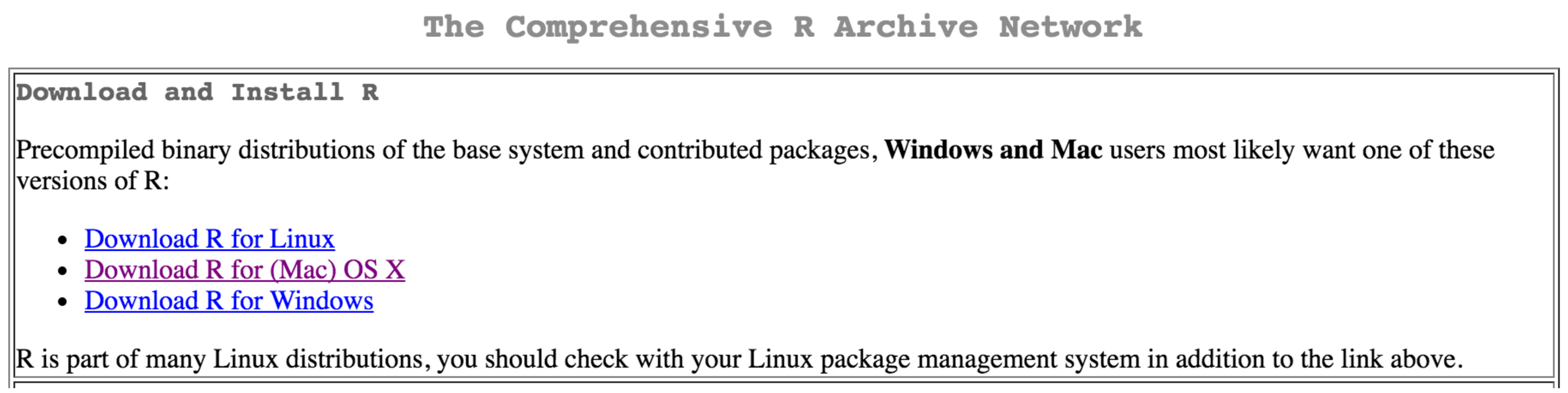
Before we begin...

Download R - CRAN R V3.4.1



The Comprehensive R Archive Network

Download and Install R

Precompiled binary distributions of the base system and contributed packages, **Windows and Mac** users most likely want one of these versions of R:

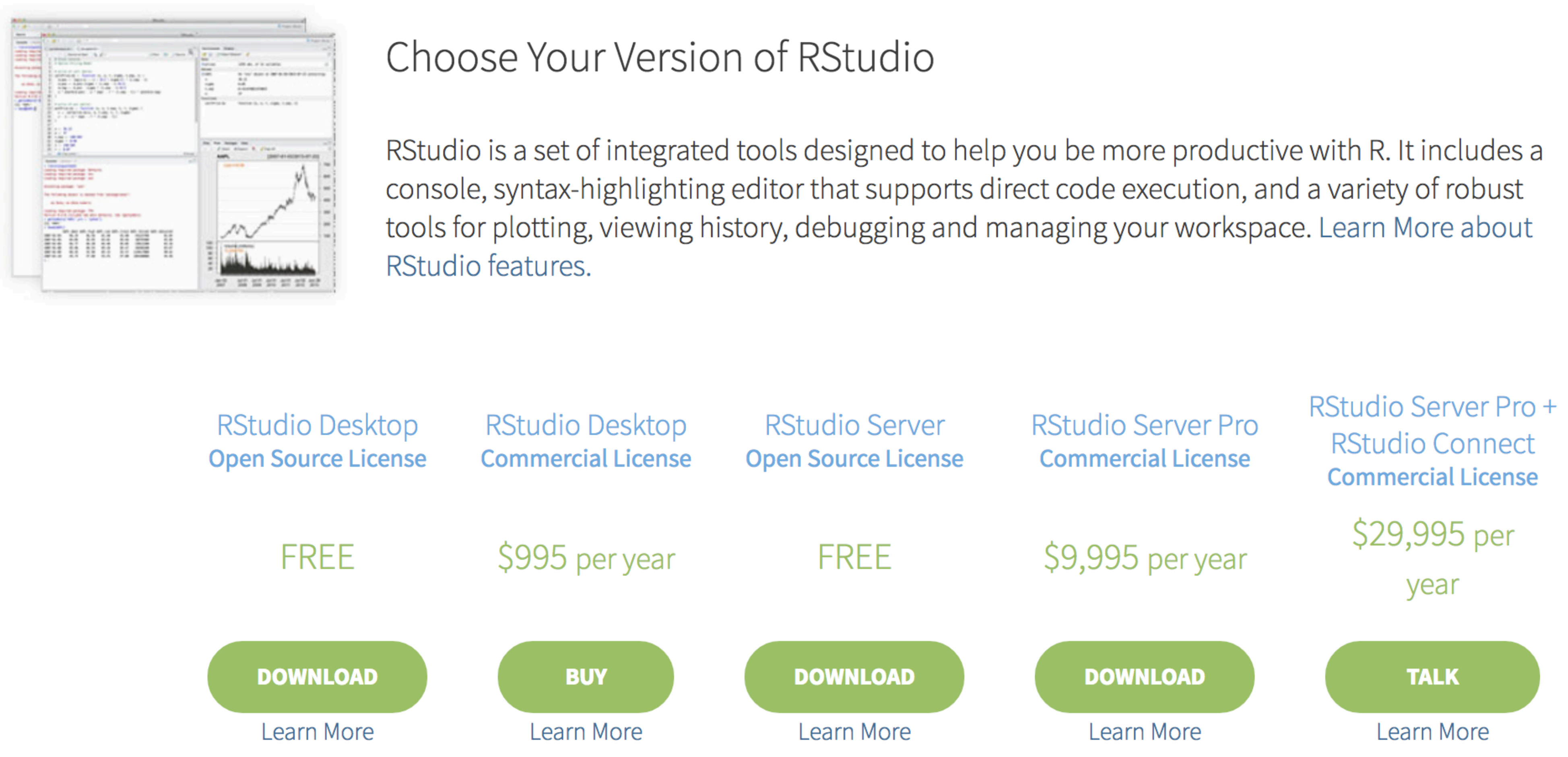
- Download R for Linux
- Download R for (Mac) OS X
- Download R for Windows

R is part of many Linux distributions, you should check with your Linux package management system in addition to the link above.

Download Rstudio - Rstudio.com

Download workshop materials

- bit.ly/2whCvqY



Choose Your Version of RStudio

RStudio is a set of integrated tools designed to help you be more productive with R. It includes a console, syntax-highlighting editor that supports direct code execution, and a variety of robust tools for plotting, viewing history, debugging and managing your workspace. Learn More about RStudio features.

