

DATA VISUALIZATION AND EXPLORATION

ANT 6973

WEEK1

INTRODUCTION, SETUP, AND R BASICS

PLAN FOR TODAY

1. Introductions
2. Orientation
 - Syllabus and course website
 - R and RStudio
3. A few R basics
4. Complete your first in-class activity!

WHO AM I?

Dr. Fernando Campos

- Department of Anthropology
- Email:
fernando.campos@utsa.edu
- Office Hours:
 - Wed, 12:30 pm – 1:30 pm
 - By appointment



WHAT DO I DO?

Dr. Fernando Campos

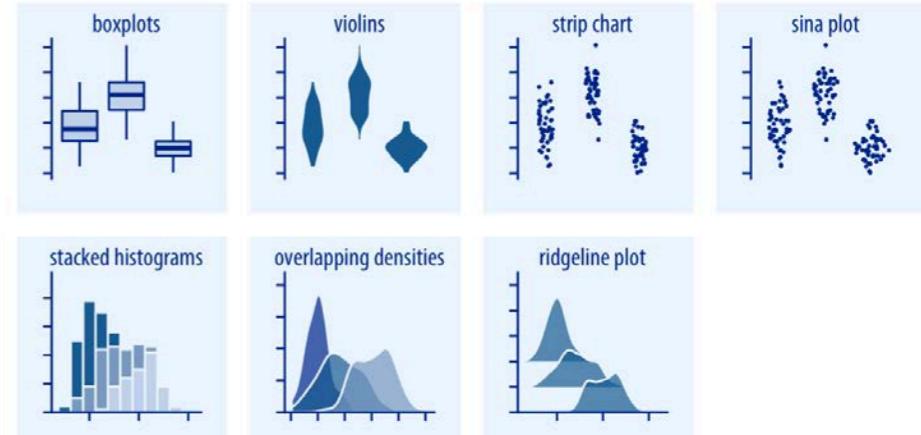
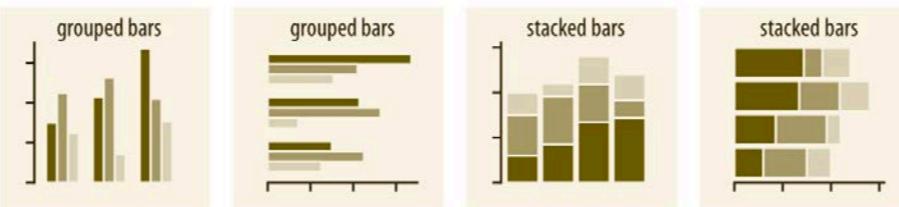
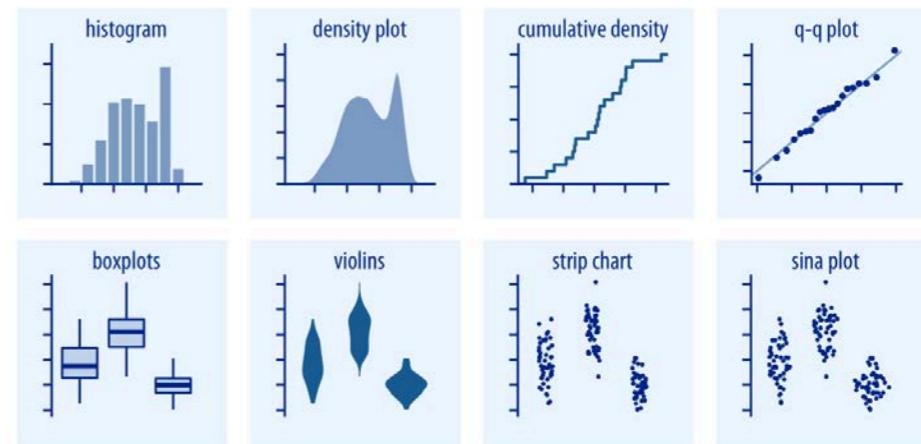
I'm a biological anthropologist, studying the behavioral ecology of wild primates.



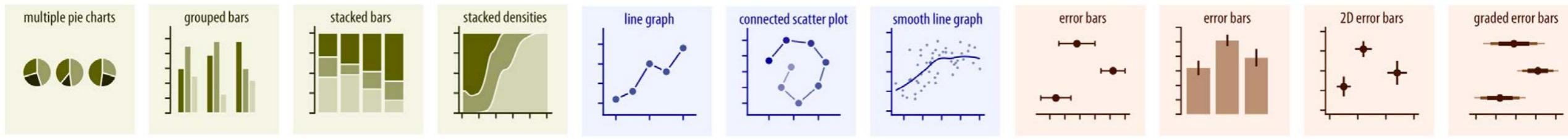
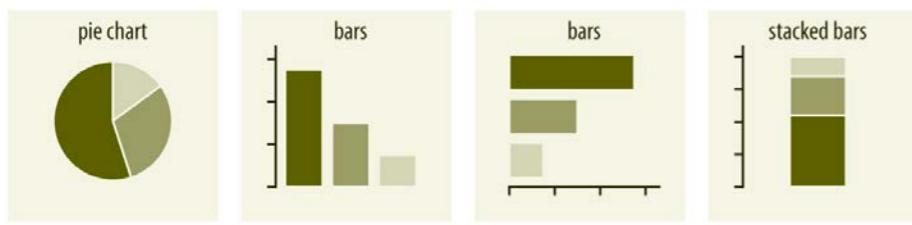
WHY AM I TEACHING
THIS COURSE?

DIRECTORY OF VISUALIZATIONS

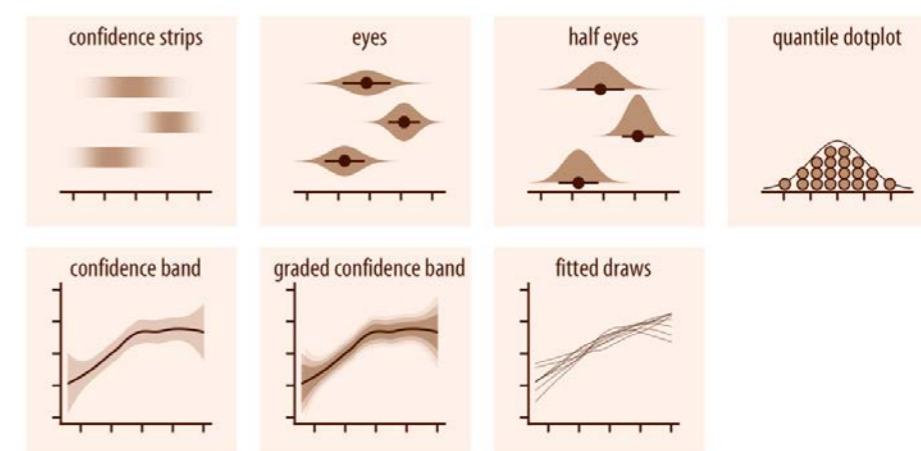
Amounts



Proportions



X-Y Relationships



DATA LITERACY



YOUR TURN

1. Who are you?
2. What are your research interests?
3. What is your experience with data?
4. Do you have any experience using R, and if so, how much?
5. Is there anything specific that you hope to learn in this course?



