A Walk on the R Side

an introduction to R for data analysis

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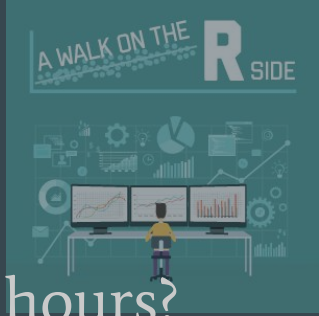
GW Libraries Workshop
Fall 2025

go.gwu.edu/rworkshop

FAQ

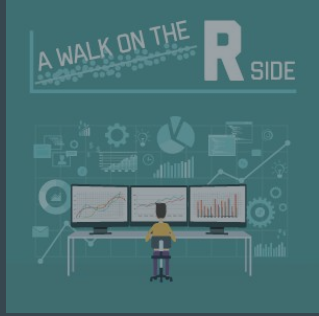


Q: Will you sign my form for Professional Enhancement hours?
A: Yes, email me!

Q: Can I get a copy of your R code?
A: Yes, email me

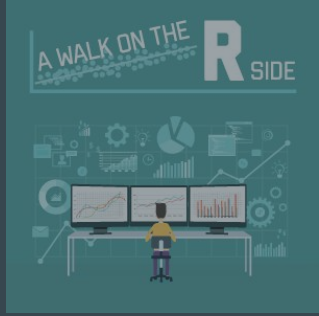
Q: Will this workshop be recorded?
A: No, so hang on for the ride!

Schedule



9:30- 2:30 with a ~1 hr break for lunch

Upcoming R workshops



Sep 9
Workshop
Tue 12:30PM - 4:30PM

A Walk on the R Side: R for Data Analysis and Visualization

This workshop will introduce participants to basic R tasks such as reading data into R, analyzing data, and plotting data.

Sep 12
Workshop
Fri 9:30AM - 11:30AM

Statistical Inference with R: Inference for Continuous Data

Walk through the R functionality you'll need to use when conducting hypothesis tests on continuous variables.

Sep 19
Workshop
Fri 9:30AM - 11:30AM

Statistical Inference with R: Inference for Categorical Data

Walk through the R functionality you'll need to use when conducting hypothesis tests on categorical data.

Sep 22
Workshop
Mon 9:30AM - 12PM

Farther into R: More R for Data Analysis

This workshop builds on R basics with additional topics. Learn to merge and join data, create functions, work with special data types, and more.

Sep 26
Workshop
Fri 9:30AM - 11:30AM

Statistical Inference with R: Linear and Logistic Regression Modeling

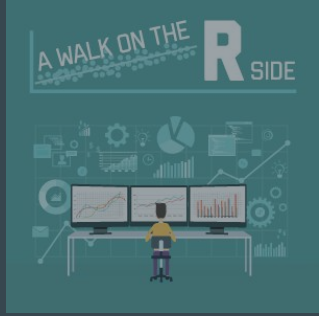
Explore the R functionality you can use to compute correlations between continuous variables, fit and interpret both linear and logistic regression models, and compute associated confidence intervals.

Nov 11
Workshop
Tue 12:30PM - 2:30PM

More Data Visualization in R

Use R to create custom data visualizations for data sets that don't quite fit the classic plot styles.

Goals



Learning Objectives

[Hopefully] You will learn how to do some of the following:

- Set up your laptop with R & RStudio ✅
- Write and run an R program in RStudio
- Variables
- Vectors and data frames
- Read/Import & write/export data files
- Use functions
- Explore data
- "Wrangle" data: Subset, clean, reshape
- Statistics and data visualizations
- Get unstuck: Look for help to overcome obstacles

