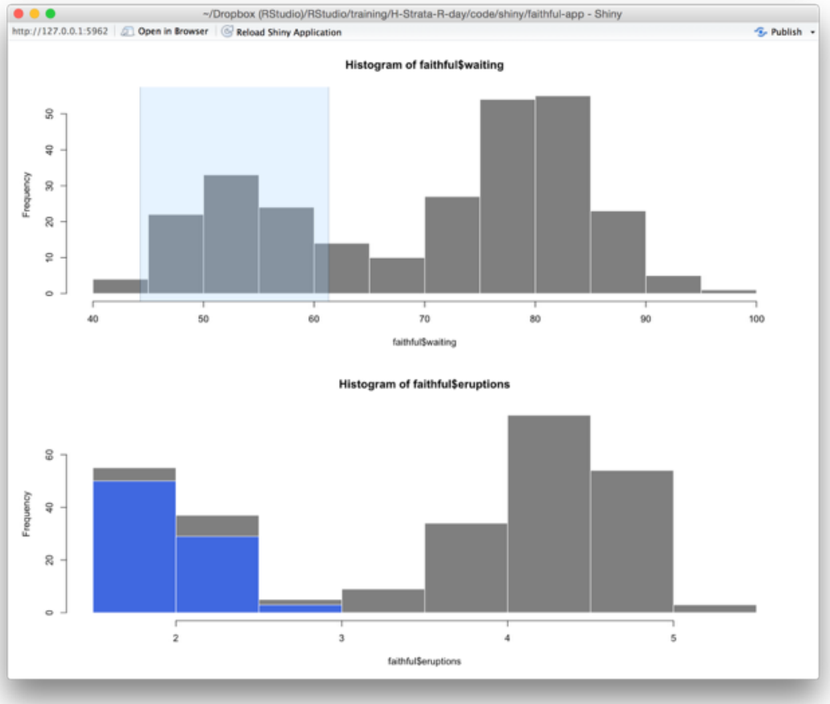
250 Northern Ave, Boston, MA 02210
Phone: 844-448-1212

Email: info@rstudio.com
Web: http://www.rstudio.com

Interactive Data Visualizations in R

with Shiny and ggplot2

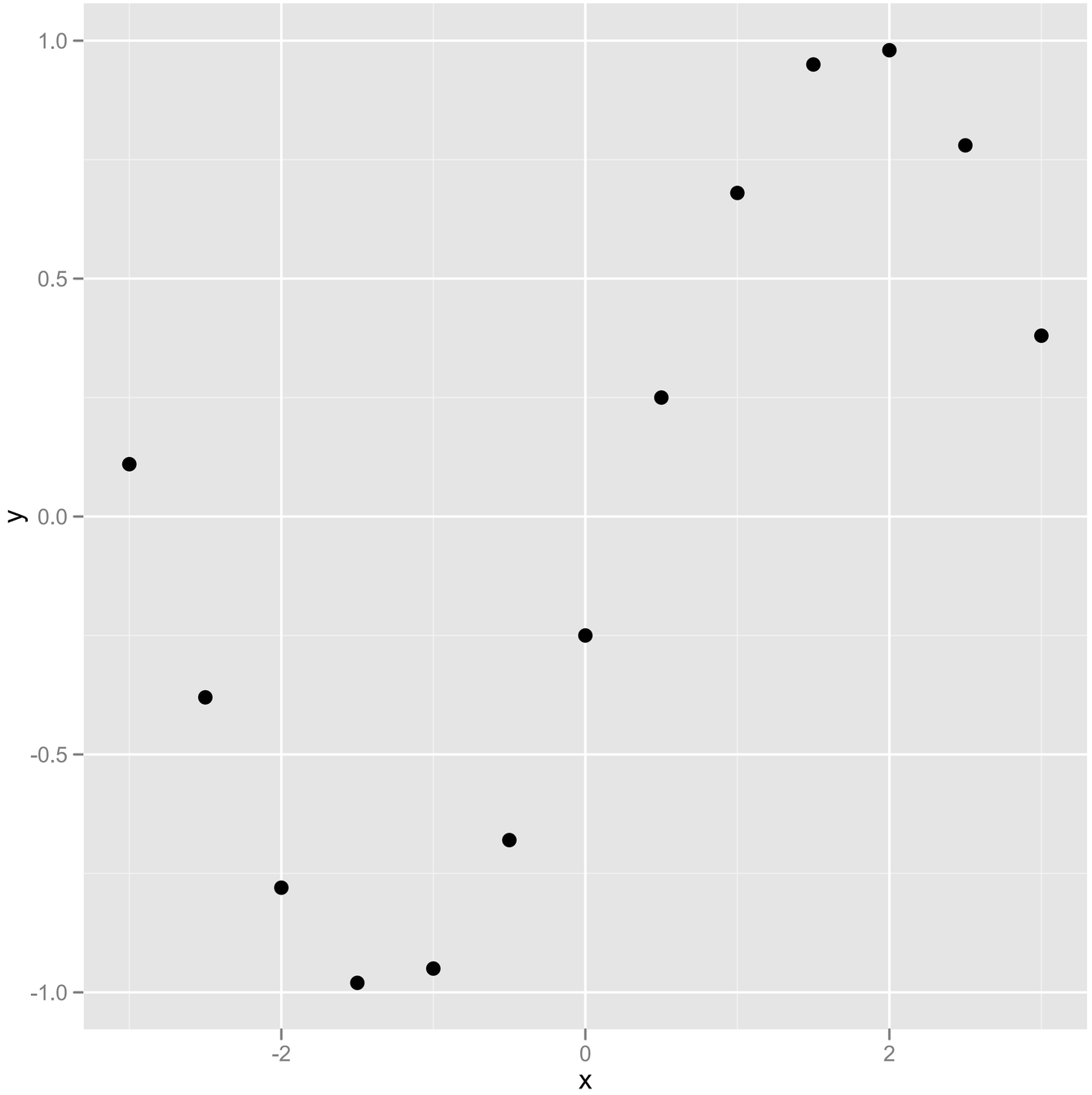


Garrett Grolemund

Data Scientist and Master Instructor
February 2016
Email: garrett@rstudio.com

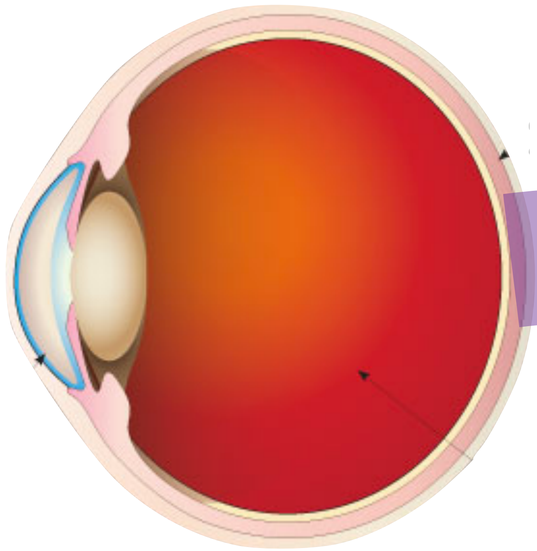
Follow @rstudio

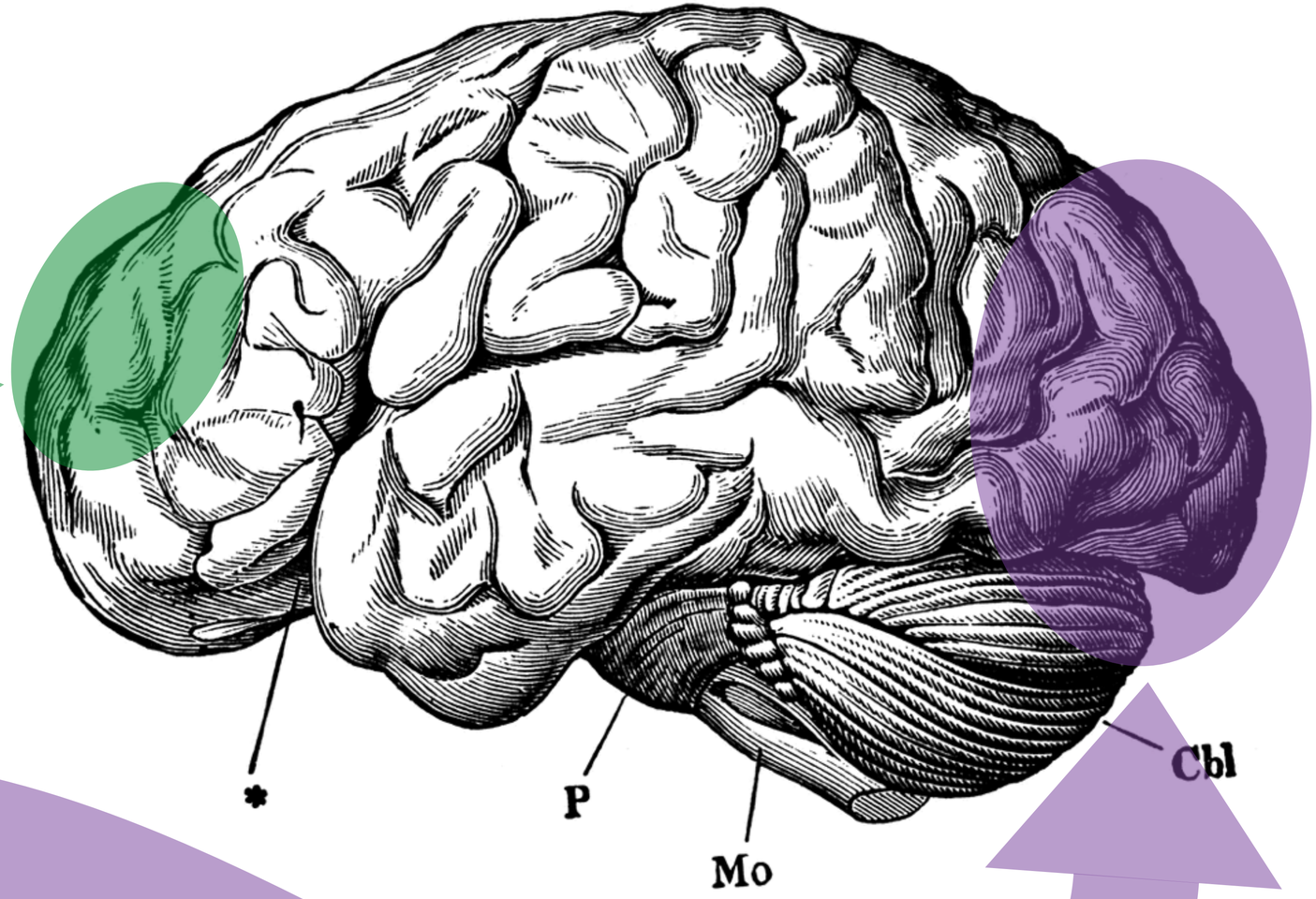
x	y
0	-0.25
-0.5	-0.68
-1	-0.95
-1.5	-0.98
-2.5	-0.38
0.5	0.25
2	0.98
1.5	0.95
3	0.38
1	0.68
2.5	0.78
-3	0.11
-2	-0.78