ORIENTATION

ORIENTATION

- Syllabus and course website
- R and RStudio

COURSE WEBSITE

- [https://www.campos-lab.net/
courses/data-viz/](https://www.campos-lab.net/courses/data-viz/)
- Bookmark it!
- Go here for up-to-date information, schedule, assignments, readings, etc.
- I'll use Canvas only for posting grades.
- Let's explore this a bit...

The screenshot shows a web browser window with the title bar 'ANT 6973: Data Visualization' and the URL 'localhost:6052/index.html'. The page content includes:

- A header section with a decorative graphic, a search bar, and navigation links for 'Home', 'Schedule', and 'Course Policies'.
- A main title 'ANT 6973: Data Visualization and Exploration'.
- A 'Course information' section listing:
 - Instructor: Dr. Fernando Campos
 - Location: Multidisciplinary Studies Bldg 2.03.18
 - Times: Wednesdays 9:00 am – 11:45 am
 - Course: ANT 6973.002
 - CRN: 24022
 - Office Hours: Wed, 12:30 pm – 1:30 pm (email to confirm meeting)
- An 'Overview' section describing the course as designed for graduate students in social or natural sciences to gain experience in data visualization and analysis using R.
- An 'Approach' section stating the course will use a mix of traditional and flipped classroom approaches, with new material introduced in reading assignments prior to class.

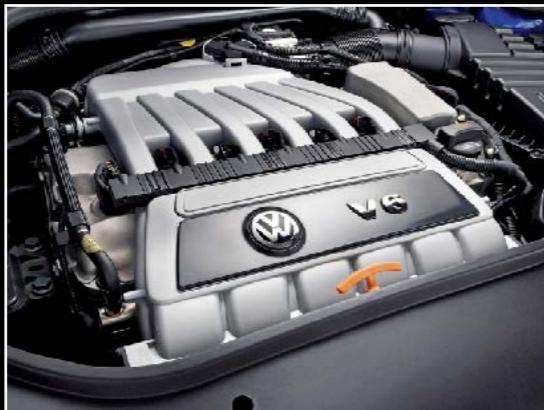
On the right side of the page, there is a sidebar titled 'On this page' with links to 'Course information', 'Overview', 'Approach', and 'Textbooks'.

ORIENTATION

- Syllabus and course website
- R and RStudio

WHAT'S R VS. RSTUDIO?

- R is a programming language.
- RStudio is a nice user interface for R (an *integrated development environment* or IDE) that provides many convenient features and tools for using R.



Engine



Dashboard

WHY R?



- R is the premier data analysis and visualization platform.

```
● ● ● 1. R
Campos-Mac-Mini-2018:~ czx412$ r

R version 3.5.1 (2018-07-02) -- "Feather Spray"
Copyright (C) 2018 The R Foundation for Statistical Computing
Platform: x86_64-apple-darwin15.6.0 (64-bit)

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.

> █
```

WHY LEARN R?

- **Pros (1 of 2):**

- Powerful, state-of-the-art, and used by many researchers, R is becoming a standard for data analysis
- Easy to extend, modify, and improve with add-on packages
 - **Programmable:** if R can't do a particular task right now, you (or someone) can program it
- Freely available for Windows, Mac, Unix



```
● ● ● 1. R
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R version 3.5.1 (2018-07-02) -- "Feather Spray"
Copyright (C) 2018 The R Foundation for Statistical Computing
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'help.start()' for an HTML browser interface to help.
Type 'q()' to quit R.
> |
```

WHY LEARN R?

- **Pros (2 of 2):**

- Reproducibility: R relies on a series of *written commands* rather than pointing and clicking (and this is a good thing!)
- Powerful plotting packages produce publication-quality graphics.
- R has a large and welcoming community.



```
● ● ● 1. R
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R version 3.5.1 (2018-07-02) -- "Feather Spray"
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Type 'q()' to quit R.

> █
```

WHY LEARN R?

- **Cons:**

- Command-based rather than interactive in the point-and-click sense (like SPSS & Excel)
 - Can be significant learning hurdle
 - Specific commands easy to forget
- Documentation sometimes poor
- Still evolving: backward-compatibility has been an issue



```
● ● ● 1. R
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'help.start()' for an HTML browser interface to help.
Type 'q()' to quit R.
> |
```

- Let's make sure we all have a current installation of R.
- <https://cloud.r-project.org/>
- If you already have R installed, it's still a good idea to update.

The Comprehensive R Archive Network



CRAN
[Mirrors](#)
[What's new?](#)
[Search](#)
[CRAN Team](#)

About R
[R Homepage](#)
[The R Journal](#)

Software
[R Sources](#)
[R Binaries](#)
[Packages](#)
[Task Views](#)
[Other](#)

Documentation
[Manuals](#)
[FAQs](#)
[Contributed](#)

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 \(Debian, Fedora/Redhat, Ubuntu\)](#)
- [Download R for macOS](#)
- [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.

Source Code for all Platforms
 Windows and Mac users most likely want to download the precompiled binaries listed in the upper box, not the source code. The sources have to be compiled before you can use them. If you do not know what this means, you probably do not want to do it!

- The latest release (2023-06-16, Beagle Scouts) [R-4.3.1.tar.gz](#), read [what's new](#) in the latest version.
- Sources of [R alpha and beta releases](#) (daily snapshots, created only in time periods before a planned release).
- Daily snapshots of current patched and development versions are [available here](#). Please read about [new features and bug fixes](#) before filing corresponding feature requests or bug reports.
- Source code of older versions of R is [available here](#).
- Contributed extension [packages](#)

Questions About R

- If you have questions about R like how to download and install the software, or what the license terms are, please read our [answers to frequently asked questions](#) before you send an email.

What are R and CRAN?
 R is 'GNU S', a freely available language and environment for statistical computing and graphics which provides a wide variety of statistical and graphical techniques: linear and nonlinear modelling, statistical tests, time series analysis, classification, clustering, etc. Please consult the [R project homepage](#) for further information.

CRAN is a network of ftp and web servers around the world that store identical, up-to-date, versions of code and documentation for R. Please use the CRAN [mirror](#) nearest to

- And a current installation of RStudio.
- <https://posit.co/download/rstudio-desktop/>
- If you already have RStudio installed, check for a new version using menus:
 - Help > Check for Updates

2: Install RStudio

[DOWNLOAD RSTUDIO DESKTOP FOR MACOS 11+](#)

This version of RStudio is only supported on macOS 11 and higher. For earlier macOS environments, please [download a previous version](#).

