# Managing Data Analysis in RStudio using project-oriented workflow

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UNIVERSITY OF CENTRAL FLORIDA

CIHR IRSC

Canadian Institutes of Health Research | Instituts de recherche en santé du Canada

https://github.com/andkov/hsif-2019-data-analysis

# About me

- Ph.D. in Quantitative Methods, Psychology (2014)
- Reproducible research enthusiast since 2012
- Graph maker
- See work at https://github.com/andkov
- These slides and more at http://andriy.rbind.io

MIDDLE TENNESSEE STATE UNIVERSITY

The UNIVERSITY of OKLAHOMA

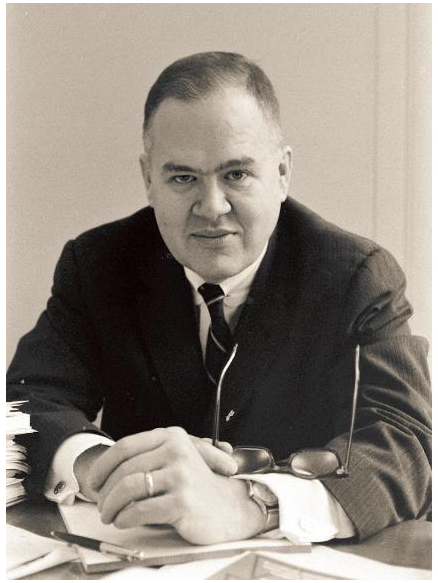
VANDERBILT

University of Victoria

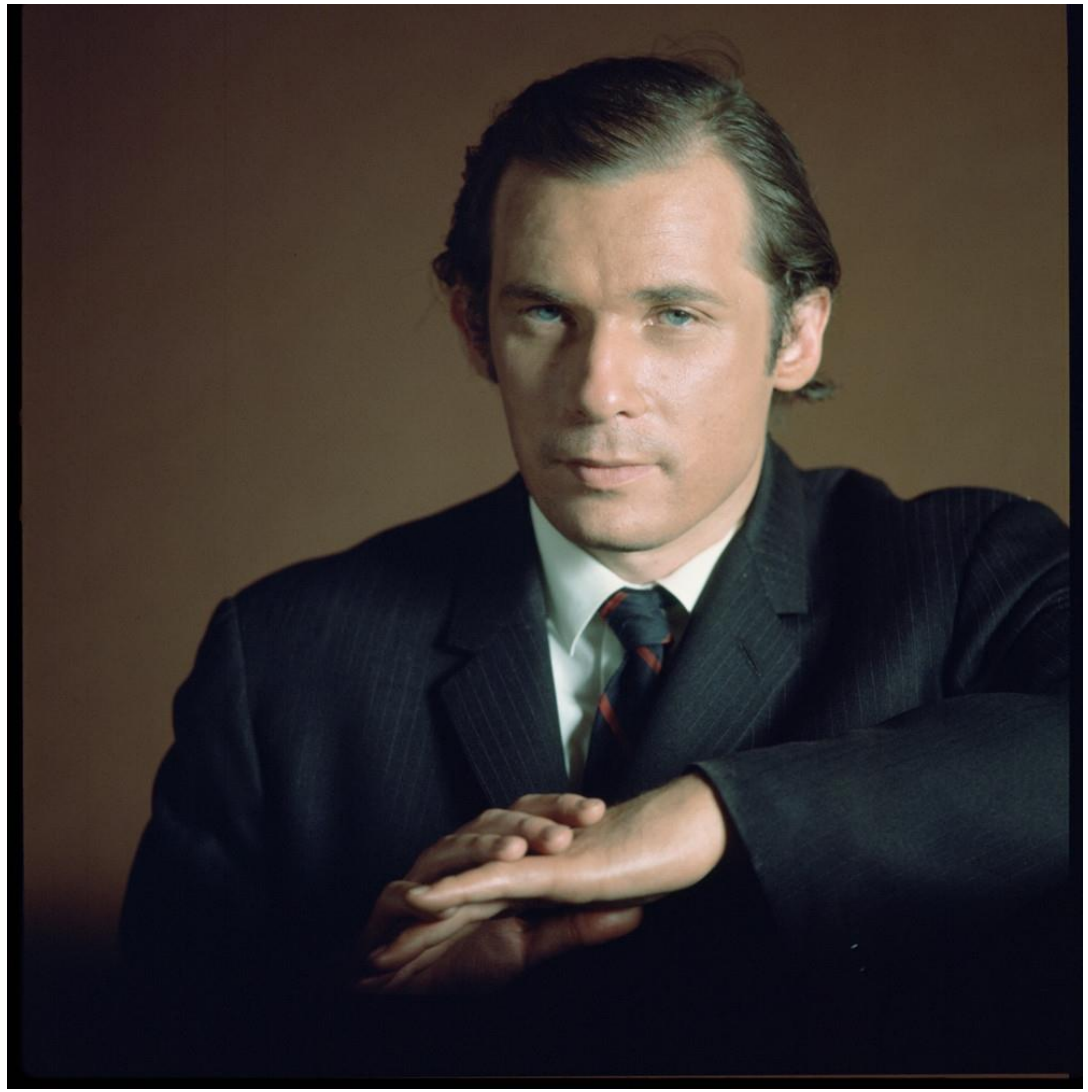
THE UNIVERSITY OF BRITISH COLUMBIA

UNIVERSITY OF CENTRAL FLORIDA

Andreas Vesalius



John Tukey



Glenn Gould

Hadley Wickham

Edward Tufte

# Dialects of data expression

## Tabular

| id | time | attend | model |
|---|---|---|---|
| 1 | 0 | 1 | 2.788 |
| 1 | 1 | 6 | 2.732 |
| 1 | 2 | 2 | 2.675 |
| 1 | 3 | 1 | 2.618 |
| 1 | 4 | 1 | 2.562 |
| 1 | 5 | 1 | 2.505 |
| 1 | 6 | 1 | 2.449 |
| 1 | 7 | 1 | 2.392 |
| 1 | 8 | 1 | 2.335 |
| 1 | 9 | 1 | 2.279 |
| 1 | 10 | 1 | 2.222 |
| 1 | 11 | 1 | 2.166 |
| 4 | 0 | 2 | 2.788 |
| 4 | 1 | 1 | 2.732 |

## Algebraic

$$y_{it} = \beta_0 + \beta_1 time_t + \varepsilon_{it}$$

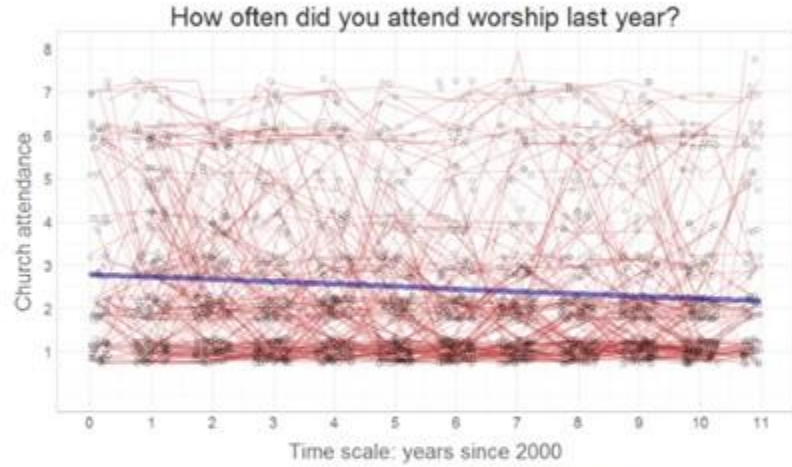
$$\beta_0 = \gamma_{00}$$

$$\beta_1 = \gamma_{10}$$

## Semantic

In 2000 respondents attended church less than once a month (2.79) and gradually declined in their attendance since (.06 per year).

## Graphical




## Syntactic

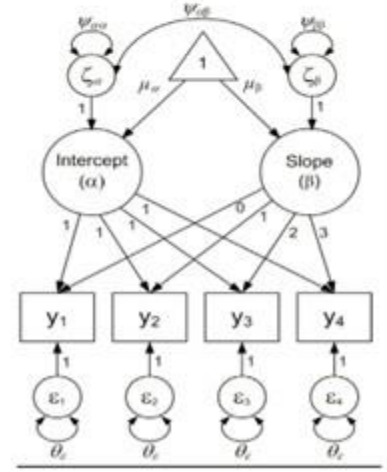
```
nlme::gls(attend ~ 1 + time, data=dsM)
```

## Numeric

```
Coefficients:
              Value Std.Error t-value p-value
(Intercept)  2.7882   0.07774   35.86       0
time        -0.0566   0.01197   -4.73       0
```

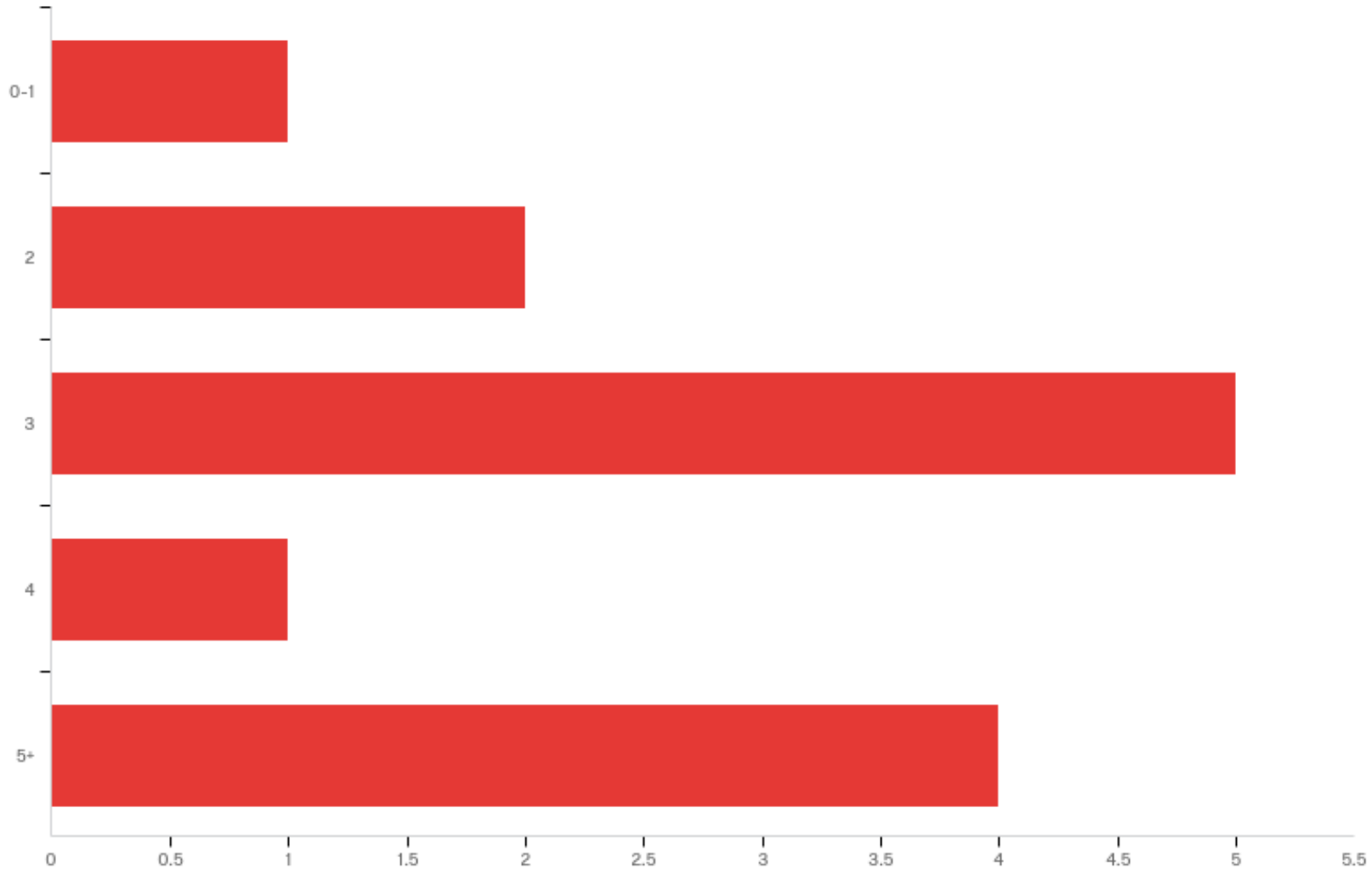
| | modelB |
|---|---|
| logLik | -3719 |
| deviance | 7438 |
| AIC | 7444 |
| BIC | 7461 |
| df.resid | 1858 |
| N | 1860 |
| p | 2 |
| ids | 155 |

