Data Visualization with R

NC State University Libraries

RStudio.Cloud Workspace

This is an online version of RStudio where we will be working today. We will use this for the hands-on activity portion. Visit this site and create an account, or log in with a gmail account:

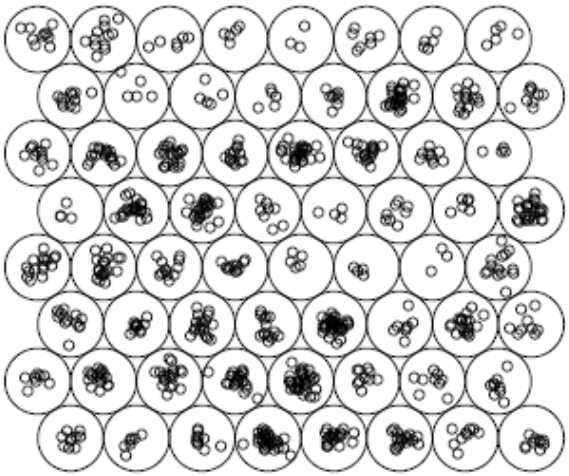
go.ncsu.edu/dvr (https://go.ncsu.edu/dvr)

Workshop goals

- learn about various packages for making data visualizations in R
- be able to determine which package to use
- understand basic syntax for the most popular package: ggplot2
- gain hands-on practice making visualizations in ggplot2
- learn ways to save visualizations

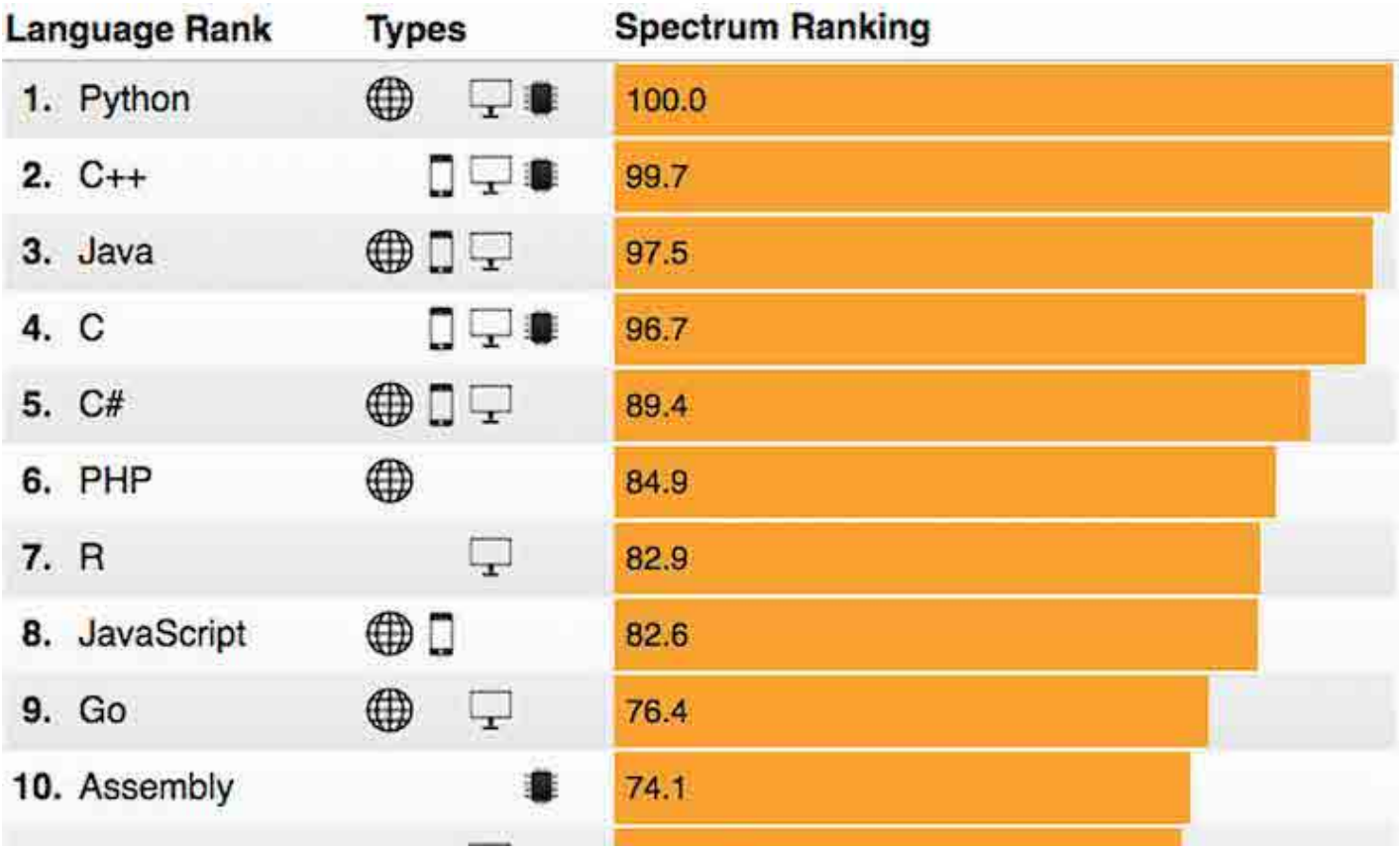
What is R?