Size: 380.82 MB | [SHA-256: 184804EA](#) | Version: 2023.06.1+524 | Released: 2023-07-07

All Installers and Tarballs

RStudio requires a 64-bit operating system. If you are on a 32 bit system, you can use [an older version of RStudio](#).

Linux users may need to import [Posit's public code-signing key](#) prior to installation, depending on the operating system's security policy.

OS	Download	Size	SHA-256
Windows 10/11	RSTUDIO-2023.06.1-524.EXE	212.77 MB	A8325AD5
Mac OS X	RSTUDIO-2023.06.1-524.DMG	212.77 MB	8A8325AD5
Linux	RSTUDIO-2023.06.1-524-Linux.tar.gz	212.77 MB	8A8325AD5

LET'S PAUSE UNTIL WE ALL
COMPLETE THESE STEPS



- If you already have RStudio installed, now would be a good time to **check for updates**.
- In RStudio, Help > Check for Updates...

The screenshot shows the RStudio interface with the Help menu open. The 'Check for Updates' option is highlighted with a blue background. The menu also includes links for R Help, Search R Help, About RStudio, Accessibility, RStudio Docs, RStudio Community Forum, Cheat Sheets, Keyboard Shortcuts Help, Markdown Quick Reference, Roxygen Quick Reference, and Diagnostics.

Check for Updates

R Help
Search R Help ^ ⌘ F1

About RStudio

Accessibility >

RStudio Docs

RStudio Community Forum

Cheat Sheets >

Keyboard Shortcuts Help ⌘ K

Markdown Quick Reference

Roxygen Quick Reference

Diagnostics >

Console

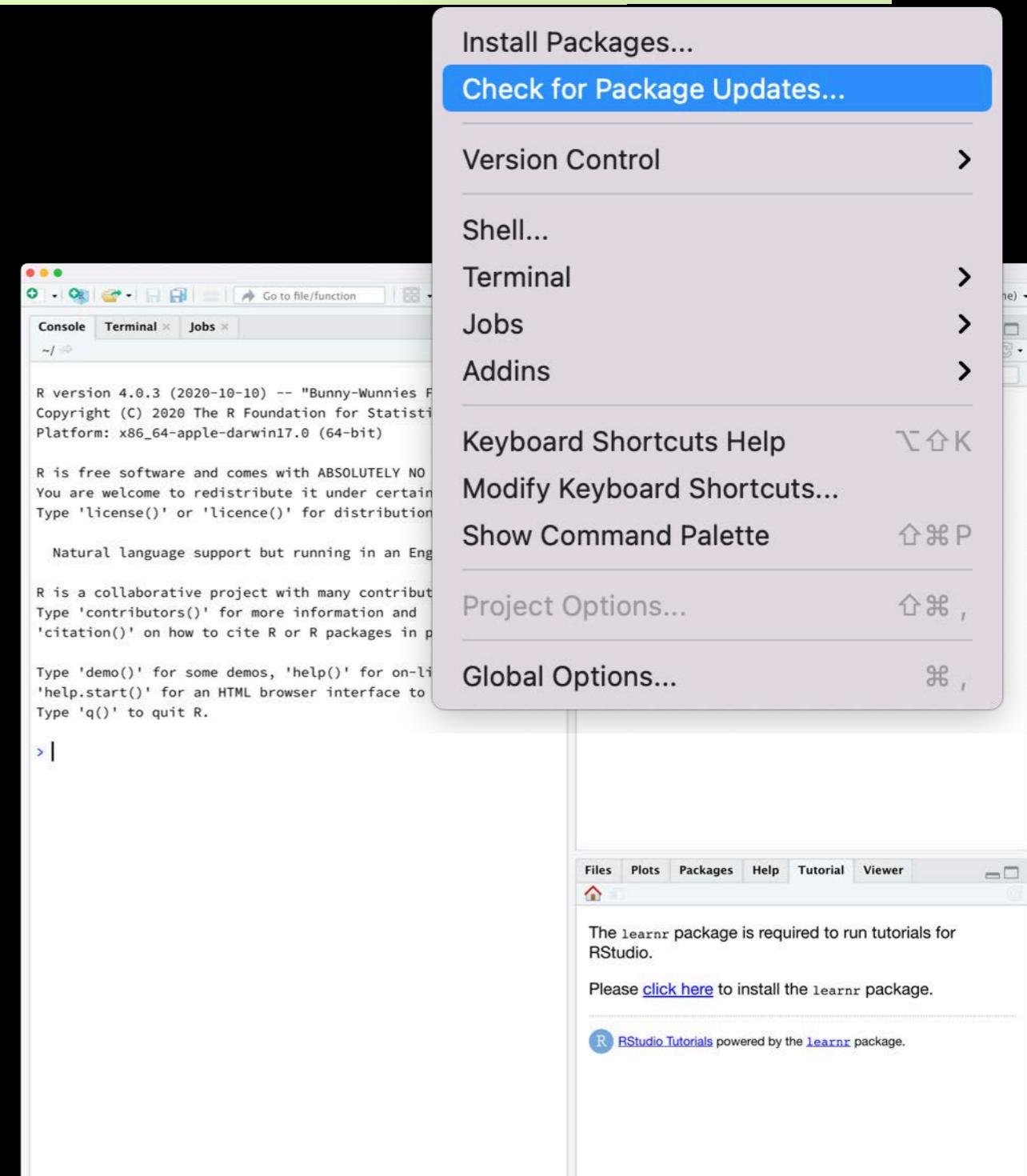
```
R version 4.0.3 (2020-10-10) -  
Copyright (C) 2020 The R Foundation  
Platform: x86_64-apple-darwin11.0.0  
  
R is free software and comes with  
no warranty. You are welcome to redistribute  
it under certain conditions.  
Type 'license()' or 'licence()' for more  
information.  
  
Natural language support but  
no machine translation.  
  
R is a collaborative project with  
many contributors. Type 'contributors()' for  
more information.  
  
Type 'citation()' on how to cite R  
or 'demo()' for some demos,  
'help.start()' for an HTML  
browser-based help system,  
or 'q()' to quit R.  
  
> |
```