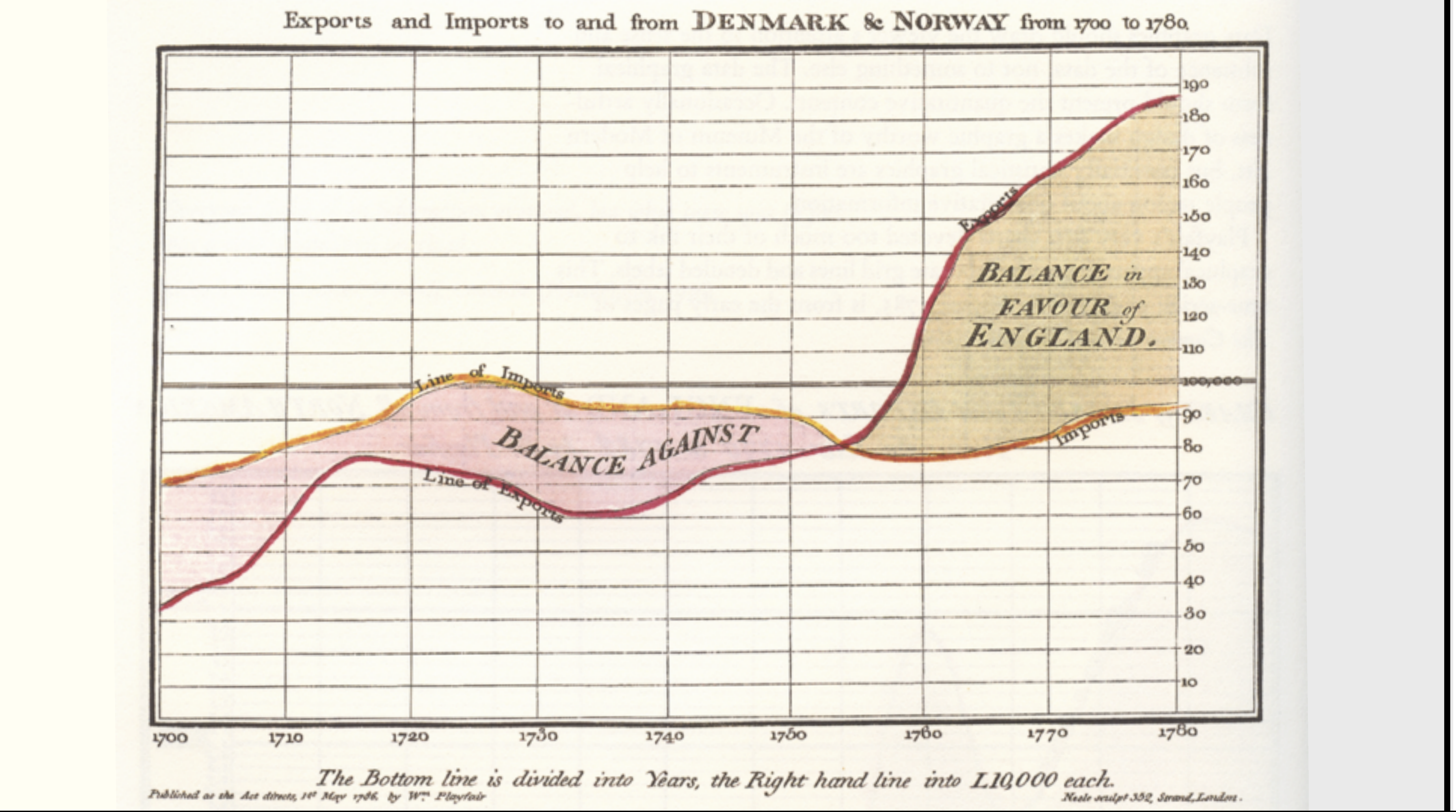


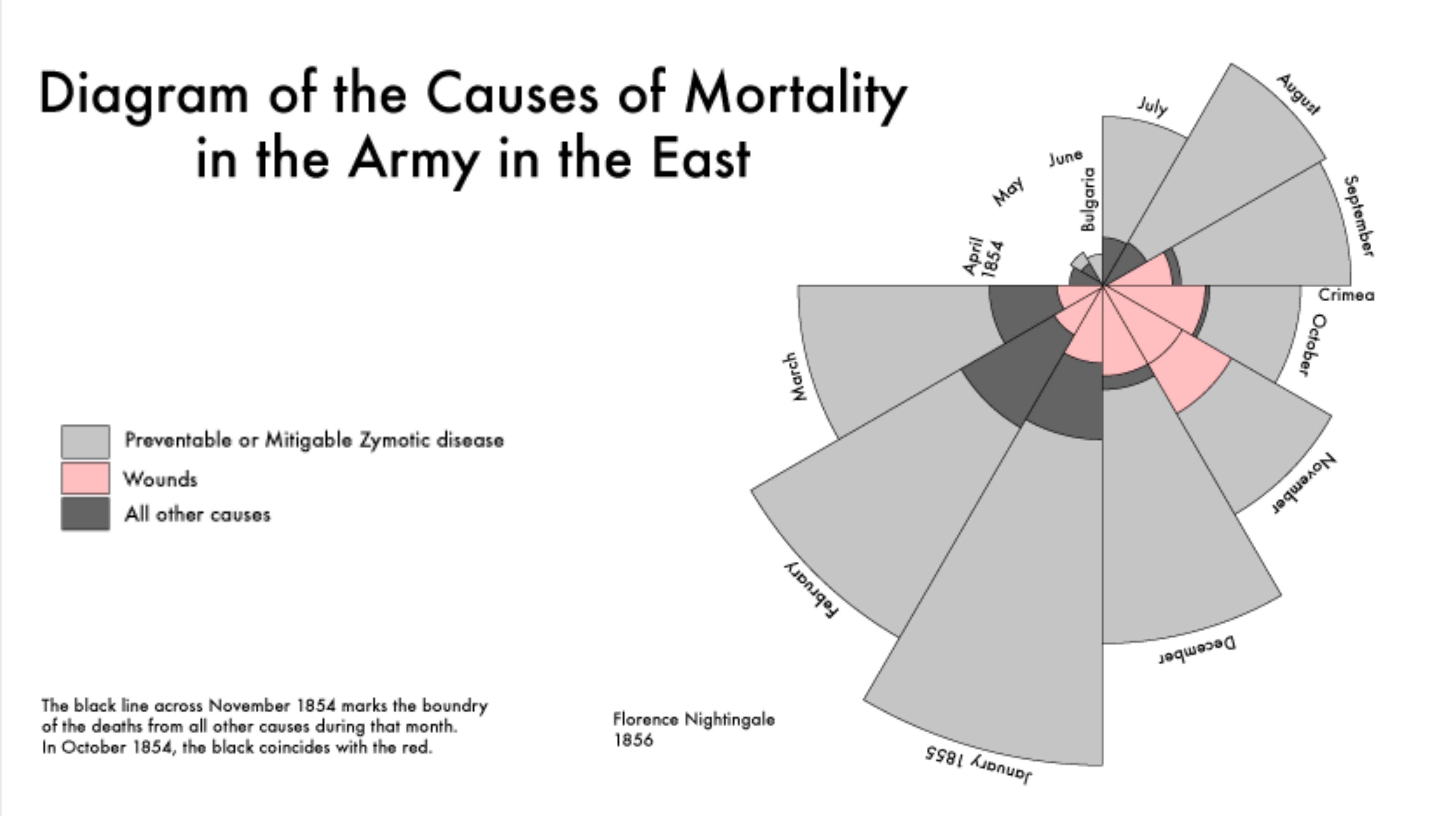
x	y
0	-0.25
-0.5	-0.68
-1	-0.95
-1.5	-0.98
-2.5	-0.38
0.5	0.25
2	0.98
1.5	0.95
3	0.38
1	0.68
2.5	0.78
-3	0.11
-2	-0.78

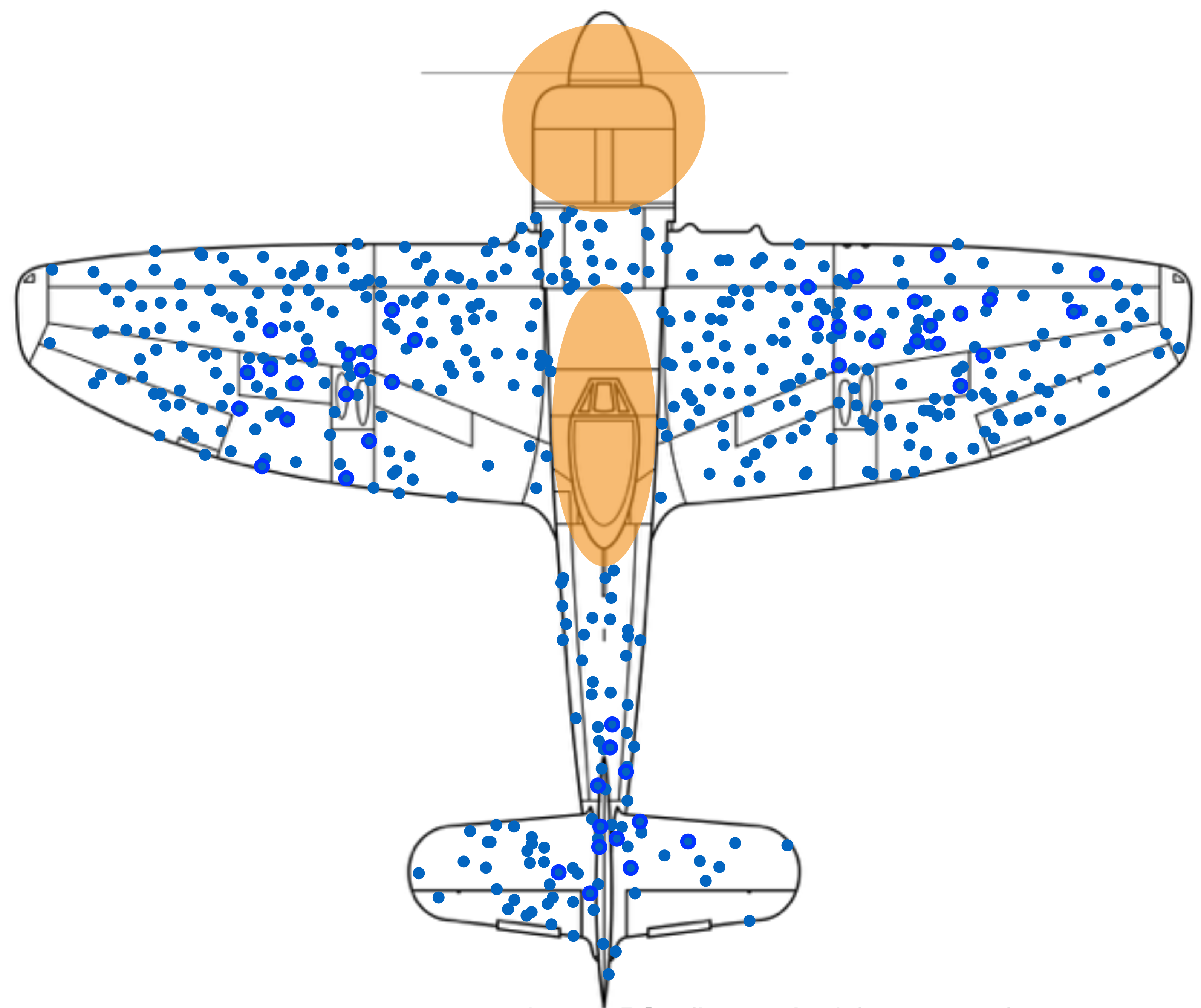
0	-0.25
-0.5	-0.68
-1	-0.95
-1.5	-0.98











A picture is not merely worth a 1,000 words, it is much more likely to be scrutinized than words are to be read.

– John Tukey

But what if you could…

Zoom?

Pan?

Brush?

Highlight points?

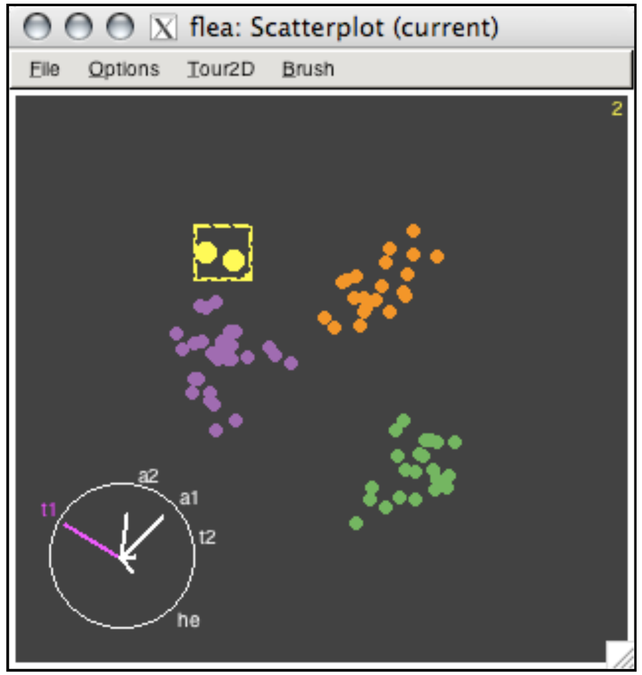
Remove points?

Add points?