RStudio Desktop Open Source License	RStudio Desktop Commercial License	RStudio Server Open Source License	RStudio Server Pro Commercial License	RStudio Server Pro + RStudio Connect Commercial License
FREE	$995 per year	FREE	$9,995 per year	$29,995 per year
DOWNLOAD	BUY	DOWNLOAD	DOWNLOAD	TALK
Learn More	Learn More	Learn More	Learn More	Learn More

Introduction to R Workshop

Session 1

Sean Nguyen

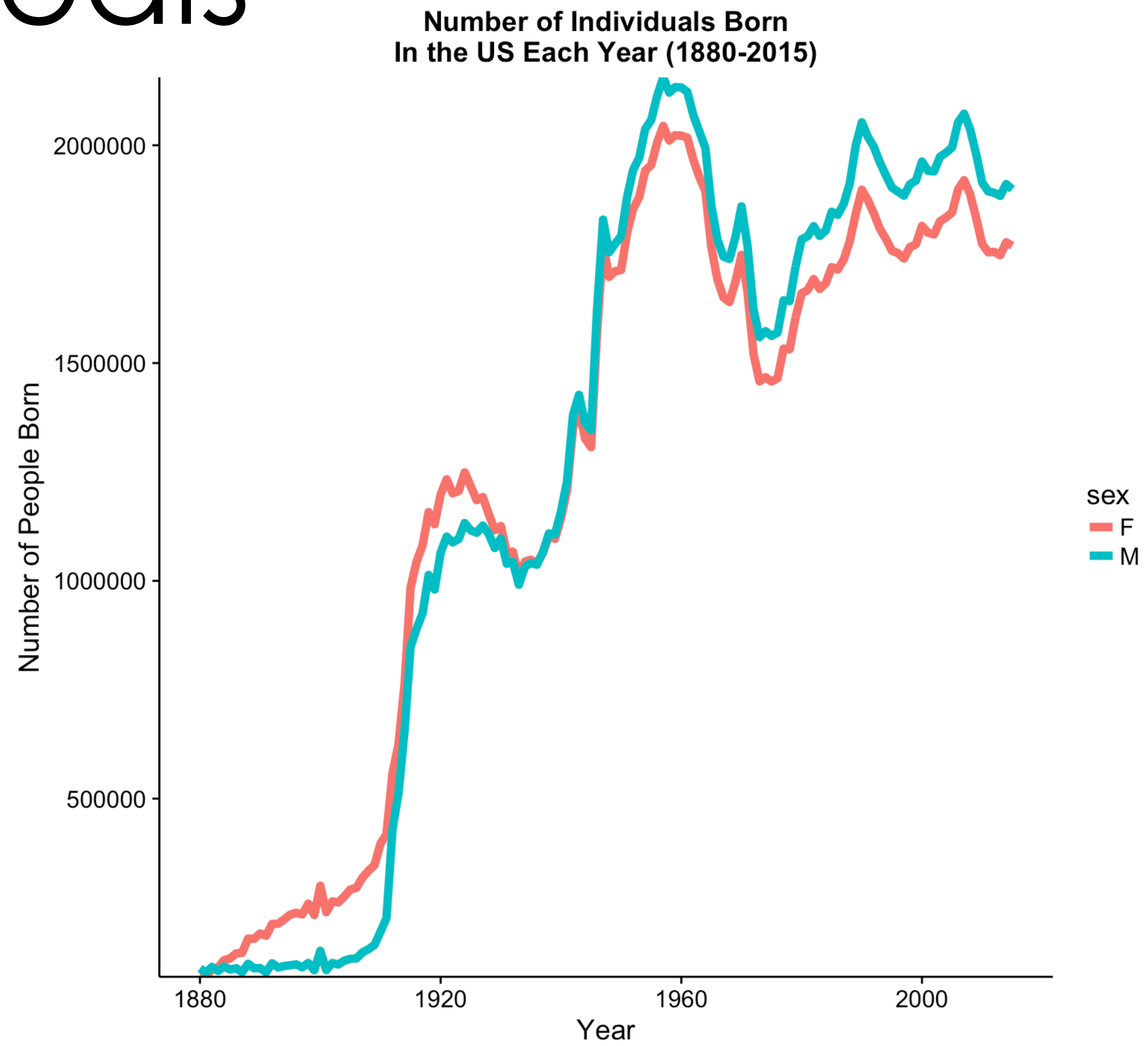
MSU BEST

Broadening Experiences in Scientific Training

MICHIGAN STATE DATA SCIENCE

Session 1: Goals

- **Install** R and Rstudio
- **Import** packages
- **Explore** a dataset
- **Visualize** data



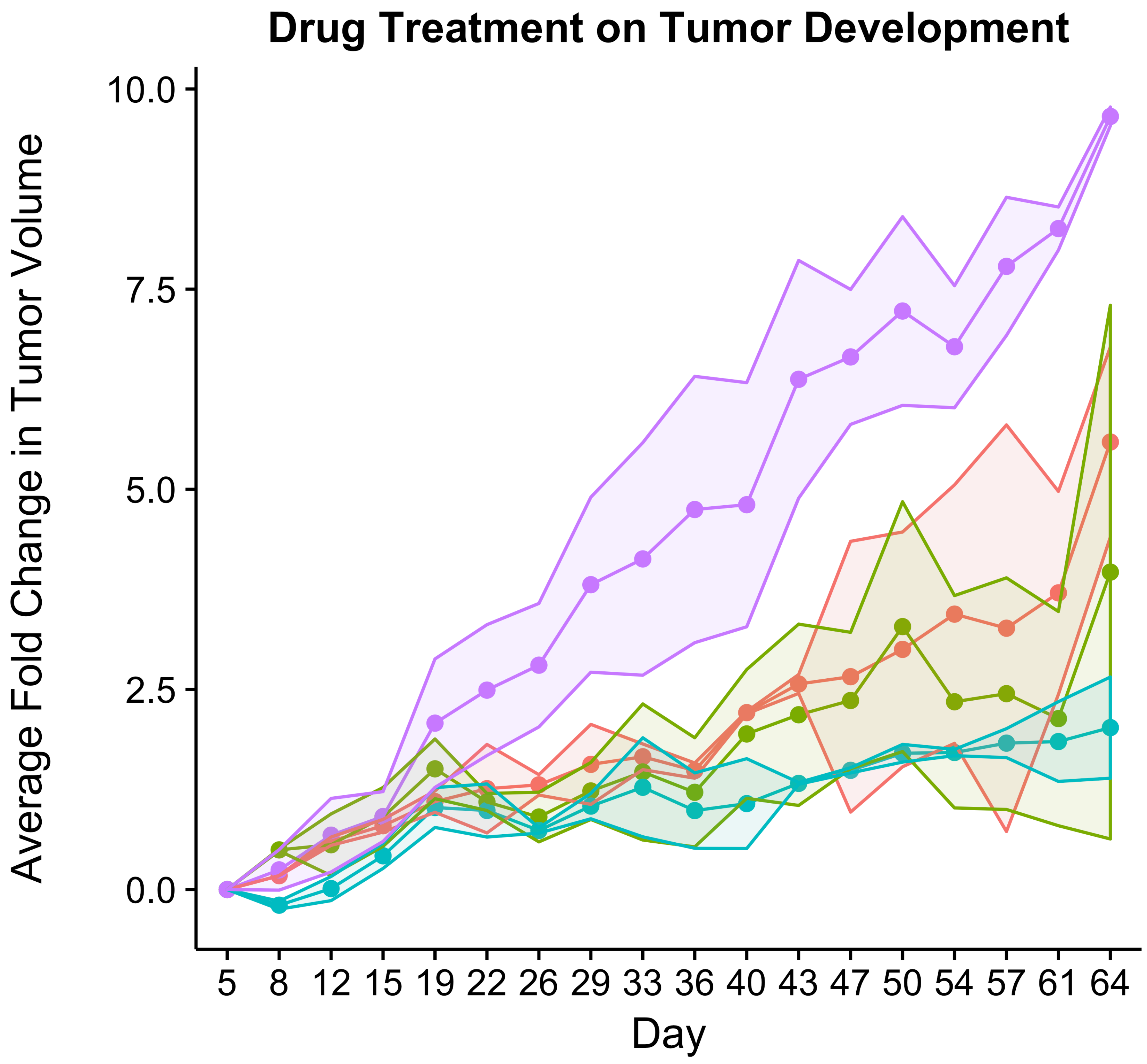
Programming language for **statistical** computing