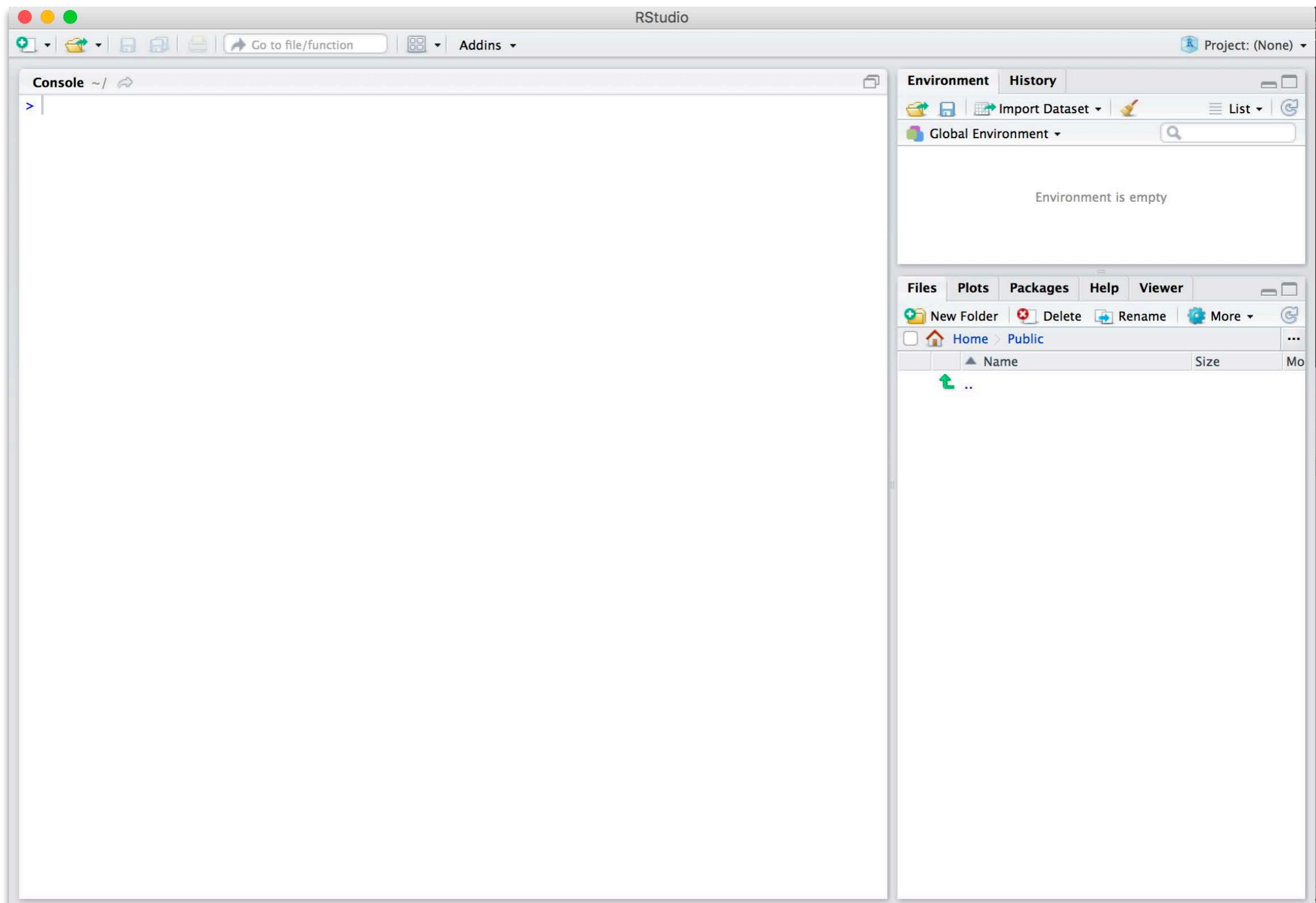
Tutorial

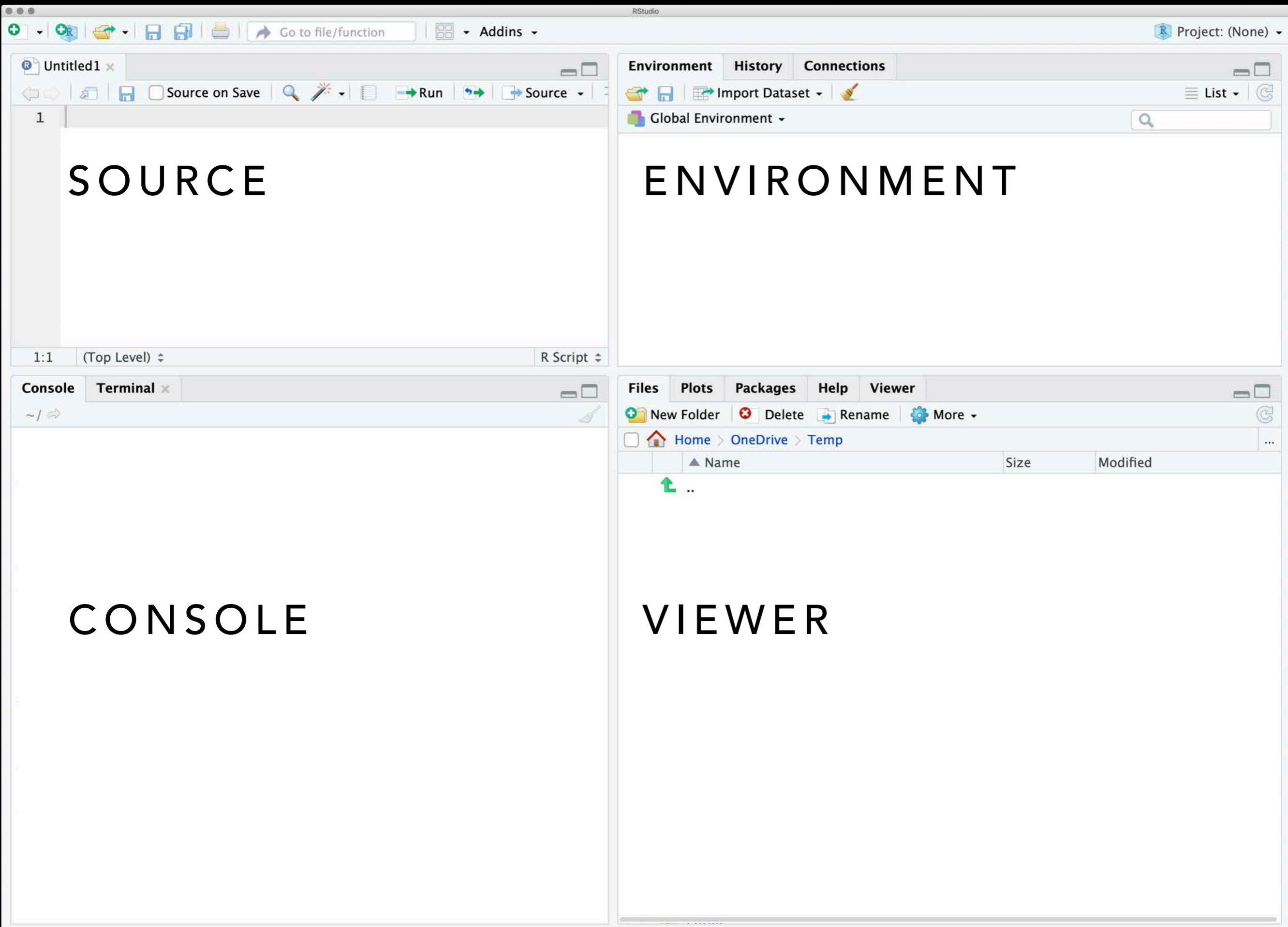
The `learnr` package is required to run tutorials for RStudio.
Please [click here](#) to install the `learnr` package.