R is a software environment for statistical computing and graphics. Using R you can do rigorous statistical analysis, clean and manipulate data, and create publication-quality graphics.



clustering map

Popularity of R



Stephen Cass, “The 2018 Top Programming Languages” (https://spectrum.ieee.org/at-work/innovation/the-2018-top-programming-languages), IEEE Spectrum

R packages

Packages are programs that you import into R to help make tasks easier. The most popular R packages for working with data include *dplyr, stringr, tidyr, and ggplot2*.

Find a package:

- Google (“Top R packages for ….”)
- Looking at trending R packages on rdocumentation.org (https://www.rdocumentation.org/trends)

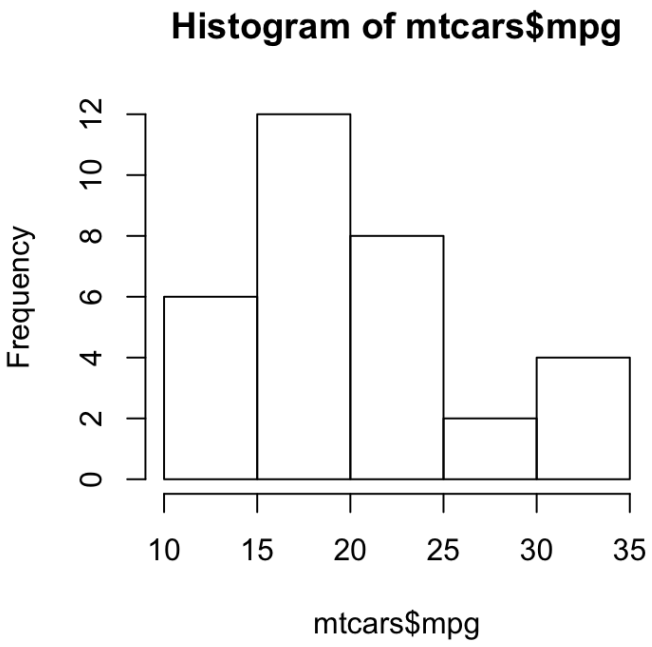
Popular R packages for data viz

- base R
- ggplot2
- highcharter
- leaflet
- plotly
- shiny

Base R Plot

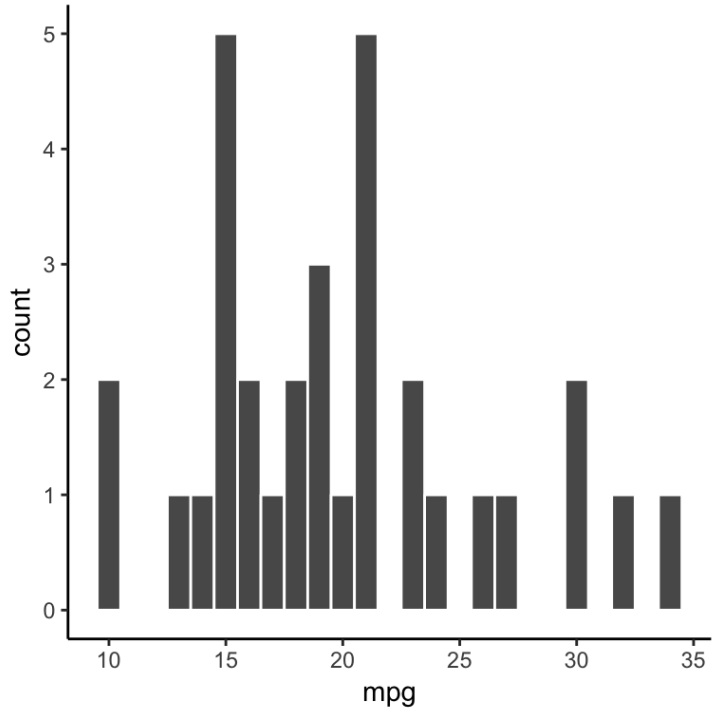
This is an example of a plot created with the base R histogram function.

```
hist(mtcars$mpg)
```