## Schematic

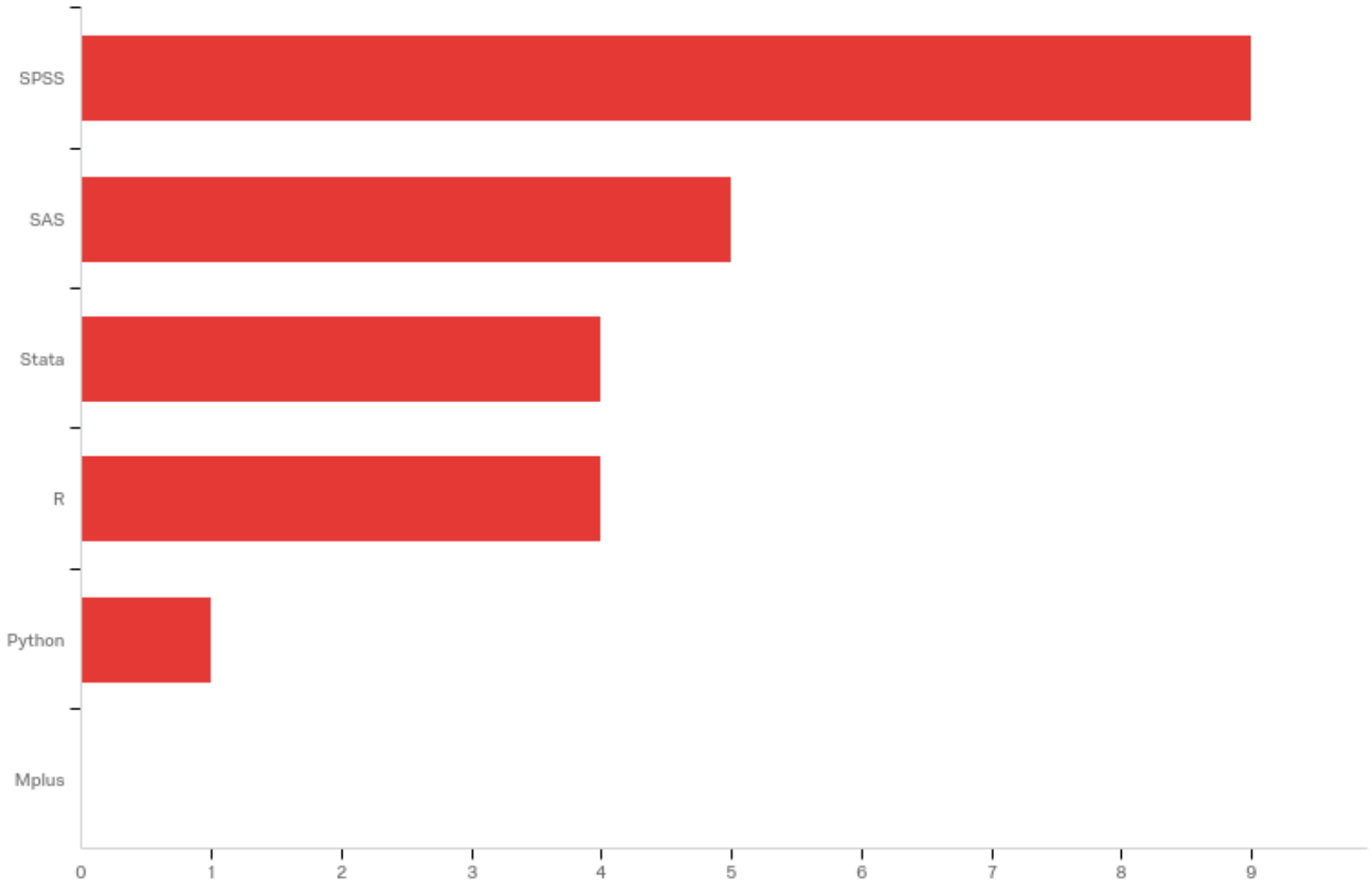


# About you

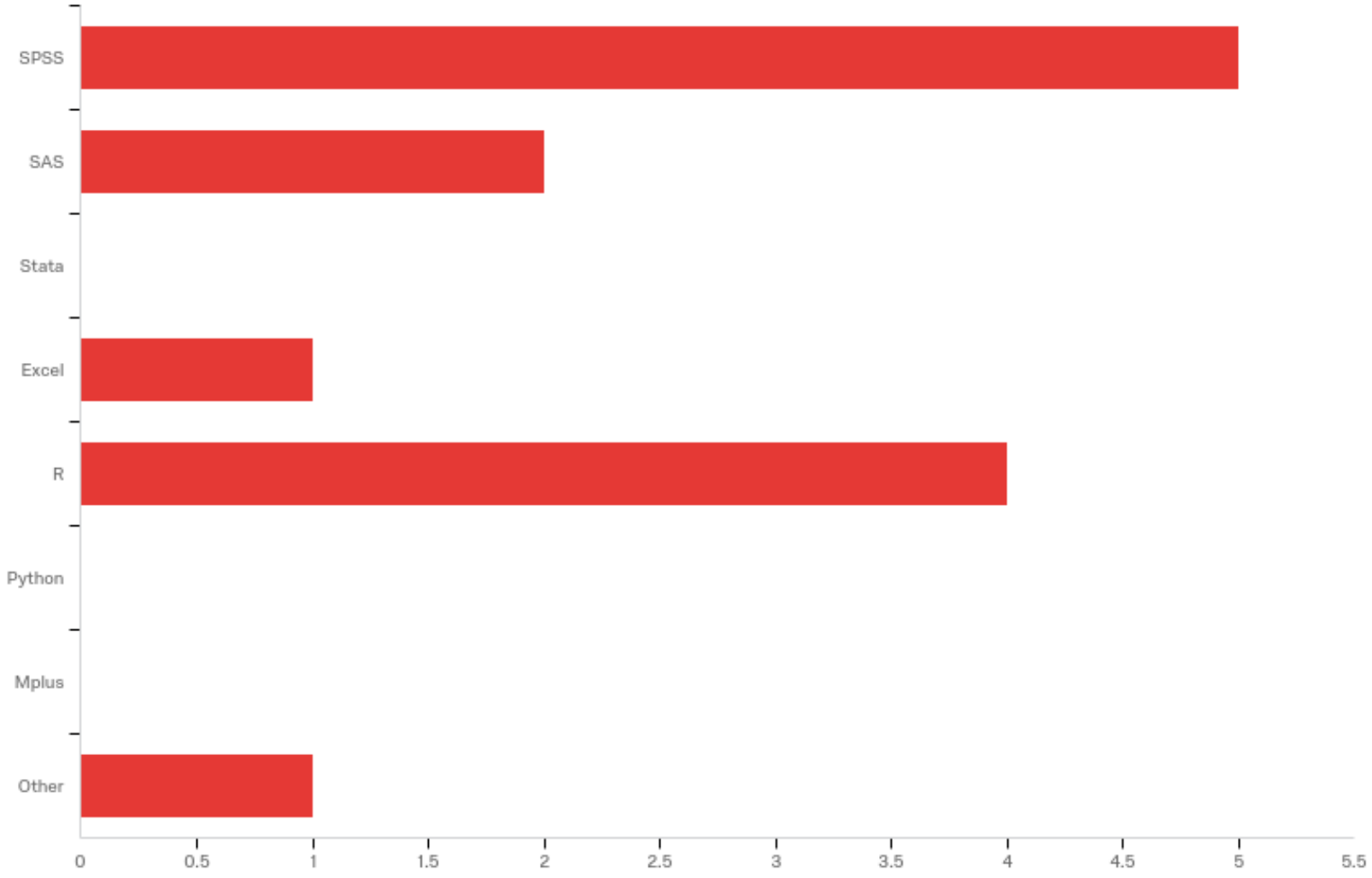
Q1.1 - How many undergraduate or graduate courses in statistics (or related field) have you taken so far?



