

Intro to R

RStudio

Working with R – RStudio

RStudio is an Integrated Development Environment (IDE) for R

- Helps you write code - makes suggestions
- Helps you view the output of your code
- Helps you find errors
- Is NOT a dropdown statistical tool (such as Stata)
 - See [Rcmdr](#) or [Radiant](#)



RStudio

Easier working with R

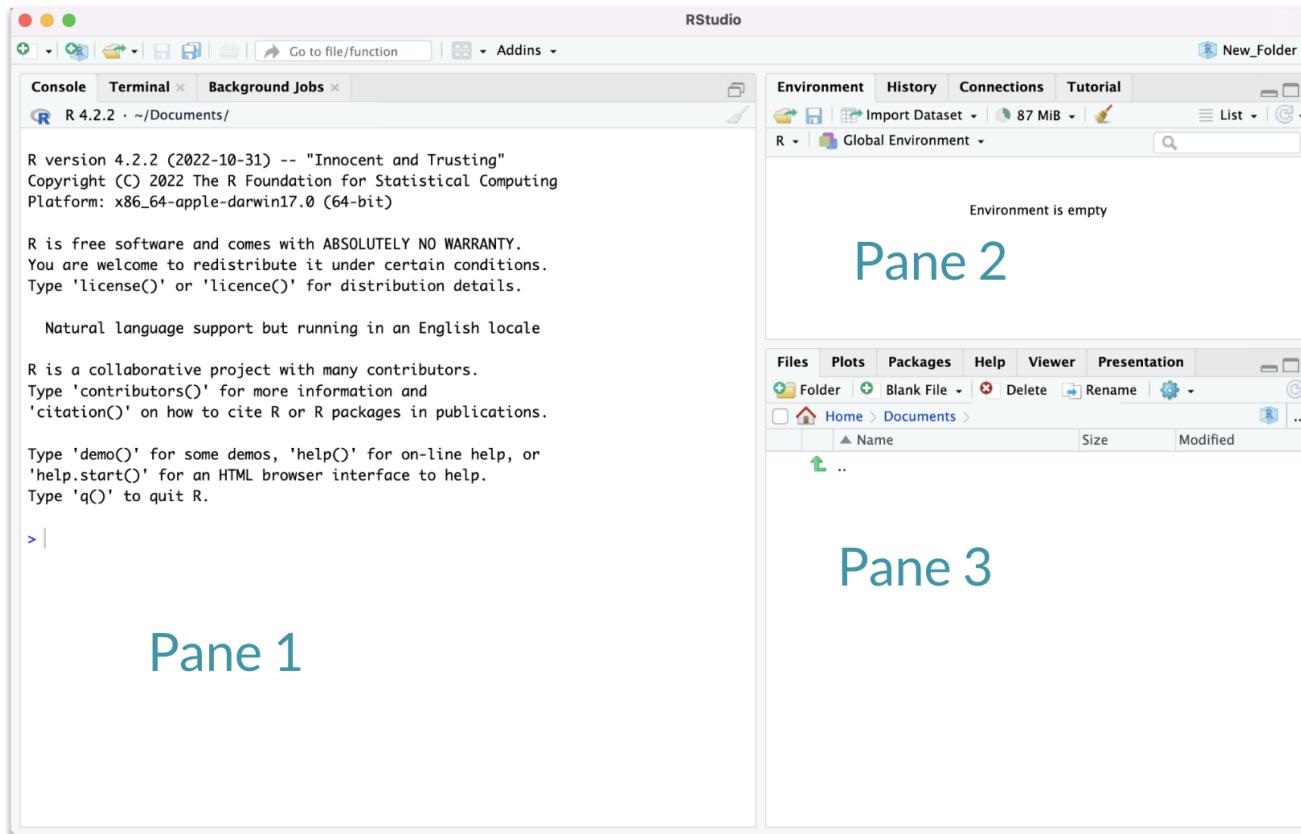
- Syntax highlighting, code completion, and smart indentation
- Easily manage multiple working directories and projects

More information

- Workspace browser and data viewer
- Plot history, zooming, and flexible image and file export
- Integrated R help and documentation

RStudio

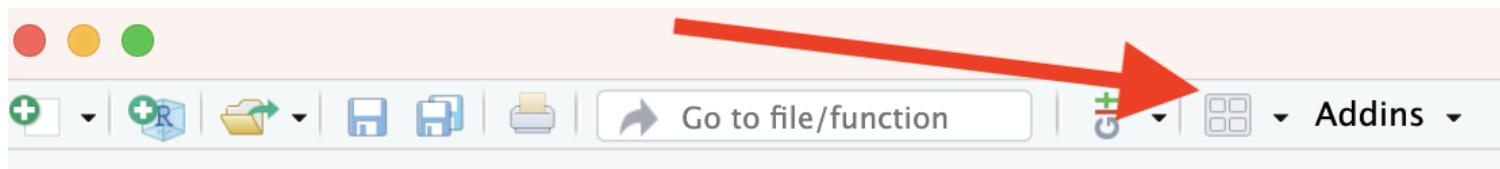
First it is important to be familiar with the layout. When you first open RStudio, you will see 3 panes.