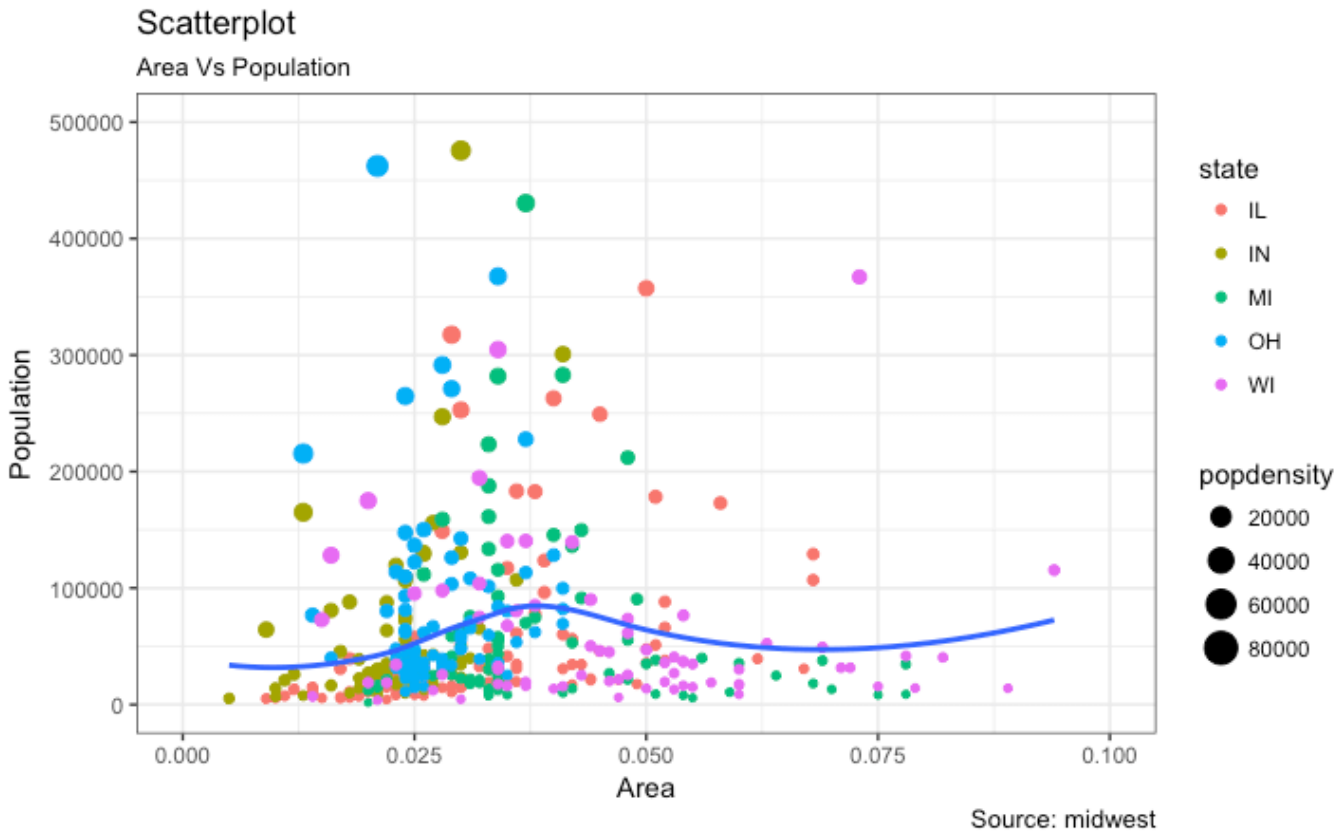
Example with R package ggplot2

```
ggplot(mtcars, aes(x=mpg)) + geom_histogram(binwidth=1, col="white") + theme_classic()
```



ggplot2

ggplot2 is the most popular visualization package for R. It's the best all-purpose package for creating many types of 2-dimensional visualizations.



Source: r-statistics.co (http://r-statistics.co/Top50-Ggplot2-Visualizations-MasterList-R-Code.html)