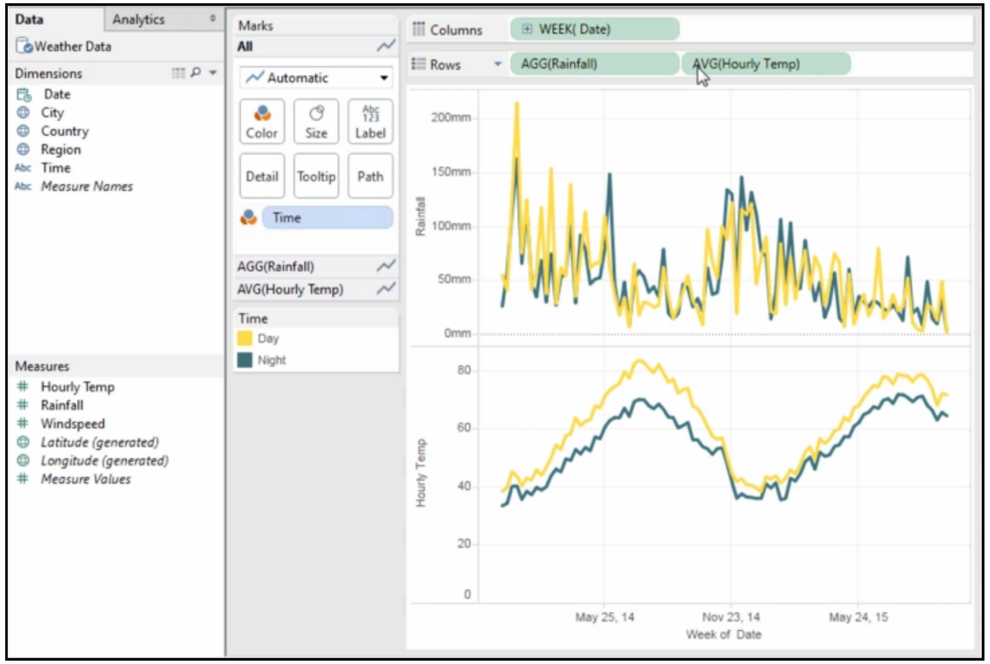
Interactive Graphics

1972
PRIM-9

2008
GGobi



2016
Tableau, JMP, etc.

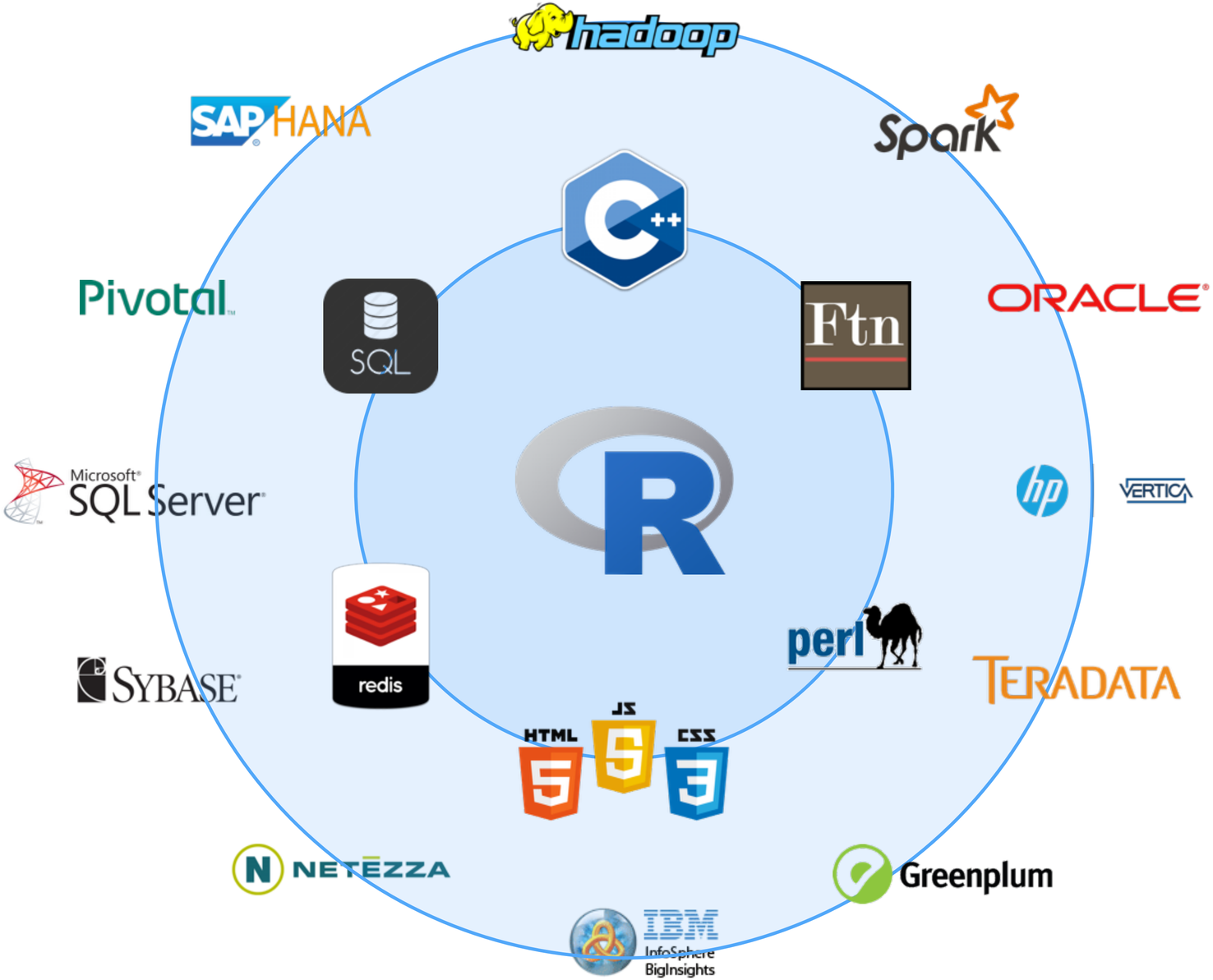


Outline

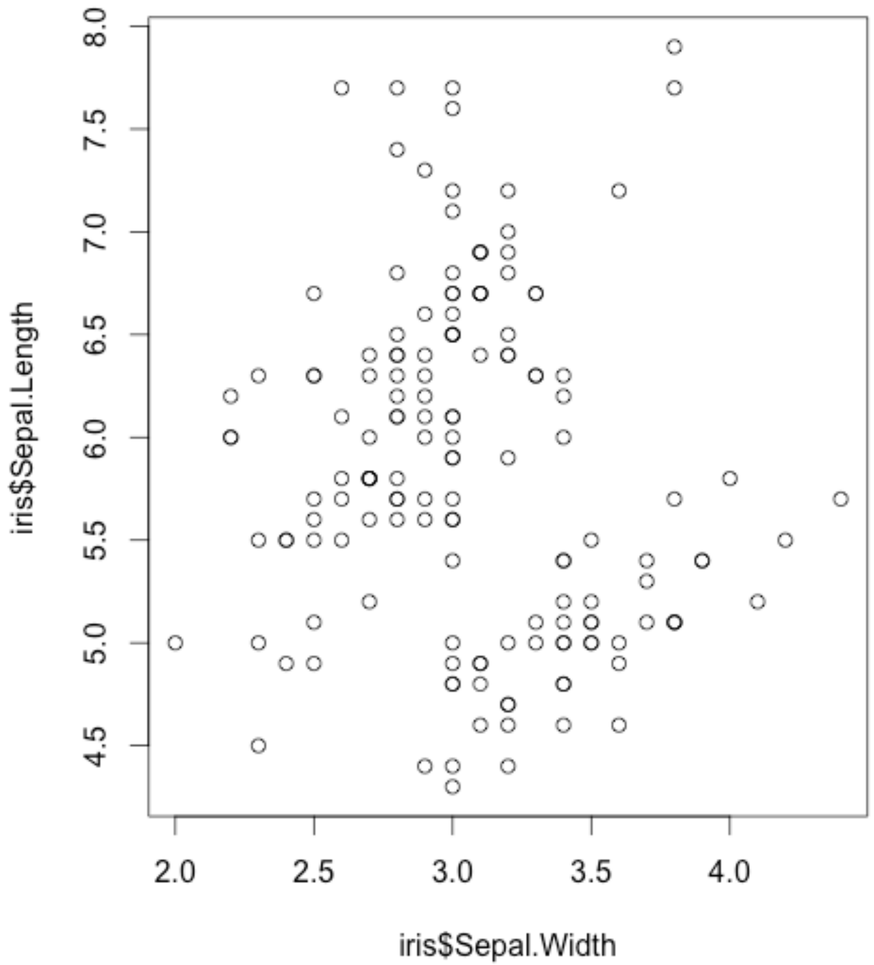
1. A little technical background
   a. R
   b. ggplot2
   c. shiny
2. Interactive Visualizations with Shiny
3. Possibilities

R

An **open source scripting language** that is very useful for analyzing data.



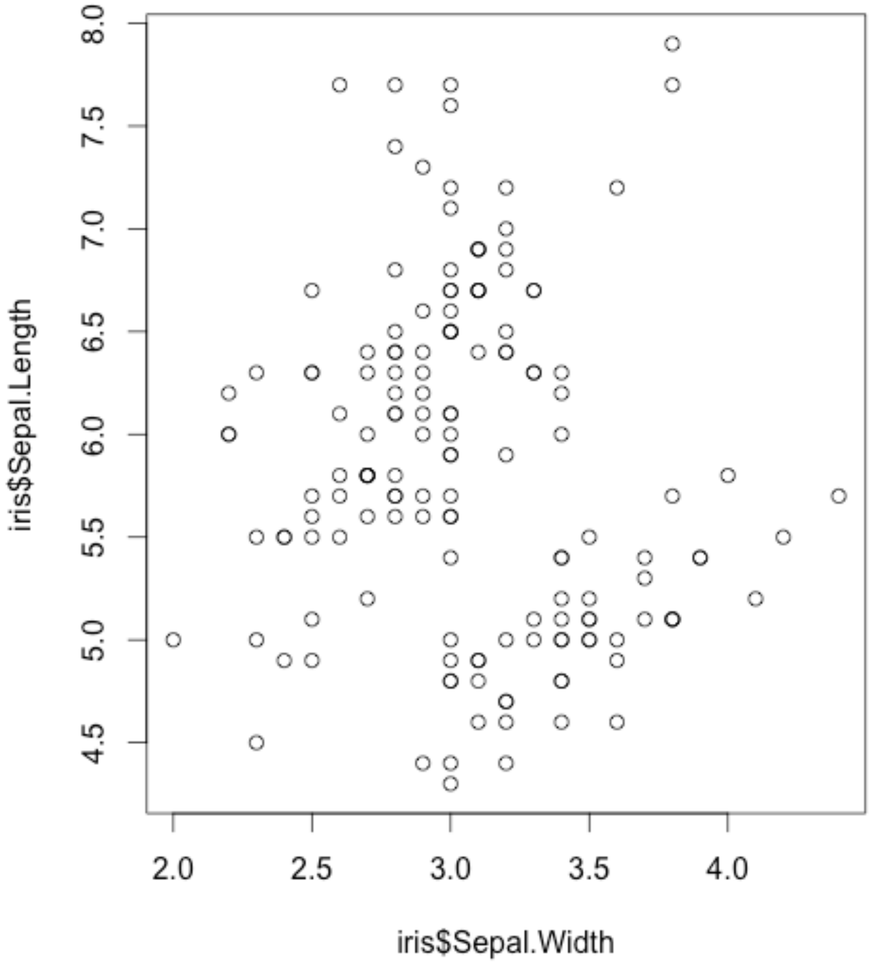
plot



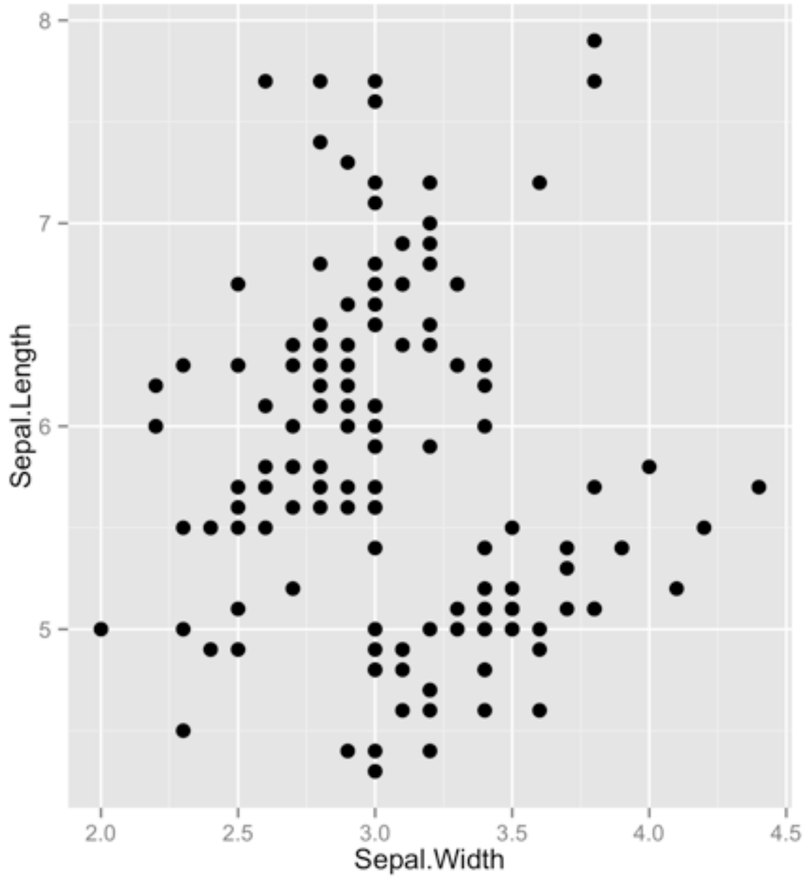

```
plot(iris$Sepal.Width,
     iris$Sepal.Length)
```