Acknowledgments

software carpentry

Teaching basic lab skills for research computing

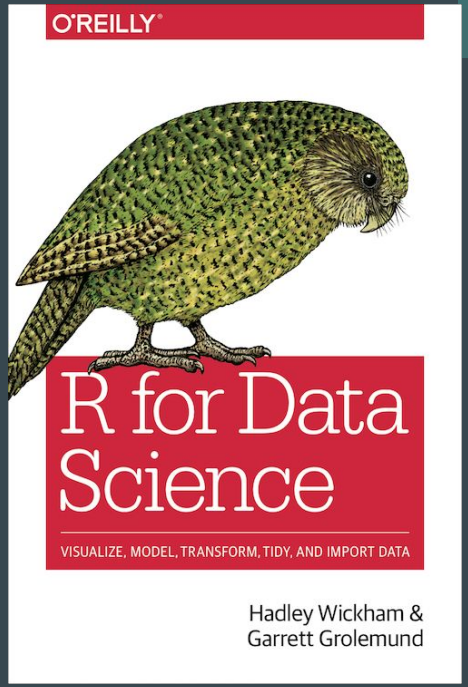
DATA CARPENTRY

BUILDING COMMUNITIES TEACHING UNIVERSAL DATA LITERACY

R Tutorial

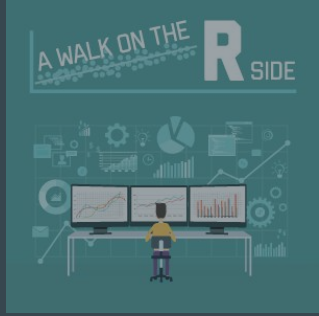
An R Introduction to Statistics

r-tutor.com



r4ds.had.co.nz

Workshop Housekeeping

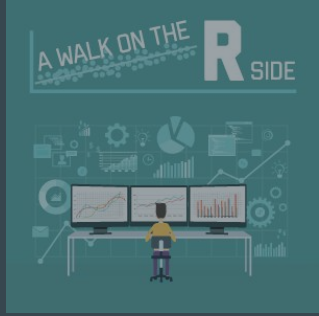


Ask questions! Either via voice or chat

Use chat to help each other out

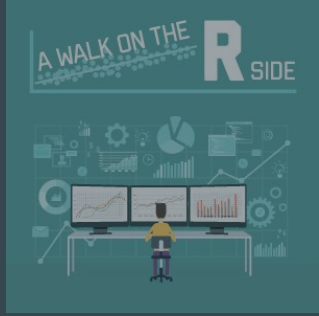
If something is confusing in the workshop, let us know.

About R



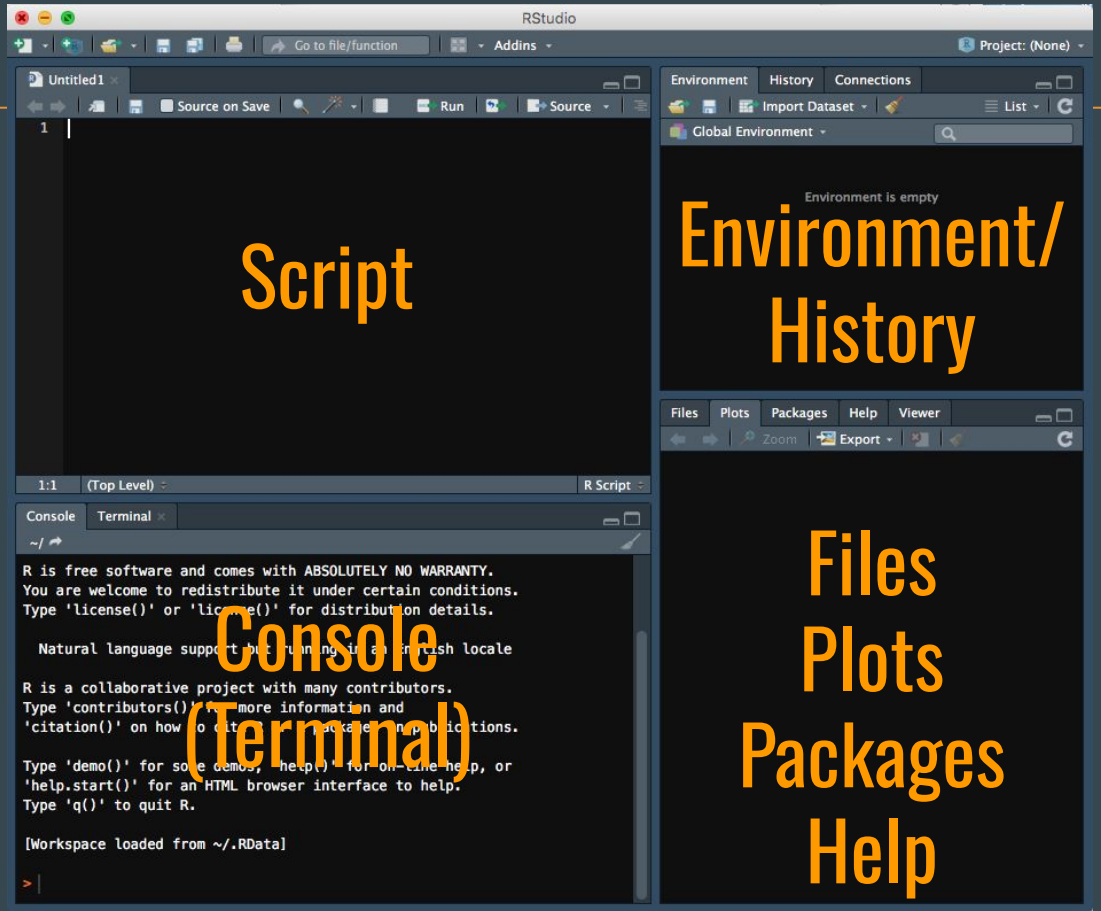
- Free/Open source
- Cross-platform (Mac, Windows, Linux)
- For statistical computing (and data visualization)
- CRAN - r-project.org
  - R packages
  - R journal