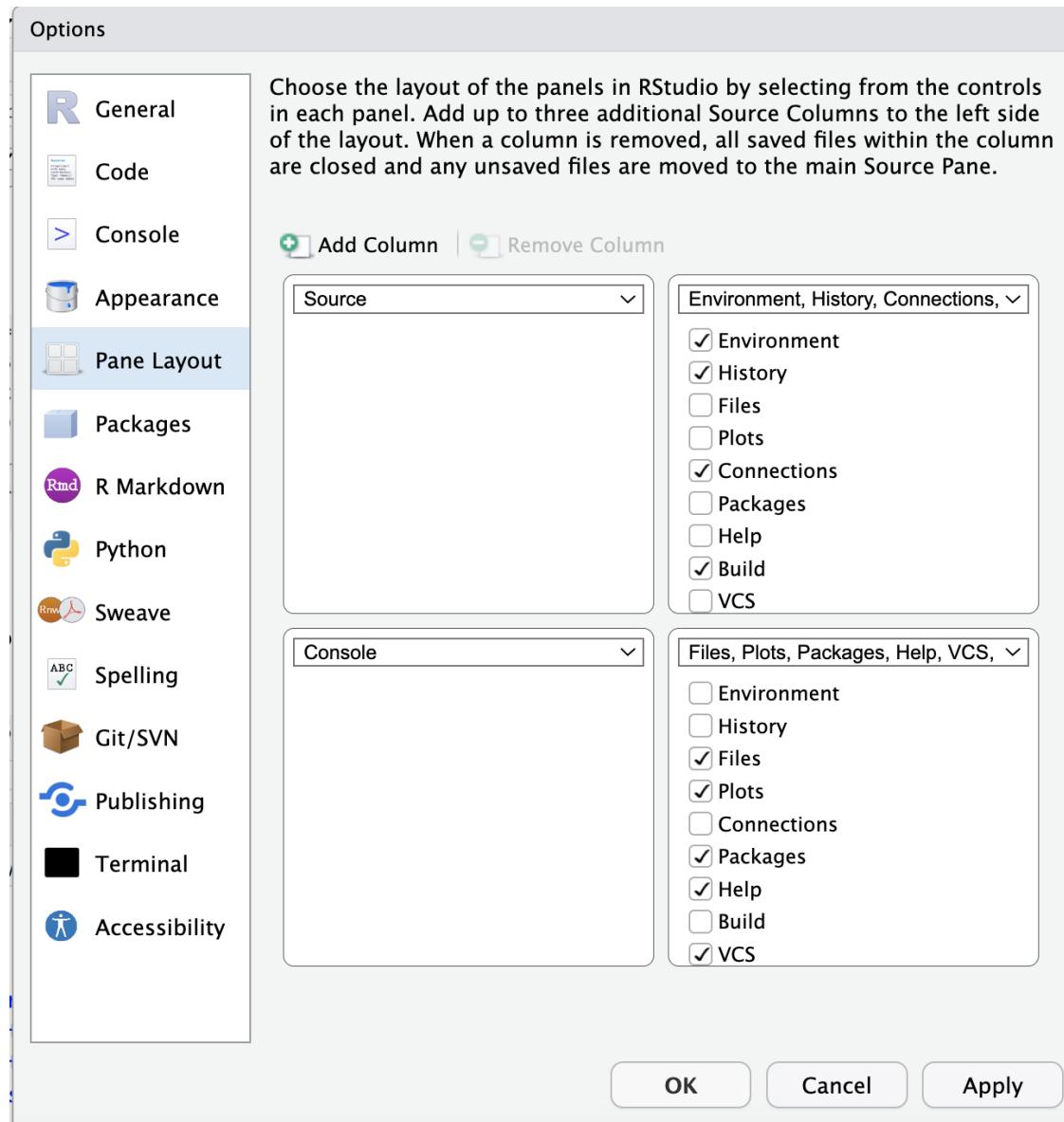
RStudio Layout

If RStudio doesn't look the way you want (or like our RStudio), then:

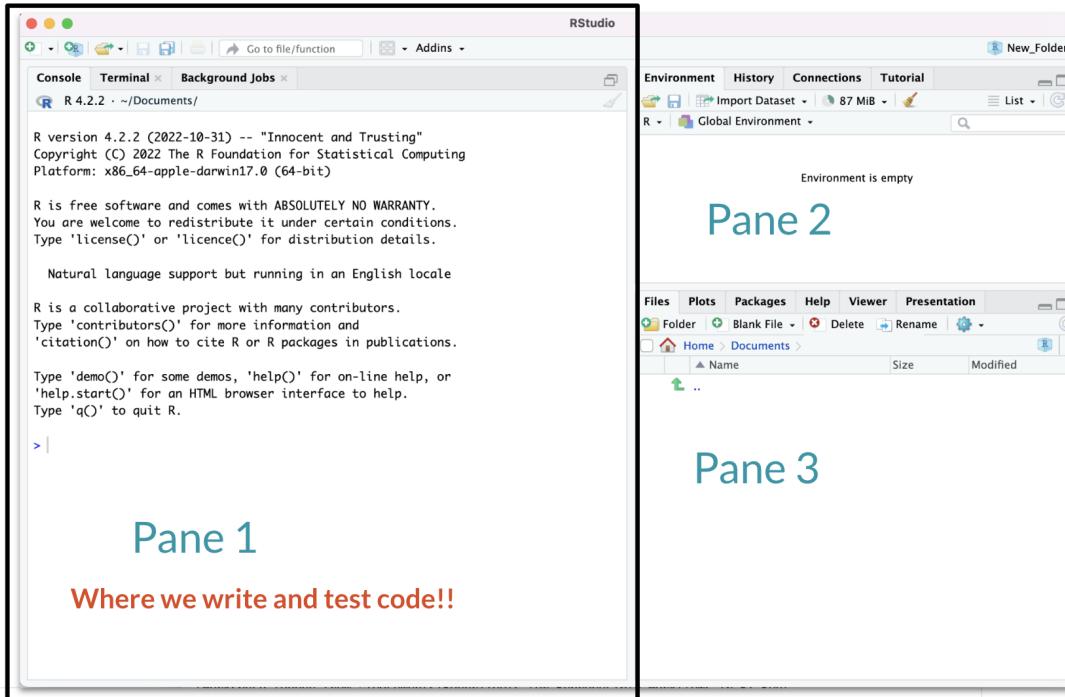
Click on the pane button, which looks like a waffle with 4 indentations. Scroll down to "Pane Layout".