- R's basic plot method
- simple
- customizable

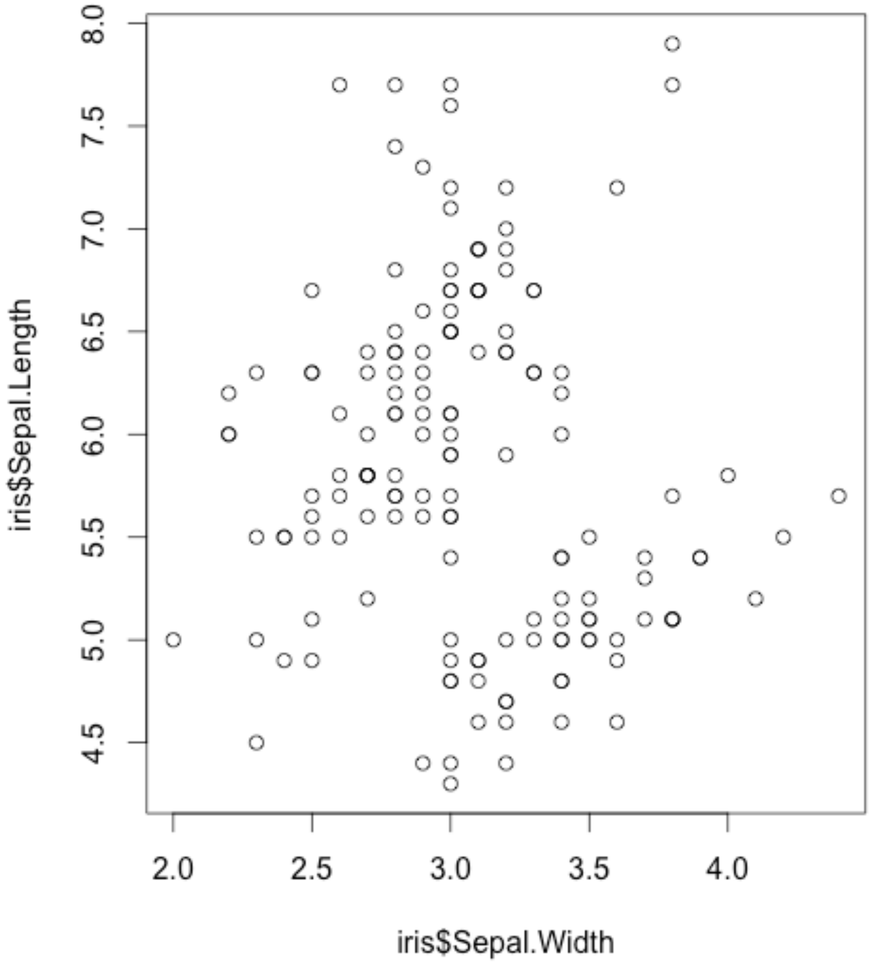
plot



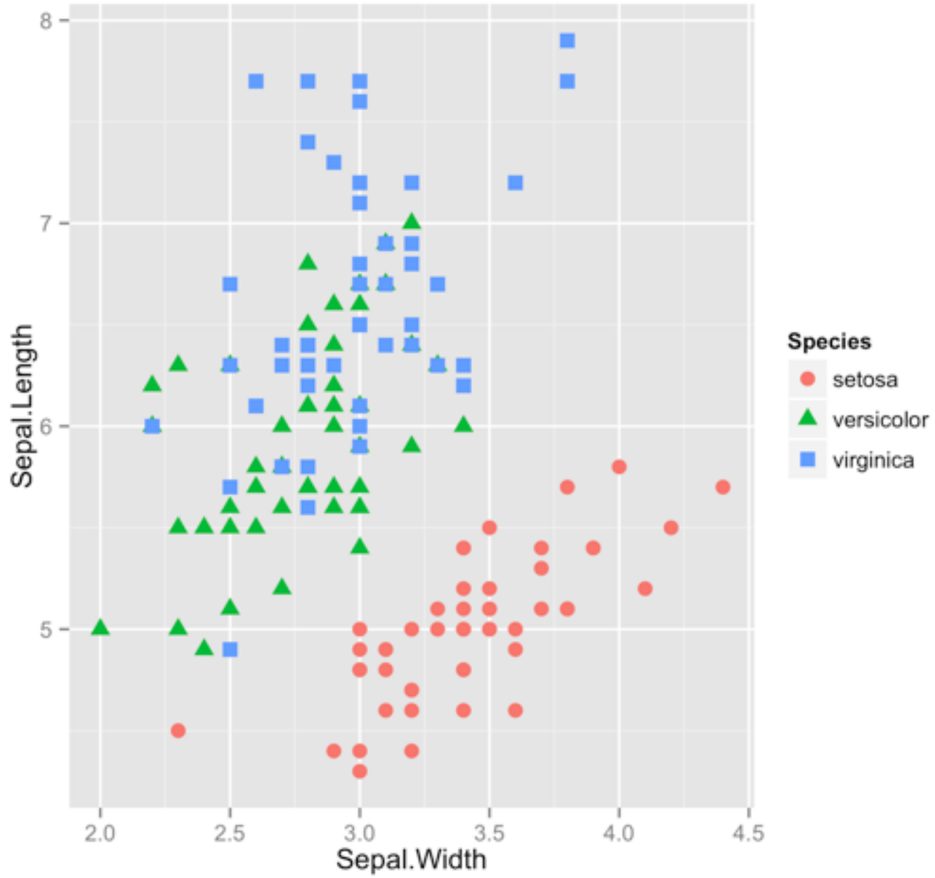
ggplot2



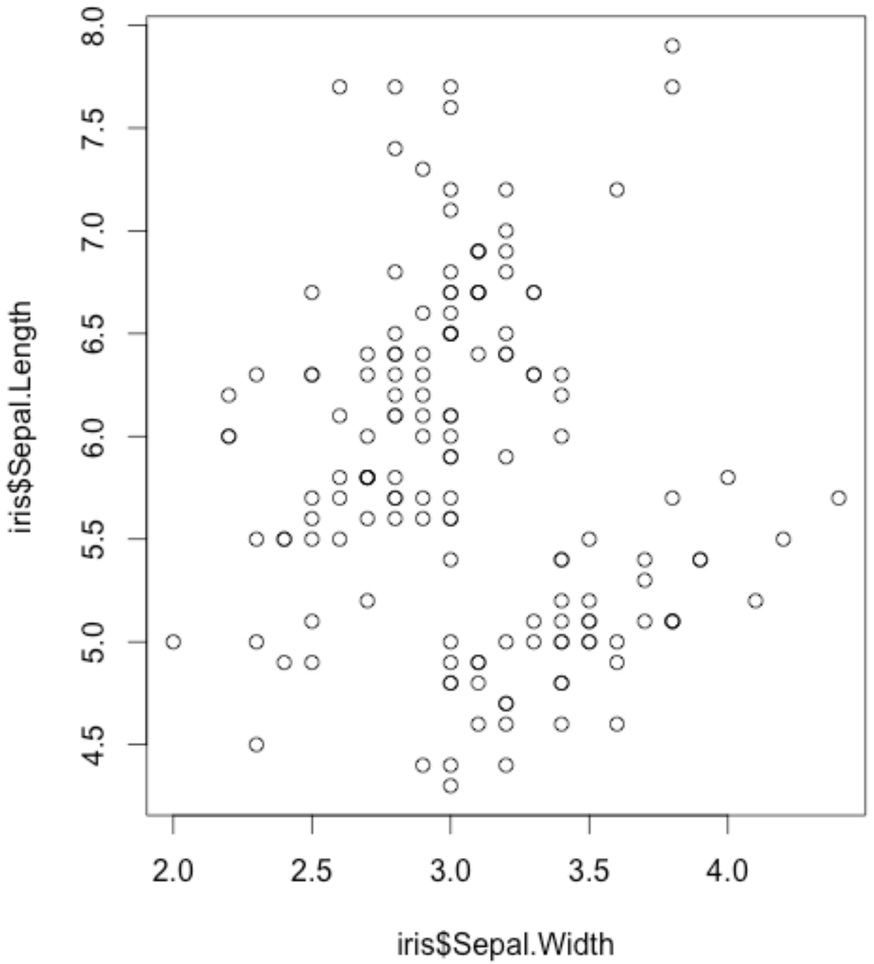
plot



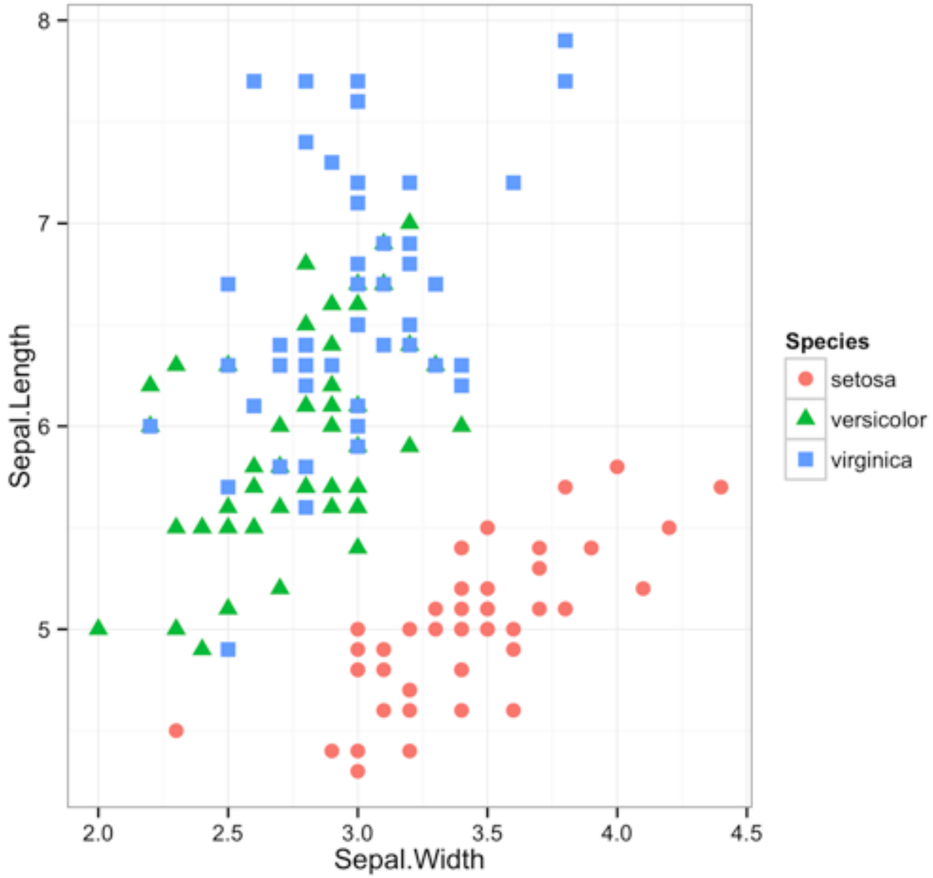
ggplot2



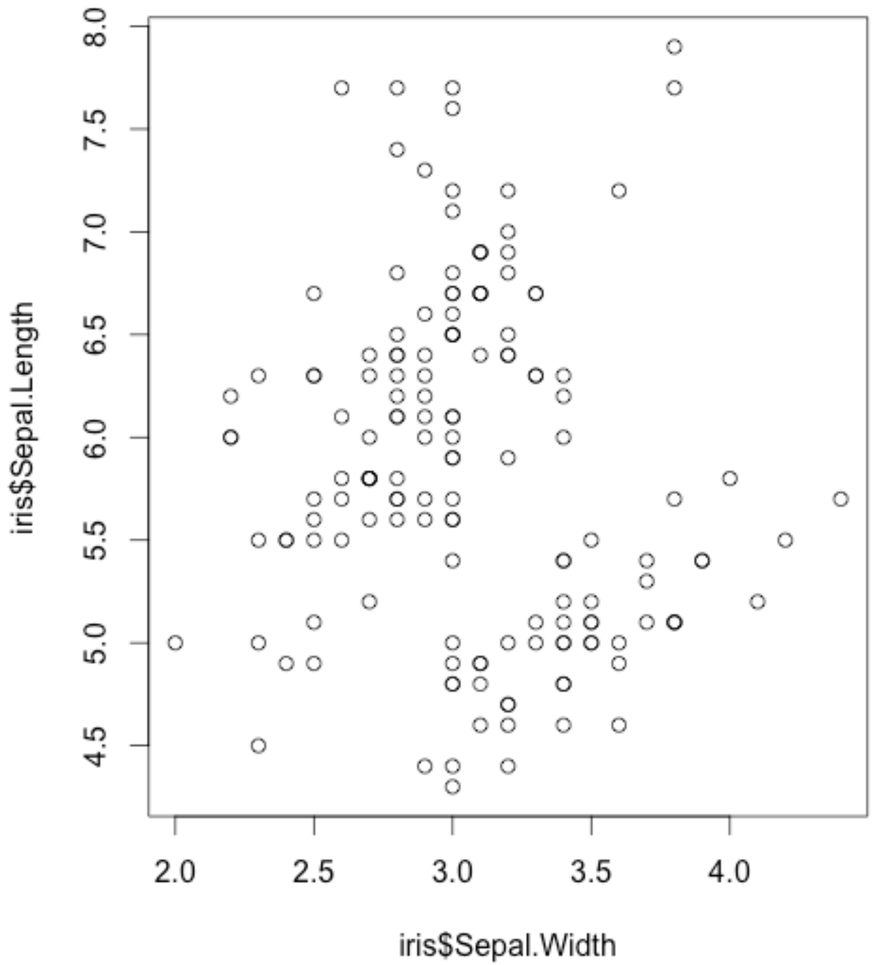
plot



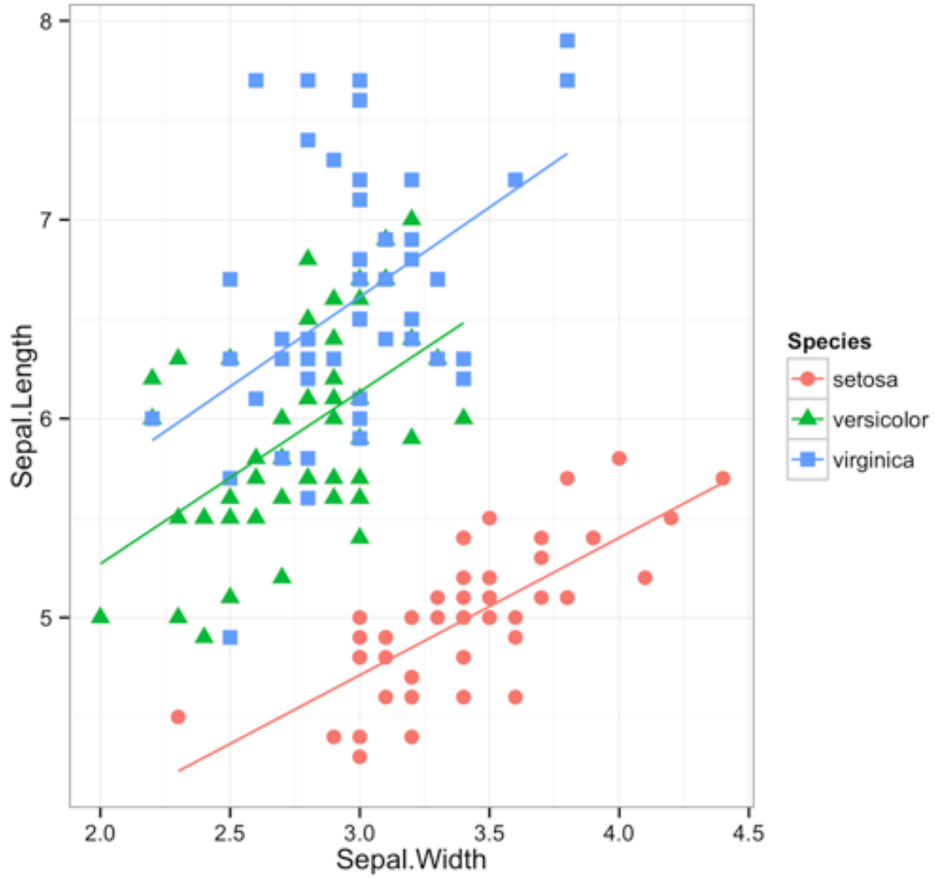
ggplot2



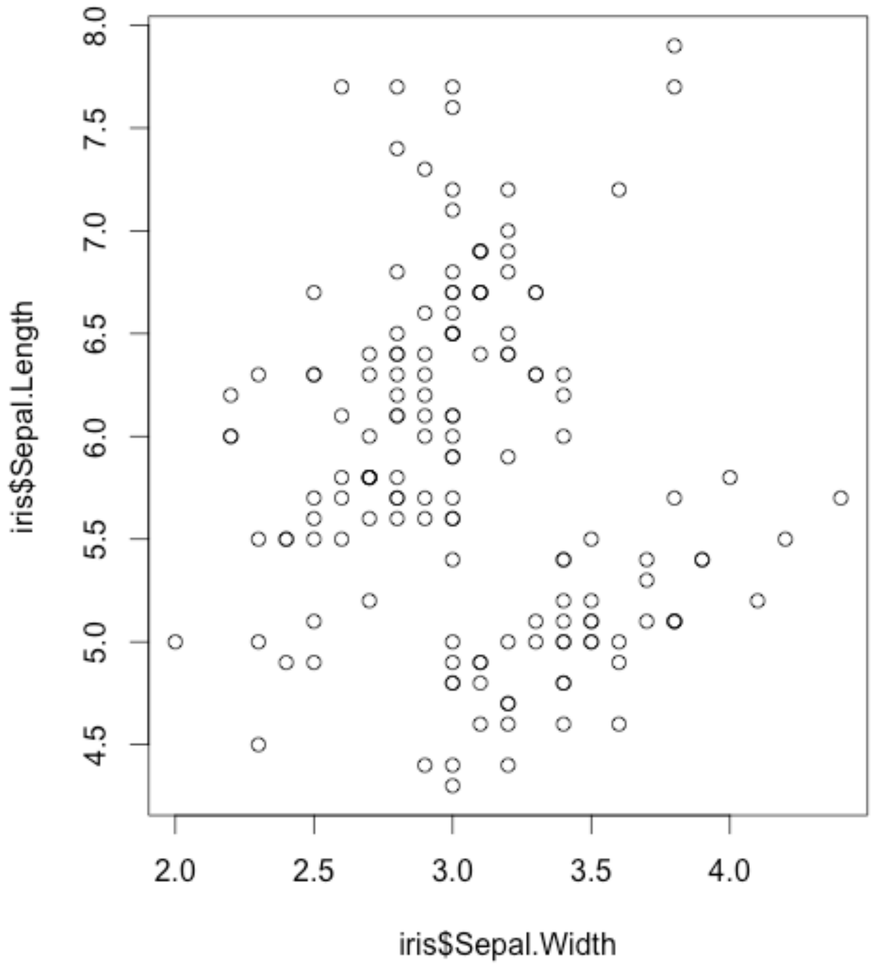
plot



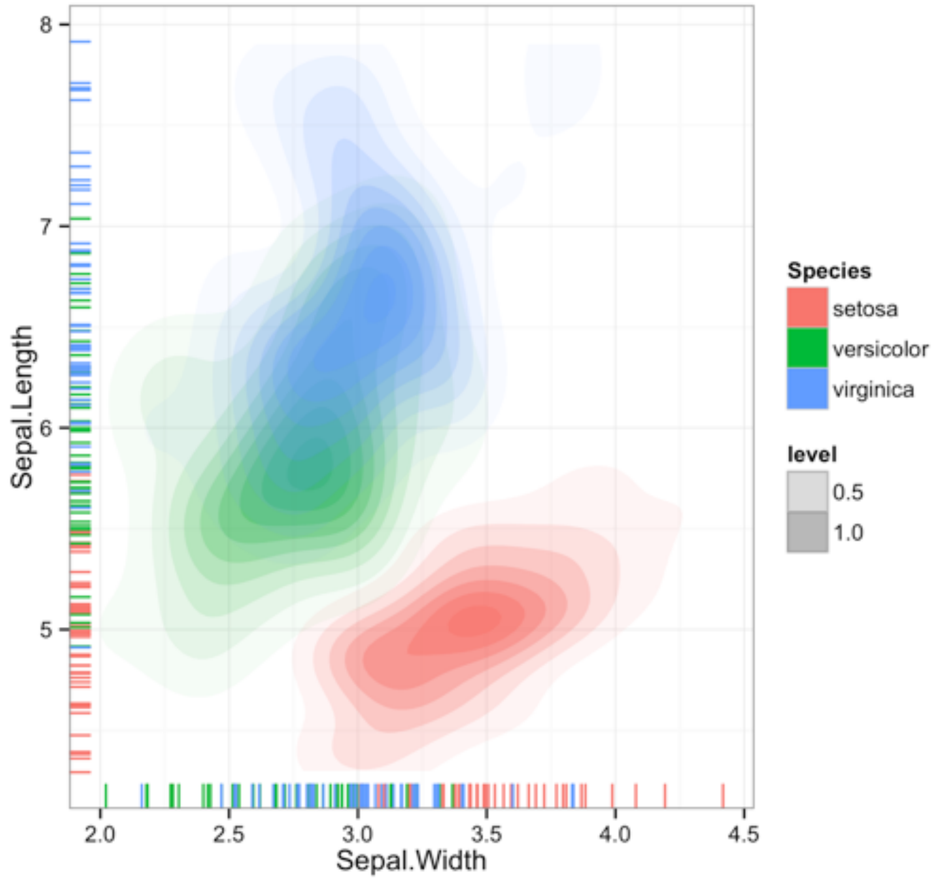
ggplot2



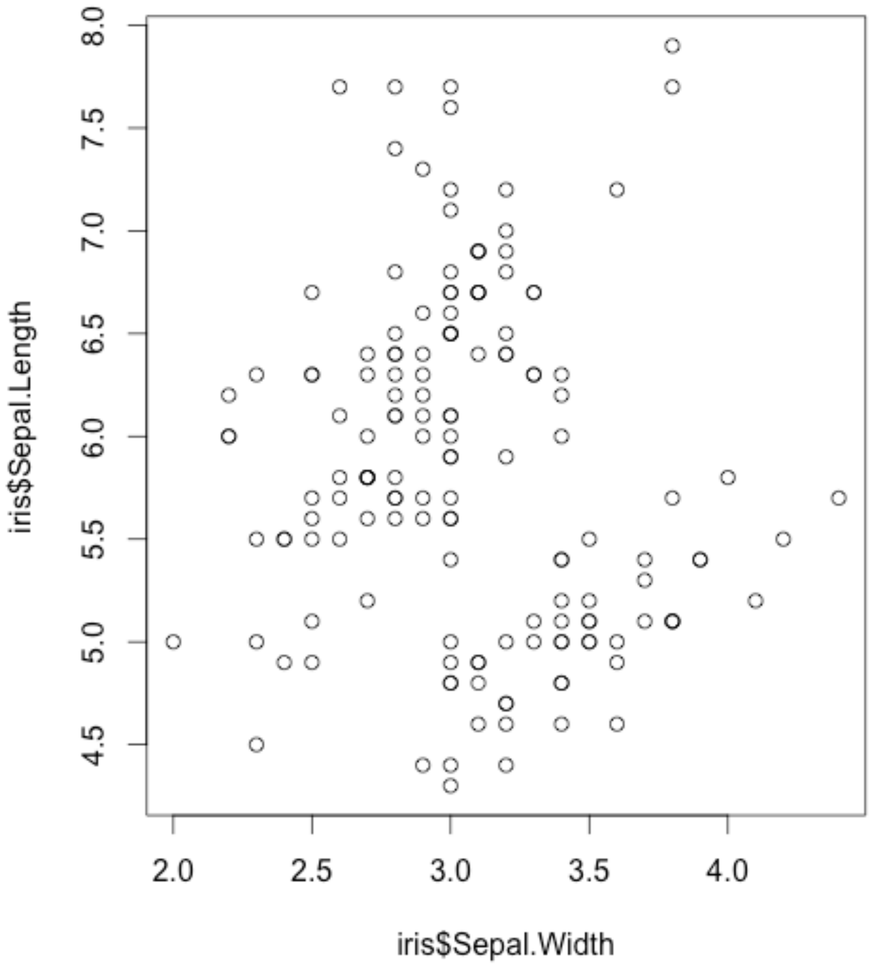
plot



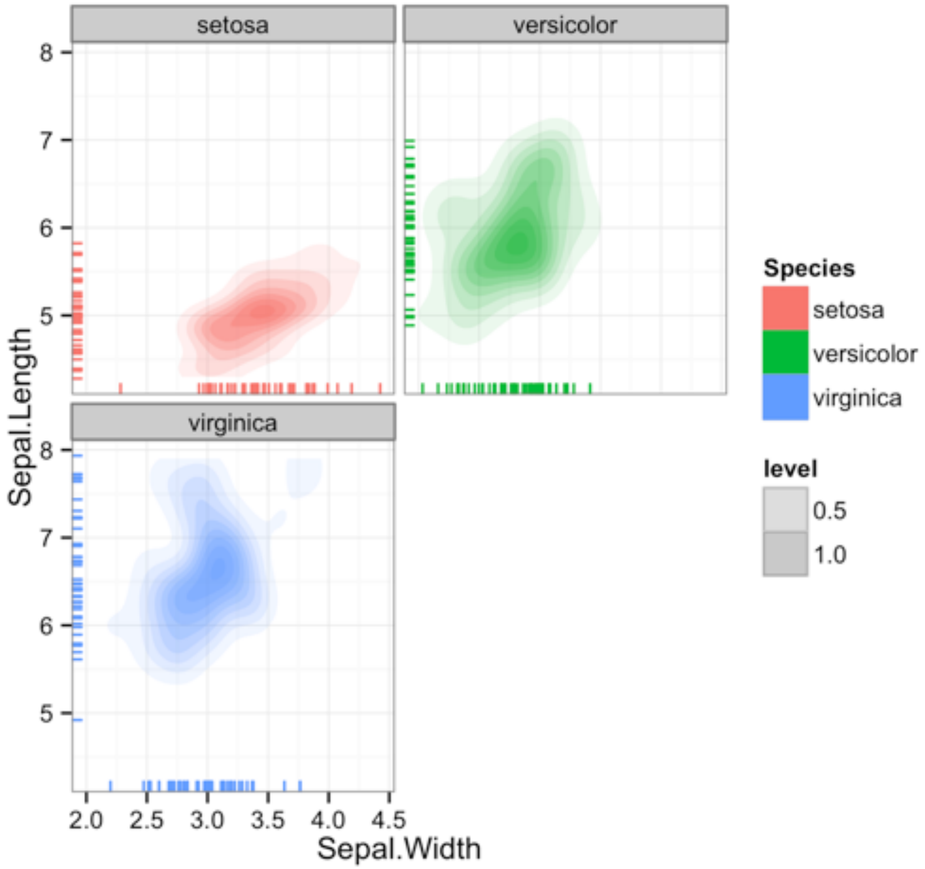
ggplot2



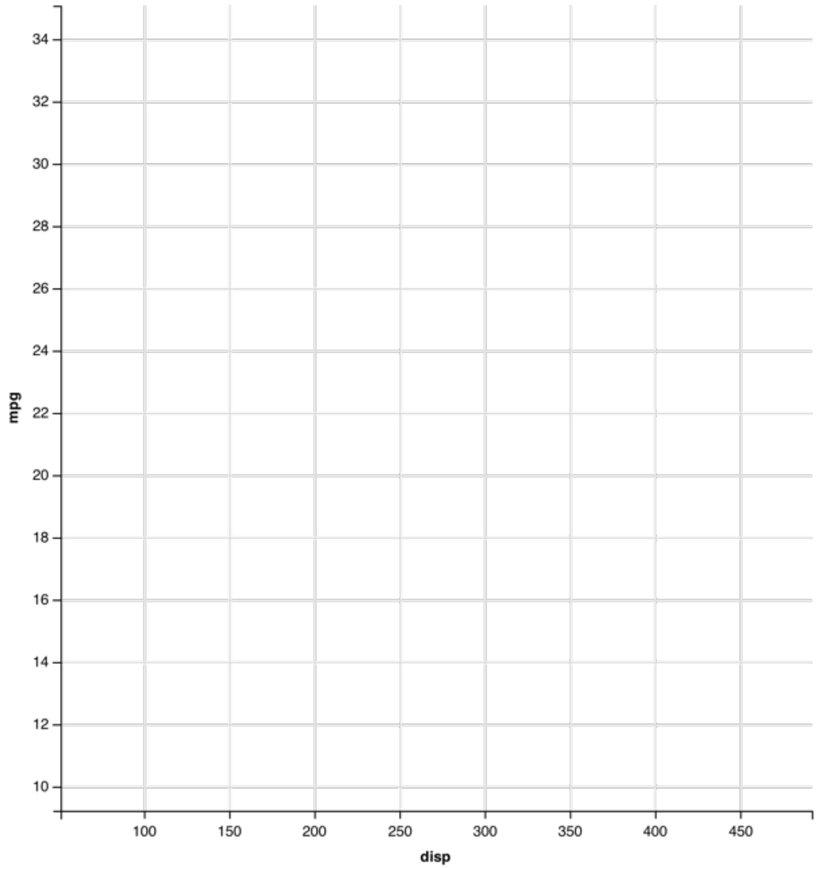
plot



ggplot2



mpg	cyl	disp	hp
21.0	6	160.0	2
21.0	6	160.0	2
22.8	4	108.0	1
21.4	6	258.0	2
18.7	8	360.0	3
18.1	6	225.0	2
14.3	8	360.0	5
24.4	4	146.7	1
22.8	4	140.8	1
19.2	6	167.6	2
17.8	6	167.6	2
16.4	8	275.8	3
17.3	8	275.8	3
15.2	8	275.8	3
10.4	8	472.0	4
10.4	8	460.0	4
14.7	8	440.0	4