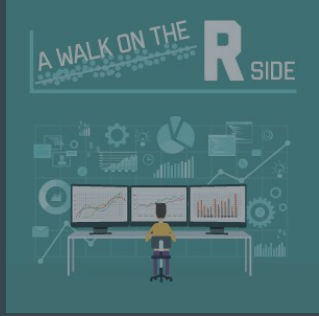
Reasons researchers prefer R



- Scripted language (vs. point/click)
- Features built around working with data
- Reproducibility
- Interdisciplinary
- Extensible
- Beautiful data visualization
- RStudio (Posit) is a well-liked R development app *Also try Positron!
- Community - RStudio Community, Stack Overflow

R Studio


RStudio
Go to file/function
Addins
Project: (None)
Untitled1
Source on Save
Run
Source
Script
Environment
History
Connections
Import Dataset
List
Global Environment
Environment is empty
Environment/
History
Files
Plots
Packages
Help
Viewer
Zoom
Export
Files
Plots
Packages
Help
1:1
(Top Level)
R Script
Console
Terminal
R is free software and comes with ABSOLUTELY NO WARRANTY.
You are welcome to redistribute it under certain conditions.
Type 'license()' or 'licence()' for distribution details.
Natural language support but running in an English locale
R is a collaborative project with many contributors.
Type 'contributors()' for more information and
'citation()' on how to cite R or R packages in publications.
Type 'demo()' for some demos, 'help()' for on-line help, or
'help.start()' for an HTML browser interface to help.
Type 'q()' to quit R.
[Workspace loaded from ~/.RData]
Console
(Terminal)



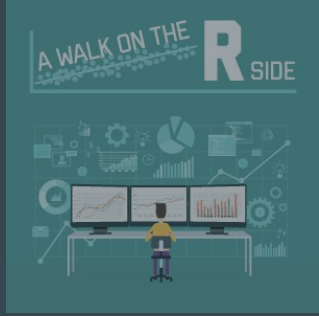
Variables/Objects

"Binding" data to a named object/variable allows you to store data in memory and access it later.

```
x <- 5

y <- c("Washington", "Chicago", "Washington", "Boston")

z <- data.frame(pt_id = c("A001", "B204"), bpm = c(60, 72))
```

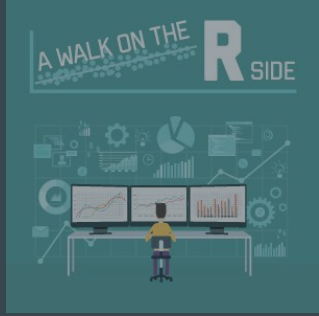


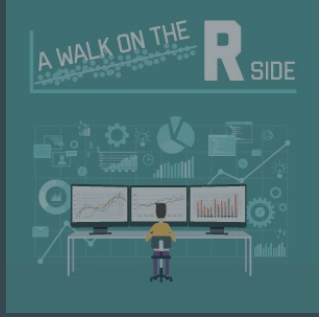
Variables

- Try using R as a "calculator" in the Console
  - Try some mathematical functions, too
- Create some variables
  - variable naming
  - `<-` for assigning values to variables (Option - on Mac, Alt - on Win)
  - numeric, character, logical
  - Watch the Environment pane!
  - `typeof()`
  - Coercion w/ `as.integer, as.character, as.logical, as...`

Logical Expressions

- Operators include:
  ==, <, >, ! (not), & (and), | (or), etc.