highcharter

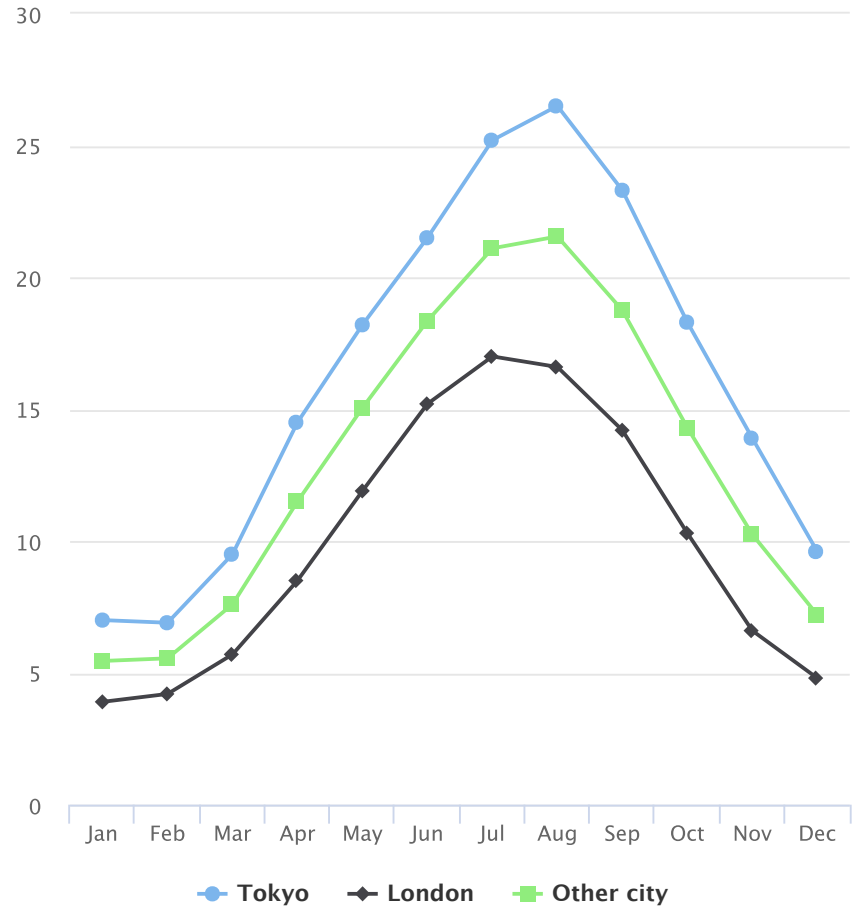
Highcharter is an R package known as an htmlwidget, which allows you to use popular javascript packages for visualization and create interactive web charts. It's free to use highcharter unless you are using it for a commercial or government purpose.

```
data(citytemp)

hc <- highchart() %>%
hc_xAxis(categories = citytemp$month) %>%
hc_add_series(name = "Tokyo", data = citytemp$tokyo) %>%
hc_add_series(name = "London", data = citytemp$london) %>%
hc_add_series(name = "Other city",
data = (citytemp$tokyo + citytemp$london)/2)

hc
```