32.4	4	78.7	1
30.4	4	75.7	1
33.9	4	71.1	1

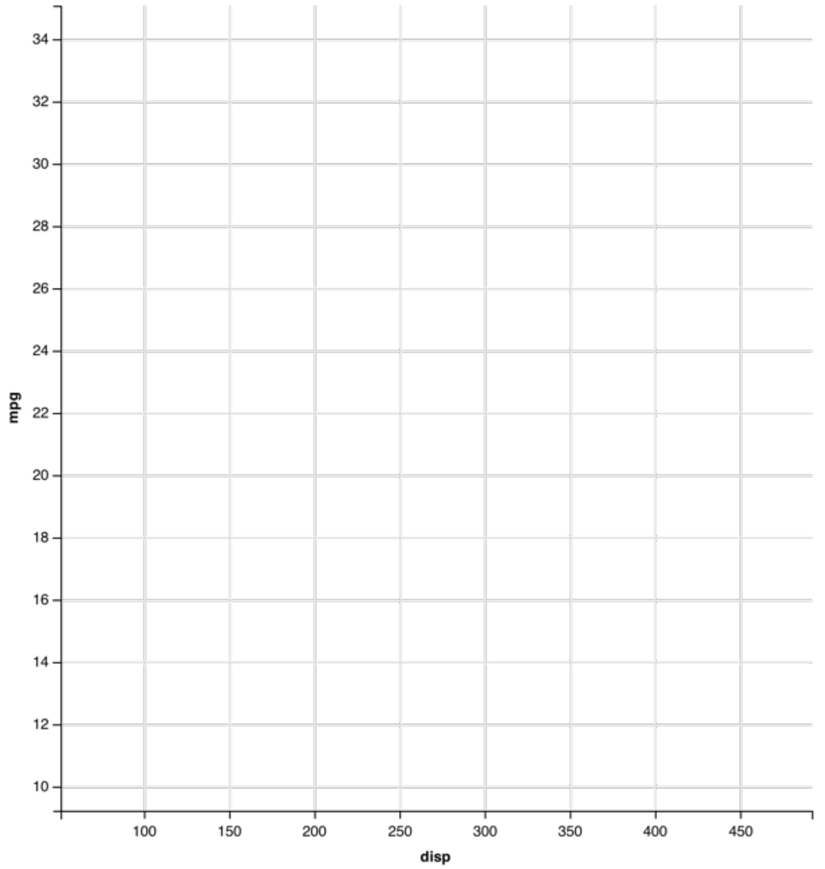


data **geom** **coordinate system**

properties

fill

mpg	cyl	disp	hp
21.0	6	160.0	2
21.0	6	160.0	2
22.8	4	108.0	1
21.4	6	258.0	2
18.7	8	360.0	3
18.1	6	225.0	2
14.3	8	360.0	5
24.4	4	146.7	1
22.8	4	140.8	1
19.2	6	167.6	2
17.8	6	167.6	2
16.4	8	275.8	3
17.3	8	275.8	3
15.2	8	275.8	3
10.4	8	472.0	4
10.4	8	460.0	4
14.7	8	440.0	4
32.4	4	78.7	1
30.4	4	75.7	1
33.9	4	71.1	1

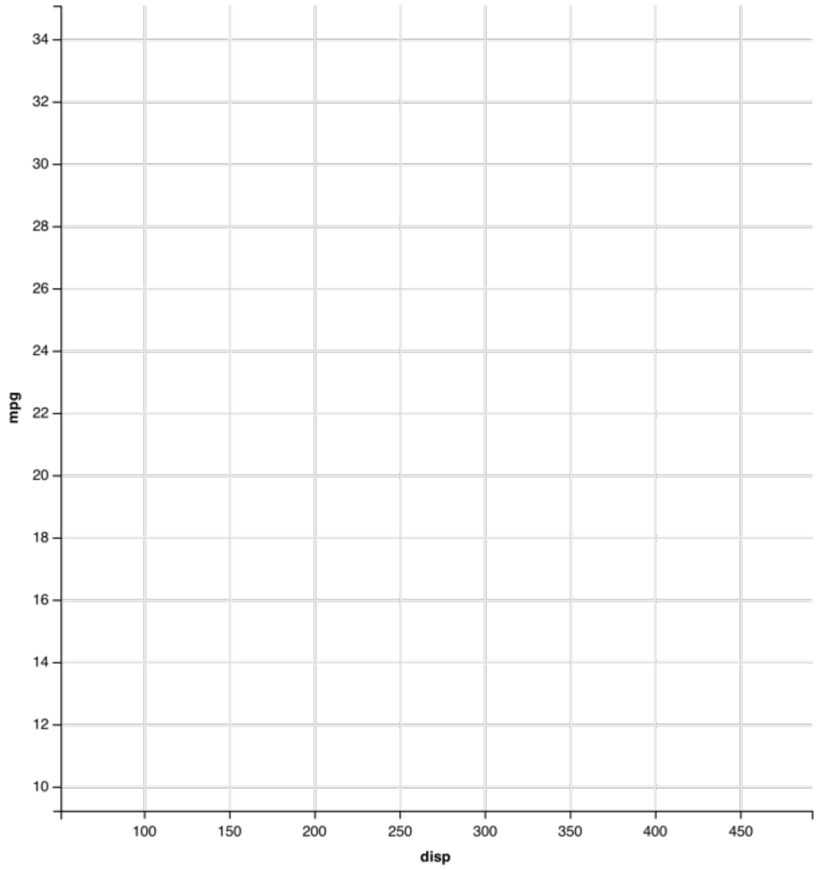


data **geom** **coordinate system**

properties

shape fill

mpg	cyl	disp	hp
21.0	6	160.0	2
21.0	6	160.0	2
22.8	4	108.0	1
21.4	6	258.0	2
18.7	8	360.0	3
18.1	6	225.0	2
14.3	8	360.0	5
24.4	4	146.7	1
22.8	4	140.8	1
19.2	6	167.6	2
17.8	6	167.6	2
16.4	8	275.8	3
17.3	8	275.8	3
15.2	8	275.8	3
10.4	8	472.0	4
10.4	8	460.0	4
14.7	8	440.0	4
32.4	4	78.7	1
30.4	4	75.7	1
33.9	4	71.1	1