R is good for: reproducible analysis

Raw data → Analyzed data

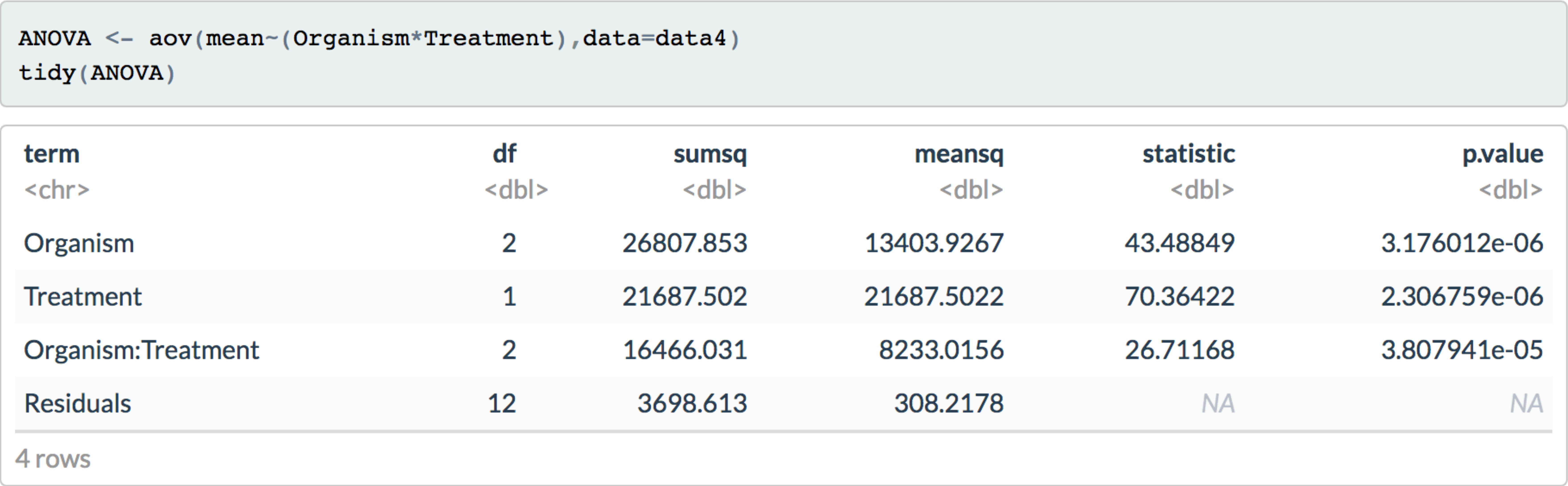
R is good for: generating beautiful figures

Raw data



R is good for: calculating statistics

Raw data



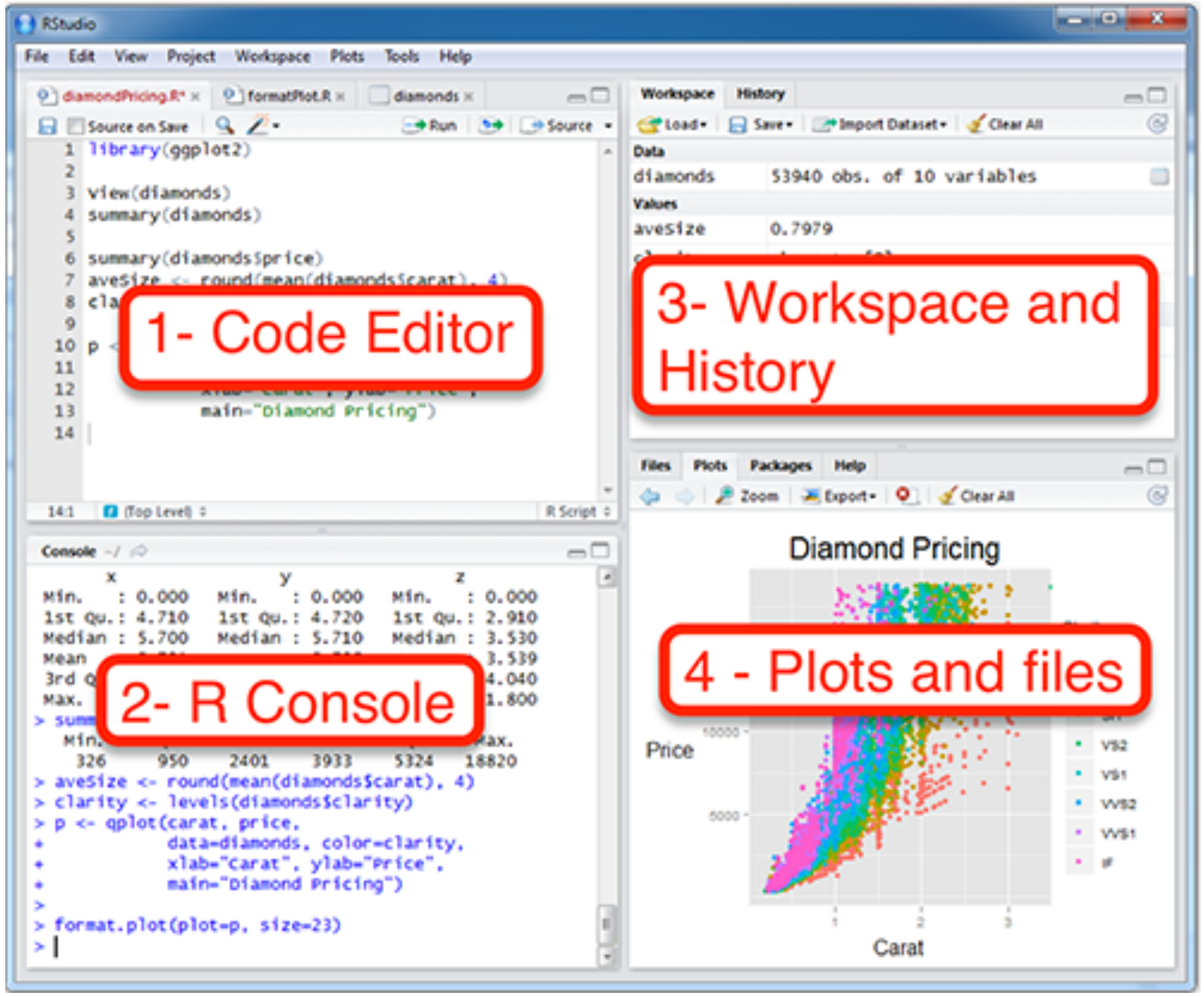
```
ANOVA <- aov(mean~(Organism*Treatment),data=data4)
tidy(ANOVA)
```

term	df	sumsq	meansq	statistic	p.value
<chr>	<dbl>	<dbl>	<dbl>	<dbl>	<dbl>
Organism	2	26807.853	13403.9267	43.48849	3.176012e-06
Treatment	1	21687.502	21687.5022	70.36422	2.306759e-06
Organism:Treatment	2	16466.031	8233.0156	26.71168	3.807941e-05
Residuals	12	3698.613	308.2178	NA	NA

4 rows

RStudio®

Integrated development environment (IDE) for easy creation and organization of R scripts