Default Layout

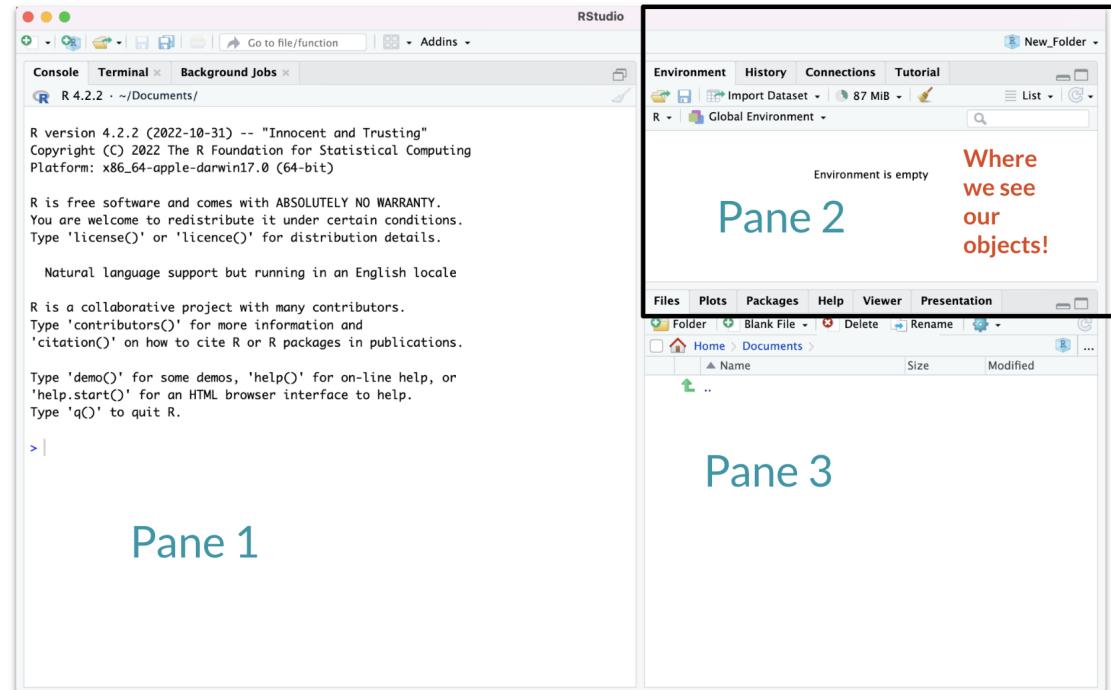


Pane 1 (Left side) for writing code

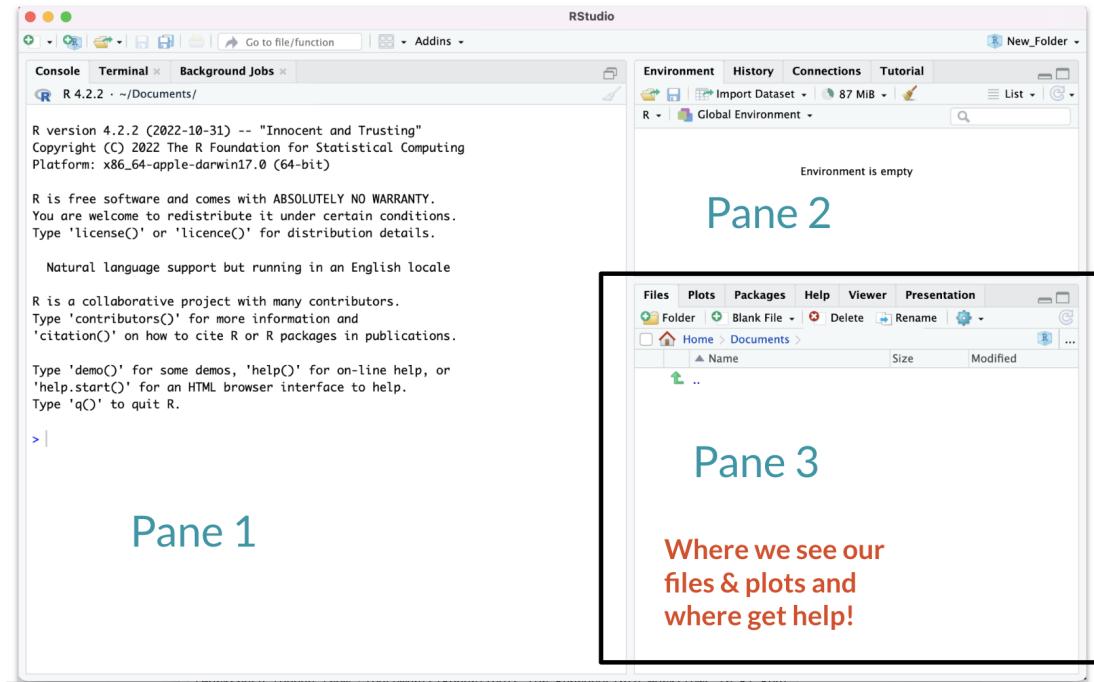


Pane 2 - where objects will be

More on this in a moment!

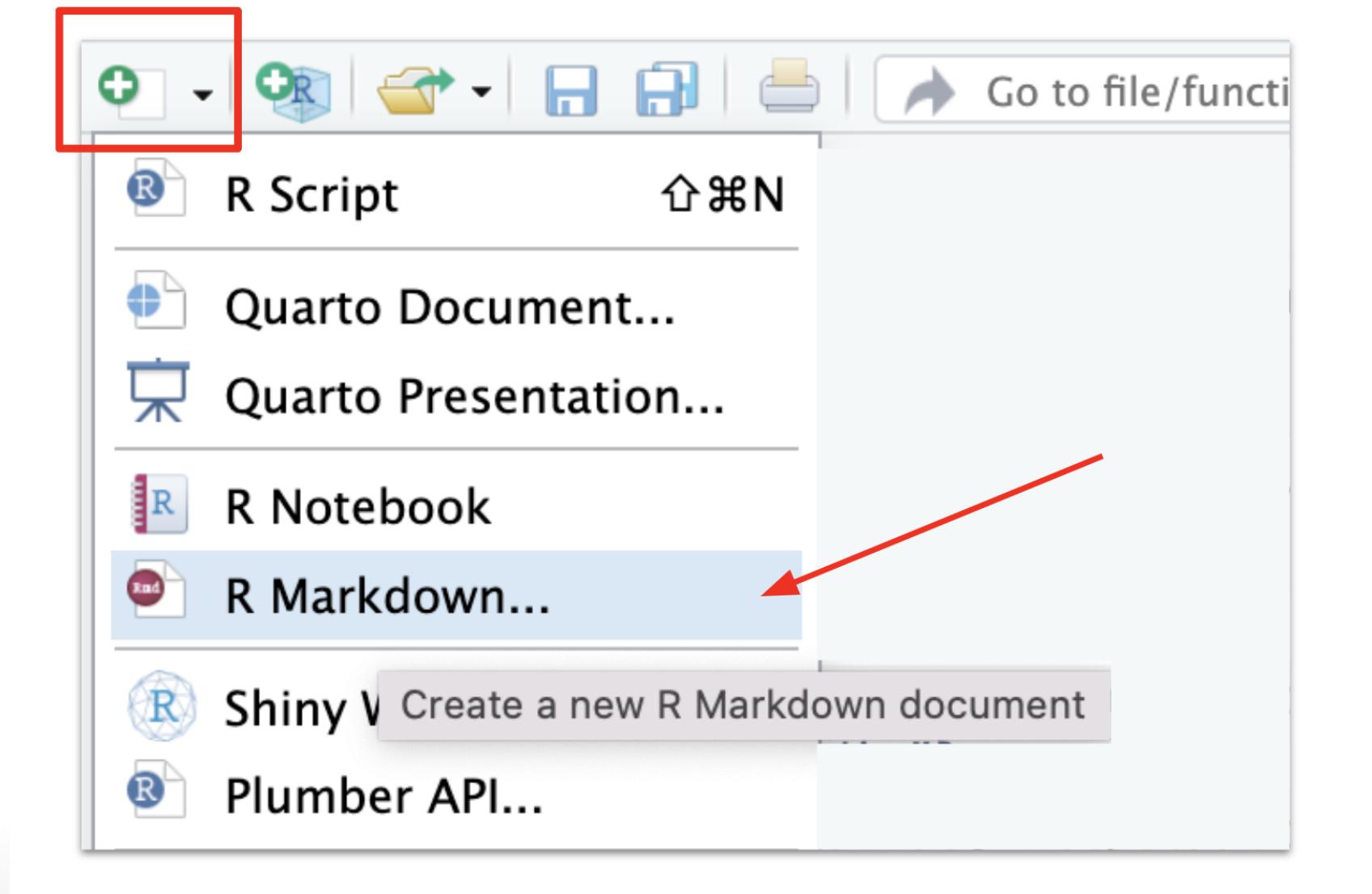


Pane 3 - where we get help and see plots



Hidden Pane

To save a copy of your code. You must open a file first - this will open a 4th pane. These files include Scripts or what are called R Markdown files.



Hidden Pane

You will see a popup that you can just say “OK” to for now.

New R Markdown

Document Presentation Shiny From Template

Title:

Author:

Date:

Use current date when rendering document

Default Output Format:

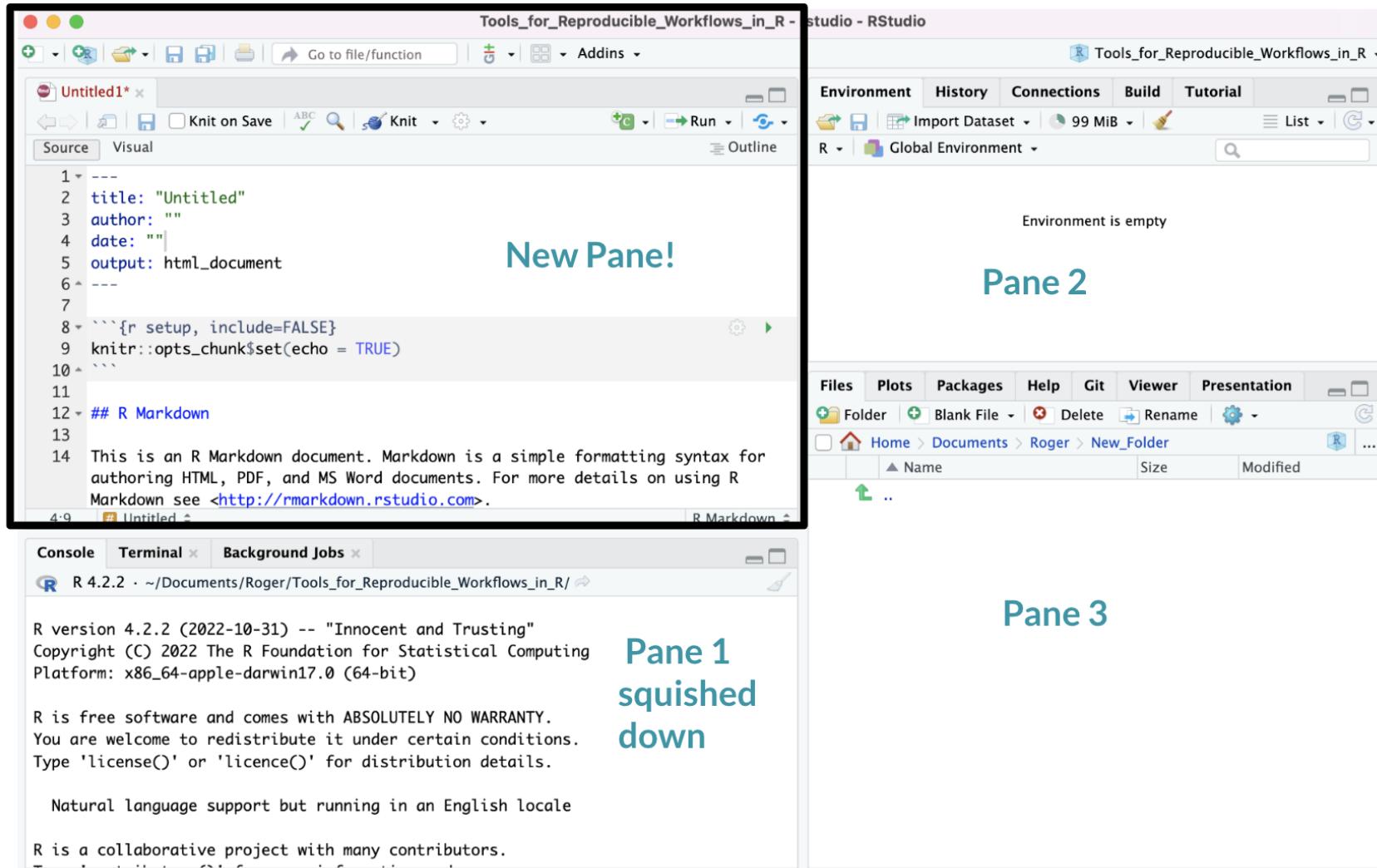
HTML
Recommended format for authoring (you can switch to PDF or Word output anytime).