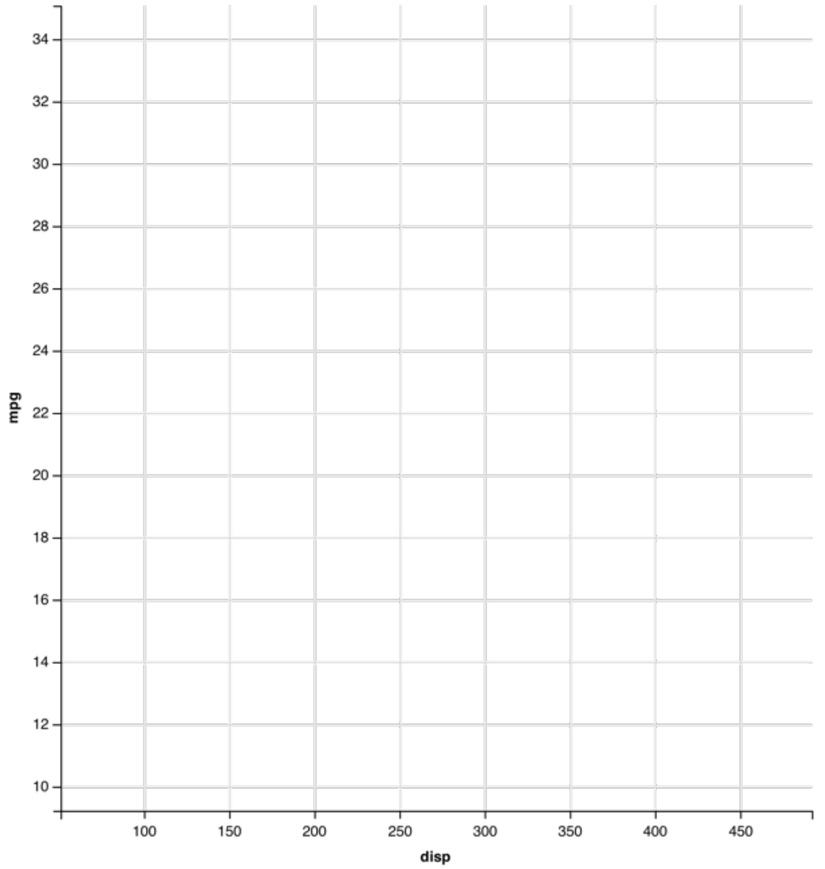
data geom

coordinate system

properties

shape x fill

mpg	cyl	disp	hp
21.0	6	160.0	2
21.0	6	160.0	2
22.8	4	108.0	1
21.4	6	258.0	2
18.7	8	360.0	3
18.1	6	225.0	2
14.3	8	360.0	5
24.4	4	146.7	1
22.8	4	140.8	1
19.2	6	167.6	2
17.8	6	167.6	2
16.4	8	275.8	3
17.3	8	275.8	3
15.2	8	275.8	3
10.4	8	472.0	4
10.4	8	460.0	4
14.7	8	440.0	4
32.4	4	78.7	1
30.4	4	75.7	1
33.9	4	71.1	1



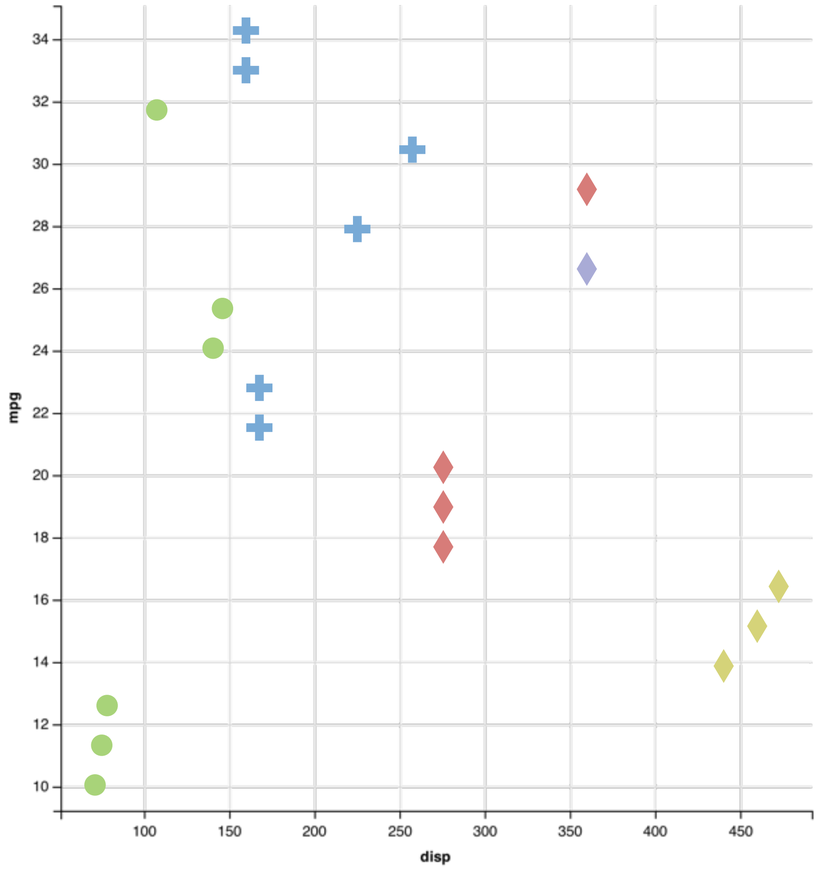
data geom

coordinate system

properties

y shape x fill

mpg	cyl	disp	hp
21.0	6	160.0	2
21.0	6	160.0	2
22.8	4	108.0	1
21.4	6	258.0	2
18.7	8	360.0	3
18.1	6	225.0	2
14.3	8	360.0	5
24.4	4	146.7	1
22.8	4	140.8	1
19.2	6	167.6	2
17.8	6	167.6	2
16.4	8	275.8	3
17.3	8	275.8	3
15.2	8	275.8	3
10.4	8	472.0	4
10.4	8	460.0	4
14.7	8	440.0	4
32.4	4	78.7	1
30.4	4	75.7	1
33.9	4	71.1	1

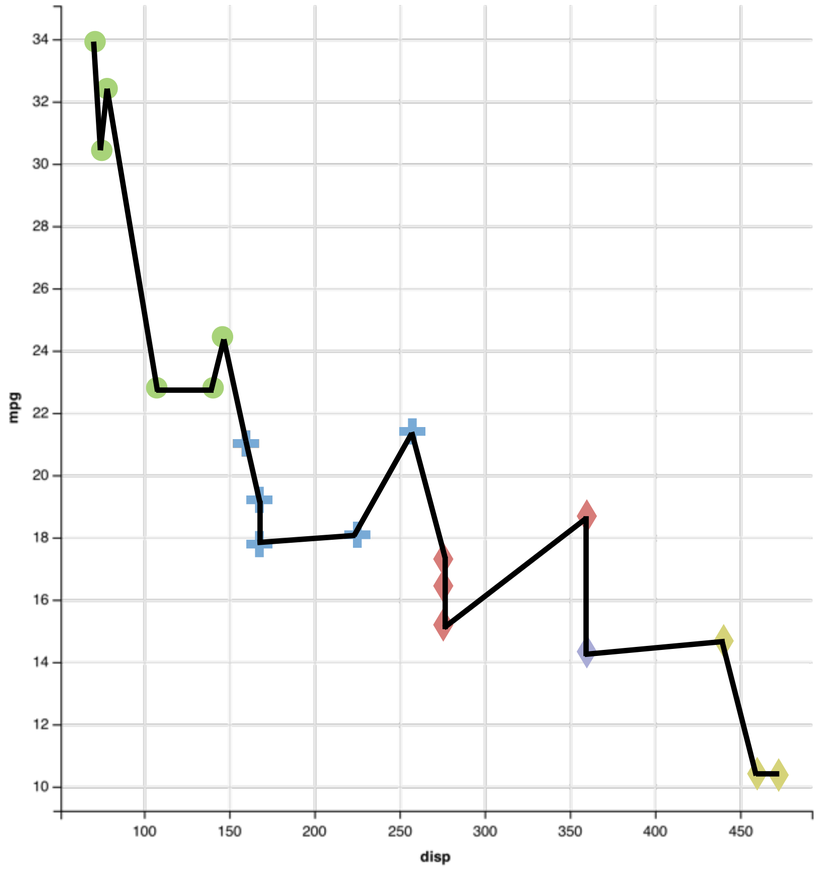


data geom coordinate system

properties

y shape x fill

mpg	cyl	disp	hp
21.0	6	160.0	2
21.0	6	160.0	2
22.8	4	108.0	1
21.4	6	258.0	2
18.7	8	360.0	3
18.1	6	225.0	2
14.3	8	360.0	5
24.4	4	146.7	1
22.8	4	140.8	1
19.2	6	167.6	2
17.8	6	167.6	2
16.4	8	275.8	3
17.3	8	275.8	3
15.2	8	275.8	3
10.4	8	472.0	4
10.4	8	460.0	4
14.7	8	440.0	4
32.4	4	78.7	1
30.4	4	75.7	1
33.9	4	71.1	1



data

geom

points

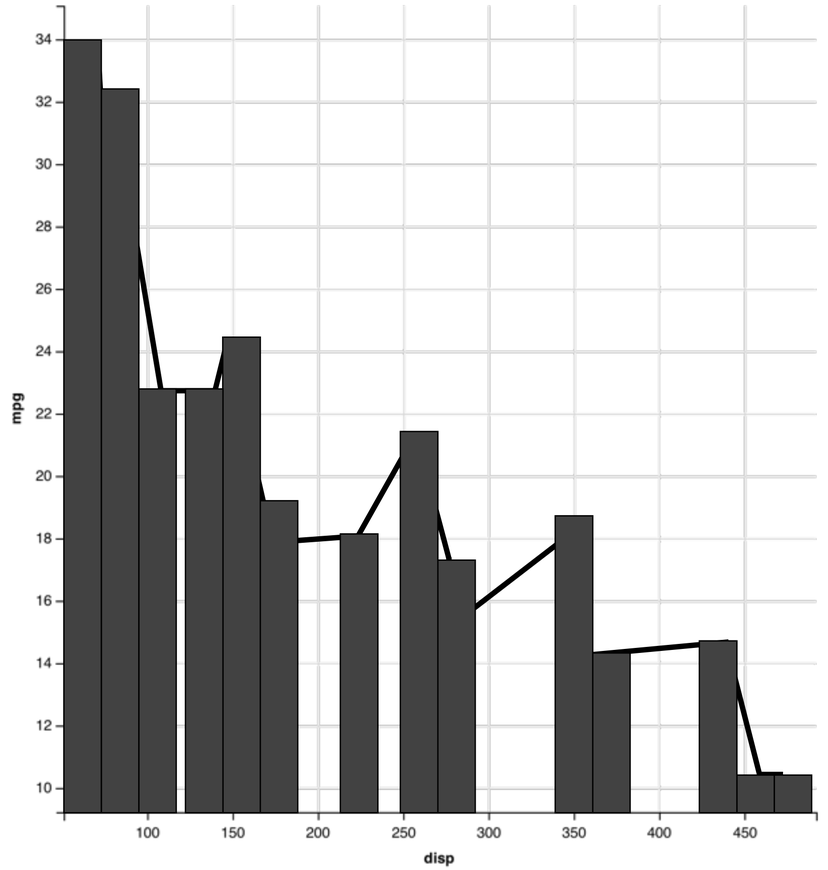
lines

coordinate system

properties

y x

mpg	cyl	disp	hp
21.0	6	160.0	2
21.0	6	160.0	2
22.8	4	108.0	1
21.4	6	258.0	2
18.7	8	360.0	3
18.1	6	225.0	2
14.3	8	360.0	5
24.4	4	146.7	1
22.8	4	140.8	1
19.2	6	167.6	2
17.8	6	167.6	2
16.4	8	275.8	3
17.3	8	275.8	3
15.2	8	275.8	3
10.4	8	472.0	4
10.4	8	460.0	4
14.7	8	440.0	4
32.4	4	78.7	1
30.4	4	75.7	1
33.9	4	71.1	1



data

geom

points

lines

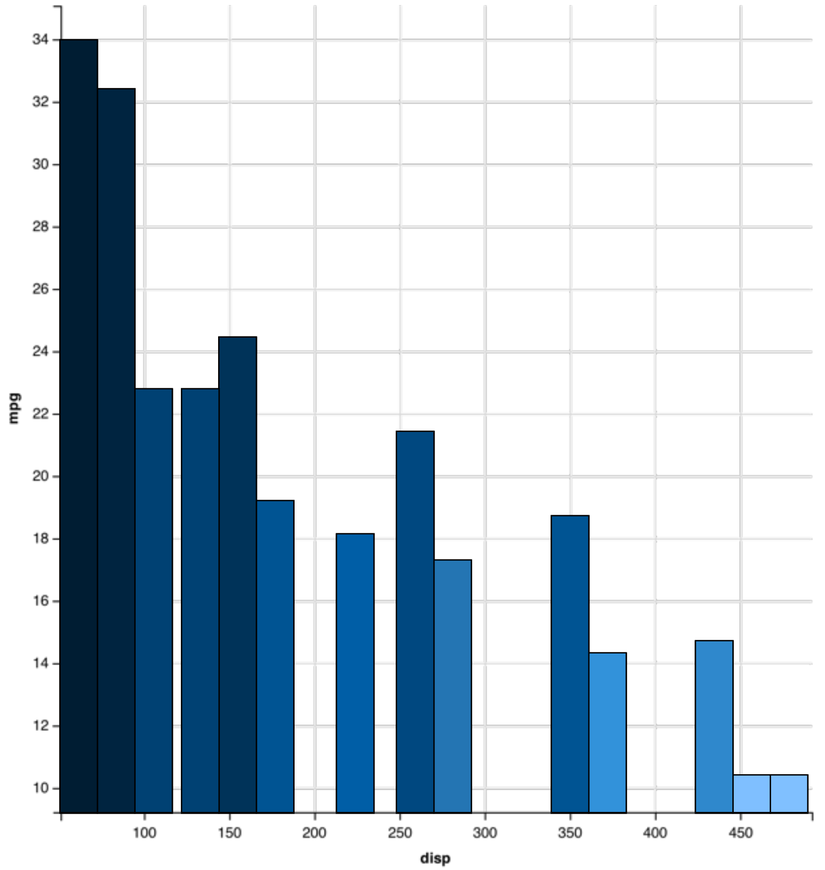
bars

coordinate system

properties

y fill

mpg	cyl	disp	hp
21.0	6	160.0	2
21.0	6	160.0	2
22.8	4	108.0	1
21.4	6	258.0	2
18.7	8	360.0	3
18.1	6	225.0	2
14.3	8	360.0	5
24.4	4	146.7	1
22.8	4	140.8	1
19.2	6	167.6	2
17.8	6	167.6	2
16.4	8	275.8	3
17.3	8	275.8	3
15.2	8	275.8	3
10.4	8	472.0	4
10.4	8	460.0	4
14.7	8	440.0	4
32.4	4	78.7	1
30.4	4	75.7	1
33.9	4	71.1	1