Basic Data Structures

Atomic Vector

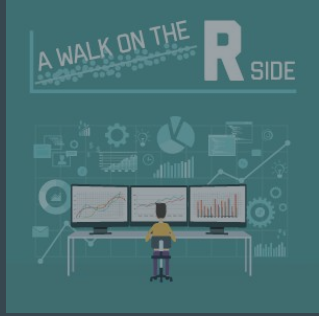
10.2

Vector

1	10.2
2	11.3
3	11.5
4	12.0

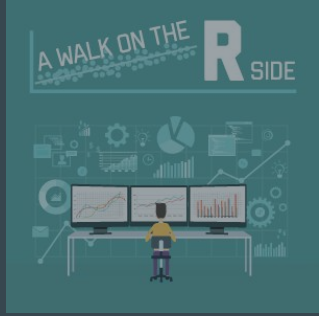
Data Frame

	time	temp	boiling
1	51	10.2	FALSE
2	58	11.3	FALSE
3	63	11.5	FALSE
4	70	12.0	TRUE

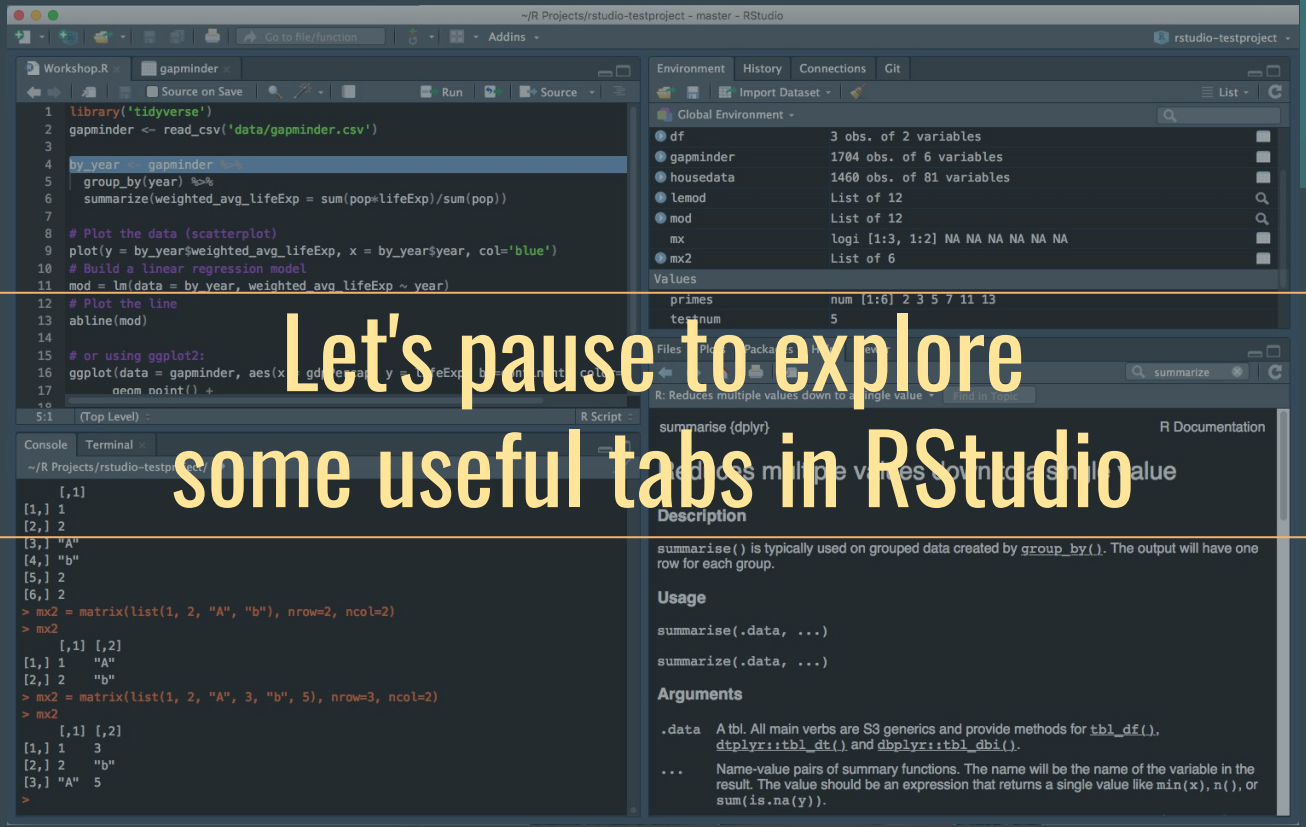


Vectors

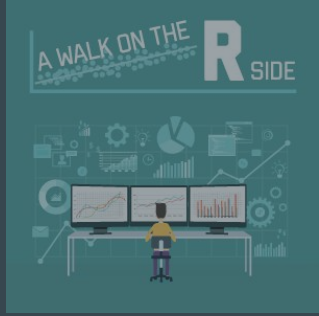
Vectors



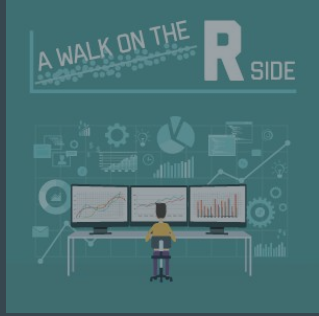
- A vector is
  - A sequence of data elements (components) all of the same type.
- Create vectors with `c()` (short for "combine")



Let's pause to explore some useful tabs in RStudio

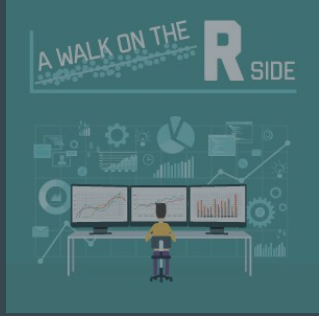


