a string naming the stat stripped of the <code>stat_</code> prefix (e.g. "count" rather than "stat_count")

position	Position adjustment, either as a string, or the result of a call to a position adjustment function. Setting this equal to "dodge" (position_dodge()) or "dodgejust" (position_dodgejust()) can be useful if you have overlapping geometries.
...	Other arguments passed to layer() . These are often aesthetics, used to set an aesthetic to a fixed value, like <code>colour = "red"</code> or <code>linewidth = 3</code> (see Aesthetics , below). They may also be parameters to the paired geom/stat.
layout	<p>The layout method used for the dots:</p> <ul style="list-style-type: none"> • "bin" (default): places dots on the off-axis at the midpoint of their bins as in the classic Wilkinson dotplot. This maintains the alignment of rows and columns in the dotplot. This layout is slightly different from the classic Wilkinson algorithm in that: (1) it nudges bins slightly to avoid overlapping bins and (2) if the input data are symmetrical it will return a symmetrical layout. • "weave": uses the same basic binning approach of "bin", but places dots in the off-axis at their actual positions (unless <code>overlaps = "nudge"</code>, in which case overlaps may be nudged out of the way). This maintains the alignment of rows but does not align dots within columns. • "hex": uses the same basic binning approach of "bin", but alternates placing dots + <code>binwidth/4</code> or - <code>binwidth/4</code> in the off-axis from the bin center. This allows hexagonal packing by setting a <code>stackratio</code> less than 1 (something like 0.9 tends to work). • "swarm": uses the "compactswarm" layout from beeswarm::beeswarm(). Does not maintain alignment of rows or columns, but can be more compact and neat looking, especially for sample data (as opposed to quantile dotplots of theoretical distributions, which may look better with "bin", "weave", or "hex"). • "bar": for discrete distributions, lays out duplicate values in rectangular bars.
overflow	<p>How to handle overflow of dots beyond the extent of the geom when a minimum binwidth (or an exact binwidth) is supplied. One of:</p> <ul style="list-style-type: none"> • "keep": Keep the overflow, drawing dots outside the geom bounds. • "warn": Keep the overflow, but produce a warning suggesting solutions, such as setting <code>binwidth = NA</code> or <code>overflow = "compress"</code>. • "compress": Compress the layout. Reduces the binwidth to the size necessary to keep the dots within bounds, then adjusts <code>stackratio</code> and <code>dotsize</code> so that the apparent dot size is the user-specified minimum binwidth times the user-specified <code>dotsize</code>. <p>If you find the default layout has dots that are too small, and you are okay with dots overlapping, consider setting <code>overflow = "compress"</code> and supplying an exact or minimum dot size using <code>binwidth</code>.</p>
binwidth	<p>The bin width to use for laying out the dots. One of:</p> <ul style="list-style-type: none"> • NA (the default): Dynamically select the bin width based on the size of the plot when drawn. This will pick a binwidth such that the tallest stack of dots is at most scale in height (ideally exactly scale in height, though this is not guaranteed).

- A length-1 (scalar) numeric or `unit` object giving the exact bin width.
- A length-2 (vector) numeric or `unit` object giving the minimum and maximum desired bin width. The bin width will be dynamically selected within these bounds.

If the value is numeric, it is assumed to be in units of data. The bin width (or its bounds) can also be specified using `unit()`, which may be useful if it is desired that the dots be a certain point size or a certain percentage of the width/height of the viewport. For example, `unit(0.1, "npc")` would make dots that are *exactly* 10% of the viewport size along whichever dimension the dotplot is drawn; `unit(c(0, 0.1), "npc")` would make dots that are *at most* 10% of the viewport size (while still ensuring the tallest stack is less than or equal to scale).

dotsize	The width of the dots relative to the binwidth. The default, 1.07, makes dots be just a bit wider than the bin width, which is a manually-tuned parameter that tends to work well with the default circular shape, preventing gaps between bins from appearing to be too large visually (as might arise from dots being <i>precisely</i> the binwidth). If it is desired to have dots be precisely the binwidth, set <code>dotsize = 1</code> .
stackratio	The distance between the center of the dots in the same stack relative to the dot height. The default, 1, makes dots in the same stack just touch each other.
overlaps	How to handle overlapping dots or bins in the "bin", "weave", and "hex" layouts (dots never overlap in the "swarm" or "bar" layouts). For the purposes of this argument, dots are only considered to be overlapping if they would be overlapping when <code>dotsize = 1</code> and <code>stackratio = 1</code> ; i.e. if you set those arguments to other values, overlaps may still occur. One of: <ul style="list-style-type: none"> • "keep": leave overlapping dots as they are. Dots may overlap (usually only slightly) in the "bin", "weave", and "hex" layouts. • "nudge": nudge overlapping dots out of the way. Overlaps are avoided using a constrained optimization which minimizes the squared distance of dots to their desired positions, subject to the constraint that adjacent dots do not overlap.
smooth	Smoother to apply to dot positions. One of: <ul style="list-style-type: none"> • A function that takes a numeric vector of dot positions and returns a smoothed version of that vector, such as <code>smooth_bounded()</code>, <code>smooth_unbounded()</code>, <code>smooth_discrete()</code>, or <code>smooth_bar()</code>. • A string indicating what smoother to use, as the suffix to a function name starting with <code>smooth_</code>; e.g. "none" (the default) applies <code>smooth_none()</code>, which simply returns the given vector without applying smoothing. <p>Smoothing is most effective when the smoother is matched to the support of the distribution; e.g. using <code>smooth_bounded(bounds = . . .)</code>.</p>
verbose	If TRUE, print out the bin width of the dotplot. Can be useful if you want to start from an automatically-selected bin width and then adjust it manually. Bin width is printed both as data units and as normalized parent coordinates or "npc"s (see <code>unit()</code>). Note that if you just want to scale the selected bin width to fit within a desired area, it is probably easier to use <code>scale</code> than to copy and scale <code>binwidth</code>

	manually, and if you just want to provide constraints on the bin width, you can pass a length-2 vector to <code>binwidth</code> .
<code>orientation</code>	Whether this geom is drawn horizontally or vertically. One of: <ul style="list-style-type: none"> • NA (default): automatically detect the orientation based on how the aesthetics are assigned. Automatic detection works most of the time. • "horizontal" (or "y"): draw horizontally, using the <code>y</code> aesthetic to identify different groups. For each group, uses the <code>x</code>, <code>xmin</code>, <code>xmax</code>, and <code>thickness</code> aesthetics to draw points, intervals, and slabs. • "vertical" (or "x"): draw vertically, using the <code>x</code> aesthetic to identify different groups. For each group, uses the <code>y</code>, <code>ymin</code>, <code>ymax</code>, and <code>thickness</code> aesthetics to draw points, intervals, and slabs. <p>For compatibility with the base <code>ggplot</code> naming scheme for orientation, "x" can be used as an alias for "vertical" and "y" as an alias for "horizontal" (<code>ggdist</code> had an orientation parameter before base <code>ggplot</code> did, hence the discrepancy).</p>
<code>subguide</code>	Sub-guide used to annotate the thickness scale. One of: <ul style="list-style-type: none"> • A function that takes a scale argument giving a <code>ggplot2::Scale</code> object and an orientation argument giving the orientation of the geometry and then returns a <code>grid::grob</code> that will draw the axis annotation, such as <code>subguide_axis()</code> (to draw a traditional axis) or <code>subguide_none()</code> (to draw no annotation). See <code>subguide_axis()</code> for a list of possibilities and examples. • A string giving the name of such a function when prefixed with "subguide"; e.g. "axis" or "none".
<code>na.rm</code>	If FALSE, the default, missing values are removed with a warning. If TRUE, missing values are silently removed.
<code>show.legend</code>	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.
<code>inherit.aes</code>	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> .

Details

The *dots* family of stats and geoms are similar to `geom_dotplot()` but with a number of differences:

- Dots geoms act like slabs in `geom_slabinterval()` and can be given x positions (or y positions when in a horizontal orientation).
- Given the available space to lay out dots, the dots geoms will automatically determine how many bins to use to fit the available space.
- Dots geoms use a dynamic layout algorithm that lays out dots from the center out if the input data are symmetrical, guaranteeing that symmetrical data results in a symmetrical plot. The layout algorithm also prevents dots from overlapping each other.
- The shape of the dots in these geoms can be changed using the `slab_shape` aesthetic (when using the `dotsinterval` family) or the `shape` or `slab_shape` aesthetic (when using the `dots` family)

Stats and geoms in this family include:

- `geom_dots()`: dotplots on raw data. Ensures the dotplot fits within available space by reducing the size of the dots automatically (may result in very small dots).
- `geom_swarm()` and `geom_weave()`: dotplots on raw data with defaults intended to create "beeswarm" plots. Used `side = "both"` by default, and sets the default dot size to the same size as `geom_point()` (`binwidth = unit(1.5, "mm")`), allowing dots to overlap instead of getting very small.
- `stat_dots()`: dotplots on raw data, **distributional** objects, and `posterior::rvar()`s
- `geom_dotsinterval()`: dotplot + interval plots on raw data with already-calculated intervals (rarely useful directly).
- `stat_dotsinterval()`: dotplot + interval plots on raw data, **distributional** objects, and `posterior::rvar()`s (will calculate intervals for you).
- `geom_blur_dots()`: blurry dotplots that allow the standard deviation of a blur applied to each dot to be specified using the `sd` aesthetic.
- `stat_mcse_dots()`: blurry dotplots of quantiles using the Monte Carlo Standard Error of each quantile.

`stat_dots()` and `stat_dotsinterval()`, when used with the `quantiles` argument, are particularly useful for constructing quantile dotplots, which can be an effective way to communicate uncertainty using a frequency framing that may be easier for laypeople to understand (Kay et al. 2016, Fernandes et al. 2018).

Value

A `ggplot2::Geom` representing a dot-weave geometry which can be added to a `ggplot()` object.

Aesthetics

The dots+interval stats and geoms have a wide variety of aesthetics that control the appearance of their three sub-geometries: the **dots** (aka the **slab**), the **point**, and the **interval**.

Positional aesthetics

- `x`: x position of the geometry
- `y`: y position of the geometry

Dots-specific (aka Slab-specific) aesthetics

- `family`: The font family used to draw the dots.
- `order`: The order in which data points are stacked within bins. Can be used to create the effect of "stacked" dots by ordering dots according to a discrete variable. If omitted (NULL), the value of the data points themselves are used to determine stacking order. Only applies when layout is "bin" or "hex", as the other layout methods fully determine both *x* and *y* positions.
- `side`: Which side to place the slab on. "topright", "top", and "right" are synonyms which cause the slab to be drawn on the top or the right depending on if orientation is "horizontal" or "vertical". "bottomleft", "bottom", and "left" are synonyms which cause the slab to be drawn on the bottom or the left depending on if orientation

is "horizontal" or "vertical". "topleft" causes the slab to be drawn on the top or the left, and "bottomright" causes the slab to be drawn on the bottom or the right. "both" draws the slab mirrored on both sides (as in a violin plot).

- **scale**: What proportion of the region allocated to this geom to use to draw the slab. If `scale = 1`, slabs that use the maximum range will just touch each other. Default is `0.9` to leave some space between adjacent slabs. For a comprehensive discussion and examples of slab scaling and normalization, see the [thickness scale article](#).
- **justification**: Justification of the interval relative to the slab, where `0` indicates bottom/left justification and `1` indicates top/right justification (depending on orientation). If `justification` is `NULL` (the default), then it is set automatically based on the value of `side`: when `side` is "top"/"right" justification is set to `0`, when `side` is "bottom"/"left" justification is set to `1`, and when `side` is "both" justification is set to `0.5`.
- **datatype**: When using composite geoms directly without a stat (e.g. `geom_slabinterval()`), `datatype` is used to indicate which part of the geom a row in the data targets: rows with `datatype = "slab"` target the slab portion of the geometry and rows with `datatype = "interval"` target the interval portion of the geometry. This is set automatically when using `ggdist` stats.

Interval-specific aesthetics

- **xmin**: Left end of the interval sub-geometry (if `orientation = "horizontal"`).
- **xmax**: Right end of the interval sub-geometry (if `orientation = "horizontal"`).
- **ymin**: Lower end of the interval sub-geometry (if `orientation = "vertical"`).
- **ymax**: Upper end of the interval sub-geometry (if `orientation = "vertical"`).

Point-specific aesthetics

- **shape**: Shape type used to draw the **point** sub-geometry.

Color aesthetics

- **colour**: (or `color`) The color of the **interval** and **point** sub-geometries. Use the `slab_color`, `interval_color`, or `point_color` aesthetics (below) to set sub-geometry colors separately.
- **fill**: The fill color of the **slab** and **point** sub-geometries. Use the `slab_fill` or `point_fill` aesthetics (below) to set sub-geometry colors separately.
- **alpha**: The opacity of the **slab**, **interval**, and **point** sub-geometries. Use the `slab_alpha`, `interval_alpha`, or `point_alpha` aesthetics (below) to set sub-geometry colors separately.
- **colour_ramp**: (or `color_ramp`) A secondary scale that modifies the color scale to "ramp" to another color. See `scale_colour_ramp()` for examples.
- **fill_ramp**: A secondary scale that modifies the fill scale to "ramp" to another color. See `scale_fill_ramp()` for examples.

Line aesthetics

- **linewidth**: Width of the line used to draw the **interval** (except with `geom_slab()`: then it is the width of the **slab**). With composite geometries including an interval and slab, use `slab_linewidth` to set the line width of the **slab** (see below). For **interval**, raw `linewidth` values are transformed according to the `interval_size_domain` and `interval_size_range` parameters of the geom (see above).

- **size**: Determines the size of the **point**. If **linewidth** is not provided, **size** will also determine the width of the line used to draw the **interval** (this allows line width and point size to be modified together by setting only **size** and not **linewidth**). Raw size values are transformed according to the **interval_size_domain**, **interval_size_range**, and **fatten_point** parameters of the geom (see above). Use the **point_size** aesthetic (below) to set sub-geometry size directly without applying the effects of **interval_size_domain**, **interval_size_range**, and **fatten_point**.
- **stroke**: Width of the outline around the **point** sub-geometry.
- **linetype**: Type of line (e.g., "solid", "dashed", etc) used to draw the **interval** and the outline of the **slab** (if it is visible). Use the **slab_linetype** or **interval_linetype** aesthetics (below) to set sub-geometry line types separately.

Slab-specific color and line override aesthetics

- **slab_fill**: Override for **fill**: the fill color of the slab.
- **slab_colour**: (or **slab_color**) Override for **colour/color**: the outline color of the slab.
- **slab_alpha**: Override for **alpha**: the opacity of the slab.
- **slab_linewidth**: Override for **linewidth**: the width of the outline of the slab.
- **slab_linetype**: Override for **linetype**: the line type of the outline of the slab.
- **slab_shape**: Override for **shape**: the shape of the dots used to draw the dotplot slab.

Interval-specific color and line override aesthetics

- **interval_colour**: (or **interval_color**) Override for **colour/color**: the color of the interval.
- **interval_alpha**: Override for **alpha**: the opacity of the interval.
- **interval_linetype**: Override for **linetype**: the line type of the interval.

Point-specific color and line override aesthetics

- **point_fill**: Override for **fill**: the fill color of the point.
- **point_colour**: (or **point_color**) Override for **colour/color**: the outline color of the point.
- **point_alpha**: Override for **alpha**: the opacity of the point.
- **point_size**: Override for **size**: the size of the point.

Deprecated aesthetics

- **slab_size**: Use **slab_linewidth**.
- **interval_size**: Use **interval_linewidth**.

Other aesthetics (these work as in standard geoms)

- **width**
- **height**
- **group**

See examples of some of these aesthetics in action in `vignette("dotsinterval")`. Learn more about the sub-geom override aesthetics (like **interval_color**) in the [scales](#) documentation. Learn more about basic ggplot aesthetics in `vignette("ggplot2-specs")`.

References

Kay, M., Kola, T., Hullman, J. R., & Munson, S. A. (2016). When (ish) is My Bus? User-centered Visualizations of Uncertainty in Everyday, Mobile Predictive Systems. *Conference on Human Factors in Computing Systems - CHI '16*, 5092–5103. doi:10.1145/2858036.2858558.

Fernandes, M., Walls, L., Munson, S., Hullman, J., & Kay, M. (2018). Uncertainty Displays Using Quantile Dotplots or CDFs Improve Transit Decision-Making. *Conference on Human Factors in Computing Systems - CHI '18*. doi:10.1145/3173574.3173718.

See Also

See `geom_dotsinterval()` for the geometry this shortcut is based on.

See `vignette("dotsinterval")` for a variety of examples of use.

Other dotsinterval geoms: `geom_blur_dots()`, `geom_dots()`, `geom_dotsinterval()`, `geom_swarm()`

Examples

```
library(dplyr)
library(ggplot2)

theme_set(theme_ggdist())

set.seed(12345)
df = tibble(
  g = rep(c("a", "b"), 200),
  value = rnorm(400, c(0, 3), c(0.75, 1))
)

# orientation is detected automatically based on
# which axis is discrete

df %>%
  ggplot(aes(x = value, y = g)) +
  geom_weave()

df %>%
  ggplot(aes(y = value, x = g)) +
  geom_weave()
```

Description

Deprecated functions and arguments and their alternatives are listed below.

Deprecated stats and geoms

The `stat_sample_...` and `stat_dist_...` families of stats were merged in ggdist 3.1. This means:

- `stat_dist_...` is deprecated. For any code using `stat_dist_XXX()`, you should now be able to use `stat_XXX()` instead without additional modifications in almost all cases.
- `stat_sample_slabinterval()` is deprecated. You should be able to use `stat_slabinterval()` instead without additional modifications in almost all cases.

The old `stat_dist_...` names are currently kept as aliases, but may be removed in the future.

Deprecated arguments

Parameters for `stat_slabinterval()` and family deprecated as of ggdist 3.1 are:

- The `.prob` argument, which is a long-deprecated alias for `.width`, was removed in ggdist 3.1.
- The `limits_function` argument: this was a parameter for determining the function to compute limits of the slab in `stat_slabinterval()` and its derived stats. This function is really an internal function only needed by subclasses of the base class, yet added a lot of noise to the documentation, so it was replaced with `AbstractStatSlabInterval$compute_limits()`.
- The `limits_args` argument: extra stat parameters are now passed through to the `...` arguments to `AbstractStatSlabInterval$compute_limits()`; use these instead.
- The `slab_function` argument: this was a parameter for determining the function to compute slabs in `stat_slabinterval()` and its derived stats. This function is really an internal function only needed by subclasses of the base class, yet added a lot of noise to the documentation, so it was replaced with `AbstractStatSlabInterval$compute_slab()`.
- The `slab_args` argument: extra stat parameters are now passed through to the `...` arguments to `AbstractStatSlabInterval$compute_slab()`; use these instead.
- The `interval_function` and `fun.data` arguments: these were parameters for determining the function to compute intervals in `stat_slabinterval()` and its derived stats. This function is really an internal function only needed by subclasses of the base class, yet added a lot of noise to the documentation, so it was replaced with `AbstractStatSlabInterval$compute_interval()`.
- The `interval_args` and `fun.args` arguments: to pass extra arguments to a `point_interval` replace the value of the `point_interval` argument with a simple wrapper; e.g. `stat_halfeye(point_interval = \()`

Parameters for `geom_slabinterval()` and family deprecated as of ggdist 3.1 are:

- The `size_domain` and `size_range` arguments, which are long-deprecated aliases for `interval_size_domain` and `interval_size_range`, were removed in ggdist 3.1.

Author(s)

Matthew Kay

guide_rampbar	<i>Continuous guide for colour ramp scales (ggplot2 guide)</i>
---------------	--

Description

A colour ramp bar guide that shows continuous colour ramp scales mapped onto values as a smooth gradient. Designed for use with `scale_fill_ramp_continuous()` and `scale_colour_ramp_continuous()`. Based on `guide_colourbar()`.

Usage

```
guide_rampbar(
  ...,
  to = "gray65",
  available_aes = c("fill_ramp", "colour_ramp")
)
```

Arguments

... Arguments passed on to `ggplot2::guide_colourbar`

title A character string or expression indicating a title of guide. If NULL, the title is not shown. By default (`waiver()`), the name of the scale object or the name specified in `labs()` is used for the title.

theme A `theme` object to style the guide individually or differently from the plot's theme settings. The theme argument in the guide overrides, and is combined with, the plot's theme.

nbin A numeric specifying the number of bins for drawing the colourbar. A smoother colourbar results from a larger value.

display A string indicating a method to display the colourbar. Can be one of the following:

- "raster" to display as a bitmap image.
- "rectangles" to display as a series of rectangles.
- "gradient" to display as a linear gradient.

Note that not all devices are able to render rasters and gradients.

raster **[Deprecated]** A logical. If TRUE then the colourbar is rendered as a raster object. If FALSE then the colourbar is rendered as a set of rectangles. Note that not all graphics devices are capable of rendering raster image.

alpha A numeric between 0 and 1 setting the colour transparency of the bar. Use NA to preserve the alpha encoded in the colour itself (default).

draw.ulim A logical specifying if the upper limit tick marks should be visible.

draw.llim A logical specifying if the lower limit tick marks should be visible.

position A character string indicating where the legend should be placed relative to the plot panels.

direction A character string indicating the direction of the guide. One of "horizontal" or "vertical."

	reverse	logical. If TRUE the colourbar is reversed. By default, the highest value is on the top and the lowest value is on the bottom
	order	positive integer less than 99 that specifies the order of this guide among multiple guides. This controls the order in which multiple guides are displayed, not the contents of the guide itself. If 0 (default), the order is determined by a secret algorithm.
to		The color to ramp to in the guide. Corresponds to 1 on the scale.
available_aes		A vector of character strings listing the aesthetics for which a <code>guide_rampbar()</code> can be drawn.

Details

This guide creates smooth gradient color bars for use with `scale_fill_ramp_continuous()` and `scale_colour_ramp_continuous()`. The color to ramp from is determined by the `from` argument of the `scale_*` function, and the color to ramp to is determined by the `to` argument to `guide_rampbar()`.

Guides can be specified in each `scale_*` function or in `guides()`. `guide = "rampbar"` in `scale_*` is syntactic sugar for `guide = guide_rampbar()`; e.g. `scale_colour_ramp_continuous(guide = "rampbar")`. For how to specify the guide for each scale in more detail, see `guides()`.

Value

A guide object.

Author(s)

Matthew Kay

See Also

Other colour ramp functions: `partial_colour_ramp()`, `ramp_colours()`, `scale_colour_ramp`

Examples

```
library(dplyr)
library(ggplot2)
library(distributional)

# The default guide for ramp scales is guide_legend(), which creates a
# discrete style scale:
tibble(d = dist_uniform(0, 1)) %>%
  ggplot(aes(y = 0, xdist = d)) +
  stat_slab(aes(fill_ramp = after_stat(x)), fill = "blue") +
  scale_fill_ramp_continuous(from = "red")

# We can use guide_rampbar() to instead create a continuous guide, but
# it does not know what color to ramp to (defaults to "gray65"):
tibble(d = dist_uniform(0, 1)) %>%
  ggplot(aes(y = 0, xdist = d)) +
```

```

stat_slab(aes(fill_ramp = after_stat(x)), fill = "blue") +
scale_fill_ramp_continuous(from = "red", guide = guide_rampbar())

# We can tell the guide what color to ramp to using the `to` argument:
tibble(d = dist_uniform(0, 1)) %>%
  ggplot(aes(y = 0, xdist = d)) +
  stat_slab(aes(fill_ramp = after_stat(x)), fill = "blue") +
  scale_fill_ramp_continuous(from = "red", guide = guide_rampbar(to = "blue"))

```

lkjcorr_marginal	<i>Marginal distribution of a single correlation from an LKJ distribution</i>
------------------	---

Description

Marginal distribution for the correlation in a single cell from a correlation matrix distributed according to an LKJ distribution.

Usage

```

dlkjcorr_marginal(x, K, eta, log = FALSE)

plkjcorr_marginal(q, K, eta, lower.tail = TRUE, log.p = FALSE)

qlkjcorr_marginal(p, K, eta, lower.tail = TRUE, log.p = FALSE)

rlkjcorr_marginal(n, K, eta)

```

Arguments

x, q	vector of quantiles.
K	Dimension of the correlation matrix. Must be greater than or equal to 2.
eta	Parameter controlling the shape of the distribution
log, log.p	logical; if TRUE, probabilities p are given as log(p).
lower.tail	logical; if TRUE (default), probabilities are $P[X \leq x]$ otherwise, $P[X > x]$.
p	vector of probabilities.
n	number of observations. If $\text{length}(n) > 1$, the length is taken to be the number required.

Details

The LKJ distribution is a distribution over correlation matrices with a single parameter, η . For a given η and a $K \times K$ correlation matrix R :

$$R \sim \text{LKJ}(\eta)$$

Each off-diagonal entry of R , $r_{ij} : i \neq j$, has the following marginal distribution (Lewandowski, Kurowicka, and Joe 2009):

$$\frac{r_{ij} + 1}{2} \sim \text{Beta} \left(\eta - 1 + \frac{K}{2}, \eta - 1 + \frac{K}{2} \right)$$

In other words, r_{ij} is marginally distributed according to the above Beta distribution scaled into $(-1, 1)$.

Value

- `dlkcorr_marginal` gives the density
- `plkcorr_marginal` gives the cumulative distribution function (CDF)
- `qlkcorr_marginal` gives the quantile function (inverse CDF)
- `rlkcorr_marginal` generates random draws.

The length of the result is determined by `n` for `rlkcorr_marginal`, and is the maximum of the lengths of the numerical arguments for the other functions.

The numerical arguments other than `n` are recycled to the length of the result. Only the first elements of the logical arguments are used.

References

Lewandowski, D., Kurowicka, D., & Joe, H. (2009). Generating random correlation matrices based on vines and extended onion method. *Journal of Multivariate Analysis*, 100(9), 1989–2001. doi:10.1016/j.jmva.2009.04.008.

See Also

`parse_dist()` and `marginalize_lkjcorr()` for parsing specs that use the LKJ correlation distribution and the `stat_slabinterval()` family of stats for visualizing them.

Examples

```
library(dplyr)
library(ggplot2)

theme_set(theme_ggdist())

expand.grid(
  eta = 1:6,
  K = 2:6
) %>%
  ggplot(aes(y = ordered(eta), dist = "lkjcorr_marginal", arg1 = K, arg2 = eta)) +
  stat_slab() +
  facet_grid(~ paste0(K, "x", K)) +
  scale_y_discrete(limits = rev) +
  labs(
    title = paste0(
```

```

    "Marginal correlation for LKJ(eta) prior on different matrix sizes:\n",
    "dlkjcorr_marginal(K, eta)"
  ),
  subtitle = "Correlation matrix size (KxK)",
  y = "eta",
  x = "Marginal correlation"
) +
theme(axis.title = element_text(hjust = 0))

```

marginalize_lkjcorr *Turn spec for LKJ distribution into spec for marginal LKJ distribution*

Description

Turns specs for an LKJ correlation matrix distribution as returned by `parse_dist()` into specs for the marginal distribution of a single cell in an LKJ-distributed correlation matrix (i.e., `lkjcorr_marginal()`). Useful for visualizing prior correlations from LKJ distributions.

Usage

```

marginalize_lkjcorr(
  data,
  K,
  predicate = NULL,
  dist = ".dist",
  args = ".args",
  dist_obj = ".dist_obj"
)

```

Arguments

data	A data frame containing a column with distribution names (" <code>.dist</code> " by default) and a list column of distribution arguments (" <code>.args</code> " by default), such as output by <code>parse_dist()</code> .
K	Dimension of the correlation matrix. Must be greater than or equal to 2.
predicate	a bare expression for selecting the rows of data to modify. This is useful if data contains more than one row with an LKJ prior in it and you only want to modify some of the distributions; if this is the case, give row a predicate expression that evaluates to TRUE on the rows you want to modify. If NULL (the default), all <code>lkjcorr</code> distributions in data are modified.
dist	The name of the column containing distribution names. See <code>parse_dist()</code> .
args	The name of the column containing distribution arguments. See <code>parse_dist()</code> .
dist_obj	The name of the column to contain a distributional object representing the distribution. See <code>parse_dist()</code> .

Details

The LKJ(η) prior on a correlation matrix induces a marginal prior on each correlation in the matrix that depends on both the value of η and K , the dimension of the $K \times K$ correlation matrix. Thus to visualize the marginal prior on the correlations, it is necessary to specify the value of K , which depends on what your model specification looks like.

Given a data frame representing parsed distribution specifications (such as returned by `parse_dist()`), this function updates any rows with `.dist == "lkjcorr"` so that the first argument to the distribution (stored in `.args`) is equal to the specified dimension of the correlation matrix (K), changes the distribution name in `.dist` to `"lkjcorr_marginal"`, and assigns a **distributional** object representing this distribution to `.dist_obj`. This allows the distribution to be easily visualized using the `stat_slabinterval()` family of `ggplot2` stats.

Value

A data frame of the same size and column names as the input, with the `dist`, and `args`, and `dist_obj` columns modified on rows where `dist == "lkjcorr"` such that they represent a marginal LKJ correlation distribution with name `lkjcorr_marginal` and `args` having K equal to the input value of K .

See Also

[parse_dist\(\)](#), [lkjcorr_marginal\(\)](#)

Examples

```
library(dplyr)
library(ggplot2)

# Say we have an LKJ(3) prior on a 2x2 correlation matrix. We can visualize
# its marginal distribution as follows...
data.frame(prior = "lkjcorr(3)") %>%
  parse_dist(prior) %>%
  marginalize_lkcorr(K = 2) %>%
  ggplot(aes(y = prior, xdist = .dist_obj)) +
  stat_halfeye() +
  xlim(-1, 1) +
  xlab("Marginal correlation for LKJ(3) prior on 2x2 correlation matrix")

# Say our prior list has multiple LKJ priors on correlation matrices
# of different sizes, we can supply a predicate expression to select
# only those rows we want to modify
data.frame(coef = c("a", "b"), prior = "lkjcorr(3)") %>%
  parse_dist(prior) %>%
  marginalize_lkcorr(K = 2, coef == "a") %>%
  marginalize_lkcorr(K = 4, coef == "b")
```

`parse_dist`*Parse distribution specifications into columns of a data frame*

Description

Parses simple string distribution specifications, like "normal(0, 1)", into two columns of a data frame, suitable for use with the `dist` and `args` aesthetics of `stat_slabinterval()` and its shortcut `stats` (like `stat_halfeye()`). This format is output by `brms::get_prior`, making it particularly useful for visualizing priors from brms models.

Usage

```
parse_dist(  
  object,  
  ...,  
  dist = ".dist",  
  args = ".args",  
  dist_obj = ".dist_obj",  
  package = NULL,  
  to_r_names = TRUE  
)  
  
## Default S3 method:  
parse_dist(object, ...)  
  
## S3 method for class 'data.frame'  
parse_dist(  
  object,  
  dist_col,  
  ...,  
  dist = ".dist",  
  args = ".args",  
  dist_obj = ".dist_obj",  
  package = NULL,  
  lb = "lb",  
  ub = "ub",  
  to_r_names = TRUE  
)  
  
## S3 method for class 'character'  
parse_dist(  
  object,  
  ...,  
  dist = ".dist",  
  args = ".args",  
  dist_obj = ".dist_obj",  
  package = NULL,
```

```

    to_r_names = TRUE
  )

## S3 method for class 'factor'
parse_dist(
  object,
  ...,
  dist = ".dist",
  args = ".args",
  dist_obj = ".dist_obj",
  package = NULL,
  to_r_names = TRUE
)

## S3 method for class 'brmsprior'
parse_dist(
  object,
  dist_col = prior,
  ...,
  dist = ".dist",
  args = ".args",
  dist_obj = ".dist_obj",
  package = NULL,
  to_r_names = TRUE
)

r_dist_name(dist_name)

```

Arguments

object	A character vector containing distribution specifications or a data frame with a column containing distribution specifications.
...	Arguments passed to other implementations of <code>parse_dist</code> .
dist	The name of the output column to contain the distribution name
args	The name of the output column to contain the arguments to the distribution
dist_obj	The name of the output column to contain a distributional object representing the distribution
package	The package or environment to search for distribution functions in. Passed to <code>distributional::dist_wrap()</code> . One of: <ul style="list-style-type: none"> • <code>NULL</code>: use the calling environment • a string: use the environment for the package with the given name • an environment: use the given environment
to_r_names	If <code>TRUE</code> (the default), certain common aliases for distribution names are automatically translated into names that R can recognize (i.e., names which have functions starting with <code>r</code> , <code>p</code> , <code>q</code> , and <code>d</code> representing random number generators,

	distribution functions, etc. for that distribution), using the <code>r_dist_name</code> function. For example, "normal" is translated into "norm" and "lognormal" is translated into "lnorm".
<code>dist_col</code>	A bare (unquoted) column or column expression that resolves to a character vector of distribution specifications.
<code>lb</code>	The name of an input column (for <code>data.frame</code> and <code>brms::prior</code> objects) that contains the lower bound of the distribution, which if present will produce a truncated distribution using <code>dist_truncated()</code> . Ignored if <code>lb</code> is <code>NULL</code> or if <code>object[[lb]]</code> is <code>NA</code> for the corresponding input row.
<code>ub</code>	The name of an input column (for <code>data.frame</code> and <code>brms::prior</code> objects) that contains the upper bound of the distribution, which if present will produce a truncated distribution using <code>dist_truncated()</code> . Ignored if <code>ub</code> is <code>NULL</code> or if <code>object[[ub]]</code> is <code>NA</code> for the corresponding input row.
<code>dist_name</code>	For <code>r_dist_name</code> , a character vector of distribution names to be translated into distribution names R recognizes. Unrecognized names are left as-is.

Details

`parse_dist()` can be applied to character vectors or to a data frame + bare column name of the column to parse, and returns a data frame with `".dist"` and `".args"` columns added. `parse_dist()` uses `r_dist_name()` to translate distribution names into names recognized by R.

`r_dist_name()` takes a character vector of names and translates common names into R distribution names. Names are first made into valid R names using `make.names()`, then translated (ignoring character case, `"."`, and `"_"`). Thus, "lognormal", "LogNormal", "log_normal", "log-Normal", and any number of other variants all get translated into "lnorm".

Value

- `parse_dist` returns a data frame containing at least two columns named after the `dist` and `args` parameters. If the input is a data frame, the output is a data frame of the same length with those two columns added. If the input is a character vector or factor, the output is a two-column data frame with the same number of rows as the length of the input.
- `r_dist_name` returns a character vector the same length as the input containing translations of the input names into distribution names R can recognize.

See Also

See `stat_slabinterval()` and its shortcut `stats`, which can easily make use of the output of this function using the `dist` and `args` aesthetics.

Examples

```
library(dplyr)

# parse dist can operate on strings directly...
parse_dist(c("normal(0,1)", "student_t(3,0,1)"))
```

```
# ... or on columns of a data frame, where it adds the
# parsed specs back on as columns
data.frame(prior = c("normal(0,1)", "student_t(3,0,1)")) %>%
  parse_dist(prior)

# parse_dist is particularly useful with the output of brms::prior(),
# which follows the same format as above
```

partial_colour_ramp *Partial colour ramp (datatype)*

Description

A representation of a partial ramp between two colours: the origin colour (from) and the distance from the origin colour to the target colour (amount, a value between 0 and 1). The target colour of the ramp can be filled in later using `ramp_colours()`, producing a colour.

Usage

```
partial_colour_ramp(amount = double(), from = "white")
```

Arguments

amount	Numeric vector between 0 and 1 giving amounts to ramp the colour. 0 corresponds to the colour from.
from	Character vector giving colours to ramp from.

Details

This datatype is used by `scale_colour_ramp` to create ramped colours in **ggdist** geoms. It is a `vctrs::rcrd` datatype with two fields: "amount", the amount to ramp, and "from", the colour to ramp from.

Colour ramps can be applied (i.e. translated into colours) using `ramp_colours()`, which can be used with `partial_colour_ramp()` to implement geoms that make use of `colour_ramp` or `fill_ramp` scales.

Value

A `vctrs::rcrd` of class "ggdist_partial_colour_ramp" with fields "amount" and "from".

Author(s)

Matthew Kay

See Also

Other colour ramp functions: `guide_rampbar()`, `ramp_colours()`, `scale_colour_ramp`

Examples

```
pcr = partial_colour_ramp(c(0, 0.25, 0.75, 1), "red")
pcr

ramp_colours("blue", pcr)
```

point_interval	<i>Point and interval summaries for tidy data frames of draws from distributions</i>
----------------	--

Description

Translates draws from distributions in a (possibly grouped) data frame into point and interval summaries (or set of point and interval summaries, if there are multiple groups in a grouped data frame).

Usage

```
point_interval(
  .data,
  ...,
  .width = 0.95,
  .point = median,
  .interval = qi,
  .simple_names = TRUE,
  na.rm = FALSE,
  .exclude = c(".chain", ".iteration", ".draw", ".row"),
  .prob
)

## Default S3 method:
point_interval(
  .data,
  ...,
  .width = 0.95,
  .point = median,
  .interval = qi,
  .simple_names = TRUE,
  na.rm = FALSE,
  .exclude = c(".chain", ".iteration", ".draw", ".row"),
  .prob
)

## S3 method for class 'numeric'
point_interval(
  .data,
  ...,
  .width = 0.95,
```

```

    .point = median,
    .interval = qi,
    .simple_names = FALSE,
    na.rm = FALSE,
    .exclude = c(".chain", ".iteration", ".draw", ".row"),
    .prob
  )

## S3 method for class 'rvar'
point_interval(
  .data,
  ...,
  .width = 0.95,
  .point = median,
  .interval = qi,
  .simple_names = TRUE,
  na.rm = FALSE
)

## S3 method for class 'distribution'
point_interval(
  .data,
  ...,
  .width = 0.95,
  .point = median,
  .interval = qi,
  .simple_names = TRUE,
  na.rm = FALSE
)

qi(x, .width = 0.95, .prob, na.rm = FALSE)

ll(x, .width = 0.95, na.rm = FALSE)

ul(x, .width = 0.95, na.rm = FALSE)

hdi(
  x,
  .width = 0.95,
  na.rm = FALSE,
  ...,
  density = density_bounded(trim = TRUE),
  n = 4096,
  .prob
)

Mode(x, na.rm = FALSE, ...)

```

```
## Default S3 method:
Mode(
  x,
  na.rm = FALSE,
  ...,
  density = density_bounded(trim = TRUE),
  n = 2001,
  weights = NULL
)

## S3 method for class 'rvar'
Mode(x, na.rm = FALSE, ...)

## S3 method for class 'distribution'
Mode(x, na.rm = FALSE, ...)

hdci(x, .width = 0.95, na.rm = FALSE)

mean_qi(.data, ..., .width = 0.95)
median_qi(.data, ..., .width = 0.95)
mode_qi(.data, ..., .width = 0.95)
mean_ll(.data, ..., .width = 0.95)
median_ll(.data, ..., .width = 0.95)
mode_ll(.data, ..., .width = 0.95)
mean_ul(.data, ..., .width = 0.95)
median_ul(.data, ..., .width = 0.95)
mode_ul(.data, ..., .width = 0.95)
mean_hdi(.data, ..., .width = 0.95)
median_hdi(.data, ..., .width = 0.95)
mode_hdi(.data, ..., .width = 0.95)
mean_hdci(.data, ..., .width = 0.95)
median_hdci(.data, ..., .width = 0.95)
mode_hdci(.data, ..., .width = 0.95)
```

Arguments

<code>.data</code>	Data frame (or grouped data frame as returned by <code>dplyr::group_by()</code>) that contains draws to summarize.
<code>...</code>	Bare column names or expressions that, when evaluated in the context of <code>.data</code> , represent draws to summarize. If this is empty, then by default all columns that are not group columns and which are not in <code>.exclude</code> (by default <code>".chain"</code> , <code>".iteration"</code> , <code>".draw"</code> , and <code>".row"</code>) will be summarized. These columns can be numeric, distributional objects, <code>posterior::rvars</code> , or list columns of numeric values to summarise.
<code>.width</code>	vector of probabilities to use that determine the widths of the resulting intervals. If multiple probabilities are provided, multiple rows per group are generated, each with a different probability interval (and value of the corresponding <code>.width</code> column).
<code>.point</code>	Point summary function, which takes a vector and returns a single value, e.g. <code>mean()</code> , <code>median()</code> , or <code>Mode()</code> .
<code>.interval</code>	Interval function, which takes a vector and a probability (<code>.width</code>) and returns a two-element vector representing the lower and upper bound of an interval; e.g. <code>qi()</code> , <code>hdi()</code>
<code>.simple_names</code>	When TRUE and only a single column / vector is to be summarized, use the name <code>.lower</code> for the lower end of the interval and <code>.upper</code> for the upper end. If <code>.data</code> is a vector and this is TRUE, this will also set the column name of the point summary to <code>.value</code> . When FALSE and <code>.data</code> is a data frame, names the lower and upper intervals for each column <code>x</code> <code>x.lower</code> and <code>x.upper</code> . When FALSE and <code>.data</code> is a vector, uses the naming scheme <code>y</code> , <code>ymin</code> and <code>ymax</code> (for use with <code>ggplot</code>).
<code>na.rm</code>	logical value indicating whether NA values should be stripped before the computation proceeds. If FALSE (the default), any vectors to be summarized that contain NA will result in point and interval summaries equal to NA.
<code>.exclude</code>	A character vector of names of columns to be excluded from summarization if no column names are specified to be summarized. Default ignores several meta-data column names used in ggdist and tidybayes .
<code>.prob</code>	Deprecated. Use <code>.width</code> instead.
<code>x</code>	vector to summarize (for interval functions: <code>qi</code> and <code>hdi</code>)
<code>density</code>	For <code>hdi()</code> and <code>Mode()</code> , the kernel density estimator to use, either as a function (e.g. <code>density_bounded</code> , <code>density_unbounded</code>) or as a string giving the suffix to a function that starts with <code>density_</code> (e.g. <code>"bounded"</code> or <code>"unbounded"</code>). The default, <code>"bounded"</code> , uses the bounded density estimator of <code>density_bounded()</code> , which itself estimates the bounds of the distribution, and tends to work well on both bounded and unbounded data.
<code>n</code>	For <code>hdi()</code> and <code>Mode()</code> , the number of points to use to estimate highest-density intervals or modes.
<code>weights</code>	For <code>Mode()</code> , an optional vector, which (if not NULL) is of the same length as <code>x</code> and provides weights for each element of <code>x</code> .

Details

If `.data` is a data frame, then `...` is a list of bare names of columns (or expressions derived from columns) of `.data`, on which the point and interval summaries are derived. Column expressions are processed using the tidy evaluation framework (see [rlang::eval_tidy\(\)](#)).

For a column named `x`, the resulting data frame will have a column named `x` containing its point summary. If there is a single column to be summarized and `.simple_names` is `TRUE`, the output will also contain columns `.lower` (the lower end of the interval), `.upper` (the upper end of the interval). Otherwise, for every summarized column `x`, the output will contain `x.lower` (the lower end of the interval) and `x.upper` (the upper end of the interval). Finally, the output will have a `.width` column containing the probability for the interval on each output row.

If `.data` includes groups (see e.g. [dplyr::group_by\(\)](#)), the points and intervals are calculated within the groups.

If `.data` is a vector, `...` is ignored and the result is a data frame with one row per value of `.width` and three columns: `y` (the point summary), `ymin` (the lower end of the interval), `ymax` (the upper end of the interval), and `.width`, the probability corresponding to the interval. This behavior allows `point_interval` and its derived functions (like `median_qi`, `mean_qi`, `mode_hdi`, etc) to be easily used to plot intervals in `ggplot` stats using methods like [stat_eye\(\)](#), [stat_halfeye\(\)](#), or [stat_summary\(\)](#).

`median_qi`, `mode_hdi`, etc are short forms for `point_interval(..., .point = median, .interval = qi)`, etc.

`qi` yields the quantile interval (also known as the percentile interval or equi-tailed interval) as a 1x2 matrix.

`hdi` yields the highest-density interval(s) (also known as the highest posterior density interval). **Note:** If the distribution is multimodal, `hdi` may return multiple intervals for each probability level (these will be spread over rows). You may wish to use `hdci` (below) instead if you want a single highest-density interval, with the caveat that when the distribution is multimodal `hdci` is not a highest-density interval.

`hdci` yields the highest-density *continuous* interval, also known as the shortest probability interval. **Note:** If the distribution is multimodal, this may not actually be the highest-density interval (there may be a higher-density discontinuous interval, which can be found using `hdi`).

`l1` and `u1` yield lower limits and upper limits, respectively (where the opposite limit is set to either `Inf` or `-Inf`).

Value

A data frame containing point summaries and intervals, with at least one column corresponding to the point summary, one to the lower end of the interval, one to the upper end of the interval, the width of the interval (`.width`), the type of point summary (`.point`), and the type of interval (`.interval`).

Author(s)

Matthew Kay

Examples

```

library(dplyr)
library(ggplot2)

set.seed(123)

rnorm(1000) %>%
  median_qi()

data.frame(x = rnorm(1000)) %>%
  median_qi(x, .width = c(.50, .80, .95))

data.frame(
  x = rnorm(1000),
  y = rnorm(1000, mean = 2, sd = 2)
) %>%
  median_qi(x, y)

data.frame(
  x = rnorm(1000),
  group = "a"
) %>%
  rbind(data.frame(
    x = rnorm(1000, mean = 2, sd = 2),
    group = "b"
  )) %>%
  group_by(group) %>%
  median_qi(.width = c(.50, .80, .95))

multimodal_draws = data.frame(
  x = c(rnorm(5000, 0, 1), rnorm(2500, 4, 1))
)

multimodal_draws %>%
  mode_hdi(.width = c(.66, .95))

multimodal_draws %>%
  ggplot(aes(x = x, y = 0)) +
  stat_halfeye(point_interval = mode_hdi, .width = c(.66, .95))

```

position_dodgejust *Dodge overlapping objects side-to-side, preserving justification*

Description

A justification-preserving variant of `ggplot2::position_dodge()` which preserves the vertical position of a geom while adjusting the horizontal position (or vice versa when in a horizontal orientation). Unlike `ggplot2::position_dodge()`, `position_dodgejust()` attempts to preserve the

"justification" of x positions relative to the bounds containing them (xmin/xmax) (or y positions relative to ymin/ymax when in a horizontal orientation). This makes it useful for dodging annotations to geoms and stats from the `geom_slabinterval()` family, which also preserve the justification of their intervals relative to their slabs when dodging.

Usage

```
position_dodgejust(
  width = NULL,
  preserve = c("total", "single"),
  justification = NULL
)
```

Arguments

<code>width</code>	Dodging width, when different to the width of the individual elements. This is useful when you want to align narrow geoms with wider geoms. See the examples.
<code>preserve</code>	Should dodging preserve the "total" width of all elements at a position, or the width of a "single" element?
<code>justification</code>	Justification of the point position (x/y) relative to its bounds (xmin/xmax or ymin/ymax), where 0 indicates bottom/left justification and 1 indicates top/right justification (depending on orientation). This is only used if xmin/xmax/ymin/ymax are not supplied; in that case, justification will be used along with width to determine the bounds of the object prior to dodging.

Examples

```
library(dplyr)
library(ggplot2)
library(distributional)

dist_df = tribble(
  ~group, ~subgroup, ~mean, ~sd,
  1,      "h",      5,  1,
  2,      "h",      7,  1.5,
  3,      "h",      8,  1,
  3,      "i",      9,  1,
  3,      "j",      7,  1
)

# An example with normal "dodge" positioning
# Notice how dodge points are placed in the center of their bounding boxes,
# which can cause slabs to be positioned outside their bounds.
dist_df %>%
  ggplot(aes(
    x = factor(group), ydist = dist_normal(mean, sd),
    fill = subgroup
  )) +
```

```

stat_halfeye(
  position = "dodge"
) +
geom_rect(
  aes(xmin = group, xmax = group + 1, ymin = 2, ymax = 13, color = subgroup),
  position = "dodge",
  data = . %>% filter(group == 3),
  alpha = 0.1
) +
geom_point(
  aes(x = group, y = 7.5, color = subgroup),
  position = position_dodge(width = 1),
  data = . %>% filter(group == 3),
  shape = 1,
  size = 4,
  stroke = 1.5
) +
scale_fill_brewer(palette = "Set2") +
scale_color_brewer(palette = "Dark2")

# This same example with "dodgejust" positioning. For the points we
# supply a justification parameter to position_dodgejust which mimics the
# justification parameter of stat_halfeye, ensuring that they are
# placed appropriately. On slabinterval family geoms, position_dodgejust()
# will automatically detect the appropriate justification.
dist_df %>%
  ggplot(aes(
    x = factor(group), ydist = dist_normal(mean, sd),
    fill = subgroup
  )) +
  stat_halfeye(
    position = "dodgejust"
  ) +
  geom_rect(
    aes(xmin = group, xmax = group + 1, ymin = 2, ymax = 13, color = subgroup),
    position = "dodgejust",
    data = . %>% filter(group == 3),
    alpha = 0.1
  ) +
  geom_point(
    aes(x = group, y = 7.5, color = subgroup),
    position = position_dodgejust(width = 1, justification = 0),
    data = . %>% filter(group == 3),
    shape = 1,
    size = 4,
    stroke = 1.5
  ) +
  scale_fill_brewer(palette = "Set2") +
  scale_color_brewer(palette = "Dark2")

```

Description

Experimental probability-like expressions that can be used in place of some `after_stat()` expressions in aesthetic assignments in **ggdist** stats.

Usage

`Pr_(x)`

`p_(x)`

Arguments

`x` Bare (unevaluated) expressions. See **Details**.

Details

`Pr_()` and `p_()` are an **experimental** mini-language for specifying aesthetic values based on probabilities and probability densities derived from distributions supplied to **ggdist** stats (e.g., in `stat_slabinterval()`, `stat_dotsinterval()`, etc.). They generate expressions that use `after_stat()` and the computed variables of the stat (such as `cdf` and `pdf`; see e.g. the **Computed Variables** section of `stat_slabinterval()`) to compute the desired probabilities or densities.

For example, one way to map the density of a distribution onto the `alpha` aesthetic of a slab is to use `after_stat(pdf)`:

```
ggplot() +
  stat_slab(aes(xdist = distributional::dist_normal(), alpha = after_stat(pdf)))
```

ggdist probability expressions offer an alternative, equivalent syntax:

```
ggplot() +
  stat_slab(aes(xdist = distributional::dist_normal(), alpha = !!p_(x)))
```

Where `p_(x)` is the probability density function. The use of `!!` is necessary to splice the generated expression into the `aes()` call; for more information, see [quasiquotation](#).

Probability expressions

Probability expressions consist of a call to `Pr_()` or `p_()` containing a small number of valid combinations of operators and variable names.

Valid variables in probability expressions include:

- `x`, `y`, or `value`: values along the `x` or `y` axis. `value` is the orientation-neutral form.

- `xdist`, `ydist`, or `dist`: distributions mapped along the x or y axis. `dist` is the orientation-neutral form. `X` and `Y` can also be used as synonyms for `xdist` and `ydist`.
- `interval`: the smallest interval containing the current `x/y` value.

`Pr_()` generates expressions for probabilities, e.g. cumulative distribution functions (CDFs). Valid operators inside `Pr_()` are:

- `<`, `<=`, `>`, `>=`: generates values of the cumulative distribution function (CDF) or complementary CDF by comparing one of `{x, y, value}` to one of `{xdist, ydist, dist, X, Y}`. For example, `Pr_(xdist <= x)` gives the CDF and `Pr_(xdist > x)` gives the CCDF.
- `%in%`: currently can only be used with `interval` on the right-hand side: gives the probability of `{x, y, value}` (left-hand side) being in the smallest interval the stat generated that contains the value; e.g. `Pr_(x %in% interval)`.

`p_()` generates expressions for probability density functions or probability mass functions (depending on if the underlying distribution is continuous or discrete). It currently does not allow any operators in the expression, and must be passed one of `x`, `y`, or `value`.

See Also

The *Computed Variables* section of `stat_slabinterval()` (especially `cdf` and `pdf`) and the `after_stat()` function.

Examples

```
library(ggplot2)
library(distributional)

df = data.frame(
  d = c(dist_normal(2.7, 1), dist_lognormal(1, 1/3)),
  name = c("normal", "lognormal")
)

# map density onto alpha of the fill
ggplot(df, aes(y = name, xdist = d)) +
  stat_slabinterval(aes(alpha = !!p_(x)))

# map CCDF onto thickness (like stat_ccdfinterval())
ggplot(df, aes(y = name, xdist = d)) +
  stat_slabinterval(aes(thickness = !!Pr_(xdist > x)))

# map containing interval onto fill
ggplot(df, aes(y = name, xdist = d)) +
  stat_slabinterval(aes(fill = !!Pr_(x %in% interval)))

# the color scale in the previous example is not great, so turn the
# probability into an ordered factor and adjust the fill scale.
# Though, see also the `level` computed variable in `stat_slabinterval()`,
# which is probably easier to use to create this style of chart.
ggplot(df, aes(y = name, xdist = d)) +
  stat_slabinterval(aes(fill = ordered(!!Pr_(x %in% interval)))) +
  scale_fill_brewer(direction = -1)
```

ramp_colours	<i>Apply partial colour ramps</i>
--------------	-----------------------------------

Description

Given vectors of colours and [partial_colour_ramps](#), ramps the colours according to the parameters of the partial colour ramps, returning a vector of the same length as the inputs giving the transformed (ramped) colours.