data

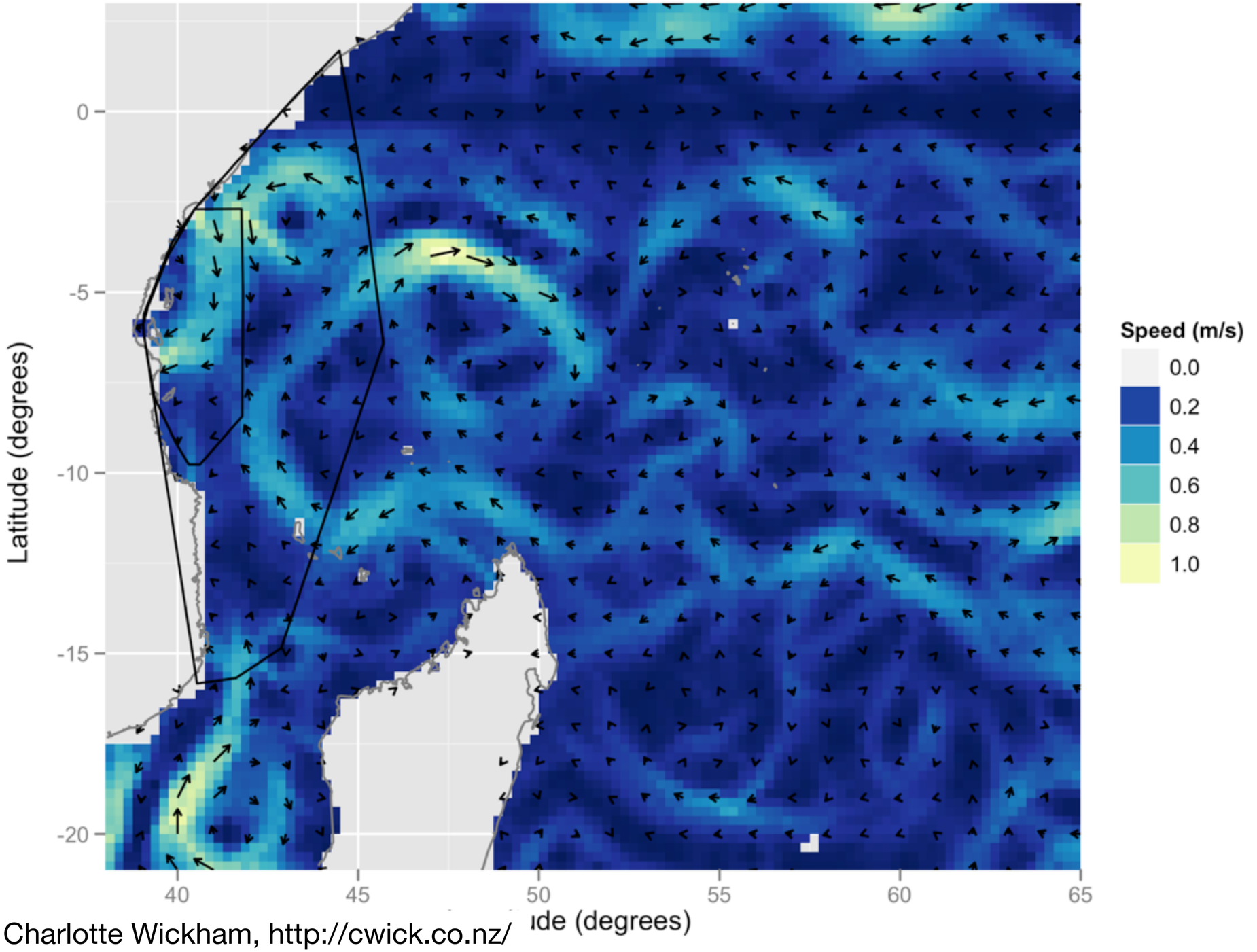
geom

points

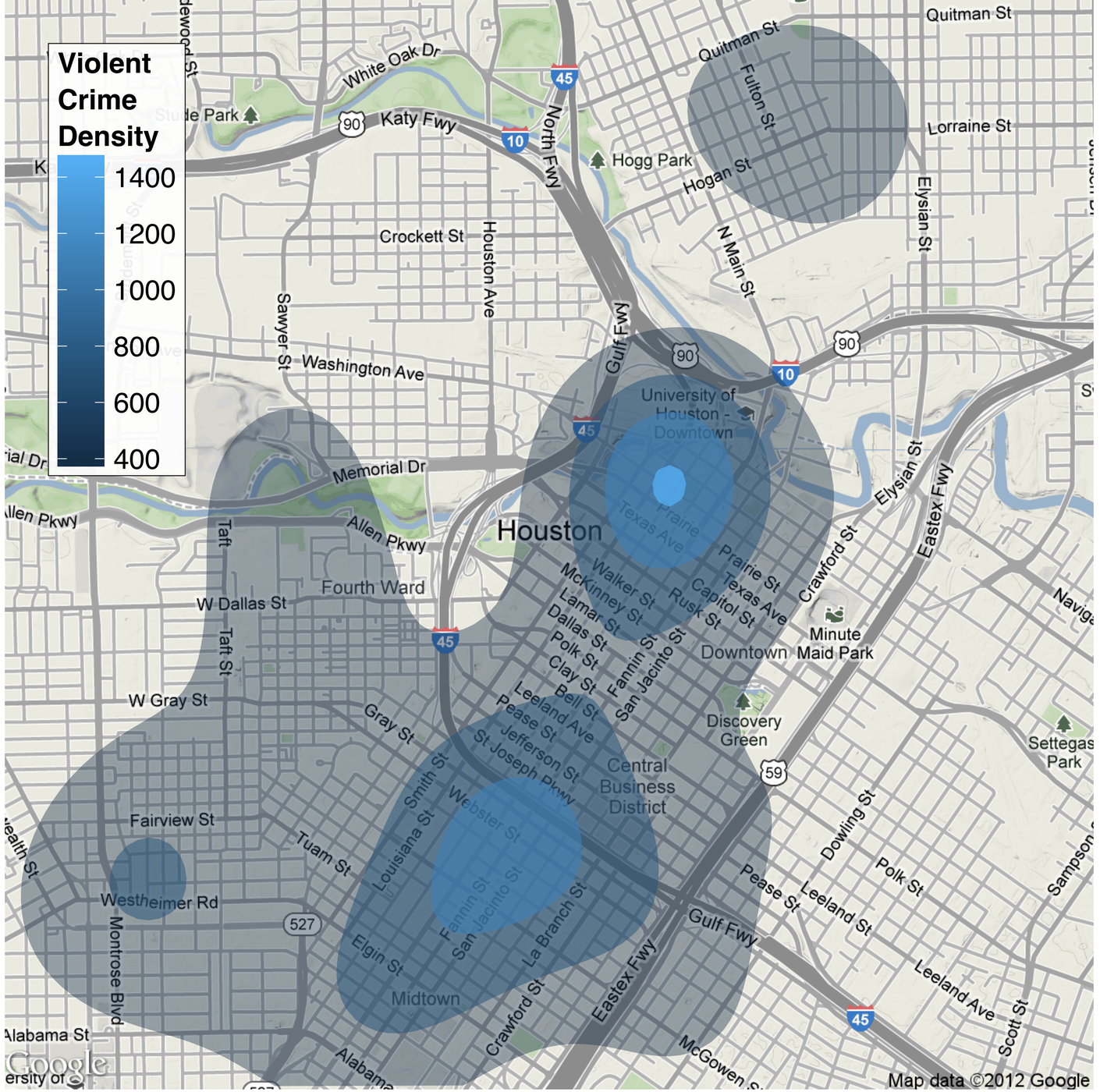
lines

bars

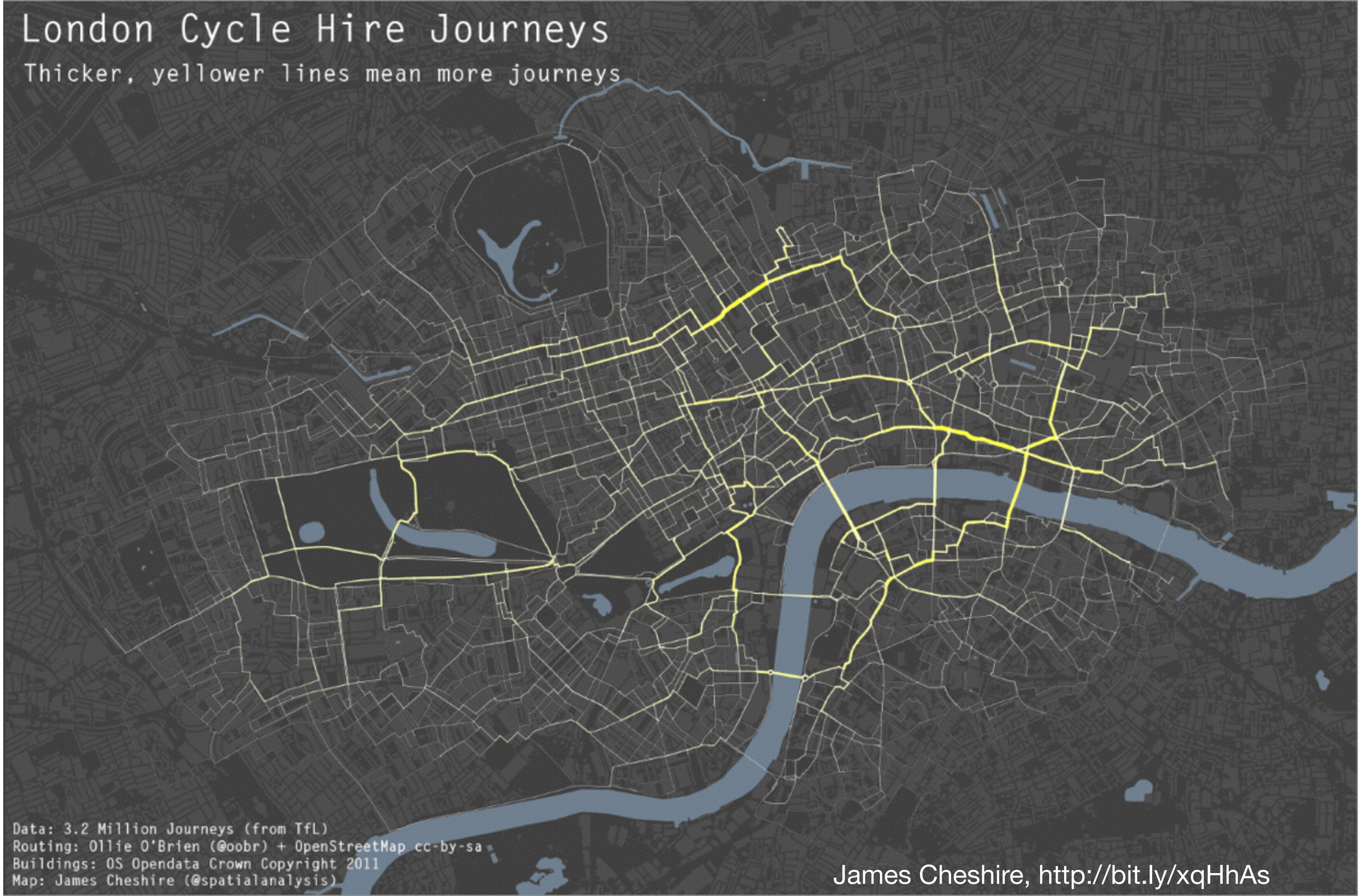
coordinate system



Charlotte Wickham, http://cwick.co.nz/



David Kahle, https://dl.dropbox.com/u/24648660/ggmap%20useR%202012.pdf



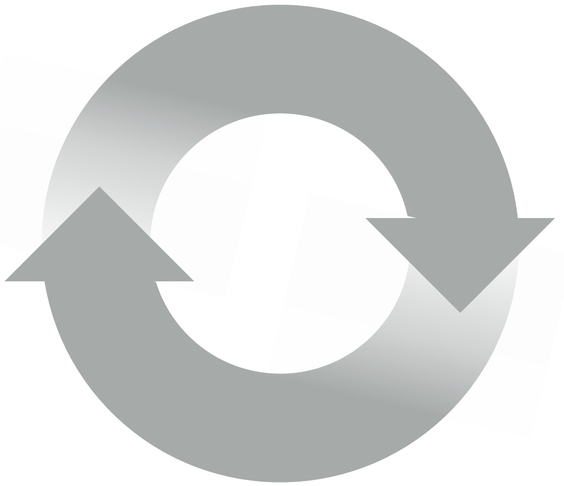
James Cheshire, http://bit.ly/xqHhAs

Shiny

Shiny

+

+



Web based
User Interface

Reactive
Programming

demo

Shiny Showcase

www.rstudio.com/products/shiny/shiny-user-showcase/

RStudio Products Resources Pricing About Us Blog

Shiny Apps for the Enterprise

Shiny Dashboard Demo

A dashboard built with Shiny.

Location tracker

Track locations over time with streaming data.

Download monitor

Streaming download rates visualized as a bubble chart.

Supply and Demand

Forecast demand to plan resource allocation.

Industry Specific Shiny Apps

Economic Dashboard

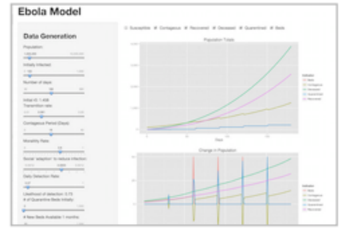
Economic forecasting with macroeconomic indicators.

ER Optimization

An app that models patient flow.

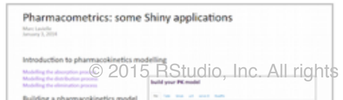
CDC Disease Monitor

Alert thresholds and automatic weekly updates.



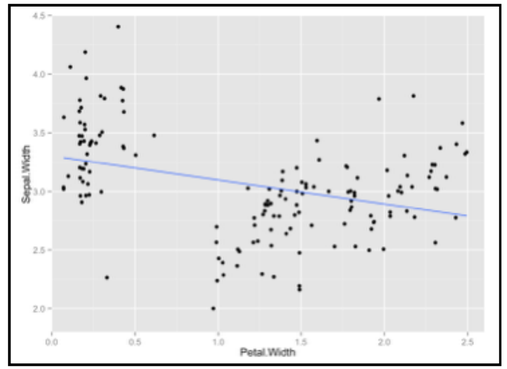
Ebola Model

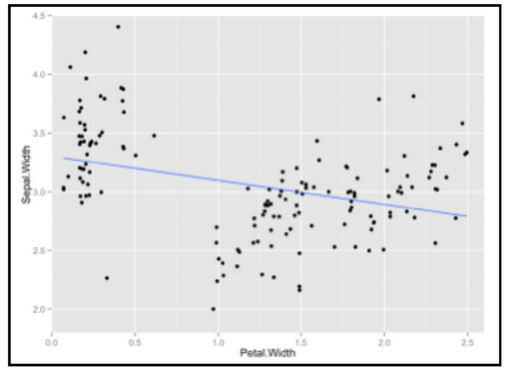
An epidemiological simulation.