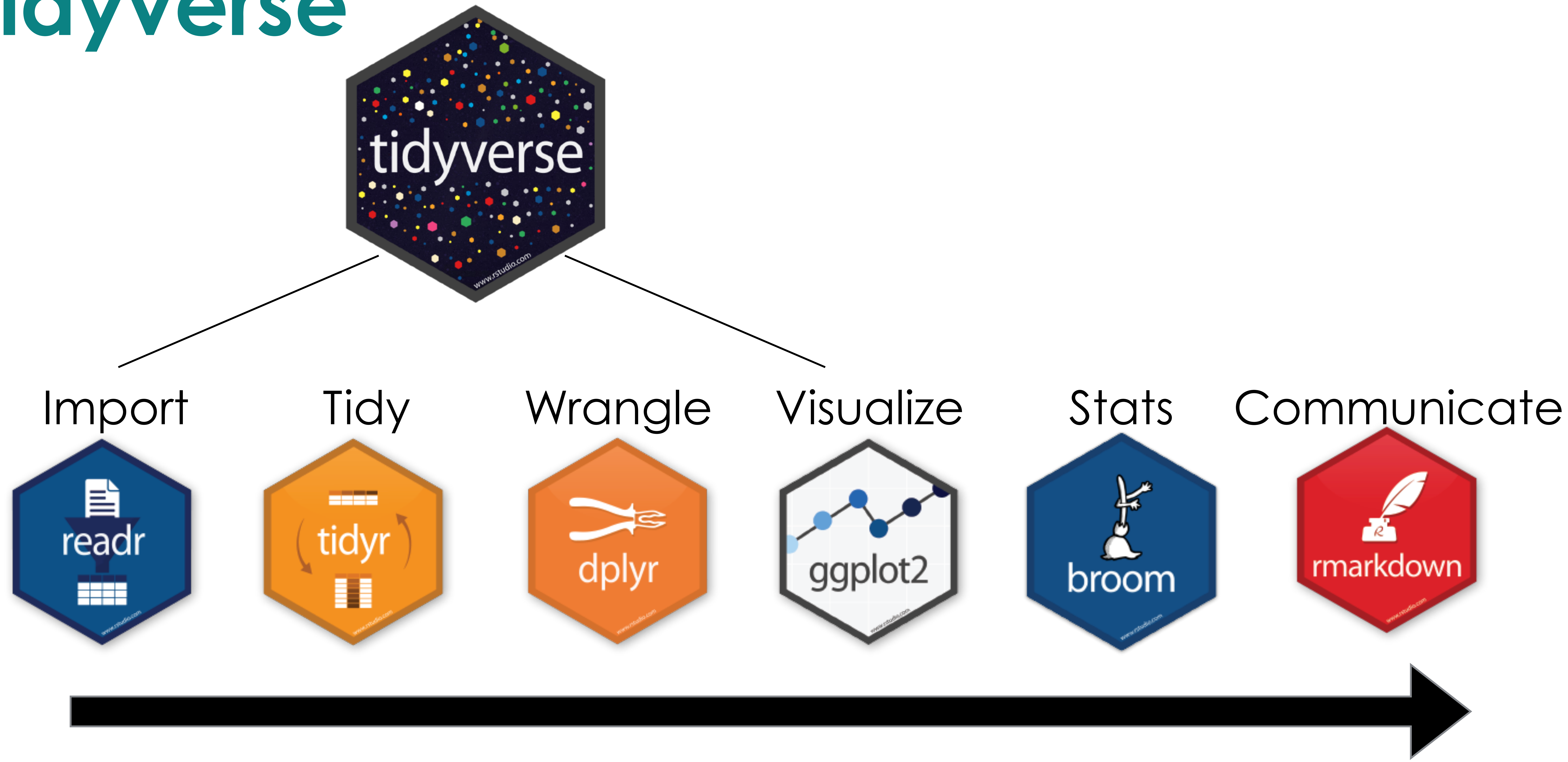
```
library(ggplot2)

View(diamonds)
summary(diamonds)

summary(diamonds$price)
aveSize <- round(mean(diamonds$carat), 4)
cla

p <


            main="Diamond Pricing")
```

```
       x                y                z
Min.   : 0.000   Min.   : 0.000   Min.   : 0.000
1st Qu.: 4.710   1st Qu.: 4.720   1st Qu.: 2.910
Median : 5.700   Median : 5.710   Median : 3.530
Mean                                          3.539
3rd Q                                         4.040
Max.                                          1.800
> summ
   Min.                                        Max.
    326     950     2401     3933     5324    18820
> aveSize <- round(mean(diamonds$carat), 4)
> clarity <- levels(diamonds$clarity)
> p <- qplot(carat, price,
+            data=diamonds, color=clarity,
+            xlab="Carat", ylab="Price",
+            main="Diamond Pricing")
>
> format.plot(plot=p, size=23)
> |
```

```
diamonds      53940 obs. of 10 variables
aveSize       0.7979
```

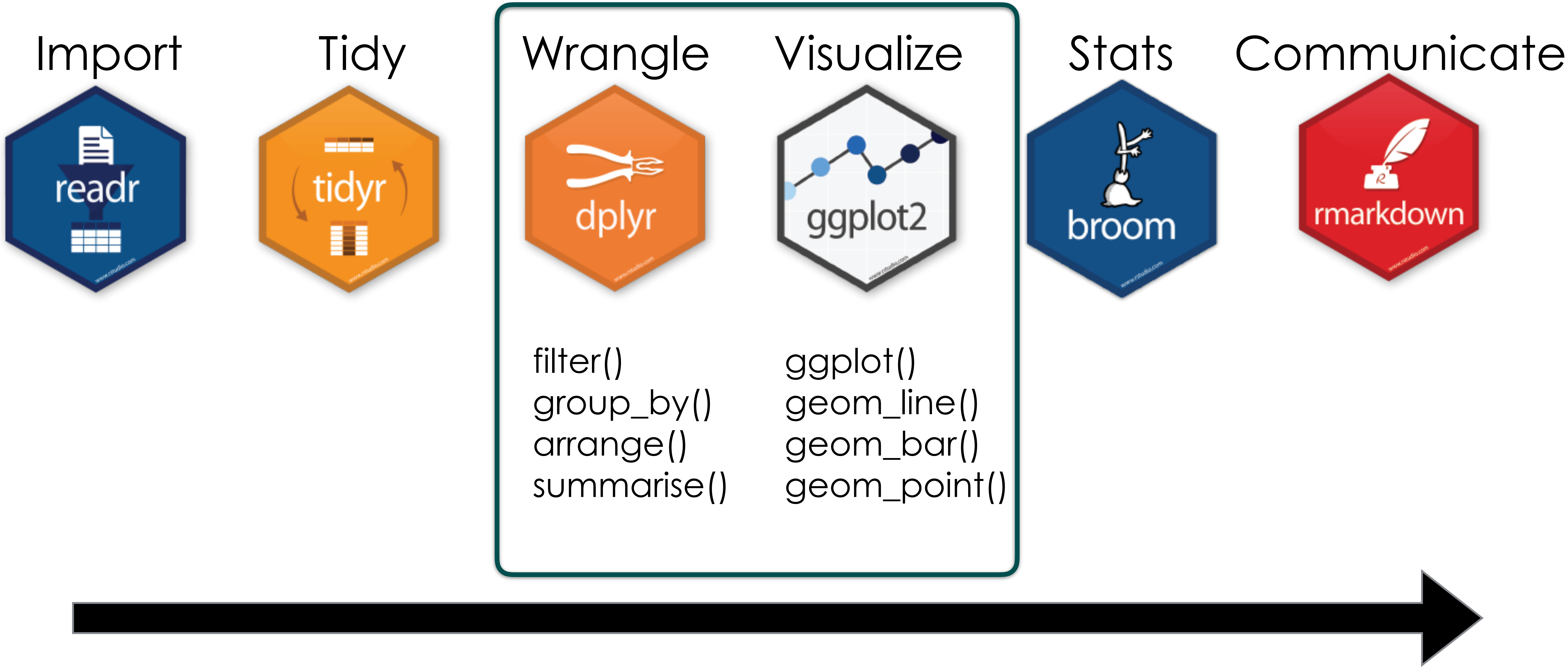
Packages are: a collection of useful functions

Data Analysis in the **Tidyverse**



Import Tidy Wrangle Visualize Stats Communicate

Data Analysis in the **Tidyverse**



Import

Tidy

Wrangle

Visualize

Stats

Communicate

filter()
group_by()
arrange()
summarise()