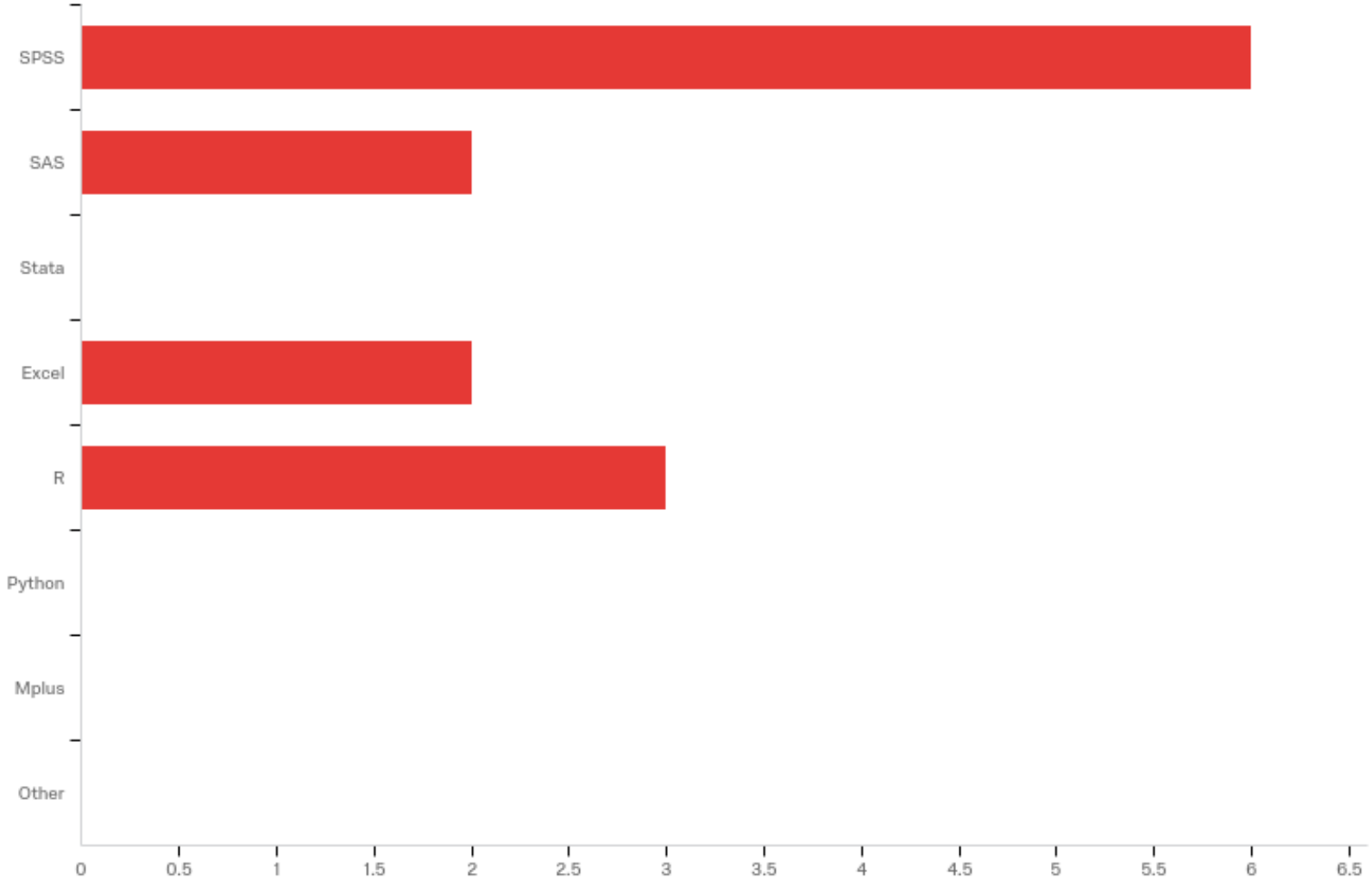
Q1.2 - What statistical software have you used AT LEAST ONCE in the last 3 years? (check all that apply)



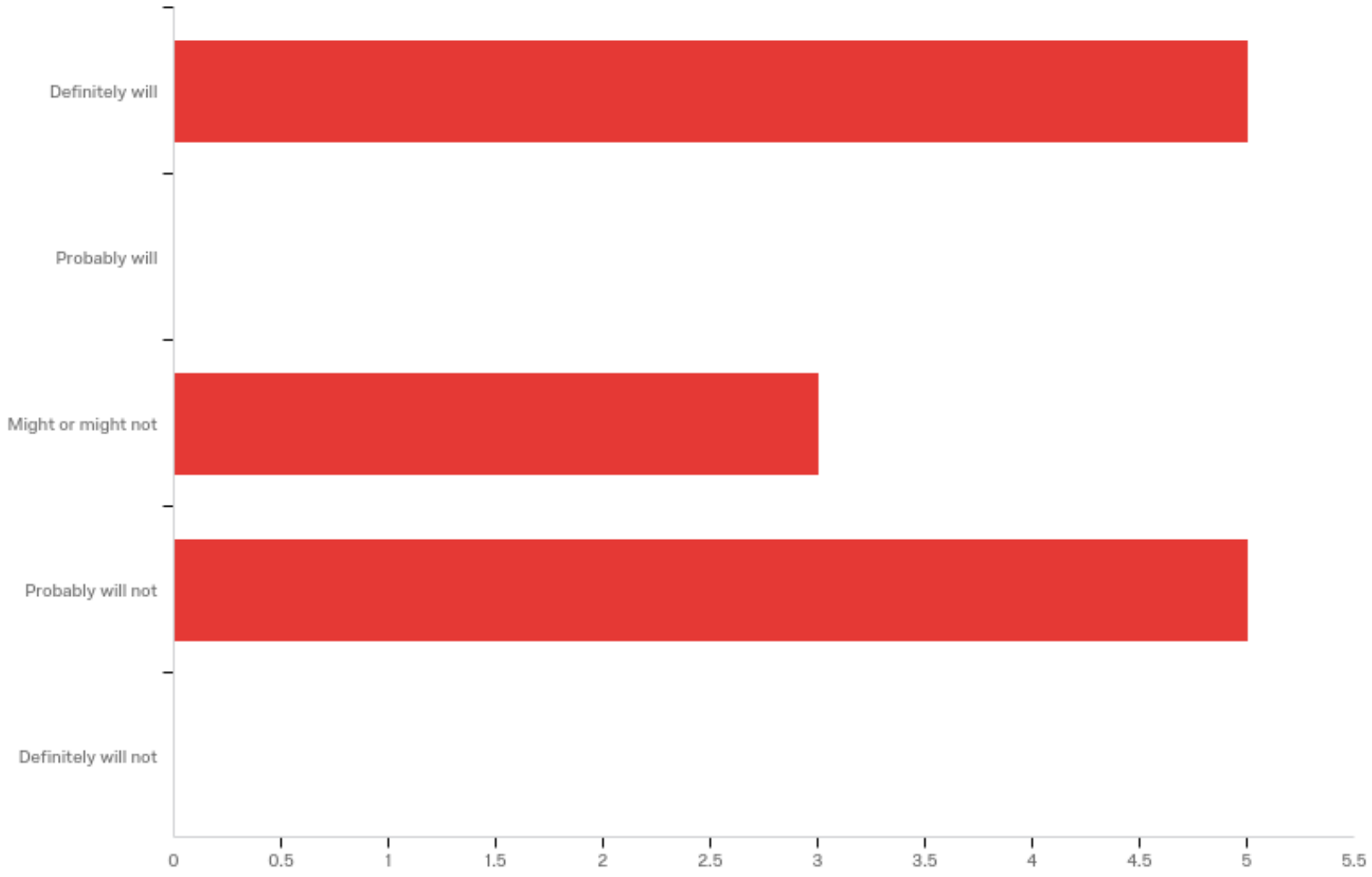
Q1.3 - You are asked to RUN A REGRESSION on an analysis-ready data set. With what software would you be most comfortable performing this task?



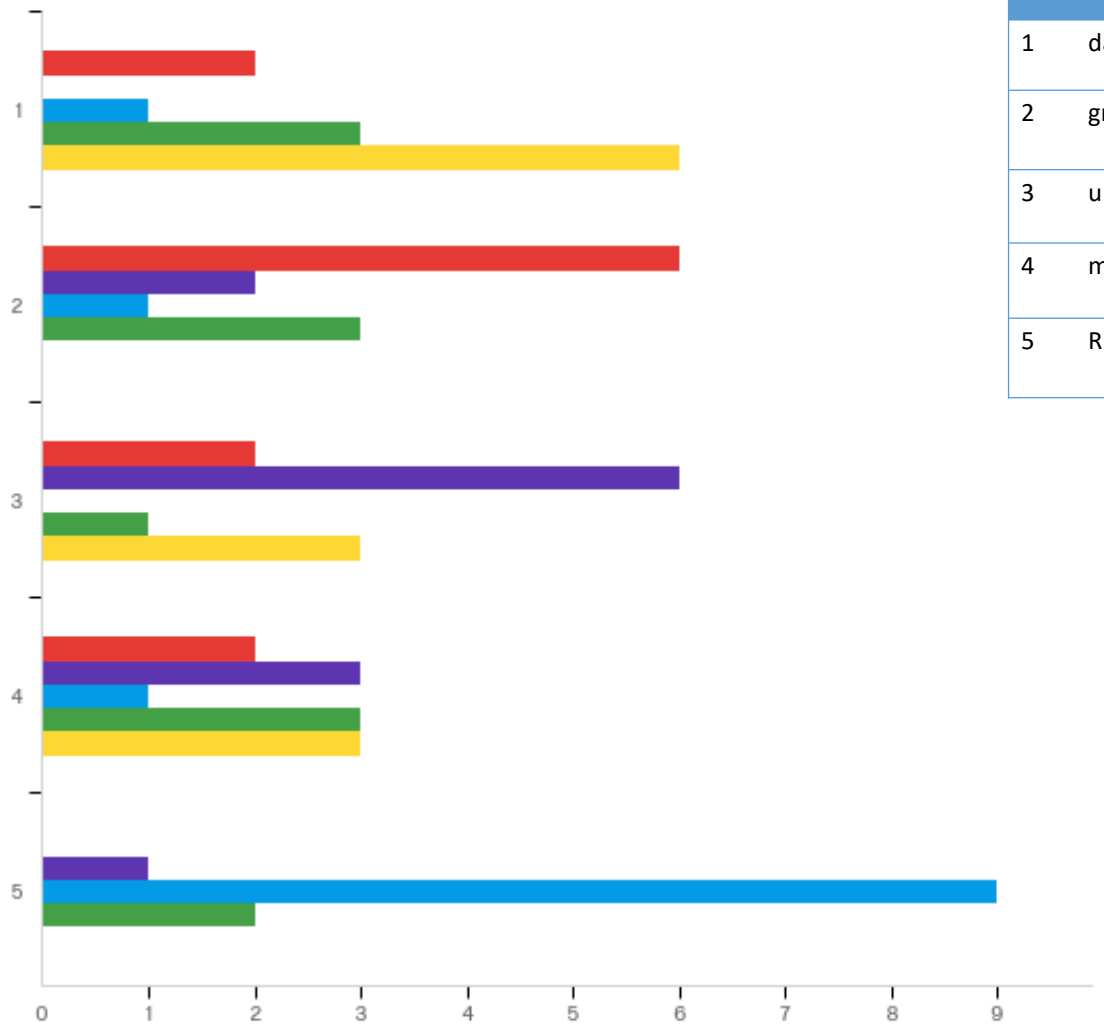
Q1.4 - You are asked to MAKE A GRAPH of a frequency distribution using an analysis-ready data set. With what software would you be most comfortable performing this task?