highcharter example

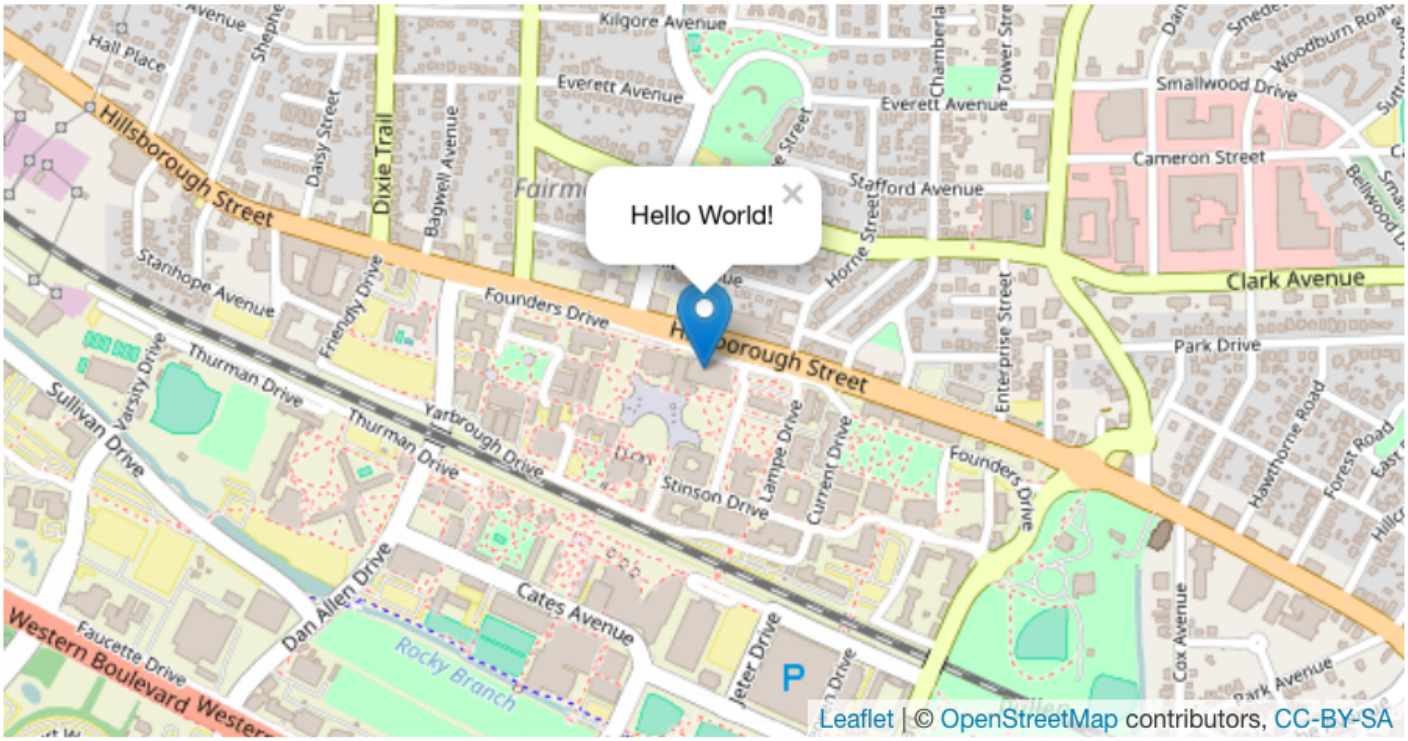


leaflet

Leaflet is popular among web developers for creating interactive web maps. It's an htmlwidget for R based on LeafletJS.

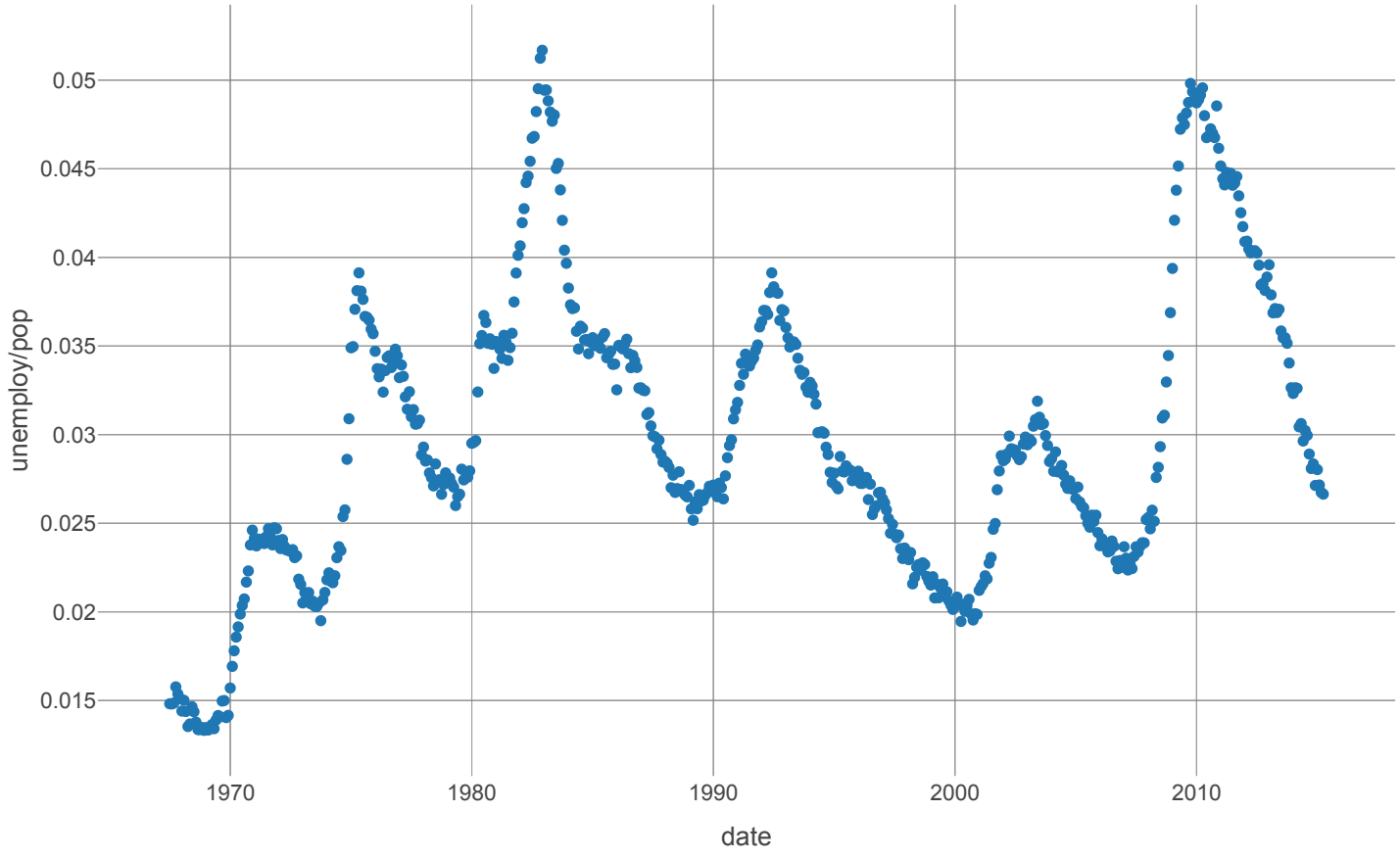
```
m <- leaflet(options = leafletOptions(zoomControl = FALSE, dragging=FALSE, minZoom = 15, maxZ
oom = 15)) %>%
  addTiles() %>%  # Add default OpenStreetMap map tiles
  addMarkers(lng=-78.6697, lat=35.7876,
             popup="Hello World!")
m  # Print the map
```