PDF
PDF output requires TeX (MiKTeX on Windows, MacTeX 2013+ on OS X, TeX Live 2013+ on Linux).

Word
Previewing Word documents requires an installation of MS Word (or Libre/Open Office on Linux).

Hidden Pane

Nice! now we have a place to save code! This is where we will mostly be working.



Working with R in R Studio - 2 major panes:

1. The **Source/Editor**: "Analysis" Script + Interactive Exploration

- Static copy of what you did (reproducibility)
- Top by default

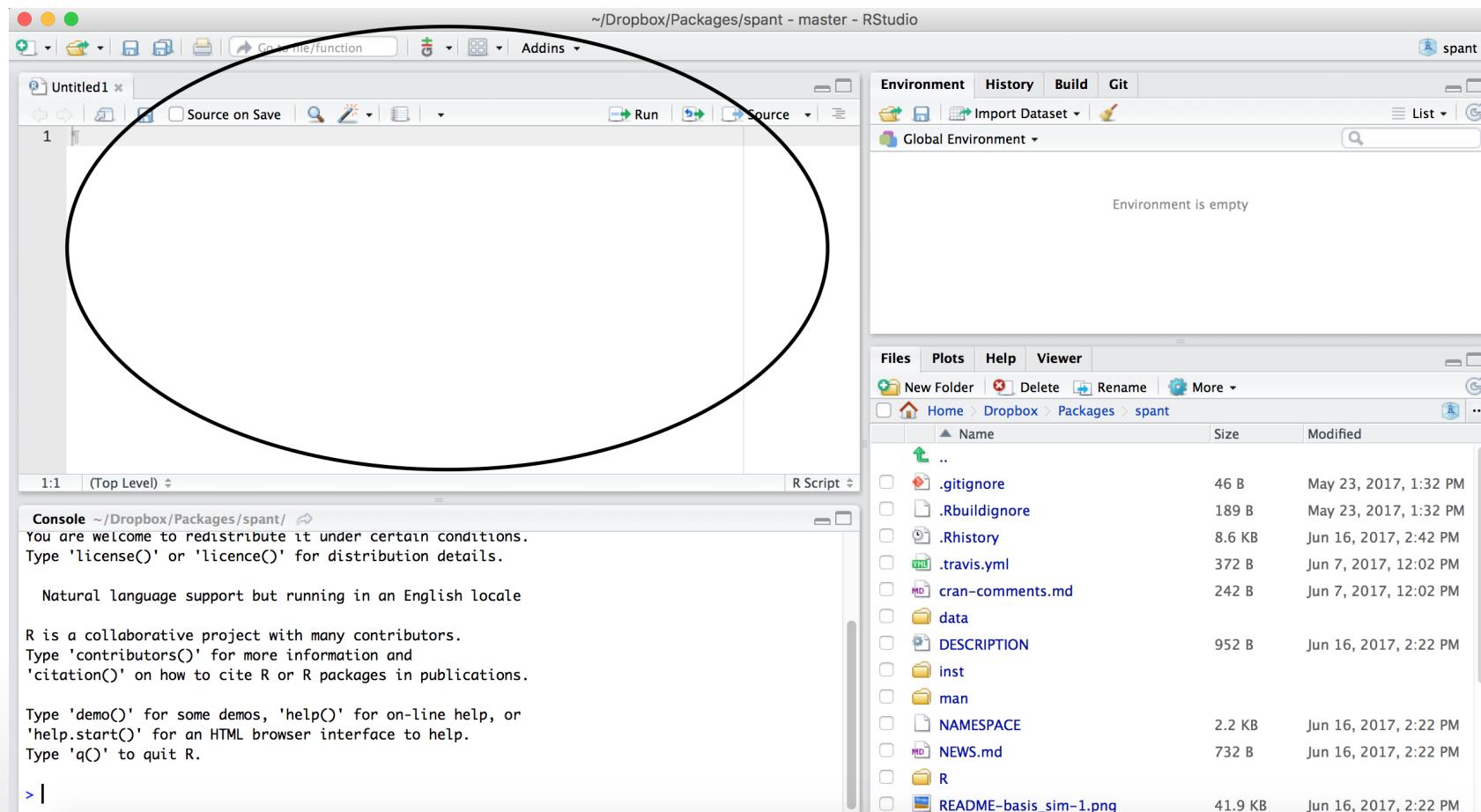
2. The **R Console**: "interprets" whatever you type

- Calculator
- Try things out interactively, then add to your editor
- Bottom by default

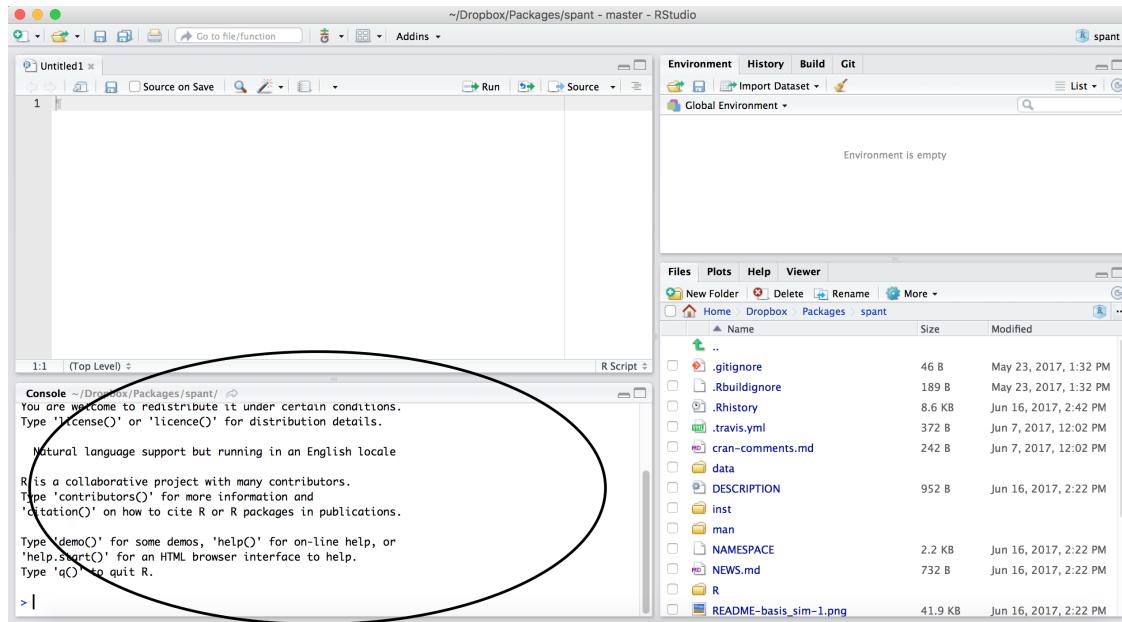
Source / Editor

- Where files open to
- Have R code and comments in them
- Can highlight and press (CMD+Enter (Mac) or Ctrl+Enter (Windows)) to run the code