Q1.5 - Please complete the following sentence "I _____ use R for data analysis in my HSI Fellowship"



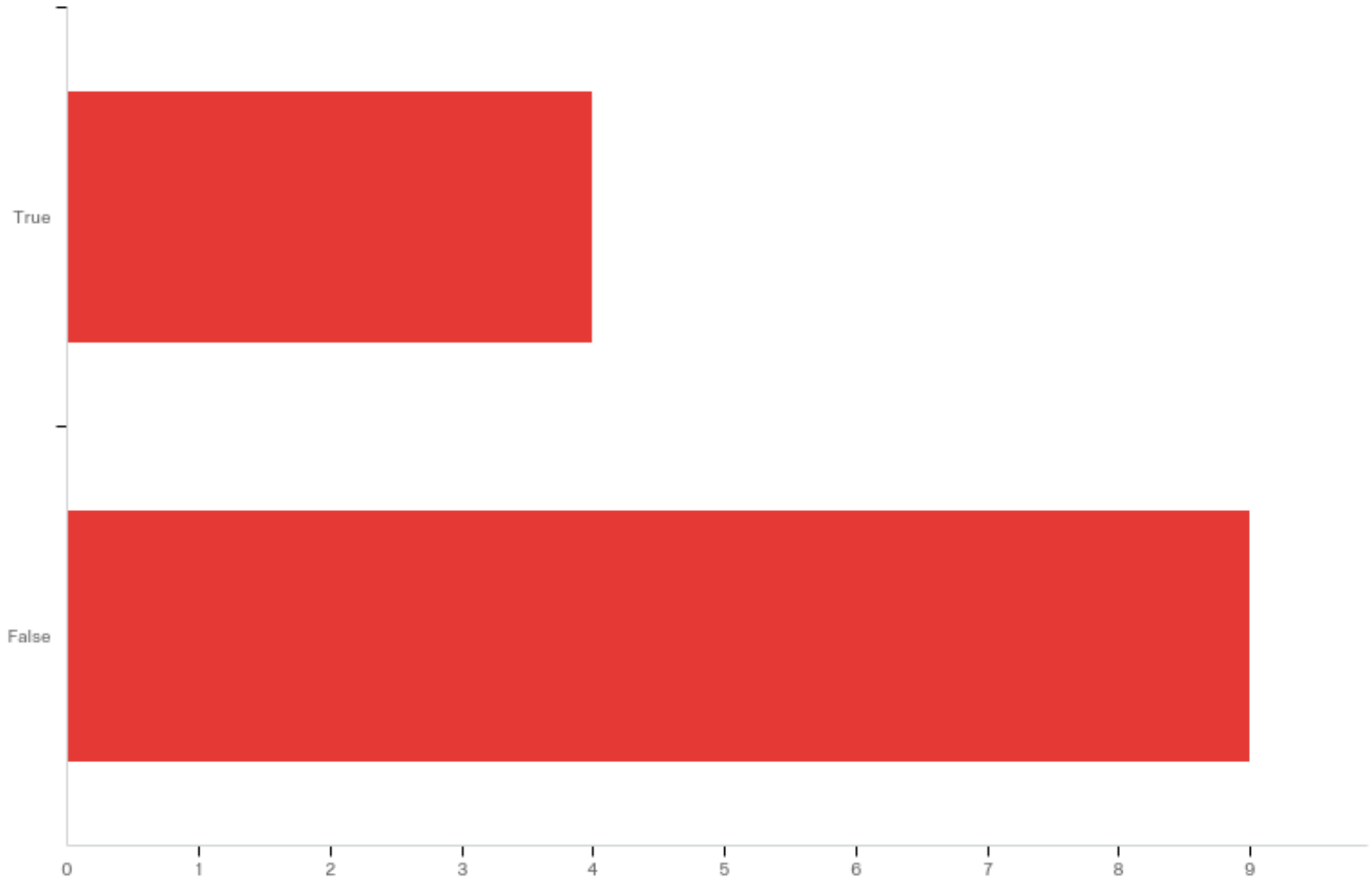
Q1.6 - With respect to learning more about data science with R, please rank your interests in the following learning objectives of this workshop.



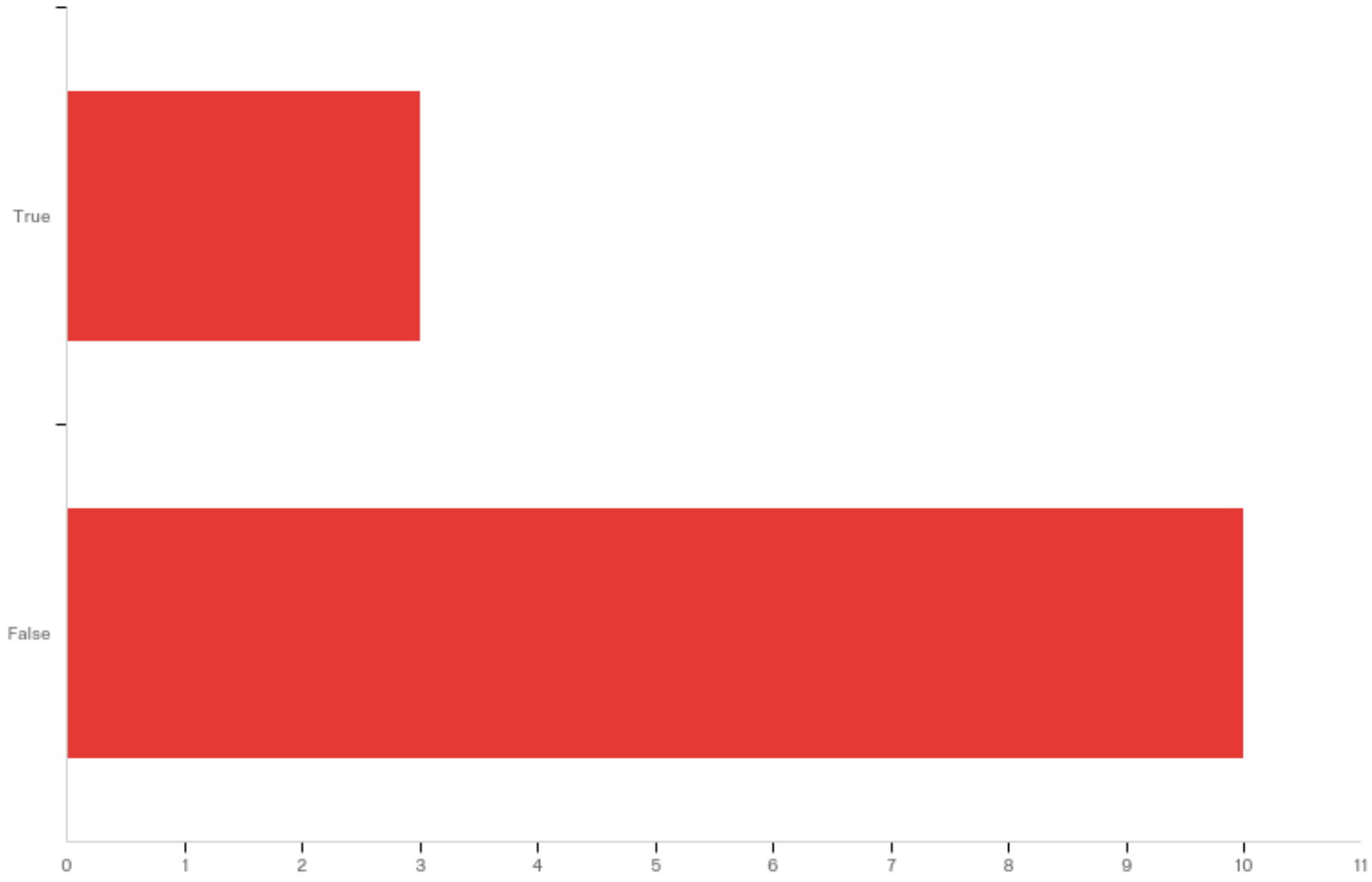

| # | Field | Mean |
|---|---|---|
| 1 | data preparation/handing | 2.33 |
| 2 | graph making | 3.25 |
| 3 | understanding  logistic regression | 4.33 |
| 4 | management of data analytic projects | 2.83 |
| 5 | R language | 2.25 |

- data preparation/handing
- graph making
- understanding logistic regression
- management of data analytic projects
- R language

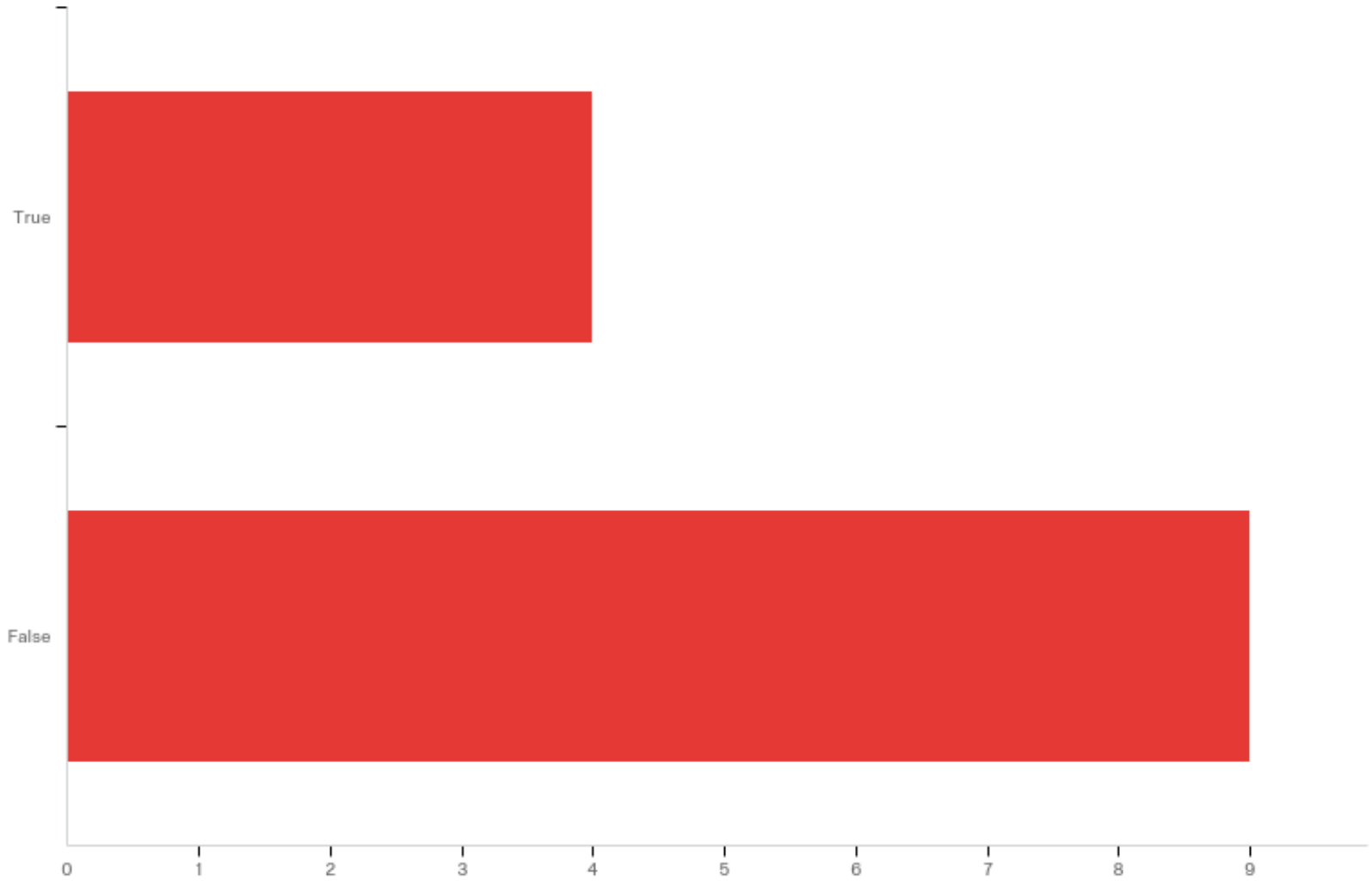
Q2.1 - I have created a graph using ggplot2  package before