Interactive visualizations

Plots and images can be both outputs *and* inputs.





plotOutput()

To collect input values, add **click**, **dblclick**, **hover**, or **brush** arguments.

```
plotOutput(…, click = "myclick")
```


```
input$myclick
```

plotOutput()

Location of mouse click (in x and y coordinates)

Location of double click (in x and y coordinates)

Location of stationary mouse (in x and y)

Bounding coordinates of brush box (in x and y)

```
plotOutput(…,
  click = "click",
  dblclick = "dblclick",
  hover = "hover",
  brush = "brushed"
)
```

nearPoints()

Returns a data frame of points near a click.

data frame to return subset of (should match plot)

click input object

x variable in plot (not needed with ggplot2)

```
nearPoints(mtcars, input$click, xvar = input$xVar,
           yvar = "mpg", maxpoints = 1)
```

y variable in plot (not needed with ggplot2)

number of points to return

brushedPoints()

Returns a data frame of points near a click.

data frame to return subset of (should match plot)

brush input object

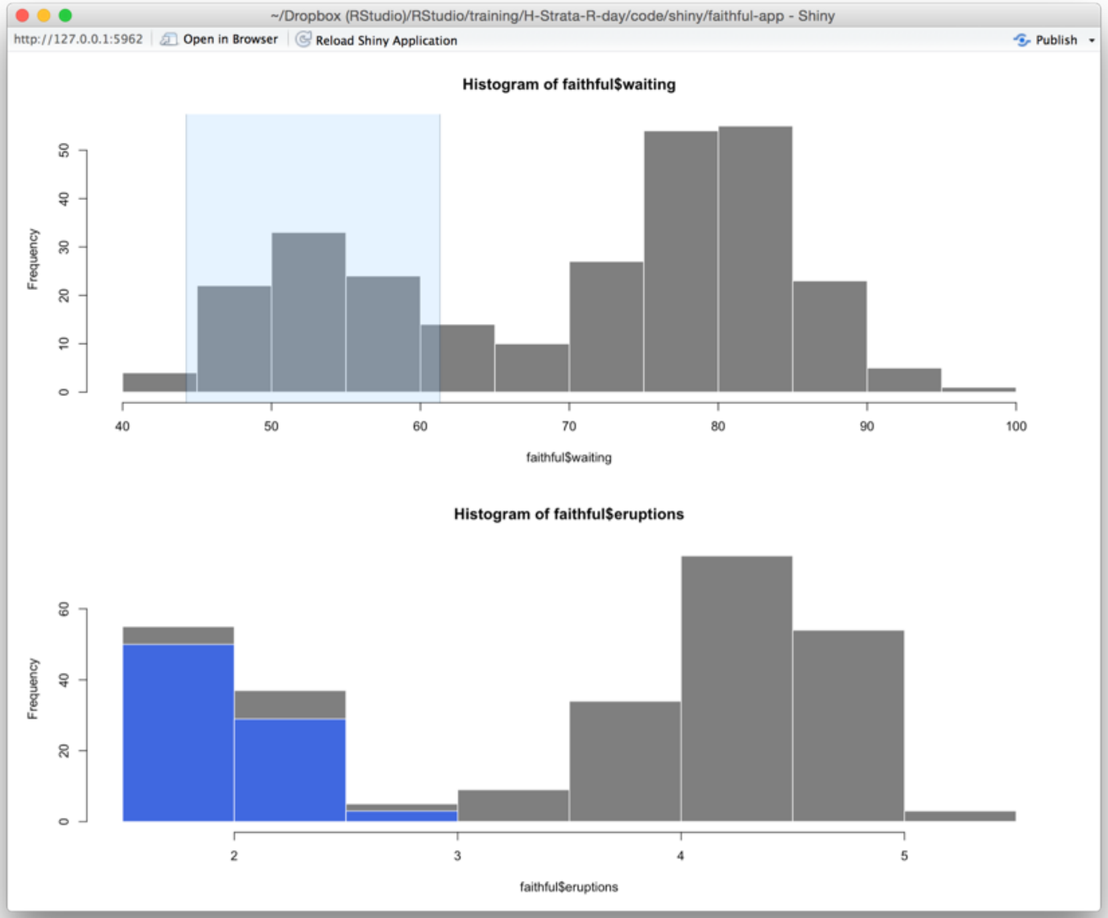
```
brushedPoints(mtcars, input$brush,
              xvar = input$xvar, yvar = "mpg")
```

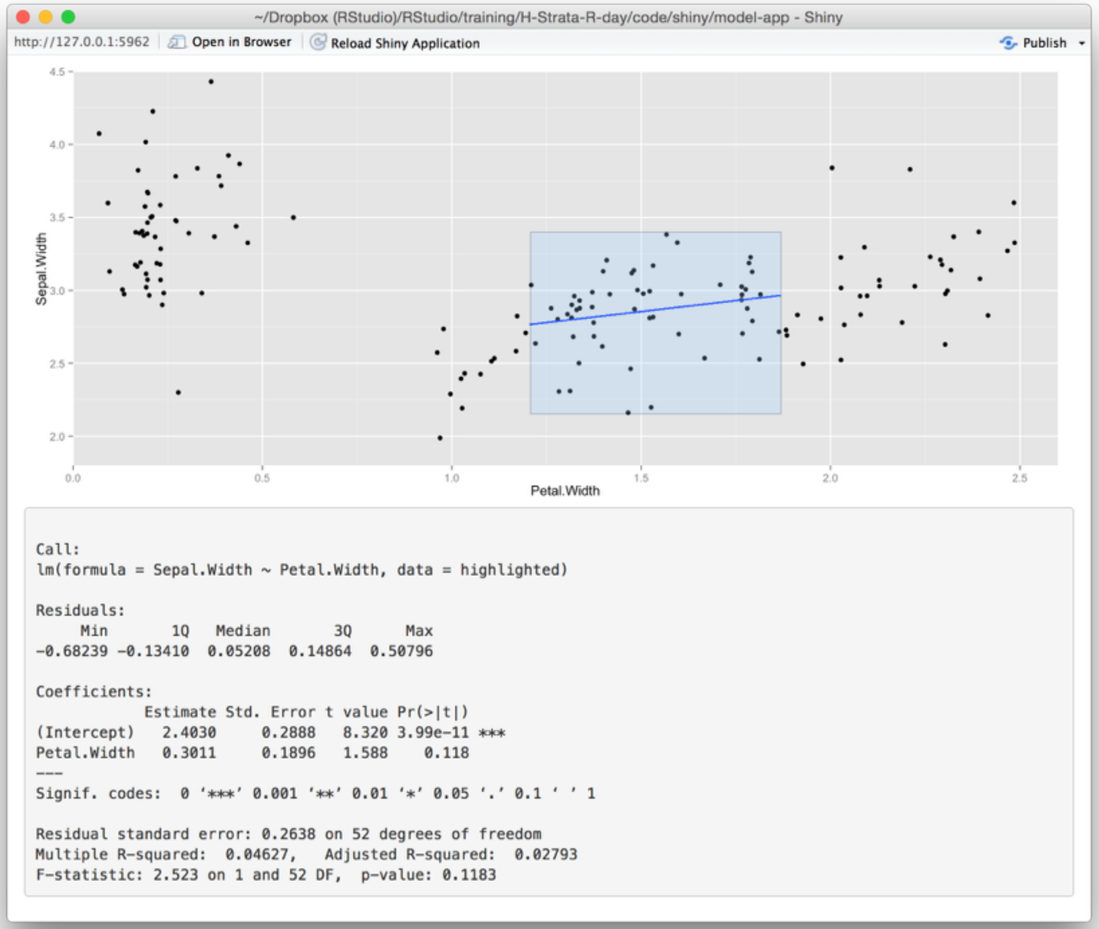
x variable in plot
(not needed with ggplot2)

y variable in plot
(not needed with ggplot2)

Ideas

demos





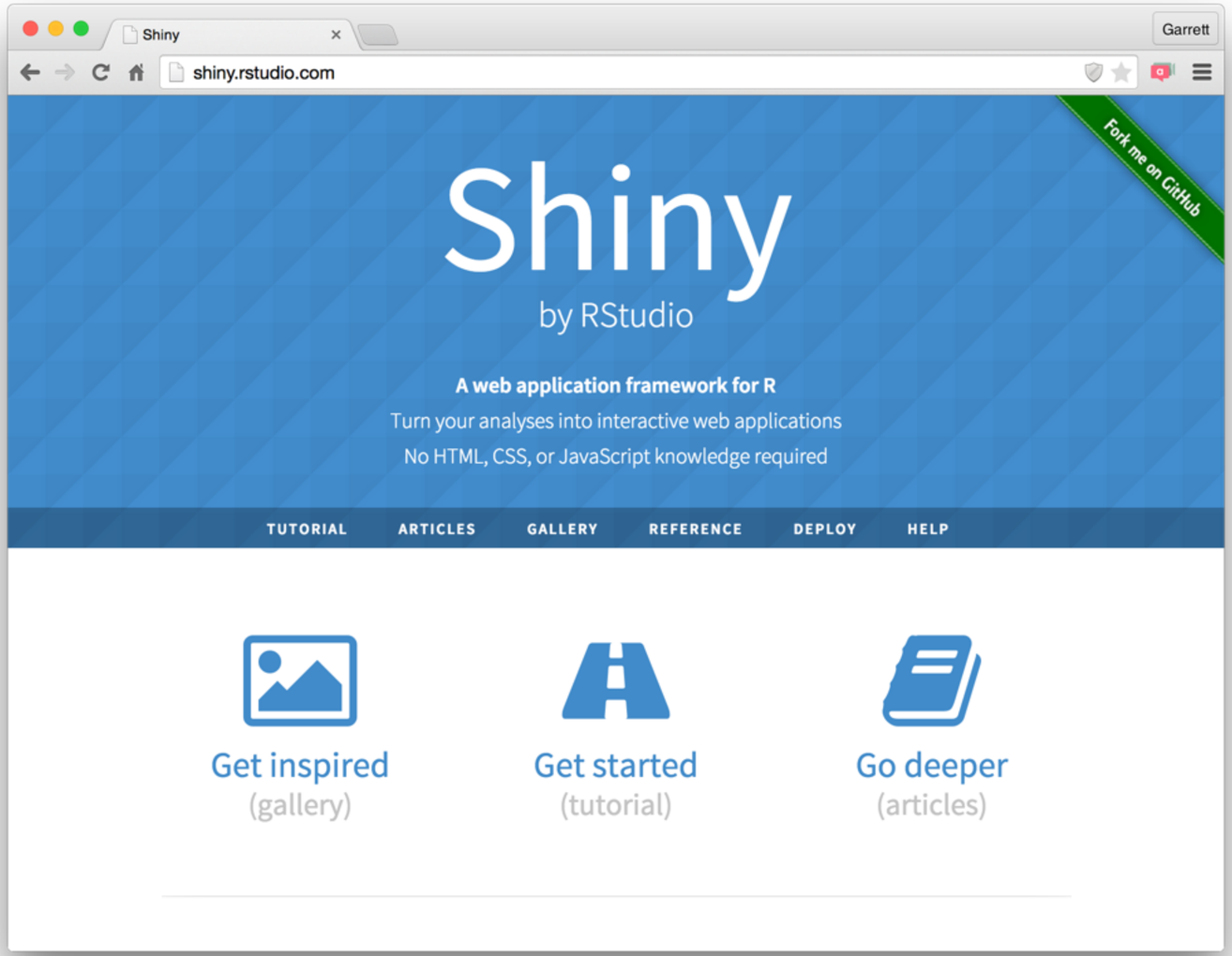
Take away

R and Shiny provide an easy way to write your own, custom interactive visualizations.

This is a language for building tools, not just tools themselves.

The Shiny Development Center

shiny.rstudio.com



Learn more

shiny.rstudio.com/articles

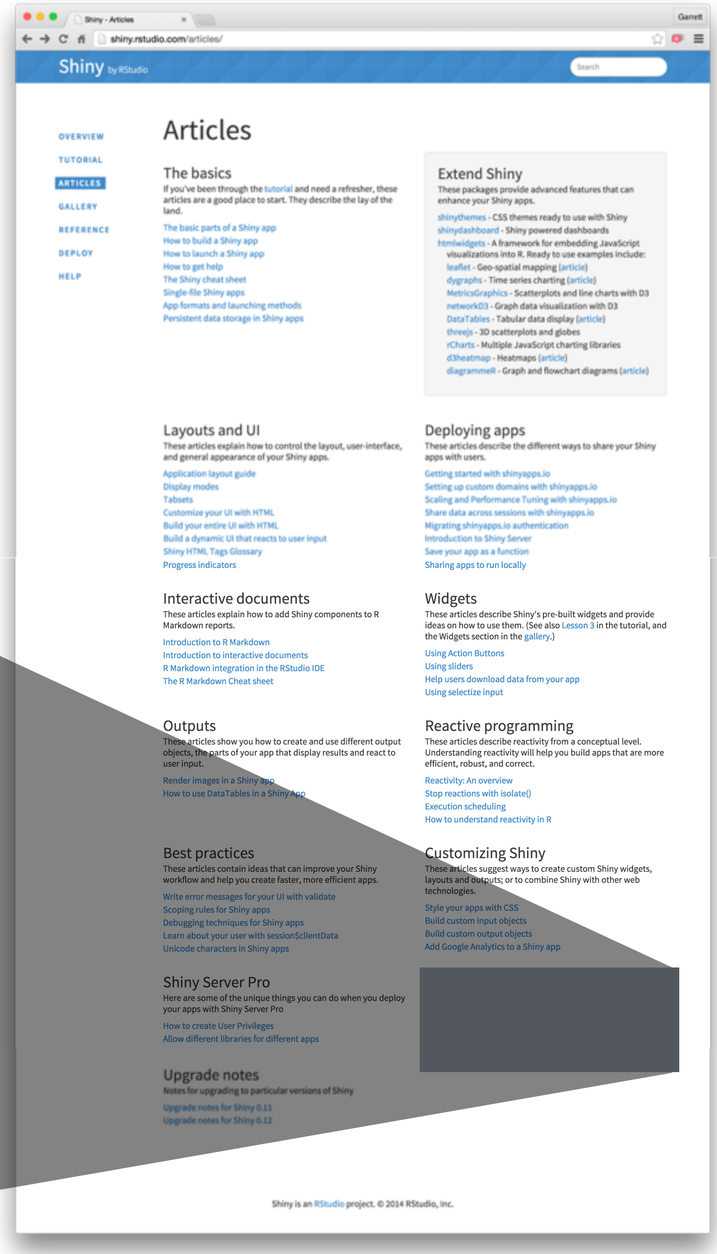
Interactive plots

Create interactive plots with base and ggplot2 graphics

Interactive plots

Selecting rows of data

Interactive plots - advanced



Slides and code available at

github.com/garrettgman/CSP2016

See Also

htmlwidgets

Use htmlwidgets in:

- RStudio viewer pane
- R Markdown files
- Shiny Apps

www.htmlwidgets.org