Usage

```
ramp_colours(colour, ramp)
```

Arguments

colour	character vector of colours.
ramp	a partial_colour_ramp vector.

Details

Takes vectors of colours and [partial_colour_ramps](#) and produces colours by interpolating between each from colour and the target colour the specified amount (where amount and from are the corresponding fields of the ramp).

For example, to add support for the `fill_ramp` aesthetic to a geometry, this line could be used inside the `draw_group()` or `draw_panel()` method of a geom:

```
data$fill = ramp_colours(data$fill, data$fill_ramp)
```

Value

A character vector of colours.

Author(s)

Matthew Kay

See Also

Other colour ramp functions: [guide_rampbar\(\)](#), [partial_colour_ramp\(\)](#), [scale_colour_ramp](#)

Examples

```
pcr = partial_colour_ramp(c(0, 0.25, 0.75, 1), "red")
pcr

ramp_colours("blue", pcr)
```

scale_colour_ramp *Secondary color scale that ramps from another color (ggplot2 scale)*

Description

This scale creates a secondary scale that modifies the fill or color scale of geoms that support it (`geom_lineribbon()` and `geom_slabinterval()`) to "ramp" from a secondary color (by default white) to the primary fill color (determined by the standard color or fill aesthetics). It uses the `partial_colour_ramp()` data type.

Usage

```
scale_colour_ramp_continuous(
  from = "white",
  ...,
  limits = function(l) c(min(0, l[[1]]), l[[2]]),
  range = c(0, 1),
  guide = "legend",
  aesthetics = "colour_ramp"
)

scale_color_ramp_continuous(
  from = "white",
  ...,
  limits = function(l) c(min(0, l[[1]]), l[[2]]),
  range = c(0, 1),
  guide = "legend",
  aesthetics = "colour_ramp"
)

scale_colour_ramp_discrete(
  from = "white",
  ...,
  range = c(0.2, 1),
  aesthetics = "colour_ramp"
)

scale_color_ramp_discrete(
  from = "white",
  ...,
  range = c(0.2, 1),
  aesthetics = "colour_ramp"
)

scale_fill_ramp_continuous(..., aesthetics = "fill_ramp")

scale_fill_ramp_discrete(..., aesthetics = "fill_ramp")
```

Arguments

from	The color to ramp from. Corresponds to 0 on the scale.
...	Arguments passed to underlying scale or guide functions. E.g. <code>scale_colour_ramp_discrete()</code> passes arguments to <code>discrete_scale()</code> , <code>scale_colour_ramp_continuous()</code> passes arguments to <code>continuous_scale()</code> . See those functions for more details.
limits	One of: <ul style="list-style-type: none"> • NULL to use the default scale range • A numeric vector of length two providing limits of the scale. Use NA to refer to the existing minimum or maximum • A function that accepts the existing (automatic) limits and returns new limits. Also accepts rlang <code>lambda</code> function notation. Note that setting limits on positional scales will remove data outside of the limits. If the purpose is to zoom, use the limit argument in the coordinate system (see <code>coord_cartesian()</code>).
range	a numeric vector of length 2 that specifies the minimum and maximum values after the scale transformation. These values should be between 0 (the from color) and 1 (the color determined by the fill aesthetic).
guide	A function used to create a guide or its name. For <code>scale_colour_ramp_continuous()</code> and <code>scale_fill_ramp_continuous()</code> , <code>guide_rampbar()</code> can be used to create gradient color bars. See <code>guides()</code> for information on other guides.
aesthetics	Names of aesthetics to set scales for.

Details

These scales transform data into `partial_colour_ramps`. Each `partial_colour_ramp` is a pair of two values: a from colour and a numeric amount between 0 and 1 representing a distance between from and the target color (where 0 indicates the from color and 1 the target color).

The target color is determined by the corresponding aesthetic: for example, the `colour_ramp` aesthetic creates ramps between from and whatever the value of the `colour` aesthetic is; the `fill_ramp` aesthetic creates ramps between from and whatever the value of the `fill` aesthetic is. When the `colour_ramp` aesthetic is set, `ggdist` geometries will modify their `colour` by applying the colour ramp between from and `colour` (and similarly for `fill_ramp` and `fill`).

Colour ramps can be applied (i.e. translated into colours) using `ramp_colours()`, which can be used with `partial_colour_ramp()` to implement geoms that make use of `colour_ramp` or `fill_ramp` scales.

Value

A `ggplot2::Scale` representing a scale for the `colour_ramp` and/or `fill_ramp` aesthetics for `ggdist` geoms. Can be added to a `ggplot()` object.

Author(s)

Matthew Kay

See Also

Other ggdist scales: [scale_side_mirrored\(\)](#), [scale_thickness](#), [sub-geometry-scales](#)

Other colour ramp functions: [guide_rampbar\(\)](#), [partial_colour_ramp\(\)](#), [ramp_colours\(\)](#)

Examples

```
library(dplyr)
library(ggplot2)
library(distributional)

tibble(d = dist_uniform(0, 1)) %>%
  ggplot(aes(y = 0, xdist = d)) +
  stat_slab(aes(fill_ramp = after_stat(x)))

tibble(d = dist_uniform(0, 1)) %>%
  ggplot(aes(y = 0, xdist = d)) +
  stat_slab(aes(fill_ramp = after_stat(x)), fill = "blue") +
  scale_fill_ramp_continuous(from = "red")

# you can invert the order of `range` to change the order of the blend
tibble(d = dist_normal(0, 1)) %>%
  ggplot(aes(y = 0, xdist = d)) +
  stat_slab(aes(fill_ramp = after_stat(cut_cdf_qi(cdf))), fill = "blue") +
  scale_fill_ramp_discrete(from = "red", range = c(1, 0))
```

scale_side_mirrored *Side scale for mirrored slabs (ggplot2 scale)*

Description

This scale creates mirrored slabs for the side aesthetic of the [geom_slabinterval\(\)](#) and [geom_dotsinterval\(\)](#) family of geoms and stats. It works on discrete variables of two or three levels.

Usage

```
scale_side_mirrored(start = "topright", ..., aesthetics = "side")
```

Arguments

start	The side to start from. Can be any valid value of the side aesthetic except "both".
...	Arguments passed on to ggplot2::discrete_scale
scale_name	[Deprecated] The name of the scale that should be used for error messages associated with this scale.

palette A palette function that when called with a single integer argument (the number of levels in the scale) returns the values that they should take (e.g., `scales::pal_hue()`).

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 (the scale limits)
- A character vector of breaks
- A function that takes the limits as input and returns breaks as output. Also accepts rlang `lambda` function notation.

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 `?plot-math` for details.
- A function that takes the breaks as input and returns labels as output. Also accepts rlang `lambda` function notation.

limits One of:

- `NULL` to use the default scale values
- A character vector that defines possible values of the scale and their order
- A function that accepts the existing (automatic) values and returns new ones. Also accepts rlang `lambda` function notation.

expand For position scales, a vector of range expansion constants used to add some padding around the data to ensure that they are placed some distance away from the axes. Use the convenience function `expansion()` to generate the values for the `expand` argument. The defaults are to expand the scale by 5% on each side for continuous variables, and by 0.6 units on each side for discrete variables.

na.translate Unlike continuous scales, discrete scales can easily show missing values, and do so by default. If you want to remove missing values from a discrete scale, specify `na.translate = FALSE`.

na.value If `na.translate = TRUE`, what aesthetic value should the missing values be displayed as? Does not apply to position scales where `NA` is always placed at the far right.

drop Should unused factor levels be omitted from the scale? The default, `TRUE`, uses the levels that appear in the data; `FALSE` uses all the levels in the factor.

guide A function used to create a guide or its name. See `guides()` for more information.

position For position scales, The position of the axis. `left` or `right` for y axes, `top` or `bottom` for x axes.

call The call used to construct the scale for reporting messages.

super The super class to use for the constructed scale

aesthetics Names of aesthetics to set scales for.

Value

A `ggplot2::Scale` representing a scale for the side aesthetic for **ggdist** geoms. Can be added to a `ggplot()` object.

Author(s)

Matthew Kay

See Also

Other ggdist scales: [scale_colour_ramp](#), [scale_thickness](#), [sub-geometry-scales](#)

Examples

```
library(dplyr)
library(ggplot2)

set.seed(1234)
data.frame(
  x = rnorm(400, c(1,4)),
  g = c("a", "b")
) %>%
  ggplot(aes(x, fill = g, side = g)) +
  geom_weave(linewidth = 0, scale = 0.5) +
  scale_side_mirrored()
```

scale_thickness

Slab thickness scale (ggplot2 scale)

Description

This **ggplot2** scale linearly scales all thickness values of geoms that support the thickness aesthetic (such as [geom_slabinterval\(\)](#)). It can be used to align the thickness scales across multiple geoms (by default, thickness is normalized on a per-geom level instead of as a global scale). For a comprehensive discussion and examples of slab scaling and normalization, see the [thickness scale article](#).

Usage

```

scale_thickness_shared(
  name = waiver(),
  breaks = waiver(),
  labels = waiver(),
  limits = function(l) c(min(0, l[[1]]), l[[2]]),
  renormalize = FALSE,
  oob = scales::oob_keep,
  guide = "none",
  ...
)

scale_thickness_identity(..., guide = "none")

thickness(x = double(), lower = NA_real_, upper = NA_real_)

```

Arguments

name	The name of the scale. Used as the axis or legend title. If <code>waiver()</code> , the default, the name of the scale is taken from the first mapping used for that aesthetic. If <code>NULL</code> , the legend title will be omitted.
breaks	One of: <ul style="list-style-type: none"> • <code>NULL</code> for no breaks • <code>waiver()</code> 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 <code>scales::extended_breaks()</code>). Also accepts <code>rlang</code> lambda function notation.
labels	One of: <ul style="list-style-type: none"> • <code>NULL</code> for no labels • <code>waiver()</code> 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 <code>?plotmath</code> for details. • A function that takes the breaks as input and returns labels as output. Also accepts <code>rlang</code> lambda function notation.
limits	One of: <ul style="list-style-type: none"> • <code>NULL</code> to use the default scale range • A numeric vector of length two providing limits of the scale. Use <code>NA</code> to refer to the existing minimum or maximum • A function that accepts the existing (automatic) limits and returns new limits. Also accepts <code>rlang</code> lambda function notation. Note that setting limits on positional scales will remove data outside of the limits. If the purpose is to zoom, use the <code>limit</code> argument in the coordinate system (see <code>coord_cartesian()</code>).

renormalize	When mapping values to the thickness scale, should those values be allowed to be renormalized by geoms (e.g. via the normalize parameter to <code>geom_slabinterval()</code>)? The default is FALSE: if <code>scale_thickness_shared()</code> is in use, the geom-specific normalize parameter is ignored (this is achieved by flagging values as already normalized by wrapping them in <code>thickness()</code>). Set this to TRUE to allow geoms to also apply their own normalization. Note that if you set <code>renormalize</code> to TRUE, subguides created via the <code>subguide</code> parameter to <code>geom_slabinterval()</code> will display the scaled values output by this scale, not the original data values.
oob	One of: <ul style="list-style-type: none"> • Function that handles limits outside of the scale limits (out of bounds). Also accepts rlang <code>lambda</code> function notation. • The default (<code>scales::censor()</code>) replaces out of bounds values with NA. • <code>scales::squish()</code> for squishing out of bounds values into range. • <code>scales::squish_infinite()</code> for squishing infinite values into range.
guide	A function used to create a guide or its name. See <code>guides()</code> for more information.
...	Arguments passed on to <code>ggplot2::continuous_scale</code>
aesthetics	The names of the aesthetics that this scale works with.
scale_name	[Deprecated] The name of the scale that should be used for error messages associated with this scale.
palette	A palette function that when called with a numeric vector with values between 0 and 1 returns the corresponding output values (e.g., <code>scales::pal_area()</code>).
minor_breaks	One of: <ul style="list-style-type: none"> • NULL for no minor breaks • <code>waiver()</code> 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 <code>lambda</code> function notation. When the function has two arguments, it will be given the limits and major breaks.
n.breaks	An integer guiding the number of major breaks. The algorithm may choose a slightly different number to ensure nice break labels. Will only have an effect if <code>breaks = waiver()</code> . Use NULL to use the default number of breaks given by the transformation.
rescaler	A function used to scale the input values to the range [0, 1]. This is always <code>scales::rescale()</code> , except for diverging and n colour gradients (i.e., <code>scale_colour_gradient2()</code> , <code>scale_colour_gradientn()</code>). The rescaler is ignored by position scales, which always use <code>scales::rescale()</code> . Also accepts rlang <code>lambda</code> function notation.
expand	For position scales, a vector of range expansion constants used to add some padding around the data to ensure that they are placed some distance away from the axes. Use the convenience function <code>expansion()</code> to generate the values for the <code>expand</code> argument. The defaults are to expand the scale by 5% on each side for continuous variables, and by 0.6 units on each side for discrete variables.

na.value	Missing values will be replaced with this value.
transform	For continuous scales, the name of a transformation object or the object itself. Built-in transformations include "asn", "atanh", "boxcox", "date", "exp", "hms", "identity", "log", "log10", "log1p", "log2", "logit", "modulus", "probability", "probit", "pseudo_log", "reciprocal", "reverse", "sqrt" and "time". A transformation object bundles together a transform, its inverse, and methods for generating breaks and labels. Transformation objects are defined in the scales package, and are called <code>transform_<name></code> . If transformations require arguments, you can call them from the scales package, e.g. <code>scales::transform_boxcox(p = 2)</code> . You can create your own transformation with <code>scales::new_transform()</code> .
trans	[Deprecated] Deprecated in favour of transform.
position	For position scales, The position of the axis. left or right for y axes, top or bottom for x axes.
call	The call used to construct the scale for reporting messages.
super	The super class to use for the constructed scale
x	An object (typically a <code>numeric()</code>) to be converted to a <code>thickness()</code> object.
lower	The original lower bounds of thickness values before scaling.
upper	The original upper bounds of thickness values before scaling.

Details

By default, normalization/scaling of slab thicknesses is controlled by geometries, not by a **ggplot2** scale function. This allows various functionality not otherwise possible, such as (1) allowing different geometries to have different thickness scales and (2) allowing the user to control at what level of aggregation (panels, groups, the entire plot, etc) thickness scaling is done via the `normalize` parameter to `geom_slabinterval()`.

However, this default approach has one drawback: two different geoms will always have their own scaling of thickness. `scale_thickness_shared()` offers an alternative approach: when added to a chart, all geoms will use the same thickness scale, and geom-level normalization (via their `normalize` parameters) is ignored. This is achieved by "marking" thickness values as already normalized by wrapping them in the `thickness()` data type (this can be disabled by setting `renormalize = TRUE`).

`thickness()` is used by `scale_thickness_shared()` to create `numeric()`-like objects marked as being in units of slab "thickness". Unlike regular `numeric()`s, `thickness()` values mapped onto the `thickness` aesthetic are not rescaled by `scale_thickness_shared()` or `geom_slabinterval()`. In most cases `thickness()` is not useful directly; though it can be used to mark values that should not be rescaled—see the definitions of `stat_ccdfinterval()` and `stat_gradientinterval()` for some usages.

Note: while a slightly more typical name for `scale_thickness_shared()` might be `scale_thickness_continuous()`, the latter name would cause this scale to be applied to all `thickness` aesthetics by default according to the rules **ggplot2** uses to find default scales. Thus, to retain the usual behavior of `stat_slabinterval()` (per-geom normalization of thickness), this scale is called `scale_thickness_shared()`.

Value

A `ggplot2::Scale` representing a scale for the thickness aesthetic for `ggdist` geoms. Can be added to a `ggplot()` object.

Author(s)

Matthew Kay

See Also

The thickness aesthetic of `geom_slabinterval()`.

Other `ggdist` scales: `scale_colour_ramp`, `scale_side_mirrored()`, `sub-geometry-scales`

Examples

```
library(distributional)
library(ggplot2)
library(dplyr)

prior_post = data.frame(
  prior = dist_normal(0, 1),
  posterior = dist_normal(0.1, 0.5)
)

# By default, separate geoms have their own thickness scales, which means
# distributions plotted using two separate geoms will not have their slab
# functions drawn on the same scale (thus here, the two distributions have
# different areas under their density curves):
prior_post %>%
  ggplot() +
  stat_halfeye(aes(xdist = posterior)) +
  stat_slab(aes(xdist = prior), fill = NA, color = "red")

# For this kind of prior/posterior chart, it makes more sense to have the
# densities on the same scale; thus, the areas under both would be the same.
# We can do that using scale_thickness_shared():
prior_post %>%
  ggplot() +
  stat_halfeye(aes(xdist = posterior)) +
  stat_slab(aes(xdist = prior), fill = NA, color = "#e41a1c") +
  scale_thickness_shared()
```

smooth_density

*Smooth dot positions in a dotplot using a kernel density estimator
("density dotplots")*

Description

Smooths x values using a density estimator, returning new x of the same length. Can be used with a dotplot (e.g. `geom_dots(smooth = ...)`) to create "density dotplots".

Supports [automatic partial function application](#).

Usage

```
smooth_bounded(
  x,
  density = "bounded",
  bounds = c(NA, NA),
  bounder = "cooke",
  trim = FALSE,
  ...
)

smooth_unbounded(x, density = "unbounded", trim = FALSE, ...)
```

Arguments

<code>x</code>	a numeric vector
<code>density</code>	Density estimator to use for smoothing. One of: <ul style="list-style-type: none"> • A function which takes a numeric vector and returns a list with elements x (giving grid points for the density estimator) and y (the corresponding densities). <code>ggdist</code> provides a family of functions following this format, including <code>density_unbounded()</code> and <code>density_bounded()</code>. • A string giving the suffix of a function name that starts with "density_"; e.g. "bounded" for <code>[density_bounded()]</code>.
<code>bounds</code>	length-2 vector of min and max bounds. If a bound is NA, then that bound is estimated from the data using the method specified by <code>bounder</code> .
<code>bounder</code>	Method to use to find missing (NA) bounds. A function that takes a numeric vector of values and returns a length-2 vector of the estimated lower and upper bound of the distribution. Can also be a string giving the suffix of the name of such a function that starts with "bounder_". Useful values include: <ul style="list-style-type: none"> • "cdf": Use the CDF of the the minimum and maximum order statistics of the sample to estimate the bounds. See <code>bounder_cdf()</code>. • "cooke": Use the method from Cooke (1979); i.e. method 2.3 from Loh (1984). See <code>bounder_cooke()</code>. • "range": Use the range of x (i.e the min or max). See <code>bounder_range()</code>.
<code>trim</code>	Should the density estimate be trimmed to the bounds of the data?
<code>...</code>	Arguments passed to the density estimator specified by <code>density</code> .

Details

Applies a kernel density estimator (KDE) to x , then uses weighted quantiles of the KDE to generate a new set of x values with smoothed values. Plotted using a dotplot (e.g. `geom_dots(smooth =`

"bounded") or `geom_dots(smooth = smooth_bounded(...))`, these values create a variation on a "density dotplot" (Zvinca 2018).

Such plots are recommended **only** in very large sample sizes where precise positions of individual values are not particularly meaningful. In small samples, normal dotplots should generally be used.

Two variants are supplied by default:

- `smooth_bounded()`, which uses `density_bounded()`. Passes the bounds arguments to the estimator.
- `smooth_unbounded()`, which uses `density_unbounded()`.

It is generally recommended to pick the smooth based on the known bounds of your data, e.g. by using `smooth_bounded()` with the `bounds` parameter if there are finite bounds, or `smooth_unbounded()` if both bounds are infinite.

Value

A numeric vector of `length(x)`, where each entry is a smoothed version of the corresponding entry in `x`.

If `x` is missing, returns a partial application of itself. See [automatic-partial-functions](#).

References

Zvinca, Daniel. "In the pursuit of diversity in data visualization. Jittering data to access details."

<https://www.linkedin.com/pulse/pursuit-diversity-data-visualization-jittering-access-daniel-zvinca>

See Also

Other dotplot smooths: `smooth_discrete()`, `smooth_none()`

Examples

```
library(ggplot2)

set.seed(1234)
x = rnorm(1000)

# basic dotplot is noisy
ggplot(data.frame(x), aes(x)) +
  geom_dots()

# density dotplot is smoother, but does move points (most noticeable
# in areas of low density)
ggplot(data.frame(x), aes(x)) +
  geom_dots(smooth = "unbounded")

# you can adjust the kernel and bandwidth...
ggplot(data.frame(x), aes(x)) +
  geom_dots(smooth = smooth_unbounded(kernel = "triangular", adjust = 0.5))
```

```
# for bounded data, you should use the bounded smoother
x_beta = rbeta(1000, 0.5, 0.5)

ggplot(data.frame(x_beta), aes(x_beta)) +
  geom_dots(smooth = smooth_bounded(bounds = c(0, 1)))
```

smooth_discrete

Smooth dot positions in a dotplot of discrete values ("bar dotplots")

Description

Note: Better-looking bar dotplots are typically easier to achieve using `layout = "bar"` with the `geom_dotsinterval()` family instead of `smooth = "bar"` or `smooth = "discrete"`.

Smooths `x` values where `x` is presumed to be discrete, returning a new `x` of the same length. Both `smooth_discrete()` and `smooth_bar()` use the `resolution()` of the data to apply smoothing around unique values in the dataset; `smooth_discrete()` uses a kernel density estimator and `smooth_bar()` places values in an evenly-spaced grid. Can be used with a dotplot (e.g. `geom_dots(smooth = ...)`) to create "bar dotplots".

Supports [automatic partial function application](#).

Usage

```
smooth_discrete(
  x,
  kernel = c("rectangular", "gaussian", "epanechnikov", "triangular", "biweight",
    "cosine", "optcosine"),
  width = 0.7,
  ...
)

smooth_bar(x, width = 0.7, ...)
```

Arguments

<code>x</code>	a numeric vector
<code>kernel</code>	string: the smoothing kernel to be used. This must partially match one of "gaussian", "rectangular", "triangular", "epanechnikov", "biweight", "cosine", or "optcosine". See <code>stats::density()</code> .
<code>width</code>	approximate width of the bars as a fraction of data <code>resolution()</code> .
<code>...</code>	additional parameters; <code>smooth_discrete()</code> passes these to <code>smooth_unbounded()</code> and thereby to <code>density_unbounded()</code> ; <code>smooth_bar()</code> ignores them.

Details

smooth_discrete() applies a kernel density estimator (default: rectangular) to x . It automatically sets the bandwidth to be such that the kernel's width (for each kernel type) is approximately width times the `resolution()` of the data. This means it essentially creates smoothed bins around each unique value. It calls down to `smooth_unbounded()`.

smooth_bar() generates an evenly-spaced grid of values spanning \pm width/2 around each unique value in x .

Value

A numeric vector of length(x), where each entry is a smoothed version of the corresponding entry in x .

If x is missing, returns a partial application of itself. See [automatic-partial-functions](#).

See Also

Other dotplot smooths: [smooth_density](#), [smooth_none\(\)](#)

Examples

```
library(ggplot2)

set.seed(1234)
x = rpois(1000, 2)

# automatic binwidth in basic dotplot on large counts in discrete
# distributions is very small
ggplot(data.frame(x), aes(x)) +
  geom_dots()

# NOTE: It is now recommended to use layout = "bar" instead of
# smooth = "discrete" or smooth = "bar"; the latter are retained because
# they can sometimes be useful in combination with other layouts for
# more specialized (but finicky) applications.
ggplot(data.frame(x), aes(x)) +
  geom_dots(layout = "bar")

# smooth_discrete() constructs wider bins of dots
ggplot(data.frame(x), aes(x)) +
  geom_dots(smooth = "discrete")

# smooth_bar() is an alternative approach to rectangular layouts
ggplot(data.frame(x), aes(x)) +
  geom_dots(smooth = "bar")

# adjust the shape by changing the kernel or the width. epanechnikov
# works well with side = "both"
ggplot(data.frame(x), aes(x)) +
  geom_dots(smooth = smooth_discrete(kernel = "epanechnikov", width = 0.8), side = "both")
```

smooth_none	<i>Apply no smooth to a dotplot</i>
-------------	-------------------------------------

Description

Default smooth for dotplots: no smooth. Simply returns the input values.

Supports [automatic partial function application](#).

Usage

```
smooth_none(x, ...)
```

Arguments

x	a numeric vector
...	ignored

Details

This is the default value for the smooth argument of `geom_dotsinterval()`.

Value

x

If x is missing, returns a partial application of itself. See [automatic-partial-functions](#).

See Also

Other dotplot smooths: [smooth_density](#), [smooth_discrete\(\)](#)

stat_ccdfinterval	<i>CCDF bar plot (shortcut stat)</i>
-------------------	--------------------------------------

Description

Shortcut version of `stat_slabinterval()` with `geom_slabinterval()` for creating CCDF bar plots.

Roughly equivalent to:

```
stat_slabinterval(
  aes(
    thickness = after_stat(thickness(1 - cdf, 0, 1)),
    justification = after_stat(0.5),
    side = after_stat("topleft")
  ),
  normalize = "none",
  expand = TRUE
)
```

Usage

```
stat_ccdfinterval(
  mapping = NULL,
  data = NULL,
  geom = "slabinterval",
  position = "identity",
  ...,
  normalize = "none",
  expand = TRUE,
  p_limits = c(NA, NA),
  density = "bounded",
  adjust = waiver(),
  trim = TRUE,
  breaks = waiver(),
  align = "none",
  outline_bars = FALSE,
  point_interval = "median_qi",
  slab_type = NULL,
  limits = NULL,
  n = 501,
  .width = c(0.66, 0.95),
  orientation = NA,
  na.rm = FALSE,
  show.legend = c(size = FALSE),
  inherit.aes = TRUE
)
```

Arguments

mapping	Set of aesthetic mappings created by <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	Use to override the default connection between <code>stat_ccdfinterval()</code> and <code>geom_slabinterval()</code>
position	Position adjustment, either as a string, or the result of a call to a position adjustment function. Setting this equal to "dodge" (<code>position_dodge()</code>) or "dodgejust" (<code>position_dodgejust()</code>) can be useful if you have overlapping geometries.
...	Other arguments passed to <code>layer()</code> . These are often aesthetics, used to set an aesthetic to a fixed value, like <code>colour = "red"</code> or <code>linewidth = 3</code> (see Aesthetics , below). They may also be parameters to the paired geom/stat. When paired with the default geom, <code>geom_slabinterval()</code> , these include:
	<p><code>fill_type</code> What type of fill to use when the fill color or alpha varies within a slab. One of:</p> <ul style="list-style-type: none"> "segments": breaks up the slab geometry into segments for each unique combination of fill color and alpha value. This approach is supported by all graphics devices and works well for sharp cutoff values, but can give ugly results if a large number of unique fill colors are being used (as in gradients, like in <code>stat_gradientinterval()</code>). "gradient": a <code>grid::linearGradient()</code> is used to create a smooth gradient fill. This works well for large numbers of unique fill colors, but requires <code>R >= 4.1</code> and is not yet supported on all graphics devices. As of this writing, the <code>png()</code> graphics device with <code>type = "cairo"</code>, the <code>svg()</code> device, the <code>pdf()</code> device, and the <code>ragg::agg_png()</code> devices are known to support this option. On <code>R < 4.1</code>, this option will fall back to <code>fill_type = "segments"</code> with a message. "auto": attempts to use <code>fill_type = "gradient"</code> if support for it can be auto-detected. On <code>R >= 4.2</code>, support for gradients can be auto-detected on some graphics devices; if support is not detected, this option will fall back to <code>fill_type = "segments"</code> (in case of a false negative, <code>fill_type = "gradient"</code> can be set explicitly). On <code>R < 4.2</code>, support for gradients cannot be auto-detected, so this will always fall back to <code>fill_type = "segments"</code>, in which case you can set <code>fill_type = "gradient"</code> explicitly if you are using a graphics device that support gradients.

`interval_size_domain` A length-2 numeric vector giving the minimum and maximum of the values of the size and linewidth aesthetics that will be translated into actual sizes for intervals drawn according to `interval_size_range` (see the documentation for that argument.)

`interval_size_range` A length-2 numeric vector. This geom scales the raw size aesthetic values when drawing interval and point sizes, as they tend to be too thick when using the default settings of `scale_size_continuous()`, which give sizes with a range of `c(1, 6)`. The `interval_size_domain` value indicates the input domain of raw size values (typically this should be equal to the value of the range argument of the `scale_size_continuous()` function), and `interval_size_range` indicates the desired output range of the size values (the min and max of the actual sizes used to draw intervals). Most of the time it is not recommended to change the value of this argument, as it may result in strange scaling of legends; this argument is a holdover from earlier versions that did not have size aesthetics targeting the point and interval separately. If you want to adjust the size of the interval or points separately, you can also use the `linewidth` or `point_size` aesthetics; see [sub-geometry-scales](#).

`fatten_point` A multiplicative factor used to adjust the size of the point relative to the size of the thickest interval line. If you wish to specify point sizes directly, you can also use the `point_size` aesthetic and `scale_point_size_continuous()` or `scale_point_size_discrete()`; sizes specified with that aesthetic will not be adjusted using `fatten_point`.

`arrow` `grid::arrow()` giving the arrow heads to use on the interval, or `NULL` for no arrows.

`subguide` Sub-guide used to annotate the thickness scale. One of:

- A function that takes a scale argument giving a `ggplot2::Scale` object and an orientation argument giving the orientation of the geometry and then returns a `grid::grob` that will draw the axis annotation, such as `subguide_axis()` (to draw a traditional axis) or `subguide_none()` (to draw no annotation). See `subguide_axis()` for a list of possibilities and examples.
- A string giving the name of such a function when prefixed with "subguide"; e.g. "axis" or "none".

`normalize`

How to normalize heights of functions input to the thickness aesthetic. One of:

- "all": normalize so that the maximum height across all data is 1.
- "panels": normalize within panels so that the maximum height in each panel is 1.
- "xy": normalize within the x/y axis opposite the orientation of this geom so that the maximum height at each value of the opposite axis is 1.
- "groups": normalize within values of the opposite axis and within each group so that the maximum height in each group is 1.
- "none": values are taken as is with no normalization (this should probably only be used with functions whose values are in `[0,1]`, such as CDFs).

For a comprehensive discussion and examples of slab scaling and normalization, see the [thickness scale article](#).

expand	For sample data, should the slab be expanded to the limits of the scale? Default FALSE. Can be length two to control expansion to the lower and upper limit respectively.
p_limits	Probability limits (as a vector of size 2) used to determine the lower and upper limits of <i>theoretical</i> distributions (distributions from <i>samples</i> ignore this parameter and determine their limits based on the limits of the sample). E.g., if this is <code>c(.001, .999)</code> , then a slab is drawn for the distribution from the quantile at $p = .001$ to the quantile at $p = .999$. If the lower (respectively upper) limit is NA, then the lower (upper) limit will be the minimum (maximum) of the distribution's support if it is finite, and 0.001 (0.999) if it is not finite. E.g., if <code>p_limits</code> is <code>c(NA, NA)</code> , on a gamma distribution the effective value of <code>p_limits</code> would be <code>c(0, .999)</code> since the gamma distribution is defined on $(0, \text{Inf})$; whereas on a normal distribution it would be equivalent to <code>c(.001, .999)</code> since the normal distribution is defined on $(-\text{Inf}, \text{Inf})$.
density	Density estimator for sample data. One of: <ul style="list-style-type: none"> • A function which takes a numeric vector and returns a list with elements <code>x</code> (giving grid points for the density estimator) and <code>y</code> (the corresponding densities). ggdist provides a family of functions following this format, including <code>density_unbounded()</code> and <code>density_bounded()</code>. This format is also compatible with <code>stats::density()</code>. • A string giving the suffix of a function name that starts with "density_"; e.g. "bounded" for <code>[density_bounded()]</code>, "unbounded" for <code>[density_unbounded()]</code>, or "histogram" for <code>density_histogram()</code>. Defaults to "bounded", i.e. <code>density_bounded()</code>, which estimates the bounds from the data and then uses a bounded density estimator based on the reflection method.
adjust	Passed to <code>density</code> : the bandwidth for the density estimator for sample data is adjusted by multiplying it by this value. See e.g. <code>density_bounded()</code> for more information. Default (<code>waiver()</code>) defers to the default of the density estimator, which is usually 1.
trim	For sample data, should the density estimate be trimmed to the range of the data? Passed on to the density estimator; see the <code>density</code> parameter. Default TRUE.
breaks	Determines the breakpoints defining bins. Defaults to "Scott". Similar to (but not exactly the same as) the <code>breaks</code> argument to <code>graphics::hist()</code> . One of: <ul style="list-style-type: none"> • A scalar (length-1) numeric giving the number of bins • A vector numeric giving the breakpoints between histogram bins • A function taking <code>x</code> and <code>weights</code> and returning either the number of bins or a vector of breakpoints • A string giving the suffix of a function that starts with "breaks_". ggdist provides weighted implementations of the "Sturges", "Scott", and "FD" break-finding algorithms from <code>graphics::hist()</code>, as well as <code>breaks_fixed()</code> for manually setting the bin width. See <code>breaks</code>. <p>For example, <code>breaks = "Sturges"</code> will use the <code>breaks_Sturges()</code> algorithm, <code>breaks = 9</code> will create 9 bins, and <code>breaks = breaks_fixed(width = 1)</code> will set the bin width to 1.</p>
align	Determines how to align the breakpoints defining bins. Default ("none") performs no alignment. One of:

- A scalar (length-1) numeric giving an offset that is subtracted from the breaks. The offset must be between 0 and the bin width.
- A function taking a sorted vector of breaks (bin edges) and returning an offset to subtract from the breaks.
- A string giving the suffix of a function that starts with "align_" used to determine the alignment, such as `align_none()`, `align_boundary()`, or `align_center()`.

For example, `align = "none"` will provide no alignment, `align = align_center(at = 0)` will center a bin on 0, and `align = align_boundary(at = 0)` will align a bin edge on 0.

<code>outline_bars</code>	For sample data (if density is "histogram") and for discrete analytical distributions (whose slabs are drawn as histograms), determines if outlines in between the bars are drawn when the <code>slab_color</code> aesthetic is used. If FALSE (the default), the outline is drawn only along the tops of the bars; if TRUE, outlines in between bars are also drawn. See <code>density_histogram()</code> .
<code>point_interval</code>	A function from the <code>point_interval()</code> family (e.g., <code>median_qi</code> , <code>mean_qi</code> , <code>mode_hdi</code> , etc), or a string giving the name of a function from that family (e.g., "median_qi", "mean_qi", "mode_hdi", etc; if a string, the caller's environment is searched for the function, followed by the <code>ggdist</code> environment). This function determines the point summary (typically mean, median, or mode) and interval type (quantile interval, qi; highest-density interval, hdi; or highest-density continuous interval, hdc). Output will be converted to the appropriate x- or y-based aesthetics depending on the value of <code>orientation</code> . See the <code>point_interval()</code> family of functions for more information.
<code>slab_type</code>	(deprecated) The type of slab function to calculate: probability density (or mass) function ("pdf"), cumulative distribution function ("cdf"), or complementary CDF ("ccdf"). Instead of using <code>slab_type</code> to change <code>f</code> and then mapping <code>f</code> onto an aesthetic, it is now recommended to simply map the corresponding computed variable (e.g. pdf, cdf, or 1 - cdf) directly onto the desired aesthetic.
<code>limits</code>	Manually-specified limits for the slab, as a vector of length two. These limits are combined with those computed based on <code>p_limits</code> as well as the limits defined by the scales of the plot to determine the limits used to draw the slab functions: these limits specify the maximal limits; i.e., if specified, the limits will not be wider than these (but may be narrower). Use NA to leave a limit alone; e.g. <code>limits = c(0, NA)</code> will ensure that the lower limit does not go below 0, but let the upper limit be determined by either <code>p_limits</code> or the scale settings.
<code>n</code>	Number of points at which to evaluate the function that defines the slab.
<code>.width</code>	The <code>.width</code> argument passed to <code>point_interval</code> : a vector of probabilities to use that determine the widths of the resulting intervals. If multiple probabilities are provided, multiple intervals per group are generated, each with a different probability interval (and value of the corresponding <code>.width</code> and <code>level</code> generated variables).
<code>orientation</code>	Whether this geom is drawn horizontally or vertically. One of: <ul style="list-style-type: none"> • NA (default): automatically detect the orientation based on how the aesthetics are assigned. Automatic detection works most of the time.

- "horizontal" (or "y"): draw horizontally, using the y aesthetic to identify different groups. For each group, uses the x, xmin, xmax, and thickness aesthetics to draw points, intervals, and slabs.
- "vertical" (or "x"): draw vertically, using the x aesthetic to identify different groups. For each group, uses the y, ymin, ymax, and thickness aesthetics to draw points, intervals, and slabs.

For compatibility with the base ggplot naming scheme for orientation, "x" can be used as an alias for "vertical" and "y" as an alias for "horizontal" (**ggdist** had an orientation parameter before base ggplot did, hence the discrepancy).

na.rm	If FALSE, the default, missing values are removed with a warning. If TRUE, missing values are silently removed.
show.legend	Should this layer be included in the legends? Default is <code>c(size = FALSE)</code> , unlike most geoms, to match its common use cases. FALSE hides all legends, TRUE shows all legends, and NA shows only those that are mapped (the default for most geoms).
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> .

Details

To visualize sample data, such as a data distribution, samples from a bootstrap distribution, or a Bayesian posterior, you can supply samples to the x or y aesthetic.

To visualize analytical distributions, you can use the `xdist` or `ydist` aesthetic. For historical reasons, you can also use `dist` to specify the distribution, though this is not recommended as it does not work as well with orientation detection. These aesthetics can be used as follows:

- `xdist`, `ydist`, and `dist` can be any distribution object from the **distributional** package (`dist_normal()`, `dist_beta()`, etc) or can be a `posterior::rvar()` object. Since these functions are vectorized, other columns can be passed directly to them in an `aes()` specification; e.g. `aes(dist = dist_normal(mu, sigma))` will work if `mu` and `sigma` are columns in the input data frame.
- `dist` can be a character vector giving the distribution name. Then the `arg1`, ... `arg9` aesthetics (or `args` as a list column) specify distribution arguments. Distribution names should correspond to R functions that have "p", "q", and "d" functions; e.g. "norm" is a valid distribution name because R defines the `pnorm()`, `qnorm()`, and `dnorm()` functions for Normal distributions.

See the `parse_dist()` function for a useful way to generate `dist` and `args` values from human-readable distribution specs (like "normal(0,1)"). Such specs are also produced by other packages (like the `brms::get_prior` function in `brms`); thus, `parse_dist()` combined with the stats described here can help you visualize the output of those functions.

Value

A `ggplot2::Stat` representing a CCDF bar geometry which can be added to a `ggplot()` object.

Computed Variables

The following variables are computed by this stat and made available for use in aesthetic specifications (`aes()`) using the `after_stat()` function or the `after_stat` argument of `stage()`:

- `x` or `y`: For slabs, the input values to the slab function. For intervals, the point summary from the interval function. Whether it is `x` or `y` depends on `orientation`
- `xmin` or `ymin`: For intervals, the lower end of the interval from the interval function.
- `xmax` or `ymax`: For intervals, the upper end of the interval from the interval function.
- `.width`: For intervals, the interval width as a numeric value in $[0, 1]$. For slabs, the width of the smallest interval containing that value of the slab.
- `level`: For intervals, the interval width as an ordered factor. For slabs, the level of the smallest interval containing that value of the slab.
- `pdf`: For slabs, the probability density function (PDF). If `options("ggdist.experimental.slab_data_in_intervals")` is TRUE: For intervals, the PDF at the point summary; intervals also have `pdf_min` and `pdf_max` for the PDF at the lower and upper ends of the interval.
- `cdf`: For slabs, the cumulative distribution function. If `options("ggdist.experimental.slab_data_in_intervals")` is TRUE: For intervals, the CDF at the point summary; intervals also have `cdf_min` and `cdf_max` for the CDF at the lower and upper ends of the interval.
- `n`: For slabs, the number of data points summarized into that slab. If the slab was created from an analytical distribution via the `xdist`, `ydist`, or `dist` aesthetic, `n` will be `Inf`.
- `f`: (deprecated) For slabs, the output values from the slab function (such as the PDF, CDF, or CCDF), determined by `slab_type`. Instead of using `slab_type` to change `f` and then mapping `f` onto an aesthetic, it is now recommended to simply map the corresponding computed variable (e.g. `pdf`, `cdf`, or `1 - cdf`) directly onto the desired aesthetic.

Aesthetics

The slab+interval stats and geoms have a wide variety of aesthetics that control the appearance of their three sub-geometries: the **slab**, the **point**, and the **interval**.

These stats support the following aesthetics:

- `x`: `x` position of the geometry (when `orientation = "vertical"`); or sample data to be summarized (when `orientation = "horizontal"` with sample data).
- `y`: `y` position of the geometry (when `orientation = "horizontal"`); or sample data to be summarized (when `orientation = "vertical"` with sample data).
- `weight`: When using samples (i.e. the `x` and `y` aesthetics, not `xdist` or `ydist`), optional weights to be applied to each draw.
- `xdist`: When using analytical distributions, distribution to map on the `x` axis: a **distributional** object (e.g. `dist_normal()`) or a `posterior::rvar()` object.
- `ydist`: When using analytical distributions, distribution to map on the `y` axis: a **distributional** object (e.g. `dist_normal()`) or a `posterior::rvar()` object.
- `dist`: When using analytical distributions, a name of a distribution (e.g. `"norm"`), a **distributional** object (e.g. `dist_normal()`), or a `posterior::rvar()` object. See **Details**.
- `args`: Distribution arguments (`args` or `arg1, ... arg9`). See **Details**.

In addition, in their default configuration (paired with `geom_slabinterval()`) the following aesthetics are supported by the underlying geom:

Slab-specific aesthetics

- **thickness**: The thickness of the slab at each x value (if orientation = "horizontal") or y value (if orientation = "vertical") of the slab.
- **side**: Which side to place the slab on. "topright", "top", and "right" are synonyms which cause the slab to be drawn on the top or the right depending on if orientation is "horizontal" or "vertical". "bottomleft", "bottom", and "left" are synonyms which cause the slab to be drawn on the bottom or the left depending on if orientation is "horizontal" or "vertical". "topleft" causes the slab to be drawn on the top or the left, and "bottomright" causes the slab to be drawn on the bottom or the right. "both" draws the slab mirrored on both sides (as in a violin plot).
- **scale**: What proportion of the region allocated to this geom to use to draw the slab. If scale = 1, slabs that use the maximum range will just touch each other. Default is 0.9 to leave some space between adjacent slabs. For a comprehensive discussion and examples of slab scaling and normalization, see the [thickness scale article](#).
- **justification**: Justification of the interval relative to the slab, where 0 indicates bottom/left justification and 1 indicates top/right justification (depending on orientation). If justification is NULL (the default), then it is set automatically based on the value of side: when side is "top"/"right" justification is set to 0, when side is "bottom"/"left" justification is set to 1, and when side is "both" justification is set to 0.5.
- **datatype**: When using composite geoms directly without a stat (e.g. `geom_slabinterval()`), datatype is used to indicate which part of the geom a row in the data targets: rows with datatype = "slab" target the slab portion of the geometry and rows with datatype = "interval" target the interval portion of the geometry. This is set automatically when using ggdist stats.

Interval-specific aesthetics

- **xmin**: Left end of the interval sub-geometry (if orientation = "horizontal").
- **xmax**: Right end of the interval sub-geometry (if orientation = "horizontal").
- **ymin**: Lower end of the interval sub-geometry (if orientation = "vertical").
- **ymax**: Upper end of the interval sub-geometry (if orientation = "vertical").

Point-specific aesthetics

- **shape**: Shape type used to draw the **point** sub-geometry.

Color aesthetics

- **colour**: (or **color**) The color of the **interval** and **point** sub-geometries. Use the `slab_color`, `interval_color`, or `point_color` aesthetics (below) to set sub-geometry colors separately.
- **fill**: The fill color of the **slab** and **point** sub-geometries. Use the `slab_fill` or `point_fill` aesthetics (below) to set sub-geometry colors separately.
- **alpha**: The opacity of the **slab**, **interval**, and **point** sub-geometries. Use the `slab_alpha`, `interval_alpha`, or `point_alpha` aesthetics (below) to set sub-geometry colors separately.

- `colour_ramp`: (or `color_ramp`) A secondary scale that modifies the color scale to "ramp" to another color. See `scale_colour_ramp()` for examples.
- `fill_ramp`: A secondary scale that modifies the fill scale to "ramp" to another color. See `scale_fill_ramp()` for examples.

Line aesthetics

- `linewidth`: Width of the line used to draw the **interval** (except with `geom_slab()`: then it is the width of the **slab**). With composite geometries including an interval and slab, use `slab_linewidth` to set the line width of the **slab** (see below). For **interval**, raw `linewidth` values are transformed according to the `interval_size_domain` and `interval_size_range` parameters of the geom (see above).
- `size`: Determines the size of the **point**. If `linewidth` is not provided, `size` will also determine the width of the line used to draw the **interval** (this allows line width and point size to be modified together by setting only `size` and not `linewidth`). Raw `size` values are transformed according to the `interval_size_domain`, `interval_size_range`, and `fatten_point` parameters of the geom (see above). Use the `point_size` aesthetic (below) to set sub-geometry size directly without applying the effects of `interval_size_domain`, `interval_size_range`, and `fatten_point`.
- `stroke`: Width of the outline around the **point** sub-geometry.
- `linetype`: Type of line (e.g., "solid", "dashed", etc) used to draw the **interval** and the outline of the **slab** (if it is visible). Use the `slab_linetype` or `interval_linetype` aesthetics (below) to set sub-geometry line types separately.

Slab-specific color and line override aesthetics

- `slab_fill`: Override for `fill`: the fill color of the slab.
- `slab_colour`: (or `slab_color`) Override for `colour/color`: the outline color of the slab.
- `slab_alpha`: Override for `alpha`: the opacity of the slab.
- `slab_linewidth`: Override for `linewidth`: the width of the outline of the slab.
- `slab_linetype`: Override for `linetype`: the line type of the outline of the slab.

Interval-specific color and line override aesthetics

- `interval_colour`: (or `interval_color`) Override for `colour/color`: the color of the interval.
- `interval_alpha`: Override for `alpha`: the opacity of the interval.
- `interval_linetype`: Override for `linetype`: the line type of the interval.

Point-specific color and line override aesthetics

- `point_fill`: Override for `fill`: the fill color of the point.
- `point_colour`: (or `point_color`) Override for `colour/color`: the outline color of the point.
- `point_alpha`: Override for `alpha`: the opacity of the point.
- `point_size`: Override for `size`: the size of the point.

Deprecated aesthetics

- `slab_size`: Use `slab_linewidth`.
- `interval_size`: Use `interval_linewidth`.

Other aesthetics (these work as in standard geoms)

- `width`
- `height`
- `group`

See examples of some of these aesthetics in action in `vignette("slabinterval")`. Learn more about the sub-geom override aesthetics (like `interval_color`) in the [scales](#) documentation. Learn more about basic ggplot aesthetics in `vignette("ggplot2-specs")`.

See Also

See `geom_slabinterval()` for the geom underlying this stat. See `stat_slabinterval()` for the stat this shortcut is based on.

Other slabinterval stats: `stat_ccdfinterval()`, `stat_eye()`, `stat_gradientinterval()`, `stat_halfeye()`, `stat_histinterval()`, `stat_interval()`, `stat_pointinterval()`, `stat_slab()`, `stat_spike()`

Examples

```
library(dplyr)
library(ggplot2)
library(distributional)

theme_set(theme_ggdist())

# ON SAMPLE DATA
set.seed(1234)
df = data.frame(
  group = c("a", "b", "c"),
  value = rnorm(1500, mean = c(5, 7, 9), sd = c(1, 1.5, 1))
)
df %>%
  ggplot(aes(x = value, y = group)) +
  stat_ccdfinterval() +
  expand_limits(x = 0)

# ON ANALYTICAL DISTRIBUTIONS
dist_df = data.frame(
  group = c("a", "b", "c"),
  mean = c( 5,  7,  8),
  sd = c( 1, 1.5,  1)
)
# Vectorized distribution types, like distributional::dist_normal()
# and posterior::rvar(), can be used with the `xdist` / `ydist` aesthetics
dist_df %>%
  ggplot(aes(y = group, xdist = dist_normal(mean, sd))) +
```

```
stat_ccdfinterval() +
expand_limits(x = 0)
```

```
stat_cdfinterval      CDF bar plot (shortcut stat)
```

Description

Shortcut version of `stat_slabinterval()` with `geom_slabinterval()` for creating CDF bar plots.

Roughly equivalent to:

```
stat_slabinterval(
  aes(
    thickness = after_stat(thickness(cdf, 0, 1)),
    justification = after_stat(0.5),
    side = after_stat("topleft")
  ),
  normalize = "none",
  expand = TRUE
)
```

Usage

```
stat_cdfinterval(
  mapping = NULL,
  data = NULL,
  geom = "slabinterval",
  position = "identity",
  ...,
  normalize = "none",
  expand = TRUE,
  p_limits = c(NA, NA),
  density = "bounded",
  adjust = waiver(),
  trim = TRUE,
  breaks = waiver(),
  align = "none",
  outline_bars = FALSE,
  point_interval = "median_qi",
  slab_type = NULL,
  limits = NULL,
  n = 501,
  .width = c(0.66, 0.95),
  orientation = NA,
  na.rm = FALSE,
  show.legend = c(size = FALSE),
  inherit.aes = TRUE
)
```

Arguments

mapping	Set of aesthetic mappings created by <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	Use to override the default connection between <code>stat_cdfinterval()</code> and <code>geom_slabinterval()</code>
position	Position adjustment, either as a string, or the result of a call to a position adjustment function. Setting this equal to "dodge" (<code>position_dodge()</code>) or "dodgejust" (<code>position_dodgejust()</code>) can be useful if you have overlapping geometries.
...	Other arguments passed to <code>layer()</code> . These are often aesthetics, used to set an aesthetic to a fixed value, like <code>colour = "red"</code> or <code>linewidth = 3</code> (see Aesthetics , below). They may also be parameters to the paired geom/stat. When paired with the default geom, <code>geom_slabinterval()</code> , these include: <code>fill_type</code> What type of fill to use when the fill color or alpha varies within a slab. One of: <ul style="list-style-type: none"> "segments": breaks up the slab geometry into segments for each unique combination of fill color and alpha value. This approach is supported by all graphics devices and works well for sharp cutoff values, but can give ugly results if a large number of unique fill colors are being used (as in gradients, like in <code>stat_gradientinterval()</code>). "gradient": a <code>grid::linearGradient()</code> is used to create a smooth gradient fill. This works well for large numbers of unique fill colors, but requires <code>R >= 4.1</code> and is not yet supported on all graphics devices. As of this writing, the <code>png()</code> graphics device with <code>type = "cairo"</code>, the <code>svg()</code> device, the <code>pdf()</code> device, and the <code>ragg::agg_png()</code> devices are known to support this option. On <code>R < 4.1</code>, this option will fall back to <code>fill_type = "segments"</code> with a message. "auto": attempts to use <code>fill_type = "gradient"</code> if support for it can be auto-detected. On <code>R >= 4.2</code>, support for gradients can be auto-detected on some graphics devices; if support is not detected, this option will fall back to <code>fill_type = "segments"</code> (in case of a false negative, <code>fill_type = "gradient"</code> can be set explicitly). On <code>R < 4.2</code>, support for gradients cannot be auto-detected, so this will always fall back to <code>fill_type = "segments"</code>, in which case you can set <code>fill_type = "gradient"</code> explicitly if you are using a graphics device that support gradients. <code>interval_size_domain</code> A length-2 numeric vector giving the minimum and maximum of the values of the size and linewidth aesthetics that will be

translated into actual sizes for intervals drawn according to `interval_size_range` (see the documentation for that argument.)

- `interval_size_range` A length-2 numeric vector. This geom scales the raw size aesthetic values when drawing interval and point sizes, as they tend to be too thick when using the default settings of `scale_size_continuous()`, which give sizes with a range of `c(1, 6)`. The `interval_size_domain` value indicates the input domain of raw size values (typically this should be equal to the value of the `range` argument of the `scale_size_continuous()` function), and `interval_size_range` indicates the desired output range of the size values (the min and max of the actual sizes used to draw intervals). Most of the time it is not recommended to change the value of this argument, as it may result in strange scaling of legends; this argument is a holdover from earlier versions that did not have size aesthetics targeting the point and interval separately. If you want to adjust the size of the interval or points separately, you can also use the `linewidth` or `point_size` aesthetics; see [sub-geometry-scales](#).
- `fatten_point` A multiplicative factor used to adjust the size of the point relative to the size of the thickest interval line. If you wish to specify point sizes directly, you can also use the `point_size` aesthetic and `scale_point_size_continuous()` or `scale_point_size_discrete()`; sizes specified with that aesthetic will not be adjusted using `fatten_point`.
- `arrow` `grid::arrow()` giving the arrow heads to use on the interval, or `NULL` for no arrows.
- `subguide` Sub-guide used to annotate the thickness scale. One of:
- A function that takes a scale argument giving a `ggplot2::Scale` object and an orientation argument giving the orientation of the geometry and then returns a `grid::grob` that will draw the axis annotation, such as `subguide_axis()` (to draw a traditional axis) or `subguide_none()` (to draw no annotation). See `subguide_axis()` for a list of possibilities and examples.
 - A string giving the name of such a function when prefixed with "subguide"; e.g. "axis" or "none".