leaflet example



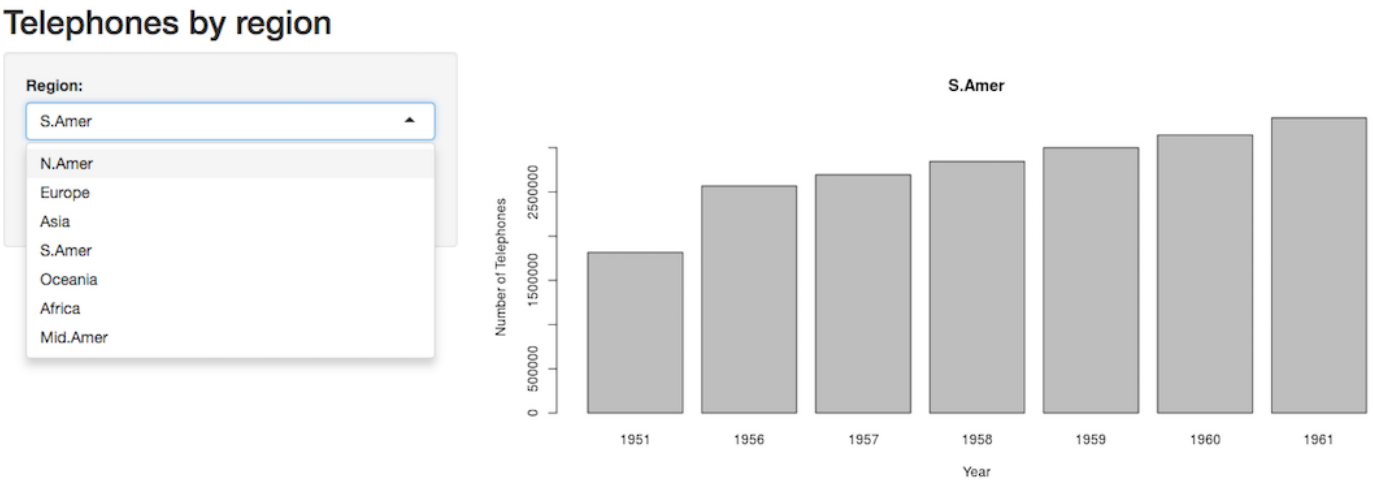
plotly

```
plot_ly(economics, x = ~date, y = ~unemploy / pop)
```



shiny

shiny is a popular R package for creating web applications.



Deciding on the right package

- static or interactive
- single viz or dashboard
- the nature of the data: geospatial? quantitative? qualitative?
- purpose and licensing