Data Frames

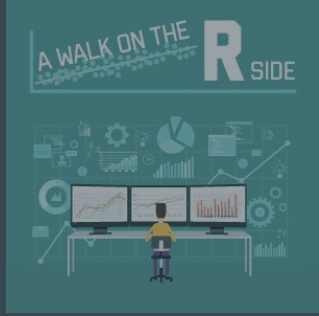


Data Frames

- A **`data.frame`** stores a data table
- Comprised of vectors of equal length.
  Vectors become columns.
- Columns and rows can have names.
- **`tibble`** (from the tibble package) has some advantages over **`data.frame`**

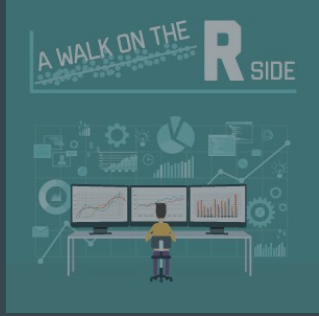


A brief word on `list` and `matrix`



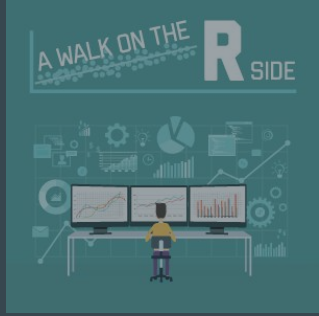
Projects in RStudio

Projects in RStudio

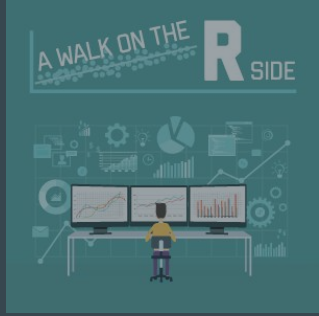


Recommendations:

- Use [Github for] **version control** !
- Create folders to keep things organized



It's time to import some data!