`normalize` How to normalize heights of functions input to the thickness aesthetic. One of:

- "all": normalize so that the maximum height across all data is 1.
- "panels": normalize within panels so that the maximum height in each panel is 1.
- "xy": normalize within the x/y axis opposite the orientation of this geom so that the maximum height at each value of the opposite axis is 1.
- "groups": normalize within values of the opposite axis and within each group so that the maximum height in each group is 1.
- "none": values are taken as is with no normalization (this should probably only be used with functions whose values are in `[0,1]`, such as CDFs).

For a comprehensive discussion and examples of slab scaling and normalization, see the [thickness scale article](#).

expand	For sample data, should the slab be expanded to the limits of the scale? Default FALSE. Can be length two to control expansion to the lower and upper limit respectively.
p_limits	Probability limits (as a vector of size 2) used to determine the lower and upper limits of <i>theoretical</i> distributions (distributions from <i>samples</i> ignore this parameter and determine their limits based on the limits of the sample). E.g., if this is <code>c(.001, .999)</code> , then a slab is drawn for the distribution from the quantile at $p = .001$ to the quantile at $p = .999$. If the lower (respectively upper) limit is NA, then the lower (upper) limit will be the minimum (maximum) of the distribution's support if it is finite, and 0.001 (0.999) if it is not finite. E.g., if <code>p_limits</code> is <code>c(NA, NA)</code> , on a gamma distribution the effective value of <code>p_limits</code> would be <code>c(0, .999)</code> since the gamma distribution is defined on $(0, \text{Inf})$; whereas on a normal distribution it would be equivalent to <code>c(.001, .999)</code> since the normal distribution is defined on $(-\text{Inf}, \text{Inf})$.
density	Density estimator for sample data. One of: <ul style="list-style-type: none"> • A function which takes a numeric vector and returns a list with elements <code>x</code> (giving grid points for the density estimator) and <code>y</code> (the corresponding densities). ggdist provides a family of functions following this format, including <code>density_unbounded()</code> and <code>density_bounded()</code>. This format is also compatible with <code>stats::density()</code>. • A string giving the suffix of a function name that starts with "density_"; e.g. "bounded" for <code>[density_bounded()]</code>, "unbounded" for <code>[density_unbounded()]</code>, or "histogram" for <code>density_histogram()</code>. Defaults to "bounded", i.e. <code>density_bounded()</code>, which estimates the bounds from the data and then uses a bounded density estimator based on the reflection method.
adjust	Passed to <code>density</code> : the bandwidth for the density estimator for sample data is adjusted by multiplying it by this value. See e.g. <code>density_bounded()</code> for more information. Default (<code>waiver()</code>) defers to the default of the density estimator, which is usually 1.
trim	For sample data, should the density estimate be trimmed to the range of the data? Passed on to the density estimator; see the <code>density</code> parameter. Default TRUE.
breaks	Determines the breakpoints defining bins. Defaults to "Scott". Similar to (but not exactly the same as) the <code>breaks</code> argument to <code>graphics::hist()</code> . One of: <ul style="list-style-type: none"> • A scalar (length-1) numeric giving the number of bins • A vector numeric giving the breakpoints between histogram bins • A function taking <code>x</code> and <code>weights</code> and returning either the number of bins or a vector of breakpoints • A string giving the suffix of a function that starts with "breaks_". ggdist provides weighted implementations of the "Sturges", "Scott", and "FD" break-finding algorithms from <code>graphics::hist()</code>, as well as <code>breaks_fixed()</code> for manually setting the bin width. See <code>breaks</code>. <p>For example, <code>breaks = "Sturges"</code> will use the <code>breaks_Sturges()</code> algorithm, <code>breaks = 9</code> will create 9 bins, and <code>breaks = breaks_fixed(width = 1)</code> will set the bin width to 1.</p>
align	Determines how to align the breakpoints defining bins. Default ("none") performs no alignment. One of:

- A scalar (length-1) numeric giving an offset that is subtracted from the breaks. The offset must be between 0 and the bin width.
- A function taking a sorted vector of breaks (bin edges) and returning an offset to subtract from the breaks.
- A string giving the suffix of a function that starts with "align_" used to determine the alignment, such as `align_none()`, `align_boundary()`, or `align_center()`.

For example, `align = "none"` will provide no alignment, `align = align_center(at = 0)` will center a bin on 0, and `align = align_boundary(at = 0)` will align a bin edge on 0.

<code>outline_bars</code>	For sample data (if density is "histogram") and for discrete analytical distributions (whose slabs are drawn as histograms), determines if outlines in between the bars are drawn when the <code>slab_color</code> aesthetic is used. If FALSE (the default), the outline is drawn only along the tops of the bars; if TRUE, outlines in between bars are also drawn. See <code>density_histogram()</code> .
<code>point_interval</code>	A function from the <code>point_interval()</code> family (e.g., <code>median_qi</code> , <code>mean_qi</code> , <code>mode_hdi</code> , etc), or a string giving the name of a function from that family (e.g., "median_qi", "mean_qi", "mode_hdi", etc; if a string, the caller's environment is searched for the function, followed by the <code>ggdist</code> environment). This function determines the point summary (typically mean, median, or mode) and interval type (quantile interval, qi; highest-density interval, hdi; or highest-density continuous interval, hdc). Output will be converted to the appropriate x- or y-based aesthetics depending on the value of <code>orientation</code> . See the <code>point_interval()</code> family of functions for more information.
<code>slab_type</code>	(deprecated) The type of slab function to calculate: probability density (or mass) function ("pdf"), cumulative distribution function ("cdf"), or complementary CDF ("ccdf"). Instead of using <code>slab_type</code> to change <code>f</code> and then mapping <code>f</code> onto an aesthetic, it is now recommended to simply map the corresponding computed variable (e.g. pdf, cdf, or 1 - cdf) directly onto the desired aesthetic.
<code>limits</code>	Manually-specified limits for the slab, as a vector of length two. These limits are combined with those computed based on <code>p_limits</code> as well as the limits defined by the scales of the plot to determine the limits used to draw the slab functions: these limits specify the maximal limits; i.e., if specified, the limits will not be wider than these (but may be narrower). Use NA to leave a limit alone; e.g. <code>limits = c(0, NA)</code> will ensure that the lower limit does not go below 0, but let the upper limit be determined by either <code>p_limits</code> or the scale settings.
<code>n</code>	Number of points at which to evaluate the function that defines the slab.
<code>.width</code>	The <code>.width</code> argument passed to <code>point_interval</code> : a vector of probabilities to use that determine the widths of the resulting intervals. If multiple probabilities are provided, multiple intervals per group are generated, each with a different probability interval (and value of the corresponding <code>.width</code> and <code>level</code> generated variables).
<code>orientation</code>	Whether this geom is drawn horizontally or vertically. One of: <ul style="list-style-type: none"> • NA (default): automatically detect the orientation based on how the aesthetics are assigned. Automatic detection works most of the time.

- "horizontal" (or "y"): draw horizontally, using the y aesthetic to identify different groups. For each group, uses the x, xmin, xmax, and thickness aesthetics to draw points, intervals, and slabs.
- "vertical" (or "x"): draw vertically, using the x aesthetic to identify different groups. For each group, uses the y, ymin, ymax, and thickness aesthetics to draw points, intervals, and slabs.

For compatibility with the base ggplot naming scheme for orientation, "x" can be used as an alias for "vertical" and "y" as an alias for "horizontal" (**ggdist** had an orientation parameter before base ggplot did, hence the discrepancy).

na.rm	If FALSE, the default, missing values are removed with a warning. If TRUE, missing values are silently removed.
show.legend	Should this layer be included in the legends? Default is <code>c(size = FALSE)</code> , unlike most geoms, to match its common use cases. FALSE hides all legends, TRUE shows all legends, and NA shows only those that are mapped (the default for most geoms).
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> .

Details

To visualize sample data, such as a data distribution, samples from a bootstrap distribution, or a Bayesian posterior, you can supply samples to the x or y aesthetic.

To visualize analytical distributions, you can use the `xdist` or `ydist` aesthetic. For historical reasons, you can also use `dist` to specify the distribution, though this is not recommended as it does not work as well with orientation detection. These aesthetics can be used as follows:

- `xdist`, `ydist`, and `dist` can be any distribution object from the **distributional** package (`dist_normal()`, `dist_beta()`, etc) or can be a `posterior::rvar()` object. Since these functions are vectorized, other columns can be passed directly to them in an `aes()` specification; e.g. `aes(dist = dist_normal(mu, sigma))` will work if `mu` and `sigma` are columns in the input data frame.
- `dist` can be a character vector giving the distribution name. Then the `arg1`, ... `arg9` aesthetics (or `args` as a list column) specify distribution arguments. Distribution names should correspond to R functions that have "p", "q", and "d" functions; e.g. "norm" is a valid distribution name because R defines the `pnorm()`, `qnorm()`, and `dnorm()` functions for Normal distributions.

See the `parse_dist()` function for a useful way to generate `dist` and `args` values from human-readable distribution specs (like "normal(0,1)"). Such specs are also produced by other packages (like the `brms::get_prior` function in `brms`); thus, `parse_dist()` combined with the stats described here can help you visualize the output of those functions.

Value

A `ggplot2::Stat` representing a CDF bar geometry which can be added to a `ggplot()` object.

Computed Variables

The following variables are computed by this stat and made available for use in aesthetic specifications (`aes()`) using the `after_stat()` function or the `after_stat` argument of `stage()`:

- `x` or `y`: For slabs, the input values to the slab function. For intervals, the point summary from the interval function. Whether it is `x` or `y` depends on `orientation`
- `xmin` or `ymin`: For intervals, the lower end of the interval from the interval function.
- `xmax` or `ymax`: For intervals, the upper end of the interval from the interval function.
- `.width`: For intervals, the interval width as a numeric value in $[0, 1]$. For slabs, the width of the smallest interval containing that value of the slab.
- `level`: For intervals, the interval width as an ordered factor. For slabs, the level of the smallest interval containing that value of the slab.
- `pdf`: For slabs, the probability density function (PDF). If `options("ggdist.experimental.slab_data_in_interval")` is TRUE: For intervals, the PDF at the point summary; intervals also have `pdf_min` and `pdf_max` for the PDF at the lower and upper ends of the interval.
- `cdf`: For slabs, the cumulative distribution function. If `options("ggdist.experimental.slab_data_in_intervals")` is TRUE: For intervals, the CDF at the point summary; intervals also have `cdf_min` and `cdf_max` for the CDF at the lower and upper ends of the interval.
- `n`: For slabs, the number of data points summarized into that slab. If the slab was created from an analytical distribution via the `xdist`, `ydist`, or `dist` aesthetic, `n` will be `Inf`.
- `f`: (deprecated) For slabs, the output values from the slab function (such as the PDF, CDF, or CCDF), determined by `slab_type`. Instead of using `slab_type` to change `f` and then mapping `f` onto an aesthetic, it is now recommended to simply map the corresponding computed variable (e.g. `pdf`, `cdf`, or `1 - cdf`) directly onto the desired aesthetic.

Aesthetics

The slab+interval stats and geoms have a wide variety of aesthetics that control the appearance of their three sub-geometries: the **slab**, the **point**, and the **interval**.

These stats support the following aesthetics:

- `x`: `x` position of the geometry (when `orientation = "vertical"`); or sample data to be summarized (when `orientation = "horizontal"` with sample data).
- `y`: `y` position of the geometry (when `orientation = "horizontal"`); or sample data to be summarized (when `orientation = "vertical"` with sample data).
- `weight`: When using samples (i.e. the `x` and `y` aesthetics, not `xdist` or `ydist`), optional weights to be applied to each draw.
- `xdist`: When using analytical distributions, distribution to map on the `x` axis: a **distributional** object (e.g. `dist_normal()`) or a `posterior::rvar()` object.
- `ydist`: When using analytical distributions, distribution to map on the `y` axis: a **distributional** object (e.g. `dist_normal()`) or a `posterior::rvar()` object.
- `dist`: When using analytical distributions, a name of a distribution (e.g. `"norm"`), a **distributional** object (e.g. `dist_normal()`), or a `posterior::rvar()` object. See **Details**.
- `args`: Distribution arguments (`args` or `arg1, ... arg9`). See **Details**.

In addition, in their default configuration (paired with `geom_slabinterval()`) the following aesthetics are supported by the underlying geom:

Slab-specific aesthetics

- **thickness**: The thickness of the slab at each x value (if orientation = "horizontal") or y value (if orientation = "vertical") of the slab.
- **side**: Which side to place the slab on. "topright", "top", and "right" are synonyms which cause the slab to be drawn on the top or the right depending on if orientation is "horizontal" or "vertical". "bottomleft", "bottom", and "left" are synonyms which cause the slab to be drawn on the bottom or the left depending on if orientation is "horizontal" or "vertical". "topleft" causes the slab to be drawn on the top or the left, and "bottomright" causes the slab to be drawn on the bottom or the right. "both" draws the slab mirrored on both sides (as in a violin plot).
- **scale**: What proportion of the region allocated to this geom to use to draw the slab. If scale = 1, slabs that use the maximum range will just touch each other. Default is 0.9 to leave some space between adjacent slabs. For a comprehensive discussion and examples of slab scaling and normalization, see the [thickness scale article](#).
- **justification**: Justification of the interval relative to the slab, where 0 indicates bottom/left justification and 1 indicates top/right justification (depending on orientation). If justification is NULL (the default), then it is set automatically based on the value of side: when side is "top"/"right" justification is set to 0, when side is "bottom"/"left" justification is set to 1, and when side is "both" justification is set to 0.5.
- **datatype**: When using composite geoms directly without a stat (e.g. `geom_slabinterval()`), datatype is used to indicate which part of the geom a row in the data targets: rows with datatype = "slab" target the slab portion of the geometry and rows with datatype = "interval" target the interval portion of the geometry. This is set automatically when using ggdist stats.

Interval-specific aesthetics

- **xmin**: Left end of the interval sub-geometry (if orientation = "horizontal").
- **xmax**: Right end of the interval sub-geometry (if orientation = "horizontal").
- **ymin**: Lower end of the interval sub-geometry (if orientation = "vertical").
- **ymax**: Upper end of the interval sub-geometry (if orientation = "vertical").

Point-specific aesthetics

- **shape**: Shape type used to draw the **point** sub-geometry.

Color aesthetics

- **colour**: (or **color**) The color of the **interval** and **point** sub-geometries. Use the `slab_color`, `interval_color`, or `point_color` aesthetics (below) to set sub-geometry colors separately.
- **fill**: The fill color of the **slab** and **point** sub-geometries. Use the `slab_fill` or `point_fill` aesthetics (below) to set sub-geometry colors separately.
- **alpha**: The opacity of the **slab**, **interval**, and **point** sub-geometries. Use the `slab_alpha`, `interval_alpha`, or `point_alpha` aesthetics (below) to set sub-geometry colors separately.

- `colour_ramp`: (or `color_ramp`) A secondary scale that modifies the color scale to "ramp" to another color. See `scale_colour_ramp()` for examples.
- `fill_ramp`: A secondary scale that modifies the fill scale to "ramp" to another color. See `scale_fill_ramp()` for examples.

Line aesthetics

- `linewidth`: Width of the line used to draw the **interval** (except with `geom_slab()`: then it is the width of the **slab**). With composite geometries including an interval and slab, use `slab_linewidth` to set the line width of the **slab** (see below). For **interval**, raw `linewidth` values are transformed according to the `interval_size_domain` and `interval_size_range` parameters of the geom (see above).
- `size`: Determines the size of the **point**. If `linewidth` is not provided, `size` will also determine the width of the line used to draw the **interval** (this allows line width and point size to be modified together by setting only `size` and not `linewidth`). Raw `size` values are transformed according to the `interval_size_domain`, `interval_size_range`, and `fatten_point` parameters of the geom (see above). Use the `point_size` aesthetic (below) to set sub-geometry size directly without applying the effects of `interval_size_domain`, `interval_size_range`, and `fatten_point`.
- `stroke`: Width of the outline around the **point** sub-geometry.
- `linetype`: Type of line (e.g., "solid", "dashed", etc) used to draw the **interval** and the outline of the **slab** (if it is visible). Use the `slab_linetype` or `interval_linetype` aesthetics (below) to set sub-geometry line types separately.

Slab-specific color and line override aesthetics

- `slab_fill`: Override for `fill`: the fill color of the slab.
- `slab_colour`: (or `slab_color`) Override for `colour/color`: the outline color of the slab.
- `slab_alpha`: Override for `alpha`: the opacity of the slab.
- `slab_linewidth`: Override for `linewidth`: the width of the outline of the slab.
- `slab_linetype`: Override for `linetype`: the line type of the outline of the slab.

Interval-specific color and line override aesthetics

- `interval_colour`: (or `interval_color`) Override for `colour/color`: the color of the interval.
- `interval_alpha`: Override for `alpha`: the opacity of the interval.
- `interval_linetype`: Override for `linetype`: the line type of the interval.

Point-specific color and line override aesthetics

- `point_fill`: Override for `fill`: the fill color of the point.
- `point_colour`: (or `point_color`) Override for `colour/color`: the outline color of the point.
- `point_alpha`: Override for `alpha`: the opacity of the point.
- `point_size`: Override for `size`: the size of the point.

Deprecated aesthetics

- `slab_size`: Use `slab_linewidth`.
- `interval_size`: Use `interval_linewidth`.

Other aesthetics (these work as in standard geoms)

- `width`
- `height`
- `group`

See examples of some of these aesthetics in action in `vignette("slabinterval")`. Learn more about the sub-geom override aesthetics (like `interval_color`) in the [scales](#) documentation. Learn more about basic ggplot aesthetics in `vignette("ggplot2-specs")`.

See Also

See [geom_slabinterval\(\)](#) for the geom underlying this stat. See [stat_slabinterval\(\)](#) for the stat this shortcut is based on.

Other slabinterval stats: [stat_ccdfinterval\(\)](#), [stat_eye\(\)](#), [stat_gradientinterval\(\)](#), [stat_halfeye\(\)](#), [stat_histinterval\(\)](#), [stat_interval\(\)](#), [stat_pointinterval\(\)](#), [stat_slab\(\)](#), [stat_spike\(\)](#)

Examples

```
library(dplyr)
library(ggplot2)
library(distributional)

theme_set(theme_ggdist())

# ON SAMPLE DATA
set.seed(1234)
df = data.frame(
  group = c("a", "b", "c"),
  value = rnorm(1500, mean = c(5, 7, 9), sd = c(1, 1.5, 1))
)
df %>%
  ggplot(aes(x = value, y = group)) +
  stat_cdfinterval()

# ON ANALYTICAL DISTRIBUTIONS
dist_df = data.frame(
  group = c("a", "b", "c"),
  mean = c( 5,  7,  8),
  sd = c( 1, 1.5,  1)
)
# Vectorized distribution types, like distributional::dist_normal()
# and posterior::rvar(), can be used with the `xdist` / `ydist` aesthetics
dist_df %>%
  ggplot(aes(y = group, xdist = dist_normal(mean, sd))) +
  stat_cdfinterval()
```

stat_dots

*Dot plot (shortcut stat)***Description**

A combination of `stat_slabinterval()` and `geom_dotsinterval()` with sensible defaults for making dot plots. While `geom_dotsinterval()` is intended for use on data frames that have already been summarized using a `point_interval()` function, `stat_dots()` is intended for use directly on data frames of draws or of analytical distributions, and will perform the summarization using a `point_interval()` function. Geoms based on `geom_dotsinterval()` create dotplots that automatically determine a bin width that ensures the plot fits within the available space. They can also ensure dots do not overlap.

Roughly equivalent to:

```
stat_dotsinterval(
  aes(size = NULL),
  geom = "dots",
  show_point = FALSE,
  show_interval = FALSE,
  show.legend = NA
)
```

Usage

```
stat_dots(
  mapping = NULL,
  data = NULL,
  geom = "dots",
  position = "identity",
  ...,
  quantiles = NA,
  orientation = NA,
  na.rm = FALSE,
  show.legend = NA,
  inherit.aes = TRUE
)
```

Arguments

mapping	Set of aesthetic mappings created by <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 `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)`).

`geom` Use to override the default connection between `stat_dots()` and `geom_dots()`

`position` Position adjustment, either as a string, or the result of a call to a position adjustment function. Setting this equal to "dodge" (`position_dodge()`) or "dodgejust" (`position_dodgejust()`) can be useful if you have overlapping geometries.

... Other arguments passed to `layer()`. These are often aesthetics, used to set an aesthetic to a fixed value, like `colour = "red"` or `linewidth = 3` (see **Aesthetics**, below). They may also be parameters to the paired geom/stat. When paired with the default geom, `geom_dots()`, these include:

`binwidth` The bin width to use for laying out the dots. One of:

- NA (the default): Dynamically select the bin width based on the size of the plot when drawn. This will pick a binwidth such that the tallest stack of dots is at most scale in height (ideally exactly scale in height, though this is not guaranteed).
- A length-1 (scalar) numeric or `unit` object giving the exact bin width.
- A length-2 (vector) numeric or `unit` object giving the minimum and maximum desired bin width. The bin width will be dynamically selected within these bounds.

If the value is numeric, it is assumed to be in units of data. The bin width (or its bounds) can also be specified using `unit()`, which may be useful if it is desired that the dots be a certain point size or a certain percentage of the width/height of the viewport. For example, `unit(0.1, "npc")` would make dots that are *exactly* 10% of the viewport size along whichever dimension the dotplot is drawn; `unit(c(0, 0.1), "npc")` would make dots that are *at most* 10% of the viewport size (while still ensuring the tallest stack is less than or equal to scale).

`dotsize` The width of the dots relative to the binwidth. The default, `1.07`, makes dots be just a bit wider than the bin width, which is a manually-tuned parameter that tends to work well with the default circular shape, preventing gaps between bins from appearing to be too large visually (as might arise from dots being *precisely* the binwidth). If it is desired to have dots be precisely the binwidth, set `dotsize = 1`.

`stackratio` The distance between the center of the dots in the same stack relative to the dot height. The default, `1`, makes dots in the same stack just touch each other.

`layout` The layout method used for the dots:

- "bin" (default): places dots on the off-axis at the midpoint of their bins as in the classic Wilkinson dotplot. This maintains the alignment of rows and columns in the dotplot. This layout is slightly different from the classic Wilkinson algorithm in that: (1) it nudges bins slightly to avoid overlapping bins and (2) if the input data are symmetrical it will return a symmetrical layout.

- "weave": uses the same basic binning approach of "bin", but places dots in the off-axis at their actual positions (unless overlaps = "nudge", in which case overlaps may be nudged out of the way). This maintains the alignment of rows but does not align dots within columns.
- "hex": uses the same basic binning approach of "bin", but alternates placing dots + binwidth/4 or - binwidth/4 in the off-axis from the bin center. This allows hexagonal packing by setting a stackratio less than 1 (something like 0.9 tends to work).
- "swarm": uses the "compactswarm" layout from [beeswarm: :beeswarm\(\)](#). Does not maintain alignment of rows or columns, but can be more compact and neat looking, especially for sample data (as opposed to quantile dotplots of theoretical distributions, which may look better with "bin", "weave", or "hex").
- "bar": for discrete distributions, lays out duplicate values in rectangular bars.

overlaps How to handle overlapping dots or bins in the "bin", "weave", and "hex" layouts (dots never overlap in the "swarm" or "bar" layouts). For the purposes of this argument, dots are only considered to be overlapping if they would be overlapping when `dotsize = 1` and `stackratio = 1`; i.e. if you set those arguments to other values, overlaps may still occur. One of:

- "keep": leave overlapping dots as they are. Dots may overlap (usually only slightly) in the "bin", "weave", and "hex" layouts.
- "nudge": nudge overlapping dots out of the way. Overlaps are avoided using a constrained optimization which minimizes the squared distance of dots to their desired positions, subject to the constraint that adjacent dots do not overlap.

smooth Smoother to apply to dot positions. One of:

- A function that takes a numeric vector of dot positions and returns a smoothed version of that vector, such as `smooth_bounded()`, `smooth_unbounded()`, `smooth_discrete()`, or `smooth_bar()`.
- A string indicating what smoother to use, as the suffix to a function name starting with `smooth_`; e.g. "none" (the default) applies `smooth_none()`, which simply returns the given vector without applying smoothing.

Smoothing is most effective when the smoother is matched to the support of the distribution; e.g. using `smooth_bounded(bounds = ...)`.

overflow How to handle overflow of dots beyond the extent of the geom when a minimum binwidth (or an exact binwidth) is supplied. One of:

- "keep": Keep the overflow, drawing dots outside the geom bounds.
- "warn": Keep the overflow, but produce a warning suggesting solutions, such as setting `binwidth = NA` or `overflow = "compress"`.
- "compress": Compress the layout. Reduces the binwidth to the size necessary to keep the dots within bounds, then adjusts `stackratio` and `dotsize` so that the apparent dot size is the user-specified minimum binwidth times the user-specified `dotsize`.

If you find the default layout has dots that are too small, and you are okay with dots overlapping, consider setting `overflow = "compress"` and supplying an exact or minimum dot size using `binwidth`.

	<p>verbose If TRUE, print out the bin width of the dotplot. Can be useful if you want to start from an automatically-selected bin width and then adjust it manually. Bin width is printed both as data units and as normalized parent coordinates or "npc"s (see <code>unit()</code>). Note that if you just want to scale the selected bin width to fit within a desired area, it is probably easier to use <code>scale</code> than to copy and scale <code>binwidth</code> manually, and if you just want to provide constraints on the bin width, you can pass a length-2 vector to <code>binwidth</code>.</p> <p>subguide Sub-guide used to annotate the thickness scale. One of:</p> <ul style="list-style-type: none"> • A function that takes a <code>scale</code> argument giving a <code>ggplot2::Scale</code> object and an <code>orientation</code> argument giving the orientation of the geometry and then returns a <code>grid::grob</code> that will draw the axis annotation, such as <code>subguide_axis()</code> (to draw a traditional axis) or <code>subguide_none()</code> (to draw no annotation). See <code>subguide_axis()</code> for a list of possibilities and examples. • A string giving the name of such a function when prefixed with "subguide"; e.g. "axis" or "none".
quantiles	<p>Setting this to a value other than NA will produce a quantile dotplot: that is, a dotplot of quantiles from the sample or distribution (for analytical distributions, the default of NA is taken to mean 100 quantiles). The value of <code>quantiles</code> determines the number of quantiles to plot. See Kay et al. (2016) and Fernandes et al. (2018) for more information on quantile dotplots.</p>
orientation	<p>Whether this geom is drawn horizontally or vertically. One of:</p> <ul style="list-style-type: none"> • NA (default): automatically detect the orientation based on how the aesthetics are assigned. Automatic detection works most of the time. • "horizontal" (or "y"): draw horizontally, using the <code>y</code> aesthetic to identify different groups. For each group, uses the <code>x</code>, <code>xmin</code>, <code>xmax</code>, and <code>thickness</code> aesthetics to draw points, intervals, and slabs. • "vertical" (or "x"): draw vertically, using the <code>x</code> aesthetic to identify different groups. For each group, uses the <code>y</code>, <code>ymin</code>, <code>ymax</code>, and <code>thickness</code> aesthetics to draw points, intervals, and slabs. <p>For compatibility with the base <code>ggplot</code> naming scheme for orientation, "x" can be used as an alias for "vertical" and "y" as an alias for "horizontal" (<code>ggdist</code> had an <code>orientation</code> parameter before base <code>ggplot</code> did, hence the discrepancy).</p>
na.rm	<p>If FALSE, the default, missing values are removed with a warning. If TRUE, missing values are silently removed.</p>
show.legend	<p>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.</p>
inherit.aes	<p>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>.</p>

Details

The *dots* family of stats and geoms are similar to `geom_dotplot()` but with a number of differences:

- Dots geoms act like slabs in `geom_slabinterval()` and can be given x positions (or y positions when in a horizontal orientation).
- Given the available space to lay out dots, the dots geoms will automatically determine how many bins to use to fit the available space.
- Dots geoms use a dynamic layout algorithm that lays out dots from the center out if the input data are symmetrical, guaranteeing that symmetrical data results in a symmetrical plot. The layout algorithm also prevents dots from overlapping each other.
- The shape of the dots in these geoms can be changed using the `slab_shape` aesthetic (when using the `dotsinterval` family) or the `shape` or `slab_shape` aesthetic (when using the `dots` family)

Stats and geoms in this family include:

- `geom_dots()`: dotplots on raw data. Ensures the dotplot fits within available space by reducing the size of the dots automatically (may result in very small dots).
- `geom_swarm()` and `geom_weave()`: dotplots on raw data with defaults intended to create "beeswarm" plots. Used `side = "both"` by default, and sets the default dot size to the same size as `geom_point()` (`binwidth = unit(1.5, "mm")`), allowing dots to overlap instead of getting very small.
- `stat_dots()`: dotplots on raw data, **distributional** objects, and `posterior::rvar()`s
- `geom_dotsinterval()`: dotplot + interval plots on raw data with already-calculated intervals (rarely useful directly).
- `stat_dotsinterval()`: dotplot + interval plots on raw data, **distributional** objects, and `posterior::rvar()`s (will calculate intervals for you).
- `geom_blur_dots()`: blurry dotplots that allow the standard deviation of a blur applied to each dot to be specified using the `sd` aesthetic.
- `stat_mcse_dots()`: blurry dotplots of quantiles using the Monte Carlo Standard Error of each quantile.

`stat_dots()` and `stat_dotsinterval()`, when used with the `quantiles` argument, are particularly useful for constructing quantile dotplots, which can be an effective way to communicate uncertainty using a frequency framing that may be easier for laypeople to understand (Kay et al. 2016, Fernandes et al. 2018).

To visualize sample data, such as a data distribution, samples from a bootstrap distribution, or a Bayesian posterior, you can supply samples to the `x` or `y` aesthetic.

To visualize analytical distributions, you can use the `xdist` or `ydist` aesthetic. For historical reasons, you can also use `dist` to specify the distribution, though this is not recommended as it does not work as well with orientation detection. These aesthetics can be used as follows:

- `xdist`, `ydist`, and `dist` can be any distribution object from the **distributional** package (`dist_normal()`, `dist_beta()`, etc) or can be a `posterior::rvar()` object. Since these functions are vectorized, other columns can be passed directly to them in an `aes()` specification; e.g. `aes(dist = dist_normal(mu, sigma))` will work if `mu` and `sigma` are columns in the input data frame.
- `dist` can be a character vector giving the distribution name. Then the `arg1`, ... `arg9` aesthetics (or `args` as a list column) specify distribution arguments. Distribution names should

correspond to R functions that have "p", "q", and "d" functions; e.g. "norm" is a valid distribution name because R defines the `pnorm()`, `qnorm()`, and `dnorm()` functions for Normal distributions.

See the `parse_dist()` function for a useful way to generate `dist` and `args` values from human-readable distribution specs (like `"normal(0,1)"`). Such specs are also produced by other packages (like the `brms::get_prior` function in `brms`); thus, `parse_dist()` combined with the stats described here can help you visualize the output of those functions.

Value

A `ggplot2::Stat` representing a dot geometry which can be added to a `ggplot()` object.

Computed Variables

The following variables are computed by this stat and made available for use in aesthetic specifications (`aes()`) using the `after_stat()` function or the `after_stat` argument of `stage()`:

- `x` or `y`: For slabs, the input values to the slab function. For intervals, the point summary from the interval function. Whether it is `x` or `y` depends on `orientation`
- `xmin` or `ymin`: For intervals, the lower end of the interval from the interval function.
- `xmax` or `ymax`: For intervals, the upper end of the interval from the interval function.
- `.width`: For intervals, the interval width as a numeric value in $[0, 1]$. For slabs, the width of the smallest interval containing that value of the slab.
- `level`: For intervals, the interval width as an ordered factor. For slabs, the level of the smallest interval containing that value of the slab.
- `pdf`: For slabs, the probability density function (PDF). If `options("ggdist.experimental.slab_data_in_interval")` is `TRUE`: For intervals, the PDF at the point summary; intervals also have `pdf_min` and `pdf_max` for the PDF at the lower and upper ends of the interval.
- `cdf`: For slabs, the cumulative distribution function. If `options("ggdist.experimental.slab_data_in_intervals")` is `TRUE`: For intervals, the CDF at the point summary; intervals also have `cdf_min` and `cdf_max` for the CDF at the lower and upper ends of the interval.
- `n`: For slabs, the number of data points summarized into that slab. If the slab was created from an analytical distribution via the `xdist`, `ydist`, or `dist` aesthetic, `n` will be `Inf`.
- `f`: (deprecated) For slabs, the output values from the slab function (such as the PDF, CDF, or CCDF), determined by `slab_type`. Instead of using `slab_type` to change `f` and then mapping `f` onto an aesthetic, it is now recommended to simply map the corresponding computed variable (e.g. `pdf`, `cdf`, or `1 - cdf`) directly onto the desired aesthetic.

Aesthetics

The dots+interval stats and geoms have a wide variety of aesthetics that control the appearance of their three sub-geometries: the **dots** (aka the **slab**), the **point**, and the **interval**.

These stats support the following aesthetics:

- `x`: `x` position of the geometry (when `orientation = "vertical"`); or sample data to be summarized (when `orientation = "horizontal"` with sample data).

- `y`: `y` position of the geometry (when `orientation = "horizontal"`); or sample data to be summarized (when `orientation = "vertical"` with sample data).
- `weight`: When using samples (i.e. the `x` and `y` aesthetics, not `xdist` or `ydist`), optional weights to be applied to each draw.
- `xdist`: When using analytical distributions, distribution to map on the `x` axis: a **distributional** object (e.g. `dist_normal()`) or a `posterior::rvar()` object.
- `ydist`: When using analytical distributions, distribution to map on the `y` axis: a **distributional** object (e.g. `dist_normal()`) or a `posterior::rvar()` object.
- `dist`: When using analytical distributions, a name of a distribution (e.g. `"norm"`), a **distributional** object (e.g. `dist_normal()`), or a `posterior::rvar()` object. See **Details**.
- `args`: Distribution arguments (`args` or `arg1, ... arg9`). See **Details**.

In addition, in their default configuration (paired with `geom_dots()`) the following aesthetics are supported by the underlying geom:

Dots-specific (aka Slab-specific) aesthetics

- `family`: The font family used to draw the dots.
- `order`: The order in which data points are stacked within bins. Can be used to create the effect of "stacked" dots by ordering dots according to a discrete variable. If omitted (NULL), the value of the data points themselves are used to determine stacking order. Only applies when layout is `"bin"` or `"hex"`, as the other layout methods fully determine both `x` and `y` positions.
- `side`: Which side to place the slab on. `"topright"`, `"top"`, and `"right"` are synonyms which cause the slab to be drawn on the top or the right depending on if orientation is `"horizontal"` or `"vertical"`. `"bottomleft"`, `"bottom"`, and `"left"` are synonyms which cause the slab to be drawn on the bottom or the left depending on if orientation is `"horizontal"` or `"vertical"`. `"topleft"` causes the slab to be drawn on the top or the left, and `"bottomright"` causes the slab to be drawn on the bottom or the right. `"both"` draws the slab mirrored on both sides (as in a violin plot).
- `scale`: What proportion of the region allocated to this geom to use to draw the slab. If `scale = 1`, slabs that use the maximum range will just touch each other. Default is `0.9` to leave some space between adjacent slabs. For a comprehensive discussion and examples of slab scaling and normalization, see the [thickness scale article](#).
- `justification`: Justification of the interval relative to the slab, where `0` indicates bottom/left justification and `1` indicates top/right justification (depending on orientation). If justification is NULL (the default), then it is set automatically based on the value of `side`: when `side` is `"top"/"right"` justification is set to `0`, when `side` is `"bottom"/"left"` justification is set to `1`, and when `side` is `"both"` justification is set to `0.5`.
- `datatype`: When using composite geoms directly without a `stat` (e.g. `geom_slabinterval()`), `datatype` is used to indicate which part of the geom a row in the data targets: rows with `datatype = "slab"` target the slab portion of the geometry and rows with `datatype = "interval"` target the interval portion of the geometry. This is set automatically when using `ggdist` stats.

Interval-specific aesthetics

- `xmin`: Left end of the interval sub-geometry (if `orientation = "horizontal"`).
- `xmax`: Right end of the interval sub-geometry (if `orientation = "horizontal"`).

- `ymin`: Lower end of the interval sub-geometry (if `orientation = "vertical"`).
- `ymax`: Upper end of the interval sub-geometry (if `orientation = "vertical"`).

Point-specific aesthetics

- `shape`: Shape type used to draw the **point** sub-geometry.

Color aesthetics

- `colour`: (or `color`) The color of the **interval** and **point** sub-geometries. Use the `slab_color`, `interval_color`, or `point_color` aesthetics (below) to set sub-geometry colors separately.
- `fill`: The fill color of the **slab** and **point** sub-geometries. Use the `slab_fill` or `point_fill` aesthetics (below) to set sub-geometry colors separately.
- `alpha`: The opacity of the **slab**, **interval**, and **point** sub-geometries. Use the `slab_alpha`, `interval_alpha`, or `point_alpha` aesthetics (below) to set sub-geometry colors separately.
- `colour_ramp`: (or `color_ramp`) A secondary scale that modifies the color scale to "ramp" to another color. See [scale_colour_ramp\(\)](#) for examples.
- `fill_ramp`: A secondary scale that modifies the fill scale to "ramp" to another color. See [scale_fill_ramp\(\)](#) for examples.

Line aesthetics

- `linewidth`: Width of the line used to draw the **interval** (except with [geom_slab\(\)](#): then it is the width of the **slab**). With composite geometries including an interval and slab, use `slab_linewidth` to set the line width of the **slab** (see below). For **interval**, raw `linewidth` values are transformed according to the `interval_size_domain` and `interval_size_range` parameters of the geom (see above).
- `size`: Determines the size of the **point**. If `linewidth` is not provided, `size` will also determine the width of the line used to draw the **interval** (this allows line width and point size to be modified together by setting only `size` and not `linewidth`). Raw `size` values are transformed according to the `interval_size_domain`, `interval_size_range`, and `fatten_point` parameters of the geom (see above). Use the `point_size` aesthetic (below) to set sub-geometry size directly without applying the effects of `interval_size_domain`, `interval_size_range`, and `fatten_point`.
- `stroke`: Width of the outline around the **point** sub-geometry.
- `linetype`: Type of line (e.g., "solid", "dashed", etc) used to draw the **interval** and the outline of the **slab** (if it is visible). Use the `slab_linetype` or `interval_linetype` aesthetics (below) to set sub-geometry line types separately.

Slab-specific color and line override aesthetics

- `slab_fill`: Override for `fill`: the fill color of the slab.
- `slab_colour`: (or `slab_color`) Override for `colour/color`: the outline color of the slab.
- `slab_alpha`: Override for `alpha`: the opacity of the slab.
- `slab_linewidth`: Override for `linewidth`: the width of the outline of the slab.
- `slab_linetype`: Override for `linetype`: the line type of the outline of the slab.

- `slab_shape`: Override for `shape`: the shape of the dots used to draw the dotplot slab.

Interval-specific color and line override aesthetics

- `interval_colour`: (or `interval_color`) Override for `colour/color`: the color of the interval.
- `interval_alpha`: Override for `alpha`: the opacity of the interval.
- `interval_linetype`: Override for `linetype`: the line type of the interval.

Point-specific color and line override aesthetics

- `point_fill`: Override for `fill`: the fill color of the point.
- `point_colour`: (or `point_color`) Override for `colour/color`: the outline color of the point.
- `point_alpha`: Override for `alpha`: the opacity of the point.
- `point_size`: Override for `size`: the size of the point.

Deprecated aesthetics

- `slab_size`: Use `slab_linewidth`.
- `interval_size`: Use `interval_linewidth`.

Other aesthetics (these work as in standard geoms)

- `width`
- `height`
- `group`

See examples of some of these aesthetics in action in `vignette("dotsinterval")`. Learn more about the sub-geom override aesthetics (like `interval_color`) in the [scales](#) documentation. Learn more about basic ggplot aesthetics in `vignette("ggplot2-specs")`.

References

Kay, M., Kola, T., Hullman, J. R., & Munson, S. A. (2016). When (ish) is My Bus? User-centered Visualizations of Uncertainty in Everyday, Mobile Predictive Systems. *Conference on Human Factors in Computing Systems - CHI '16*, 5092–5103. doi:10.1145/2858036.2858558.

Fernandes, M., Walls, L., Munson, S., Hullman, J., & Kay, M. (2018). Uncertainty Displays Using Quantile Dotplots or CDFs Improve Transit Decision-Making. *Conference on Human Factors in Computing Systems - CHI '18*. doi:10.1145/3173574.3173718.

See Also

See `geom_dots()` for the geom underlying this stat. See `vignette("dotsinterval")` for a variety of examples of use.

Other `dotsinterval` stats: `stat_dotsinterval()`, `stat_mcse_dots()`

Examples

```

library(dplyr)
library(ggplot2)
library(distributional)

theme_set(theme_ggdist())

# ON SAMPLE DATA
set.seed(12345)
tibble(
  x = rep(1:10, 100),
  y = rnorm(1000, x)
) %>%
  ggplot(aes(x = x, y = y)) +
  stat_dots()

# ON ANALYTICAL DISTRIBUTIONS
# Vectorized distribution types, like distributional::dist_normal()
# and posterior::rvar(), can be used with the `xdist` / `ydist` aesthetics
tibble(
  x = 1:10,
  sd = seq(1, 3, length.out = 10)
) %>%
  ggplot(aes(x = x, ydist = dist_normal(x, sd))) +
  stat_dots(quantiles = 50)

```

stat_dotsinterval	<i>Dots + point + interval plot (shortcut stat)</i>
-------------------	---

Description

A combination of [stat_slabinterval\(\)](#) and [geom_dotsinterval\(\)](#) with sensible defaults for making dots + point + interval plots. While [geom_dotsinterval\(\)](#) is intended for use on data frames that have already been summarized using a [point_interval\(\)](#) function, [stat_dotsinterval\(\)](#) is intended for use directly on data frames of draws or of analytical distributions, and will perform the summarization using a [point_interval\(\)](#) function. Geoms based on [geom_dotsinterval\(\)](#) create dotplots that automatically determine a bin width that ensures the plot fits within the available space. They can also ensure dots do not overlap.

Usage

```

stat_dotsinterval(
  mapping = NULL,
  data = NULL,
  geom = "dotsinterval",
  position = "identity",
  ...,
  quantiles = NA,

```

```

point_interval = "median_qi",
.width = c(0.66, 0.95),
orientation = NA,
na.rm = FALSE,
show.legend = c(size = FALSE),
inherit.aes = TRUE
)

```

Arguments

mapping	Set of aesthetic mappings created by <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	Use to override the default connection between <code>stat_dotsinterval()</code> and <code>geom_dotsinterval()</code>
position	Position adjustment, either as a string, or the result of a call to a position adjustment function. Setting this equal to "dodge" (<code>position_dodge()</code>) or "dodgejust" (<code>position_dodgejust()</code>) can be useful if you have overlapping geometries.
...	<p>Other arguments passed to <code>layer()</code>. These are often aesthetics, used to set an aesthetic to a fixed value, like <code>colour = "red"</code> or <code>linewidth = 3</code> (see Aesthetics, below). They may also be parameters to the paired geom/stat. When paired with the default geom, <code>geom_dotsinterval()</code>, these include:</p> <p><code>binwidth</code> The bin width to use for laying out the dots. One of:</p> <ul style="list-style-type: none"> • <code>NA</code> (the default): Dynamically select the bin width based on the size of the plot when drawn. This will pick a <code>binwidth</code> such that the tallest stack of dots is at most scale in height (ideally exactly scale in height, though this is not guaranteed). • A length-1 (scalar) numeric or <code>unit</code> object giving the exact bin width. • A length-2 (vector) numeric or <code>unit</code> object giving the minimum and maximum desired bin width. The bin width will be dynamically selected within these bounds. <p>If the value is numeric, it is assumed to be in units of data. The bin width (or its bounds) can also be specified using <code>unit()</code>, which may be useful if it is desired that the dots be a certain point size or a certain percentage of the width/height of the viewport. For example, <code>unit(0.1, "npc")</code> would make dots that are <i>exactly</i> 10% of the viewport size along whichever dimension the dotplot is drawn; <code>unit(c(0, 0.1), "npc")</code> would make dots that are <i>at</i></p>

most 10% of the viewport size (while still ensuring the tallest stack is less than or equal to scale).

`dotsize` The width of the dots relative to the binwidth. The default, 1.07, makes dots be just a bit wider than the bin width, which is a manually-tuned parameter that tends to work well with the default circular shape, preventing gaps between bins from appearing to be too large visually (as might arise from dots being *precisely* the binwidth). If it is desired to have dots be precisely the binwidth, set `dotsize = 1`.

`stackratio` The distance between the center of the dots in the same stack relative to the dot height. The default, 1, makes dots in the same stack just touch each other.

`layout` The layout method used for the dots:

- "bin" (default): places dots on the off-axis at the midpoint of their bins as in the classic Wilkinson dotplot. This maintains the alignment of rows and columns in the dotplot. This layout is slightly different from the classic Wilkinson algorithm in that: (1) it nudges bins slightly to avoid overlapping bins and (2) if the input data are symmetrical it will return a symmetrical layout.
- "weave": uses the same basic binning approach of "bin", but places dots in the off-axis at their actual positions (unless `overlaps = "nudge"`, in which case overlaps may be nudged out of the way). This maintains the alignment of rows but does not align dots within columns.
- "hex": uses the same basic binning approach of "bin", but alternates placing dots $+ \text{binwidth}/4$ or $- \text{binwidth}/4$ in the off-axis from the bin center. This allows hexagonal packing by setting a `stackratio` less than 1 (something like 0.9 tends to work).
- "swarm": uses the "compactswarm" layout from `beeswarm: :beeswarm()`. Does not maintain alignment of rows or columns, but can be more compact and neat looking, especially for sample data (as opposed to quantile dotplots of theoretical distributions, which may look better with "bin", "weave", or "hex").
- "bar": for discrete distributions, lays out duplicate values in rectangular bars.

`overlaps` How to handle overlapping dots or bins in the "bin", "weave", and "hex" layouts (dots never overlap in the "swarm" or "bar" layouts). For the purposes of this argument, dots are only considered to be overlapping if they would be overlapping when `dotsize = 1` and `stackratio = 1`; i.e. if you set those arguments to other values, overlaps may still occur. One of:

- "keep": leave overlapping dots as they are. Dots may overlap (usually only slightly) in the "bin", "weave", and "hex" layouts.
- "nudge": nudge overlapping dots out of the way. Overlaps are avoided using a constrained optimization which minimizes the squared distance of dots to their desired positions, subject to the constraint that adjacent dots do not overlap.

`smooth` Smoother to apply to dot positions. One of:

- A function that takes a numeric vector of dot positions and returns a smoothed version of that vector, such as `smooth_bounded()`, `smooth_unbounded()`,

`smooth_discrete()`, or `smooth_bar()`’.

- A string indicating what smoother to use, as the suffix to a function name starting with `smooth_`; e.g. "none" (the default) applies `smooth_none()`, which simply returns the given vector without applying smoothing.

Smoothing is most effective when the smoother is matched to the support of the distribution; e.g. using `smooth_bounded(bounds = ...)`.

overflow How to handle overflow of dots beyond the extent of the geom when a minimum binwidth (or an exact binwidth) is supplied. One of:

- "keep": Keep the overflow, drawing dots outside the geom bounds.
- "warn": Keep the overflow, but produce a warning suggesting solutions, such as setting `binwidth = NA` or `overflow = "compress"`.
- "compress": Compress the layout. Reduces the binwidth to the size necessary to keep the dots within bounds, then adjusts `stackratio` and `dotsize` so that the apparent dot size is the user-specified minimum binwidth times the user-specified `dotsize`.

If you find the default layout has dots that are too small, and you are okay with dots overlapping, consider setting `overflow = "compress"` and supplying an exact or minimum dot size using `binwidth`.

verbose If TRUE, print out the bin width of the dotplot. Can be useful if you want to start from an automatically-selected bin width and then adjust it manually. Bin width is printed both as data units and as normalized parent coordinates or "npc"s (see `unit()`). Note that if you just want to scale the selected bin width to fit within a desired area, it is probably easier to use `scale` than to copy and scale `binwidth` manually, and if you just want to provide constraints on the bin width, you can pass a length-2 vector to `binwidth`.

interval_size_domain A length-2 numeric vector giving the minimum and maximum of the values of the `size` and `linewidth` aesthetics that will be translated into actual sizes for intervals drawn according to `interval_size_range` (see the documentation for that argument.)

interval_size_range A length-2 numeric vector. This geom scales the raw size aesthetic values when drawing interval and point sizes, as they tend to be too thick when using the default settings of `scale_size_continuous()`, which give sizes with a range of `c(1, 6)`. The `interval_size_domain` value indicates the input domain of raw size values (typically this should be equal to the value of the `range` argument of the `scale_size_continuous()` function), and `interval_size_range` indicates the desired output range of the size values (the min and max of the actual sizes used to draw intervals). Most of the time it is not recommended to change the value of this argument, as it may result in strange scaling of legends; this argument is a holdover from earlier versions that did not have size aesthetics targeting the point and interval separately. If you want to adjust the size of the interval or points separately, you can also use the `linewidth` or `point_size` aesthetics; see [sub-geometry-scales](#).

fatten_point A multiplicative factor used to adjust the size of the point relative to the size of the thickest interval line. If you wish to specify point sizes directly, you can also use the `point_size` aesthetic and `scale_point_size_continuous()`

or `scale_point_size_discrete()`; sizes specified with that aesthetic will not be adjusted using `fatten_point`.

arrow `grid::arrow()` giving the arrow heads to use on the interval, or `NULL` for no arrows.

subguide Sub-guide used to annotate the thickness scale. One of:

- A function that takes a scale argument giving a `ggplot2::Scale` object and an orientation argument giving the orientation of the geometry and then returns a `grid::grob` that will draw the axis annotation, such as `subguide_axis()` (to draw a traditional axis) or `subguide_none()` (to draw no annotation). See `subguide_axis()` for a list of possibilities and examples.
- A string giving the name of such a function when prefixed with "subguide"; e.g. "axis" or "none".

quantiles Setting this to a value other than `NA` will produce a quantile dotplot: that is, a dotplot of quantiles from the sample or distribution (for analytical distributions, the default of `NA` is taken to mean 100 quantiles). The value of `quantiles` determines the number of quantiles to plot. See Kay et al. (2016) and Fernandes et al. (2018) for more information on quantile dotplots.

point_interval A function from the `point_interval()` family (e.g., `median_qi`, `mean_qi`, `mode_hdi`, etc), or a string giving the name of a function from that family (e.g., "median_qi", "mean_qi", "mode_hdi", etc; if a string, the caller's environment is searched for the function, followed by the `ggdist` environment). This function determines the point summary (typically mean, median, or mode) and interval type (quantile interval, `qi`; highest-density interval, `hdi`; or highest-density continuous interval, `hdc`). Output will be converted to the appropriate x- or y-based aesthetics depending on the value of `orientation`. See the `point_interval()` family of functions for more information.

.width The `.width` argument passed to `point_interval`: a vector of probabilities to use that determine the widths of the resulting intervals. If multiple probabilities are provided, multiple intervals per group are generated, each with a different probability interval (and value of the corresponding `.width` and `level` generated variables).

orientation Whether this geom is drawn horizontally or vertically. One of:

- `NA` (default): automatically detect the orientation based on how the aesthetics are assigned. Automatic detection works most of the time.
- "horizontal" (or "y"): draw horizontally, using the `y` aesthetic to identify different groups. For each group, uses the `x`, `xmin`, `xmax`, and `thickness` aesthetics to draw points, intervals, and slabs.
- "vertical" (or "x"): draw vertically, using the `x` aesthetic to identify different groups. For each group, uses the `y`, `ymin`, `ymax`, and `thickness` aesthetics to draw points, intervals, and slabs.

For compatibility with the base `ggplot` naming scheme for orientation, "x" can be used as an alias for "vertical" and "y" as an alias for "horizontal" (`ggdist` had an orientation parameter before base `ggplot` did, hence the discrepancy).

na.rm	If FALSE, the default, missing values are removed with a warning. If TRUE, missing values are silently removed.
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> .

Details

The *dots* family of stats and geoms are similar to `geom_dotplot()` but with a number of differences:

- Dots geoms act like slabs in `geom_slabinterval()` and can be given x positions (or y positions when in a horizontal orientation).
- Given the available space to lay out dots, the dots geoms will automatically determine how many bins to use to fit the available space.
- Dots geoms use a dynamic layout algorithm that lays out dots from the center out if the input data are symmetrical, guaranteeing that symmetrical data results in a symmetrical plot. The layout algorithm also prevents dots from overlapping each other.
- The shape of the dots in these geoms can be changed using the `slab_shape` aesthetic (when using the *dotsinterval* family) or the `shape` or `slab_shape` aesthetic (when using the *dots* family)

Stats and geoms in this family include:

- `geom_dots()`: dotplots on raw data. Ensures the dotplot fits within available space by reducing the size of the dots automatically (may result in very small dots).
- `geom_swarm()` and `geom_weave()`: dotplots on raw data with defaults intended to create "beeswarm" plots. Used `side = "both"` by default, and sets the default dot size to the same size as `geom_point()` (`binwidth = unit(1.5, "mm")`), allowing dots to overlap instead of getting very small.
- `stat_dots()`: dotplots on raw data, **distributional** objects, and `posterior::rvar()`s
- `geom_dotsinterval()`: dotplot + interval plots on raw data with already-calculated intervals (rarely useful directly).
- `stat_dotsinterval()`: dotplot + interval plots on raw data, **distributional** objects, and `posterior::rvar()`s (will calculate intervals for you).
- `geom_blur_dots()`: blurry dotplots that allow the standard deviation of a blur applied to each dot to be specified using the `sd` aesthetic.
- `stat_mcse_dots()`: blurry dotplots of quantiles using the Monte Carlo Standard Error of each quantile.