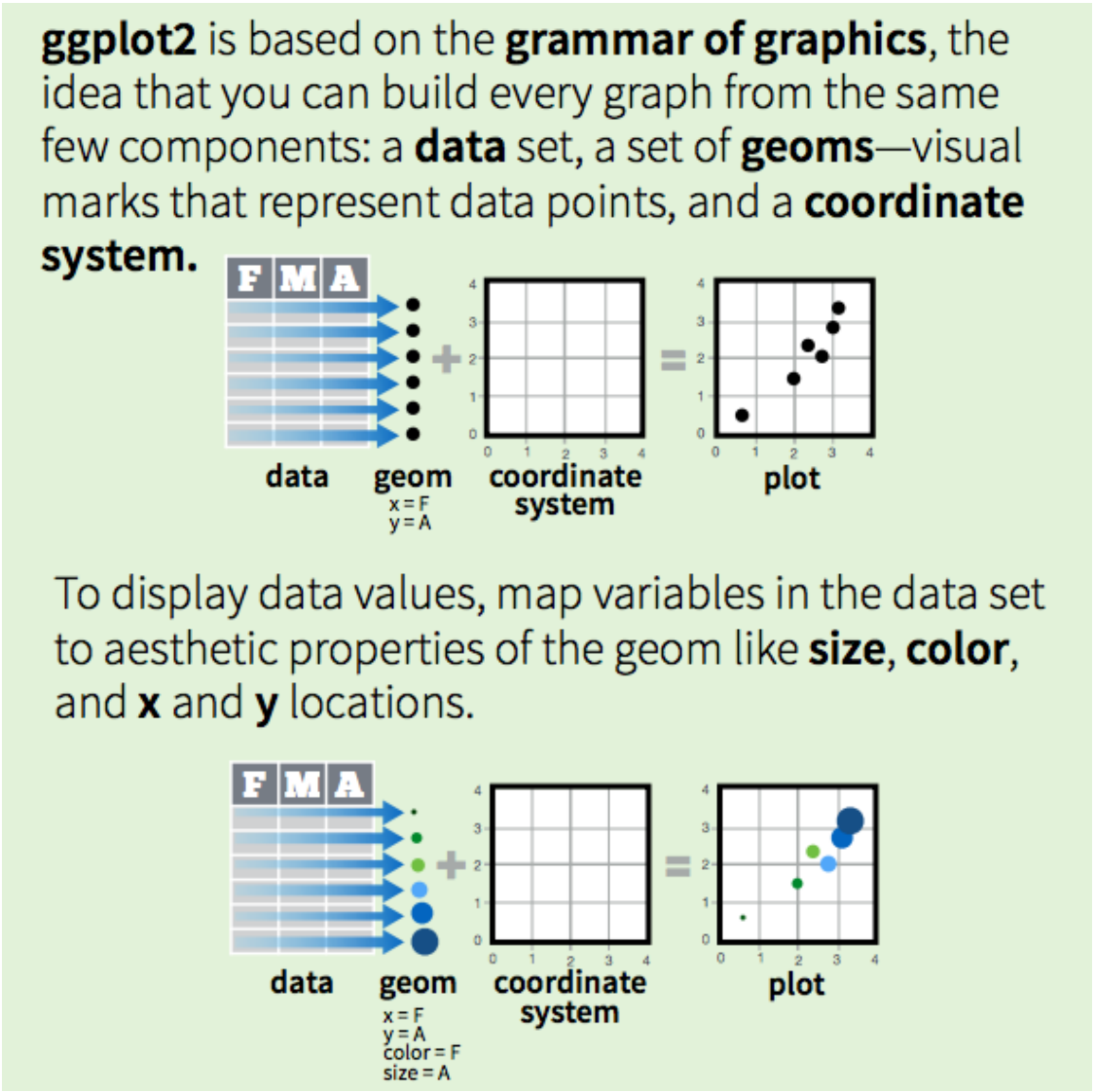
Recommended packages

- 2D vizzes: **ggplot2**, **ggpubr**
- 3D vizzes: **rgl**
- maps: **leaflet**
- interactive: **shiny, plotly, or highcharter**
- network graphs: **igraph, ggnet, diagrammeR, visNetwork**
- web applications: **shiny**

ggplot2: one of the most popular

ggplot2 was created on the principles of the **Layered Grammar of Graphics** (2010), by Hadley Wickham and based of off work from Wilkinson, Anand, & Grossman (2005) and Jaques Bertin (1983).

Grammar of Graphics



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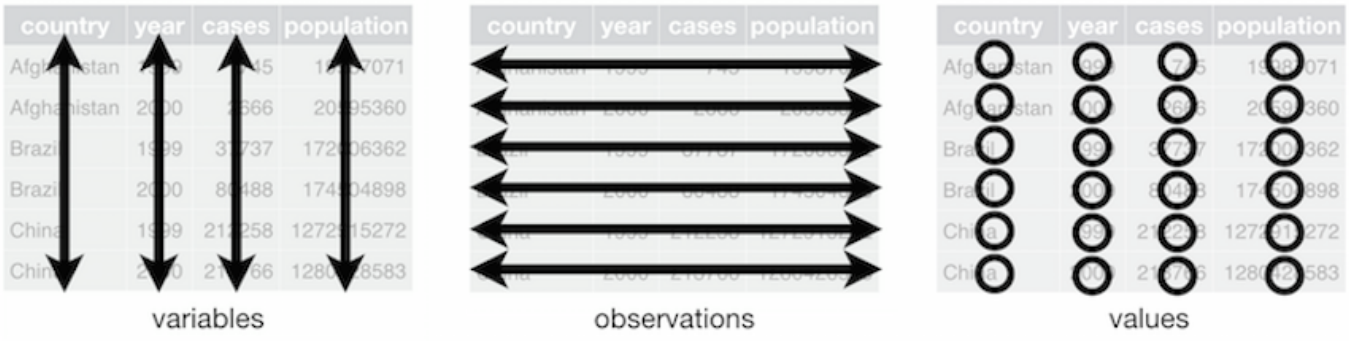
Tidy Data

Proposed by Hadley Wickham (2014).