In a .R file (we call a script), code is saved on your disk



R Console



- Where code is executed (where things happen)
- You can type here for things interactively to test code
- Code is **not saved** on your disk

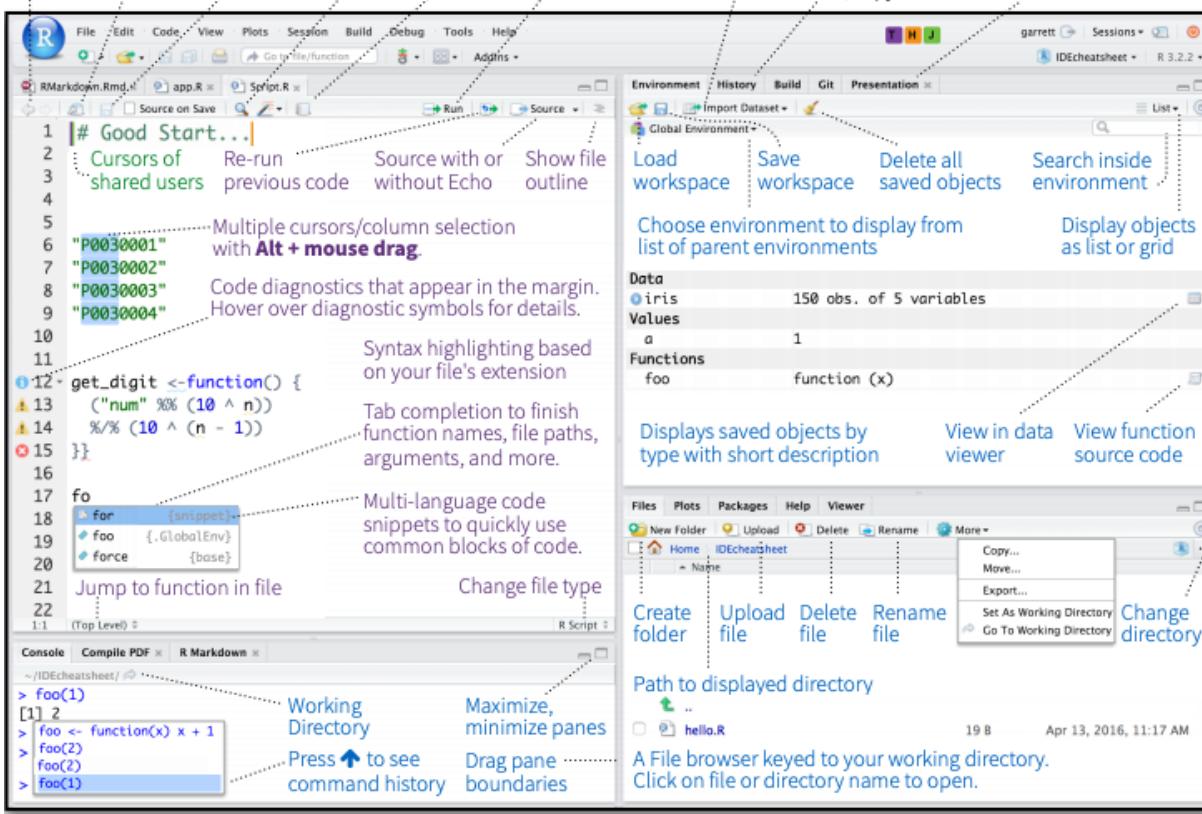
RStudio

Super useful “cheat sheet”:

<https://github.com/rstudio/cheatsheets/raw/master/rstudio-ide.pdf>

Write Code

Navigate tabs
Open in new window
Save
Find and replace
Compile as notebook
Run selected code



R Support

Import data with wizard
History of past commands to run/copy
Display .RPres slideshows
File > New File > R Presentation

R Markdown files look different from scripts

It will look like this with text in it, unlike a script.

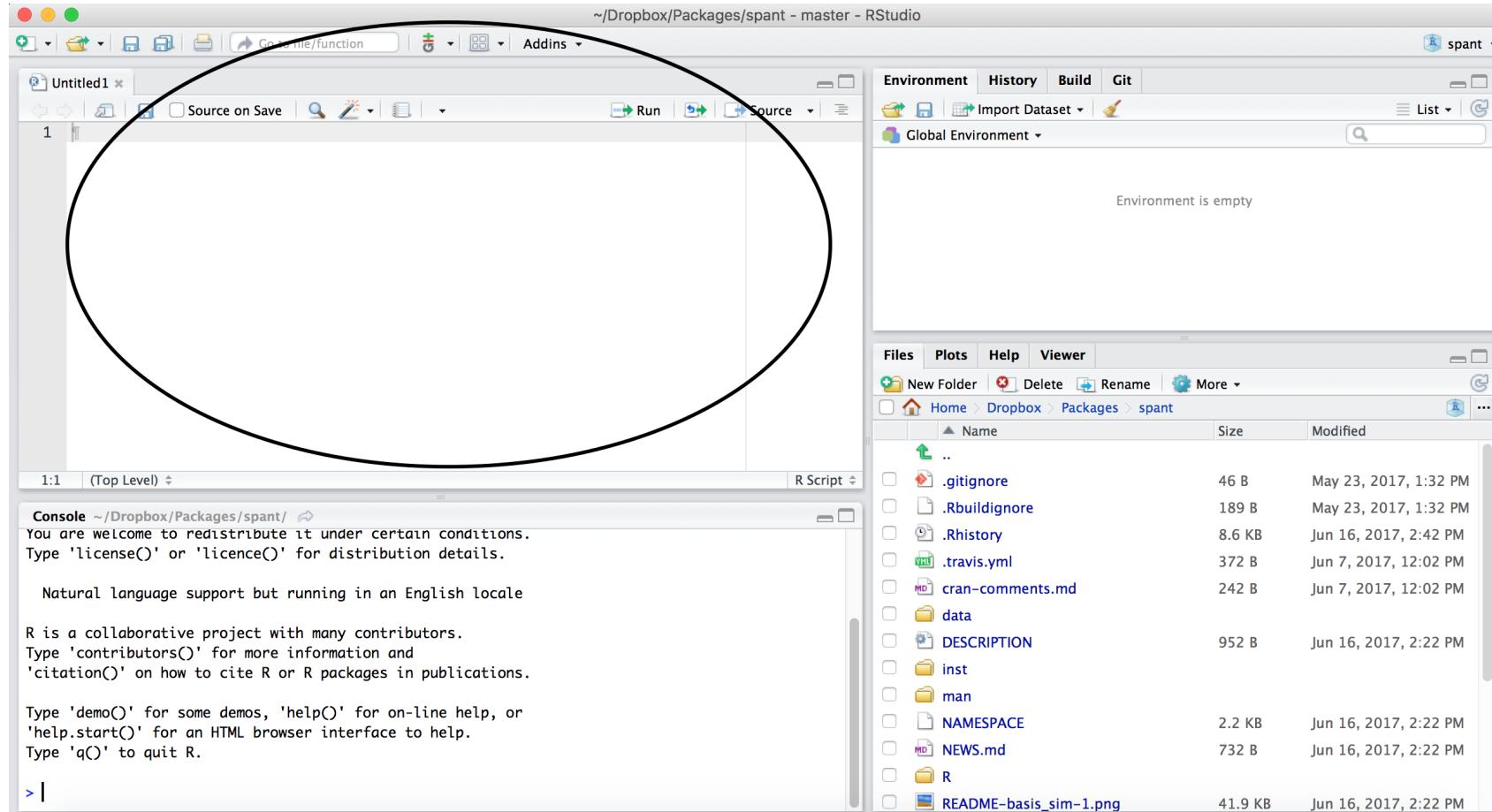
The screenshot shows the RStudio interface with a red box highlighting the code editor area. The code editor contains an R Markdown document named 'Untitled1'. The document includes YAML front matter, R code chunks, and explanatory text. The environment pane shows an empty global environment. The file browser pane displays the project directory structure.

```
1 ---  
2 title: "first_markdown"  
3 output: html_document  
4 ---  
5  
6 ```{r setup, include=FALSE}  
7 knitr::opts_chunk$set(echo = TRUE)  
8 ````  
9  
10 ## R Markdown  
11  
12 This is an R Markdown document. Markdown is a simple formatting syntax for  
authoring HTML, PDF, and MS Word documents. For more details on using R  
Markdown see <http://rmarkdown.rstudio.com>.  
13  
14 When you click the **Knit** button a document will be generated that includes  
both content as well as the output of any embedded R code chunks within the  
document. You can embed an R code chunk like this:  
15  
16 ```{r cars}  
2:23 # first_markdown
```