`stat_dots()` and `stat_dotsinterval()`, when used with the `quantiles` argument, are particularly useful for constructing quantile dotplots, which can be an effective way to communicate uncertainty using a frequency framing that may be easier for laypeople to understand (Kay et al. 2016, Fernandes et al. 2018).

To visualize sample data, such as a data distribution, samples from a bootstrap distribution, or a Bayesian posterior, you can supply samples to the `x` or `y` aesthetic.

To visualize analytical distributions, you can use the `xdist` or `ydist` aesthetic. For historical reasons, you can also use `dist` to specify the distribution, though this is not recommended as it does not work as well with orientation detection. These aesthetics can be used as follows:

- `xdist`, `ydist`, and `dist` can be any distribution object from the `distributional` package (`dist_normal()`, `dist_beta()`, etc) or can be a `posterior::rvar()` object. Since these functions are vectorized, other columns can be passed directly to them in an `aes()` specification; e.g. `aes(dist = dist_normal(mu, sigma))` will work if `mu` and `sigma` are columns in the input data frame.
- `dist` can be a character vector giving the distribution name. Then the `arg1`, ... `arg9` aesthetics (or `args` as a list column) specify distribution arguments. Distribution names should correspond to R functions that have "p", "q", and "d" functions; e.g. "norm" is a valid distribution name because R defines the `pnorm()`, `qnorm()`, and `dnorm()` functions for Normal distributions.

See the `parse_dist()` function for a useful way to generate `dist` and `args` values from human-readable distribution specs (like "normal(0,1)"). Such specs are also produced by other packages (like the `brms::get_prior` function in `brms`); thus, `parse_dist()` combined with the stats described here can help you visualize the output of those functions.

Value

A `ggplot2::Stat` representing a dots + point + interval geometry which can be added to a `ggplot()` object.

Computed Variables

The following variables are computed by this stat and made available for use in aesthetic specifications (`aes()`) using the `after_stat()` function or the `after_stat` argument of `stage()`:

- `x` or `y`: For slabs, the input values to the slab function. For intervals, the point summary from the interval function. Whether it is `x` or `y` depends on `orientation`
- `xmin` or `ymin`: For intervals, the lower end of the interval from the interval function.
- `xmax` or `ymax`: For intervals, the upper end of the interval from the interval function.
- `.width`: For intervals, the interval width as a numeric value in $[0, 1]$. For slabs, the width of the smallest interval containing that value of the slab.
- `level`: For intervals, the interval width as an ordered factor. For slabs, the level of the smallest interval containing that value of the slab.
- `pdf`: For slabs, the probability density function (PDF). If `options("ggdist.experimental.slab_data_in_intervals")` is TRUE: For intervals, the PDF at the point summary; intervals also have `pdf_min` and `pdf_max` for the PDF at the lower and upper ends of the interval.
- `cdf`: For slabs, the cumulative distribution function. If `options("ggdist.experimental.slab_data_in_intervals")` is TRUE: For intervals, the CDF at the point summary; intervals also have `cdf_min` and `cdf_max` for the CDF at the lower and upper ends of the interval.
- `n`: For slabs, the number of data points summarized into that slab. If the slab was created from an analytical distribution via the `xdist`, `ydist`, or `dist` aesthetic, `n` will be `Inf`.

- `f`: (deprecated) For slabs, the output values from the slab function (such as the PDF, CDF, or CCDF), determined by `slab_type`. Instead of using `slab_type` to change `f` and then mapping `f` onto an aesthetic, it is now recommended to simply map the corresponding computed variable (e.g. `pdf`, `cdf`, or `1 - cdf`) directly onto the desired aesthetic.

Aesthetics

The dots+interval stats and geoms have a wide variety of aesthetics that control the appearance of their three sub-geometries: the **dots** (aka the **slab**), the **point**, and the **interval**.

These stats support the following aesthetics:

- `x`: x position of the geometry (when `orientation = "vertical"`); or sample data to be summarized (when `orientation = "horizontal"` with sample data).
- `y`: y position of the geometry (when `orientation = "horizontal"`); or sample data to be summarized (when `orientation = "vertical"` with sample data).
- `weight`: When using samples (i.e. the `x` and `y` aesthetics, not `xdist` or `ydist`), optional weights to be applied to each draw.
- `xdist`: When using analytical distributions, distribution to map on the x axis: a **distributional** object (e.g. `dist_normal()`) or a `posterior::rvar()` object.
- `ydist`: When using analytical distributions, distribution to map on the y axis: a **distributional** object (e.g. `dist_normal()`) or a `posterior::rvar()` object.
- `dist`: When using analytical distributions, a name of a distribution (e.g. `"norm"`), a **distributional** object (e.g. `dist_normal()`), or a `posterior::rvar()` object. See **Details**.
- `args`: Distribution arguments (`args` or `arg1, ... arg9`). See **Details**.

In addition, in their default configuration (paired with `geom_dotsinterval()`) the following aesthetics are supported by the underlying geom:

Dots-specific (aka Slab-specific) aesthetics

- `family`: The font family used to draw the dots.
- `order`: The order in which data points are stacked within bins. Can be used to create the effect of "stacked" dots by ordering dots according to a discrete variable. If omitted (NULL), the value of the data points themselves are used to determine stacking order. Only applies when layout is `"bin"` or `"hex"`, as the other layout methods fully determine both `x` and `y` positions.
- `side`: Which side to place the slab on. `"topright"`, `"top"`, and `"right"` are synonyms which cause the slab to be drawn on the top or the right depending on if `orientation` is `"horizontal"` or `"vertical"`. `"bottomleft"`, `"bottom"`, and `"left"` are synonyms which cause the slab to be drawn on the bottom or the left depending on if `orientation` is `"horizontal"` or `"vertical"`. `"topleft"` causes the slab to be drawn on the top or the left, and `"bottomright"` causes the slab to be drawn on the bottom or the right. `"both"` draws the slab mirrored on both sides (as in a violin plot).
- `scale`: What proportion of the region allocated to this geom to use to draw the slab. If `scale = 1`, slabs that use the maximum range will just touch each other. Default is `0.9` to leave some space between adjacent slabs. For a comprehensive discussion and examples of slab scaling and normalization, see the [thickness scale article](#).

- **justification**: Justification of the interval relative to the slab, where 0 indicates bottom/left justification and 1 indicates top/right justification (depending on orientation). If justification is NULL (the default), then it is set automatically based on the value of side: when side is "top"/"right" justification is set to 0, when side is "bottom"/"left" justification is set to 1, and when side is "both" justification is set to 0.5.
- **datatype**: When using composite geoms directly without a stat (e.g. `geom_slabinterval()`), datatype is used to indicate which part of the geom a row in the data targets: rows with datatype = "slab" target the slab portion of the geometry and rows with datatype = "interval" target the interval portion of the geometry. This is set automatically when using ggdist stats.

Interval-specific aesthetics

- **xmin**: Left end of the interval sub-geometry (if orientation = "horizontal").
- **xmax**: Right end of the interval sub-geometry (if orientation = "horizontal").
- **ymin**: Lower end of the interval sub-geometry (if orientation = "vertical").
- **ymax**: Upper end of the interval sub-geometry (if orientation = "vertical").

Point-specific aesthetics

- **shape**: Shape type used to draw the **point** sub-geometry.

Color aesthetics

- **colour**: (or **color**) The color of the **interval** and **point** sub-geometries. Use the `slab_color`, `interval_color`, or `point_color` aesthetics (below) to set sub-geometry colors separately.
- **fill**: The fill color of the **slab** and **point** sub-geometries. Use the `slab_fill` or `point_fill` aesthetics (below) to set sub-geometry colors separately.
- **alpha**: The opacity of the **slab**, **interval**, and **point** sub-geometries. Use the `slab_alpha`, `interval_alpha`, or `point_alpha` aesthetics (below) to set sub-geometry colors separately.
- **colour_ramp**: (or **color_ramp**) A secondary scale that modifies the color scale to "ramp" to another color. See `scale_colour_ramp()` for examples.
- **fill_ramp**: A secondary scale that modifies the fill scale to "ramp" to another color. See `scale_fill_ramp()` for examples.

Line aesthetics

- **linewidth**: Width of the line used to draw the **interval** (except with `geom_slab()`: then it is the width of the **slab**). With composite geometries including an interval and slab, use `slab_linewidth` to set the line width of the **slab** (see below). For **interval**, raw linewidth values are transformed according to the `interval_size_domain` and `interval_size_range` parameters of the geom (see above).
- **size**: Determines the size of the **point**. If linewidth is not provided, size will also determine the width of the line used to draw the **interval** (this allows line width and point size to be modified together by setting only size and not linewidth). Raw size values are transformed according to the `interval_size_domain`, `interval_size_range`, and `fatten_point` parameters of the geom (see above). Use the `point_size` aesthetic (below) to set sub-geometry size directly without applying the effects of `interval_size_domain`, `interval_size_range`, and `fatten_point`.

- `stroke`: Width of the outline around the **point** sub-geometry.
- `linetype`: Type of line (e.g., "solid", "dashed", etc) used to draw the **interval** and the outline of the **slab** (if it is visible). Use the `slab_linetype` or `interval_linetype` aesthetics (below) to set sub-geometry line types separately.

Slab-specific color and line override aesthetics

- `slab_fill`: Override for `fill`: the fill color of the slab.
- `slab_colour`: (or `slab_color`) Override for `colour/color`: the outline color of the slab.
- `slab_alpha`: Override for `alpha`: the opacity of the slab.
- `slab_linewidth`: Override for `linewidth`: the width of the outline of the slab.
- `slab_linetype`: Override for `linetype`: the line type of the outline of the slab.
- `slab_shape`: Override for `shape`: the shape of the dots used to draw the dotplot slab.

Interval-specific color and line override aesthetics

- `interval_colour`: (or `interval_color`) Override for `colour/color`: the color of the interval.
- `interval_alpha`: Override for `alpha`: the opacity of the interval.
- `interval_linetype`: Override for `linetype`: the line type of the interval.

Point-specific color and line override aesthetics

- `point_fill`: Override for `fill`: the fill color of the point.
- `point_colour`: (or `point_color`) Override for `colour/color`: the outline color of the point.
- `point_alpha`: Override for `alpha`: the opacity of the point.
- `point_size`: Override for `size`: the size of the point.

Deprecated aesthetics

- `slab_size`: Use `slab_linewidth`.
- `interval_size`: Use `interval_linewidth`.

Other aesthetics (these work as in standard geoms)

- `width`
- `height`
- `group`

See examples of some of these aesthetics in action in `vignette("dotsinterval")`. Learn more about the sub-geom override aesthetics (like `interval_color`) in the [scales](#) documentation. Learn more about basic ggplot aesthetics in `vignette("ggplot2-specs")`.

References

- Kay, M., Kola, T., Hullman, J. R., & Munson, S. A. (2016). When (ish) is My Bus? User-centered Visualizations of Uncertainty in Everyday, Mobile Predictive Systems. *Conference on Human Factors in Computing Systems - CHI '16*, 5092–5103. doi:10.1145/2858036.2858558.
- Fernandes, M., Walls, L., Munson, S., Hullman, J., & Kay, M. (2018). Uncertainty Displays Using Quantile Dotplots or CDFs Improve Transit Decision-Making. *Conference on Human Factors in Computing Systems - CHI '18*. doi:10.1145/3173574.3173718.

See Also

See [geom_dotsinterval\(\)](#) for the geom underlying this stat. See `vignette("dotsinterval")` for a variety of examples of use.

Other dotsinterval stats: [stat_dots\(\)](#), [stat_mcse_dots\(\)](#)

Examples

```
library(dplyr)
library(ggplot2)
library(distributional)

theme_set(theme_ggdist())

# ON SAMPLE DATA
set.seed(12345)
tibble(
  x = rep(1:10, 100),
  y = rnorm(1000, x)
) %>%
  ggplot(aes(x = x, y = y)) +
  stat_dotsinterval()

# ON ANALYTICAL DISTRIBUTIONS
# Vectorized distribution types, like distributional::dist_normal()
# and posterior::rvar(), can be used with the `xdist` / `ydist` aesthetics
tibble(
  x = 1:10,
  sd = seq(1, 3, length.out = 10)
) %>%
  ggplot(aes(x = x, ydist = dist_normal(x, sd))) +
  stat_dotsinterval(quantiles = 50)
```

Description

Shortcut version of `stat_slabinterval()` with `geom_slabinterval()` for creating eye (violin + interval) plots.

Roughly equivalent to:

```
stat_slabinterval(
  aes(side = after_stat("both"))
)
```

Usage

```
stat_eye(
  mapping = NULL,
  data = NULL,
  geom = "slabinterval",
  position = "identity",
  ...,
  p_limits = c(NA, NA),
  density = "bounded",
  adjust = waiver(),
  trim = TRUE,
  expand = FALSE,
  breaks = waiver(),
  align = "none",
  outline_bars = FALSE,
  point_interval = "median_qi",
  slab_type = NULL,
  limits = NULL,
  n = 501,
  .width = c(0.66, 0.95),
  orientation = NA,
  na.rm = FALSE,
  show.legend = c(size = FALSE),
  inherit.aes = TRUE
)
```

Arguments

- | | |
|---------|--|
| mapping | Set of aesthetic mappings created by <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 `data.frame`, and will be used as the layer data. A function can be created from a formula (e.g. `~ head(.x, 10)`).

`geom` Use to override the default connection between `stat_eye()` and `geom_slabinterval()`

`position` Position adjustment, either as a string, or the result of a call to a position adjustment function. Setting this equal to "dodge" (`position_dodge()`) or "dodgejust" (`position_dodgejust()`) can be useful if you have overlapping geometries.

...

Other arguments passed to `layer()`. These are often aesthetics, used to set an aesthetic to a fixed value, like `colour = "red"` or `linewidth = 3` (see **Aesthetics**, below). They may also be parameters to the paired geom/stat. When paired with the default geom, `geom_slabinterval()`, these include:

`normalize` How to normalize heights of functions input to the thickness aesthetic. One of:

- "all": normalize so that the maximum height across all data is 1.
- "panels": normalize within panels so that the maximum height in each panel is 1.
- "xy": normalize within the x/y axis opposite the orientation of this geom so that the maximum height at each value of the opposite axis is 1.
- "groups": normalize within values of the opposite axis and within each group so that the maximum height in each group is 1.
- "none": values are taken as is with no normalization (this should probably only be used with functions whose values are in [0,1], such as CDFs).

For a comprehensive discussion and examples of slab scaling and normalization, see the [thickness scale article](#).

`fill_type` What type of fill to use when the fill color or alpha varies within a slab. One of:

- "segments": breaks up the slab geometry into segments for each unique combination of fill color and alpha value. This approach is supported by all graphics devices and works well for sharp cutoff values, but can give ugly results if a large number of unique fill colors are being used (as in gradients, like in `stat_gradientinterval()`).
- "gradient": a `grid::linearGradient()` is used to create a smooth gradient fill. This works well for large numbers of unique fill colors, but requires R \geq 4.1 and is not yet supported on all graphics devices. As of this writing, the `png()` graphics device with `type = "cairo"`, the `svg()` device, the `pdf()` device, and the `ragg::agg_png()` devices are known to support this option. On R $<$ 4.1, this option will fall back to `fill_type = "segments"` with a message.
- "auto": attempts to use `fill_type = "gradient"` if support for it can be auto-detected. On R \geq 4.2, support for gradients can be auto-detected on some graphics devices; if support is not detected, this option will fall back to `fill_type = "segments"` (in case of a false negative, `fill_type = "gradient"` can be set explicitly). On R $<$ 4.2, support for gradients cannot be auto-detected, so this will always fall back

to `fill_type = "segments"`, in which case you can set `fill_type = "gradient"` explicitly if you are using a graphics device that support gradients.

`interval_size_domain` A length-2 numeric vector giving the minimum and maximum of the values of the size and linewidth aesthetics that will be translated into actual sizes for intervals drawn according to `interval_size_range` (see the documentation for that argument.)

`interval_size_range` A length-2 numeric vector. This geom scales the raw size aesthetic values when drawing interval and point sizes, as they tend to be too thick when using the default settings of `scale_size_continuous()`, which give sizes with a range of `c(1, 6)`. The `interval_size_domain` value indicates the input domain of raw size values (typically this should be equal to the value of the range argument of the `scale_size_continuous()` function), and `interval_size_range` indicates the desired output range of the size values (the min and max of the actual sizes used to draw intervals). Most of the time it is not recommended to change the value of this argument, as it may result in strange scaling of legends; this argument is a holdover from earlier versions that did not have size aesthetics targeting the point and interval separately. If you want to adjust the size of the interval or points separately, you can also use the `linewidth` or `point_size` aesthetics; see [sub-geometry-scales](#).

`fatten_point` A multiplicative factor used to adjust the size of the point relative to the size of the thickest interval line. If you wish to specify point sizes directly, you can also use the `point_size` aesthetic and `scale_point_size_continuous()` or `scale_point_size_discrete()`; sizes specified with that aesthetic will not be adjusted using `fatten_point`.

arrow `grid::arrow()` giving the arrow heads to use on the interval, or NULL for no arrows.

`subguide` Sub-guide used to annotate the thickness scale. One of:

- A function that takes a scale argument giving a `ggplot2::Scale` object and an orientation argument giving the orientation of the geometry and then returns a `grid::grob` that will draw the axis annotation, such as `subguide_axis()` (to draw a traditional axis) or `subguide_none()` (to draw no annotation). See `subguide_axis()` for a list of possibilities and examples.
- A string giving the name of such a function when prefixed with "subguide"; e.g. "axis" or "none".

`p_limits`

Probability limits (as a vector of size 2) used to determine the lower and upper limits of *theoretical* distributions (distributions from *samples* ignore this parameter and determine their limits based on the limits of the sample). E.g., if this is `c(.001, .999)`, then a slab is drawn for the distribution from the quantile at $p = .001$ to the quantile at $p = .999$. If the lower (respectively upper) limit is NA, then the lower (upper) limit will be the minimum (maximum) of the distribution's support if it is finite, and 0.001 (0.999) if it is not finite. E.g., if `p_limits` is `c(NA, NA)`, on a gamma distribution the effective value of `p_limits` would be `c(0, .999)` since the gamma distribution is defined on $(0, \text{Inf})$; whereas on a normal distribution it would be equivalent to `c(.001, .999)` since the normal distribution is defined on $(-\text{Inf}, \text{Inf})$.

density	<p>Density estimator for sample data. One of:</p> <ul style="list-style-type: none"> • A function which takes a numeric vector and returns a list with elements <code>x</code> (giving grid points for the density estimator) and <code>y</code> (the corresponding densities). ggdist provides a family of functions following this format, including <code>density_unbounded()</code> and <code>density_bounded()</code>. This format is also compatible with <code>stats::density()</code>. • A string giving the suffix of a function name that starts with "density_"; e.g. "bounded" for [<code>density_bounded()</code>], "unbounded" for [<code>density_unbounded()</code>], or "histogram" for <code>density_histogram()</code>. Defaults to "bounded", i.e. <code>density_bounded()</code>, which estimates the bounds from the data and then uses a bounded density estimator based on the reflection method.
adjust	<p>Passed to density: the bandwidth for the density estimator for sample data is adjusted by multiplying it by this value. See e.g. <code>density_bounded()</code> for more information. Default (<code>waiver()</code>) defers to the default of the density estimator, which is usually 1.</p>
trim	<p>For sample data, should the density estimate be trimmed to the range of the data? Passed on to the density estimator; see the <code>density</code> parameter. Default TRUE.</p>
expand	<p>For sample data, should the slab be expanded to the limits of the scale? Default FALSE. Can be length two to control expansion to the lower and upper limit respectively.</p>
breaks	<p>Determines the breakpoints defining bins. Defaults to "Scott". Similar to (but not exactly the same as) the <code>breaks</code> argument to <code>graphics::hist()</code>. One of:</p> <ul style="list-style-type: none"> • A scalar (length-1) numeric giving the number of bins • A vector numeric giving the breakpoints between histogram bins • A function taking <code>x</code> and <code>weights</code> and returning either the number of bins or a vector of breakpoints • A string giving the suffix of a function that starts with "breaks_". ggdist provides weighted implementations of the "Sturges", "Scott", and "FD" break-finding algorithms from <code>graphics::hist()</code>, as well as <code>breaks_fixed()</code> for manually setting the bin width. See breaks. <p>For example, <code>breaks = "Sturges"</code> will use the <code>breaks_Sturges()</code> algorithm, <code>breaks = 9</code> will create 9 bins, and <code>breaks = breaks_fixed(width = 1)</code> will set the bin width to 1.</p>
align	<p>Determines how to align the breakpoints defining bins. Default ("none") performs no alignment. One of:</p> <ul style="list-style-type: none"> • A scalar (length-1) numeric giving an offset that is subtracted from the breaks. The offset must be between 0 and the bin width. • A function taking a sorted vector of breaks (bin edges) and returning an offset to subtract from the breaks. • A string giving the suffix of a function that starts with "align_" used to determine the alignment, such as <code>align_none()</code>, <code>align_boundary()</code>, or <code>align_center()</code>. <p>For example, <code>align = "none"</code> will provide no alignment, <code>align = align_center(at = 0)</code> will center a bin on 0, and <code>align = align_boundary(at = 0)</code> will align a bin edge on 0.</p>

<code>outline_bars</code>	For sample data (if density is "histogram") and for discrete analytical distributions (whose slabs are drawn as histograms), determines if outlines in between the bars are drawn when the <code>slab_color</code> aesthetic is used. If FALSE (the default), the outline is drawn only along the tops of the bars; if TRUE, outlines in between bars are also drawn. See <code>density_histogram()</code> .
<code>point_interval</code>	A function from the <code>point_interval()</code> family (e.g., <code>median_qi</code> , <code>mean_qi</code> , <code>mode_hdi</code> , etc), or a string giving the name of a function from that family (e.g., "median_qi", "mean_qi", "mode_hdi", etc; if a string, the caller's environment is searched for the function, followed by the <code>ggdist</code> environment). This function determines the point summary (typically mean, median, or mode) and interval type (quantile interval, qi; highest-density interval, hdi; or highest-density continuous interval, hdc). Output will be converted to the appropriate x- or y-based aesthetics depending on the value of <code>orientation</code> . See the <code>point_interval()</code> family of functions for more information.
<code>slab_type</code>	(deprecated) The type of slab function to calculate: probability density (or mass) function ("pdf"), cumulative distribution function ("cdf"), or complementary CDF ("ccdf"). Instead of using <code>slab_type</code> to change <code>f</code> and then mapping <code>f</code> onto an aesthetic, it is now recommended to simply map the corresponding computed variable (e.g. pdf, cdf, or 1 - cdf) directly onto the desired aesthetic.
<code>limits</code>	Manually-specified limits for the slab, as a vector of length two. These limits are combined with those computed based on <code>p_limits</code> as well as the limits defined by the scales of the plot to determine the limits used to draw the slab functions: these limits specify the maximal limits; i.e., if specified, the limits will not be wider than these (but may be narrower). Use NA to leave a limit alone; e.g. <code>limits = c(0, NA)</code> will ensure that the lower limit does not go below 0, but let the upper limit be determined by either <code>p_limits</code> or the scale settings.
<code>n</code>	Number of points at which to evaluate the function that defines the slab.
<code>.width</code>	The <code>.width</code> argument passed to <code>point_interval</code> : a vector of probabilities to use that determine the widths of the resulting intervals. If multiple probabilities are provided, multiple intervals per group are generated, each with a different probability interval (and value of the corresponding <code>.width</code> and <code>level</code> generated variables).
<code>orientation</code>	Whether this geom is drawn horizontally or vertically. One of: <ul style="list-style-type: none"> • NA (default): automatically detect the orientation based on how the aesthetics are assigned. Automatic detection works most of the time. • "horizontal" (or "y"): draw horizontally, using the y aesthetic to identify different groups. For each group, uses the x, <code>xmin</code>, <code>xmax</code>, and <code>thickness</code> aesthetics to draw points, intervals, and slabs. • "vertical" (or "x"): draw vertically, using the x aesthetic to identify different groups. For each group, uses the y, <code>ymin</code>, <code>ymax</code>, and <code>thickness</code> aesthetics to draw points, intervals, and slabs. <p>For compatibility with the base <code>ggplot</code> naming scheme for orientation, "x" can be used as an alias for "vertical" and "y" as an alias for "horizontal" (<code>ggdist</code> had an orientation parameter before base <code>ggplot</code> did, hence the discrepancy).</p>

na.rm	If FALSE, the default, missing values are removed with a warning. If TRUE, missing values are silently removed.
show.legend	Should this layer be included in the legends? Default is <code>c(size = FALSE)</code> , unlike most geoms, to match its common use cases. FALSE hides all legends, TRUE shows all legends, and NA shows only those that are mapped (the default for most geoms).
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> .

Details

To visualize sample data, such as a data distribution, samples from a bootstrap distribution, or a Bayesian posterior, you can supply samples to the `x` or `y` aesthetic.

To visualize analytical distributions, you can use the `xdist` or `ydist` aesthetic. For historical reasons, you can also use `dist` to specify the distribution, though this is not recommended as it does not work as well with orientation detection. These aesthetics can be used as follows:

- `xdist`, `ydist`, and `dist` can be any distribution object from the `distributional` package (`dist_normal()`, `dist_beta()`, etc) or can be a `posterior::rvar()` object. Since these functions are vectorized, other columns can be passed directly to them in an `aes()` specification; e.g. `aes(dist = dist_normal(mu, sigma))` will work if `mu` and `sigma` are columns in the input data frame.
- `dist` can be a character vector giving the distribution name. Then the `arg1, ... arg9` aesthetics (or `args` as a list column) specify distribution arguments. Distribution names should correspond to R functions that have "p", "q", and "d" functions; e.g. "norm" is a valid distribution name because R defines the `pnorm()`, `qnorm()`, and `dnorm()` functions for Normal distributions.

See the `parse_dist()` function for a useful way to generate `dist` and `args` values from human-readable distribution specs (like `"normal(0, 1)"`). Such specs are also produced by other packages (like the `brms::get_prior` function in `brms`); thus, `parse_dist()` combined with the stats described here can help you visualize the output of those functions.

Value

A `ggplot2::Stat` representing a eye (violin + interval) geometry which can be added to a `ggplot()` object.

Computed Variables

The following variables are computed by this stat and made available for use in aesthetic specifications (`aes()`) using the `after_stat()` function or the `after_stat` argument of `stage()`:

- `x` or `y`: For slabs, the input values to the slab function. For intervals, the point summary from the interval function. Whether it is `x` or `y` depends on `orientation`.
- `xmin` or `ymin`: For intervals, the lower end of the interval from the interval function.
- `xmax` or `ymax`: For intervals, the upper end of the interval from the interval function.
- `.width`: For intervals, the interval width as a numeric value in $[0, 1]$. For slabs, the width of the smallest interval containing that value of the slab.

- `level`: For intervals, the interval width as an ordered factor. For slabs, the level of the smallest interval containing that value of the slab.
- `pdf`: For slabs, the probability density function (PDF). If `options("ggdist.experimental.slab_data_in_intervals")` is TRUE: For intervals, the PDF at the point summary; intervals also have `pdf_min` and `pdf_max` for the PDF at the lower and upper ends of the interval.
- `cdf`: For slabs, the cumulative distribution function. If `options("ggdist.experimental.slab_data_in_intervals")` is TRUE: For intervals, the CDF at the point summary; intervals also have `cdf_min` and `cdf_max` for the CDF at the lower and upper ends of the interval.
- `n`: For slabs, the number of data points summarized into that slab. If the slab was created from an analytical distribution via the `xdist`, `ydist`, or `dist` aesthetic, `n` will be `Inf`.
- `f`: (deprecated) For slabs, the output values from the slab function (such as the PDF, CDF, or CCDF), determined by `slab_type`. Instead of using `slab_type` to change `f` and then mapping `f` onto an aesthetic, it is now recommended to simply map the corresponding computed variable (e.g. `pdf`, `cdf`, or `1 - cdf`) directly onto the desired aesthetic.

Aesthetics

The slab+interval stats and geoms have a wide variety of aesthetics that control the appearance of their three sub-geometries: the **slab**, the **point**, and the **interval**.

These stats support the following aesthetics:

- `x`: x position of the geometry (when `orientation = "vertical"`); or sample data to be summarized (when `orientation = "horizontal"` with sample data).
- `y`: y position of the geometry (when `orientation = "horizontal"`); or sample data to be summarized (when `orientation = "vertical"` with sample data).
- `weight`: When using samples (i.e. the `x` and `y` aesthetics, not `xdist` or `ydist`), optional weights to be applied to each draw.
- `xdist`: When using analytical distributions, distribution to map on the x axis: a **distributional** object (e.g. `dist_normal()`) or a `posterior::rvar()` object.
- `ydist`: When using analytical distributions, distribution to map on the y axis: a **distributional** object (e.g. `dist_normal()`) or a `posterior::rvar()` object.
- `dist`: When using analytical distributions, a name of a distribution (e.g. `"norm"`), a **distributional** object (e.g. `dist_normal()`), or a `posterior::rvar()` object. See **Details**.
- `args`: Distribution arguments (`args` or `arg1, ... arg9`). See **Details**.

In addition, in their default configuration (paired with `geom_slabinterval()`) the following aesthetics are supported by the underlying geom:

Slab-specific aesthetics

- `thickness`: The thickness of the slab at each x value (if `orientation = "horizontal"`) or y value (if `orientation = "vertical"`) of the slab.
- `side`: Which side to place the slab on. `"topright"`, `"top"`, and `"right"` are synonyms which cause the slab to be drawn on the top or the right depending on if `orientation` is `"horizontal"` or `"vertical"`. `"bottomleft"`, `"bottom"`, and `"left"` are synonyms which cause the slab to be drawn on the bottom or the left depending on if `orientation`

is "horizontal" or "vertical". "topleft" causes the slab to be drawn on the top or the left, and "bottomright" causes the slab to be drawn on the bottom or the right. "both" draws the slab mirrored on both sides (as in a violin plot).

- **scale**: What proportion of the region allocated to this geom to use to draw the slab. If `scale = 1`, slabs that use the maximum range will just touch each other. Default is `0.9` to leave some space between adjacent slabs. For a comprehensive discussion and examples of slab scaling and normalization, see the [thickness scale article](#).
- **justification**: Justification of the interval relative to the slab, where `0` indicates bottom/left justification and `1` indicates top/right justification (depending on orientation). If `justification` is `NULL` (the default), then it is set automatically based on the value of `side`: when `side` is "top"/"right" justification is set to `0`, when `side` is "bottom"/"left" justification is set to `1`, and when `side` is "both" justification is set to `0.5`.
- **datatype**: When using composite geoms directly without a stat (e.g. `geom_slabinterval()`), `datatype` is used to indicate which part of the geom a row in the data targets: rows with `datatype = "slab"` target the slab portion of the geometry and rows with `datatype = "interval"` target the interval portion of the geometry. This is set automatically when using `ggdist` stats.

Interval-specific aesthetics

- **xmin**: Left end of the interval sub-geometry (if `orientation = "horizontal"`).
- **xmax**: Right end of the interval sub-geometry (if `orientation = "horizontal"`).
- **ymin**: Lower end of the interval sub-geometry (if `orientation = "vertical"`).
- **ymax**: Upper end of the interval sub-geometry (if `orientation = "vertical"`).

Point-specific aesthetics

- **shape**: Shape type used to draw the **point** sub-geometry.

Color aesthetics

- **colour**: (or `color`) The color of the **interval** and **point** sub-geometries. Use the `slab_color`, `interval_color`, or `point_color` aesthetics (below) to set sub-geometry colors separately.
- **fill**: The fill color of the **slab** and **point** sub-geometries. Use the `slab_fill` or `point_fill` aesthetics (below) to set sub-geometry colors separately.
- **alpha**: The opacity of the **slab**, **interval**, and **point** sub-geometries. Use the `slab_alpha`, `interval_alpha`, or `point_alpha` aesthetics (below) to set sub-geometry colors separately.
- **colour_ramp**: (or `color_ramp`) A secondary scale that modifies the color scale to "ramp" to another color. See `scale_colour_ramp()` for examples.
- **fill_ramp**: A secondary scale that modifies the fill scale to "ramp" to another color. See `scale_fill_ramp()` for examples.

Line aesthetics

- **linewidth**: Width of the line used to draw the **interval** (except with `geom_slab()`: then it is the width of the **slab**). With composite geometries including an interval and slab, use `slab_linewidth` to set the line width of the **slab** (see below). For **interval**, raw `linewidth` values are transformed according to the `interval_size_domain` and `interval_size_range` parameters of the geom (see above).

- **size**: Determines the size of the **point**. If **linewidth** is not provided, **size** will also determine the width of the line used to draw the **interval** (this allows line width and point size to be modified together by setting only **size** and not **linewidth**). Raw **size** values are transformed according to the **interval_size_domain**, **interval_size_range**, and **fatten_point** parameters of the geom (see above). Use the **point_size** aesthetic (below) to set sub-geometry size directly without applying the effects of **interval_size_domain**, **interval_size_range**, and **fatten_point**.
- **stroke**: Width of the outline around the **point** sub-geometry.
- **linetype**: Type of line (e.g., "solid", "dashed", etc) used to draw the **interval** and the outline of the **slab** (if it is visible). Use the **slab_linetype** or **interval_linetype** aesthetics (below) to set sub-geometry line types separately.

Slab-specific color and line override aesthetics

- **slab_fill**: Override for **fill**: the fill color of the slab.
- **slab_colour**: (or **slab_color**) Override for **colour/color**: the outline color of the slab.
- **slab_alpha**: Override for **alpha**: the opacity of the slab.
- **slab_linewidth**: Override for **linewidth**: the width of the outline of the slab.
- **slab_linetype**: Override for **linetype**: the line type of the outline of the slab.

Interval-specific color and line override aesthetics

- **interval_colour**: (or **interval_color**) Override for **colour/color**: the color of the interval.
- **interval_alpha**: Override for **alpha**: the opacity of the interval.
- **interval_linetype**: Override for **linetype**: the line type of the interval.

Point-specific color and line override aesthetics

- **point_fill**: Override for **fill**: the fill color of the point.
- **point_colour**: (or **point_color**) Override for **colour/color**: the outline color of the point.
- **point_alpha**: Override for **alpha**: the opacity of the point.
- **point_size**: Override for **size**: the size of the point.

Deprecated aesthetics

- **slab_size**: Use **slab_linewidth**.
- **interval_size**: Use **interval_linewidth**.

Other aesthetics (these work as in standard geoms)

- **width**
- **height**
- **group**

See examples of some of these aesthetics in action in `vignette("slabinterval")`. Learn more about the sub-geom override aesthetics (like **interval_color**) in the [scales](#) documentation. Learn more about basic ggplot aesthetics in `vignette("ggplot2-specs")`.

See Also

See [geom_slabinterval\(\)](#) for the geom underlying this stat. See [stat_slabinterval\(\)](#) for the stat this shortcut is based on.

Other slabinterval stats: [stat_ccdfinterval\(\)](#), [stat_cdfinterval\(\)](#), [stat_gradientinterval\(\)](#), [stat_halfeye\(\)](#), [stat_histinterval\(\)](#), [stat_interval\(\)](#), [stat_pointinterval\(\)](#), [stat_slab\(\)](#), [stat_spike\(\)](#)

Examples

```
library(dplyr)
library(ggplot2)
library(distributional)

theme_set(theme_ggdist())

# ON SAMPLE DATA
set.seed(1234)
df = data.frame(
  group = c("a", "b", "c"),
  value = rnorm(1500, mean = c(5, 7, 9), sd = c(1, 1.5, 1))
)
df %>%
  ggplot(aes(x = value, y = group)) +
  stat_eye()

# ON ANALYTICAL DISTRIBUTIONS
dist_df = data.frame(
  group = c("a", "b", "c"),
  mean = c( 5,  7,  8),
  sd = c( 1, 1.5,  1)
)
# Vectorized distribution types, like distributional::dist_normal()
# and posterior::rvar(), can be used with the `xdist` / `ydist` aesthetics
dist_df %>%
  ggplot(aes(y = group, xdist = dist_normal(mean, sd))) +
  stat_eye()
```

stat_gradientinterval *Gradient + interval plot (shortcut stat)*

Description

Shortcut version of [stat_slabinterval\(\)](#) with [geom_slabinterval\(\)](#) for creating gradient + interval plots.

Roughly equivalent to:

```
stat_slabinterval(
  aes(
```

```

    justification = after_stat(0.5),
    thickness = after_stat(thickness(1)),
    slab_alpha = after_stat(f)
  ),
  fill_type = "auto",
  show.legend = c(size = FALSE, slab_alpha = FALSE)
)

```

If your graphics device supports it, it is recommended to use this stat with `fill_type = "gradient"` (see the description of that parameter). On R \geq 4.2, support for `fill_type = "gradient"` should be auto-detected based on the graphics device you are using.

Usage

```

stat_gradientinterval(
  mapping = NULL,
  data = NULL,
  geom = "slabinterval",
  position = "identity",
  ...,
  fill_type = "auto",
  p_limits = c(NA, NA),
  density = "bounded",
  adjust = waiver(),
  trim = TRUE,
  expand = FALSE,
  breaks = waiver(),
  align = "none",
  outline_bars = FALSE,
  point_interval = "median_qi",
  slab_type = NULL,
  limits = NULL,
  n = 501,
  .width = c(0.66, 0.95),
  orientation = NA,
  na.rm = FALSE,
  show.legend = c(size = FALSE, slab_alpha = FALSE),
  inherit.aes = TRUE
)

```

Arguments

mapping	Set of aesthetic mappings created by <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 `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)`).

geom	Use to override the default connection between <code>stat_gradientinterval()</code> and <code>geom_slabinterval()</code>
position	Position adjustment, either as a string, or the result of a call to a position adjustment function. Setting this equal to "dodge" (<code>position_dodge()</code>) or "dodgejust" (<code>position_dodgejust()</code>) can be useful if you have overlapping geometries.
...	Other arguments passed to <code>layer()</code> . These are often aesthetics, used to set an aesthetic to a fixed value, like <code>colour = "red"</code> or <code>linewidth = 3</code> (see Aesthetics , below). They may also be parameters to the paired geom/stat. When paired with the default geom, <code>geom_slabinterval()</code> , these include:

`normalize` How to normalize heights of functions input to the thickness aesthetic. One of:

- "all": normalize so that the maximum height across all data is 1.
- "panels": normalize within panels so that the maximum height in each panel is 1.
- "xy": normalize within the x/y axis opposite the orientation of this geom so that the maximum height at each value of the opposite axis is 1.
- "groups": normalize within values of the opposite axis and within each group so that the maximum height in each group is 1.
- "none": values are taken as is with no normalization (this should probably only be used with functions whose values are in [0,1], such as CDFs).

For a comprehensive discussion and examples of slab scaling and normalization, see the [thickness scale article](#).

`interval_size_domain` A length-2 numeric vector giving the minimum and maximum of the values of the size and linewidth aesthetics that will be translated into actual sizes for intervals drawn according to `interval_size_range` (see the documentation for that argument.)

`interval_size_range` A length-2 numeric vector. This geom scales the raw size aesthetic values when drawing interval and point sizes, as they tend to be too thick when using the default settings of `scale_size_continuous()`, which give sizes with a range of `c(1, 6)`. The `interval_size_domain` value indicates the input domain of raw size values (typically this should be equal to the value of the range argument of the `scale_size_continuous()` function), and `interval_size_range` indicates the desired output range of the size values (the min and max of the actual sizes used to draw intervals). Most of the time it is not recommended to change the value of this argument, as it may result in strange scaling of legends; this argument is a holdover from earlier versions that did not have size aesthetics targeting

the point and interval separately. If you want to adjust the size of the interval or points separately, you can also use the `linewidth` or `point_size` aesthetics; see [sub-geometry-scales](#).

`fatten_point` A multiplicative factor used to adjust the size of the point relative to the size of the thickest interval line. If you wish to specify point sizes directly, you can also use the `point_size` aesthetic and [scale_point_size_continuous\(\)](#) or [scale_point_size_discrete\(\)](#); sizes specified with that aesthetic will not be adjusted using `fatten_point`.

`arrow` [grid::arrow\(\)](#) giving the arrow heads to use on the interval, or `NULL` for no arrows.

`subguide` Sub-guide used to annotate the thickness scale. One of:

- A function that takes a `scale` argument giving a [ggplot2::Scale](#) object and an `orientation` argument giving the orientation of the geometry and then returns a [grid::grob](#) that will draw the axis annotation, such as [subguide_axis\(\)](#) (to draw a traditional axis) or [subguide_none\(\)](#) (to draw no annotation). See [subguide_axis\(\)](#) for a list of possibilities and examples.
- A string giving the name of such a function when prefixed with "subguide"; e.g. "axis" or "none".

`fill_type`

What type of fill to use when the fill color or alpha varies within a slab. One of:

- "segments": breaks up the slab geometry into segments for each unique combination of fill color and alpha value. This approach is supported by all graphics devices and works well for sharp cutoff values, but can give ugly results if a large number of unique fill colors are being used (as in gradients, like in [stat_gradientinterval\(\)](#)).
- "gradient": a [grid::linearGradient\(\)](#) is used to create a smooth gradient fill. This works well for large numbers of unique fill colors, but requires R \geq 4.1 and is not yet supported on all graphics devices. As of this writing, the `png()` graphics device with `type = "cairo"`, the `svg()` device, the `pdf()` device, and the `ragg::agg_png()` devices are known to support this option. On R $<$ 4.1, this option will fall back to `fill_type = "segments"` with a message.
- "auto": attempts to use `fill_type = "gradient"` if support for it can be auto-detected. On R \geq 4.2, support for gradients can be auto-detected on some graphics devices; if support is not detected, this option will fall back to `fill_type = "segments"` (in case of a false negative, `fill_type = "gradient"` can be set explicitly). On R $<$ 4.2, support for gradients cannot be auto-detected, so this will always fall back to `fill_type = "segments"`, in which case you can set `fill_type = "gradient"` explicitly if you are using a graphics device that support gradients.

`p_limits`

Probability limits (as a vector of size 2) used to determine the lower and upper limits of *theoretical* distributions (distributions from *samples* ignore this parameter and determine their limits based on the limits of the sample). E.g., if this is `c(.001, .999)`, then a slab is drawn for the distribution from the quantile at $p = .001$ to the quantile at $p = .999$. If the lower (respectively upper) limit is `NA`, then the lower (upper) limit will be the minimum (maximum) of the distribution's support if it is finite, and `0.001` (`0.999`) if it is not finite. E.g., if `p_limits`

is `c(NA, NA)`, on a gamma distribution the effective value of `p_limits` would be `c(0, .999)` since the gamma distribution is defined on $(0, \text{Inf})$; whereas on a normal distribution it would be equivalent to `c(.001, .999)` since the normal distribution is defined on $(-\text{Inf}, \text{Inf})$.

density	<p>Density estimator for sample data. One of:</p> <ul style="list-style-type: none"> • A function which takes a numeric vector and returns a list with elements <code>x</code> (giving grid points for the density estimator) and <code>y</code> (the corresponding densities). <code>ggdist</code> provides a family of functions following this format, including <code>density_unbounded()</code> and <code>density_bounded()</code>. This format is also compatible with <code>stats::density()</code>. • A string giving the suffix of a function name that starts with "density_"; e.g. "bounded" for <code>[density_bounded()]</code>, "unbounded" for <code>[density_unbounded()]</code>, or "histogram" for <code>density_histogram()</code>. Defaults to "bounded", i.e. <code>density_bounded()</code>, which estimates the bounds from the data and then uses a bounded density estimator based on the reflection method.
adjust	<p>Passed to density: the bandwidth for the density estimator for sample data is adjusted by multiplying it by this value. See e.g. <code>density_bounded()</code> for more information. Default (<code>waiver()</code>) defers to the default of the density estimator, which is usually 1.</p>
trim	<p>For sample data, should the density estimate be trimmed to the range of the data? Passed on to the density estimator; see the density parameter. Default TRUE.</p>
expand	<p>For sample data, should the slab be expanded to the limits of the scale? Default FALSE. Can be length two to control expansion to the lower and upper limit respectively.</p>
breaks	<p>Determines the breakpoints defining bins. Defaults to "Scott". Similar to (but not exactly the same as) the <code>breaks</code> argument to <code>graphics::hist()</code>. One of:</p> <ul style="list-style-type: none"> • A scalar (length-1) numeric giving the number of bins • A vector numeric giving the breakpoints between histogram bins • A function taking <code>x</code> and <code>weights</code> and returning either the number of bins or a vector of breakpoints • A string giving the suffix of a function that starts with "breaks_". <code>ggdist</code> provides weighted implementations of the "Sturges", "Scott", and "FD" break-finding algorithms from <code>graphics::hist()</code>, as well as <code>breaks_fixed()</code> for manually setting the bin width. See <code>breaks</code>. <p>For example, <code>breaks = "Sturges"</code> will use the <code>breaks_Sturges()</code> algorithm, <code>breaks = 9</code> will create 9 bins, and <code>breaks = breaks_fixed(width = 1)</code> will set the bin width to 1.</p>
align	<p>Determines how to align the breakpoints defining bins. Default ("none") performs no alignment. One of:</p> <ul style="list-style-type: none"> • A scalar (length-1) numeric giving an offset that is subtracted from the breaks. The offset must be between 0 and the bin width. • A function taking a sorted vector of breaks (bin edges) and returning an offset to subtract from the breaks. • A string giving the suffix of a function that starts with "align_" used to determine the alignment, such as <code>align_none()</code>, <code>align_boundary()</code>, or <code>align_center()</code>.

For example, `align = "none"` will provide no alignment, `align = align_center(at = 0)` will center a bin on 0, and `align = align_boundary(at = 0)` will align a bin edge on 0.

<code>outline_bars</code>	For sample data (if <code>density</code> is "histogram") and for discrete analytical distributions (whose slabs are drawn as histograms), determines if outlines in between the bars are drawn when the <code>slab_color</code> aesthetic is used. If <code>FALSE</code> (the default), the outline is drawn only along the tops of the bars; if <code>TRUE</code> , outlines in between bars are also drawn. See <code>density_histogram()</code> .
<code>point_interval</code>	A function from the <code>point_interval()</code> family (e.g., <code>median_qi</code> , <code>mean_qi</code> , <code>mode_hdi</code> , etc), or a string giving the name of a function from that family (e.g., "median_qi", "mean_qi", "mode_hdi", etc; if a string, the caller's environment is searched for the function, followed by the <code>ggdist</code> environment). This function determines the point summary (typically mean, median, or mode) and interval type (quantile interval, qi; highest-density interval, hdi; or highest-density continuous interval, hdi). Output will be converted to the appropriate x- or y-based aesthetics depending on the value of <code>orientation</code> . See the <code>point_interval()</code> family of functions for more information.
<code>slab_type</code>	(deprecated) The type of slab function to calculate: probability density (or mass) function ("pdf"), cumulative distribution function ("cdf"), or complementary CDF ("ccdf"). Instead of using <code>slab_type</code> to change <code>f</code> and then mapping <code>f</code> onto an aesthetic, it is now recommended to simply map the corresponding computed variable (e.g. pdf, cdf, or 1 - cdf) directly onto the desired aesthetic.
<code>limits</code>	Manually-specified limits for the slab, as a vector of length two. These limits are combined with those computed based on <code>p_limits</code> as well as the limits defined by the scales of the plot to determine the limits used to draw the slab functions: these limits specify the maximal limits; i.e., if specified, the limits will not be wider than these (but may be narrower). Use <code>NA</code> to leave a limit alone; e.g. <code>limits = c(0, NA)</code> will ensure that the lower limit does not go below 0, but let the upper limit be determined by either <code>p_limits</code> or the scale settings.
<code>n</code>	Number of points at which to evaluate the function that defines the slab.
<code>.width</code>	The <code>.width</code> argument passed to <code>point_interval</code> : a vector of probabilities to use that determine the widths of the resulting intervals. If multiple probabilities are provided, multiple intervals per group are generated, each with a different probability interval (and value of the corresponding <code>.width</code> and <code>level</code> generated variables).
<code>orientation</code>	Whether this geom is drawn horizontally or vertically. One of: <ul style="list-style-type: none"> • <code>NA</code> (default): automatically detect the orientation based on how the aesthetics are assigned. Automatic detection works most of the time. • "horizontal" (or "y"): draw horizontally, using the <code>y</code> aesthetic to identify different groups. For each group, uses the <code>x</code>, <code>xmin</code>, <code>xmax</code>, and <code>thickness</code> aesthetics to draw points, intervals, and slabs. • "vertical" (or "x"): draw vertically, using the <code>x</code> aesthetic to identify different groups. For each group, uses the <code>y</code>, <code>ymin</code>, <code>ymax</code>, and <code>thickness</code> aesthetics to draw points, intervals, and slabs.

For compatibility with the base `ggplot` naming scheme for `orientation`, "x" can be used as an alias for "vertical" and "y" as an alias for "horizontal"

	(<code>ggdist</code> had an orientation parameter before base <code>ggplot</code> did, hence the discrepancy).
<code>na.rm</code>	If <code>FALSE</code> , the default, missing values are removed with a warning. If <code>TRUE</code> , missing values are silently removed.
<code>show.legend</code>	Should this layer be included in the legends? Default is <code>c(size = FALSE)</code> , unlike most geoms, to match its common use cases. <code>FALSE</code> hides all legends, <code>TRUE</code> shows all legends, and <code>NA</code> shows only those that are mapped (the default for most geoms).
<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> .

Details

To visualize sample data, such as a data distribution, samples from a bootstrap distribution, or a Bayesian posterior, you can supply samples to the `x` or `y` aesthetic.

To visualize analytical distributions, you can use the `xdist` or `ydist` aesthetic. For historical reasons, you can also use `dist` to specify the distribution, though this is not recommended as it does not work as well with orientation detection. These aesthetics can be used as follows:

- `xdist`, `ydist`, and `dist` can be any distribution object from the `distributional` package (`dist_normal()`, `dist_beta()`, etc) or can be a `posterior::rvar()` object. Since these functions are vectorized, other columns can be passed directly to them in an `aes()` specification; e.g. `aes(dist = dist_normal(mu, sigma))` will work if `mu` and `sigma` are columns in the input data frame.
- `dist` can be a character vector giving the distribution name. Then the `arg1`, ... `arg9` aesthetics (or `args` as a list column) specify distribution arguments. Distribution names should correspond to R functions that have "p", "q", and "d" functions; e.g. "norm" is a valid distribution name because R defines the `pnorm()`, `qnorm()`, and `dnorm()` functions for Normal distributions.

See the `parse_dist()` function for a useful way to generate `dist` and `args` values from human-readable distribution specs (like "normal(0,1)"). Such specs are also produced by other packages (like the `brms::get_prior` function in `brms`); thus, `parse_dist()` combined with the stats described here can help you visualize the output of those functions.

Value

A `ggplot2::Stat` representing a gradient + interval geometry which can be added to a `ggplot()` object.

Computed Variables

The following variables are computed by this stat and made available for use in aesthetic specifications (`aes()`) using the `after_stat()` function or the `after_stat` argument of `stage()`:

- `x` or `y`: For slabs, the input values to the slab function. For intervals, the point summary from the interval function. Whether it is `x` or `y` depends on `orientation`
- `xmin` or `ymin`: For intervals, the lower end of the interval from the interval function.
- `xmax` or `ymax`: For intervals, the upper end of the interval from the interval function.

- `.width`: For intervals, the interval width as a numeric value in $[0, 1]$. For slabs, the width of the smallest interval containing that value of the slab.
- `level`: For intervals, the interval width as an ordered factor. For slabs, the level of the smallest interval containing that value of the slab.
- `pdf`: For slabs, the probability density function (PDF). If `options("ggdist.experimental.slab_data_in_intervals")` is TRUE: For intervals, the PDF at the point summary; intervals also have `pdf_min` and `pdf_max` for the PDF at the lower and upper ends of the interval.
- `cdf`: For slabs, the cumulative distribution function. If `options("ggdist.experimental.slab_data_in_intervals")` is TRUE: For intervals, the CDF at the point summary; intervals also have `cdf_min` and `cdf_max` for the CDF at the lower and upper ends of the interval.
- `n`: For slabs, the number of data points summarized into that slab. If the slab was created from an analytical distribution via the `xdist`, `ydist`, or `dist` aesthetic, `n` will be `Inf`.
- `f`: (deprecated) For slabs, the output values from the slab function (such as the PDF, CDF, or CCDF), determined by `slab_type`. Instead of using `slab_type` to change `f` and then mapping `f` onto an aesthetic, it is now recommended to simply map the corresponding computed variable (e.g. `pdf`, `cdf`, or `1 - cdf`) directly onto the desired aesthetic.

Aesthetics

The slab+interval stats and geoms have a wide variety of aesthetics that control the appearance of their three sub-geometries: the **slab**, the **point**, and the **interval**.