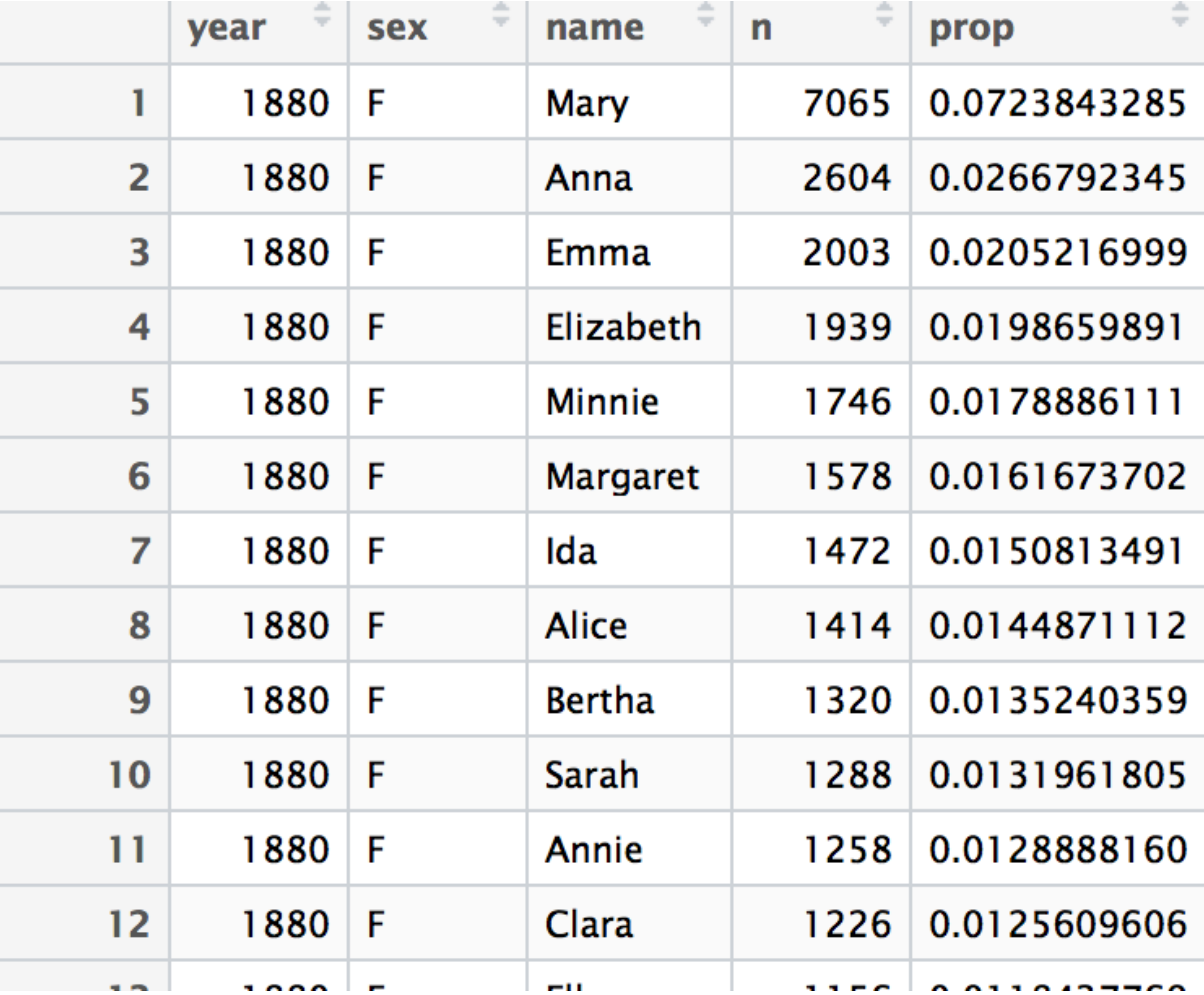
ggplot()
geom_line()
geom_bar()
geom_point()

Install packages

Package - Collection of R functions

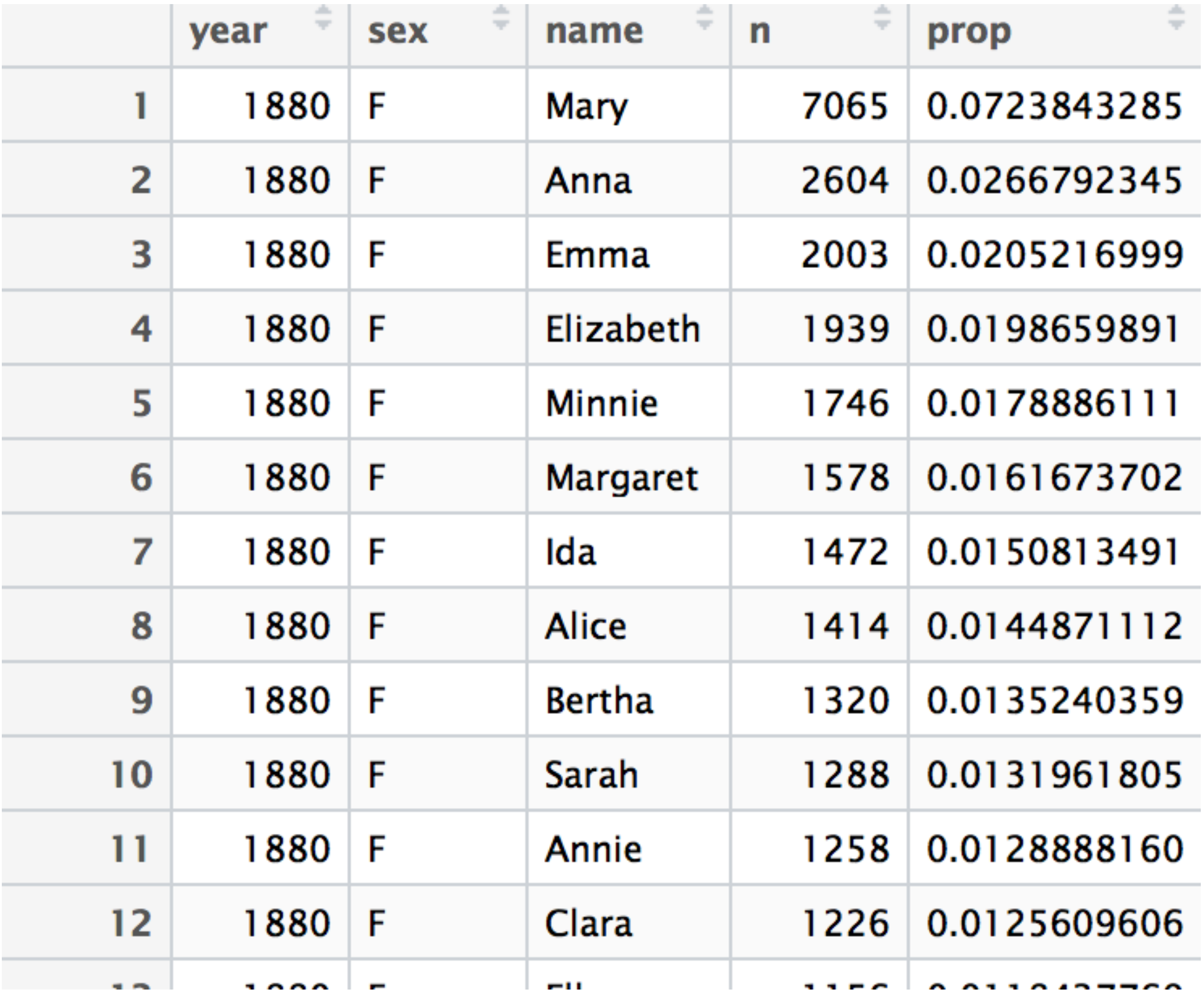
- Only install once
- Load them each time you run a script

tidyverse, babynames, cowplot



	year	sex	name	n	prop
1	1880	F	Mary	7065	0.0723843285
2	1880	F	Anna	2604	0.0266792345
3	1880	F	Emma	2003	0.0205216999
4	1880	F	Elizabeth	1939	0.0198659891
5	1880	F	Minnie	1746	0.0178886111
6	1880	F	Margaret	1578	0.0161673702
7	1880	F	Ida	1472	0.0150813491
8	1880	F	Alice	1414	0.0144871112
9	1880	F	Bertha	1320	0.0135240359
10	1880	F	Sarah	1288	0.0131961805
11	1880	F	Annie	1258	0.0128888160
12	1880	F	Clara	1226	0.0125609606