Environment is empty

Name	Size	Modified
.gitignore	245 B	May 18, 2021, 11:53 AM
.Rbuildignore	16 B	May 18, 2021, 11:53 AM
.Rhistory	43 B	Jun 10, 2021, 11:53 AM
.travis.yml	666 B	Jun 9, 2021, 11:53 AM
all_functions.xlsx	13.4 KB	Jun 8, 2021, 3:11 PM
all_the_functions.csv	57.3 KB	Jun 8, 2021, 3:11 PM
all_the_packages.txt	211 B	May 18, 2021, 11:53 AM
Arrays_Split		
Basic_R		
Best_Model_Coefficients.csv	587 B	May 18, 2021, 11:53 AM
Best_Model_Coefficients.xlsx	3.8 KB	May 18, 2021, 11:53 AM
bibliography.bib	599 B	May 18, 2021, 11:53 AM
black_and_white_theme.pdf	45.1 KB	May 18, 2021, 11:53 AM
bloomberg logo small horizontal	25.4 KB	May 18, 2021, 11:53 AM

Recall that a script was just empty

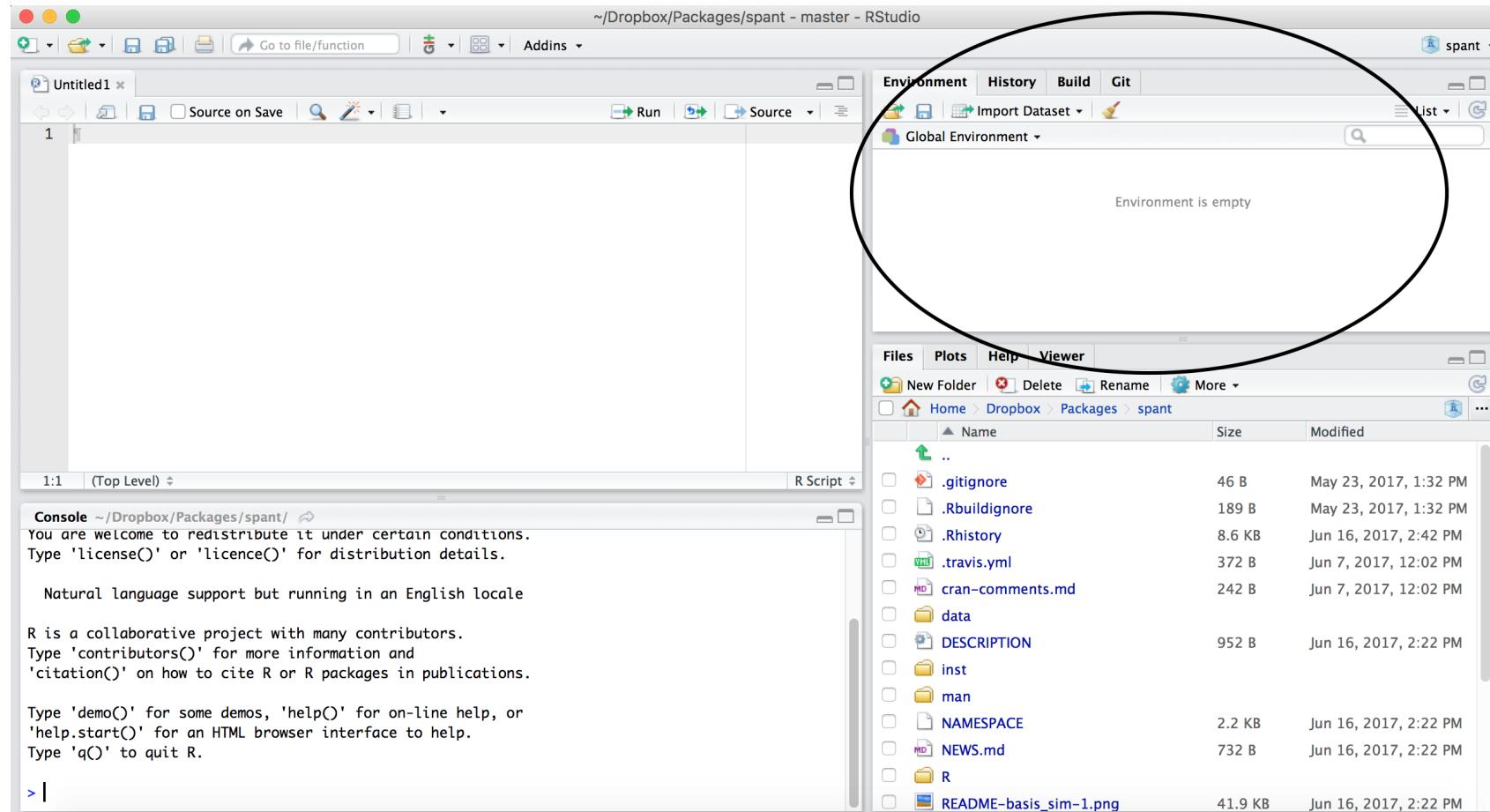


Scripts and R Markdown

Although people will use scripts often, and they are good for more programmatic purposes, we generally don't recommend them for Public Health Researchers.

For data analyses, R Markdown files are generally superior because they allow you to check your code and write more info about your code.

Workspace/Environment



TERM: Object



object: an object is something that can be worked with or on in R - can be lots of different things! You can think of objects as **nouns** in R.

- a vector of numbers
- a plot
- a function
- data
- ... many more

Workspace/Environment

- Tells you what **objects** are in R
- What exists in memory/what is loaded?/what did I read in?

History

- Shows previous commands. Good to look at for debugging, but **don't rely** on it.
Instead use RMarkdown!
- Also type the “up” key in the Console to scroll through previous commands

Other Panes

- **Files** - shows the files on your computer or the directory you are working in
- **Viewer** - can view data or R objects
- **Help** - shows help of R commands
- **Plots** - pictures and figures
- **Packages** - list of R packages that are loaded in memory

Practice: Let's take a look at R
Studio ourselves!