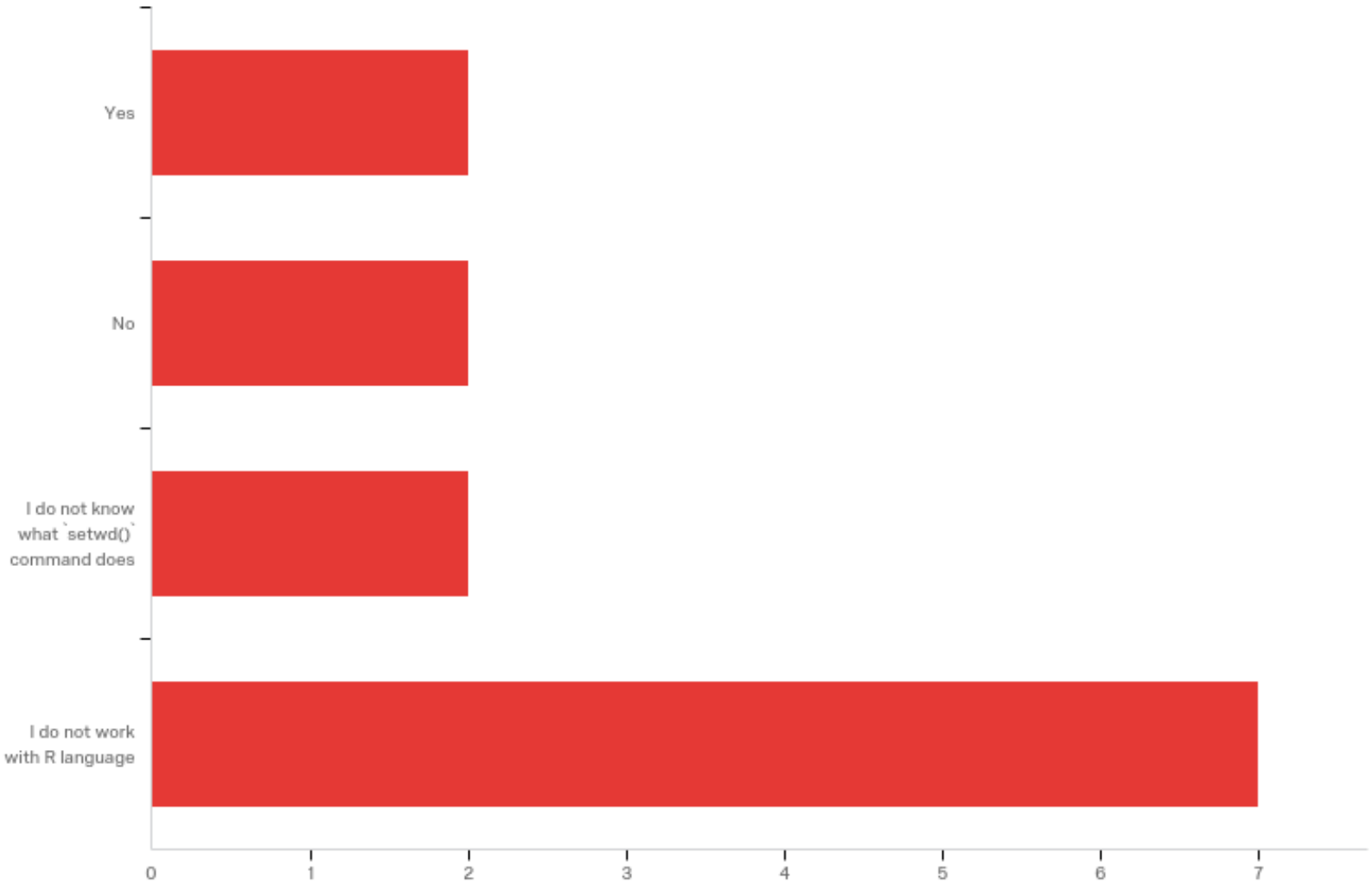
# Q2.2 - I have worked with a Rmarkdown notebook before



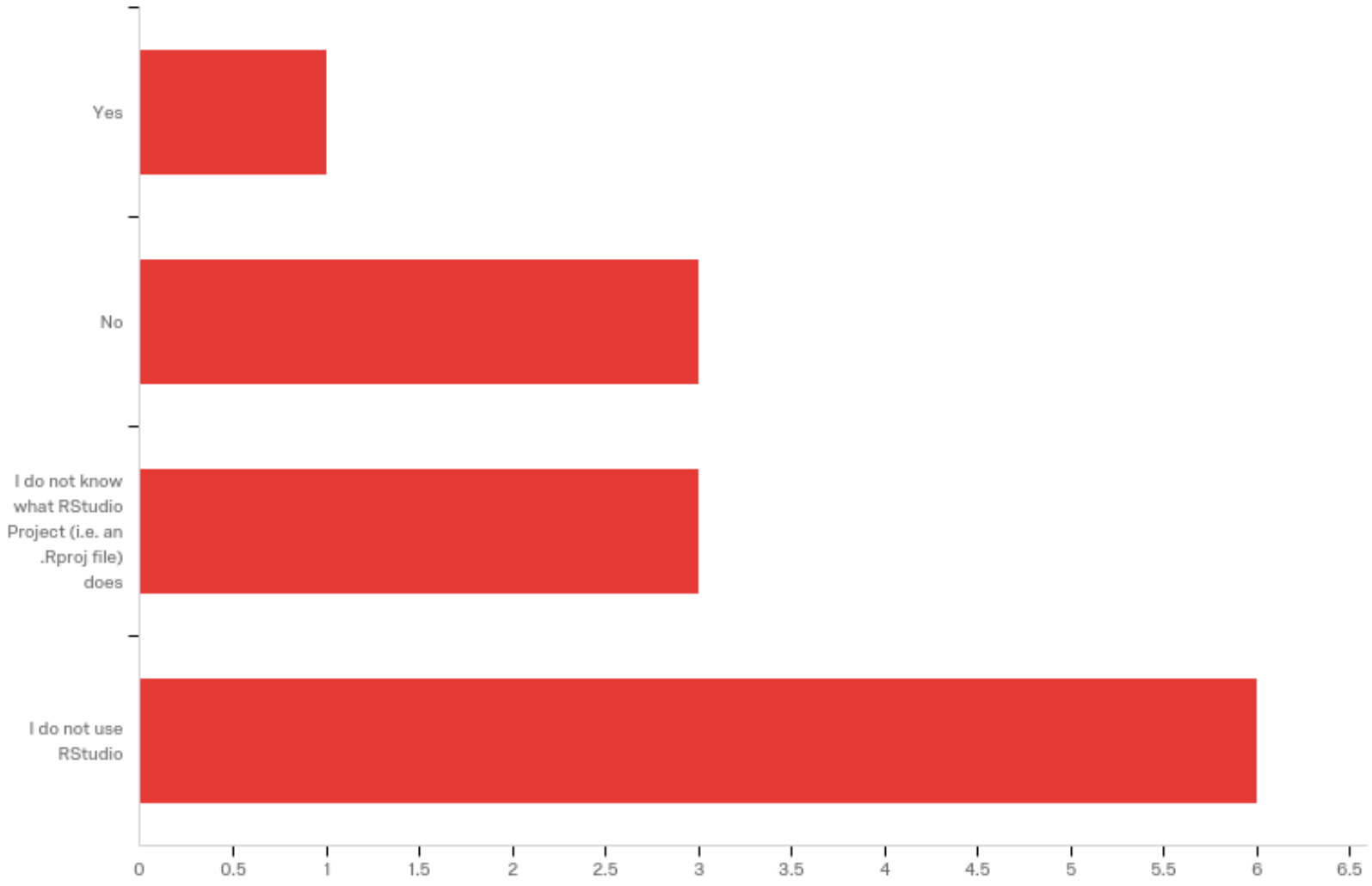
# Q2.3 - I have written a custom function in R before



Q2.4 - When working with R language,  I use `setdw()` command to establish a home directory



# Q2.5 - When working in RStudio, I use Projects ( i.e. create an .Rproj file)



# About today

# Today we will learn to use R + RStudio for

- Wrangling
- Tabulating
- Modeling
- Graphing

We will re-create the analytic report posted on

https://github.com/andkov/hsif-2019-data-analysis

# Things to keep in mind

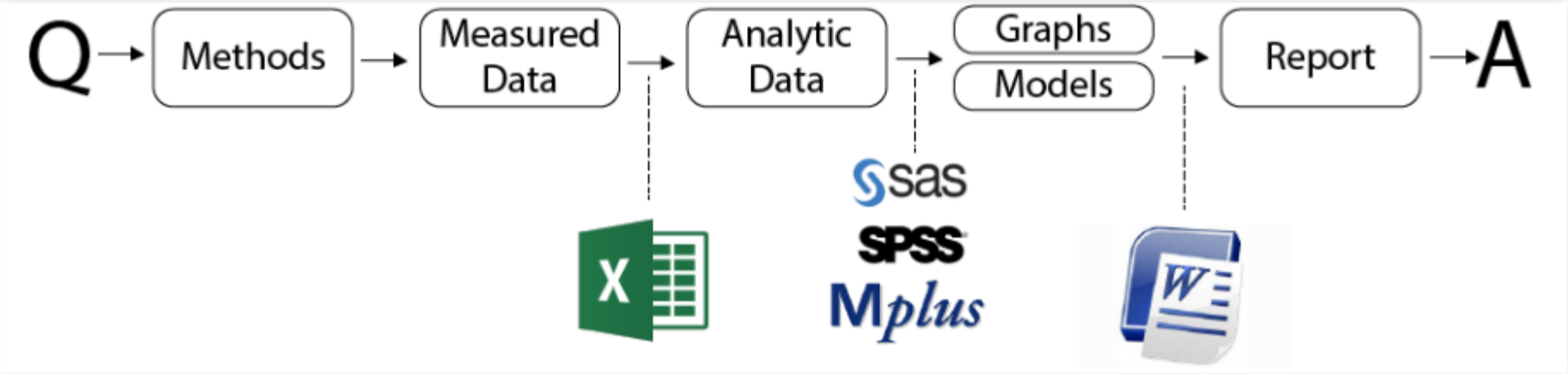
- What makes “data science” a science? Reproducibility