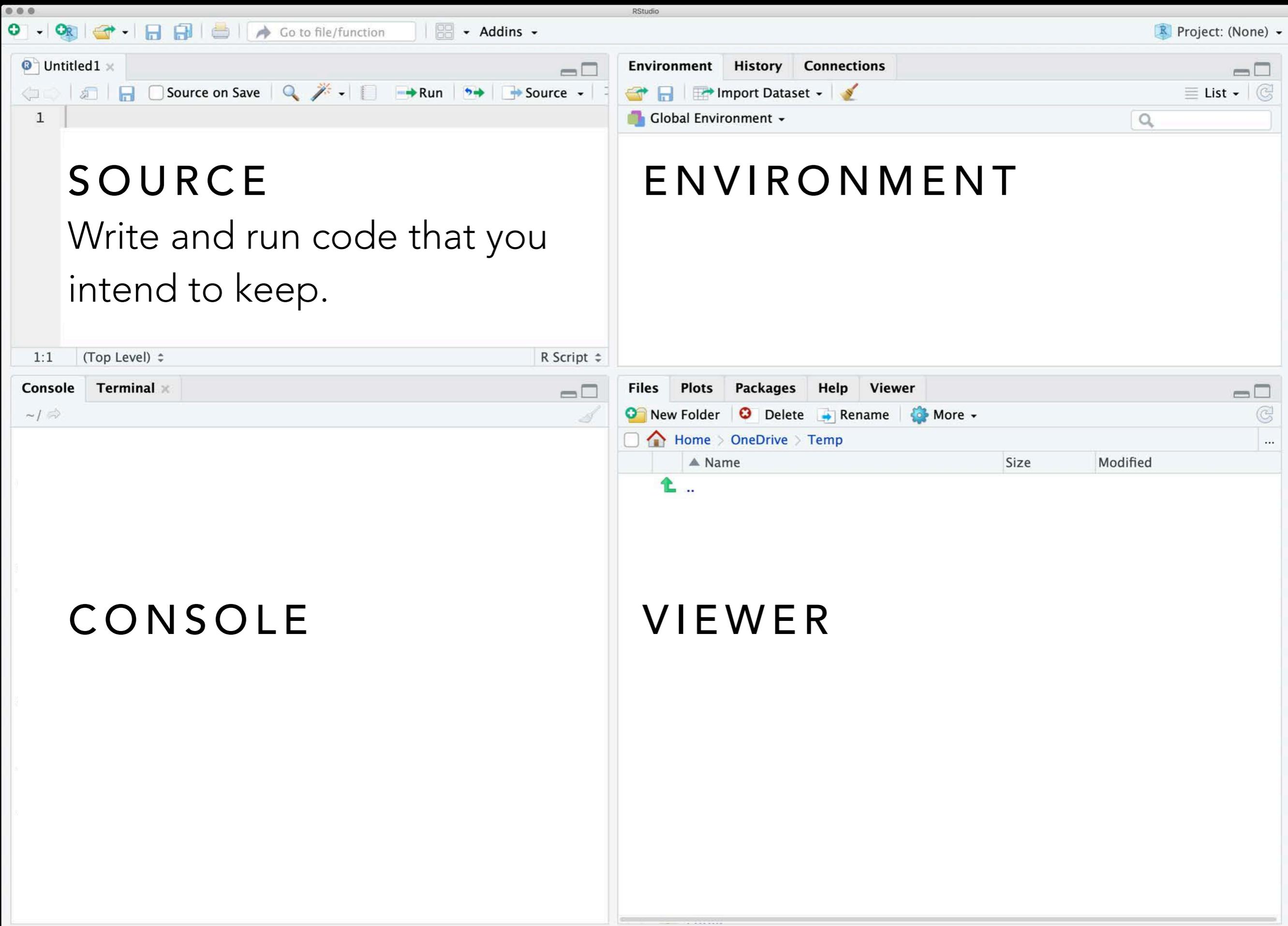
RStudio Tutorials powered by the `learnr` package.

- ... and while you're at it, update all your packages.
- In RStudio, Tools > Check for Package Updates...
- It is good practice to periodically update R and start with a clean slate
 - Outdated packages are a common source of errors









The image shows the RStudio interface with four main sections labeled SOURCE, ENVIRONMENT, CONSOLE, and VIEWER.

- SOURCE**: Located in the top-left pane, it contains a code editor window titled "Untitled1 x". The code editor has tabs for "Source on Save", "Run", and "Source". Below the editor is a status bar showing "1:1 (Top Level) R Script".
- ENVIRONMENT**: Located in the top-right pane, it displays the "Global Environment" tab under the "Environment" tab. It includes a search bar and a "List" button.
- CONSOLE**: Located in the bottom-left pane, it contains a "Console" tab and a "Terminal" tab. The console tab has a command prompt " ~/ ".
- VIEWER**: Located in the bottom-right pane, it shows a file browser window titled "Files". The path is "Home > OneDrive > Temp". The browser includes tabs for "Plots", "Packages", "Help", and "Viewer". It features a toolbar with "New Folder", "Delete", "Rename", and "More" buttons, and a search bar.

The image shows the RStudio IDE interface with four main sections labeled: SOURCE, ENVIRONMENT, CONSOLE, and VIEWER.

SOURCE
Write and run code that you intend to keep.

ENVIRONMENT
View objects, functions, etc.
View command history.

CONSOLE
View executed code. Use sparingly for experimentation.

VIEWER

The RStudio interface includes a top menu bar with File, Edit, View, Insert, Cell, Run, Tools, Help, and Addins. The left pane features a file browser, a source editor with tabs for Untitled1 (R Script), and a console tab. The right pane includes an environment viewer, a file browser, and a viewer pane.

The image shows the RStudio IDE interface with four main sections labeled: SOURCE, ENVIRONMENT, CONSOLE, and VIEWER.

SOURCE
Write and run code that you intend to keep.

ENVIRONMENT
View objects, functions, etc.
View command history.

CONSOLE
View executed code. Use sparingly for experimentation.

VIEWER
View files in working directory, packages, image outputs, etc.

WEEK1

R BASICS

TOPICS

- Some R basics
- Dealing with R Packages

YOUR TURN

Please complete the activity
for this week listed on the
course website under:

Schedule > Assignments

It's short!