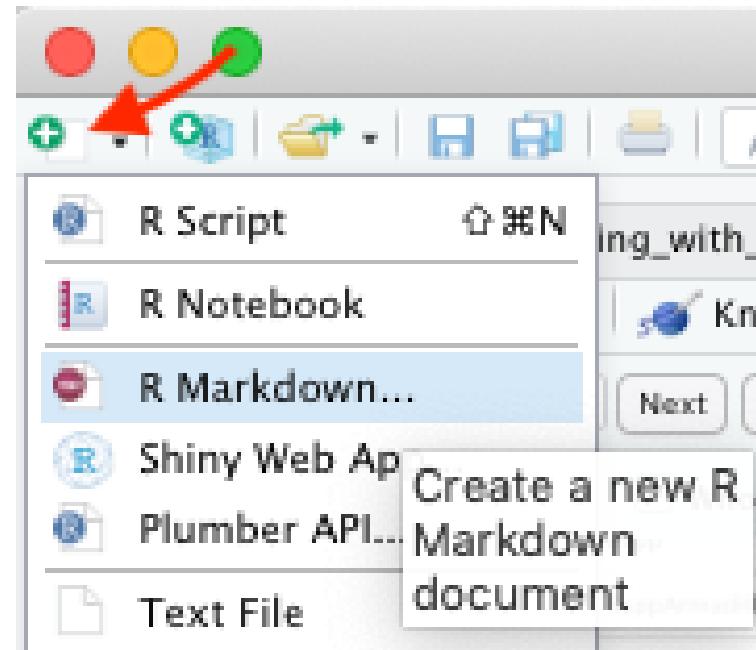
R Markdown file

R Markdown files (.Rmd) help generate reports that include your code and output. Think of them as fancier scripts.

1. Helps you describe your code
2. Allows you to check the output
3. Can create many different file types

Create an R Markdown file

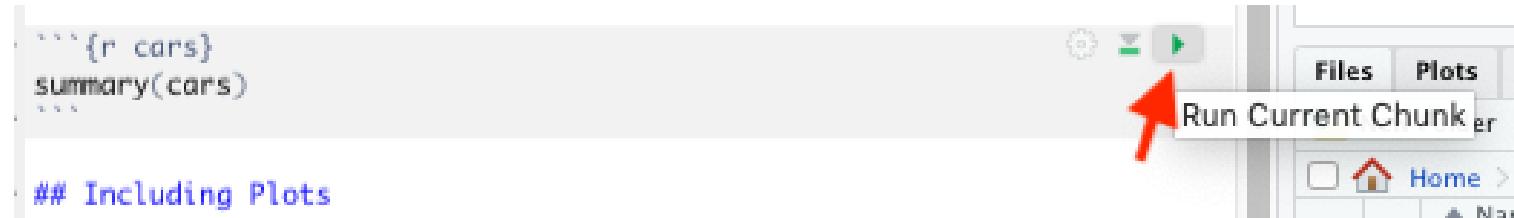
Go to File → New File → R Markdown or click the green add file button.



Code chunks

Within R Markdown files are code “chunks”.

This is where you can type R code and run it!



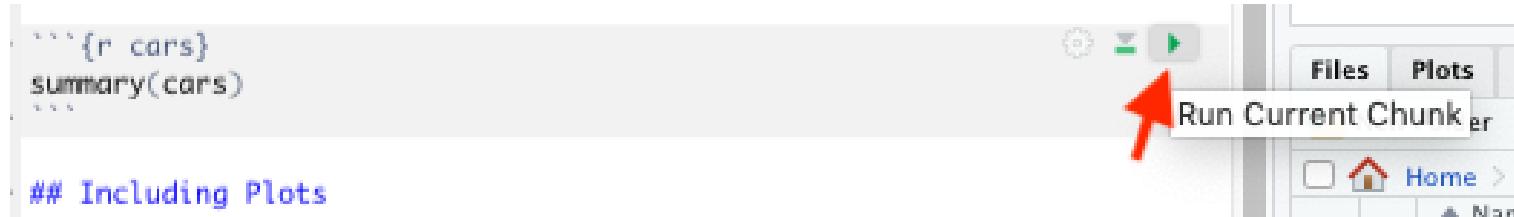
The image shows a screenshot of the RStudio IDE. On the left, there is a code editor window containing R code. The code includes a code chunk indicator (three backticks) followed by `summary(cars)`, and then a comment `## Including Plots`. On the right, the RStudio toolbar is visible, featuring various icons for file operations like 'New File', 'Open', 'Save', and 'Run'. A red arrow points specifically to the 'Run' icon, which is a green square with a white play symbol. The menu bar at the top has 'File', 'Plots', 'Edit', 'View', 'Tools', 'Help', and 'More' options.

```
```{r cars}
summary(cars)
```

## Including Plots
```

Run code in a chunk

Clicking the run (play) button runs the code in the chunk.



Ctrl + Enter on Windows or Command + Enter on Mac in your script evaluates that line of code

Running a chunk executes the code

- generally see a preview of the output of the code just below the chunk
- see the code in the console

The screenshot shows the RStudio interface. At the top, there are two tabs: "Untitled2" and "RStudio.Rmd". Below the tabs is a toolbar with various icons for file operations, knitting, and running code. The main area is divided into two sections: "Source" (active) and "Visual". In the Source tab, the R Markdown code is displayed:

```
14 This is an R Markdown document. Markdown is a simple formatting syntax for authoring HTML, PDF, and MS  
Word documents. For more details on using R Markdown see <http://rmarkdown.rstudio.com>.  
15  
16 When you click the **Knit** button a document will be generated that includes both content as well as  
the output of any embedded R code chunks within the document. You can embed an R code chunk like this:  
17  
18 ```{r cars}  
19 summary(cars)  
20 ```
```

Below the code, the "Visual" tab displays the rendered output of the R code chunk, which is a summary statistics table:

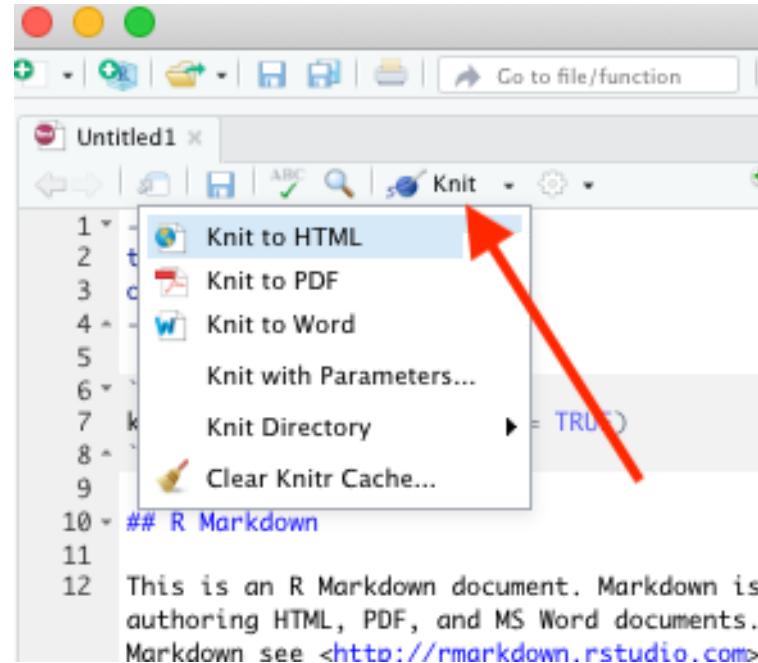
| | speed | dist |
|----------|-------|--------|
| Min. : | 4.0 | 2.00 |
| 1st Qu.: | 12.0 | 26.00 |
| Median : | 15.0 | 36.00 |
| Mean : | 15.4 | 42.98 |
| 3rd Qu.: | 19.0 | 56.00 |
| Max. : | 25.0 | 120.00 |

At the bottom of the RStudio window, the "Console" tab is active, showing the R command history and the output of the `summary(cars)` command:

```
>  
>  
>  
> summary(cars)  
    speed          dist  
Min. : 4.0   Min. : 2.00  
1st Qu.:12.0  1st Qu.: 26.00  
Median :15.0  Median : 36.00  
Mean   :15.4  Mean   : 42.98  
3rd Qu.:19.0  3rd Qu.: 56.00
```

Knit file to html

Running all chunks - this will create a report from the R Markdown document!



