

sunflower — Density-distribution sunflower plots

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Description

`sunflower` draws density-distribution sunflower plots (Plummer and Dupont 2003). Dark sunflowers, light sunflowers, and marker symbols represent high-, medium-, and low-density regions of the data, respectively. These plots are useful for displaying bivariate data whose density is too great for conventional scatterplots to be effective.

Quick start

Density-distribution sunflower plot showing the relationship between x and y

```
sunflower y x
```

Set the center of the reference bin to $x = 5$ and $y = 8$

```
sunflower y x, xcenter(5) ycenter(8)
```

Same as above, but specify the width of the hexagonal bins to be 1.5

```
sunflower y x, xcenter(5) ycenter(8) binwidth(1.5)
```

Same as above, but set the minimum number of observations needed for a bin to be represented by a light sunflower to 4

```
sunflower y x, xcenter(5) ycenter(8) binwidth(1.5) light(4)
```

Use the `sicolor` scheme

```
sunflower y x, scheme(sicolor)
```

Specify that only the petals are shown and the hexagons are omitted

```
sunflower y x, floweronly
```

Suppress display of the table

```
sunflower y x, notable
```

Menu

Graphics > Smoothing and densities > Density-distribution sunflower plot

Syntax

```
sunflower yvar xvar [if] [in] [weight] [, options]
```

<i>options</i>	Description
Main	
<code>nograph</code>	do not show graph
<code>notable</code>	do not show summary table; implied when <code>by()</code> is specified
<code>marker_options</code>	affect rendition of markers drawn at the plotted points
Bins/Petals	
<code>binwidth(#)</code>	width of the hexagonal bins
<code>binar(#)</code>	aspect ratio of the hexagonal bins
<code>bin_options</code>	affect rendition of hexagonal bins
<code>light(#)</code>	minimum observations for a light sunflower; default is <code>light(3)</code>
<code>dark(#)</code>	minimum observations for a dark sunflower; default is <code>dark(13)</code>
<code>xcenter(#)</code>	<i>x</i> -coordinate of the reference bin
<code>ycenter(#)</code>	<i>y</i> -coordinate of the reference bin
<code>petalweight(#)</code>	observations in a dark sunflower petal
<code>petallength(#)</code>	length of sunflower petal as a percentage
<code>petal_options</code>	affect rendition of sunflower petals
<code>floweronly</code>	show petals only; do not render bins
<code>nosinglepetal</code>	suppress single petals
Add plots	
<code>addplot(plot)</code>	add other plots to generated graph
Y axis, X axis, Titles, Legend, Overall, By	
<code>twoway_options</code>	any options documented in [G-3] <code>twoway_options</code>

<i>bin_options</i>	Description
<code>[1d] bstyle(<i>areastyle</i>)</code>	overall look of hexagonal bins
<code>[1d] bcolor(<i>colorstyle</i>)</code>	outline and fill color
<code>[1d] bfcolor(<i>colorstyle</i>)</code>	fill color
<code>[1d] blstyle(<i>linestyle</i>)</code>	overall look of outline
<code>[1d] blcolor(<i>colorstyle</i>)</code>	outline color
<code>[1d] blwidth(<i>linewidthstyle</i>)</code>	thickness of outline

<i>petal_options</i>	Description
<code>[1d] flstyle(<i>linestyle</i>)</code>	overall style of sunflower petals
<code>[1d] flcolor(<i>colorstyle</i>)</code>	color of sunflower petals
<code>[1d] flwidth(<i>linewidthstyle</i>)</code>	thickness of sunflower petals

All options are *rightmost*; see [G-4] **Concept: repeated options**.

`fweights` are allowed; see [U] **11.1.6 weight**.

Options

Main

`nograph` prevents the graph from being generated.

`notable` prevents the summary table from being displayed. This option is implied when the `by()` option is specified.

`marker_options` affect the rendition of markers drawn at the plotted points, including their shape, size, color, and outline; see [G-3] [marker_options](#).

Bins/Petals

`binwidth(#)` specifies the horizontal width of the hexagonal bins in the same units as `xvar`. By default,

$$\text{binwidth} = \max(\text{rbw}, \text{nbw})$$

where

$$\text{rbw} = \text{range of } xvar / 40$$

$$\text{nbw} = \text{range of } xvar / \max(1, \text{nb})$$

and

$$\text{nb} = \text{int}(\min(\text{sqrt}(n), 10 * \log_{10}(n)))$$

where

$$n = \text{the number of observations in the dataset}$$

`binar(#)` specifies the aspect ratio for the hexagonal bins. The height of the bins is given by

$$\text{binheight} = \text{binwidth} \times \# \times 2 / \sqrt{3}$$

where `binheight` and `binwidth` are specified in the units of `yvar` and `xvar`, respectively. The default is `binar(r)`, where `r` results in the rendering of regular hexagons.

`bin_options` affect how the hexagonal bins are rendered.

`lbstyle(areastyle)` and `dbstyle(areastyle)` specify the look of the light and dark hexagonal bins, respectively. The options listed below allow you to change each attribute, but `lbstyle()` and `dbstyle()` provide the starting points. See [G-4] [areastyle](#) for a list of available area styles.

`lbcolor(colorstyle)` and `dbc_color(colorstyle)` specify one color to be used both to outline the shape and to fill the interior of the light and dark hexagonal bins, respectively. See [G-4] [colorstyle](#) for a list of color choices.

`lbfcolor(colorstyle)` and `dbfcolor(colorstyle)` specify the color to be used to fill the interior of the light and dark hexagonal bins, respectively. See [G-4] [colorstyle](#) for a list of color choices.