These stats support the following aesthetics:

- `x`: x position of the geometry (when `orientation = "vertical"`); or sample data to be summarized (when `orientation = "horizontal"` with sample data).
- `y`: y position of the geometry (when `orientation = "horizontal"`); or sample data to be summarized (when `orientation = "vertical"` with sample data).
- `weight`: When using samples (i.e. the `x` and `y` aesthetics, not `xdist` or `ydist`), optional weights to be applied to each draw.
- `xdist`: When using analytical distributions, distribution to map on the x axis: a **distributional** object (e.g. `dist_normal()`) or a `posterior::rvar()` object.
- `ydist`: When using analytical distributions, distribution to map on the y axis: a **distributional** object (e.g. `dist_normal()`) or a `posterior::rvar()` object.
- `dist`: When using analytical distributions, a name of a distribution (e.g. `"norm"`), a **distributional** object (e.g. `dist_normal()`), or a `posterior::rvar()` object. See **Details**.
- `args`: Distribution arguments (`args` or `arg1, ... arg9`). See **Details**.

In addition, in their default configuration (paired with `geom_slabinterval()`) the following aesthetics are supported by the underlying geom:

Slab-specific aesthetics

- `thickness`: The thickness of the slab at each x value (if `orientation = "horizontal"`) or y value (if `orientation = "vertical"`) of the slab.

- **side**: Which side to place the slab on. "topright", "top", and "right" are synonyms which cause the slab to be drawn on the top or the right depending on if orientation is "horizontal" or "vertical". "bottomleft", "bottom", and "left" are synonyms which cause the slab to be drawn on the bottom or the left depending on if orientation is "horizontal" or "vertical". "topleft" causes the slab to be drawn on the top or the left, and "bottomright" causes the slab to be drawn on the bottom or the right. "both" draws the slab mirrored on both sides (as in a violin plot).
- **scale**: What proportion of the region allocated to this geom to use to draw the slab. If scale = 1, slabs that use the maximum range will just touch each other. Default is 0.9 to leave some space between adjacent slabs. For a comprehensive discussion and examples of slab scaling and normalization, see the [thickness scale article](#).
- **justification**: Justification of the interval relative to the slab, where 0 indicates bottom/left justification and 1 indicates top/right justification (depending on orientation). If justification is NULL (the default), then it is set automatically based on the value of side: when side is "top"/"right" justification is set to 0, when side is "bottom"/"left" justification is set to 1, and when side is "both" justification is set to 0.5.
- **datatype**: When using composite geoms directly without a stat (e.g. `geom_slabinterval()`), datatype is used to indicate which part of the geom a row in the data targets: rows with datatype = "slab" target the slab portion of the geometry and rows with datatype = "interval" target the interval portion of the geometry. This is set automatically when using ggdist stats.

Interval-specific aesthetics

- **xmin**: Left end of the interval sub-geometry (if orientation = "horizontal").
- **xmax**: Right end of the interval sub-geometry (if orientation = "horizontal").
- **ymin**: Lower end of the interval sub-geometry (if orientation = "vertical").
- **ymax**: Upper end of the interval sub-geometry (if orientation = "vertical").

Point-specific aesthetics

- **shape**: Shape type used to draw the **point** sub-geometry.

Color aesthetics

- **colour**: (or **color**) The color of the **interval** and **point** sub-geometries. Use the `slab_color`, `interval_color`, or `point_color` aesthetics (below) to set sub-geometry colors separately.
- **fill**: The fill color of the **slab** and **point** sub-geometries. Use the `slab_fill` or `point_fill` aesthetics (below) to set sub-geometry colors separately.
- **alpha**: The opacity of the **slab**, **interval**, and **point** sub-geometries. Use the `slab_alpha`, `interval_alpha`, or `point_alpha` aesthetics (below) to set sub-geometry colors separately.
- **colour_ramp**: (or **color_ramp**) A secondary scale that modifies the color scale to "ramp" to another color. See [scale_colour_ramp\(\)](#) for examples.
- **fill_ramp**: A secondary scale that modifies the fill scale to "ramp" to another color. See [scale_fill_ramp\(\)](#) for examples.

Line aesthetics

- **linewidth**: Width of the line used to draw the **interval** (except with `geom_slab()`: then it is the width of the **slab**). With composite geometries including an interval and slab, use `slab_linewidth` to set the line width of the **slab** (see below). For **interval**, raw linewidth values are transformed according to the `interval_size_domain` and `interval_size_range` parameters of the geom (see above).
- **size**: Determines the size of the **point**. If `linewidth` is not provided, `size` will also determine the width of the line used to draw the **interval** (this allows line width and point size to be modified together by setting only `size` and not `linewidth`). Raw size values are transformed according to the `interval_size_domain`, `interval_size_range`, and `fatten_point` parameters of the geom (see above). Use the `point_size` aesthetic (below) to set sub-geometry size directly without applying the effects of `interval_size_domain`, `interval_size_range`, and `fatten_point`.
- **stroke**: Width of the outline around the **point** sub-geometry.
- **linetype**: Type of line (e.g., "solid", "dashed", etc) used to draw the **interval** and the outline of the **slab** (if it is visible). Use the `slab_linetype` or `interval_linetype` aesthetics (below) to set sub-geometry line types separately.

Slab-specific color and line override aesthetics

- `slab_fill`: Override for `fill`: the fill color of the slab.
- `slab_colour`: (or `slab_color`) Override for `colour/color`: the outline color of the slab.
- `slab_alpha`: Override for `alpha`: the opacity of the slab.
- `slab_linewidth`: Override for `linewidth`: the width of the outline of the slab.
- `slab_linetype`: Override for `linetype`: the line type of the outline of the slab.

Interval-specific color and line override aesthetics

- `interval_colour`: (or `interval_color`) Override for `colour/color`: the color of the interval.
- `interval_alpha`: Override for `alpha`: the opacity of the interval.
- `interval_linetype`: Override for `linetype`: the line type of the interval.

Point-specific color and line override aesthetics

- `point_fill`: Override for `fill`: the fill color of the point.
- `point_colour`: (or `point_color`) Override for `colour/color`: the outline color of the point.
- `point_alpha`: Override for `alpha`: the opacity of the point.
- `point_size`: Override for `size`: the size of the point.

Deprecated aesthetics

- `slab_size`: Use `slab_linewidth`.
- `interval_size`: Use `interval_linewidth`.

Other aesthetics (these work as in standard geoms)

- width
- height
- group

See examples of some of these aesthetics in action in `vignette("slabinterval")`. Learn more about the sub-geom override aesthetics (like `interval_color`) in the [scales](#) documentation. Learn more about basic ggplot aesthetics in `vignette("ggplot2-specs")`.

See Also

See [geom_slabinterval\(\)](#) for the geom underlying this stat. See [stat_slabinterval\(\)](#) for the stat this shortcut is based on.

Other slabinterval stats: [stat_ccdfinterval\(\)](#), [stat_cdfinterval\(\)](#), [stat_eye\(\)](#), [stat_halfeye\(\)](#), [stat_histinterval\(\)](#), [stat_interval\(\)](#), [stat_pointinterval\(\)](#), [stat_slab\(\)](#), [stat_spike\(\)](#)

Examples

```
library(dplyr)
library(ggplot2)
library(distributional)

theme_set(theme_ggdist())

# ON SAMPLE DATA
set.seed(1234)
df = data.frame(
  group = c("a", "b", "c"),
  value = rnorm(1500, mean = c(5, 7, 9), sd = c(1, 1.5, 1))
)
df %>%
  ggplot(aes(x = value, y = group)) +
  stat_gradientinterval()

# ON ANALYTICAL DISTRIBUTIONS
dist_df = data.frame(
  group = c("a", "b", "c"),
  mean = c( 5,  7,  8),
  sd = c( 1, 1.5,  1)
)
# Vectorized distribution types, like distributional::dist_normal()
# and posterior::rvar(), can be used with the `xdist` / `ydist` aesthetics
dist_df %>%
  ggplot(aes(y = group, xdist = dist_normal(mean, sd))) +
  stat_gradientinterval()
```

stat_halfeye	<i>Half-eye (density + interval) plot (shortcut stat)</i>
--------------	---

Description

Equivalent to `stat_slabinterval()`, whose default settings create half-eye (density + interval) plots.

Usage

```
stat_halfeye(
  mapping = NULL,
  data = NULL,
  geom = "slabinterval",
  position = "identity",
  ...,
  p_limits = c(NA, NA),
  density = "bounded",
  adjust = waiver(),
  trim = TRUE,
  expand = FALSE,
  breaks = waiver(),
  align = "none",
  outline_bars = FALSE,
  point_interval = "median_qi",
  slab_type = NULL,
  limits = NULL,
  n = 501,
  .width = c(0.66, 0.95),
  orientation = NA,
  na.rm = FALSE,
  show.legend = c(size = FALSE),
  inherit.aes = TRUE
)
```

Arguments

mapping	Set of aesthetic mappings created by <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 `data.frame`, and will be used as the layer data. A function can be created from a formula (e.g. `~ head(.x, 10)`).

`geom` Use to override the default connection between `stat_halfeye()` and `geom_slabinterval()`

`position` Position adjustment, either as a string, or the result of a call to a position adjustment function. Setting this equal to "dodge" (`position_dodge()`) or "dodgejust" (`position_dodgejust()`) can be useful if you have overlapping geometries.

... Other arguments passed to `layer()`. These are often aesthetics, used to set an aesthetic to a fixed value, like `colour = "red"` or `linewidth = 3` (see **Aesthetics**, below). They may also be parameters to the paired geom/stat. When paired with the default geom, `geom_slabinterval()`, these include:

`normalize` How to normalize heights of functions input to the thickness aesthetic. One of:

- "all": normalize so that the maximum height across all data is 1.
- "panels": normalize within panels so that the maximum height in each panel is 1.
- "xy": normalize within the x/y axis opposite the orientation of this geom so that the maximum height at each value of the opposite axis is 1.
- "groups": normalize within values of the opposite axis and within each group so that the maximum height in each group is 1.
- "none": values are taken as is with no normalization (this should probably only be used with functions whose values are in [0,1], such as CDFs).

For a comprehensive discussion and examples of slab scaling and normalization, see the [thickness scale article](#).

`fill_type` What type of fill to use when the fill color or alpha varies within a slab. One of:

- "segments": breaks up the slab geometry into segments for each unique combination of fill color and alpha value. This approach is supported by all graphics devices and works well for sharp cutoff values, but can give ugly results if a large number of unique fill colors are being used (as in gradients, like in `stat_gradientinterval()`).
- "gradient": a `grid::linearGradient()` is used to create a smooth gradient fill. This works well for large numbers of unique fill colors, but requires `R >= 4.1` and is not yet supported on all graphics devices. As of this writing, the `png()` graphics device with `type = "cairo"`, the `svg()` device, the `pdf()` device, and the `ragg::agg_png()` devices are known to support this option. On `R < 4.1`, this option will fall back to `fill_type = "segments"` with a message.
- "auto": attempts to use `fill_type = "gradient"` if support for it can be auto-detected. On `R >= 4.2`, support for gradients can be auto-detected on some graphics devices; if support is not detected, this option will fall back to `fill_type = "segments"` (in case of a false negative, `fill_type = "gradient"` can be set explicitly). On `R < 4.2`, support for gradients cannot be auto-detected, so this will always fall back

to `fill_type = "segments"`, in which case you can set `fill_type = "gradient"` explicitly if you are using a graphics device that support gradients.

`interval_size_domain` A length-2 numeric vector giving the minimum and maximum of the values of the size and linewidth aesthetics that will be translated into actual sizes for intervals drawn according to `interval_size_range` (see the documentation for that argument.)

`interval_size_range` A length-2 numeric vector. This geom scales the raw size aesthetic values when drawing interval and point sizes, as they tend to be too thick when using the default settings of `scale_size_continuous()`, which give sizes with a range of `c(1, 6)`. The `interval_size_domain` value indicates the input domain of raw size values (typically this should be equal to the value of the range argument of the `scale_size_continuous()` function), and `interval_size_range` indicates the desired output range of the size values (the min and max of the actual sizes used to draw intervals). Most of the time it is not recommended to change the value of this argument, as it may result in strange scaling of legends; this argument is a holdover from earlier versions that did not have size aesthetics targeting the point and interval separately. If you want to adjust the size of the interval or points separately, you can also use the `linewidth` or `point_size` aesthetics; see [sub-geometry-scales](#).

`fatten_point` A multiplicative factor used to adjust the size of the point relative to the size of the thickest interval line. If you wish to specify point sizes directly, you can also use the `point_size` aesthetic and `scale_point_size_continuous()` or `scale_point_size_discrete()`; sizes specified with that aesthetic will not be adjusted using `fatten_point`.

arrow `grid::arrow()` giving the arrow heads to use on the interval, or `NULL` for no arrows.

`subguide` Sub-guide used to annotate the thickness scale. One of:

- A function that takes a scale argument giving a `ggplot2::Scale` object and an orientation argument giving the orientation of the geometry and then returns a `grid::grob` that will draw the axis annotation, such as `subguide_axis()` (to draw a traditional axis) or `subguide_none()` (to draw no annotation). See `subguide_axis()` for a list of possibilities and examples.
- A string giving the name of such a function when prefixed with "subguide"; e.g. "axis" or "none".

`p_limits`

Probability limits (as a vector of size 2) used to determine the lower and upper limits of *theoretical* distributions (distributions from *samples* ignore this parameter and determine their limits based on the limits of the sample). E.g., if this is `c(.001, .999)`, then a slab is drawn for the distribution from the quantile at $p = .001$ to the quantile at $p = .999$. If the lower (respectively upper) limit is `NA`, then the lower (upper) limit will be the minimum (maximum) of the distribution's support if it is finite, and `0.001` (`0.999`) if it is not finite. E.g., if `p_limits` is `c(NA, NA)`, on a gamma distribution the effective value of `p_limits` would be `c(0, .999)` since the gamma distribution is defined on $(0, \text{Inf})$; whereas on a normal distribution it would be equivalent to `c(.001, .999)` since the normal distribution is defined on $(-\text{Inf}, \text{Inf})$.

density	<p>Density estimator for sample data. One of:</p> <ul style="list-style-type: none"> • A function which takes a numeric vector and returns a list with elements <code>x</code> (giving grid points for the density estimator) and <code>y</code> (the corresponding densities). ggdist provides a family of functions following this format, including <code>density_unbounded()</code> and <code>density_bounded()</code>. This format is also compatible with <code>stats::density()</code>. • A string giving the suffix of a function name that starts with "density_"; e.g. "bounded" for [<code>density_bounded()</code>], "unbounded" for [<code>density_unbounded()</code>], or "histogram" for <code>density_histogram()</code>. Defaults to "bounded", i.e. <code>density_bounded()</code>, which estimates the bounds from the data and then uses a bounded density estimator based on the reflection method.
adjust	<p>Passed to density: the bandwidth for the density estimator for sample data is adjusted by multiplying it by this value. See e.g. <code>density_bounded()</code> for more information. Default (<code>waiver()</code>) defers to the default of the density estimator, which is usually 1.</p>
trim	<p>For sample data, should the density estimate be trimmed to the range of the data? Passed on to the density estimator; see the <code>density</code> parameter. Default TRUE.</p>
expand	<p>For sample data, should the slab be expanded to the limits of the scale? Default FALSE. Can be length two to control expansion to the lower and upper limit respectively.</p>
breaks	<p>Determines the breakpoints defining bins. Defaults to "Scott". Similar to (but not exactly the same as) the <code>breaks</code> argument to <code>graphics::hist()</code>. One of:</p> <ul style="list-style-type: none"> • A scalar (length-1) numeric giving the number of bins • A vector numeric giving the breakpoints between histogram bins • A function taking <code>x</code> and <code>weights</code> and returning either the number of bins or a vector of breakpoints • A string giving the suffix of a function that starts with "breaks_". ggdist provides weighted implementations of the "Sturges", "Scott", and "FD" break-finding algorithms from <code>graphics::hist()</code>, as well as <code>breaks_fixed()</code> for manually setting the bin width. See breaks. <p>For example, <code>breaks = "Sturges"</code> will use the <code>breaks_Sturges()</code> algorithm, <code>breaks = 9</code> will create 9 bins, and <code>breaks = breaks_fixed(width = 1)</code> will set the bin width to 1.</p>
align	<p>Determines how to align the breakpoints defining bins. Default ("none") performs no alignment. One of:</p> <ul style="list-style-type: none"> • A scalar (length-1) numeric giving an offset that is subtracted from the breaks. The offset must be between 0 and the bin width. • A function taking a sorted vector of breaks (bin edges) and returning an offset to subtract from the breaks. • A string giving the suffix of a function that starts with "align_" used to determine the alignment, such as <code>align_none()</code>, <code>align_boundary()</code>, or <code>align_center()</code>. <p>For example, <code>align = "none"</code> will provide no alignment, <code>align = align_center(at = 0)</code> will center a bin on 0, and <code>align = align_boundary(at = 0)</code> will align a bin edge on 0.</p>

outline_bars	For sample data (if density is "histogram") and for discrete analytical distributions (whose slabs are drawn as histograms), determines if outlines in between the bars are drawn when the slab_color aesthetic is used. If FALSE (the default), the outline is drawn only along the tops of the bars; if TRUE, outlines in between bars are also drawn. See density_histogram() .
point_interval	A function from the point_interval() family (e.g., median_qi, mean_qi, mode_hdi, etc), or a string giving the name of a function from that family (e.g., "median_qi", "mean_qi", "mode_hdi", etc; if a string, the caller's environment is searched for the function, followed by the ggdist environment). This function determines the point summary (typically mean, median, or mode) and interval type (quantile interval, qi; highest-density interval, hdi; or highest-density continuous interval, hdi). Output will be converted to the appropriate x- or y-based aesthetics depending on the value of orientation. See the point_interval() family of functions for more information.
slab_type	(deprecated) The type of slab function to calculate: probability density (or mass) function ("pdf"), cumulative distribution function ("cdf"), or complementary CDF ("ccdf"). Instead of using slab_type to change f and then mapping f onto an aesthetic, it is now recommended to simply map the corresponding computed variable (e.g. pdf, cdf, or 1 - cdf) directly onto the desired aesthetic.
limits	Manually-specified limits for the slab, as a vector of length two. These limits are combined with those computed based on p_limits as well as the limits defined by the scales of the plot to determine the limits used to draw the slab functions: these limits specify the maximal limits; i.e., if specified, the limits will not be wider than these (but may be narrower). Use NA to leave a limit alone; e.g. limits = c(0, NA) will ensure that the lower limit does not go below 0, but let the upper limit be determined by either p_limits or the scale settings.
n	Number of points at which to evaluate the function that defines the slab.
.width	The .width argument passed to point_interval: a vector of probabilities to use that determine the widths of the resulting intervals. If multiple probabilities are provided, multiple intervals per group are generated, each with a different probability interval (and value of the corresponding .width and level generated variables).
orientation	Whether this geom is drawn horizontally or vertically. One of: <ul style="list-style-type: none"> • NA (default): automatically detect the orientation based on how the aesthetics are assigned. Automatic detection works most of the time. • "horizontal" (or "y"): draw horizontally, using the y aesthetic to identify different groups. For each group, uses the x, xmin, xmax, and thickness aesthetics to draw points, intervals, and slabs. • "vertical" (or "x"): draw vertically, using the x aesthetic to identify different groups. For each group, uses the y, ymin, ymax, and thickness aesthetics to draw points, intervals, and slabs. <p>For compatibility with the base ggplot naming scheme for orientation, "x" can be used as an alias for "vertical" and "y" as an alias for "horizontal" (ggdist had an orientation parameter before base ggplot did, hence the discrepancy).</p>

na.rm	If FALSE, the default, missing values are removed with a warning. If TRUE, missing values are silently removed.
show.legend	Should this layer be included in the legends? Default is <code>c(size = FALSE)</code> , unlike most geoms, to match its common use cases. FALSE hides all legends, TRUE shows all legends, and NA shows only those that are mapped (the default for most geoms).
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> .

Details

To visualize sample data, such as a data distribution, samples from a bootstrap distribution, or a Bayesian posterior, you can supply samples to the `x` or `y` aesthetic.

To visualize analytical distributions, you can use the `xdist` or `ydist` aesthetic. For historical reasons, you can also use `dist` to specify the distribution, though this is not recommended as it does not work as well with orientation detection. These aesthetics can be used as follows:

- `xdist`, `ydist`, and `dist` can be any distribution object from the `distributional` package (`dist_normal()`, `dist_beta()`, etc) or can be a `posterior::rvar()` object. Since these functions are vectorized, other columns can be passed directly to them in an `aes()` specification; e.g. `aes(dist = dist_normal(mu, sigma))` will work if `mu` and `sigma` are columns in the input data frame.
- `dist` can be a character vector giving the distribution name. Then the `arg1`, ... `arg9` aesthetics (or `args` as a list column) specify distribution arguments. Distribution names should correspond to R functions that have "p", "q", and "d" functions; e.g. "norm" is a valid distribution name because R defines the `pnorm()`, `qnorm()`, and `dnorm()` functions for Normal distributions.

See the `parse_dist()` function for a useful way to generate `dist` and `args` values from human-readable distribution specs (like `"normal(0, 1)"`). Such specs are also produced by other packages (like the `brms::get_prior` function in `brms`); thus, `parse_dist()` combined with the stats described here can help you visualize the output of those functions.

Value

A `ggplot2::Stat` representing a half-eye (density + interval) geometry which can be added to a `ggplot()` object.

Computed Variables

The following variables are computed by this stat and made available for use in aesthetic specifications (`aes()`) using the `after_stat()` function or the `after_stat` argument of `stage()`:

- `x` or `y`: For slabs, the input values to the slab function. For intervals, the point summary from the interval function. Whether it is `x` or `y` depends on `orientation`.
- `xmin` or `ymin`: For intervals, the lower end of the interval from the interval function.
- `xmax` or `ymax`: For intervals, the upper end of the interval from the interval function.
- `.width`: For intervals, the interval width as a numeric value in $[0, 1]$. For slabs, the width of the smallest interval containing that value of the slab.

- **level**: For intervals, the interval width as an ordered factor. For slabs, the level of the smallest interval containing that value of the slab.
- **pdf**: For slabs, the probability density function (PDF). If `options("ggdist.experimental.slab_data_in_intervals")` is TRUE: For intervals, the PDF at the point summary; intervals also have `pdf_min` and `pdf_max` for the PDF at the lower and upper ends of the interval.
- **cdf**: For slabs, the cumulative distribution function. If `options("ggdist.experimental.slab_data_in_intervals")` is TRUE: For intervals, the CDF at the point summary; intervals also have `cdf_min` and `cdf_max` for the CDF at the lower and upper ends of the interval.
- **n**: For slabs, the number of data points summarized into that slab. If the slab was created from an analytical distribution via the `xdist`, `ydist`, or `dist` aesthetic, `n` will be `Inf`.
- **f**: (deprecated) For slabs, the output values from the slab function (such as the PDF, CDF, or CCDF), determined by `slab_type`. Instead of using `slab_type` to change `f` and then mapping `f` onto an aesthetic, it is now recommended to simply map the corresponding computed variable (e.g. `pdf`, `cdf`, or `1 - cdf`) directly onto the desired aesthetic.

Aesthetics

The slab+interval stats and geoms have a wide variety of aesthetics that control the appearance of their three sub-geometries: the **slab**, the **point**, and the **interval**.

These stats support the following aesthetics:

- **x**: x position of the geometry (when `orientation = "vertical"`); or sample data to be summarized (when `orientation = "horizontal"` with sample data).
- **y**: y position of the geometry (when `orientation = "horizontal"`); or sample data to be summarized (when `orientation = "vertical"` with sample data).
- **weight**: When using samples (i.e. the `x` and `y` aesthetics, not `xdist` or `ydist`), optional weights to be applied to each draw.
- **xdist**: When using analytical distributions, distribution to map on the x axis: a **distributional** object (e.g. `dist_normal()`) or a `posterior::rvar()` object.
- **ydist**: When using analytical distributions, distribution to map on the y axis: a **distributional** object (e.g. `dist_normal()`) or a `posterior::rvar()` object.
- **dist**: When using analytical distributions, a name of a distribution (e.g. `"norm"`), a **distributional** object (e.g. `dist_normal()`), or a `posterior::rvar()` object. See **Details**.
- **args**: Distribution arguments (`args` or `arg1, ... arg9`). See **Details**.

In addition, in their default configuration (paired with `geom_slabinterval()`) the following aesthetics are supported by the underlying geom:

Slab-specific aesthetics

- **thickness**: The thickness of the slab at each `x` value (if `orientation = "horizontal"`) or `y` value (if `orientation = "vertical"`) of the slab.
- **side**: Which side to place the slab on. `"topright"`, `"top"`, and `"right"` are synonyms which cause the slab to be drawn on the top or the right depending on if `orientation` is `"horizontal"` or `"vertical"`. `"bottomleft"`, `"bottom"`, and `"left"` are synonyms which cause the slab to be drawn on the bottom or the left depending on if `orientation`

is "horizontal" or "vertical". "topleft" causes the slab to be drawn on the top or the left, and "bottomright" causes the slab to be drawn on the bottom or the right. "both" draws the slab mirrored on both sides (as in a violin plot).

- **scale**: What proportion of the region allocated to this geom to use to draw the slab. If `scale = 1`, slabs that use the maximum range will just touch each other. Default is `0.9` to leave some space between adjacent slabs. For a comprehensive discussion and examples of slab scaling and normalization, see the [thickness scale article](#).
- **justification**: Justification of the interval relative to the slab, where `0` indicates bottom/left justification and `1` indicates top/right justification (depending on orientation). If `justification` is `NULL` (the default), then it is set automatically based on the value of `side`: when `side` is "top"/"right" justification is set to `0`, when `side` is "bottom"/"left" justification is set to `1`, and when `side` is "both" justification is set to `0.5`.
- **datatype**: When using composite geoms directly without a stat (e.g. `geom_slabinterval()`), `datatype` is used to indicate which part of the geom a row in the data targets: rows with `datatype = "slab"` target the slab portion of the geometry and rows with `datatype = "interval"` target the interval portion of the geometry. This is set automatically when using `ggdist` stats.

Interval-specific aesthetics

- **xmin**: Left end of the interval sub-geometry (if `orientation = "horizontal"`).
- **xmax**: Right end of the interval sub-geometry (if `orientation = "horizontal"`).
- **ymin**: Lower end of the interval sub-geometry (if `orientation = "vertical"`).
- **ymax**: Upper end of the interval sub-geometry (if `orientation = "vertical"`).

Point-specific aesthetics

- **shape**: Shape type used to draw the **point** sub-geometry.

Color aesthetics

- **colour**: (or `color`) The color of the **interval** and **point** sub-geometries. Use the `slab_color`, `interval_color`, or `point_color` aesthetics (below) to set sub-geometry colors separately.
- **fill**: The fill color of the **slab** and **point** sub-geometries. Use the `slab_fill` or `point_fill` aesthetics (below) to set sub-geometry colors separately.
- **alpha**: The opacity of the **slab**, **interval**, and **point** sub-geometries. Use the `slab_alpha`, `interval_alpha`, or `point_alpha` aesthetics (below) to set sub-geometry colors separately.
- **colour_ramp**: (or `color_ramp`) A secondary scale that modifies the color scale to "ramp" to another color. See [scale_colour_ramp\(\)](#) for examples.
- **fill_ramp**: A secondary scale that modifies the fill scale to "ramp" to another color. See [scale_fill_ramp\(\)](#) for examples.

Line aesthetics

- **linewidth**: Width of the line used to draw the **interval** (except with `geom_slab()`: then it is the width of the **slab**). With composite geometries including an interval and slab, use `slab_linewidth` to set the line width of the **slab** (see below). For **interval**, raw `linewidth` values are transformed according to the `interval_size_domain` and `interval_size_range` parameters of the geom (see above).

- **size**: Determines the size of the **point**. If **linewidth** is not provided, **size** will also determine the width of the line used to draw the **interval** (this allows line width and point size to be modified together by setting only **size** and not **linewidth**). Raw size values are transformed according to the **interval_size_domain**, **interval_size_range**, and **fatten_point** parameters of the geom (see above). Use the **point_size** aesthetic (below) to set sub-geometry size directly without applying the effects of **interval_size_domain**, **interval_size_range**, and **fatten_point**.
- **stroke**: Width of the outline around the **point** sub-geometry.
- **linetype**: Type of line (e.g., "solid", "dashed", etc) used to draw the **interval** and the outline of the **slab** (if it is visible). Use the **slab_linetype** or **interval_linetype** aesthetics (below) to set sub-geometry line types separately.

Slab-specific color and line override aesthetics

- **slab_fill**: Override for **fill**: the fill color of the slab.
- **slab_colour**: (or **slab_color**) Override for **colour/color**: the outline color of the slab.
- **slab_alpha**: Override for **alpha**: the opacity of the slab.
- **slab_linewidth**: Override for **linewidth**: the width of the outline of the slab.
- **slab_linetype**: Override for **linetype**: the line type of the outline of the slab.

Interval-specific color and line override aesthetics

- **interval_colour**: (or **interval_color**) Override for **colour/color**: the color of the interval.
- **interval_alpha**: Override for **alpha**: the opacity of the interval.
- **interval_linetype**: Override for **linetype**: the line type of the interval.

Point-specific color and line override aesthetics

- **point_fill**: Override for **fill**: the fill color of the point.
- **point_colour**: (or **point_color**) Override for **colour/color**: the outline color of the point.
- **point_alpha**: Override for **alpha**: the opacity of the point.
- **point_size**: Override for **size**: the size of the point.

Deprecated aesthetics

- **slab_size**: Use **slab_linewidth**.
- **interval_size**: Use **interval_linewidth**.

Other aesthetics (these work as in standard geoms)

- **width**
- **height**
- **group**

See examples of some of these aesthetics in action in `vignette("slabinterval")`. Learn more about the sub-geom override aesthetics (like **interval_color**) in the [scales](#) documentation. Learn more about basic ggplot aesthetics in `vignette("ggplot2-specs")`.

See Also

See [geom_slabinterval\(\)](#) for the geom underlying this stat. See [stat_slabinterval\(\)](#) for the stat this shortcut is based on.

Other slabinterval stats: [stat_ccdfinterval\(\)](#), [stat_cdfinterval\(\)](#), [stat_eye\(\)](#), [stat_gradientinterval\(\)](#), [stat_histinterval\(\)](#), [stat_interval\(\)](#), [stat_pointinterval\(\)](#), [stat_slab\(\)](#), [stat_spike\(\)](#)

Examples

```
library(dplyr)
library(ggplot2)
library(distributional)

theme_set(theme_ggdist())

# ON SAMPLE DATA
set.seed(1234)
df = data.frame(
  group = c("a", "b", "c"),
  value = rnorm(1500, mean = c(5, 7, 9), sd = c(1, 1.5, 1))
)
df %>%
  ggplot(aes(x = value, y = group)) +
  stat_halfeye()

# ON ANALYTICAL DISTRIBUTIONS
dist_df = data.frame(
  group = c("a", "b", "c"),
  mean = c( 5,  7,  8),
  sd = c( 1, 1.5,  1)
)
# Vectorized distribution types, like distributional::dist_normal()
# and posterior::rvar(), can be used with the `xdist` / `ydist` aesthetics
dist_df %>%
  ggplot(aes(y = group, xdist = dist_normal(mean, sd))) +
  stat_halfeye()
```

stat_histinterval	<i>Histogram + interval plot (shortcut stat)</i>
-------------------	--

Description

Shortcut version of [stat_slabinterval\(\)](#) with [geom_slabinterval\(\)](#) for creating histogram + interval plots.

Roughly equivalent to:

```
stat_slabinterval(
  density = "histogram"
)
```

Usage

```
stat_histinterval(
  mapping = NULL,
  data = NULL,
  geom = "slabinterval",
  position = "identity",
  ...,
  density = "histogram",
  p_limits = c(NA, NA),
  adjust = waiver(),
  trim = TRUE,
  expand = FALSE,
  breaks = waiver(),
  align = "none",
  outline_bars = FALSE,
  point_interval = "median_qi",
  slab_type = NULL,
  limits = NULL,
  n = 501,
  .width = c(0.66, 0.95),
  orientation = NA,
  na.rm = FALSE,
  show.legend = c(size = FALSE),
  inherit.aes = TRUE
)
```

Arguments

mapping	Set of aesthetic mappings created by <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	Use to override the default connection between <code>stat_histinterval()</code> and <code>geom_slabinterval()</code>
position	Position adjustment, either as a string, or the result of a call to a position adjustment function. Setting this equal to "dodge" (<code>position_dodge()</code>) or "dodgejust" (<code>position_dodgejust()</code>) can be useful if you have overlapping geometries.
...	Other arguments passed to <code>layer()</code> . These are often aesthetics, used to set an aesthetic to a fixed value, like <code>colour = "red"</code> or <code>linewidth = 3</code> (see Aesthet-

ics, below). They may also be parameters to the paired geom/stat. When paired with the default geom, `geom_slabinterval()`, these include:

`normalize` How to normalize heights of functions input to the thickness aesthetic. One of:

- "all": normalize so that the maximum height across all data is 1.
- "panels": normalize within panels so that the maximum height in each panel is 1.
- "xy": normalize within the x/y axis opposite the orientation of this geom so that the maximum height at each value of the opposite axis is 1.
- "groups": normalize within values of the opposite axis and within each group so that the maximum height in each group is 1.
- "none": values are taken as is with no normalization (this should probably only be used with functions whose values are in [0,1], such as CDFs).

For a comprehensive discussion and examples of slab scaling and normalization, see the [thickness scale article](#).

`fill_type` What type of fill to use when the fill color or alpha varies within a slab. One of:

- "segments": breaks up the slab geometry into segments for each unique combination of fill color and alpha value. This approach is supported by all graphics devices and works well for sharp cutoff values, but can give ugly results if a large number of unique fill colors are being used (as in gradients, like in `stat_gradientinterval()`).
- "gradient": a `grid::linearGradient()` is used to create a smooth gradient fill. This works well for large numbers of unique fill colors, but requires R \geq 4.1 and is not yet supported on all graphics devices. As of this writing, the `png()` graphics device with `type = "cairo"`, the `svg()` device, the `pdf()` device, and the `ragg::agg_png()` devices are known to support this option. On R $<$ 4.1, this option will fall back to `fill_type = "segments"` with a message.
- "auto": attempts to use `fill_type = "gradient"` if support for it can be auto-detected. On R \geq 4.2, support for gradients can be auto-detected on some graphics devices; if support is not detected, this option will fall back to `fill_type = "segments"` (in case of a false negative, `fill_type = "gradient"` can be set explicitly). On R $<$ 4.2, support for gradients cannot be auto-detected, so this will always fall back to `fill_type = "segments"`, in which case you can set `fill_type = "gradient"` explicitly if you are using a graphics device that support gradients.

`interval_size_domain` A length-2 numeric vector giving the minimum and maximum of the values of the size and linewidth aesthetics that will be translated into actual sizes for intervals drawn according to `interval_size_range` (see the documentation for that argument.)

`interval_size_range` A length-2 numeric vector. This geom scales the raw size aesthetic values when drawing interval and point sizes, as they tend to be too thick when using the default settings of `scale_size_continuous()`,

which give sizes with a range of `c(1, 6)`. The `interval_size_domain` value indicates the input domain of raw size values (typically this should be equal to the value of the `range` argument of the `scale_size_continuous()` function), and `interval_size_range` indicates the desired output range of the size values (the min and max of the actual sizes used to draw intervals). Most of the time it is not recommended to change the value of this argument, as it may result in strange scaling of legends; this argument is a holdover from earlier versions that did not have size aesthetics targeting the point and interval separately. If you want to adjust the size of the interval or points separately, you can also use the `linewidth` or `point_size` aesthetics; see [sub-geometry-scales](#).

`fatten_point` A multiplicative factor used to adjust the size of the point relative to the size of the thickest interval line. If you wish to specify point sizes directly, you can also use the `point_size` aesthetic and `scale_point_size_continuous()` or `scale_point_size_discrete()`; sizes specified with that aesthetic will not be adjusted using `fatten_point`.

`arrow` `grid::arrow()` giving the arrow heads to use on the interval, or `NULL` for no arrows.

`subguide` Sub-guide used to annotate the thickness scale. One of:

- A function that takes a `scale` argument giving a `ggplot2::Scale` object and an `orientation` argument giving the orientation of the geometry and then returns a `grid::grob` that will draw the axis annotation, such as `subguide_axis()` (to draw a traditional axis) or `subguide_none()` (to draw no annotation). See `subguide_axis()` for a list of possibilities and examples.
- A string giving the name of such a function when prefixed with "subguide"; e.g. "axis" or "none".

`density`

Density estimator for sample data. One of:

- A function which takes a numeric vector and returns a list with elements `x` (giving `grid` points for the density estimator) and `y` (the corresponding densities). `ggdist` provides a family of functions following this format, including `density_unbounded()` and `density_bounded()`. This format is also compatible with `stats::density()`.
- A string giving the suffix of a function name that starts with "density_"; e.g. "bounded" for `[density_bounded()]`, "unbounded" for `[density_unbounded()]`, or "histogram" for `density_histogram()`. Defaults to "bounded", i.e. `density_bounded()`, which estimates the bounds from the data and then uses a bounded density estimator based on the reflection method.

`p_limits`

Probability limits (as a vector of size 2) used to determine the lower and upper limits of *theoretical* distributions (distributions from *samples* ignore this parameter and determine their limits based on the limits of the sample). E.g., if this is `c(.001, .999)`, then a slab is drawn for the distribution from the quantile at `p = .001` to the quantile at `p = .999`. If the lower (respectively upper) limit is `NA`, then the lower (upper) limit will be the minimum (maximum) of the distribution's support if it is finite, and `0.001` (`0.999`) if it is not finite. E.g., if `p_limits` is `c(NA, NA)`, on a gamma distribution the effective value of `p_limits` would be `c(0, .999)` since the gamma distribution is defined on $(0, \text{Inf})$; whereas on

a normal distribution it would be equivalent to `c(.001, .999)` since the normal distribution is defined on $(-\text{Inf}, \text{Inf})$.

adjust	Passed to <code>density</code> : the bandwidth for the density estimator for sample data is adjusted by multiplying it by this value. See e.g. <code>density_bounded()</code> for more information. Default (<code>waiver()</code>) defers to the default of the density estimator, which is usually 1.
trim	For sample data, should the density estimate be trimmed to the range of the data? Passed on to the density estimator; see the <code>density</code> parameter. Default <code>TRUE</code> .
expand	For sample data, should the slab be expanded to the limits of the scale? Default <code>FALSE</code> . Can be length two to control expansion to the lower and upper limit respectively.
breaks	<p>Determines the breakpoints defining bins. Defaults to "Scott". Similar to (but not exactly the same as) the <code>breaks</code> argument to <code>graphics::hist()</code>. One of:</p> <ul style="list-style-type: none"> • A scalar (length-1) numeric giving the number of bins • A vector numeric giving the breakpoints between histogram bins • A function taking <code>x</code> and <code>weights</code> and returning either the number of bins or a vector of breakpoints • A string giving the suffix of a function that starts with "breaks_". <code>ggdist</code> provides weighted implementations of the "Sturges", "Scott", and "FD" break-finding algorithms from <code>graphics::hist()</code>, as well as <code>breaks_fixed()</code> for manually setting the bin width. See breaks. <p>For example, <code>breaks = "Sturges"</code> will use the <code>breaks_Sturges()</code> algorithm, <code>breaks = 9</code> will create 9 bins, and <code>breaks = breaks_fixed(width = 1)</code> will set the bin width to 1.</p>
align	<p>Determines how to align the breakpoints defining bins. Default ("none") performs no alignment. One of:</p> <ul style="list-style-type: none"> • A scalar (length-1) numeric giving an offset that is subtracted from the breaks. The offset must be between 0 and the bin width. • A function taking a sorted vector of breaks (bin edges) and returning an offset to subtract from the breaks. • A string giving the suffix of a function that starts with "align_" used to determine the alignment, such as <code>align_none()</code>, <code>align_boundary()</code>, or <code>align_center()</code>. <p>For example, <code>align = "none"</code> will provide no alignment, <code>align = align_center(at = 0)</code> will center a bin on 0, and <code>align = align_boundary(at = 0)</code> will align a bin edge on 0.</p>
outline_bars	For sample data (if <code>density</code> is "histogram") and for discrete analytical distributions (whose slabs are drawn as histograms), determines if outlines in between the bars are drawn when the <code>slab_color</code> aesthetic is used. If <code>FALSE</code> (the default), the outline is drawn only along the tops of the bars; if <code>TRUE</code> , outlines in between bars are also drawn. See <code>density_histogram()</code> .
point_interval	A function from the <code>point_interval()</code> family (e.g., <code>median_qi</code> , <code>mean_qi</code> , <code>mode_hdi</code> , etc), or a string giving the name of a function from that family (e.g., "median_qi", "mean_qi", "mode_hdi", etc; if a string, the caller's environment

is searched for the function, followed by the **ggdist** environment). This function determines the point summary (typically mean, median, or mode) and interval type (quantile interval, `qi`; highest-density interval, `hdi`; or highest-density continuous interval, `hdc`). Output will be converted to the appropriate x- or y-based aesthetics depending on the value of `orientation`. See the `point_interval()` family of functions for more information.

<code>slab_type</code>	(deprecated) The type of slab function to calculate: probability density (or mass) function (" <code>pdf</code> "), cumulative distribution function (" <code>cdf</code> "), or complementary CDF (" <code>ccdf</code> "). Instead of using <code>slab_type</code> to change <code>f</code> and then mapping <code>f</code> onto an aesthetic, it is now recommended to simply map the corresponding computed variable (e.g. <code>pdf</code> , <code>cdf</code> , or <code>1 - cdf</code>) directly onto the desired aesthetic.
<code>limits</code>	Manually-specified limits for the slab, as a vector of length two. These limits are combined with those computed based on <code>p_limits</code> as well as the limits defined by the scales of the plot to determine the limits used to draw the slab functions: these limits specify the maximal limits; i.e., if specified, the limits will not be wider than these (but may be narrower). Use <code>NA</code> to leave a limit alone; e.g. <code>limits = c(0, NA)</code> will ensure that the lower limit does not go below 0, but let the upper limit be determined by either <code>p_limits</code> or the scale settings.
<code>n</code>	Number of points at which to evaluate the function that defines the slab.
<code>.width</code>	The <code>.width</code> argument passed to <code>point_interval</code> : a vector of probabilities to use that determine the widths of the resulting intervals. If multiple probabilities are provided, multiple intervals per group are generated, each with a different probability interval (and value of the corresponding <code>.width</code> and <code>level</code> generated variables).
<code>orientation</code>	<p>Whether this geom is drawn horizontally or vertically. One of:</p> <ul style="list-style-type: none"> • <code>NA</code> (default): automatically detect the orientation based on how the aesthetics are assigned. Automatic detection works most of the time. • <code>"horizontal"</code> (or <code>"y"</code>): draw horizontally, using the <code>y</code> aesthetic to identify different groups. For each group, uses the <code>x</code>, <code>xmin</code>, <code>xmax</code>, and <code>thickness</code> aesthetics to draw points, intervals, and slabs. • <code>"vertical"</code> (or <code>"x"</code>): draw vertically, using the <code>x</code> aesthetic to identify different groups. For each group, uses the <code>y</code>, <code>ymin</code>, <code>ymax</code>, and <code>thickness</code> aesthetics to draw points, intervals, and slabs. <p>For compatibility with the base <code>ggplot</code> naming scheme for orientation, <code>"x"</code> can be used as an alias for <code>"vertical"</code> and <code>"y"</code> as an alias for <code>"horizontal"</code> (ggdist had an <code>orientation</code> parameter before base <code>ggplot</code> did, hence the discrepancy).</p>
<code>na.rm</code>	If <code>FALSE</code> , the default, missing values are removed with a warning. If <code>TRUE</code> , missing values are silently removed.
<code>show.legend</code>	Should this layer be included in the legends? Default is <code>c(size = FALSE)</code> , unlike most geoms, to match its common use cases. <code>FALSE</code> hides all legends, <code>TRUE</code> shows all legends, and <code>NA</code> shows only those that are mapped (the default for most geoms).
<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> .

Details

To visualize sample data, such as a data distribution, samples from a bootstrap distribution, or a Bayesian posterior, you can supply samples to the `x` or `y` aesthetic.

To visualize analytical distributions, you can use the `xdist` or `ydist` aesthetic. For historical reasons, you can also use `dist` to specify the distribution, though this is not recommended as it does not work as well with orientation detection. These aesthetics can be used as follows:

- `xdist`, `ydist`, and `dist` can be any distribution object from the `distributional` package (`dist_normal()`, `dist_beta()`, etc) or can be a `posterior::rvar()` object. Since these functions are vectorized, other columns can be passed directly to them in an `aes()` specification; e.g. `aes(dist = dist_normal(mu, sigma))` will work if `mu` and `sigma` are columns in the input data frame.
- `dist` can be a character vector giving the distribution name. Then the `arg1`, ... `arg9` aesthetics (or `args` as a list column) specify distribution arguments. Distribution names should correspond to R functions that have "p", "q", and "d" functions; e.g. "norm" is a valid distribution name because R defines the `pnorm()`, `qnorm()`, and `dnorm()` functions for Normal distributions.

See the `parse_dist()` function for a useful way to generate `dist` and `args` values from human-readable distribution specs (like "normal(0,1)"). Such specs are also produced by other packages (like the `brms::get_prior` function in `brms`); thus, `parse_dist()` combined with the stats described here can help you visualize the output of those functions.

Value

A `ggplot2::Stat` representing a histogram + interval geometry which can be added to a `ggplot()` object.

Computed Variables

The following variables are computed by this stat and made available for use in aesthetic specifications (`aes()`) using the `after_stat()` function or the `after_stat` argument of `stage()`:

- `x` or `y`: For slabs, the input values to the slab function. For intervals, the point summary from the interval function. Whether it is `x` or `y` depends on orientation
- `xmin` or `ymin`: For intervals, the lower end of the interval from the interval function.
- `xmax` or `ymax`: For intervals, the upper end of the interval from the interval function.
- `.width`: For intervals, the interval width as a numeric value in $[0, 1]$. For slabs, the width of the smallest interval containing that value of the slab.
- `level`: For intervals, the interval width as an ordered factor. For slabs, the level of the smallest interval containing that value of the slab.
- `pdf`: For slabs, the probability density function (PDF). If `options("ggdist.experimental.slab_data_in_interval")` is TRUE: For intervals, the PDF at the point summary; intervals also have `pdf_min` and `pdf_max` for the PDF at the lower and upper ends of the interval.
- `cdf`: For slabs, the cumulative distribution function. If `options("ggdist.experimental.slab_data_in_intervals")` is TRUE: For intervals, the CDF at the point summary; intervals also have `cdf_min` and `cdf_max` for the CDF at the lower and upper ends of the interval.
- `n`: For slabs, the number of data points summarized into that slab. If the slab was created from an analytical distribution via the `xdist`, `ydist`, or `dist` aesthetic, `n` will be `Inf`.

- `f`: (deprecated) For slabs, the output values from the slab function (such as the PDF, CDF, or CCDF), determined by `slab_type`. Instead of using `slab_type` to change `f` and then mapping `f` onto an aesthetic, it is now recommended to simply map the corresponding computed variable (e.g. `pdf`, `cdf`, or `1 - cdf`) directly onto the desired aesthetic.

Aesthetics

The slab+interval stats and geoms have a wide variety of aesthetics that control the appearance of their three sub-geometries: the **slab**, the **point**, and the **interval**.

These stats support the following aesthetics:

- `x`: x position of the geometry (when orientation = "vertical"); or sample data to be summarized (when orientation = "horizontal" with sample data).
- `y`: y position of the geometry (when orientation = "horizontal"); or sample data to be summarized (when orientation = "vertical" with sample data).
- `weight`: When using samples (i.e. the `x` and `y` aesthetics, not `xdist` or `ydist`), optional weights to be applied to each draw.
- `xdist`: When using analytical distributions, distribution to map on the x axis: a **distributional** object (e.g. `dist_normal()`) or a `posterior::rvar()` object.
- `ydist`: When using analytical distributions, distribution to map on the y axis: a **distributional** object (e.g. `dist_normal()`) or a `posterior::rvar()` object.
- `dist`: When using analytical distributions, a name of a distribution (e.g. "norm"), a **distributional** object (e.g. `dist_normal()`), or a `posterior::rvar()` object. See **Details**.
- `args`: Distribution arguments (`args` or `arg1, ... arg9`). See **Details**.

In addition, in their default configuration (paired with `geom_slabinterval()`) the following aesthetics are supported by the underlying geom:

Slab-specific aesthetics

- `thickness`: The thickness of the slab at each x value (if orientation = "horizontal") or y value (if orientation = "vertical") of the slab.
- `side`: Which side to place the slab on. "topright", "top", and "right" are synonyms which cause the slab to be drawn on the top or the right depending on if orientation is "horizontal" or "vertical". "bottomleft", "bottom", and "left" are synonyms which cause the slab to be drawn on the bottom or the left depending on if orientation is "horizontal" or "vertical". "topleft" causes the slab to be drawn on the top or the left, and "bottomright" causes the slab to be drawn on the bottom or the right. "both" draws the slab mirrored on both sides (as in a violin plot).
- `scale`: What proportion of the region allocated to this geom to use to draw the slab. If `scale = 1`, slabs that use the maximum range will just touch each other. Default is 0.9 to leave some space between adjacent slabs. For a comprehensive discussion and examples of slab scaling and normalization, see the [thickness scale article](#).
- `justification`: Justification of the interval relative to the slab, where 0 indicates bottom/left justification and 1 indicates top/right justification (depending on orientation). If `justification` is NULL (the default), then it is set automatically based on the value of `side`: when `side` is "top"/"right" justification is set to 0, when `side` is "bottom"/"left" justification is set to 1, and when `side` is "both" justification is set to 0.5.

- **datatype**: When using composite geoms directly without a stat (e.g. `geom_slabinterval()`), **datatype** is used to indicate which part of the geom a row in the data targets: rows with **datatype** = "slab" target the slab portion of the geometry and rows with **datatype** = "interval" target the interval portion of the geometry. This is set automatically when using `ggdist` stats.

Interval-specific aesthetics

- **xmin**: Left end of the interval sub-geometry (if **orientation** = "horizontal").
- **xmax**: Right end of the interval sub-geometry (if **orientation** = "horizontal").
- **ymin**: Lower end of the interval sub-geometry (if **orientation** = "vertical").
- **ymax**: Upper end of the interval sub-geometry (if **orientation** = "vertical").

Point-specific aesthetics

- **shape**: Shape type used to draw the **point** sub-geometry.

Color aesthetics

- **colour**: (or **color**) The color of the **interval** and **point** sub-geometries. Use the **slab_color**, **interval_color**, or **point_color** aesthetics (below) to set sub-geometry colors separately.
- **fill**: The fill color of the **slab** and **point** sub-geometries. Use the **slab_fill** or **point_fill** aesthetics (below) to set sub-geometry colors separately.
- **alpha**: The opacity of the **slab**, **interval**, and **point** sub-geometries. Use the **slab_alpha**, **interval_alpha**, or **point_alpha** aesthetics (below) to set sub-geometry colors separately.
- **colour_ramp**: (or **color_ramp**) A secondary scale that modifies the color scale to "ramp" to another color. See `scale_colour_ramp()` for examples.
- **fill_ramp**: A secondary scale that modifies the fill scale to "ramp" to another color. See `scale_fill_ramp()` for examples.

Line aesthetics

- **linewidth**: Width of the line used to draw the **interval** (except with `geom_slab()`: then it is the width of the **slab**). With composite geometries including an interval and slab, use **slab_linewidth** to set the line width of the **slab** (see below). For **interval**, raw **linewidth** values are transformed according to the **interval_size_domain** and **interval_size_range** parameters of the geom (see above).
- **size**: Determines the size of the **point**. If **linewidth** is not provided, **size** will also determine the width of the line used to draw the **interval** (this allows line width and point size to be modified together by setting only **size** and not **linewidth**). Raw **size** values are transformed according to the **interval_size_domain**, **interval_size_range**, and **fatten_point** parameters of the geom (see above). Use the **point_size** aesthetic (below) to set sub-geometry size directly without applying the effects of **interval_size_domain**, **interval_size_range**, and **fatten_point**.
- **stroke**: Width of the outline around the **point** sub-geometry.
- **linetype**: Type of line (e.g., "solid", "dashed", etc) used to draw the **interval** and the outline of the **slab** (if it is visible). Use the **slab_linetype** or **interval_linetype** aesthetics (below) to set sub-geometry line types separately.

Slab-specific color and line override aesthetics

- `slab_fill`: Override for `fill`: the fill color of the slab.
- `slab_colour`: (or `slab_color`) Override for `colour/color`: the outline color of the slab.
- `slab_alpha`: Override for `alpha`: the opacity of the slab.
- `slab_linewidth`: Override for `linewidth`: the width of the outline of the slab.
- `slab_linetype`: Override for `linetype`: the line type of the outline of the slab.

Interval-specific color and line override aesthetics

- `interval_colour`: (or `interval_color`) Override for `colour/color`: the color of the interval.
- `interval_alpha`: Override for `alpha`: the opacity of the interval.
- `interval_linetype`: Override for `linetype`: the line type of the interval.