Tidy data has the following characteristics: “each variable is a column, each observation is a row, and each type of observational unit is a table.”



credit: Hadley Wickham

Tidy data cont'd

Collapse columns of multiple years into one variable: year

country	year	cases
Afghanistan	1999	745
Afghanistan	2000	2666
Brazil	1999	37737
Brazil	2000	80488
China	1999	212258
China	2000	213766

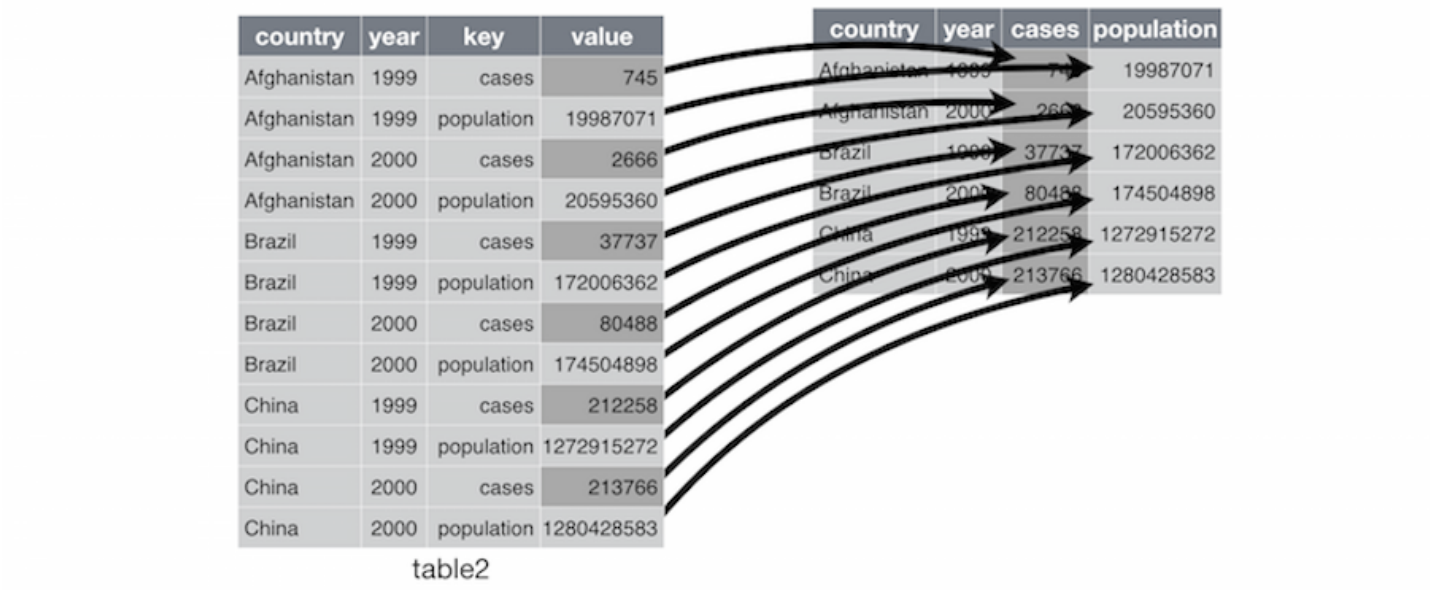
country	1999	2000
Afghanistan	745	2666
Brazil	37737	80488
China	212258	213766

table4

credit: Hadley Wickham

Tidy data cont'd

Unpack columns of more than one variable into distinct columns. Remember: only one column per variable!



country	year	key	value
Afghanistan	1999	cases	745
Afghanistan	1999	population	19987071
Afghanistan	2000	cases	2666
Afghanistan	2000	population	20595360
Brazil	1999	cases	37737
Brazil	1999	population	172006362
Brazil	2000	cases	80488
Brazil	2000	population	174504898
China	1999	cases	212258
China	1999	population	1272915272
China	2000	cases	213766
China	2000	population	1280428583

table2

country	year	cases	population
Afghanistan	1999	745	19987071
Afghanistan	2000	2666	20595360
Brazil	1999	37737	172006362
Brazil	2000	80488	174504898
China	1999	212258	1272915272
China	2000	213766	1280428583

credit: Hadley Wickham

The Tidyverse

The tidyverse is a set of packages for working with data that include packages for cleaning, manipulating, and visualizing data in R. We will be using the tidyverse package in our workshop activity. See the tidyverse website (http://tidyverse.org/) For more information about tidyverse package.

The tidyverse

Hands-On Activity: Open RStudio.Cloud Workspace

https://go.ncsu.edu/dvr (https://go.ncsu.edu/dvr)

- Log in with Google, Github, or create an account
- We will step through the code together and you will have a chance to practice!