- Principles to keep in mind
  - Scripts are better than GUIs
  - Notebooks are better than scripts
  - Projects are  better than Notebooks

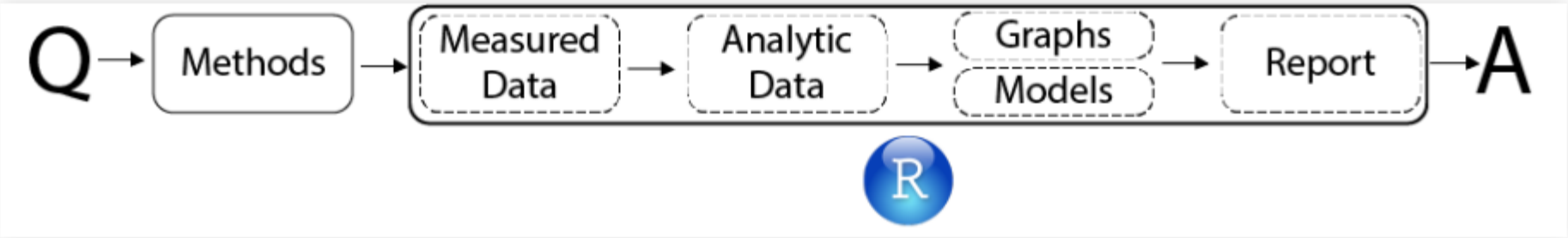
- “*There are only two hard things in programming: cache validation and naming things*” – Unknown
  - Success in Data Science = Craft + Imagination

# Approaches to managing data analysis

## Traditional

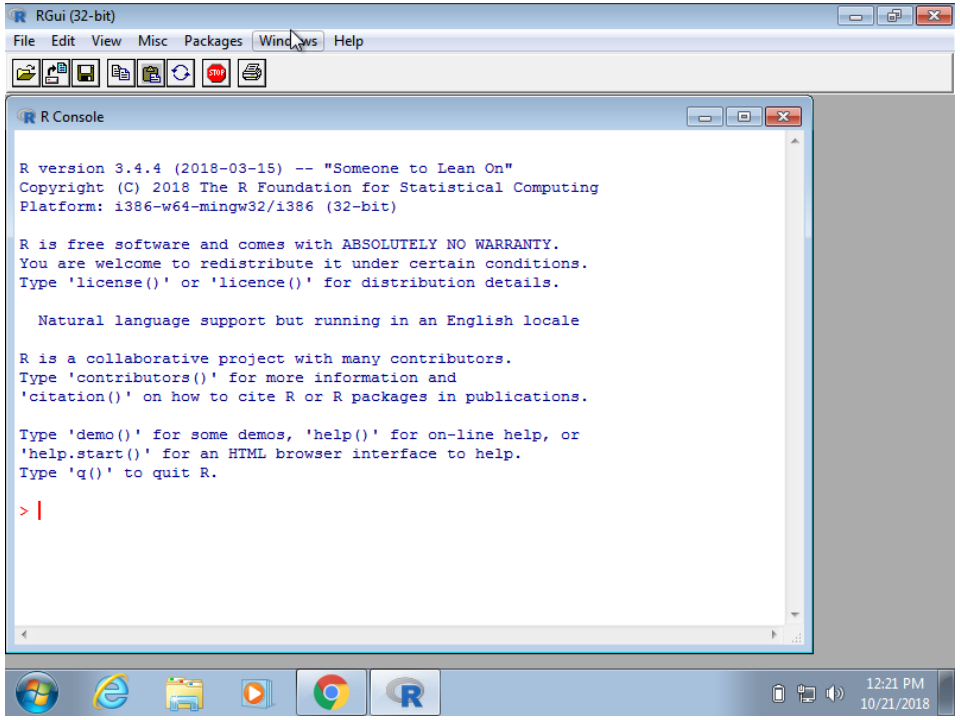


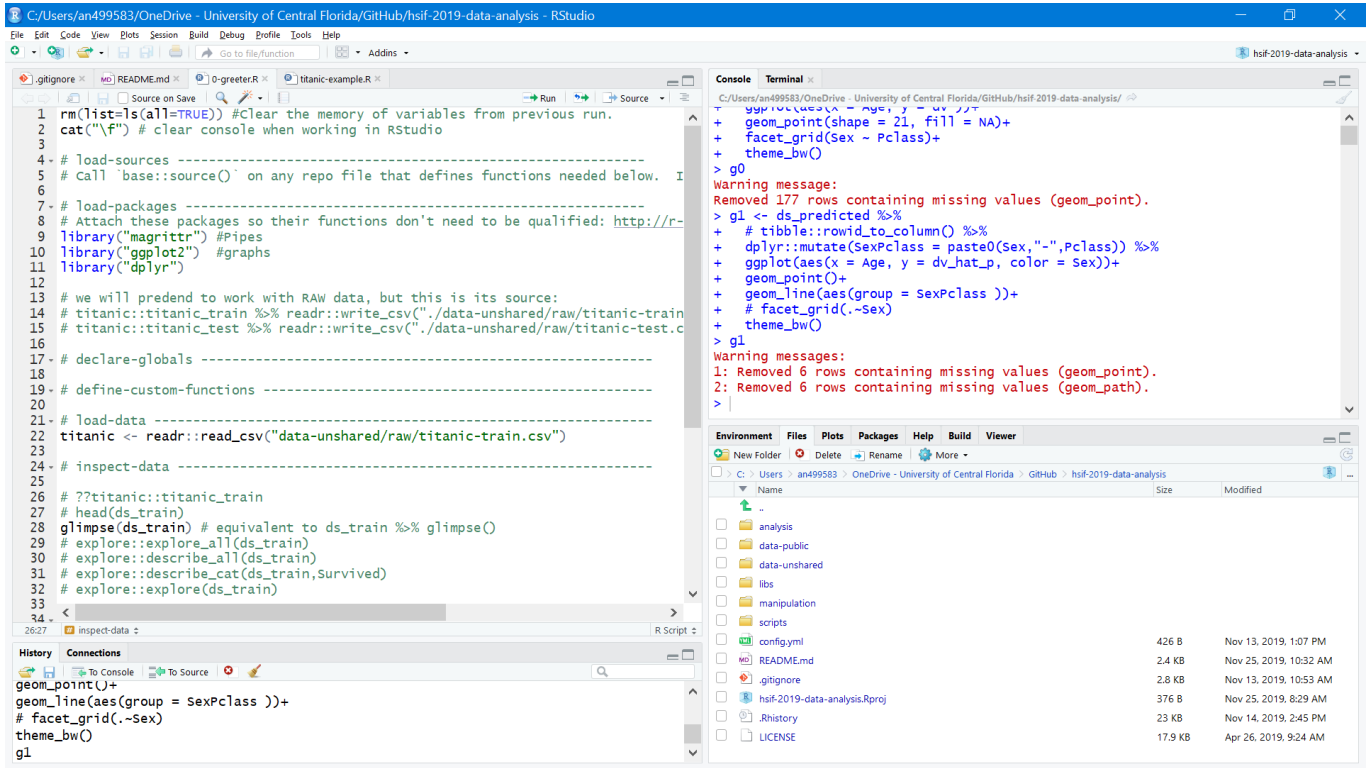

## Reproducible



language

Integrated Development Environment (IDE)