Point-specific color and line override aesthetics

- `point_fill`: Override for `fill`: the fill color of the point.
- `point_colour`: (or `point_color`) Override for `colour/color`: the outline color of the point.
- `point_alpha`: Override for `alpha`: the opacity of the point.
- `point_size`: Override for `size`: the size of the point.

Deprecated aesthetics

- `slab_size`: Use `slab_linewidth`.
- `interval_size`: Use `interval_linewidth`.

Other aesthetics (these work as in standard geoms)

- `width`
- `height`
- `group`

See examples of some of these aesthetics in action in `vignette("slabinterval")`. Learn more about the sub-geom override aesthetics (like `interval_color`) in the [scales](#) documentation. Learn more about basic ggplot aesthetics in `vignette("ggplot2-specs")`.

See Also

See `geom_slabinterval()` for the geom underlying this stat. See `stat_slabinterval()` for the stat this shortcut is based on.

Other `slabinterval` stats: `stat_ccdfinterval()`, `stat_cdfinterval()`, `stat_eye()`, `stat_gradientinterval()`, `stat_halfeye()`, `stat_interval()`, `stat_pointinterval()`, `stat_slab()`, `stat_spike()`

Examples

```

library(dplyr)
library(ggplot2)
library(distributional)

theme_set(theme_ggdist())

# ON SAMPLE DATA
set.seed(1234)
df = data.frame(
  group = c("a", "b", "c"),
  value = rnorm(1500, mean = c(5, 7, 9), sd = c(1, 1.5, 1))
)
df %>%
  ggplot(aes(x = value, y = group)) +
  stat_histinterval()

# ON ANALYTICAL DISTRIBUTIONS
dist_df = data.frame(
  group = c("a", "b", "c"),
  mean = c( 5,  7,  8),
  sd = c( 1, 1.5,  1)
)
# Vectorized distribution types, like distributional::dist_normal()
# and posterior::rvar(), can be used with the `xdist` / `ydist` aesthetics
dist_df %>%
  ggplot(aes(y = group, xdist = dist_normal(mean, sd))) +
  stat_histinterval()

```

stat_interval

Multiple-interval plot (shortcut stat)

Description

Shortcut version of `stat_slabinterval()` with `geom_interval()` for creating multiple-interval plots.

Roughly equivalent to:

```

stat_slabinterval(
  aes(
    colour = after_stat(level),
    size = NULL
  ),
  geom = "interval",
  show_point = FALSE,
  .width = c(0.5, 0.8, 0.95),
  show_slab = FALSE,
  show.legend = NA
)

```

Usage

```
stat_interval(
  mapping = NULL,
  data = NULL,
  geom = "interval",
  position = "identity",
  ...,
  .width = c(0.5, 0.8, 0.95),
  point_interval = "median_qi",
  orientation = NA,
  na.rm = FALSE,
  show.legend = NA,
  inherit.aes = TRUE
)
```

Arguments

- | | |
|----------|--|
| mapping | Set of aesthetic mappings created by aes() . 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 ggplot().</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 fortify() 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 | Use to override the default connection between stat_interval() and geom_interval() |
| position | Position adjustment, either as a string, or the result of a call to a position adjustment function. Setting this equal to <code>"dodge"</code> (position_dodge()) or <code>"dodgejust"</code> (position_dodgejust()) can be useful if you have overlapping geometries. |
| ... | <p>Other arguments passed to layer(). These are often aesthetics, used to set an aesthetic to a fixed value, like <code>colour = "red"</code> or <code>linewidth = 3</code> (see Aesthetics, below). They may also be parameters to the paired geom/stat. When paired with the default geom, geom_interval(), these include:</p> <p><code>interval_size_range</code> A length-2 numeric vector. This geom scales the raw size aesthetic values when drawing interval and point sizes, as they tend to be too thick when using the default settings of scale_size_continuous(), which give sizes with a range of <code>c(1, 6)</code>. The <code>interval_size_domain</code> value indicates the input domain of raw size values (typically this should be equal to the value of the <code>range</code> argument of the scale_size_continuous() function), and <code>interval_size_range</code> indicates the desired output range of the size values (the min and max of the actual sizes used to draw intervals). Most of the time it is not recommended to change the value of this</p> |

argument, as it may result in strange scaling of legends; this argument is a holdover from earlier versions that did not have size aesthetics targeting the point and interval separately. If you want to adjust the size of the interval or points separately, you can also use the `linewidth` or `point_size` aesthetics; see [sub-geometry-scales](#).

`interval_size_domain` A length-2 numeric vector giving the minimum and maximum of the values of the `size` and `linewidth` aesthetics that will be translated into actual sizes for intervals drawn according to `interval_size_range` (see the documentation for that argument.)

arrow `grid::arrow()` giving the arrow heads to use on the interval, or `NULL` for no arrows.

<code>.width</code>	The <code>.width</code> argument passed to <code>point_interval</code> : a vector of probabilities to use that determine the widths of the resulting intervals. If multiple probabilities are provided, multiple intervals per group are generated, each with a different probability interval (and value of the corresponding <code>.width</code> and level generated variables).
<code>point_interval</code>	A function from the <code>point_interval()</code> family (e.g., <code>median_qi</code> , <code>mean_qi</code> , <code>mode_hdi</code> , etc), or a string giving the name of a function from that family (e.g., <code>"median_qi"</code> , <code>"mean_qi"</code> , <code>"mode_hdi"</code> , etc; if a string, the caller's environment is searched for the function, followed by the <code>ggdist</code> environment). This function determines the point summary (typically mean, median, or mode) and interval type (quantile interval, <code>qi</code> ; highest-density interval, <code>hdi</code> ; or highest-density continuous interval, <code>hdc</code>). Output will be converted to the appropriate x- or y-based aesthetics depending on the value of <code>orientation</code> . See the <code>point_interval()</code> family of functions for more information.
<code>orientation</code>	Whether this geom is drawn horizontally or vertically. One of: <ul style="list-style-type: none"> • <code>NA</code> (default): automatically detect the orientation based on how the aesthetics are assigned. Automatic detection works most of the time. • <code>"horizontal"</code> (or <code>"y"</code>): draw horizontally, using the <code>y</code> aesthetic to identify different groups. For each group, uses the <code>x</code>, <code>xmin</code>, <code>xmax</code>, and <code>thickness</code> aesthetics to draw points, intervals, and slabs. • <code>"vertical"</code> (or <code>"x"</code>): draw vertically, using the <code>x</code> aesthetic to identify different groups. For each group, uses the <code>y</code>, <code>ymin</code>, <code>ymax</code>, and <code>thickness</code> aesthetics to draw points, intervals, and slabs. <p>For compatibility with the base <code>ggplot</code> naming scheme for <code>orientation</code>, <code>"x"</code> can be used as an alias for <code>"vertical"</code> and <code>"y"</code> as an alias for <code>"horizontal"</code> (<code>ggdist</code> had an <code>orientation</code> parameter before base <code>ggplot</code> did, hence the discrepancy).</p>
<code>na.rm</code>	If <code>FALSE</code> , the default, missing values are removed with a warning. If <code>TRUE</code> , missing values are silently removed.
<code>show.legend</code>	Should this layer be included in the legends? Default is <code>c(size = FALSE)</code> , unlike most geoms, to match its common use cases. <code>FALSE</code> hides all legends, <code>TRUE</code> shows all legends, and <code>NA</code> shows only those that are mapped (the default for most geoms).
<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> .

Details

To visualize sample data, such as a data distribution, samples from a bootstrap distribution, or a Bayesian posterior, you can supply samples to the `x` or `y` aesthetic.

To visualize analytical distributions, you can use the `xdist` or `ydist` aesthetic. For historical reasons, you can also use `dist` to specify the distribution, though this is not recommended as it does not work as well with orientation detection. These aesthetics can be used as follows:

- `xdist`, `ydist`, and `dist` can be any distribution object from the `distributional` package (`dist_normal()`, `dist_beta()`, etc) or can be a `posterior::rvar()` object. Since these functions are vectorized, other columns can be passed directly to them in an `aes()` specification; e.g. `aes(dist = dist_normal(mu, sigma))` will work if `mu` and `sigma` are columns in the input data frame.
- `dist` can be a character vector giving the distribution name. Then the `arg1`, ... `arg9` aesthetics (or `args` as a list column) specify distribution arguments. Distribution names should correspond to R functions that have "p", "q", and "d" functions; e.g. "norm" is a valid distribution name because R defines the `pnorm()`, `qnorm()`, and `dnorm()` functions for Normal distributions.

See the `parse_dist()` function for a useful way to generate `dist` and `args` values from human-readable distribution specs (like "normal(0,1)"). Such specs are also produced by other packages (like the `brms::get_prior` function in `brms`); thus, `parse_dist()` combined with the stats described here can help you visualize the output of those functions.

Value

A `ggplot2::Stat` representing a multiple-interval geometry which can be added to a `ggplot()` object.

Computed Variables

The following variables are computed by this stat and made available for use in aesthetic specifications (`aes()`) using the `after_stat()` function or the `after_stat` argument of `stage()`:

- `x` or `y`: For slabs, the input values to the slab function. For intervals, the point summary from the interval function. Whether it is `x` or `y` depends on orientation
- `xmin` or `ymin`: For intervals, the lower end of the interval from the interval function.
- `xmax` or `ymax`: For intervals, the upper end of the interval from the interval function.
- `.width`: For intervals, the interval width as a numeric value in $[0, 1]$. For slabs, the width of the smallest interval containing that value of the slab.
- `level`: For intervals, the interval width as an ordered factor. For slabs, the level of the smallest interval containing that value of the slab.
- `pdf`: For slabs, the probability density function (PDF). If `options("ggdist.experimental.slab_data_in_intervals")` is TRUE: For intervals, the PDF at the point summary; intervals also have `pdf_min` and `pdf_max` for the PDF at the lower and upper ends of the interval.
- `cdf`: For slabs, the cumulative distribution function. If `options("ggdist.experimental.slab_data_in_intervals")` is TRUE: For intervals, the CDF at the point summary; intervals also have `cdf_min` and `cdf_max` for the CDF at the lower and upper ends of the interval.

Aesthetics

The slab+interval stats and geoms have a wide variety of aesthetics that control the appearance of their three sub-geometries: the **slab**, the **point**, and the **interval**.

These stats support the following aesthetics:

- **x**: x position of the geometry (when orientation = "vertical"); or sample data to be summarized (when orientation = "horizontal" with sample data).
- **y**: y position of the geometry (when orientation = "horizontal"); or sample data to be summarized (when orientation = "vertical" with sample data).
- **weight**: When using samples (i.e. the x and y aesthetics, not `xdist` or `ydist`), optional weights to be applied to each draw.
- **xdist**: When using analytical distributions, distribution to map on the x axis: a **distributional** object (e.g. `dist_normal()`) or a `posterior::rvar()` object.
- **ydist**: When using analytical distributions, distribution to map on the y axis: a **distributional** object (e.g. `dist_normal()`) or a `posterior::rvar()` object.
- **dist**: When using analytical distributions, a name of a distribution (e.g. "norm"), a **distributional** object (e.g. `dist_normal()`), or a `posterior::rvar()` object. See **Details**.
- **args**: Distribution arguments (`args` or `arg1, ... arg9`). See **Details**.

In addition, in their default configuration (paired with `geom_interval()`) the following aesthetics are supported by the underlying geom:

Interval-specific aesthetics

- **xmin**: Left end of the interval sub-geometry (if orientation = "horizontal").
- **xmax**: Right end of the interval sub-geometry (if orientation = "horizontal").
- **ymin**: Lower end of the interval sub-geometry (if orientation = "vertical").
- **ymax**: Upper end of the interval sub-geometry (if orientation = "vertical").

Color aesthetics

- **colour**: (or `color`) The color of the **interval** and **point** sub-geometries. Use the `slab_color`, `interval_color`, or `point_color` aesthetics (below) to set sub-geometry colors separately.
- **fill**: The fill color of the **slab** and **point** sub-geometries. Use the `slab_fill` or `point_fill` aesthetics (below) to set sub-geometry colors separately.
- **alpha**: The opacity of the **slab**, **interval**, and **point** sub-geometries. Use the `slab_alpha`, `interval_alpha`, or `point_alpha` aesthetics (below) to set sub-geometry colors separately.
- **colour_ramp**: (or `color_ramp`) A secondary scale that modifies the color scale to "ramp" to another color. See `scale_colour_ramp()` for examples.
- **fill_ramp**: A secondary scale that modifies the fill scale to "ramp" to another color. See `scale_fill_ramp()` for examples.

Line aesthetics

- **linewidth**: Width of the line used to draw the **interval** (except with `geom_slab()`: then it is the width of the **slab**). With composite geometries including an interval and slab, use `slab_linewidth` to set the line width of the **slab** (see below). For **interval**, raw `linewidth` values are transformed according to the `interval_size_domain` and `interval_size_range` parameters of the geom (see above).
- **size**: Determines the size of the **point**. If `linewidth` is not provided, `size` will also determine the width of the line used to draw the **interval** (this allows line width and point size to be modified together by setting only `size` and not `linewidth`). Raw `size` values are transformed according to the `interval_size_domain`, `interval_size_range`, and `fatten_point` parameters of the geom (see above). Use the `point_size` aesthetic (below) to set sub-geometry size directly without applying the effects of `interval_size_domain`, `interval_size_range`, and `fatten_point`.
- **stroke**: Width of the outline around the **point** sub-geometry.
- **linetype**: Type of line (e.g., "solid", "dashed", etc) used to draw the **interval** and the outline of the **slab** (if it is visible). Use the `slab_linetype` or `interval_linetype` aesthetics (below) to set sub-geometry line types separately.

Interval-specific color and line override aesthetics

- `interval_colour`: (or `interval_color`) Override for colour/color: the color of the interval.
- `interval_alpha`: Override for alpha: the opacity of the interval.
- `interval_linetype`: Override for linetype: the line type of the interval.

Deprecated aesthetics

- `interval_size`: Use `interval_linewidth`.

Other aesthetics (these work as in standard geoms)

- `width`
- `height`
- `group`

See examples of some of these aesthetics in action in `vignette("slabinterval")`. Learn more about the sub-geom override aesthetics (like `interval_color`) in the [scales](#) documentation. Learn more about basic ggplot aesthetics in `vignette("ggplot2-specs")`.

See Also

See `geom_interval()` for the geom underlying this stat. See `stat_slabinterval()` for the stat this shortcut is based on.

Other `slabinterval` stats: `stat_ccdfinterval()`, `stat_cdfinterval()`, `stat_eye()`, `stat_gradientinterval()`, `stat_halfeye()`, `stat_histinterval()`, `stat_pointinterval()`, `stat_slab()`, `stat_spike()`

Examples

```

library(dplyr)
library(ggplot2)
library(distributional)

theme_set(theme_ggdist())

# ON SAMPLE DATA
set.seed(1234)
df = data.frame(
  group = c("a", "b", "c"),
  value = rnorm(1500, mean = c(5, 7, 9), sd = c(1, 1.5, 1))
)
df %>%
  ggplot(aes(x = value, y = group)) +
  stat_interval() +
  scale_color_brewer()

# ON ANALYTICAL DISTRIBUTIONS
dist_df = data.frame(
  group = c("a", "b", "c"),
  mean = c( 5,  7,  8),
  sd = c( 1, 1.5,  1)
)
# Vectorized distribution types, like distributional::dist_normal()
# and posterior::rvar(), can be used with the `xdist` / `ydist` aesthetics
dist_df %>%
  ggplot(aes(y = group, xdist = dist_normal(mean, sd))) +
  stat_interval() +
  scale_color_brewer()

```

stat_lineribbon

Line + multiple-ribbon plot (shortcut stat)

Description

A combination of `stat_slabinterval()` and `geom_lineribbon()` with sensible defaults for making line + multiple-ribbon plots. While `geom_lineribbon()` is intended for use on data frames that have already been summarized using a `point_interval()` function, `stat_lineribbon()` is intended for use directly on data frames of draws or of analytical distributions, and will perform the summarization using a `point_interval()` function.

Roughly equivalent to:

```

stat_slabinterval(
  aes(
    group = after_stat(level),
    fill = after_stat(level),
    order = after_stat(level),

```

```

    size = NULL
  ),
  geom = "lineribbon",
  .width = c(0.5, 0.8, 0.95),
  show_slab = FALSE,
  show.legend = NA
)

```

Usage

```

stat_lineribbon(
  mapping = NULL,
  data = NULL,
  geom = "lineribbon",
  position = "identity",
  ...,
  .width = c(0.5, 0.8, 0.95),
  point_interval = "median_qi",
  orientation = NA,
  na.rm = FALSE,
  show.legend = NA,
  inherit.aes = TRUE
)

```

Arguments

mapping	Set of aesthetic mappings created by aes() . 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 ggplot().</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 fortify() 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	Use to override the default connection between stat_lineribbon() and geom_lineribbon()
position	Position adjustment, either as a string, or the result of a call to a position adjustment function. Setting this equal to "dodge" (position_dodge()) or "dodgejust" (position_dodgejust()) can be useful if you have overlapping geometries.
...	<p>Other arguments passed to layer(). These are often aesthetics, used to set an aesthetic to a fixed value, like <code>colour = "red"</code> or <code>linewidth = 3</code> (see Aesthetics, below). They may also be parameters to the paired geom/stat. When paired with the default geom, geom_lineribbon(), these include:</p> <p><code>step</code> Should the line/ribbon be drawn as a step function? One of:</p>

- FALSE (default): do not draw as a step function.
- "mid" (or TRUE): draw steps midway between adjacent x values.
- "hv": draw horizontal-then-vertical steps.
- "vh": draw as vertical-then-horizontal steps.

TRUE is an alias for "mid" because for a step function with ribbons, "mid" is probably what you want (for the other two step approaches the ribbons at either the very first or very last x value will not be visible).

.width	The .width argument passed to point_interval: a vector of probabilities to use that determine the widths of the resulting intervals. If multiple probabilities are provided, multiple intervals per group are generated, each with a different probability interval (and value of the corresponding .width and level generated variables).
point_interval	A function from the point_interval() family (e.g., median_qi, mean_qi, mode_hdi, etc), or a string giving the name of a function from that family (e.g., "median_qi", "mean_qi", "mode_hdi", etc; if a string, the caller's environment is searched for the function, followed by the ggdist environment). This function determines the point summary (typically mean, median, or mode) and interval type (quantile interval, qi; highest-density interval, hdi; or highest-density continuous interval, hdc). Output will be converted to the appropriate x- or y-based aesthetics depending on the value of orientation. See the point_interval() family of functions for more information.
orientation	Whether this geom is drawn horizontally or vertically. One of: <ul style="list-style-type: none"> • NA (default): automatically detect the orientation based on how the aesthetics are assigned. Automatic detection works most of the time. • "horizontal" (or "y"): draw horizontally, using the y aesthetic to identify different groups. For each group, uses the x, xmin, xmax, and thickness aesthetics to draw points, intervals, and slabs. • "vertical" (or "x"): draw vertically, using the x aesthetic to identify different groups. For each group, uses the y, ymin, ymax, and thickness aesthetics to draw points, intervals, and slabs. <p>For compatibility with the base ggplot naming scheme for orientation, "x" can be used as an alias for "vertical" and "y" as an alias for "horizontal" (ggdist had an orientation parameter before base ggplot did, hence the discrepancy).</p>
na.rm	If FALSE, the default, missing values are removed with a warning. If TRUE, missing values are silently removed.
show.legend	Should this layer be included in the legends? NA, the default, includes if any aesthetics are mapped. FALSE never includes, and TRUE always includes.
inherit.aes	If FALSE, overrides the default aesthetics, rather than combining with them. This is most useful for helper functions that define both data and aesthetics and shouldn't inherit behaviour from the default plot specification, e.g. borders() .

Details

To visualize sample data, such as a data distribution, samples from a bootstrap distribution, or a Bayesian posterior, you can supply samples to the x or y aesthetic.

To visualize analytical distributions, you can use the `xdist` or `ydist` aesthetic. For historical reasons, you can also use `dist` to specify the distribution, though this is not recommended as it does not work as well with orientation detection. These aesthetics can be used as follows:

- `xdist`, `ydist`, and `dist` can be any distribution object from the **distributional** package (`dist_normal()`, `dist_beta()`, etc) or can be a `posterior::rvar()` object. Since these functions are vectorized, other columns can be passed directly to them in an `aes()` specification; e.g. `aes(dist = dist_normal(mu, sigma))` will work if `mu` and `sigma` are columns in the input data frame.
- `dist` can be a character vector giving the distribution name. Then the `arg1`, ... `arg9` aesthetics (or `args` as a list column) specify distribution arguments. Distribution names should correspond to R functions that have "p", "q", and "d" functions; e.g. "norm" is a valid distribution name because R defines the `pnorm()`, `qnorm()`, and `dnorm()` functions for Normal distributions.

See the `parse_dist()` function for a useful way to generate `dist` and `args` values from human-readable distribution specs (like "normal(0,1)"). Such specs are also produced by other packages (like the `brms::get_prior` function in `brms`); thus, `parse_dist()` combined with the stats described here can help you visualize the output of those functions.

Value

A `ggplot2::Stat` representing a line + multiple-ribbon geometry which can be added to a `ggplot()` object.

Computed Variables

The following variables are computed by this stat and made available for use in aesthetic specifications (`aes()`) using the `after_stat()` function or the `after_stat` argument of `stage()`:

- `x` or `y`: For slabs, the input values to the slab function. For intervals, the point summary from the interval function. Whether it is `x` or `y` depends on `orientation`
- `xmin` or `ymin`: For intervals, the lower end of the interval from the interval function.
- `xmax` or `ymax`: For intervals, the upper end of the interval from the interval function.
- `.width`: For intervals, the interval width as a numeric value in $[0, 1]$. For slabs, the width of the smallest interval containing that value of the slab.
- `level`: For intervals, the interval width as an ordered factor. For slabs, the level of the smallest interval containing that value of the slab.
- `pdf`: For slabs, the probability density function (PDF). If `options("ggdist.experimental.slab_data_in_intervals")` is TRUE: For intervals, the PDF at the point summary; intervals also have `pdf_min` and `pdf_max` for the PDF at the lower and upper ends of the interval.
- `cdf`: For slabs, the cumulative distribution function. If `options("ggdist.experimental.slab_data_in_intervals")` is TRUE: For intervals, the CDF at the point summary; intervals also have `cdf_min` and `cdf_max` for the CDF at the lower and upper ends of the interval.

Aesthetics

The line+ribbon stats and geoms have a wide variety of aesthetics that control the appearance of their two sub-geometries: the **line** and the **ribbon**.

These stats support the following aesthetics:

- **x**: x position of the geometry (when orientation = "vertical"); or sample data to be summarized (when orientation = "horizontal" with sample data).
- **y**: y position of the geometry (when orientation = "horizontal"); or sample data to be summarized (when orientation = "vertical" with sample data).
- **weight**: When using samples (i.e. the x and y aesthetics, not `xdist` or `ydist`), optional weights to be applied to each draw.
- **xdist**: When using analytical distributions, distribution to map on the x axis: a **distributional** object (e.g. `dist_normal()`) or a `posterior::rvar()` object.
- **ydist**: When using analytical distributions, distribution to map on the y axis: a **distributional** object (e.g. `dist_normal()`) or a `posterior::rvar()` object.
- **dist**: When using analytical distributions, a name of a distribution (e.g. "norm"), a **distributional** object (e.g. `dist_normal()`), or a `posterior::rvar()` object. See **Details**.
- **args**: Distribution arguments (`args` or `arg1, ... arg9`). See **Details**.

In addition, in their default configuration (paired with `geom_lineribbon()`) the following aesthetics are supported by the underlying geom:

Ribbon-specific aesthetics

- **xmin**: Left edge of the ribbon sub-geometry (if orientation = "horizontal").
- **xmax**: Right edge of the ribbon sub-geometry (if orientation = "horizontal").
- **ymin**: Lower edge of the ribbon sub-geometry (if orientation = "vertical").
- **ymax**: Upper edge of the ribbon sub-geometry (if orientation = "vertical").
- **order**: The order in which ribbons are drawn. Ribbons with the smallest mean value of order are drawn first (i.e., will be drawn below ribbons with larger mean values of order). If order is not supplied to `geom_lineribbon()`, `-abs(xmax - xmin)` or `-abs(ymax - ymin)` (depending on orientation) is used, having the effect of drawing the widest (on average) ribbons on the bottom. `stat_lineribbon()` uses `order = after_stat(level)` by default, causing the ribbons generated from the largest `.width` to be drawn on the bottom.

Color aesthetics

- **colour**: (or **color**) The color of the **line** sub-geometry.
- **fill**: The fill color of the **ribbon** sub-geometry.
- **alpha**: The opacity of the **line** and **ribbon** sub-geometries.
- **fill_ramp**: A secondary scale that modifies the fill scale to "ramp" to another color. See `scale_fill_ramp()` for examples.

Line aesthetics

- **linewidth**: Width of **line**. In `ggplot2` < 3.4, was called `size`.
- **linetype**: Type of **line** (e.g., "solid", "dashed", etc)

Other aesthetics (these work as in standard geoms)

- **group**

See examples of some of these aesthetics in action in `vignette("lineribbon")`. Learn more about the sub-geom override aesthetics (like `interval_color`) in the `scales` documentation. Learn more about basic `ggplot` aesthetics in `vignette("ggplot2-specs")`.

See Also

See [geom_lineribbon\(\)](#) for the geom underlying this stat.

Other lineribbon stats: [stat_ribbon\(\)](#)

Examples

```
library(dplyr)
library(ggplot2)
library(distributional)

theme_set(theme_ggdist())

# ON SAMPLE DATA
set.seed(12345)
tibble(
  x = rep(1:10, 100),
  y = rnorm(1000, x)
) %>%
  ggplot(aes(x = x, y = y)) +
  stat_lineribbon() +
  scale_fill_brewer()

# ON ANALYTICAL DISTRIBUTIONS
# Vectorized distribution types, like distributional::dist_normal()
# and posterior::rvar(), can be used with the `xdist` / `ydist` aesthetics
tibble(
  x = 1:10,
  sd = seq(1, 3, length.out = 10)
) %>%
  ggplot(aes(x = x, ydist = dist_normal(x, sd))) +
  stat_lineribbon() +
  scale_fill_brewer()
```

stat_mcse_dots

Blurry MCSE dot plot (stat)

Description

Variant of [stat_dots\(\)](#) for creating blurry dotplots of quantiles. Uses [posterior::mcse_quantile\(\)](#) to calculate the Monte Carlo Standard Error of each quantile computed for the dotplot, yielding an se computed variable that is by default mapped onto the sd aesthetic of [geom_blur_dots\(\)](#).

Usage

```
stat_mcse_dots(
  mapping = NULL,
  data = NULL,
  geom = "blur_dots",
```

```

  position = "identity",
  ...,
  quantiles = NA,
  orientation = NA,
  na.rm = FALSE,
  show.legend = NA,
  inherit.aes = TRUE
)

```

Arguments

mapping	Set of aesthetic mappings created by <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	Use to override the default connection between <code>stat_mcse_dots()</code> and <code>geom_blur_dots()</code>
position	Position adjustment, either as a string, or the result of a call to a position adjustment function. Setting this equal to "dodge" (<code>position_dodge()</code>) or "dodgejust" (<code>position_dodgejust()</code>) can be useful if you have overlapping geometries.
...	<p>Other arguments passed to <code>layer()</code>. These are often aesthetics, used to set an aesthetic to a fixed value, like <code>colour = "red"</code> or <code>linewidth = 3</code> (see Aesthetics, below). They may also be parameters to the paired geom/stat. When paired with the default geom, <code>geom_blur_dots()</code>, these include:</p> <p>blur Blur function to apply to dots. One of:</p> <ul style="list-style-type: none"> • A function that takes a numeric vector of distances from the dot center, the dot radius, and the standard deviation of the blur and returns a vector of opacities in $[0, 1]$, such as <code>blur_gaussian()</code> or <code>blur_interval()</code>. • A string indicating what blur function to use, as the suffix to a function name starting with <code>blur_</code>; e.g. "gaussian" (the default) applies <code>blur_gaussian()</code>. <p>binwidth The bin width to use for laying out the dots. One of:</p> <ul style="list-style-type: none"> • <code>NA</code> (the default): Dynamically select the bin width based on the size of the plot when drawn. This will pick a binwidth such that the tallest stack of dots is at most <code>scale</code> in height (ideally exactly <code>scale</code> in height, though this is not guaranteed). • A length-1 (scalar) numeric or <code>unit</code> object giving the exact bin width. • A length-2 (vector) numeric or <code>unit</code> object giving the minimum and maximum desired bin width. The bin width will be dynamically selected within these bounds.

If the value is numeric, it is assumed to be in units of data. The bin width (or its bounds) can also be specified using `unit()`, which may be useful if it is desired that the dots be a certain point size or a certain percentage of the width/height of the viewport. For example, `unit(0.1, "npc")` would make dots that are *exactly* 10% of the viewport size along whichever dimension the dotplot is drawn; `unit(c(0, 0.1), "npc")` would make dots that are *at most* 10% of the viewport size (while still ensuring the tallest stack is less than or equal to scale).

`dotsize` The width of the dots relative to the binwidth. The default, 1.07, makes dots be just a bit wider than the bin width, which is a manually-tuned parameter that tends to work well with the default circular shape, preventing gaps between bins from appearing to be too large visually (as might arise from dots being *precisely* the binwidth). If it is desired to have dots be precisely the binwidth, set `dotsize = 1`.

`stackratio` The distance between the center of the dots in the same stack relative to the dot height. The default, 1, makes dots in the same stack just touch each other.

`layout` The layout method used for the dots:

- "bin" (default): places dots on the off-axis at the midpoint of their bins as in the classic Wilkinson dotplot. This maintains the alignment of rows and columns in the dotplot. This layout is slightly different from the classic Wilkinson algorithm in that: (1) it nudges bins slightly to avoid overlapping bins and (2) if the input data are symmetrical it will return a symmetrical layout.
- "weave": uses the same basic binning approach of "bin", but places dots in the off-axis at their actual positions (unless `overlaps = "nudge"`, in which case overlaps may be nudged out of the way). This maintains the alignment of rows but does not align dots within columns.
- "hex": uses the same basic binning approach of "bin", but alternates placing dots $+ \text{binwidth}/4$ or $- \text{binwidth}/4$ in the off-axis from the bin center. This allows hexagonal packing by setting a `stackratio` less than 1 (something like 0.9 tends to work).
- "swarm": uses the "compactswarm" layout from `beeswarm::beeswarm()`. Does not maintain alignment of rows or columns, but can be more compact and neat looking, especially for sample data (as opposed to quantile dotplots of theoretical distributions, which may look better with "bin", "weave", or "hex").
- "bar": for discrete distributions, lays out duplicate values in rectangular bars.

`overlaps` How to handle overlapping dots or bins in the "bin", "weave", and "hex" layouts (dots never overlap in the "swarm" or "bar" layouts). For the purposes of this argument, dots are only considered to be overlapping if they would be overlapping when `dotsize = 1` and `stackratio = 1`; i.e. if you set those arguments to other values, overlaps may still occur. One of:

- "keep": leave overlapping dots as they are. Dots may overlap (usually only slightly) in the "bin", "weave", and "hex" layouts.
- "nudge": nudge overlapping dots out of the way. Overlaps are avoided

using a constrained optimization which minimizes the squared distance of dots to their desired positions, subject to the constraint that adjacent dots do not overlap.

`smooth` Smoother to apply to dot positions. One of:

- A function that takes a numeric vector of dot positions and returns a smoothed version of that vector, such as `smooth_bounded()`, `smooth_unbounded()`, `smooth_discrete()`, or `smooth_bar()`.
- A string indicating what smoother to use, as the suffix to a function name starting with `smooth_`; e.g. "none" (the default) applies `smooth_none()`, which simply returns the given vector without applying smoothing.

Smoothing is most effective when the smoother is matched to the support of the distribution; e.g. using `smooth_bounded(bounds = ...)`.

`overflow` How to handle overflow of dots beyond the extent of the geom when a minimum binwidth (or an exact binwidth) is supplied. One of:

- "keep": Keep the overflow, drawing dots outside the geom bounds.
- "warn": Keep the overflow, but produce a warning suggesting solutions, such as setting `binwidth = NA` or `overflow = "compress"`.
- "compress": Compress the layout. Reduces the binwidth to the size necessary to keep the dots within bounds, then adjusts `stackratio` and `dotsize` so that the apparent dot size is the user-specified minimum binwidth times the user-specified `dotsize`.

If you find the default layout has dots that are too small, and you are okay with dots overlapping, consider setting `overflow = "compress"` and supplying an exact or minimum dot size using `binwidth`.

`verbose` If TRUE, print out the bin width of the dotplot. Can be useful if you want to start from an automatically-selected bin width and then adjust it manually. Bin width is printed both as data units and as normalized parent coordinates or "npc"s (see `unit()`). Note that if you just want to scale the selected bin width to fit within a desired area, it is probably easier to use `scale` than to copy and scale `binwidth` manually, and if you just want to provide constraints on the bin width, you can pass a length-2 vector to `binwidth`.

`subguide` Sub-guide used to annotate the thickness scale. One of:

- A function that takes a scale argument giving a `ggplot2::Scale` object and an orientation argument giving the orientation of the geometry and then returns a `grid::grob` that will draw the axis annotation, such as `subguide_axis()` (to draw a traditional axis) or `subguide_none()` (to draw no annotation). See `subguide_axis()` for a list of possibilities and examples.
- A string giving the name of such a function when prefixed with "subguide"; e.g. "axis" or "none".

`quantiles`

Setting this to a value other than NA will produce a quantile dotplot: that is, a dotplot of quantiles from the sample or distribution (for analytical distributions, the default of NA is taken to mean 100 quantiles). The value of `quantiles` determines the number of quantiles to plot. See Kay et al. (2016) and Fernandes et al. (2018) for more information on quantile dotplots.

orientation	<p>Whether this geom is drawn horizontally or vertically. One of:</p> <ul style="list-style-type: none"> • NA (default): automatically detect the orientation based on how the aesthetics are assigned. Automatic detection works most of the time. • "horizontal" (or "y"): draw horizontally, using the y aesthetic to identify different groups. For each group, uses the x, xmin, xmax, and thickness aesthetics to draw points, intervals, and slabs. • "vertical" (or "x"): draw vertically, using the x aesthetic to identify different groups. For each group, uses the y, ymin, ymax, and thickness aesthetics to draw points, intervals, and slabs. <p>For compatibility with the base ggplot naming scheme for orientation, "x" can be used as an alias for "vertical" and "y" as an alias for "horizontal" (ggdist had an orientation parameter before base ggplot did, hence the discrepancy).</p>
na.rm	If FALSE, the default, missing values are removed with a warning. If TRUE, missing values are silently removed.
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> .

Details

The *dots* family of stats and geoms are similar to `geom_dotplot()` but with a number of differences:

- Dots geoms act like slabs in `geom_slabinterval()` and can be given x positions (or y positions when in a horizontal orientation).
- Given the available space to lay out dots, the dots geoms will automatically determine how many bins to use to fit the available space.
- Dots geoms use a dynamic layout algorithm that lays out dots from the center out if the input data are symmetrical, guaranteeing that symmetrical data results in a symmetrical plot. The layout algorithm also prevents dots from overlapping each other.
- The shape of the dots in these geoms can be changed using the `slab_shape` aesthetic (when using the `dotsinterval` family) or the `shape` or `slab_shape` aesthetic (when using the `dots` family)

Stats and geoms in this family include:

- `geom_dots()`: dotplots on raw data. Ensures the dotplot fits within available space by reducing the size of the dots automatically (may result in very small dots).
- `geom_swarm()` and `geom_weave()`: dotplots on raw data with defaults intended to create "beeswarm" plots. Used `side = "both"` by default, and sets the default dot size to the same size as `geom_point()` (`binwidth = unit(1.5, "mm")`), allowing dots to overlap instead of getting very small.
- `stat_dots()`: dotplots on raw data, **distributional** objects, and `posterior::rvar()`s

- `geom_dotsinterval()`: dotplot + interval plots on raw data with already-calculated intervals (rarely useful directly).
- `stat_dotsinterval()`: dotplot + interval plots on raw data, **distributional** objects, and `posterior::rvar()`s (will calculate intervals for you).
- `geom_blur_dots()`: blurry dotplots that allow the standard deviation of a blur applied to each dot to be specified using the `sd` aesthetic.
- `stat_mcse_dots()`: blurry dotplots of quantiles using the Monte Carlo Standard Error of each quantile.

`stat_dots()` and `stat_dotsinterval()`, when used with the `quantiles` argument, are particularly useful for constructing quantile dotplots, which can be an effective way to communicate uncertainty using a frequency framing that may be easier for laypeople to understand (Kay et al. 2016, Fernandes et al. 2018).

To visualize sample data, such as a data distribution, samples from a bootstrap distribution, or a Bayesian posterior, you can supply samples to the `x` or `y` aesthetic.

To visualize analytical distributions, you can use the `xdist` or `ydist` aesthetic. For historical reasons, you can also use `dist` to specify the distribution, though this is not recommended as it does not work as well with orientation detection. These aesthetics can be used as follows:

- `xdist`, `ydist`, and `dist` can be any distribution object from the **distributional** package (`dist_normal()`, `dist_beta()`, etc) or can be a `posterior::rvar()` object. Since these functions are vectorized, other columns can be passed directly to them in an `aes()` specification; e.g. `aes(dist = dist_normal(mu, sigma))` will work if `mu` and `sigma` are columns in the input data frame.
- `dist` can be a character vector giving the distribution name. Then the `arg1, ... arg9` aesthetics (or `args` as a list column) specify distribution arguments. Distribution names should correspond to R functions that have "p", "q", and "d" functions; e.g. "norm" is a valid distribution name because R defines the `pnorm()`, `qnorm()`, and `dnorm()` functions for Normal distributions.

See the `parse_dist()` function for a useful way to generate `dist` and `args` values from human-readable distribution specs (like `"normal(0,1)"`). Such specs are also produced by other packages (like the `brms::get_prior` function in `brms`); thus, `parse_dist()` combined with the stats described here can help you visualize the output of those functions.

Value

A `ggplot2::Stat` representing a blurry MCSE dot geometry which can be added to a `ggplot()` object.

Computed Variables

The following variables are computed by this stat and made available for use in aesthetic specifications (`aes()`) using the `after_stat()` function or the `after_stat` argument of `stage()`:

- `x` or `y`: For slabs, the input values to the slab function. For intervals, the point summary from the interval function. Whether it is `x` or `y` depends on orientation
- `xmin` or `ymin`: For intervals, the lower end of the interval from the interval function.
- `xmax` or `ymax`: For intervals, the upper end of the interval from the interval function.

- `.width`: For intervals, the interval width as a numeric value in $[0, 1]$. For slabs, the width of the smallest interval containing that value of the slab.
- `level`: For intervals, the interval width as an ordered factor. For slabs, the level of the smallest interval containing that value of the slab.
- `pdf`: For slabs, the probability density function (PDF). If `options("ggdist.experimental.slab_data_in_intervals")` is TRUE: For intervals, the PDF at the point summary; intervals also have `pdf_min` and `pdf_max` for the PDF at the lower and upper ends of the interval.
- `cdf`: For slabs, the cumulative distribution function. If `options("ggdist.experimental.slab_data_in_intervals")` is TRUE: For intervals, the CDF at the point summary; intervals also have `cdf_min` and `cdf_max` for the CDF at the lower and upper ends of the interval.
- `n`: For slabs, the number of data points summarized into that slab. If the slab was created from an analytical distribution via the `xdist`, `ydist`, or `dist` aesthetic, `n` will be `Inf`.
- `f`: (deprecated) For slabs, the output values from the slab function (such as the PDF, CDF, or CCDF), determined by `slab_type`. Instead of using `slab_type` to change `f` and then mapping `f` onto an aesthetic, it is now recommended to simply map the corresponding computed variable (e.g. `pdf`, `cdf`, or `1 - cdf`) directly onto the desired aesthetic.
- `se`: For dots, the Monte Carlo Standard Error of the quantile corresponding to each dot.

Aesthetics

The dots+interval stats and geoms have a wide variety of aesthetics that control the appearance of their three sub-geometries: the **dots** (aka the **slab**), the **point**, and the **interval**.

These stats support the following aesthetics:

- `x`: x position of the geometry (when `orientation = "vertical"`); or sample data to be summarized (when `orientation = "horizontal"` with sample data).
- `y`: y position of the geometry (when `orientation = "horizontal"`); or sample data to be summarized (when `orientation = "vertical"` with sample data).
- `weight`: When using samples (i.e. the `x` and `y` aesthetics, not `xdist` or `ydist`), optional weights to be applied to each draw.
- `xdist`: When using analytical distributions, distribution to map on the x axis: a **distributional** object (e.g. `dist_normal()`) or a `posterior::rvar()` object.
- `ydist`: When using analytical distributions, distribution to map on the y axis: a **distributional** object (e.g. `dist_normal()`) or a `posterior::rvar()` object.
- `dist`: When using analytical distributions, a name of a distribution (e.g. "norm"), a **distributional** object (e.g. `dist_normal()`), or a `posterior::rvar()` object. See **Details**.
- `args`: Distribution arguments (`args` or `arg1, ... arg9`). See **Details**.

In addition, in their default configuration (paired with `geom_blur_dots()`) the following aesthetics are supported by the underlying geom:

Dots-specific (aka Slab-specific) aesthetics

- `sd`: The standard deviation (in data units) of the blur associated with each dot.

- **order**: The order in which data points are stacked within bins. Can be used to create the effect of "stacked" dots by ordering dots according to a discrete variable. If omitted (NULL), the value of the data points themselves are used to determine stacking order. Only applies when layout is "bin" or "hex", as the other layout methods fully determine both x and y positions.
- **side**: Which side to place the slab on. "topright", "top", and "right" are synonyms which cause the slab to be drawn on the top or the right depending on if orientation is "horizontal" or "vertical". "bottomleft", "bottom", and "left" are synonyms which cause the slab to be drawn on the bottom or the left depending on if orientation is "horizontal" or "vertical". "topleft" causes the slab to be drawn on the top or the left, and "bottomright" causes the slab to be drawn on the bottom or the right. "both" draws the slab mirrored on both sides (as in a violin plot).
- **scale**: What proportion of the region allocated to this geom to use to draw the slab. If scale = 1, slabs that use the maximum range will just touch each other. Default is 0.9 to leave some space between adjacent slabs. For a comprehensive discussion and examples of slab scaling and normalization, see the [thickness scale article](#).
- **justification**: Justification of the interval relative to the slab, where 0 indicates bottom/left justification and 1 indicates top/right justification (depending on orientation). If justification is NULL (the default), then it is set automatically based on the value of side: when side is "top"/"right" justification is set to 0, when side is "bottom"/"left" justification is set to 1, and when side is "both" justification is set to 0.5.
- **datatype**: When using composite geoms directly without a stat (e.g. `geom_slabinterval()`), datatype is used to indicate which part of the geom a row in the data targets: rows with datatype = "slab" target the slab portion of the geometry and rows with datatype = "interval" target the interval portion of the geometry. This is set automatically when using ggdist stats.

Interval-specific aesthetics

- **xmin**: Left end of the interval sub-geometry (if orientation = "horizontal").
- **xmax**: Right end of the interval sub-geometry (if orientation = "horizontal").
- **ymin**: Lower end of the interval sub-geometry (if orientation = "vertical").
- **ymax**: Upper end of the interval sub-geometry (if orientation = "vertical").

Color aesthetics

- **colour**: (or color) The color of the **interval** and **point** sub-geometries. Use the `slab_color`, `interval_color`, or `point_color` aesthetics (below) to set sub-geometry colors separately.
- **fill**: The fill color of the **slab** and **point** sub-geometries. Use the `slab_fill` or `point_fill` aesthetics (below) to set sub-geometry colors separately.
- **alpha**: The opacity of the **slab**, **interval**, and **point** sub-geometries. Use the `slab_alpha`, `interval_alpha`, or `point_alpha` aesthetics (below) to set sub-geometry colors separately.
- **colour_ramp**: (or color_ramp) A secondary scale that modifies the color scale to "ramp" to another color. See [scale_colour_ramp\(\)](#) for examples.
- **fill_ramp**: A secondary scale that modifies the fill scale to "ramp" to another color. See [scale_fill_ramp\(\)](#) for examples.

Line aesthetics

- **linewidth**: Width of the line used to draw the **interval** (except with `geom_slab()`: then it is the width of the **slab**). With composite geometries including an interval and slab, use `slab_linewidth` to set the line width of the **slab** (see below). For **interval**, raw `linewidth` values are transformed according to the `interval_size_domain` and `interval_size_range` parameters of the geom (see above).
- **size**: Determines the size of the **point**. If `linewidth` is not provided, `size` will also determine the width of the line used to draw the **interval** (this allows line width and point size to be modified together by setting only `size` and not `linewidth`). Raw `size` values are transformed according to the `interval_size_domain`, `interval_size_range`, and `fatten_point` parameters of the geom (see above). Use the `point_size` aesthetic (below) to set sub-geometry size directly without applying the effects of `interval_size_domain`, `interval_size_range`, and `fatten_point`.
- **stroke**: Width of the outline around the **point** sub-geometry.
- **linetype**: Type of line (e.g., "solid", "dashed", etc) used to draw the **interval** and the outline of the **slab** (if it is visible). Use the `slab_linetype` or `interval_linetype` aesthetics (below) to set sub-geometry line types separately.

Slab-specific color and line override aesthetics

- `slab_fill`: Override for `fill`: the fill color of the slab.
- `slab_colour`: (or `slab_color`) Override for `colour/color`: the outline color of the slab.
- `slab_alpha`: Override for `alpha`: the opacity of the slab.
- `slab_linewidth`: Override for `linewidth`: the width of the outline of the slab.
- `slab_linetype`: Override for `linetype`: the line type of the outline of the slab.
- `slab_shape`: Override for `shape`: the shape of the dots used to draw the dotplot slab.

Interval-specific color and line override aesthetics

- `interval_colour`: (or `interval_color`) Override for `colour/color`: the color of the interval.
- `interval_alpha`: Override for `alpha`: the opacity of the interval.
- `interval_linetype`: Override for `linetype`: the line type of the interval.

Point-specific color and line override aesthetics

- `point_fill`: Override for `fill`: the fill color of the point.
- `point_colour`: (or `point_color`) Override for `colour/color`: the outline color of the point.
- `point_alpha`: Override for `alpha`: the opacity of the point.
- `point_size`: Override for `size`: the size of the point.

Deprecated aesthetics

- `slab_size`: Use `slab_linewidth`.
- `interval_size`: Use `interval_linewidth`.

Other aesthetics (these work as in standard geoms)

- width
- height
- group

See examples of some of these aesthetics in action in `vignette("dotsinterval")`. Learn more about the sub-geom override aesthetics (like `interval_color`) in the [scales](#) documentation. Learn more about basic ggplot aesthetics in `vignette("ggplot2-specs")`.

References

Kay, M., Kola, T., Hullman, J. R., & Munson, S. A. (2016). When (ish) is My Bus? User-centered Visualizations of Uncertainty in Everyday, Mobile Predictive Systems. *Conference on Human Factors in Computing Systems - CHI '16*, 5092–5103. doi:10.1145/2858036.2858558.

Fernandes, M., Walls, L., Munson, S., Hullman, J., & Kay, M. (2018). Uncertainty Displays Using Quantile Dotplots or CDFs Improve Transit Decision-Making. *Conference on Human Factors in Computing Systems - CHI '18*. doi:10.1145/3173574.3173718.

See Also

See `geom_blur_dots()` for the geom underlying this stat. See `vignette("dotsinterval")` for a variety of examples of use.

Other dotsinterval stats: `stat_dots()`, `stat_dotsinterval()`

Examples

```
library(dplyr)
library(ggplot2)

theme_set(theme_ggdist())

set.seed(1234)
data.frame(x = rnorm(1000)) %>%
  ggplot(aes(x = x)) +
  stat_mcse_dots(quantiles = 100, layout = "weave")
```

stat_pointinterval *Point + multiple-interval plot (shortcut stat)*

Description

Shortcut version of `stat_slabinterval()` with `geom_pointinterval()` for creating point + multiple-interval plots.

Roughly equivalent to:

```
stat_slabinterval(
  geom = "pointinterval",
  show_slab = FALSE
)
```

Usage

```
stat_pointinterval(
  mapping = NULL,
  data = NULL,
  geom = "pointinterval",
  position = "identity",
  ...,
  point_interval = "median_qi",
  .width = c(0.66, 0.95),
  orientation = NA,
  na.rm = FALSE,
  show.legend = c(size = FALSE),
  inherit.aes = TRUE
)
```

Arguments

mapping	Set of aesthetic mappings created by <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	Use to override the default connection between <code>stat_pointinterval()</code> and <code>geom_pointinterval()</code>
position	Position adjustment, either as a string, or the result of a call to a position adjustment function. Setting this equal to "dodge" (<code>position_dodge()</code>) or "dodgejust" (<code>position_dodgejust()</code>) can be useful if you have overlapping geometries.
...	Other arguments passed to <code>layer()</code> . These are often aesthetics, used to set an aesthetic to a fixed value, like <code>colour = "red"</code> or <code>linewidth = 3</code> (see Aesthetics , below). They may also be parameters to the paired geom/stat. When paired with the default geom, <code>geom_pointinterval()</code> , these include: <code>interval_size_domain</code> A length-2 numeric vector giving the minimum and maximum of the values of the size and linewidth aesthetics that will be translated into actual sizes for intervals drawn according to <code>interval_size_range</code> (see the documentation for that argument.)

- `interval_size_range` A length-2 numeric vector. This geom scales the raw size aesthetic values when drawing interval and point sizes, as they tend to be too thick when using the default settings of `scale_size_continuous()`, which give sizes with a range of `c(1, 6)`. The `interval_size_domain` value indicates the input domain of raw size values (typically this should be equal to the value of the `range` argument of the `scale_size_continuous()` function), and `interval_size_range` indicates the desired output range of the size values (the min and max of the actual sizes used to draw intervals). Most of the time it is not recommended to change the value of this argument, as it may result in strange scaling of legends; this argument is a holdover from earlier versions that did not have size aesthetics targeting the point and interval separately. If you want to adjust the size of the interval or points separately, you can also use the `linewidth` or `point_size` aesthetics; see [sub-geometry-scales](#).
- `fatten_point` A multiplicative factor used to adjust the size of the point relative to the size of the thickest interval line. If you wish to specify point sizes directly, you can also use the `point_size` aesthetic and `scale_point_size_continuous()` or `scale_point_size_discrete()`; sizes specified with that aesthetic will not be adjusted using `fatten_point`.
- `arrow` `grid::arrow()` giving the arrow heads to use on the interval, or `NULL` for no arrows.
- `point_interval` A function from the `point_interval()` family (e.g., `median_qi`, `mean_qi`, `mode_hdi`, etc), or a string giving the name of a function from that family (e.g., `"median_qi"`, `"mean_qi"`, `"mode_hdi"`, etc; if a string, the caller's environment is searched for the function, followed by the `ggdist` environment). This function determines the point summary (typically mean, median, or mode) and interval type (quantile interval, `qi`; highest-density interval, `hdi`; or highest-density continuous interval, `hdc`). Output will be converted to the appropriate x- or y-based aesthetics depending on the value of `orientation`. See the `point_interval()` family of functions for more information.
- `.width` The `.width` argument passed to `point_interval`: a vector of probabilities to use that determine the widths of the resulting intervals. If multiple probabilities are provided, multiple intervals per group are generated, each with a different probability interval (and value of the corresponding `.width` and `level` generated variables).
- `orientation` Whether this geom is drawn horizontally or vertically. One of:
- `NA` (default): automatically detect the orientation based on how the aesthetics are assigned. Automatic detection works most of the time.
 - `"horizontal"` (or `"y"`): draw horizontally, using the `y` aesthetic to identify different groups. For each group, uses the `x`, `xmin`, `xmax`, and `thickness` aesthetics to draw points, intervals, and slabs.
 - `"vertical"` (or `"x"`): draw vertically, using the `x` aesthetic to identify different groups. For each group, uses the `y`, `ymin`, `ymax`, and `thickness` aesthetics to draw points, intervals, and slabs.

For compatibility with the base `ggplot` naming scheme for orientation, `"x"` can be used as an alias for `"vertical"` and `"y"` as an alias for `"horizontal"`

	(ggdist had an orientation parameter before base ggplot did, hence the discrepancy).
na.rm	If FALSE, the default, missing values are removed with a warning. If TRUE, missing values are silently removed.
show.legend	Should this layer be included in the legends? Default is <code>c(size = FALSE)</code> , unlike most geoms, to match its common use cases. FALSE hides all legends, TRUE shows all legends, and NA shows only those that are mapped (the default for most geoms).
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> .

Details

To visualize sample data, such as a data distribution, samples from a bootstrap distribution, or a Bayesian posterior, you can supply samples to the `x` or `y` aesthetic.

To visualize analytical distributions, you can use the `xdist` or `ydist` aesthetic. For historical reasons, you can also use `dist` to specify the distribution, though this is not recommended as it does not work as well with orientation detection. These aesthetics can be used as follows:

- `xdist`, `ydist`, and `dist` can be any distribution object from the **distributional** package (`dist_normal()`, `dist_beta()`, etc) or can be a `posterior::rvar()` object. Since these functions are vectorized, other columns can be passed directly to them in an `aes()` specification; e.g. `aes(dist = dist_normal(mu, sigma))` will work if `mu` and `sigma` are columns in the input data frame.
- `dist` can be a character vector giving the distribution name. Then the `arg1`, ... `arg9` aesthetics (or `args` as a list column) specify distribution arguments. Distribution names should correspond to R functions that have "p", "q", and "d" functions; e.g. "norm" is a valid distribution name because R defines the `pnorm()`, `qnorm()`, and `dnorm()` functions for Normal distributions.