`lbstyle(linestyle)` and `dbstyle(linestyle)` specify the overall style of the line used to outline the area, which includes its pattern (solid, dashed, etc.), thickness, and color. The other options listed below allow you to change the line's attributes, but `lbstyle()` and `dbstyle()` are the starting points. See [G-4] [linestyle](#) for a list of choices.

`lbc_color(colorstyle)` and `dbl_color(colorstyle)` specify the color to be used to outline the light and dark hexagonal bins, respectively. See [G-4] [colorstyle](#) for a list of color choices.

`lblwidth(linewidthstyle)` and `dblwidth(linewidthstyle)` specify the thickness of the line to be used to outline the light and dark hexagonal bins, respectively. See [G-4] [linewidthstyle](#) for a list of choices.

`light(#)` specifies the minimum number of observations needed for a bin to be represented by a light sunflower. The default is `light(3)`.

`dark(#)` specifies the minimum number of observations needed for a bin to be represented by a dark sunflower. The default is `dark(13)`.

`xcenter(#)` and `ycenter(#)` specify the center of the reference bin. The default values are the median values of `xvar` and `yvar`, respectively. The centers of the other bins are implicitly defined by the location of the reference bin together with the common bin width and height.

`petalweight(#)` specifies the number of observations represented by each petal of a dark sunflower. The default value is chosen so that the maximum number of petals on a dark sunflower is 14.

`petalength(#)` specifies the length of petals in the sunflowers. The value specified is interpreted as a percentage of half the bin width. The default is 100%.

petal_options affect how the sunflower petals are rendered.

`lflstyle(linestyle)` and `dflstyle(linestyle)` specify the overall style of the light and dark sunflower petals, respectively.

`lflcolor(colorstyle)` and `dflcolor(colorstyle)` specify the color of the light and dark sunflower petals, respectively.

`lflwidth(linewidthstyle)` and `dflwidth(linewidthstyle)` specify the width of the light and dark sunflower petals, respectively.

`floweronly` suppresses rendering of the bins. This option is equivalent to specifying `lbcolor(none)` and `dbcolor(none)`.

`nosinglepetal` suppresses flowers from being drawn in light bins that contain only 1 observation and dark bins that contain as many observations as the petal weight (see the `petalweight()` option).

Add plots

`addplot(plot)` provides a way to add other plots to the generated graph; see [G-3] [addplot_option](#).

Y axis, X axis, Titles, Legend, Overall, By

twoway_options are any of the options documented in [G-3] [twoway_options](#). These include options for titling the graph (see [G-3] [title_options](#)), options for saving the graph to disk (see [G-3] [saving_option](#)), and the `by()` option (see [G-3] [by_option](#)).

Remarks and examples

[stata.com](http://www.stata.com)

A sunflower is several line segments of equal length, called petals, that radiate from a central point. There are two varieties of sunflowers: light and dark. Each petal of a light sunflower represents 1 observation. Each petal of a dark sunflower represents several observations. Dark and light sunflowers represent high- and medium-density regions of the data, and marker symbols represent individual observations in low-density regions.

`sunflower` divides the plane defined by the variables `yvar` and `xvar` into contiguous hexagonal bins. The number of observations contained within a bin determines how the bin will be represented.

- When there are fewer than `light(#)` observations in a bin, each point is plotted using the usual marker symbols in a scatterplot.
- Bins with at least `light(#)` but fewer than `dark(#)` observations are represented by a light sunflower. Each petal of a light sunflower represents one observation in the bin.
- Bins with at least `dark(#)` observations are represented by a dark sunflower. Each petal of a dark sunflower represents multiple observations.

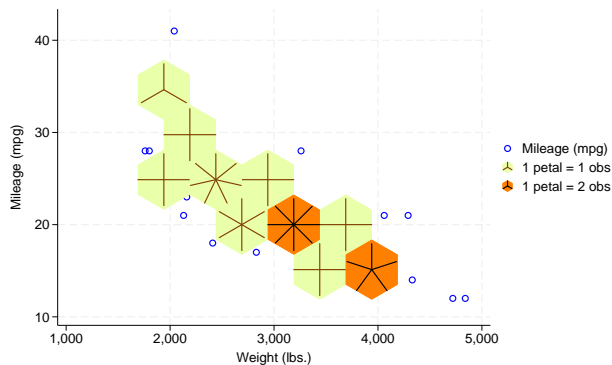
See [Dupont \(2009, 87–92\)](#) for a discussion of sunflower plots and how to create them using Stata.

▷ Example 1

Using the auto dataset, we want to examine the relationship between `weight` and `mpg`. To do that, we type

```
. use https://www.stata-press.com/data/r18/auto
(1978 automobile data)
. sunflower mpg weight, binwid(500) petalw(2) dark(8) scheme(stcolor)
Bin width           =          500
Bin height          =    6.50422
Bin aspect ratio    =    .0112656
Max obs in a bin    =           15
Light               =            3
Dark                =            8
X-center            =         3190
Y-center            =            20
Petal weight        =            2
```

Flower type	Petal weight	No. of petals	No. of flowers	Estimated obs	Actual obs
none				13	13
light	1	3	1	3	3
light	1	4	5	20	20
light	1	6	1	6	6
light	1	7	1	7	7
dark	2	5	1	10	10
dark	2	8	1	16	15
				75	74



The two darkly shaded sunflowers immediately catch our eyes, indicating a group of 10 cars that are heavy (nearly 4,000 pounds) and fuel inefficient and a group 16 of cars that get about 20 miles per gallon and weight in the neighborhood of 3,000 pounds. The lighter sunflowers each indicate groups of three to seven cars that share similar weight and fuel economy characteristics. To obtain the number of cars in each group, we count the number of petals in each flower and consult the graph legend to see how many observations each petal represents.

◀

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