language

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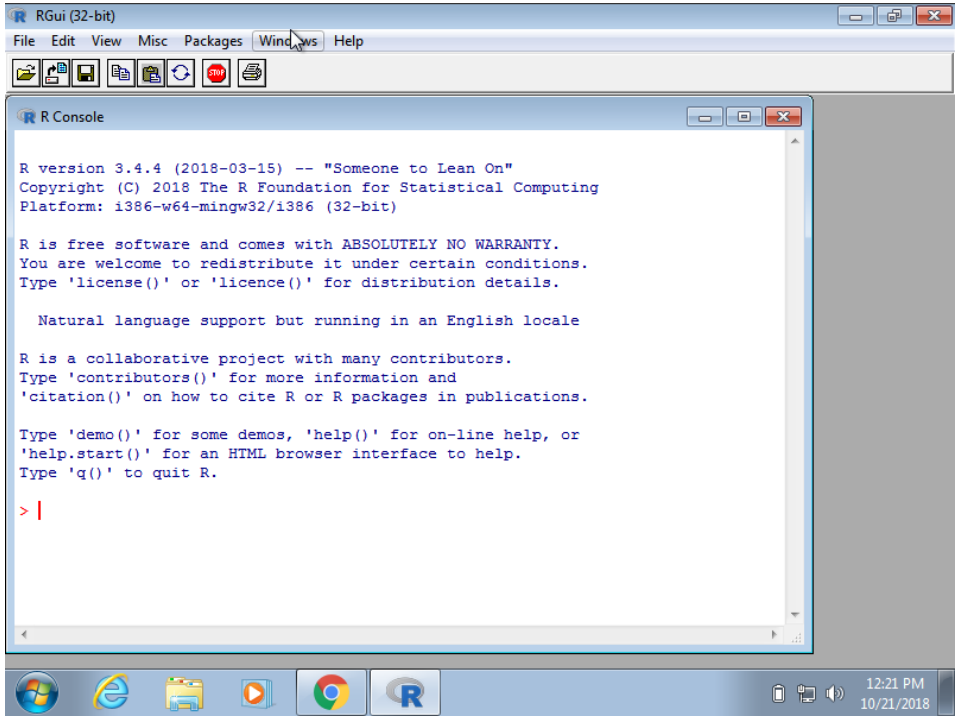
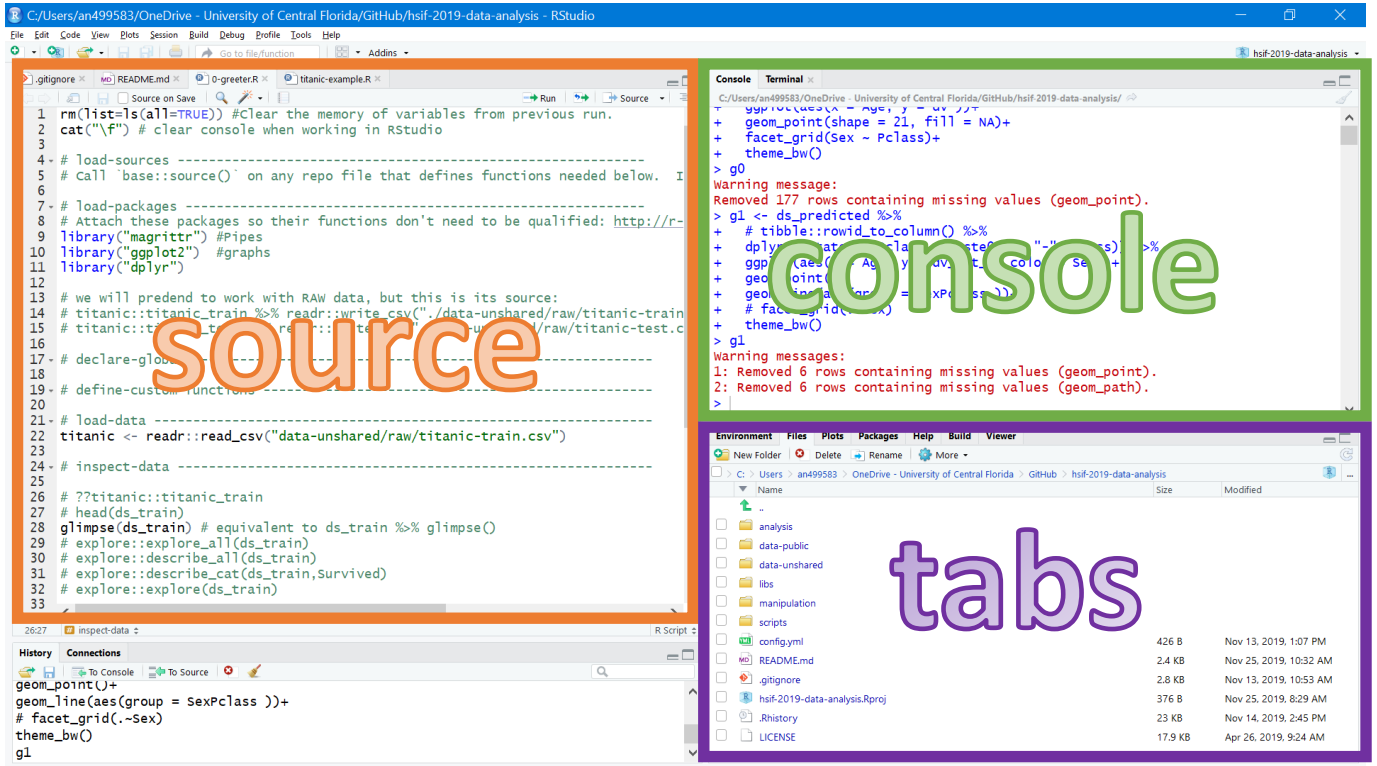
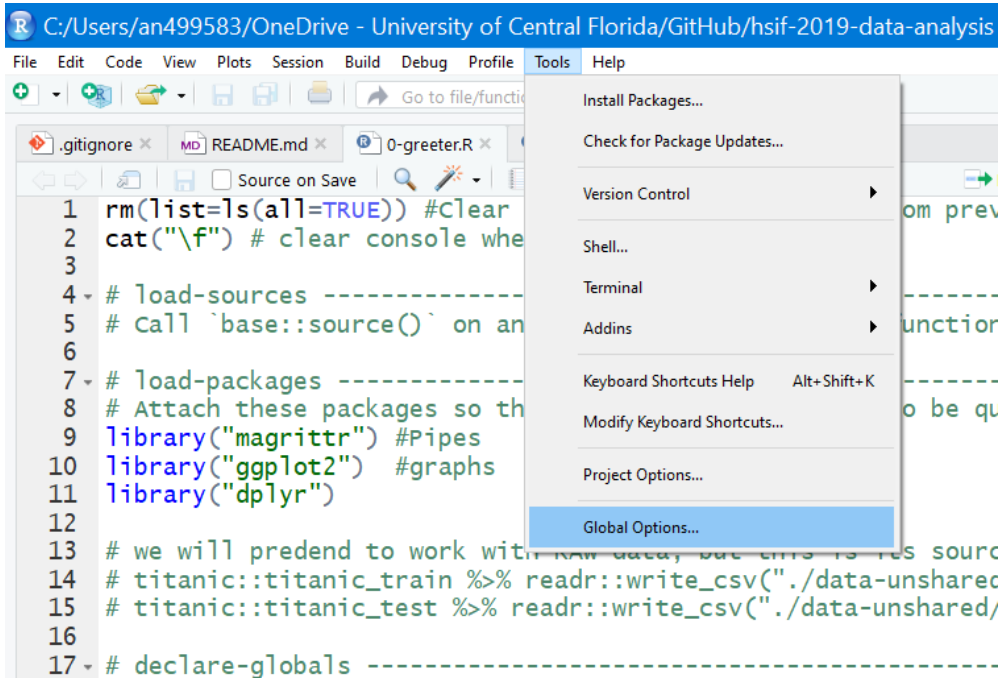
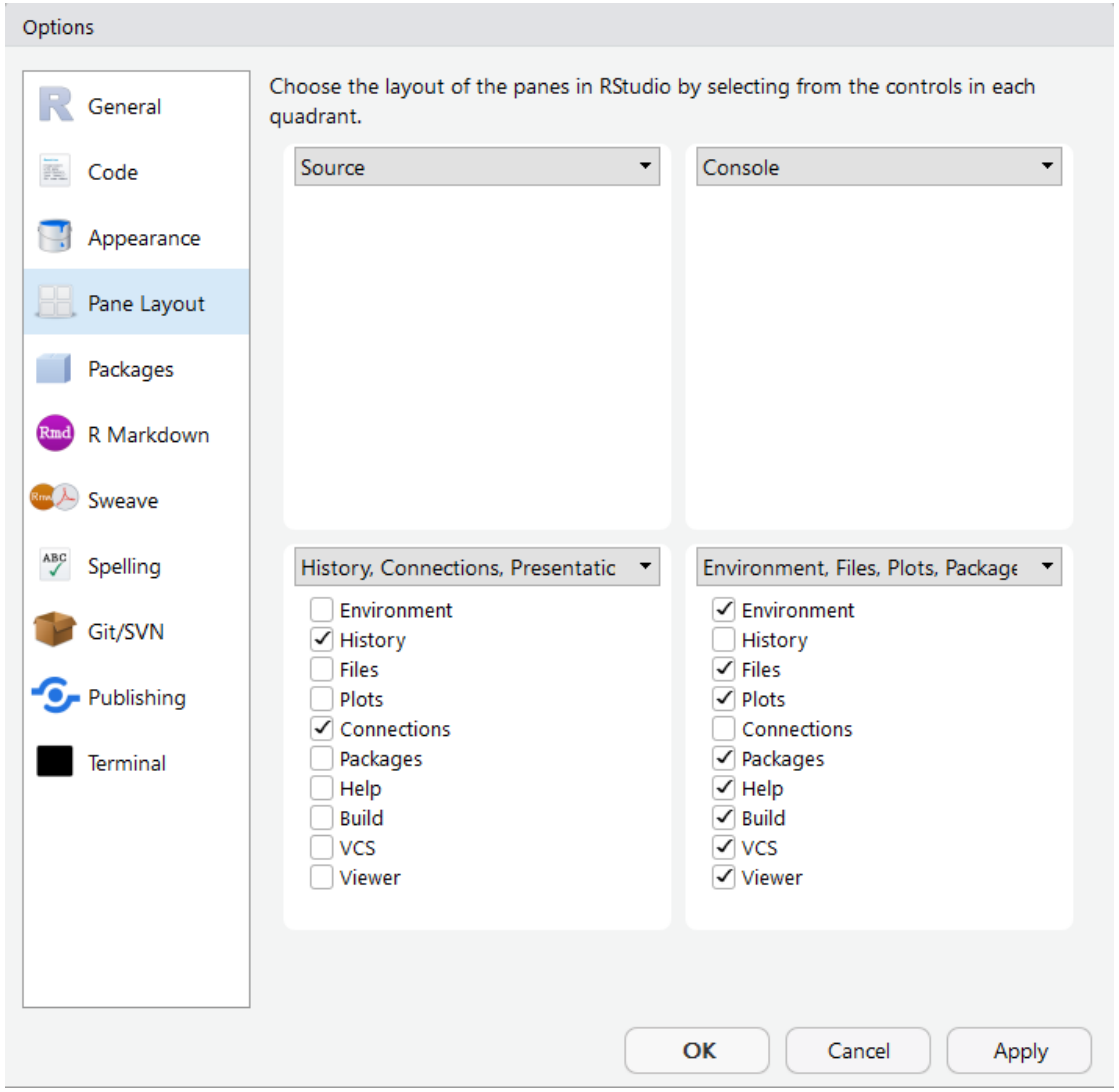


Let us begin!