See the `parse_dist()` function for a useful way to generate `dist` and `args` values from human-readable distribution specs (like "normal(0,1)"). Such specs are also produced by other packages (like the `brms::get_prior` function in `brms`); thus, `parse_dist()` combined with the stats described here can help you visualize the output of those functions.

Value

A `ggplot2::Stat` representing a point + multiple-interval geometry which can be added to a `ggplot()` object.

Computed Variables

The following variables are computed by this stat and made available for use in aesthetic specifications (`aes()`) using the `after_stat()` function or the `after_stat` argument of `stage()`:

- `x` or `y`: For slabs, the input values to the slab function. For intervals, the point summary from the interval function. Whether it is `x` or `y` depends on `orientation`
- `xmin` or `ymin`: For intervals, the lower end of the interval from the interval function.
- `xmax` or `ymax`: For intervals, the upper end of the interval from the interval function.

- `.width`: For intervals, the interval width as a numeric value in $[0, 1]$. For slabs, the width of the smallest interval containing that value of the slab.
- `level`: For intervals, the interval width as an ordered factor. For slabs, the level of the smallest interval containing that value of the slab.
- `pdf`: For slabs, the probability density function (PDF). If `options("ggdist.experimental.slab_data_in_interval" is TRUE)`: For intervals, the PDF at the point summary; intervals also have `pdf_min` and `pdf_max` for the PDF at the lower and upper ends of the interval.
- `cdf`: For slabs, the cumulative distribution function. If `options("ggdist.experimental.slab_data_in_intervals" is TRUE)`: For intervals, the CDF at the point summary; intervals also have `cdf_min` and `cdf_max` for the CDF at the lower and upper ends of the interval.

Aesthetics

The slab+interval stats and geoms have a wide variety of aesthetics that control the appearance of their three sub-geometries: the **slab**, the **point**, and the **interval**.

These stats support the following aesthetics:

- `x`: x position of the geometry (when `orientation = "vertical"`); or sample data to be summarized (when `orientation = "horizontal"` with sample data).
- `y`: y position of the geometry (when `orientation = "horizontal"`); or sample data to be summarized (when `orientation = "vertical"` with sample data).
- `weight`: When using samples (i.e. the `x` and `y` aesthetics, not `xdist` or `ydist`), optional weights to be applied to each draw.
- `xdist`: When using analytical distributions, distribution to map on the x axis: a **distributional** object (e.g. `dist_normal()`) or a `posterior::rvar()` object.
- `ydist`: When using analytical distributions, distribution to map on the y axis: a **distributional** object (e.g. `dist_normal()`) or a `posterior::rvar()` object.
- `dist`: When using analytical distributions, a name of a distribution (e.g. `"norm"`), a **distributional** object (e.g. `dist_normal()`), or a `posterior::rvar()` object. See **Details**.
- `args`: Distribution arguments (`args` or `arg1, ... arg9`). See **Details**.

In addition, in their default configuration (paired with `geom_pointinterval()`) the following aesthetics are supported by the underlying geom:

Interval-specific aesthetics

- `xmin`: Left end of the interval sub-geometry (if `orientation = "horizontal"`).
- `xmax`: Right end of the interval sub-geometry (if `orientation = "horizontal"`).
- `ymin`: Lower end of the interval sub-geometry (if `orientation = "vertical"`).
- `ymax`: Upper end of the interval sub-geometry (if `orientation = "vertical"`).

Point-specific aesthetics

- `shape`: Shape type used to draw the **point** sub-geometry.

Color aesthetics

- **colour:** (or **color**) The color of the **interval** and **point** sub-geometries. Use the `slab_color`, `interval_color`, or `point_color` aesthetics (below) to set sub-geometry colors separately.
- **fill:** The fill color of the **slab** and **point** sub-geometries. Use the `slab_fill` or `point_fill` aesthetics (below) to set sub-geometry colors separately.
- **alpha:** The opacity of the **slab**, **interval**, and **point** sub-geometries. Use the `slab_alpha`, `interval_alpha`, or `point_alpha` aesthetics (below) to set sub-geometry colors separately.
- **colour_ramp:** (or **color_ramp**) A secondary scale that modifies the color scale to "ramp" to another color. See `scale_colour_ramp()` for examples.
- **fill_ramp:** A secondary scale that modifies the fill scale to "ramp" to another color. See `scale_fill_ramp()` for examples.

Line aesthetics

- **linewidth:** Width of the line used to draw the **interval** (except with `geom_slab()`: then it is the width of the **slab**). With composite geometries including an interval and slab, use `slab_linewidth` to set the line width of the **slab** (see below). For **interval**, raw `linewidth` values are transformed according to the `interval_size_domain` and `interval_size_range` parameters of the geom (see above).
- **size:** Determines the size of the **point**. If `linewidth` is not provided, `size` will also determine the width of the line used to draw the **interval** (this allows line width and point size to be modified together by setting only `size` and not `linewidth`). Raw `size` values are transformed according to the `interval_size_domain`, `interval_size_range`, and `fatten_point` parameters of the geom (see above). Use the `point_size` aesthetic (below) to set sub-geometry size directly without applying the effects of `interval_size_domain`, `interval_size_range`, and `fatten_point`.
- **stroke:** Width of the outline around the **point** sub-geometry.
- **linetype:** Type of line (e.g., "solid", "dashed", etc) used to draw the **interval** and the outline of the **slab** (if it is visible). Use the `slab_linetype` or `interval_linetype` aesthetics (below) to set sub-geometry line types separately.

Interval-specific color and line override aesthetics

- **interval_colour:** (or **interval_color**) Override for `colour/color`: the color of the interval.
- **interval_alpha:** Override for `alpha`: the opacity of the interval.
- **interval_linetype:** Override for `linetype`: the line type of the interval.

Point-specific color and line override aesthetics

- **point_fill:** Override for `fill`: the fill color of the point.
- **point_colour:** (or **point_color**) Override for `colour/color`: the outline color of the point.
- **point_alpha:** Override for `alpha`: the opacity of the point.
- **point_size:** Override for `size`: the size of the point.

Deprecated aesthetics

- **interval_size:** Use `interval_linewidth`.

Other aesthetics (these work as in standard geoms)

- width
- height
- group

See examples of some of these aesthetics in action in `vignette("slabinterval")`. Learn more about the sub-geom override aesthetics (like `interval_color`) in the [scales](#) documentation. Learn more about basic ggplot aesthetics in `vignette("ggplot2-specs")`.

See Also

See `geom_pointinterval()` for the geom underlying this stat. See `stat_slabinterval()` for the stat this shortcut is based on.

Other slabinterval stats: `stat_ccdfinterval()`, `stat_cdfinterval()`, `stat_eye()`, `stat_gradientinterval()`, `stat_halfeye()`, `stat_histinterval()`, `stat_interval()`, `stat_slab()`, `stat_spike()`

Examples

```
library(dplyr)
library(ggplot2)
library(distributional)

theme_set(theme_ggdist())

# ON SAMPLE DATA
set.seed(1234)
df = data.frame(
  group = c("a", "b", "c"),
  value = rnorm(1500, mean = c(5, 7, 9), sd = c(1, 1.5, 1))
)
df %>%
  ggplot(aes(x = value, y = group)) +
  stat_pointinterval()

# ON ANALYTICAL DISTRIBUTIONS
dist_df = data.frame(
  group = c("a", "b", "c"),
  mean = c( 5,  7,  8),
  sd = c( 1, 1.5,  1)
)
# Vectorized distribution types, like distributional::dist_normal()
# and posterior::rvar(), can be used with the `xdist` / `ydist` aesthetics
dist_df %>%
  ggplot(aes(y = group, xdist = dist_normal(mean, sd))) +
  stat_pointinterval()
```

stat_ribbon

*Multiple-ribbon plot (shortcut stat)***Description**

A combination of `stat_slabinterval()` and `geom_lineribbon()` with sensible defaults for making multiple-ribbon plots. While `geom_lineribbon()` is intended for use on data frames that have already been summarized using a `point_interval()` function, `stat_ribbon()` is intended for use directly on data frames of draws or of analytical distributions, and will perform the summarization using a `point_interval()` function.

Roughly equivalent to:

```
stat_lineribbon(  
  show_point = FALSE  
)
```

Usage

```
stat_ribbon(  
  mapping = NULL,  
  data = NULL,  
  geom = "linerribbon",  
  position = "identity",  
  ...,  
  .width = c(0.5, 0.8, 0.95),  
  point_interval = "median_qi",  
  orientation = NA,  
  na.rm = FALSE,  
  show.legend = NA,  
  inherit.aes = TRUE  
)
```

Arguments

- | | |
|---------|---|
| mapping | Set of aesthetic mappings created by <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	Use to override the default connection between <code>stat_ribbon()</code> and <code>geom_lineribbon()</code>
position	Position adjustment, either as a string, or the result of a call to a position adjustment function. Setting this equal to "dodge" (<code>position_dodge()</code>) or "dodgejust" (<code>position_dodgejust()</code>) can be useful if you have overlapping geometries.
...	Other arguments passed to <code>layer()</code> . These are often aesthetics, used to set an aesthetic to a fixed value, like <code>colour = "red"</code> or <code>linewidth = 3</code> (see Aesthetics , below). They may also be parameters to the paired geom/stat. When paired with the default geom, <code>geom_lineribbon()</code> , these include: <ul style="list-style-type: none"> step Should the line/ribbon be drawn as a step function? One of: <ul style="list-style-type: none"> FALSE (default): do not draw as a step function. "mid" (or TRUE): draw steps midway between adjacent x values. "hv": draw horizontal-then-vertical steps. "vh": draw as vertical-then-horizontal steps. <p>TRUE is an alias for "mid" because for a step function with ribbons, "mid" is probably what you want (for the other two step approaches the ribbons at either the very first or very last x value will not be visible).</p>
.width	The <code>.width</code> argument passed to <code>point_interval</code> : a vector of probabilities to use that determine the widths of the resulting intervals. If multiple probabilities are provided, multiple intervals per group are generated, each with a different probability interval (and value of the corresponding <code>.width</code> and level generated variables).
point_interval	A function from the <code>point_interval()</code> family (e.g., <code>median_qi</code> , <code>mean_qi</code> , <code>mode_hdi</code> , etc), or a string giving the name of a function from that family (e.g., "median_qi", "mean_qi", "mode_hdi", etc; if a string, the caller's environment is searched for the function, followed by the ggdist environment). This function determines the point summary (typically mean, median, or mode) and interval type (quantile interval, qi; highest-density interval, hdi; or highest-density continuous interval, hdc). Output will be converted to the appropriate x- or y-based aesthetics depending on the value of <code>orientation</code> . See the <code>point_interval()</code> family of functions for more information.
orientation	Whether this geom is drawn horizontally or vertically. One of: <ul style="list-style-type: none"> NA (default): automatically detect the orientation based on how the aesthetics are assigned. Automatic detection works most of the time. "horizontal" (or "y"): draw horizontally, using the y aesthetic to identify different groups. For each group, uses the x, xmin, xmax, and thickness aesthetics to draw points, intervals, and slabs. "vertical" (or "x"): draw vertically, using the x aesthetic to identify different groups. For each group, uses the y, ymin, ymax, and thickness aesthetics to draw points, intervals, and slabs. <p>For compatibility with the base ggplot naming scheme for orientation, "x" can be used as an alias for "vertical" and "y" as an alias for "horizontal" (ggdist had an orientation parameter before base ggplot did, hence the discrepancy).</p>
na.rm	If FALSE, the default, missing values are removed with a warning. If TRUE, missing values are silently removed.

show.legend	Should this layer be included in the legends? NA, the default, includes if any aesthetics are mapped. FALSE never includes, and TRUE always includes.
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> .

Details

To visualize sample data, such as a data distribution, samples from a bootstrap distribution, or a Bayesian posterior, you can supply samples to the x or y aesthetic.

To visualize analytical distributions, you can use the `xdist` or `ydist` aesthetic. For historical reasons, you can also use `dist` to specify the distribution, though this is not recommended as it does not work as well with orientation detection. These aesthetics can be used as follows:

- `xdist`, `ydist`, and `dist` can be any distribution object from the `distributional` package (`dist_normal()`, `dist_beta()`, etc) or can be a `posterior::rvar()` object. Since these functions are vectorized, other columns can be passed directly to them in an `aes()` specification; e.g. `aes(dist = dist_normal(mu, sigma))` will work if `mu` and `sigma` are columns in the input data frame.
- `dist` can be a character vector giving the distribution name. Then the `arg1`, ... `arg9` aesthetics (or `args` as a list column) specify distribution arguments. Distribution names should correspond to R functions that have "p", "q", and "d" functions; e.g. "norm" is a valid distribution name because R defines the `pnorm()`, `qnorm()`, and `dnorm()` functions for Normal distributions.

See the `parse_dist()` function for a useful way to generate `dist` and `args` values from human-readable distribution specs (like "normal(0,1)"). Such specs are also produced by other packages (like the `brms::get_prior` function in `brms`); thus, `parse_dist()` combined with the stats described here can help you visualize the output of those functions.

Value

A `ggplot2::Stat` representing a multiple-ribbon geometry which can be added to a `ggplot()` object.

Computed Variables

The following variables are computed by this stat and made available for use in aesthetic specifications (`aes()`) using the `after_stat()` function or the `after_stat` argument of `stage()`:

- `x` or `y`: For slabs, the input values to the slab function. For intervals, the point summary from the interval function. Whether it is `x` or `y` depends on orientation
- `xmin` or `ymin`: For intervals, the lower end of the interval from the interval function.
- `xmax` or `ymax`: For intervals, the upper end of the interval from the interval function.
- `.width`: For intervals, the interval width as a numeric value in $[0, 1]$. For slabs, the width of the smallest interval containing that value of the slab.
- `level`: For intervals, the interval width as an ordered factor. For slabs, the level of the smallest interval containing that value of the slab.
- `pdf`: For slabs, the probability density function (PDF). If `options("ggdist.experimental.slab_data_in_interval")` is TRUE: For intervals, the PDF at the point summary; intervals also have `pdf_min` and `pdf_max` for the PDF at the lower and upper ends of the interval.

- `cdf`: For slabs, the cumulative distribution function. If `options("ggdist.experimental.slab_data_in_intervals")` is `TRUE`: For intervals, the CDF at the point summary; intervals also have `cdf_min` and `cdf_max` for the CDF at the lower and upper ends of the interval.

Aesthetics

The line+ribbon stats and geoms have a wide variety of aesthetics that control the appearance of their two sub-geometries: the **line** and the **ribbon**.

These stats support the following aesthetics:

- `x`: x position of the geometry (when `orientation = "vertical"`); or sample data to be summarized (when `orientation = "horizontal"` with sample data).
- `y`: y position of the geometry (when `orientation = "horizontal"`); or sample data to be summarized (when `orientation = "vertical"` with sample data).
- `weight`: When using samples (i.e. the x and y aesthetics, not `xdist` or `ydist`), optional weights to be applied to each draw.
- `xdist`: When using analytical distributions, distribution to map on the x axis: a **distributional** object (e.g. `dist_normal()`) or a `posterior::rvar()` object.
- `ydist`: When using analytical distributions, distribution to map on the y axis: a **distributional** object (e.g. `dist_normal()`) or a `posterior::rvar()` object.
- `dist`: When using analytical distributions, a name of a distribution (e.g. "norm"), a **distributional** object (e.g. `dist_normal()`), or a `posterior::rvar()` object. See **Details**.
- `args`: Distribution arguments (`args` or `arg1, ... arg9`). See **Details**.

In addition, in their default configuration (paired with `geom_lineribbon()`) the following aesthetics are supported by the underlying geom:

Ribbon-specific aesthetics

- `xmin`: Left edge of the ribbon sub-geometry (if `orientation = "horizontal"`).
- `xmax`: Right edge of the ribbon sub-geometry (if `orientation = "horizontal"`).
- `ymin`: Lower edge of the ribbon sub-geometry (if `orientation = "vertical"`).
- `ymax`: Upper edge of the ribbon sub-geometry (if `orientation = "vertical"`).
- `order`: The order in which ribbons are drawn. Ribbons with the smallest mean value of `order` are drawn first (i.e., will be drawn below ribbons with larger mean values of `order`). If `order` is not supplied to `geom_lineribbon()`, `-abs(xmax - xmin)` or `-abs(ymax - ymin)` (depending on orientation) is used, having the effect of drawing the widest (on average) ribbons on the bottom. `stat_lineribbon()` uses `order = after_stat(level)` by default, causing the ribbons generated from the largest `.width` to be drawn on the bottom.

Color aesthetics

- `colour`: (or `color`) The color of the **line** sub-geometry.
- `fill`: The fill color of the **ribbon** sub-geometry.
- `alpha`: The opacity of the **line** and **ribbon** sub-geometries.

- `fill_ramp`: A secondary scale that modifies the fill scale to "ramp" to another color. See [scale_fill_ramp\(\)](#) for examples.

Other aesthetics (these work as in standard geoms)

- `group`

See examples of some of these aesthetics in action in `vignette("lineribbon")`. Learn more about the sub-geom override aesthetics (like `interval_color`) in the [scales](#) documentation. Learn more about basic ggplot aesthetics in `vignette("ggplot2-specs")`.

See Also

See [geom_lineribbon\(\)](#) for the geom underlying this stat.

Other `lineribbon` stats: [stat_lineribbon\(\)](#)

Examples

```
library(dplyr)
library(ggplot2)
library(distributional)

theme_set(theme_ggdist())

# ON SAMPLE DATA
set.seed(12345)
tibble(
  x = rep(1:10, 100),
  y = rnorm(1000, x)
) %>%
  ggplot(aes(x = x, y = y)) +
  stat_ribbon() +
  scale_fill_brewer()

# ON ANALYTICAL DISTRIBUTIONS
# Vectorized distribution types, like distributional::dist_normal()
# and posterior::rvar(), can be used with the `xdist` / `ydist` aesthetics
tibble(
  x = 1:10,
  sd = seq(1, 3, length.out = 10)
) %>%
  ggplot(aes(x = x, ydist = dist_normal(x, sd))) +
  stat_ribbon() +
  scale_fill_brewer()
```

stat_slab	<i>Slab (ridge) plot (shortcut stat)</i>
-----------	--

Description

Shortcut version of `stat_slabinterval()` with `geom_slab()` for creating slab (ridge) plots.

Roughly equivalent to:

```
stat_slabinterval(  
  aes(size = NULL),  
  geom = "slab",  
  show_point = FALSE,  
  show_interval = FALSE,  
  show.legend = NA  
)
```

Usage

```
stat_slab(  
  mapping = NULL,  
  data = NULL,  
  geom = "slab",  
  position = "identity",  
  ...,  
  p_limits = c(NA, NA),  
  density = "bounded",  
  adjust = waiver(),  
  trim = TRUE,  
  expand = FALSE,  
  breaks = waiver(),  
  align = "none",  
  outline_bars = FALSE,  
  slab_type = NULL,  
  limits = NULL,  
  n = 501,  
  orientation = NA,  
  na.rm = FALSE,  
  show.legend = NA,  
  inherit.aes = TRUE  
)
```

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	<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>
geom	Use to override the default connection between <code>stat_slab()</code> and <code>geom_slab()</code>
position	Position adjustment, either as a string, or the result of a call to a position adjustment function. Setting this equal to "dodge" (<code>position_dodge()</code>) or "dodgejust" (<code>position_dodgejust()</code>) can be useful if you have overlapping geometries.
...	Other arguments passed to <code>layer()</code> . These are often aesthetics, used to set an aesthetic to a fixed value, like <code>colour = "red"</code> or <code>linewidth = 3</code> (see Aesthetics , below). They may also be parameters to the paired geom/stat. When paired with the default geom, <code>geom_slab()</code> , these include:
	<p><code>normalize</code> How to normalize heights of functions input to the thickness aesthetic. One of:</p> <ul style="list-style-type: none"> • "all": normalize so that the maximum height across all data is 1. • "panels": normalize within panels so that the maximum height in each panel is 1. • "xy": normalize within the x/y axis opposite the orientation of this geom so that the maximum height at each value of the opposite axis is 1. • "groups": normalize within values of the opposite axis and within each group so that the maximum height in each group is 1. • "none": values are taken as is with no normalization (this should probably only be used with functions whose values are in [0,1], such as CDFs).
	For a comprehensive discussion and examples of slab scaling and normalization, see the thickness scale article .
fill_type	<p>What type of fill to use when the fill color or alpha varies within a slab. One of:</p> <ul style="list-style-type: none"> • "segments": breaks up the slab geometry into segments for each unique combination of fill color and alpha value. This approach is supported by all graphics devices and works well for sharp cutoff values, but can give ugly results if a large number of unique fill colors are being used (as in gradients, like in <code>stat_gradientinterval()</code>). • "gradient": a <code>grid::linearGradient()</code> is used to create a smooth gradient fill. This works well for large numbers of unique fill colors, but requires R \geq 4.1 and is not yet supported on all graphics devices. As of this writing, the <code>png()</code> graphics device with <code>type = "cairo"</code>, the <code>svg()</code> device, the <code>pdf()</code> device, and the <code>ragg::agg_png()</code> devices are known to support this option. On R $<$ 4.1, this option will fall back to <code>fill_type = "segments"</code> with a message.

- "auto": attempts to use `fill_type = "gradient"` if support for it can be auto-detected. On $R \geq 4.2$, support for gradients can be auto-detected on some graphics devices; if support is not detected, this option will fall back to `fill_type = "segments"` (in case of a false negative, `fill_type = "gradient"` can be set explicitly). On $R < 4.2$, support for gradients cannot be auto-detected, so this will always fall back to `fill_type = "segments"`, in which case you can set `fill_type = "gradient"` explicitly if you are using a graphics device that support gradients.

`subguide` Sub-guide used to annotate the thickness scale. One of:

- A function that takes a scale argument giving a `ggplot2::Scale` object and an orientation argument giving the orientation of the geometry and then returns a `grid::grob` that will draw the axis annotation, such as `subguide_axis()` (to draw a traditional axis) or `subguide_none()` (to draw no annotation). See `subguide_axis()` for a list of possibilities and examples.
- A string giving the name of such a function when prefixed with "subguide"; e.g. "axis" or "none".

`p_limits` Probability limits (as a vector of size 2) used to determine the lower and upper limits of *theoretical* distributions (distributions from *samples* ignore this parameter and determine their limits based on the limits of the sample). E.g., if this is `c(.001, .999)`, then a slab is drawn for the distribution from the quantile at $p = .001$ to the quantile at $p = .999$. If the lower (respectively upper) limit is NA, then the lower (upper) limit will be the minimum (maximum) of the distribution's support if it is finite, and 0.001 (0.999) if it is not finite. E.g., if `p_limits` is `c(NA, NA)`, on a gamma distribution the effective value of `p_limits` would be `c(0, .999)` since the gamma distribution is defined on $(0, \text{Inf})$; whereas on a normal distribution it would be equivalent to `c(.001, .999)` since the normal distribution is defined on $(-\text{Inf}, \text{Inf})$.

`density` Density estimator for sample data. One of:

- A function which takes a numeric vector and returns a list with elements `x` (giving grid points for the density estimator) and `y` (the corresponding densities). `ggdist` provides a family of functions following this format, including `density_unbounded()` and `density_bounded()`. This format is also compatible with `stats::density()`.
- A string giving the suffix of a function name that starts with "density_"; e.g. "bounded" for `[density_bounded()]`, "unbounded" for `[density_unbounded()]`, or "histogram" for `density_histogram()`. Defaults to "bounded", i.e. `density_bounded()`, which estimates the bounds from the data and then uses a bounded density estimator based on the reflection method.

`adjust` Passed to `density`: the bandwidth for the density estimator for sample data is adjusted by multiplying it by this value. See e.g. `density_bounded()` for more information. Default (`waiver()`) defers to the default of the density estimator, which is usually 1.

`trim` For sample data, should the density estimate be trimmed to the range of the data? Passed on to the density estimator; see the `density` parameter. Default TRUE.

expand	For sample data, should the slab be expanded to the limits of the scale? Default FALSE. Can be length two to control expansion to the lower and upper limit respectively.
breaks	<p>Determines the breakpoints defining bins. Defaults to "Scott". Similar to (but not exactly the same as) the breaks argument to <code>graphics::hist()</code>. One of:</p> <ul style="list-style-type: none"> • A scalar (length-1) numeric giving the number of bins • A vector numeric giving the breakpoints between histogram bins • A function taking <code>x</code> and <code>weights</code> and returning either the number of bins or a vector of breakpoints • A string giving the suffix of a function that starts with "breaks_". <code>ggdist</code> provides weighted implementations of the "Sturges", "Scott", and "FD" break-finding algorithms from <code>graphics::hist()</code>, as well as <code>breaks_fixed()</code> for manually setting the bin width. See breaks. <p>For example, <code>breaks = "Sturges"</code> will use the <code>breaks_Sturges()</code> algorithm, <code>breaks = 9</code> will create 9 bins, and <code>breaks = breaks_fixed(width = 1)</code> will set the bin width to 1.</p>
align	<p>Determines how to align the breakpoints defining bins. Default ("none") performs no alignment. One of:</p> <ul style="list-style-type: none"> • A scalar (length-1) numeric giving an offset that is subtracted from the breaks. The offset must be between 0 and the bin width. • A function taking a sorted vector of breaks (bin edges) and returning an offset to subtract from the breaks. • A string giving the suffix of a function that starts with "align_" used to determine the alignment, such as <code>align_none()</code>, <code>align_boundary()</code>, or <code>align_center()</code>. <p>For example, <code>align = "none"</code> will provide no alignment, <code>align = align_center(at = 0)</code> will center a bin on 0, and <code>align = align_boundary(at = 0)</code> will align a bin edge on 0.</p>
outline_bars	For sample data (if density is "histogram") and for discrete analytical distributions (whose slabs are drawn as histograms), determines if outlines in between the bars are drawn when the <code>slab_color</code> aesthetic is used. If FALSE (the default), the outline is drawn only along the tops of the bars; if TRUE, outlines in between bars are also drawn. See density_histogram() .
slab_type	(deprecated) The type of slab function to calculate: probability density (or mass) function ("pdf"), cumulative distribution function ("cdf"), or complementary CDF ("ccdf"). Instead of using <code>slab_type</code> to change <code>f</code> and then mapping <code>f</code> onto an aesthetic, it is now recommended to simply map the corresponding computed variable (e.g. <code>pdf</code> , <code>cdf</code> , or <code>1 - cdf</code>) directly onto the desired aesthetic.
limits	Manually-specified limits for the slab, as a vector of length two. These limits are combined with those computed based on <code>p_limits</code> as well as the limits defined by the scales of the plot to determine the limits used to draw the slab functions: these limits specify the maximal limits; i.e., if specified, the limits will not be wider than these (but may be narrower). Use NA to leave a limit alone; e.g. <code>limits = c(0, NA)</code> will ensure that the lower limit does not go below 0, but let the upper limit be determined by either <code>p_limits</code> or the scale settings.

n	Number of points at which to evaluate the function that defines the slab.
orientation	Whether this geom is drawn horizontally or vertically. One of: <ul style="list-style-type: none"> • NA (default): automatically detect the orientation based on how the aesthetics are assigned. Automatic detection works most of the time. • "horizontal" (or "y"): draw horizontally, using the y aesthetic to identify different groups. For each group, uses the x, xmin, xmax, and thickness aesthetics to draw points, intervals, and slabs. • "vertical" (or "x"): draw vertically, using the x aesthetic to identify different groups. For each group, uses the y, ymin, ymax, and thickness aesthetics to draw points, intervals, and slabs. <p>For compatibility with the base ggplot naming scheme for orientation, "x" can be used as an alias for "vertical" and "y" as an alias for "horizontal" (ggdist had an orientation parameter before base ggplot did, hence the discrepancy).</p>
na.rm	If FALSE, the default, missing values are removed with a warning. If TRUE, missing values are silently removed.
show.legend	Should this layer be included in the legends? Default is <code>c(size = FALSE)</code> , unlike most geoms, to match its common use cases. FALSE hides all legends, TRUE shows all legends, and NA shows only those that are mapped (the default for most geoms).
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> .

Details

To visualize sample data, such as a data distribution, samples from a bootstrap distribution, or a Bayesian posterior, you can supply samples to the x or y aesthetic.

To visualize analytical distributions, you can use the `xdist` or `ydist` aesthetic. For historical reasons, you can also use `dist` to specify the distribution, though this is not recommended as it does not work as well with orientation detection. These aesthetics can be used as follows:

- `xdist`, `ydist`, and `dist` can be any distribution object from the **distributional** package (`dist_normal()`, `dist_beta()`, etc) or can be a `posterior::rvar()` object. Since these functions are vectorized, other columns can be passed directly to them in an `aes()` specification; e.g. `aes(dist = dist_normal(mu, sigma))` will work if `mu` and `sigma` are columns in the input data frame.
- `dist` can be a character vector giving the distribution name. Then the `arg1`, ... `arg9` aesthetics (or `args` as a list column) specify distribution arguments. Distribution names should correspond to R functions that have "p", "q", and "d" functions; e.g. "norm" is a valid distribution name because R defines the `pnorm()`, `qnorm()`, and `dnorm()` functions for Normal distributions.

See the `parse_dist()` function for a useful way to generate `dist` and `args` values from human-readable distribution specs (like `"normal(0, 1)"`). Such specs are also produced by other packages (like the `brms::get_prior` function in `brms`); thus, `parse_dist()` combined with the stats described here can help you visualize the output of those functions.

Value

A `ggplot2::Stat` representing a slab (ridge) geometry which can be added to a `ggplot()` object.

Computed Variables

The following variables are computed by this stat and made available for use in aesthetic specifications (`aes()`) using the `after_stat()` function or the `after_stat` argument of `stage()`:

- `x` or `y`: For slabs, the input values to the slab function. For intervals, the point summary from the interval function. Whether it is `x` or `y` depends on `orientation`
- `xmin` or `ymin`: For intervals, the lower end of the interval from the interval function.
- `xmax` or `ymax`: For intervals, the upper end of the interval from the interval function.
- `.width`: For intervals, the interval width as a numeric value in $[0, 1]$. For slabs, the width of the smallest interval containing that value of the slab.
- `level`: For intervals, the interval width as an ordered factor. For slabs, the level of the smallest interval containing that value of the slab.
- `pdf`: For slabs, the probability density function (PDF). If `options("ggdist.experimental.slab_data_in_interval")` is `TRUE`: For intervals, the PDF at the point summary; intervals also have `pdf_min` and `pdf_max` for the PDF at the lower and upper ends of the interval.
- `cdf`: For slabs, the cumulative distribution function. If `options("ggdist.experimental.slab_data_in_intervals")` is `TRUE`: For intervals, the CDF at the point summary; intervals also have `cdf_min` and `cdf_max` for the CDF at the lower and upper ends of the interval.
- `n`: For slabs, the number of data points summarized into that slab. If the slab was created from an analytical distribution via the `xdist`, `ydist`, or `dist` aesthetic, `n` will be `Inf`.
- `f`: (deprecated) For slabs, the output values from the slab function (such as the PDF, CDF, or CCDF), determined by `slab_type`. Instead of using `slab_type` to change `f` and then mapping `f` onto an aesthetic, it is now recommended to simply map the corresponding computed variable (e.g. `pdf`, `cdf`, or `1 - cdf`) directly onto the desired aesthetic.

Aesthetics

The slab+interval stats and geoms have a wide variety of aesthetics that control the appearance of their three sub-geometries: the **slab**, the **point**, and the **interval**.

These stats support the following aesthetics:

- `x`: `x` position of the geometry (when `orientation = "vertical"`); or sample data to be summarized (when `orientation = "horizontal"` with sample data).
- `y`: `y` position of the geometry (when `orientation = "horizontal"`); or sample data to be summarized (when `orientation = "vertical"` with sample data).
- `weight`: When using samples (i.e. the `x` and `y` aesthetics, not `xdist` or `ydist`), optional weights to be applied to each draw.
- `xdist`: When using analytical distributions, distribution to map on the `x` axis: a **distributional** object (e.g. `dist_normal()`) or a `posterior::rvar()` object.
- `ydist`: When using analytical distributions, distribution to map on the `y` axis: a **distributional** object (e.g. `dist_normal()`) or a `posterior::rvar()` object.

- `dist`: When using analytical distributions, a name of a distribution (e.g. "norm"), a **distributional** object (e.g. `dist_normal()`), or a `posterior::rvar()` object. See **Details**.
- `args`: Distribution arguments (`args` or `arg1, ... arg9`). See **Details**.

In addition, in their default configuration (paired with `geom_slab()`) the following aesthetics are supported by the underlying geom:

Slab-specific aesthetics

- `thickness`: The thickness of the slab at each x value (if `orientation = "horizontal"`) or y value (if `orientation = "vertical"`) of the slab.
- `side`: Which side to place the slab on. "topright", "top", and "right" are synonyms which cause the slab to be drawn on the top or the right depending on if orientation is "horizontal" or "vertical". "bottomleft", "bottom", and "left" are synonyms which cause the slab to be drawn on the bottom or the left depending on if orientation is "horizontal" or "vertical". "topleft" causes the slab to be drawn on the top or the left, and "bottomright" causes the slab to be drawn on the bottom or the right. "both" draws the slab mirrored on both sides (as in a violin plot).
- `scale`: What proportion of the region allocated to this geom to use to draw the slab. If `scale = 1`, slabs that use the maximum range will just touch each other. Default is 0.9 to leave some space between adjacent slabs. For a comprehensive discussion and examples of slab scaling and normalization, see the [thickness scale article](#).
- `justification`: Justification of the interval relative to the slab, where 0 indicates bottom/left justification and 1 indicates top/right justification (depending on orientation). If `justification` is NULL (the default), then it is set automatically based on the value of `side`: when `side` is "top"/"right" justification is set to 0, when `side` is "bottom"/"left" justification is set to 1, and when `side` is "both" justification is set to 0.5.

Color aesthetics

- `colour`: (or `color`) The color of the **interval** and **point** sub-geometries. Use the `slab_color`, `interval_color`, or `point_color` aesthetics (below) to set sub-geometry colors separately.
- `fill`: The fill color of the **slab** and **point** sub-geometries. Use the `slab_fill` or `point_fill` aesthetics (below) to set sub-geometry colors separately.
- `alpha`: The opacity of the **slab**, **interval**, and **point** sub-geometries. Use the `slab_alpha`, `interval_alpha`, or `point_alpha` aesthetics (below) to set sub-geometry colors separately.
- `colour_ramp`: (or `color_ramp`) A secondary scale that modifies the color scale to "ramp" to another color. See `scale_colour_ramp()` for examples.
- `fill_ramp`: A secondary scale that modifies the fill scale to "ramp" to another color. See `scale_fill_ramp()` for examples.

Line aesthetics

- `linewidth`: Width of the line used to draw the **interval** (except with `geom_slab()`: then it is the width of the **slab**). With composite geometries including an interval and slab, use `slab_linewidth` to set the line width of the **slab** (see below). For **interval**, raw `linewidth` values are transformed according to the `interval_size_domain` and `interval_size_range` parameters of the geom (see above).

- **size**: Determines the size of the **point**. If **linewidth** is not provided, **size** will also determine the width of the line used to draw the **interval** (this allows line width and point size to be modified together by setting only **size** and not **linewidth**). Raw **size** values are transformed according to the **interval_size_domain**, **interval_size_range**, and **fatten_point** parameters of the geom (see above). Use the **point_size** aesthetic (below) to set sub-geometry size directly without applying the effects of **interval_size_domain**, **interval_size_range**, and **fatten_point**.
- **stroke**: Width of the outline around the **point** sub-geometry.
- **linetype**: Type of line (e.g., "solid", "dashed", etc) used to draw the **interval** and the outline of the **slab** (if it is visible). Use the **slab_linetype** or **interval_linetype** aesthetics (below) to set sub-geometry line types separately.

Slab-specific color and line override aesthetics

- **slab_fill**: Override for fill: the fill color of the slab.
- **slab_colour**: (or **slab_color**) Override for colour/color: the outline color of the slab.
- **slab_alpha**: Override for alpha: the opacity of the slab.
- **slab_linewidth**: Override for linewidth: the width of the outline of the slab.
- **slab_linetype**: Override for linetype: the line type of the outline of the slab.

Deprecated aesthetics

- **slab_size**: Use **slab_linewidth**.

Other aesthetics (these work as in standard geoms)

- **width**
- **height**
- **group**

See examples of some of these aesthetics in action in `vignette("slabinterval")`. Learn more about the sub-geom override aesthetics (like **interval_color**) in the [scales](#) documentation. Learn more about basic ggplot aesthetics in `vignette("ggplot2-specs")`.

See Also

See `geom_slab()` for the geom underlying this stat. See `stat_slabinterval()` for the stat this shortcut is based on.

Other `slabinterval` stats: `stat_ccdfinterval()`, `stat_cdfinterval()`, `stat_eye()`, `stat_gradientinterval()`, `stat_halfeye()`, `stat_histinterval()`, `stat_interval()`, `stat_pointinterval()`, `stat_spike()`

Examples

```

library(dplyr)
library(ggplot2)
library(distributional)

theme_set(theme_ggdist())

# ON SAMPLE DATA
set.seed(1234)
df = data.frame(
  group = c("a", "b", "c"),
  value = rnorm(1500, mean = c(5, 7, 9), sd = c(1, 1.5, 1))
)
df %>%
  ggplot(aes(x = value, y = group)) +
  stat_slab()

# ON ANALYTICAL DISTRIBUTIONS
dist_df = data.frame(
  group = c("a", "b", "c"),
  mean = c( 5,  7,  8),
  sd = c( 1, 1.5,  1)
)
# Vectorized distribution types, like distributional::dist_normal()
# and posterior::rvar(), can be used with the `xdist` / `ydist` aesthetics
dist_df %>%
  ggplot(aes(y = group, xdist = dist_normal(mean, sd))) +
  stat_slab()

# RIDGE PLOTS
# "ridge" plots can be created by expanding the slabs to the limits of the plot
# (expand = TRUE), allowing the density estimator to be nonzero outside the
# limits of the data (trim = FALSE), and increasing the height of the slabs.
data.frame(
  group = letters[1:3],
  value = rnorm(3000, 3:1)
) %>%
  ggplot(aes(y = group, x = value)) +
  stat_slab(color = "black", expand = TRUE, trim = FALSE, height = 2)

```

stat_slabinterval	<i>Slab + interval plots for sample data and analytical distributions (ggplot stat)</i>
-------------------	---

Description

"Meta" stat for computing distribution functions (densities or CDFs) + intervals for use with `geom_slabinterval()`. Useful for creating eye plots, half-eye plots, CCDF bar plots, gradient plots, histograms, and more. Sample data can be supplied to the x and y aesthetics or analytical distributions (in a variety of formats) can be supplied to the xdist and ydist aesthetics. See **Details**.

Usage

```
stat_slabinterval(
  mapping = NULL,
  data = NULL,
  geom = "slabinterval",
  position = "identity",
  ...,
  p_limits = c(NA, NA),
  density = "bounded",
  adjust = waiver(),
  trim = TRUE,
  expand = FALSE,
  breaks = waiver(),
  align = "none",
  outline_bars = FALSE,
  point_interval = "median_qi",
  slab_type = NULL,
  limits = NULL,
  n = 501,
  .width = c(0.66, 0.95),
  orientation = NA,
  na.rm = FALSE,
  show.legend = c(size = FALSE),
  inherit.aes = TRUE
)
```

Arguments

mapping	Set of aesthetic mappings created by <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	Use to override the default connection between <code>stat_slabinterval()</code> and <code>geom_slabinterval()</code>
position	Position adjustment, either as a string, or the result of a call to a position adjustment function. Setting this equal to "dodge" (<code>position_dodge()</code>) or "dodgejust" (<code>position_dodgejust()</code>) can be useful if you have overlapping geometries.
...	Other arguments passed to <code>layer()</code> . These are often aesthetics, used to set an aesthetic to a fixed value, like <code>colour = "red"</code> or <code>linewidth = 3</code> (see Aesthet-

ics, below). They may also be parameters to the paired geom/stat. When paired with the default geom, `geom_slabinterval()`, these include:

`normalize` How to normalize heights of functions input to the thickness aesthetic. One of:

- "all": normalize so that the maximum height across all data is 1.
- "panels": normalize within panels so that the maximum height in each panel is 1.
- "xy": normalize within the x/y axis opposite the orientation of this geom so that the maximum height at each value of the opposite axis is 1.
- "groups": normalize within values of the opposite axis and within each group so that the maximum height in each group is 1.
- "none": values are taken as is with no normalization (this should probably only be used with functions whose values are in [0,1], such as CDFs).

For a comprehensive discussion and examples of slab scaling and normalization, see the [thickness scale article](#).

`fill_type` What type of fill to use when the fill color or alpha varies within a slab. One of:

- "segments": breaks up the slab geometry into segments for each unique combination of fill color and alpha value. This approach is supported by all graphics devices and works well for sharp cutoff values, but can give ugly results if a large number of unique fill colors are being used (as in gradients, like in `stat_gradientinterval()`).
- "gradient": a `grid::linearGradient()` is used to create a smooth gradient fill. This works well for large numbers of unique fill colors, but requires R \geq 4.1 and is not yet supported on all graphics devices. As of this writing, the `png()` graphics device with `type = "cairo"`, the `svg()` device, the `pdf()` device, and the `ragg::agg_png()` devices are known to support this option. On R $<$ 4.1, this option will fall back to `fill_type = "segments"` with a message.
- "auto": attempts to use `fill_type = "gradient"` if support for it can be auto-detected. On R \geq 4.2, support for gradients can be auto-detected on some graphics devices; if support is not detected, this option will fall back to `fill_type = "segments"` (in case of a false negative, `fill_type = "gradient"` can be set explicitly). On R $<$ 4.2, support for gradients cannot be auto-detected, so this will always fall back to `fill_type = "segments"`, in which case you can set `fill_type = "gradient"` explicitly if you are using a graphics device that support gradients.

`interval_size_domain` A length-2 numeric vector giving the minimum and maximum of the values of the size and linewidth aesthetics that will be translated into actual sizes for intervals drawn according to `interval_size_range` (see the documentation for that argument.)

`interval_size_range` A length-2 numeric vector. This geom scales the raw size aesthetic values when drawing interval and point sizes, as they tend to be too thick when using the default settings of `scale_size_continuous()`,

which give sizes with a range of `c(1, 6)`. The `interval_size_domain` value indicates the input domain of raw size values (typically this should be equal to the value of the range argument of the `scale_size_continuous()` function), and `interval_size_range` indicates the desired output range of the size values (the min and max of the actual sizes used to draw intervals). Most of the time it is not recommended to change the value of this argument, as it may result in strange scaling of legends; this argument is a holdover from earlier versions that did not have size aesthetics targeting the point and interval separately. If you want to adjust the size of the interval or points separately, you can also use the `linewidth` or `point_size` aesthetics; see [sub-geometry-scales](#).

`fatten_point` A multiplicative factor used to adjust the size of the point relative to the size of the thickest interval line. If you wish to specify point sizes directly, you can also use the `point_size` aesthetic and `scale_point_size_continuous()` or `scale_point_size_discrete()`; sizes specified with that aesthetic will not be adjusted using `fatten_point`.

`arrow` `grid::arrow()` giving the arrow heads to use on the interval, or `NULL` for no arrows.

`subguide` Sub-guide used to annotate the thickness scale. One of:

- A function that takes a scale argument giving a `ggplot2::Scale` object and an `orientation` argument giving the orientation of the geometry and then returns a `grid::grob` that will draw the axis annotation, such as `subguide_axis()` (to draw a traditional axis) or `subguide_none()` (to draw no annotation). See `subguide_axis()` for a list of possibilities and examples.
- A string giving the name of such a function when prefixed with "subguide"; e.g. "axis" or "none".

`p_limits` Probability limits (as a vector of size 2) used to determine the lower and upper limits of *theoretical* distributions (distributions from *samples* ignore this parameter and determine their limits based on the limits of the sample). E.g., if this is `c(.001, .999)`, then a slab is drawn for the distribution from the quantile at $p = .001$ to the quantile at $p = .999$. If the lower (respectively upper) limit is `NA`, then the lower (upper) limit will be the minimum (maximum) of the distribution's support if it is finite, and `0.001` (`0.999`) if it is not finite. E.g., if `p_limits` is `c(NA, NA)`, on a gamma distribution the effective value of `p_limits` would be `c(0, .999)` since the gamma distribution is defined on $(0, \text{Inf})$; whereas on a normal distribution it would be equivalent to `c(.001, .999)` since the normal distribution is defined on $(-\text{Inf}, \text{Inf})$.

`density` Density estimator for sample data. One of:

- A function which takes a numeric vector and returns a list with elements `x` (giving grid points for the density estimator) and `y` (the corresponding densities). `ggdist` provides a family of functions following this format, including `density_unbounded()` and `density_bounded()`. This format is also compatible with `stats::density()`.
- A string giving the suffix of a function name that starts with "density_"; e.g. "bounded" for `[density_bounded()]`, "unbounded" for `[density_unbounded()]`, or "histogram" for `density_histogram()`. Defaults to "bounded", i.e.

	density_bounded() , which estimates the bounds from the data and then uses a bounded density estimator based on the reflection method.
adjust	Passed to <code>density</code> : the bandwidth for the density estimator for sample data is adjusted by multiplying it by this value. See e.g. density_bounded() for more information. Default (<code>waiver()</code>) defers to the default of the density estimator, which is usually 1.
trim	For sample data, should the density estimate be trimmed to the range of the data? Passed on to the density estimator; see the <code>density</code> parameter. Default TRUE.
expand	For sample data, should the slab be expanded to the limits of the scale? Default FALSE. Can be length two to control expansion to the lower and upper limit respectively.
breaks	<p>Determines the breakpoints defining bins. Defaults to "Scott". Similar to (but not exactly the same as) the <code>breaks</code> argument to graphics::hist(). One of:</p> <ul style="list-style-type: none"> • A scalar (length-1) numeric giving the number of bins • A vector numeric giving the breakpoints between histogram bins • A function taking <code>x</code> and <code>weights</code> and returning either the number of bins or a vector of breakpoints • A string giving the suffix of a function that starts with "breaks_". <code>ggdist</code> provides weighted implementations of the "Sturges", "Scott", and "FD" break-finding algorithms from graphics::hist(), as well as breaks_fixed() for manually setting the bin width. See breaks. <p>For example, <code>breaks = "Sturges"</code> will use the breaks_Sturges() algorithm, <code>breaks = 9</code> will create 9 bins, and <code>breaks = breaks_fixed(width = 1)</code> will set the bin width to 1.</p>
align	<p>Determines how to align the breakpoints defining bins. Default ("none") performs no alignment. One of:</p> <ul style="list-style-type: none"> • A scalar (length-1) numeric giving an offset that is subtracted from the breaks. The offset must be between 0 and the bin width. • A function taking a sorted vector of breaks (bin edges) and returning an offset to subtract from the breaks. • A string giving the suffix of a function that starts with "align_" used to determine the alignment, such as align_none(), align_boundary(), or align_center(). <p>For example, <code>align = "none"</code> will provide no alignment, <code>align = align_center(at = 0)</code> will center a bin on 0, and <code>align = align_boundary(at = 0)</code> will align a bin edge on 0.</p>
outline_bars	For sample data (if <code>density</code> is "histogram") and for discrete analytical distributions (whose slabs are drawn as histograms), determines if outlines in between the bars are drawn when the <code>slab_color</code> aesthetic is used. If FALSE (the default), the outline is drawn only along the tops of the bars; if TRUE, outlines in between bars are also drawn. See density_histogram() .
point_interval	A function from the point_interval() family (e.g., <code>median_qi</code> , <code>mean_qi</code> , <code>mode_hdi</code> , etc), or a string giving the name of a function from that family (e.g., "median_qi", "mean_qi", "mode_hdi", etc; if a string, the caller's environment

is searched for the function, followed by the **ggdist** environment). This function determines the point summary (typically mean, median, or mode) and interval type (quantile interval, `qi`; highest-density interval, `hdi`; or highest-density continuous interval, `hdc`). Output will be converted to the appropriate x- or y-based aesthetics depending on the value of `orientation`. See the `point_interval()` family of functions for more information.

<code>slab_type</code>	(deprecated) The type of slab function to calculate: probability density (or mass) function (" <code>pdf</code> "), cumulative distribution function (" <code>cdf</code> "), or complementary CDF (" <code>ccdf</code> "). Instead of using <code>slab_type</code> to change <code>f</code> and then mapping <code>f</code> onto an aesthetic, it is now recommended to simply map the corresponding computed variable (e.g. <code>pdf</code> , <code>cdf</code> , or <code>1 - cdf</code>) directly onto the desired aesthetic.
<code>limits</code>	Manually-specified limits for the slab, as a vector of length two. These limits are combined with those computed based on <code>p_limits</code> as well as the limits defined by the scales of the plot to determine the limits used to draw the slab functions: these limits specify the maximal limits; i.e., if specified, the limits will not be wider than these (but may be narrower). Use <code>NA</code> to leave a limit alone; e.g. <code>limits = c(0, NA)</code> will ensure that the lower limit does not go below 0, but let the upper limit be determined by either <code>p_limits</code> or the scale settings.
<code>n</code>	Number of points at which to evaluate the function that defines the slab.
<code>.width</code>	The <code>.width</code> argument passed to <code>point_interval</code> : a vector of probabilities to use that determine the widths of the resulting intervals. If multiple probabilities are provided, multiple intervals per group are generated, each with a different probability interval (and value of the corresponding <code>.width</code> and <code>level</code> generated variables).
<code>orientation</code>	Whether this geom is drawn horizontally or vertically. One of: <ul style="list-style-type: none"> • <code>NA</code> (default): automatically detect the orientation based on how the aesthetics are assigned. Automatic detection works most of the time. • <code>"horizontal"</code> (or <code>"y"</code>): draw horizontally, using the <code>y</code> aesthetic to identify different groups. For each group, uses the <code>x</code>, <code>xmin</code>, <code>xmax</code>, and <code>thickness</code> aesthetics to draw points, intervals, and slabs. • <code>"vertical"</code> (or <code>"x"</code>): draw vertically, using the <code>x</code> aesthetic to identify different groups. For each group, uses the <code>y</code>, <code>ymin</code>, <code>ymax</code>, and <code>thickness</code> aesthetics to draw points, intervals, and slabs. <p>For compatibility with the base <code>ggplot</code> naming scheme for orientation, <code>"x"</code> can be used as an alias for <code>"vertical"</code> and <code>"y"</code> as an alias for <code>"horizontal"</code> (ggdist had an <code>orientation</code> parameter before base <code>ggplot</code> did, hence the discrepancy).</p>
<code>na.rm</code>	If <code>FALSE</code> , the default, missing values are removed with a warning. If <code>TRUE</code> , missing values are silently removed.
<code>show.legend</code>	Should this layer be included in the legends? Default is <code>c(size = FALSE)</code> , unlike most geoms, to match its common use cases. <code>FALSE</code> hides all legends, <code>TRUE</code> shows all legends, and <code>NA</code> shows only those that are mapped (the default for most geoms).
<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> .

Details

A highly configurable stat for generating a variety of plots that combine a "slab" that describes a distribution plus a point summary and any number of intervals. Several "shortcut" stats are provided which combine multiple options to create useful geoms, particularly *eye plots* (a violin plot of density plus interval), *half-eye plots* (a density plot plus interval), *CCDF bar plots* (a complementary CDF plus interval), and *gradient plots* (a density encoded in color alpha plus interval).

The shortcut stats include:

- `stat_eye()`: Eye plots (violin + interval)
- `stat_halfeye()`: Half-eye plots (density + interval)
- `stat_ccdfinterval()`: CCDF bar plots (CCDF + interval)
- `stat_cdfinterval()`: CDF bar plots (CDF + interval)
- `stat_gradientinterval()`: Density gradient + interval plots
- `stat_slab()`: Density plots
- `stat_histinterval()`: Histogram + interval plots
- `stat_pointinterval()`: Point + interval plots
- `stat_interval()`: Interval plots

To visualize sample data, such as a data distribution, samples from a bootstrap distribution, or a Bayesian posterior, you can supply samples to the `x` or `y` aesthetic.

To visualize analytical distributions, you can use the `xdist` or `ydist` aesthetic. For historical reasons, you can also use `dist` to specify the distribution, though this is not recommended as it does not work as well with orientation detection. These aesthetics can be used as follows:

- `xdist`, `ydist`, and `dist` can be any distribution object from the `distributional` package (`dist_normal()`, `dist_beta()`, etc) or can be a `posterior::rvar()` object. Since these functions are vectorized, other columns can be passed directly to them in an `aes()` specification; e.g. `aes(dist = dist_normal(mu, sigma))` will work if `mu` and `sigma` are columns in the input data frame.
- `dist` can be a character vector giving the distribution name. Then the `arg1`, ... `arg9` aesthetics (or `args` as a list column) specify distribution arguments. Distribution names should correspond to R functions that have "p", "q", and "d" functions; e.g. "norm" is a valid distribution name because R defines the `pnorm()`, `qnorm()`, and `dnorm()` functions for Normal distributions.