BASIC R: IMPORTANT CONCEPTS

- "Running code" involves giving commands to R that are executed in the Console pane.
- You can type each line of code in the Console, but it is a better idea to write a *draft of your code as you go* by using an R script.
 - A script is just a text file that you save R code in.
 - Use **Cmd + Enter** (Mac) or **Ctrl + Enter** (Windows) to run selected lines from your R script.

BASIC R: IMPORTANT CONCEPTS

- Comments (lines that R does not try to evaluate) start with **#**
 - Good code includes lots of comments!
- Computers are stupid: R can't guess what you want to do. Attention to detail is important!

BASIC R: IMPORTANT CONCEPTS

- Values are saved in *objects*, which have names.
 - Names are case-sensitive!
 - When creating objects, aim for short, meaningful names.
 - Style guides recommend names in all lowercase, with words separated by underscores (e.g., **my_name**).
 - Valid names in R cannot start with a number or include the following special symbols: **^ ! \$ @ + - / * [space]**
 - Create new objects using the assignment operator (**<-** which will appear as **←** hereafter)

BASIC R: IMPORTANT CONCEPTS

- You do things using operators and functions.
 - Example operators: `+`, `←`
 - Example functions: `c()`, `mean()`, `summary()`

```
# Combine multiple elements into a vector with c()
primes ← c(2, 3, 5, 7, 11, 13)
```

BASIC R: OPERATORS

ASSIGNMENT OPERATORS

OPERATOR	DESCRIPTION
←	ASSIGN A VALUE TO A NAME
=	SAME BUT MORE LIMITED (DON'T USE FOR NOW)

```
my_name ← "Fernando Campos"  
my_height ← 182
```

Tip: use RStudio shortcut (**⌘ + -** in macOS, **Alt + -** in Windows)

BASIC R: OPERATORS

ARITHMETIC OPERATORS

OPERATOR	DESCRIPTION
+	ADDITION
-	SUBTRACTION
*	MULTIPLICATION
/	DIVISION
^	EXPONENTIATION

```
2 + 4  
2 - 4  
2 * 4  
2 / 4  
2 ^ 4
```

BASIC R: OPERATORS

COMPARISON OPERATORS

OPERATOR	DESCRIPTION
<	LESS THAN
\leq	LESS THAN OR EQUAL TO
>	GREATER THAN
\geq	GREATER THAN OR EQUAL TO
\equiv	EXACTLY EQUAL TO
\neq	NOT EQUAL TO

BASIC R: OPERATORS

COMPARISON OPERATORS

OPERATOR	DESCRIPTION
<	LESS THAN
≤	LESS THAN OR EQUAL TO
>	GREATER THAN
≥	GREATER THAN OR EQUAL TO
=	EXACTLY EQUAL TO
≠	NOT EQUAL TO

Or using font with ligatures:
(Jetbrains mono)



BASIC R: OPERATORS

COMPARISON OPERATORS

OPERATOR	DESCRIPTION
<	LESS THAN
\leq	LESS THAN OR EQUAL TO
>	GREATER THAN
\geq	GREATER THAN OR EQUAL TO
=	EXACTLY EQUAL TO
\neq	NOT EQUAL TO

```
# What kind of values will be returned?
```

```
2 < 4
```

```
2  $\geq$  4
```

```
2 = 4
```

```
2  $\neq$  4
```

BASIC R: OPERATORS

LOGICAL OPERATORS

OPERATOR	DESCRIPTION
!	NOT
	OR
&	AND

```
!TRUE  
TRUE | FALSE  
TRUE & FALSE  
(1 < 5) & (7 > 1)
```

```
my_name ← "Fernando Campos"  
my_height ← 182  
(my_height > 190) | (my_name == "Fernando Campos")
```

BASIC R: IMPORTANT CONCEPTS

- R comes with many built-in **functions**, and packages provide additional specialized functions.
- Data that you pass into a function is called the function's argument.
- Some arguments are optional, some are required. Optional arguments have a default value if none is specified.
- Arguments have names, which you can (but usually should not) omit.
- Nested functions are evaluated inside to outside.

```
round(3.1415)
round(x = 3.1415, digits = 2)
round(mean(1:6), digits = 0)
```