Data Importing

- Prepare data as "tidy"
  - rectangular
  - one table per file
  - rows are observations, columns are variables

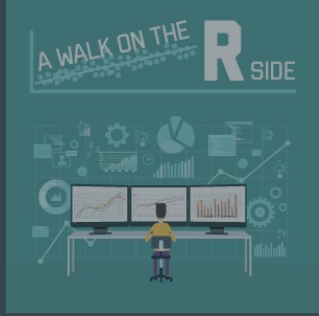
- Formats: CSV, TSV, Excel, Fixed-Width, JSON... and with the right packages: Stata, SPSS, SAS... (using **`rio`** or **`haven`**)

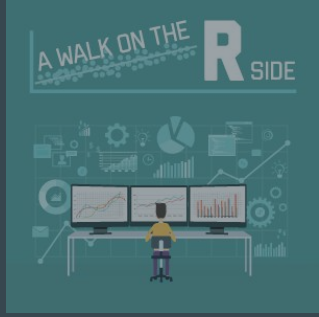
- A word about "big data" (consider **`data.table`**)

R Packages

Installing and loading R packages

- `install.packages('mypackage')`
- `library(mypackage)`



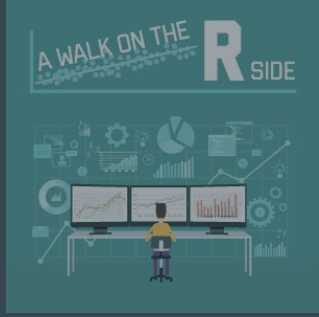


Tidyverse Core Packages

tidyverse.org

- ggplot2 - graphics
- dplyr - data manipulation
- tidyr - tidying data
- readr - reading in data
- tibble - modern data frame
- purrr - functional programming

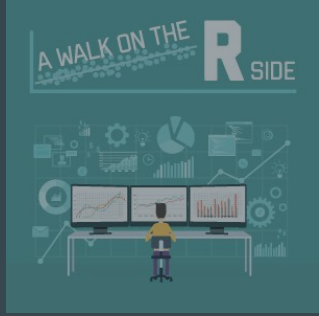
Other often-used R packages



Loading in various data file types	haven, readxl
Mapping	rgdal, tmap, leaflet
Analyzing 2D and 3D shapes	geomorph
Genomic data	bioconductor
Cluster analyses	cluster
Time series data	forecast
Text mining	qdap, sentimentr, tidytext
graph/network analysis	igraph, sna
Interactive web visualizations	shiny
Web scraping	rvest

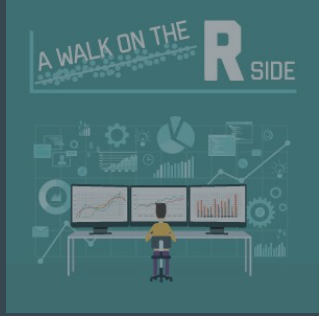
Exploring Data

- head, tail
- subsetting
- slicing and dicing



Data Wrangling

flickr.com/photos/thewomensmuseum/3607075017

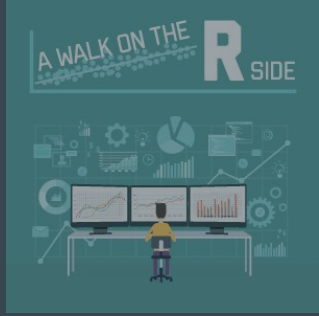


Data Transformation using the dplyr package

- select() # keep only certain columns
- filter() # keep only certain rows
- mutate() # add/modify variables
- group_by() %>% summarize()
  # compute summary statistics per group
- arrange() # order by a variable
- dropna() # drop rows with NAs in specified vars.

You will want to use a "pipe": %>%

(shortcut: control-shift-M)



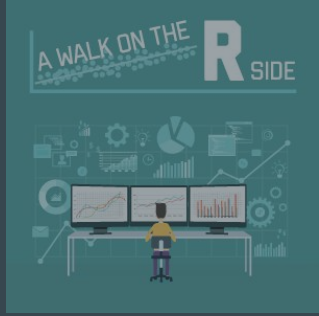
Joining with dplyr

"Merge" tables together

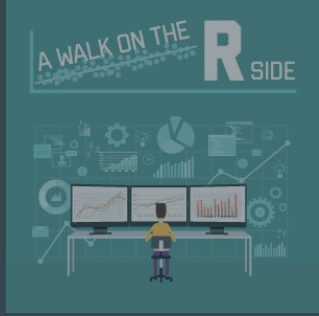
- left_join()
- right_join()
- ...

Data Tidying/Reshaping with tidyr

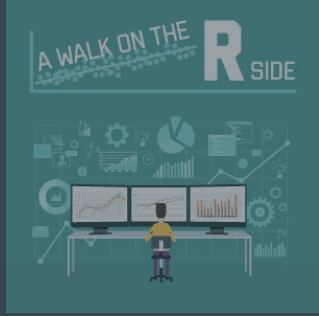
- pivot_wider()
- pivot_longer()
- ...