Data Analysis in the **Tidyverse**



	year	sex	name	n	prop
1	1880	F	Mary	7065	0.0723843285
2	1880	F	Anna	2604	0.0266792345
3	1880	F	Emma	2003	0.0205216999
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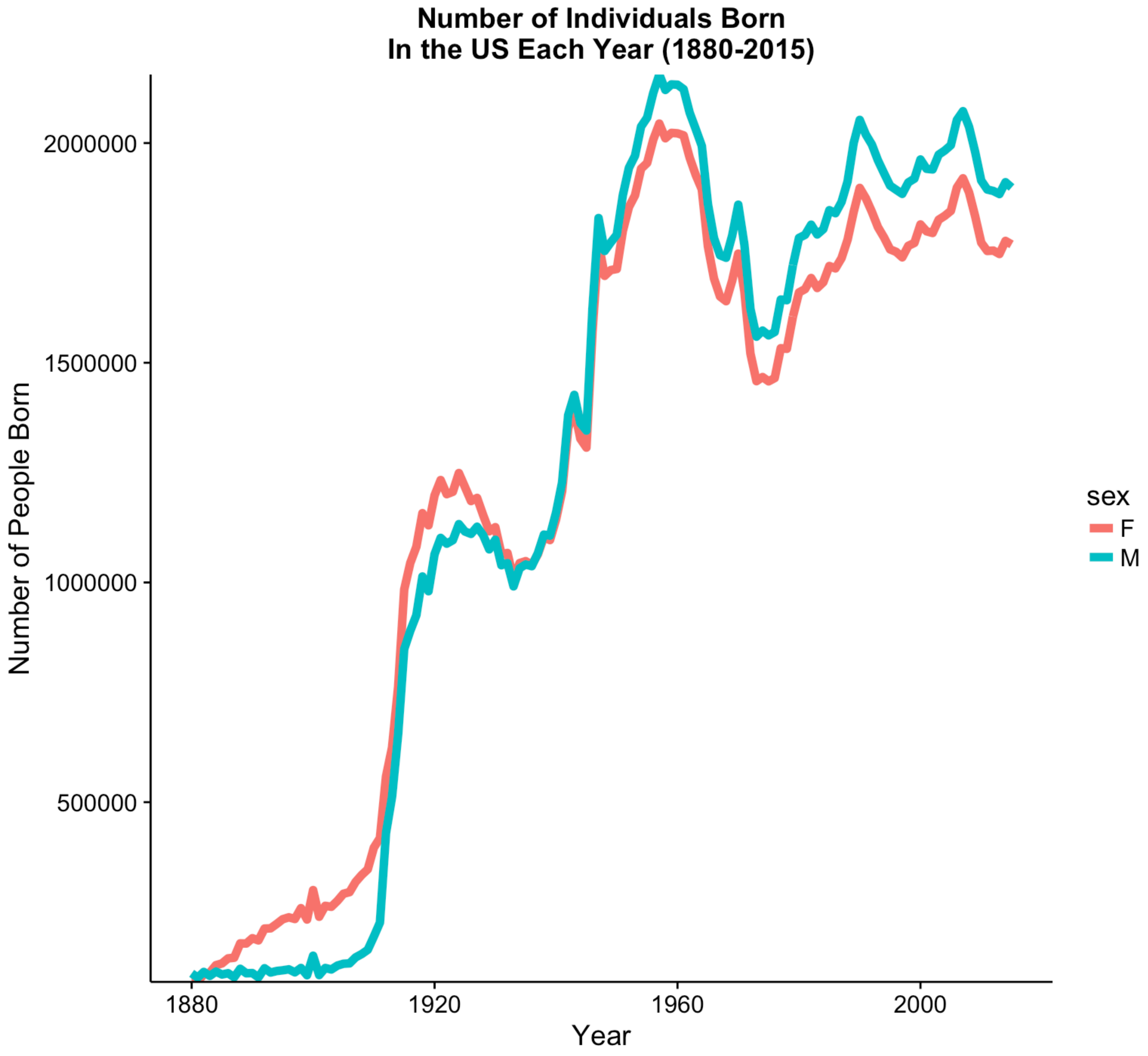
Wrangle	Visualize

filter()
group_by()
arrange()
summarise()
	ggplot()
	geom_line()
	geom_bar()
	geom_point()



dplyr - clean up/aggregate data

- filter()
- arrange()
- group_by()
- summarize()

filter()- picks **rows** based on values

Fruit	Count
Apple	34
Raspberry	67
Pear	35
Plum	27
Peach	5
Strawberry	2
Melon	97
Mango	5

```
filter(Fruit == “Raspberry”)
```

Fruit	Count
Raspberry	67

```
filter(Count < 10)
```

Fruit	Count
Peach	5
Strawberry	2
Mango	5

arrange()- changes row order

Fruit	Count
Apple	34
Raspberry	67
Pear	35
Plum	27
Peach	5
Strawberry	2
Melon	97
Mango	5

```
arrange(desc(Count))
```

Fruit	Count
Melon	97
Raspberry	67
Pear	35
Apple	34
Mango	5
Peach	5

The Assignment Operator

<-

- Assigns value to an **object**

```
x <- 4
x
> 4
```

Pipe operator

%>%

- Interpreted as “then”

Fruit	Count
Apple	34
Raspberry	67
Pear	35
Plum	27
Peach	5
Strawberry	2
Melon	97
Mango	5

```
data %>%
      filter(Fruit == “Raspberry”)
```

Fruit	Count
Raspberry	67

- **group_by()**- ‘**lock-in**’ by certain criteria
- **summarize()** - **reduce** multiple values to a **single value**

Cat	Fruit	Count
1	Apple	34
1	Raspberry	67
1	Pear	35
1	Plum	27
2	Peach	5
2	Strawberry	2
2	Melon	97
2	Mango	5

```
data %>%
    group_by(Cat) %>%
    summarize( Total = sum(Count))
```