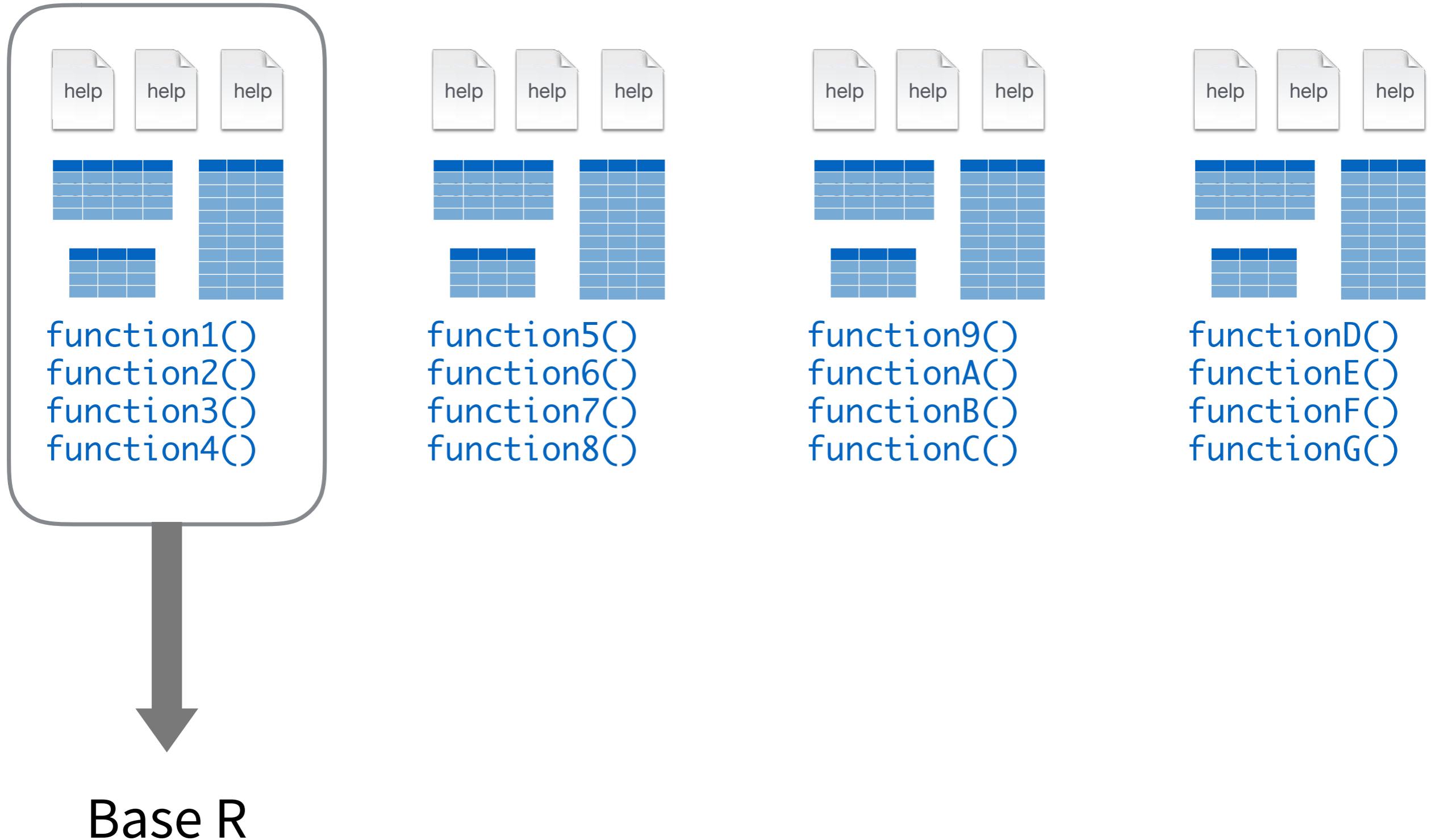
BASIC R: IMPORTANT CONCEPTS

- R uses *element-wise execution*
 - An operation on an object with multiple element is applied to each element in the set.
 - When both objects have multiple elements, they elements are matched up by position and the operations are applied separately to each pair.

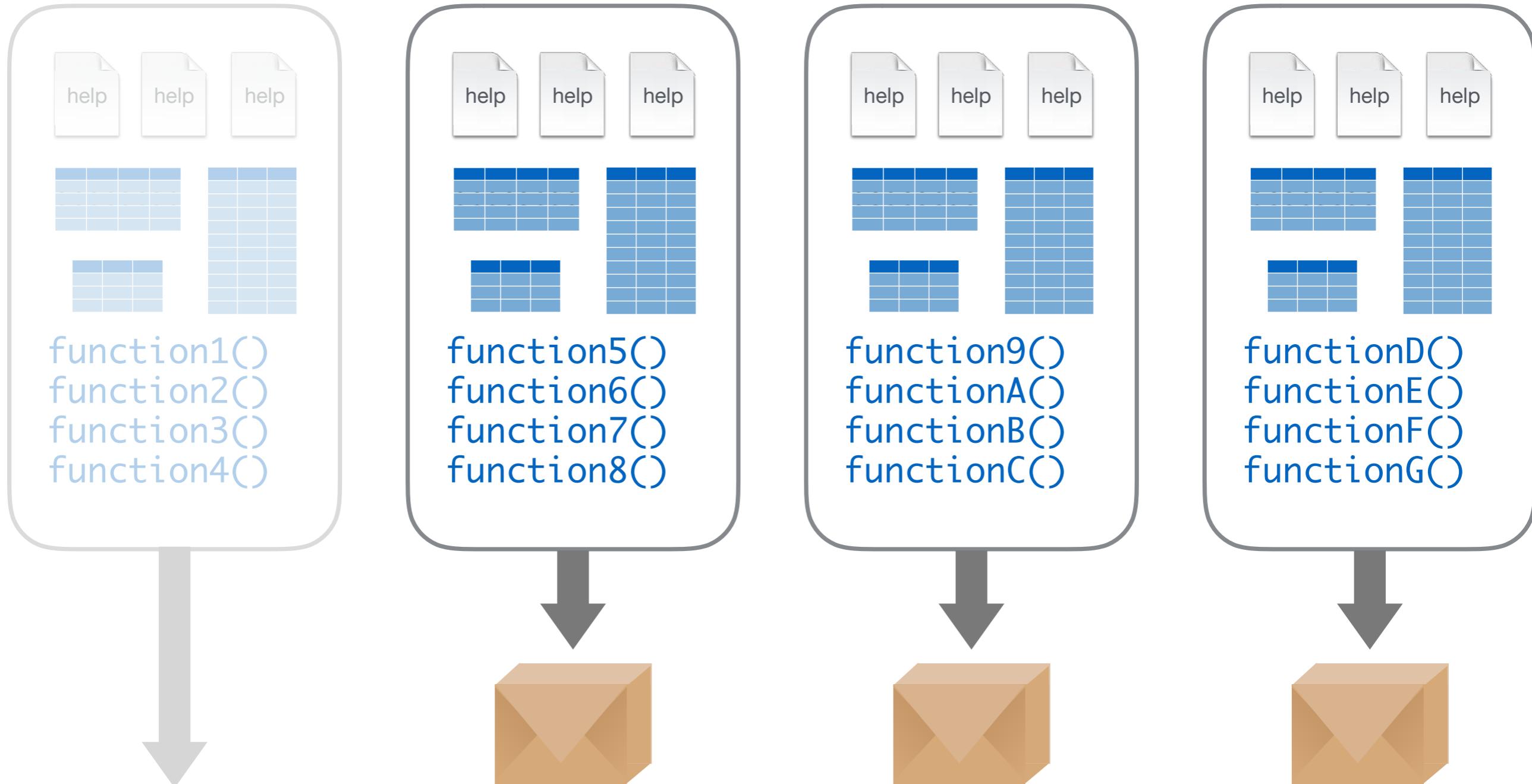
```
dice ← 1:6
dice * 10
dice * dice
dice + c(10, 100)
```

R PACKAGES

R PACKAGES



R PACKAGES



Base R

R Packages

R PACKAGES

The screenshot shows the homepage of The Comprehensive R Archive Network (CRAN). At the top, there's a navigation bar with tabs for "The Comprehensive R Archive" and a search bar with the URL "https://cran.r-project.org". Below the header is the CRAN logo and a sidebar with links to "CRAN Mirrors", "What's new?", "Task Views", and "Search". The main content area features a large blue banner in the center with white text: "There are now > 10,000 R packages on CRAN. You will never use >99% of them." To the right of the banner, the text "Available CRAN Packages By Name" is displayed above a grid of package names and their descriptions. The packages listed include: A3, abbyyR, abc, abc.data, ABC.RAP, abcdeFBA, ABCop, ABCp2, abcfr, abctools, abd, abe, abf2, ABHgenotypeR, abind, abjutils, abn, abnormality, abodOutlier, ABPS, AbsFilterGSEA, AbSim, abstractr, abundant, Ac3net, ACA, acc, and acc. The descriptions for these packages are provided in the grid.

The banner text is:
There are now > 10,000 R packages on CRAN.
You will never use >99% of them.