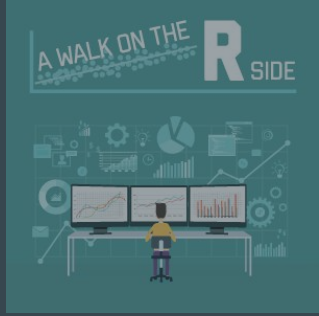
Data Visualization with "base R" and `ggplot`



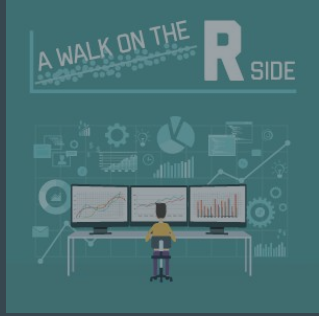
Data Analysis



Functions



R Markdown

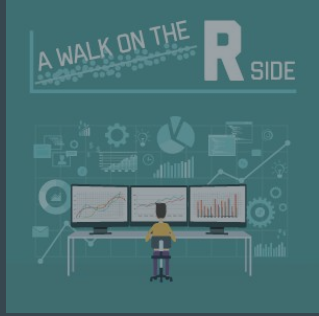


R Markdown

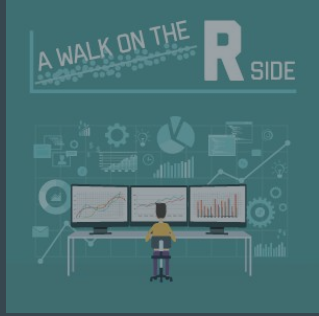
- A format for writing reproducible, dynamic reports with R (as HTML, PDF, MS Word, and more)
- rmarkdown.rstudio.com
- # Header 1
  ## Header 2
  Italic ****bold****
- Insert R code directly into your document

  ```
  ```{r setup}
  # your R code goes here
  ```
  ```

- Include LaTeX code with $ or $$

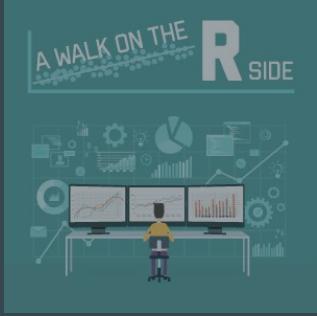


R Shiny

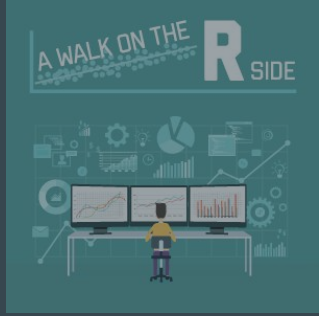


Parting thoughts

Recommended practices

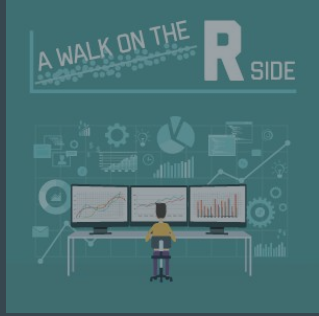


- Use Projects in RStudio
  - Set up folders
- Use tidyverse packages (dplyr, tidyr, etc.) to wrangle your data
- Leave raw data raw
- 🧹 Empty out your variables, then make sure your script runs from the top
- Learn by finding and using working examples



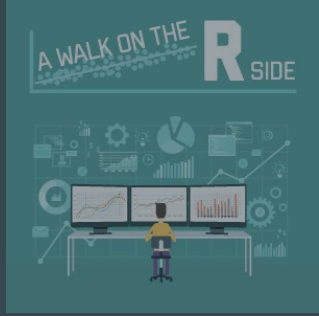
Some Handy R Links

NEW for 2024!! R "libguide"



Only the best R links:

libguides.gwu.edu/Rstats



Thanks!

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These slides: go.gwu.edu/rworkshop

Statistics focused (+ R/Python/SAS/etc.) appointments w/graduate student consultants: go.gwu.edu/dataconsulting

Appointments with me: calendly.com/kerchner

Coding consultations (**R**, Python, HTML/CSS, etc.): calendly.com/gwul-coding