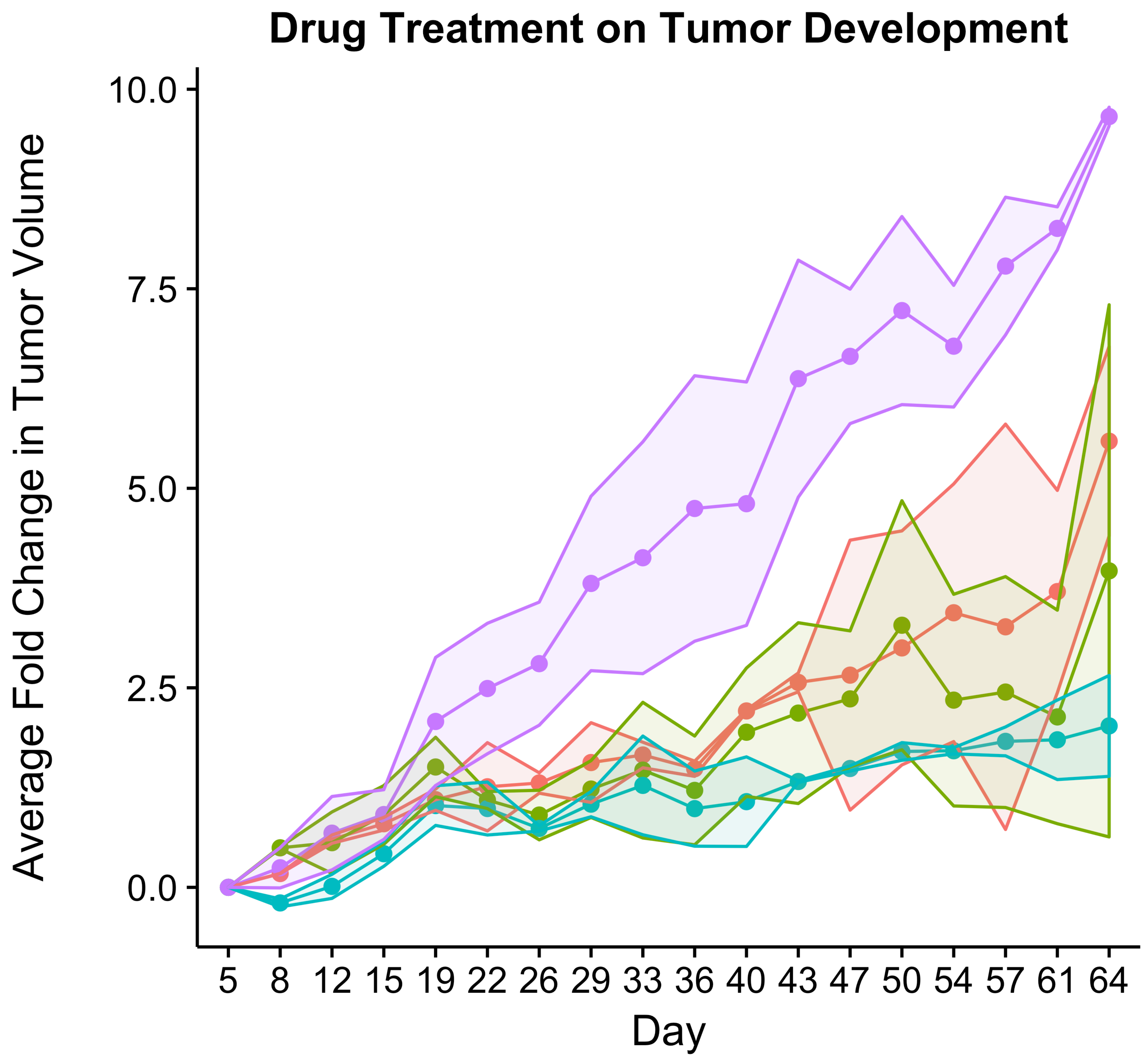
Cat	Total
1	163
2	109

dplyr - clean up/aggregate data

- **filter()**- picks **rows** based on values
- **arrange()**- changes **row order**
- **group_by()**- ‘**lock-in**’ by certain criteria
- **summarize()** - **reduce** multiple values to a **single value**

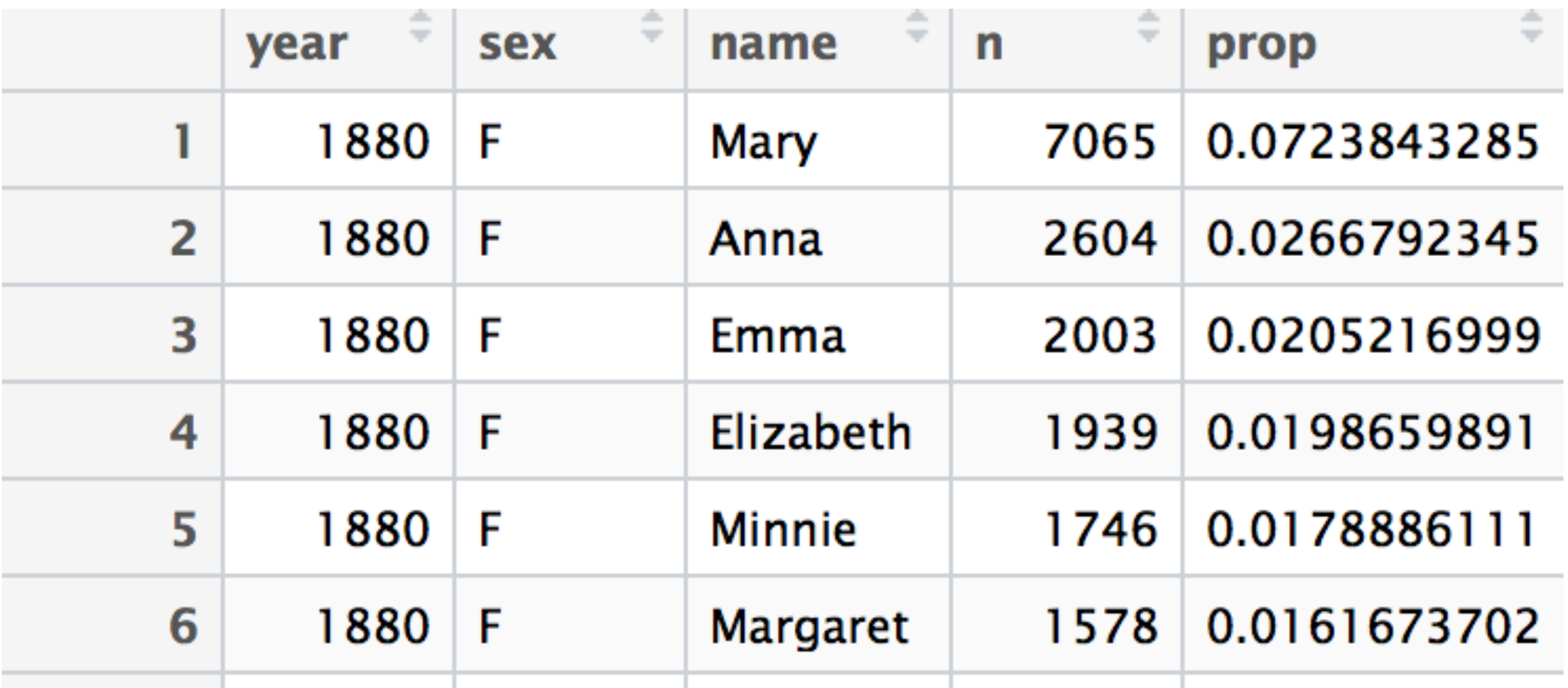
ggplot2

Powerful graphing package for generating high quality figures based on the grammar of graphics



ggplot2

```
data %>%
   ggplot(aes( x =  year,
                     y = n,
                     color = sex) +
     geom_line()
```