See the `parse_dist()` function for a useful way to generate `dist` and `args` values from human-readable distribution specs (like "normal(0,1)"). Such specs are also produced by other packages (like the `brms::get_prior` function in `brms`); thus, `parse_dist()` combined with the stats described here can help you visualize the output of those functions.

Value

A `ggplot2::Stat` representing a slab or combined slab+interval geometry which can be added to a `ggplot()` object.

Computed Variables

The following variables are computed by this stat and made available for use in aesthetic specifications (`aes()`) using the `after_stat()` function or the `after_stat` argument of `stage()`:

- `x` or `y`: For slabs, the input values to the slab function. For intervals, the point summary from the interval function. Whether it is `x` or `y` depends on `orientation`
- `xmin` or `ymin`: For intervals, the lower end of the interval from the interval function.
- `xmax` or `ymax`: For intervals, the upper end of the interval from the interval function.
- `.width`: For intervals, the interval width as a numeric value in $[0, 1]$. For slabs, the width of the smallest interval containing that value of the slab.
- `level`: For intervals, the interval width as an ordered factor. For slabs, the level of the smallest interval containing that value of the slab.
- `pdf`: For slabs, the probability density function (PDF). If `options("ggdist.experimental.slab_data_in_intervals")` is TRUE: For intervals, the PDF at the point summary; intervals also have `pdf_min` and `pdf_max` for the PDF at the lower and upper ends of the interval.
- `cdf`: For slabs, the cumulative distribution function. If `options("ggdist.experimental.slab_data_in_intervals")` is TRUE: For intervals, the CDF at the point summary; intervals also have `cdf_min` and `cdf_max` for the CDF at the lower and upper ends of the interval.
- `n`: For slabs, the number of data points summarized into that slab. If the slab was created from an analytical distribution via the `xdist`, `ydist`, or `dist` aesthetic, `n` will be `Inf`.
- `f`: (deprecated) For slabs, the output values from the slab function (such as the PDF, CDF, or CCDF), determined by `slab_type`. Instead of using `slab_type` to change `f` and then mapping `f` onto an aesthetic, it is now recommended to simply map the corresponding computed variable (e.g. `pdf`, `cdf`, or `1 - cdf`) directly onto the desired aesthetic.

Aesthetics

The slab+interval stats and geoms have a wide variety of aesthetics that control the appearance of their three sub-geometries: the **slab**, the **point**, and the **interval**.

These stats support the following aesthetics:

- `x`: `x` position of the geometry (when `orientation = "vertical"`); or sample data to be summarized (when `orientation = "horizontal"` with sample data).
- `y`: `y` position of the geometry (when `orientation = "horizontal"`); or sample data to be summarized (when `orientation = "vertical"` with sample data).
- `weight`: When using samples (i.e. the `x` and `y` aesthetics, not `xdist` or `ydist`), optional weights to be applied to each draw.
- `xdist`: When using analytical distributions, distribution to map on the `x` axis: a **distributional** object (e.g. `dist_normal()`) or a `posterior::rvar()` object.
- `ydist`: When using analytical distributions, distribution to map on the `y` axis: a **distributional** object (e.g. `dist_normal()`) or a `posterior::rvar()` object.
- `dist`: When using analytical distributions, a name of a distribution (e.g. `"norm"`), a **distributional** object (e.g. `dist_normal()`), or a `posterior::rvar()` object. See **Details**.
- `args`: Distribution arguments (`args` or `arg1, ... arg9`). See **Details**.

In addition, in their default configuration (paired with `geom_slabinterval()`) the following aesthetics are supported by the underlying geom:

Slab-specific aesthetics

- **thickness**: The thickness of the slab at each x value (if orientation = "horizontal") or y value (if orientation = "vertical") of the slab.
- **side**: Which side to place the slab on. "topright", "top", and "right" are synonyms which cause the slab to be drawn on the top or the right depending on if orientation is "horizontal" or "vertical". "bottomleft", "bottom", and "left" are synonyms which cause the slab to be drawn on the bottom or the left depending on if orientation is "horizontal" or "vertical". "topleft" causes the slab to be drawn on the top or the left, and "bottomright" causes the slab to be drawn on the bottom or the right. "both" draws the slab mirrored on both sides (as in a violin plot).
- **scale**: What proportion of the region allocated to this geom to use to draw the slab. If scale = 1, slabs that use the maximum range will just touch each other. Default is 0.9 to leave some space between adjacent slabs. For a comprehensive discussion and examples of slab scaling and normalization, see the [thickness scale article](#).
- **justification**: Justification of the interval relative to the slab, where 0 indicates bottom/left justification and 1 indicates top/right justification (depending on orientation). If justification is NULL (the default), then it is set automatically based on the value of side: when side is "top"/"right" justification is set to 0, when side is "bottom"/"left" justification is set to 1, and when side is "both" justification is set to 0.5.
- **datatype**: When using composite geoms directly without a stat (e.g. `geom_slabinterval()`), datatype is used to indicate which part of the geom a row in the data targets: rows with datatype = "slab" target the slab portion of the geometry and rows with datatype = "interval" target the interval portion of the geometry. This is set automatically when using ggdist stats.

Interval-specific aesthetics

- **xmin**: Left end of the interval sub-geometry (if orientation = "horizontal").
- **xmax**: Right end of the interval sub-geometry (if orientation = "horizontal").
- **ymin**: Lower end of the interval sub-geometry (if orientation = "vertical").
- **ymax**: Upper end of the interval sub-geometry (if orientation = "vertical").

Point-specific aesthetics

- **shape**: Shape type used to draw the **point** sub-geometry.

Color aesthetics

- **colour**: (or **color**) The color of the **interval** and **point** sub-geometries. Use the `slab_color`, `interval_color`, or `point_color` aesthetics (below) to set sub-geometry colors separately.
- **fill**: The fill color of the **slab** and **point** sub-geometries. Use the `slab_fill` or `point_fill` aesthetics (below) to set sub-geometry colors separately.
- **alpha**: The opacity of the **slab**, **interval**, and **point** sub-geometries. Use the `slab_alpha`, `interval_alpha`, or `point_alpha` aesthetics (below) to set sub-geometry colors separately.

- `colour_ramp`: (or `color_ramp`) A secondary scale that modifies the color scale to "ramp" to another color. See `scale_colour_ramp()` for examples.
- `fill_ramp`: A secondary scale that modifies the fill scale to "ramp" to another color. See `scale_fill_ramp()` for examples.

Line aesthetics

- `linewidth`: Width of the line used to draw the **interval** (except with `geom_slab()`: then it is the width of the **slab**). With composite geometries including an interval and slab, use `slab_linewidth` to set the line width of the **slab** (see below). For **interval**, raw `linewidth` values are transformed according to the `interval_size_domain` and `interval_size_range` parameters of the geom (see above).
- `size`: Determines the size of the **point**. If `linewidth` is not provided, `size` will also determine the width of the line used to draw the **interval** (this allows line width and point size to be modified together by setting only `size` and not `linewidth`). Raw `size` values are transformed according to the `interval_size_domain`, `interval_size_range`, and `fatten_point` parameters of the geom (see above). Use the `point_size` aesthetic (below) to set sub-geometry size directly without applying the effects of `interval_size_domain`, `interval_size_range`, and `fatten_point`.
- `stroke`: Width of the outline around the **point** sub-geometry.
- `linetype`: Type of line (e.g., "solid", "dashed", etc) used to draw the **interval** and the outline of the **slab** (if it is visible). Use the `slab_linetype` or `interval_linetype` aesthetics (below) to set sub-geometry line types separately.

Slab-specific color and line override aesthetics

- `slab_fill`: Override for `fill`: the fill color of the slab.
- `slab_colour`: (or `slab_color`) Override for `colour/color`: the outline color of the slab.
- `slab_alpha`: Override for `alpha`: the opacity of the slab.
- `slab_linewidth`: Override for `linewidth`: the width of the outline of the slab.
- `slab_linetype`: Override for `linetype`: the line type of the outline of the slab.

Interval-specific color and line override aesthetics

- `interval_colour`: (or `interval_color`) Override for `colour/color`: the color of the interval.
- `interval_alpha`: Override for `alpha`: the opacity of the interval.
- `interval_linetype`: Override for `linetype`: the line type of the interval.

Point-specific color and line override aesthetics

- `point_fill`: Override for `fill`: the fill color of the point.
- `point_colour`: (or `point_color`) Override for `colour/color`: the outline color of the point.
- `point_alpha`: Override for `alpha`: the opacity of the point.
- `point_size`: Override for `size`: the size of the point.

Deprecated aesthetics

- `slab_size`: Use `slab_linewidth`.
- `interval_size`: Use `interval_linewidth`.

Other aesthetics (these work as in standard geoms)

- `width`
- `height`
- `group`

See examples of some of these aesthetics in action in `vignette("slabinterval")`. Learn more about the sub-geom override aesthetics (like `interval_color`) in the [scales](#) documentation. Learn more about basic ggplot aesthetics in `vignette("ggplot2-specs")`.

See Also

See `geom_slabinterval()` for more information on the geom these stats use by default and some of the options it has. See `vignette("slabinterval")` for a variety of examples of use.

Examples

```
library(dplyr)
library(ggplot2)
library(distributional)

theme_set(theme_ggdist())

# EXAMPLES ON SAMPLE DATA
set.seed(1234)
df = data.frame(
  group = c("a", "b", "c", "c", "c"),
  value = rnorm(2500, mean = c(5, 7, 9, 9, 9), sd = c(1, 1.5, 1, 1, 1))
)

# here are vertical eyes:
df %>%
  ggplot(aes(x = group, y = value)) +
  stat_eye()

# note the sample size is not automatically incorporated into the
# area of the densities in case one wishes to plot densities against
# a reference (e.g. a prior distribution).
# But you may wish to account for sample size if using these geoms
# for something other than visualizing posteriors; in which case
# you can use after_stat(f*n):
df %>%
  ggplot(aes(x = group, y = value)) +
  stat_eye(aes(thickness = after_stat(pdf*n)))
```

```

# EXAMPLES ON ANALYTICAL DISTRIBUTIONS

dist_df = tribble(
  ~group, ~subgroup, ~mean, ~sd,
  "a",    "h",      5,  1,
  "b",    "h",      7,  1.5,
  "c",    "h",      8,  1,
  "c",    "i",      9,  1,
  "c",    "j",      7,  1
)

# Using functions from the distributional package (like dist_normal()) with the
# dist aesthetic can lead to more compact/expressive specifications

dist_df %>%
  ggplot(aes(x = group, ydist = dist_normal(mean, sd), fill = subgroup)) +
  stat_eye(position = "dodge")

# using the old character vector + args approach
dist_df %>%
  ggplot(aes(x = group, dist = "norm", arg1 = mean, arg2 = sd, fill = subgroup)) +
  stat_eye(position = "dodge")

# the stat_slabininterval family applies a Jacobian adjustment to densities
# when plotting on transformed scales in order to plot them correctly.
# It determines the Jacobian using symbolic differentiation if possible,
# using stats::D(). If symbolic differentiation fails, it falls back
# to numericDeriv(), which is less reliable; therefore, it is
# advisable to use scale transformation functions that are defined in
# terms of basic math functions so that their derivatives can be
# determined analytically (most of the transformation functions in the
# scales package currently have this property).
# For example, here is a log-Normal distribution plotted on the log
# scale, where it will appear Normal:
data.frame(dist = "lnorm", logmean = log(10), logsd = 2*log(10)) %>%
  ggplot(aes(y = 1, dist = dist, arg1 = logmean, arg2 = logsd)) +
  stat_halfeye() +
  scale_x_log10(breaks = 10^seq(-5,7, by = 2))

# see vignette("slabininterval") for many more examples.

```

stat_spike

Spike plot (ggplot2 stat)

Description

Stat for drawing "spikes" (optionally with points on them) at specific points on a distribution (numerical or determined as a function of the distribution), intended for annotating [stat_slabininterval\(\)](#)

geometries.

Usage

```
stat_spike(
  mapping = NULL,
  data = NULL,
  geom = "spike",
  position = "identity",
  ...,
  at = "median",
  p_limits = c(NA, NA),
  density = "bounded",
  adjust = waiver(),
  trim = TRUE,
  expand = FALSE,
  breaks = waiver(),
  align = "none",
  outline_bars = FALSE,
  slab_type = NULL,
  limits = NULL,
  n = 501,
  orientation = NA,
  na.rm = FALSE,
  show.legend = NA,
  inherit.aes = TRUE
)
```

Arguments

- | | |
|----------|---|
| mapping | Set of aesthetic mappings created by aes() . 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 ggplot() .
A <code>data.frame</code> , 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 <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 | Use to override the default connection between stat_spike() and geom_spike() |
| position | Position adjustment, either as a string, or the result of a call to a position adjustment function. Setting this equal to "dodge" (position_dodge()) or "dodgejust" (position_dodgejust()) can be useful if you have overlapping geometries. |

...

Other arguments passed to `layer()`. These are often aesthetics, used to set an aesthetic to a fixed value, like `colour = "red"` or `linewidth = 3` (see **Aesthetics**, below). They may also be parameters to the paired geom/stat. When paired with the default geom, `geom_spike()`, these include:

`normalize` How to normalize heights of functions input to the thickness aesthetic. One of:

- "all": normalize so that the maximum height across all data is 1.
- "panels": normalize within panels so that the maximum height in each panel is 1.
- "xy": normalize within the x/y axis opposite the orientation of this geom so that the maximum height at each value of the opposite axis is 1.
- "groups": normalize within values of the opposite axis and within each group so that the maximum height in each group is 1.
- "none": values are taken as is with no normalization (this should probably only be used with functions whose values are in [0,1], such as CDFs).

For a comprehensive discussion and examples of slab scaling and normalization, see the [thickness scale article](#).

arrow `grid::arrow()` giving the arrow heads to use on the spike, or NULL for no arrows.

`subguide` Sub-guide used to annotate the thickness scale. One of:

- A function that takes a scale argument giving a `ggplot2::Scale` object and an orientation argument giving the orientation of the geometry and then returns a `grid::grob` that will draw the axis annotation, such as `subguide_axis()` (to draw a traditional axis) or `subguide_none()` (to draw no annotation). See `subguide_axis()` for a list of possibilities and examples.
- A string giving the name of such a function when prefixed with "subguide"; e.g. "axis" or "none".

at

The points at which to evaluate the PDF and CDF of the distribution. One of:

- `numeric` vector: points to evaluate the PDF and CDF of the distributions at.
- function or character vector: function (or names of functions) which, when applied on a distribution-like object (e.g. a **distributional** object or a `posterior::rvar()`), returns a vector of values to evaluate the distribution functions at.
- a `list` where each element is any of the above (e.g. a `numeric`, function, or name of a function): the evaluation points determined by each element of the list are concatenated together. This means, e.g., `c(0, median, qi)` would add a spike at 0, the median, and the endpoints of the qi of the distribution.

The values of `at` are also converted into a character vector which is supplied as a computed variable (also called `at`) generated by this `stat`, which can be mapped onto aesthetics using `after_stat()`. Non-empty names can be used to override the values of the computed variable; e.g. `at = c(zero = 0, "median", mode = "Mode")` will generate a computed variable with the values `c("zero",`

	"median", "mode") that is evaluated at 0, the median, and the mode of the distribution.
p_limits	Probability limits (as a vector of size 2) used to determine the lower and upper limits of <i>theoretical</i> distributions (distributions from <i>samples</i> ignore this parameter and determine their limits based on the limits of the sample). E.g., if this is <code>c(.001, .999)</code> , then a slab is drawn for the distribution from the quantile at <code>p = .001</code> to the quantile at <code>p = .999</code> . If the lower (respectively upper) limit is NA, then the lower (upper) limit will be the minimum (maximum) of the distribution's support if it is finite, and <code>0.001</code> (<code>0.999</code>) if it is not finite. E.g., if <code>p_limits</code> is <code>c(NA, NA)</code> , on a gamma distribution the effective value of <code>p_limits</code> would be <code>c(0, .999)</code> since the gamma distribution is defined on <code>(0, Inf)</code> ; whereas on a normal distribution it would be equivalent to <code>c(.001, .999)</code> since the normal distribution is defined on <code>(-Inf, Inf)</code> .
density	Density estimator for sample data. One of: <ul style="list-style-type: none"> • A function which takes a numeric vector and returns a list with elements <code>x</code> (giving grid points for the density estimator) and <code>y</code> (the corresponding densities). <code>ggdist</code> provides a family of functions following this format, including <code>density_unbounded()</code> and <code>density_bounded()</code>. This format is also compatible with <code>stats::density()</code>. • A string giving the suffix of a function name that starts with "density_"; e.g. "bounded" for <code>[density_bounded()]</code>, "unbounded" for <code>[density_unbounded()]</code>, or "histogram" for <code>density_histogram()</code>. Defaults to "bounded", i.e. <code>density_bounded()</code>, which estimates the bounds from the data and then uses a bounded density estimator based on the reflection method.
adjust	Passed to <code>density</code> : the bandwidth for the density estimator for sample data is adjusted by multiplying it by this value. See e.g. <code>density_bounded()</code> for more information. Default (<code>waiver()</code>) defers to the default of the density estimator, which is usually 1.
trim	For sample data, should the density estimate be trimmed to the range of the data? Passed on to the density estimator; see the <code>density</code> parameter. Default TRUE.
expand	For sample data, should the slab be expanded to the limits of the scale? Default FALSE. Can be length two to control expansion to the lower and upper limit respectively.
breaks	Determines the breakpoints defining bins. Defaults to "Scott". Similar to (but not exactly the same as) the <code>breaks</code> argument to <code>graphics::hist()</code> . One of: <ul style="list-style-type: none"> • A scalar (length-1) numeric giving the number of bins • A vector numeric giving the breakpoints between histogram bins • A function taking <code>x</code> and weights and returning either the number of bins or a vector of breakpoints • A string giving the suffix of a function that starts with "breaks_". <code>ggdist</code> provides weighted implementations of the "Sturges", "Scott", and "FD" break-finding algorithms from <code>graphics::hist()</code>, as well as <code>breaks_fixed()</code> for manually setting the bin width. See <code>breaks</code>. <p>For example, <code>breaks = "Sturges"</code> will use the <code>breaks_Sturges()</code> algorithm, <code>breaks = 9</code> will create 9 bins, and <code>breaks = breaks_fixed(width = 1)</code> will set the bin width to 1.</p>

align	<p>Determines how to align the breakpoints defining bins. Default ("none") performs no alignment. One of:</p> <ul style="list-style-type: none"> • A scalar (length-1) numeric giving an offset that is subtracted from the breaks. The offset must be between 0 and the bin width. • A function taking a sorted vector of breaks (bin edges) and returning an offset to subtract from the breaks. • A string giving the suffix of a function that starts with "align_" used to determine the alignment, such as align_none(), align_boundary(), or align_center(). <p>For example, align = "none" will provide no alignment, align = align_center(at = 0) will center a bin on 0, and align = align_boundary(at = 0) will align a bin edge on 0.</p>
outline_bars	<p>For sample data (if density is "histogram") and for discrete analytical distributions (whose slabs are drawn as histograms), determines if outlines between the bars are drawn when the slab_color aesthetic is used. If FALSE (the default), the outline is drawn only along the tops of the bars; if TRUE, outlines in between bars are also drawn. See density_histogram().</p>
slab_type	<p>(deprecated) The type of slab function to calculate: probability density (or mass) function ("pdf"), cumulative distribution function ("cdf"), or complementary CDF ("ccdf"). Instead of using slab_type to change f and then mapping f onto an aesthetic, it is now recommended to simply map the corresponding computed variable (e.g. pdf, cdf, or 1 - cdf) directly onto the desired aesthetic.</p>
limits	<p>Manually-specified limits for the slab, as a vector of length two. These limits are combined with those computed based on p_limits as well as the limits defined by the scales of the plot to determine the limits used to draw the slab functions: these limits specify the maximal limits; i.e., if specified, the limits will not be wider than these (but may be narrower). Use NA to leave a limit alone; e.g. limits = c(0, NA) will ensure that the lower limit does not go below 0, but let the upper limit be determined by either p_limits or the scale settings.</p>
n	<p>Number of points at which to evaluate the function that defines the slab.</p>
orientation	<p>Whether this geom is drawn horizontally or vertically. One of:</p> <ul style="list-style-type: none"> • NA (default): automatically detect the orientation based on how the aesthetics are assigned. Automatic detection works most of the time. • "horizontal" (or "y"): draw horizontally, using the y aesthetic to identify different groups. For each group, uses the x, xmin, xmax, and thickness aesthetics to draw points, intervals, and slabs. • "vertical" (or "x"): draw vertically, using the x aesthetic to identify different groups. For each group, uses the y, ymin, ymax, and thickness aesthetics to draw points, intervals, and slabs. <p>For compatibility with the base ggplot naming scheme for orientation, "x" can be used as an alias for "vertical" and "y" as an alias for "horizontal" (ggdist had an orientation parameter before base ggplot did, hence the discrepancy).</p>
na.rm	<p>If FALSE, the default, missing values are removed with a warning. If TRUE, missing values are silently removed.</p>

show.legend	Should this layer be included in the legends? Default is <code>c(size = FALSE)</code> , unlike most geoms, to match its common use cases. <code>FALSE</code> hides all legends, <code>TRUE</code> shows all legends, and <code>NA</code> shows only those that are mapped (the default for most geoms).
inherit.aes	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> .

Details

This stat computes slab values (i.e. PDF and CDF values) at specified locations on a distribution, as determined by the `at` parameter.

To visualize sample data, such as a data distribution, samples from a bootstrap distribution, or a Bayesian posterior, you can supply samples to the `x` or `y` aesthetic.

To visualize analytical distributions, you can use the `xdist` or `ydist` aesthetic. For historical reasons, you can also use `dist` to specify the distribution, though this is not recommended as it does not work as well with orientation detection. These aesthetics can be used as follows:

- `xdist`, `ydist`, and `dist` can be any distribution object from the `distributional` package (`dist_normal()`, `dist_beta()`, etc) or can be a `posterior::rvar()` object. Since these functions are vectorized, other columns can be passed directly to them in an `aes()` specification; e.g. `aes(dist = dist_normal(mu, sigma))` will work if `mu` and `sigma` are columns in the input data frame.
- `dist` can be a character vector giving the distribution name. Then the `arg1`, ... `arg9` aesthetics (or `args` as a list column) specify distribution arguments. Distribution names should correspond to R functions that have "p", "q", and "d" functions; e.g. "norm" is a valid distribution name because R defines the `pnorm()`, `qnorm()`, and `dnorm()` functions for Normal distributions.

See the `parse_dist()` function for a useful way to generate `dist` and `args` values from human-readable distribution specs (like `"normal(0,1)"`). Such specs are also produced by other packages (like the `brms::get_prior` function in `brms`); thus, `parse_dist()` combined with the stats described here can help you visualize the output of those functions.

Value

A `ggplot2::Stat` representing a spike geometry which can be added to a `ggplot()` object.

Aesthetics

The spike geom has a wide variety of aesthetics that control the appearance of its two sub-geometries: the **spike** and the **point**.

These stats support the following aesthetics:

- `x`: `x` position of the geometry (when `orientation = "vertical"`); or sample data to be summarized (when `orientation = "horizontal"` with sample data).
- `y`: `y` position of the geometry (when `orientation = "horizontal"`); or sample data to be summarized (when `orientation = "vertical"` with sample data).
- `weight`: When using samples (i.e. the `x` and `y` aesthetics, not `xdist` or `ydist`), optional weights to be applied to each draw.

- `xdist`: When using analytical distributions, distribution to map on the x axis: a **distributional** object (e.g. `dist_normal()`) or a `posterior::rvar()` object.
- `ydist`: When using analytical distributions, distribution to map on the y axis: a **distributional** object (e.g. `dist_normal()`) or a `posterior::rvar()` object.
- `dist`: When using analytical distributions, a name of a distribution (e.g. "norm"), a **distributional** object (e.g. `dist_normal()`), or a `posterior::rvar()` object. See **Details**.
- `args`: Distribution arguments (`args` or `arg1, ... arg9`). See **Details**.

In addition, in their default configuration (paired with `geom_spike()`) the following aesthetics are supported by the underlying geom:

Spike-specific (aka Slab-specific) aesthetics

- `thickness`: The thickness of the slab at each x value (if orientation = "horizontal") or y value (if orientation = "vertical") of the slab.
- `side`: Which side to place the slab on. "topright", "top", and "right" are synonyms which cause the slab to be drawn on the top or the right depending on if orientation is "horizontal" or "vertical". "bottomleft", "bottom", and "left" are synonyms which cause the slab to be drawn on the bottom or the left depending on if orientation is "horizontal" or "vertical". "topleft" causes the slab to be drawn on the top or the left, and "bottomright" causes the slab to be drawn on the bottom or the right. "both" draws the slab mirrored on both sides (as in a violin plot).
- `scale`: What proportion of the region allocated to this geom to use to draw the slab. If `scale = 1`, slabs that use the maximum range will just touch each other. Default is 0.9 to leave some space between adjacent slabs. For a comprehensive discussion and examples of slab scaling and normalization, see the [thickness scale article](#).

Color aesthetics

- `colour`: (or `color`) The color of the **spike** and **point** sub-geometries.
- `fill`: The fill color of the **point** sub-geometry.
- `alpha`: The opacity of the **spike** and **point** sub-geometries.
- `colour_ramp`: (or `color_ramp`) A secondary scale that modifies the color scale to "ramp" to another color. See `scale_colour_ramp()` for examples.
- `fill_ramp`: A secondary scale that modifies the fill scale to "ramp" to another color. See `scale_fill_ramp()` for examples.

Line aesthetics

- `linewidth`: Width of the line used to draw the **spike** sub-geometry.
- `size`: Size of the **point** sub-geometry.
- `stroke`: Width of the outline around the **point** sub-geometry.
- `linetype`: Type of line (e.g., "solid", "dashed", etc) used to draw the **spike**.

Other aesthetics (these work as in standard geoms)

- `width`

- height
- group

See examples of some of these aesthetics in action in `vignette("slabinterval")`. Learn more about the sub-geom override aesthetics (like `interval_color`) in the [scales](#) documentation. Learn more about basic ggplot aesthetics in `vignette("ggplot2-specs")`.

Computed Variables

The following variables are computed by this stat and made available for use in aesthetic specifications (`aes()`) using the `after_stat()` function or the `after_stat` argument of `stage()`:

- `x` or `y`: For slabs, the input values to the slab function. For intervals, the point summary from the interval function. Whether it is `x` or `y` depends on `orientation`
- `xmin` or `ymin`: For intervals, the lower end of the interval from the interval function.
- `xmax` or `ymax`: For intervals, the upper end of the interval from the interval function.
- `.width`: For intervals, the interval width as a numeric value in $[0, 1]$. For slabs, the width of the smallest interval containing that value of the slab.
- `level`: For intervals, the interval width as an ordered factor. For slabs, the level of the smallest interval containing that value of the slab.
- `pdf`: For slabs, the probability density function (PDF). If `options("ggdist.experimental.slab_data_in_interval")` is `TRUE`: For intervals, the PDF at the point summary; intervals also have `pdf_min` and `pdf_max` for the PDF at the lower and upper ends of the interval.
- `cdf`: For slabs, the cumulative distribution function. If `options("ggdist.experimental.slab_data_in_intervals")` is `TRUE`: For intervals, the CDF at the point summary; intervals also have `cdf_min` and `cdf_max` for the CDF at the lower and upper ends of the interval.
- `n`: For slabs, the number of data points summarized into that slab. If the slab was created from an analytical distribution via the `xdist`, `ydist`, or `dist` aesthetic, `n` will be `Inf`.
- `f`: (deprecated) For slabs, the output values from the slab function (such as the PDF, CDF, or CCDF), determined by `slab_type`. Instead of using `slab_type` to change `f` and then mapping `f` onto an aesthetic, it is now recommended to simply map the corresponding computed variable (e.g. `pdf`, `cdf`, or `1 - cdf`) directly onto the desired aesthetic.
- `at`: For spikes, a character vector of names of the functions or expressions used to determine the points at which the slab functions were evaluated to create spikes. Values of this computed variable are determined by the `at` parameter; see its description above.

See Also

See `geom_spike()` for the geom underlying this stat. See `stat_slabinterval()` for the stat this shortcut is based on.

Other `slabinterval` stats: `stat_ccdfinterval()`, `stat_cdfinterval()`, `stat_eye()`, `stat_gradientinterval()`, `stat_halfeye()`, `stat_histinterval()`, `stat_interval()`, `stat_pointinterval()`, `stat_slab()`

Examples

```

library(ggplot2)
library(distributional)
library(dplyr)

df = tibble(
  d = c(dist_normal(1), dist_gamma(2,2)), g = c("a", "b")
)

# annotate the density at the mode of a distribution
df %>%
  ggplot(aes(y = g, xdist = d)) +
  stat_slab(aes(xdist = d)) +
  stat_spike(at = "Mode") +
  # need shared thickness scale so that stat_slab and geom_spike line up
  scale_thickness_shared()

# annotate the endpoints of intervals of a distribution
# here we'll use an arrow instead of a point by setting size = 0
arrow_spec = arrow(angle = 45, type = "closed", length = unit(4, "pt"))
df %>%
  ggplot(aes(y = g, xdist = d)) +
  stat_halfeye(point_interval = mode_hdci) +
  stat_spike(
    at = function(x) hdci(x, .width = .66),
    size = 0, arrow = arrow_spec, color = "blue", linewidth = 0.75
  ) +
  scale_thickness_shared()

# annotate quantiles of a sample
set.seed(1234)
data.frame(x = rnorm(1000, 1:2), g = c("a","b")) %>%
  ggplot(aes(x, g)) +
  stat_slab() +
  stat_spike(at = function(x) quantile(x, ppoints(10))) +
  scale_thickness_shared()

```

student_t

Scaled and shifted Student's t distribution

Description

Density, distribution function, quantile function and random generation for the scaled and shifted Student's t distribution, parameterized by degrees of freedom (df), location (mu), and scale (sigma).

Usage

```
dstudent_t(x, df, mu = 0, sigma = 1, log = FALSE)
```

```
pstudent_t(q, df, mu = 0, sigma = 1, lower.tail = TRUE, log.p = FALSE)
```

```
qstudent_t(p, df, mu = 0, sigma = 1, lower.tail = TRUE, log.p = FALSE)
```

```
rstudent_t(n, df, mu = 0, sigma = 1)
```

Arguments

x, q	vector of quantiles.
df	degrees of freedom (> 0, maybe non-integer). df = Inf is allowed.
mu	Location parameter (median)
sigma	Scale parameter
log, log.p	logical; if TRUE, probabilities p are given as log(p).
lower.tail	logical; if TRUE (default), probabilities are $P[X \leq x]$, otherwise, $P[X > x]$.
p	vector of probabilities.
n	number of observations. If <code>length(n) > 1</code> , the length is taken to be the number required.

Value

- `dstudent_t` gives the density
- `pstudent_t` gives the cumulative distribution function (CDF)
- `qstudent_t` gives the quantile function (inverse CDF)
- `rstudent_t` generates random draws.

The length of the result is determined by `n` for `rstudent_t`, and is the maximum of the lengths of the numerical arguments for the other functions.

The numerical arguments other than `n` are recycled to the length of the result. Only the first elements of the logical arguments are used.

See Also

[parse_dist\(\)](#) and parsing distribution specs and the [stat_slabinterval\(\)](#) family of stats for visualizing them.

Examples

```
library(dplyr)
library(ggplot2)

expand.grid(
  df = c(3,5,10,30),
  scale = c(1,1.5)
) %>%
  ggplot(aes(y = 0, dist = "student_t", arg1 = df, arg2 = 0, arg3 = scale, color = ordered(df))) +
```

```

stat_slab(p_limits = c(.01, .99), fill = NA) +
scale_y_continuous(breaks = NULL) +
facet_grid( ~ scale) +
labs(
  title = "dstudent_t(x, df, 0, sigma)",
  subtitle = "Scale (sigma)",
  y = NULL,
  x = NULL
) +
theme_ggdist() +
theme(axis.title = element_text(hjust = 0))

```

sub-geometry-scales *Sub-geometry scales for geom_slabinterval (ggplot2 scales)*

Description

These scales allow more specific aesthetic mappings to be made when using `geom_slabinterval()` and stats/geoms based on it (like eye plots).

Usage

```

scale_point_colour_discrete(..., aesthetics = "point_colour")

scale_point_color_discrete(..., aesthetics = "point_colour")

scale_point_colour_continuous(
  ...,
  aesthetics = "point_colour",
  guide = guide_colourbar2()
)

scale_point_color_continuous(
  ...,
  aesthetics = "point_colour",
  guide = guide_colourbar2()
)

scale_point_fill_discrete(..., aesthetics = "point_fill")

scale_point_fill_continuous(
  ...,
  aesthetics = "point_fill",
  guide = guide_colourbar2()
)

scale_point_alpha_continuous(..., range = c(0.1, 1))

```

```
scale_point_alpha_discrete(..., range = c(0.1, 1))
scale_point_size_continuous(..., range = c(1, 6))
scale_point_size_discrete(..., range = c(1, 6), na.translate = FALSE)
scale_interval_colour_discrete(..., aesthetics = "interval_colour")
scale_interval_color_discrete(..., aesthetics = "interval_colour")
scale_interval_colour_continuous(
  ...,
  aesthetics = "interval_colour",
  guide = guide_colourbar2()
)
scale_interval_color_continuous(
  ...,
  aesthetics = "interval_colour",
  guide = guide_colourbar2()
)
scale_interval_alpha_continuous(..., range = c(0.1, 1))
scale_interval_alpha_discrete(..., range = c(0.1, 1))
scale_interval_size_continuous(..., range = c(1, 6))
scale_interval_size_discrete(..., range = c(1, 6), na.translate = FALSE)
scale_interval_linetype_discrete(..., na.value = "blank")
scale_interval_linetype_continuous(...)
scale_slab_colour_discrete(..., aesthetics = "slab_colour")
scale_slab_color_discrete(..., aesthetics = "slab_colour")
scale_slab_colour_continuous(
  ...,
  aesthetics = "slab_colour",
  guide = guide_colourbar2()
)
scale_slab_color_continuous(
  ...,
  aesthetics = "slab_colour",
```

```

  guide = guide_colourbar2()
)

scale_slab_fill_discrete(..., aesthetics = "slab_fill")

scale_slab_fill_continuous(
  ...,
  aesthetics = "slab_fill",
  guide = guide_colourbar2()
)

scale_slab_alpha_continuous(
  ...,
  limits = function(l) c(min(0, l[[1]]), l[[2]]),
  range = c(0, 1)
)

scale_slab_alpha_discrete(..., range = c(0.1, 1))

scale_slab_size_continuous(..., range = c(1, 6))

scale_slab_size_discrete(..., range = c(1, 6), na.translate = FALSE)

scale_slab_linewidth_continuous(..., range = c(1, 6))

scale_slab_linewidth_discrete(..., range = c(1, 6), na.translate = FALSE)

scale_slab_linetype_discrete(..., na.value = "blank")

scale_slab_linetype_continuous(...)

scale_slab_shape_discrete(..., solid = TRUE)

scale_slab_shape_continuous(...)

guide_colourbar2(...)

guide_colorbar2(...)

```

Arguments

...	Arguments passed to underlying scale or guide functions. E.g. <code>scale_point_color_discrete</code> passes arguments to <code>scale_color_discrete()</code> . See those functions for more details.
aesthetics	Names of aesthetics to set scales for.
guide	Guide to use for legends for an aesthetic.
range	a numeric vector of length 2 that specifies the minimum and maximum size of the plotting symbol after transformation.

<code>na.translate</code>	In discrete scales, should we show missing values?
<code>na.value</code>	When <code>na.translate</code> is true, what value should be shown?
<code>limits</code>	One of: <ul style="list-style-type: none"> • NULL to use the default scale range • A numeric vector of length two providing limits of the scale. Use NA to refer to the existing minimum or maximum • A function that accepts the existing (automatic) limits and returns new limits. Also accepts rlang <code>lambda</code> function notation. Note that setting limits on positional scales will remove data outside of the limits. If the purpose is to zoom, use the limit argument in the coordinate system (see <code>coord_cartesian()</code>).
<code>solid</code>	Should the shapes be solid, TRUE, or hollow, FALSE?

Details

The following additional scales / aesthetics are defined for use with `geom_slabinterval()` and related geoms:

`scale_point_color_*` Point color
`scale_point_fill_*` Point fill color
`scale_point_alpha_*` Point alpha level / opacity
`scale_point_size_*` Point size
`scale_interval_color_*` Interval line color
`scale_interval_alpha_*` Interval alpha level / opacity
`scale_interval_linetype_*` Interval line type
`scale_slab_color_*` Slab outline color
`scale_slab_fill_*` Slab fill color
`scale_slab_alpha_*` Slab alpha level / opacity. The default settings of `scale_slab_alpha_continuous` differ from `scale_alpha_continuous()` and are designed for gradient plots (e.g. `stat_gradientinterval()`) by ensuring that densities of 0 get mapped to 0 in the output.
`scale_slab_linewidth_*` Slab outline line width
`scale_slab_linetype_*` Slab outline line type
`scale_slab_shape_*` Slab dot shape (for `geom_dotsinterval()`)

See the corresponding scale documentation in ggplot for more information; e.g. `scale_color_discrete()`, `scale_color_continuous()`, etc.

Other scale functions can be used with the aesthetics/scales defined here by using the `aesthetics` argument to that scale function. For example, to use color brewer scales with the `point_color` aesthetic:

```
scale_color_brewer(..., aesthetics = "point_color")
```

With continuous color scales, you may also need to provide a guide as the default guide does not work properly; this is what `guide_colorbar2` is for:

```
scale_color_distiller(..., guide = "colorbar2", aesthetics = "point_color")
```

These scales have been deprecated:

scale_interval_size_* Use scale_linewidth_*
 scale_slab_size_* Slab scale_size_linewidth_*

Value

A `ggplot2::Scale` representing one of the aesthetics used to target the appearance of specific parts of composite `ggdist` geoms. Can be added to a `ggplot()` object.

Author(s)

Matthew Kay

See Also

Other `ggplot2` scales: `scale_color_discrete()`, `scale_color_continuous()`, etc.

Other `ggdist` scales: `scale_colour_ramp`, `scale_side_mirrored()`, `scale_thickness`

Examples

```
library(dplyr)
library(ggplot2)

# This plot shows how to set multiple specific aesthetics
# NB it is very ugly and is only for demo purposes.
data.frame(distribution = "Normal(1,2)") %>%
  parse_dist(distribution) %>%
  ggplot(aes(y = distribution, xdist = .dist, args = .args)) +
  stat_halfeye(
    shape = 21, # this point shape has a fill and outline
    point_color = "red",
    point_fill = "black",
    point_alpha = .1,
    point_size = 6,
    stroke = 2,
    interval_color = "blue",
    # interval line widths are scaled from [1, 6] onto [0.6, 1.4] by default
    # see the interval_size_range parameter in help("geom_slabinterval")
    linewidth = 8,
    interval_linetype = "dashed",
    interval_alpha = .25,
    # fill sets the fill color of the slab (here the density)
    slab_color = "green",
    slab_fill = "purple",
    slab_linewidth = 3,
    slab_linetype = "dotted",
    slab_alpha = .5
  )
)
```

subguide_axis *Axis sub-guide for thickness scales*

Description

This is a sub-guide intended for annotating the `thickness` aesthetic in **ggdist**. It can be used with the `subguide` parameter of `geom_slabinterval()`.

Supports [automatic partial function application](#).

Usage

```
subguide_axis(
  values,
  title = NULL,
  breaks = waiver(),
  labels = waiver(),
  position = 0,
  just = 0,
  label_side = "topright",
  orientation = "horizontal",
  theme = theme_get()
)

subguide_inside(..., label_side = "inside")

subguide_outside(..., label_side = "outside", just = 1)

subguide_integer(..., breaks = scales::breaks_extended(Q = c(1, 5, 2, 4, 3)))

subguide_count(..., breaks = scales::breaks_width(1))
```

Arguments

values	Values used to construct the scale used for this guide. Typically provided automatically by <code>geom_slabinterval()</code> .
title	The title of the scale shown on the sub-guide's axis.
breaks	One of: <ul style="list-style-type: none"> • <code>NULL</code> for no breaks • <code>waiver()</code> 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 <code>scales::extended_breaks()</code>). Also accepts rlang lambda function notation.
labels	One of: <ul style="list-style-type: none"> • <code>NULL</code> for no labels

	<ul style="list-style-type: none"> • <code>waiver()</code> 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 <code>?plotmath</code> for details. • A function that takes the breaks as input and returns labels as output. Also accepts <code>rlang::lambda</code> function notation.
<code>position</code>	Numeric value between 0 and 1 giving the position of the guide relative to the axis: 0 causes the sub-guide to be drawn on the left or bottom depending on if orientation is "horizontal" or "vertical", and 1 causes the sub-guide to be drawn on the top or right depending on if orientation is "horizontal" or "vertical". May also be a string indicating the position: "top", "right", "bottom", "left", "topright", "topleft", "bottomright", or "bottomleft".
<code>just</code>	Numeric value between 0 and 1 giving the justification of the guide relative to its position: 0 means aligned towards the inside of the axis edge, 1 means aligned towards the outside of the axis edge.
<code>label_side</code>	Which side of the axis to draw the ticks and labels on. "topright", "top", and "right" are synonyms which cause the labels to be drawn on the top or the right depending on if orientation is "horizontal" or "vertical". "bottomleft", "bottom", and "left" are synonyms which cause the labels to be drawn on the bottom or the left depending on if orientation is "horizontal" or "vertical". "topleft" causes the labels to be drawn on the top or the left, and "bottomright" causes the labels to be drawn on the bottom or the right. "inside" causes the labels to be drawn on the side closest to the inside of the chart, depending on position, and "outside" on the side closest to the outside of the chart.
<code>orientation</code>	Orientation of the geometry this sub-guide is for. One of "horizontal" ("y") or "vertical" ("x"). See the orientation parameter to <code>geom_slabinterval()</code> .
<code>theme</code>	A <code>ggplot2::theme</code> object used to determine the style that the sub-guide elements are drawn in. The title label is drawn using the "axis.title.x" or "axis.title.y" theme setting, and the axis line, ticks, and tick labels are drawn using <code>guide_axis()</code> , so the same theme settings that normally apply to axis guides will be followed.
<code>...</code>	Arguments passed to other functions, typically back to <code>subguide_axis()</code> itself.

Details

`subguide_inside()` is a shortcut for drawing labels inside of the chart region.

`subguide_outside()` is a shortcut for drawing labels outside of the chart region.

`subguide_integer()` only draws breaks that are integer values, useful for labeling counts in `geom_dots()`.

`subguide_count()` is a shortcut for drawing labels where *every* whole number is labeled, useful for labeling counts in `geom_dots()`. If your max count is large, `subguide_integer()` may be better.

See Also

Other sub-guides: `subguide_none()`

Examples

```

# example code
library(ggplot2)
library(distributional)

df = data.frame(d = dist_normal(2:3, 2:3), g = c("a", "b"))

# subguides allow you to label thickness axes
ggplot(df, aes(xdist = d, y = g)) +
  stat_slabinterval(subguide = "inside")

# they respect normalization and use of scale_thickness_shared()
ggplot(df, aes(xdist = d, y = g)) +
  stat_slabinterval(subguide = "inside", normalize = "groups")

# they can also be positioned outside the plot area, though
# this typically requires manually adjusting plot margins
ggplot(df, aes(xdist = d, y = g)) +
  stat_slabinterval(subguide = subguide_outside(title = "density", position = "right")) +
  theme(plot.margin = margin(5.5, 50, 5.5, 5.5))

# any of the subguide types will also work to indicate bin counts in
# geom_dots(); subguide_integer() and subguide_count() can be useful for
# dotplots as they only label integers / whole numbers:
df = data.frame(d = dist_gamma(2:3, 2:3), g = c("a", "b"))
ggplot(df, aes(xdist = d, y = g)) +
  stat_dots(subguide = subguide_count(label_side = "left", title = "count")) +
  scale_y_discrete(expand = expansion(add = 0.1)) +
  scale_x_continuous(expand = expansion(add = 0.5))

```

subguide_none

Empty sub-guide for thickness scales

Description

This is a blank sub-guide that omits annotations for the [thickness](#) aesthetic in **ggdist**. It can be used with the subguide parameter of [geom_slabinterval\(\)](#).

Usage

```
subguide_none(...)
```

Arguments

... ignored.

See Also

Other sub-guides: [subguide_axis\(\)](#)

`theme_ggdist`*Simple, light ggplot2 theme for ggdist and tidybayes*

Description

A simple, relatively minimalist ggplot2 theme, and some helper functions to go with it.

Usage

```
theme_ggdist(  
  base_size = 11,  
  base_family = "",  
  base_line_size = base_size/22,  
  base_rect_size = base_size/22  
)  
  
theme_tidybayes(  
  base_size = 11,  
  base_family = "",  
  base_line_size = base_size/22,  
  base_rect_size = base_size/22  
)  
  
facet_title_horizontal()  
  
axis_titles_bottom_left()  
  
facet_title_left_horizontal()  
  
facet_title_right_horizontal()
```

Arguments

<code>base_size</code>	base font size, given in pts.
<code>base_family</code>	base font family
<code>base_line_size</code>	base size for line elements
<code>base_rect_size</code>	base size for rect elements

Details

This is a relatively minimalist ggplot2 theme, intended to be used for making publication-ready plots. It is currently based on `ggplot2::theme_light()`.

A word of warning: this theme may (and very likely will) change in the future as I tweak it to my taste.

`theme_ggdist()` and `theme_tidybayes()` are aliases.

Value

A named list in the format of `ggplot2::theme()`

Author(s)

Matthew Kay

See Also

`ggplot2::theme()`, `ggplot2::theme_set()`

Examples

```
library(ggplot2)

theme_set(theme_ggdist())
```

tidy-format-translators

Translate between different tidy data frame formats for draws from distributions

Description

These functions translate **ggdist/tidybayes**-style data frames to/from different data frame formats (each format using a different naming scheme for its columns).

Usage

```
to_broom_names(data)

from_broom_names(data)

to_ggmcmc_names(data)

from_ggmcmc_names(data)
```

Arguments

`data` A data frame to translate.

Details

Function prefixed with `to_` translate from the **ggdist/tidybayes** format to another format, functions prefixed with `from_` translate from that format back to the **ggdist/tidybayes** format. Formats include:

`to_broom_names()` / `from_broom_names()`:

- `.variable` <-> `term`
- `.value` <-> `estimate`
- `.prediction` <-> `.fitted`
- `.lower` <-> `conf.low`
- `.upper` <-> `conf.high`

`to_ggmcmc_names()` / `from_ggmcmc_names()`:

- `.chain` <-> `Chain`
- `.iteration` <-> `Iteration`
- `.variable` <-> `Parameter`
- `.value` <-> `value`

Value

A data frame with (possibly) new names in some columns, according to the translation scheme described in **Details**.

Author(s)

Matthew Kay

Examples

```
library(dplyr)

data(RankCorr_u_tau, package = "ggdist")

df = RankCorr_u_tau %>%
  dplyr::rename(.variable = i, .value = u_tau) %>%
  group_by(.variable) %>%
  median_qi(.value)

df

df %>%
  to_broom_names()
```

weighted_ecdf	<i>Weighted empirical cumulative distribution function</i>
---------------	--

Description

A variation of `ecdf()` that can be applied to weighted samples.

Usage

```
weighted_ecdf(x, weights = NULL, na.rm = FALSE)
```

Arguments

<code>x</code>	numeric vector: sample values
<code>weights</code>	Weights for the sample. One of: <ul style="list-style-type: none">• numeric vector of same length as <code>x</code>: weights for corresponding values in <code>x</code>, which will be normalized to sum to 1.• <code>NULL</code>: indicates no weights are provided, so the unweighted empirical cumulative distribution function (equivalent to <code>ecdf()</code>) is returned.
<code>na.rm</code>	logical: if <code>TRUE</code> , corresponding entries in <code>x</code> and <code>weights</code> are removed if either is <code>NA</code> .

Details

Generates a weighted empirical cumulative distribution function, $F(x)$. Given x , a sorted vector (derived from `x`), and w_i , the corresponding weight for x_i , $F(x)$ is a step function with steps at each x_i with $F(x_i)$ equal to the sum of all weights up to and including w_i .

Value

`weighted_ecdf()` returns a function of class "weighted_ecdf", which also inherits from the `stepfun()` class. Thus, it also has `plot()` and `print()` methods. Like `ecdf()`, `weighted_ecdf()` also provides a `quantile()` method, which dispatches to `weighted_quantile()`.

See Also

[weighted_quantile\(\)](#)

Examples

```
weighted_ecdf(1:3, weights = 1:3)
plot(weighted_ecdf(1:3, weights = 1:3))
quantile(weighted_ecdf(1:3, weights = 1:3), 0.4)
```

weighted_quantile	<i>Weighted sample quantiles</i>
-------------------	----------------------------------

Description

A variation of `quantile()` that can be applied to weighted samples.

Usage

```
weighted_quantile(
  x,
  probs = seq(0, 1, 0.25),
  weights = NULL,
  n = NULL,
  na.rm = FALSE,
  names = TRUE,
  type = 7,
  digits = 7
)
```

```
weighted_quantile_fun(x, weights = NULL, n = NULL, na.rm = FALSE, type = 7)
```

Arguments

<code>x</code>	numeric vector: sample values
<code>probs</code>	numeric vector: probabilities in $[0, 1]$
<code>weights</code>	Weights for the sample. One of: <ul style="list-style-type: none"> • numeric vector of same length as <code>x</code>: weights for corresponding values in <code>x</code>, which will be normalized to sum to 1. • <code>NULL</code>: indicates no weights are provided, so unweighted sample quantiles (equivalent to <code>quantile()</code>) are returned.
<code>n</code>	Presumed effective sample size. If this is greater than 1 and continuous quantiles (<code>type >= 4</code>) are requested, flat regions may be added to the approximation to the inverse CDF in areas where the normalized weight exceeds $1/n$ (i.e., regions of high density). This can be used to ensure that if a sample of size <code>n</code> with duplicate <code>x</code> values is summarized into a weighted sample without duplicates, the result of <code>weighted_quantile(..., n = n)</code> on the weighted sample is equal to the result of <code>quantile()</code> on the original sample. One of: <ul style="list-style-type: none"> • <code>NULL</code>: do not make a sample size adjustment. • numeric: presumed effective sample size. • function or name of function (as a string): A function applied to <code>weights</code> (prior to normalization) to determine the sample size. Some useful values may be: <ul style="list-style-type: none"> – <code>"length"</code>: i.e. use the number of elements in <code>weights</code> (equivalently in <code>x</code>) as the effective sample size.

	– "sum": i.e. use the sum of the unnormalized weights as the sample size. Useful if the provided weights is unnormalized so that its sum represents the true sample size.
na.rm	logical: if TRUE, corresponding entries in x and weights are removed if either is NA.
names	logical: If TRUE, add names to the output giving the input probs formatted as a percentage.
type	integer between 1 and 9: determines the type of quantile estimator to be used. Types 1 to 3 are for discontinuous quantiles, types 4 to 9 are for continuous quantiles. See Details .
digits	numeric: the number of digits to use to format percentages when names is TRUE.

Details

Calculates weighted quantiles using a variation of the quantile types based on a generalization of `quantile()`.

Type 1–3 (discontinuous) quantiles are directly a function of the inverse CDF as a step function, and so can be directly translated to the weighted case using the natural definition of the weighted ECDF as the cumulative sum of the normalized weights.

Type 4–9 (continuous) quantiles require some translation from the definitions in `quantile()`. `quantile()` defines continuous estimators in terms of x_k , which is the k th order statistic, and p_k , which is a function of k and n (the sample size). In the weighted case, we instead take x_k as the k th smallest value of x in the weighted sample (not necessarily an order statistic, because of the weights). Then we can re-write the formulas for p_k in terms of $F(x_k)$ (the empirical CDF at x_k , i.e. the cumulative sum of normalized weights) and $f(x_k)$ (the normalized weight at x_k), by using the fact that, in the unweighted case, $k = F(x_k) \cdot n$ and $1/n = f(x_k)$:

$$\text{Type 4 } p_k = \frac{k}{n} = F(x_k)$$

$$\text{Type 5 } p_k = \frac{k-0.5}{n} = F(x_k) - \frac{f(x_k)}{2}$$

$$\text{Type 6 } p_k = \frac{k}{n+1} = \frac{F(x_k)}{1+f(x_k)}$$

$$\text{Type 7 } p_k = \frac{k-1}{n-1} = \frac{F(x_k)-f(x_k)}{1-f(x_k)}$$

$$\text{Type 8 } p_k = \frac{k-1/3}{n+1/3} = \frac{F(x_k)-f(x_k)/3}{1+f(x_k)/3}$$

$$\text{Type 9 } p_k = \frac{k-3/8}{n+1/4} = \frac{F(x_k)-f(x_k) \cdot 3/8}{1+f(x_k)/4}$$

Then the quantile function (inverse CDF) is the piece-wise linear function defined by the points (p_k, x_k) .

Value

`weighted_quantile()` returns a numeric vector of `length(probs)` with the estimate of the corresponding quantile from `probs`.

`weighted_quantile_fun()` returns a function that takes a single argument, a vector of probabilities, which itself returns the corresponding quantile estimates. It may be useful when `weighted_quantile()` needs to be called repeatedly for the same sample, re-using some pre-computation.

See Also[weighted_ecdf\(\)](#)

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