Available CRAN Packages By Name

A B C D E F G H I J K L M N O P Q R S T U V W X Y Z

Package	Description
A3	Accurate, Adaptable, and Accessible Error Metrics for Predictive Models
abbyyR	Access to Abbyy Optical Character Recognition (OCR) API
abc	Tools for Approximate Bayesian Computation (ABC)
abc.data	Data Only: Tools for Approximate Bayesian Computation (ABC)
ABC.RAP	Array-Based C-Gaussian Analysis Pipeline
abcdeFBA	ABCDE_FBA: A-Biologist-Can-Do-Everything of Flux Balance Analysis with this package
ABCop	Implementation of Artificial Bayesian Computation (ABC) via Optimisation
ABCp2	Approximate Bayesian Computational Model for Estimating P2
abcfr	Approximate Bayesian Computation via Random Forests
abctools	Tools for ABC Analyses
abd	The Analysis of Biological Data
abe	Augmented Backward Elimination
abf2	Load Gap-Free Axon ABF2 Files
ABHgenotypeR	Easy Visualization of ABH Genotypes
abind	Combine Multidimensional Arrays
abjutils	Useful Tools for Jurimetical Analysis Used by the Brazilian Jurimetrics Association
abn	Modelling Multivariate Data with Additive Bayesian Networks
abnormality	Measure a Subject's Abnormality with Respect to a Reference Population
abodOutlier	Angle-Based Outlier Detection
ABPS	The Abnormal Blood Profile Score to Detect Blood Doping
AbsFilterGSEA	Improved False Positive Control of Gene-Permuting GSEA with Absolute Filtering
AbSim	Time Resolved Simulations of Antibody Repertoires
abstractr	An R-Shiny Application for Creating Visual Abstracts
abundant	High-Dimensional Principal Fitted Components and Abundant Regression
Ac3net	Inferring Directional Conservative Causal Core Gene Networks
ACA	Abrupt Change-Point or Aberration Detection in Point Series
acc	Exploring Accelerometer Data

USING PACKAGES

1

```
install.packages("foo")
```

Downloads files to computer

1 x per computer

2

```
library("foo")
```

Loads package

1 x per R Session





1. ORGANIZE YOUR WORK INTO PROJECTS

(more on this next week)



2. ALWAYS START A SESSION
WITH A CLEAN SLATE

RStudio File Edit Code View Plots Session Build Debug Profile Tools Window Help

Install Packages...
Check for Package Updates...

Version Control >

Shell...
Terminal
Jobs
Addins

Keyboard Shortcuts Help ⌘K
Modify Keyboard Shortcuts...
Show Command Palette ⌘P

Project Options... ⌘,

Global Options... ⌘,

RStudio

Console Terminal Jobs

~/Documents/academic-website/ ↵

R version 4.0.3 (2020-10-10) -- "Bunny-Wunnies Freak Out"
Copyright (C) 2020 The R Foundation for Statistical Computing
Platform: x86_64-apple-darwin17.0 (64-bit)

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Type 'q()' to quit R.

> |

Environment History Connections

R Global Environment

Env

Files Plots Packages Help Tutorial Viewer

New Folder Delete Rename More

Home > Documents > academic-website

	Name	Size	Modified
..			
	.gitignore	53 B	Apr 12, 2020, 9:53 AM
	.Rhistory	2 KB	Jan 14, 2021, 10:44 AM
	academic.Rproj	258 B	Jan 14, 2021, 10:44 AM
	assets		
	config		
	content		
	data		
	LICENSE.md	1.1 KB	Apr 12, 2020, 9:51 AM
	public		
	README.md	3.3 KB	Apr 12, 2020, 9:51 AM
	resources		

R version 4.0.3 (2020-10-10) -- "Bunny"
Copyright (C) 2020 The R Foundation for Statistical Computing
Platform: x86_64-apple-darwin17.0 (64-bit)

R is free software and comes with ABSOLUTELY NO WARRANTY.
You are welcome to redistribute it under certain conditions.
Type 'license()' or 'licence()' for details.

Natural language support but running

R is a collaborative project with many contributors.
Type 'contributors()' for more information.
'citation()' on how to cite R or R packages.

Type 'demo()' for some demos, 'help()' or 'help.start()' for an HTML browser interface.
Type 'q()' to quit R.

>

Project: (None)

Console Terminal Jobs

~/Documents/academic-website/

Options General

Code Console Appearance Pane Layout Packages R Markdown Sweave Spelling Git/SVN Publishing Terminal Accessibility Python

Basic Graphics Advanced

R Sessions

Default working directory (when not in a project):
~/Documents/academic-website

Restore most recently opened project at startup

Restore previously open source documents at startup

Workspace

Restore .RData into workspace at startup

Save workspace to .RData on exit:

History

Always save history (even when not saving .RData)

Remove duplicate entries in history

Other

Wrap around when navigating to previous/next tab

Automatically notify me of updates to RStudio

Send automated crash reports to RStudio

OK Cancel Apply

resources

Size	Modified
53 B	Apr 12, 2020, 9:53 AM
2 KB	Jan 14, 2021, 10:44 AM
258 B	Jan 14, 2021, 10:44 AM
1.1 KB	Apr 12, 2020, 9:51 AM
3.3 KB	Apr 12, 2020, 9:51 AM



3. TWO WAYS OF INTERACTING WITH R: CONSOLE AND SCRIPTS

(most of the time, use scripts)

RStudio

Project: (None)

Untitled1*

```
1 2 > 3
2
3 2 + 2 == 4
4
5 isTRUE(2 + 2 == 5)
6
```

Source on Save | Run | Source | Environment | History | Connections | Import Dataset | Global Environment | List | Search

Environment is empty

Files Plots Packages Help Tutorial Viewer

New Folder Delete Rename More

Home > Documents > academic-website

	Name	Size	Modified
	..		
	.gitignore	53 B	Apr 12, 2020, 9:53 AM
	.Rhistory	2.2 KB	Jan 19, 2021, 12:51 PM
	academic.Rproj	258 B	Jan 14, 2021, 10:44 AM
	assets		
	config		
	content		
	data		
	LICENSE.md	1.1 KB	Apr 12, 2020, 9:51 AM
	public		
	README.md	3.3 KB	Apr 12, 2020, 9:51 AM
	resources		

Console Terminal Jobs

```
~/Documents/academic-website/
```

```
> 2 > 3
[1] FALSE
> 2 + 2 == 4
[1] TRUE
> isTRUE(2 + 2 == 5)
[1] FALSE
>
```



4. BECOME COMFORTABLE WITH ERROR MESSAGES



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.

```
> my_data <- read.csv("my_data.csv")
Error in file(file, "rt") : cannot open the connection
In addition: Warning message:
In file(file, "rt") :
  cannot open file 'my_data.csv': No such file or directory
> Can you say that in plain English please?
Error: unexpected symbol in "Can you"
> :(
Error: unexpected ':' in ":"
```

> |



5. USE R STUDIO'S TOOLS
TO MAKE LIFE EASIER