# Setting up RStudio: Suggested Pane Layout



# In conclusion

# Verbs we have learned today

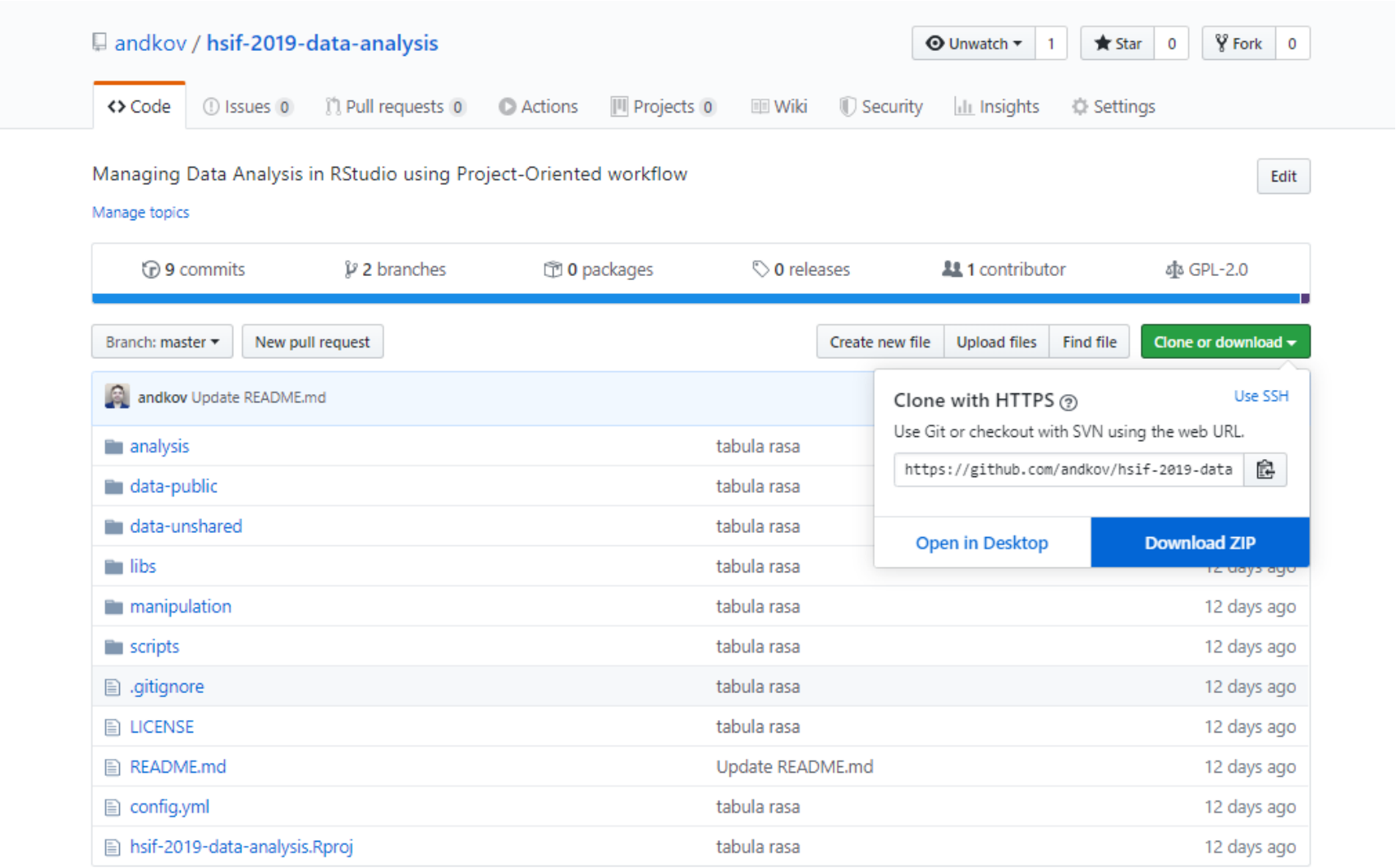
- head()
- dplyr::glimpse()
- explore::describe_all()
- names()
- dplyr::group_by()
- dplyr::summarize()
- tolower()
- dplyr::rename()
- dplyr::mutate()
- factor()

- stats::glm()
- summary()
- predict()
- plogis()

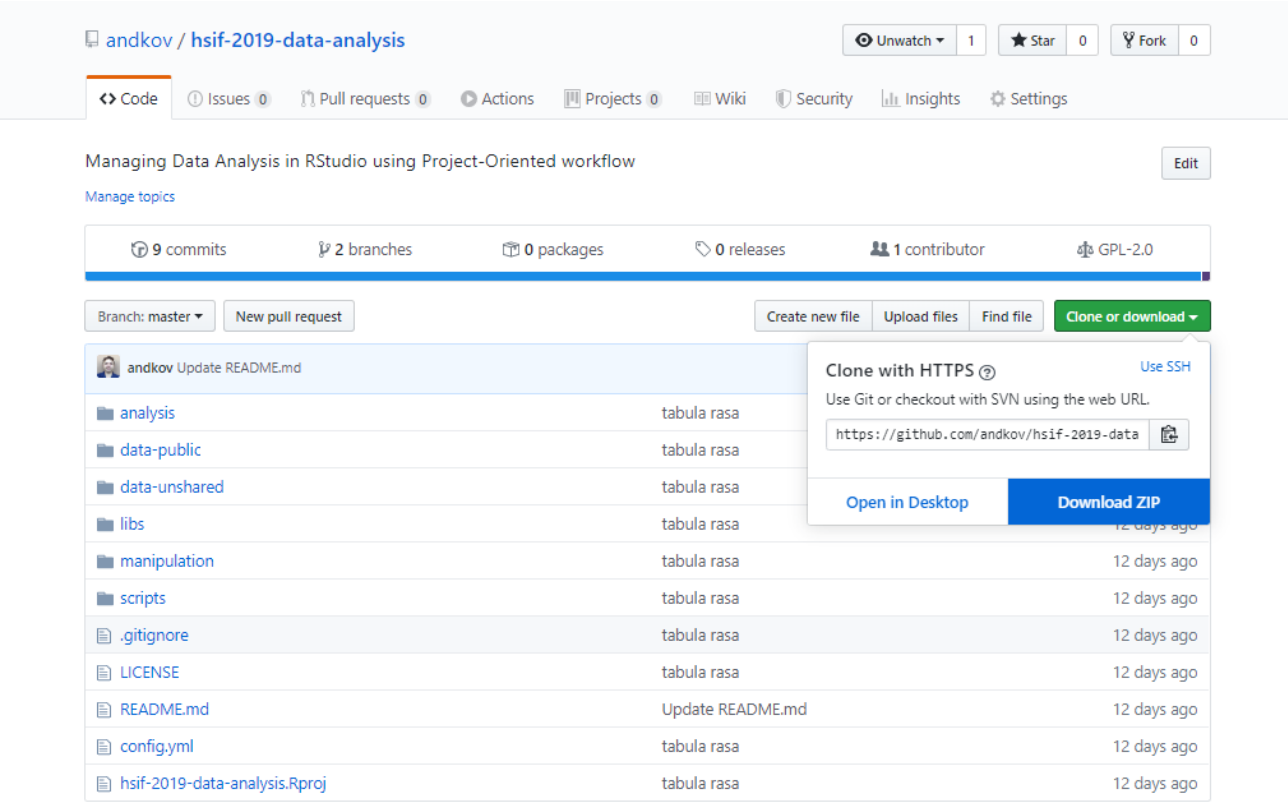
- ggplot()
- geom_bar()
- geom_point(

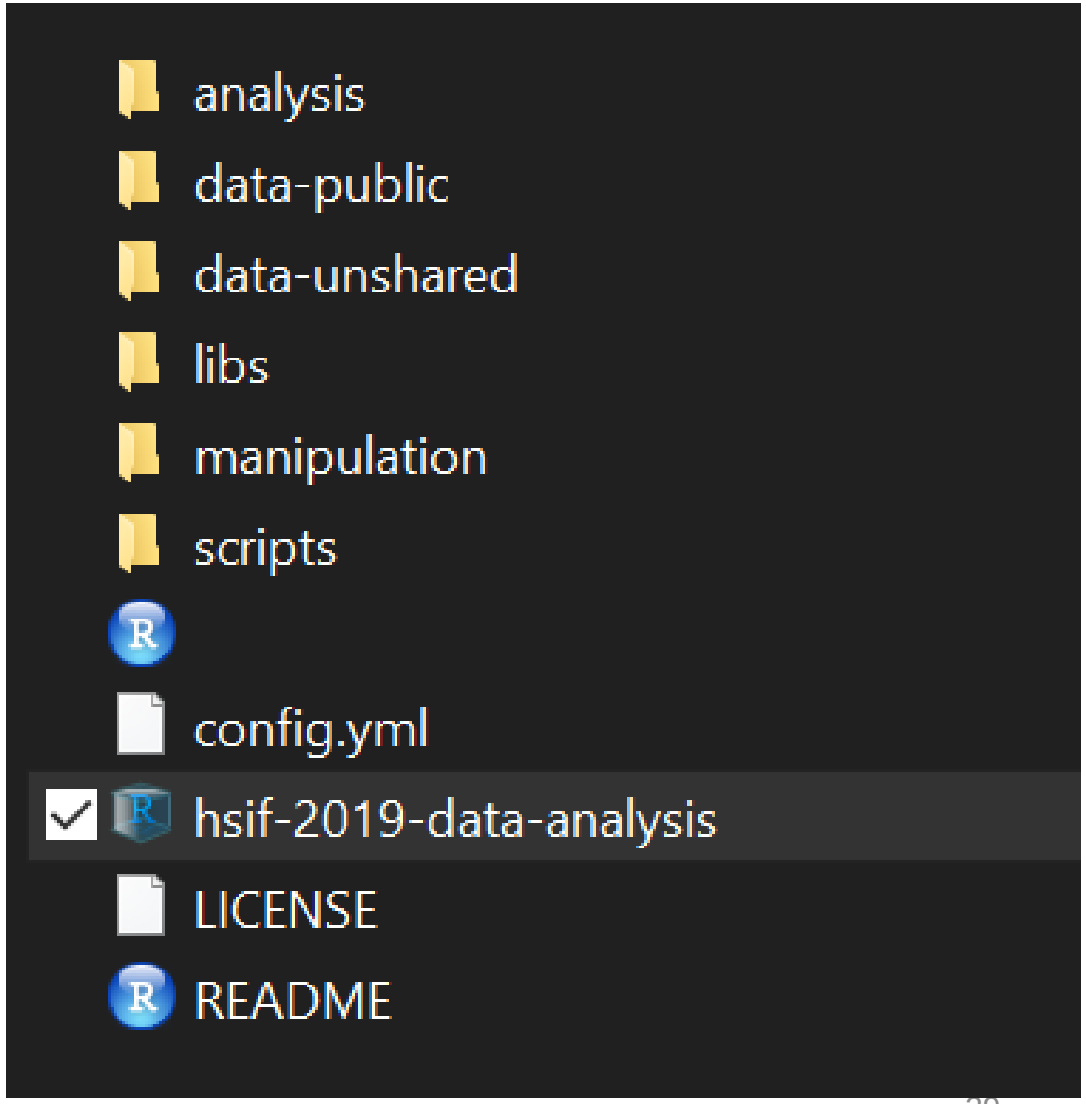
# https://github.com/andkov/hsif-2019-data-analysis

Download repository to view all materials



# Folder Architecture



# Learning Resources

- Rmarkdown guide (https://rmarkdown.rstudio.com/)
- Logistic regression (Youtube: StatQuest + Logistic Regression)
- R4DS (https://r4ds.had.co.nz/) + swirl (https://swirlstats.com/)
- Introduction to ggplot2 (http://www.cookbook-r.com/Graphs/)

# Lessons & Metaphors

- Handle your data! (Vesalius) 
- Look at your data! (Tukey) 
- Graph is art (Tufte) 
- Graph is language (Wickham) 
- Coding is music (Gould) 

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# Questions? Comments?

Andriy Koval

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