	year	sex	name	n	prop
1	1880	F	Mary	7065	0.0723843285
2	1880	F	Anna	2604	0.0266792345
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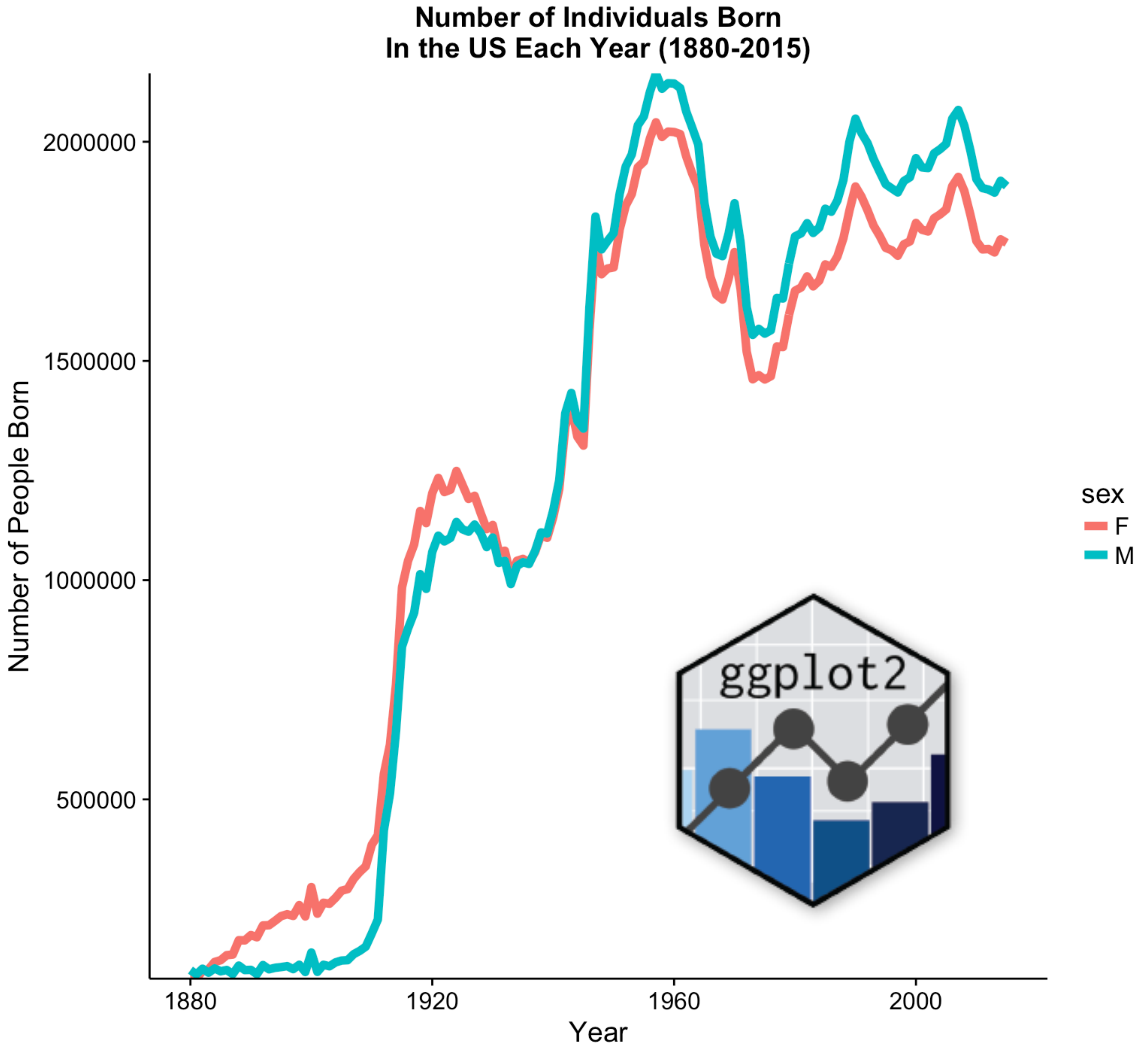
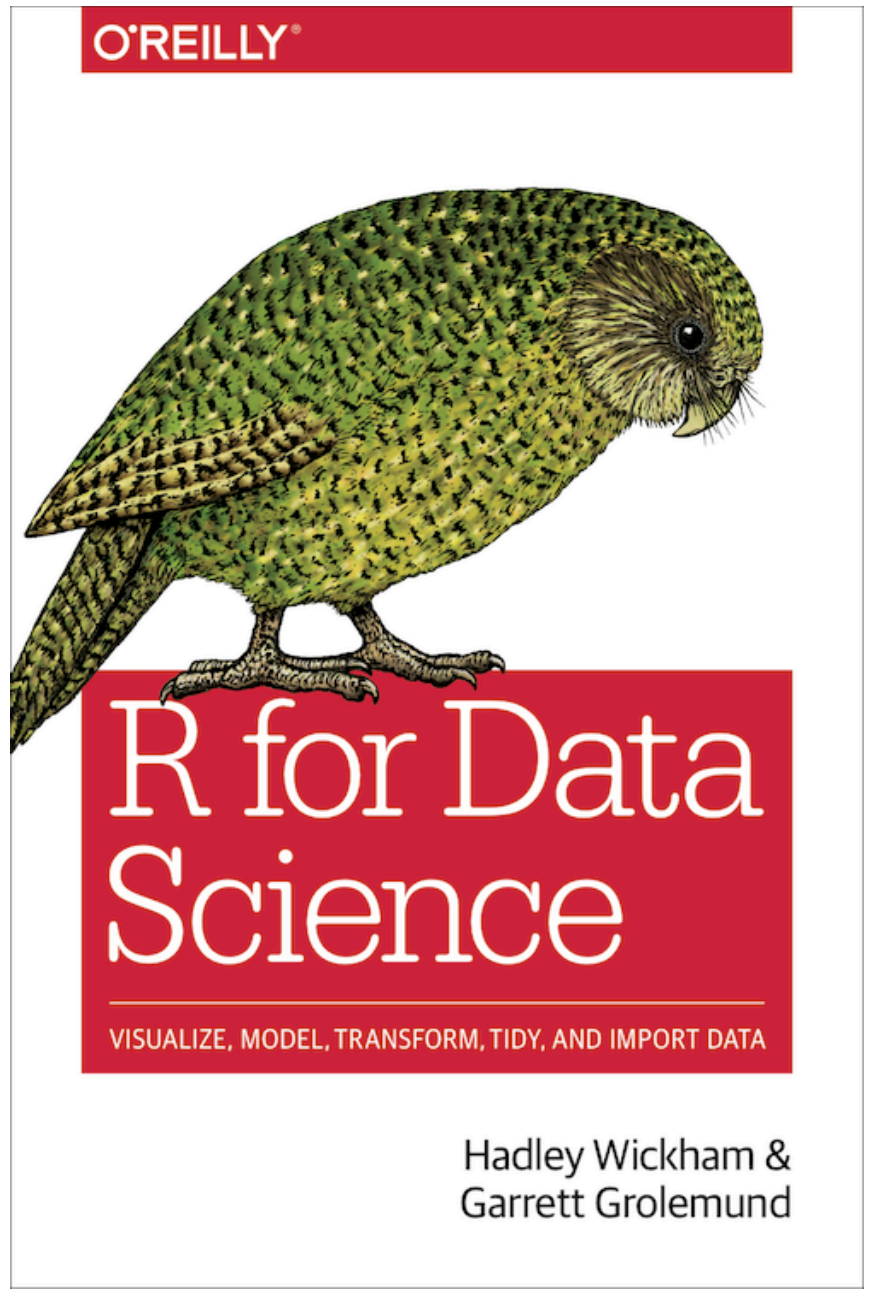
4	1880	F	Elizabeth	1939	0.0198659891
5	1880	F	Minnie	1746	0.0178886111
6	1880	F	Margaret	1578	0.0161673702



Number of Individuals Born
In the US Each Year (1880-2015)

Resources



O'REILLY

R for Data Science

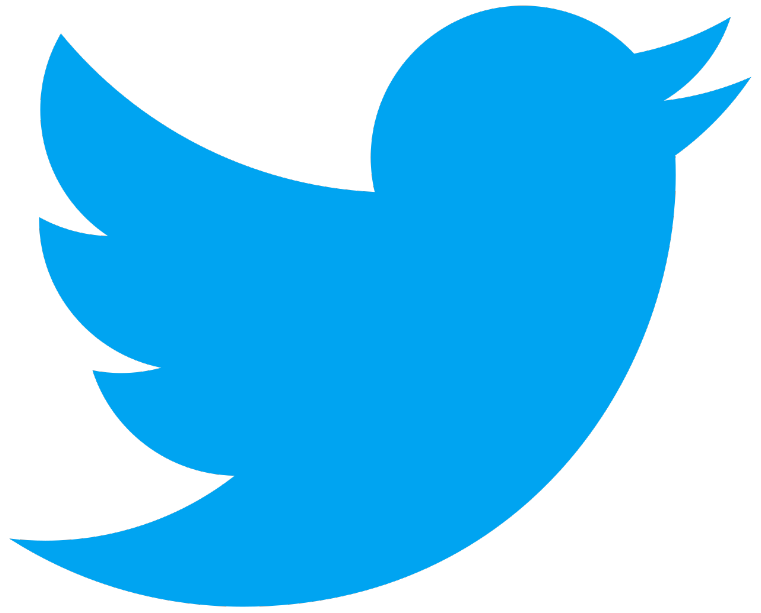
VISUALIZE, MODEL, TRANSFORM, TIDY, AND IMPORT DATA

Hadley Wickham &
Garrett Grolemund

YouTube

GitHub

stackoverflow



Demo!

Try to determine:

- Total number of babies born between 1980:1990

- Total number of males and females named “Frankie”
    - Graph it!

- Determine if you or your partners have a more popular name
    - Graph it!