Nice report!

This generates a nice report that you can share with others who can open in any browser.

The screenshot shows a window titled 'Untitled.html' with the URL ' ~/Documents/Roger/New_Folder/Untitled.html'. The window includes standard OS X window controls (red, yellow, green) and a toolbar with 'Untitled.html', 'Open in Browser', 'Find', and a 'Publish' button. The main content area displays an R Markdown document:

Untitled

Your Name
2023-03-29

R Markdown

This is an R Markdown document. Markdown is a simple formatting syntax for authoring HTML, PDF, and MS Word documents. For more details on using R Markdown see <http://rmarkdown.rstudio.com>.

When you click the **Knit** button a document will be generated that includes both content as well as the output of any embedded R code chunks within the document. You can embed an R code chunk like this:

```
summary(cars)
```

```
##      speed      dist
## Min.   : 4.0   Min.   : 2.00
## 1st Qu.:12.0   1st Qu.: 26.00
## Median :15.0   Median : 36.00
## Mean   :15.4   Mean   : 42.98
## 3rd Qu.:19.0   3rd Qu.: 56.00
## Max.   :25.0   Max.   :120.00
```

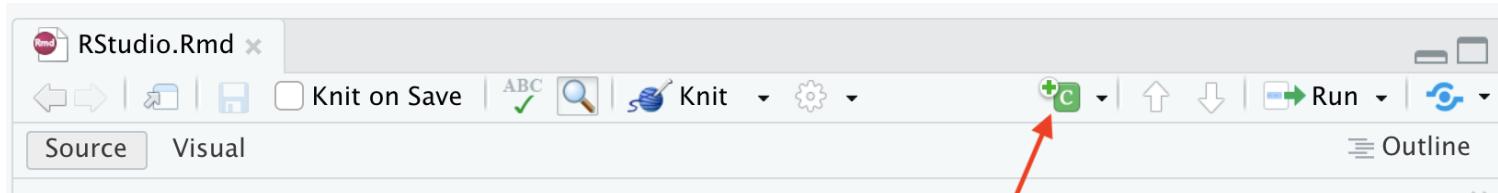
Including Plots

You can also embed plots, for example:

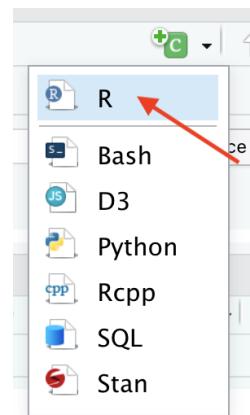
Create Chunks

To create a new R code chunk:

- Use the insert code chunk button at the top of RStudio.

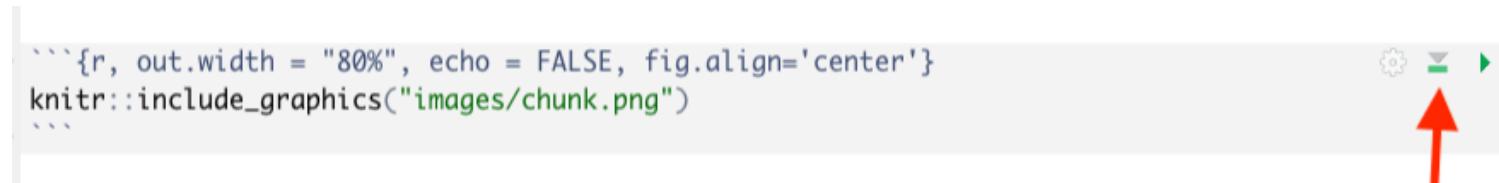


- Select R (default) as the language:

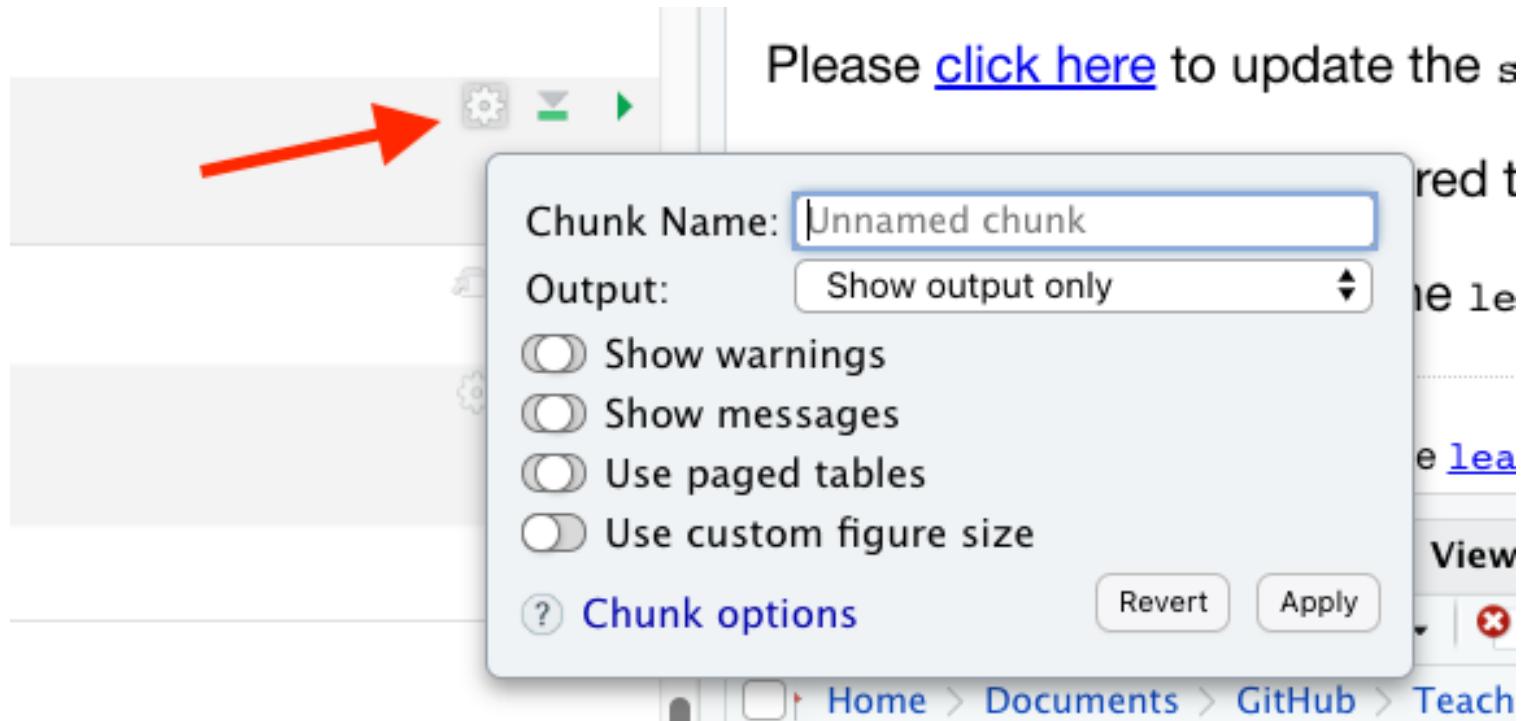


Run previous chunks button

You can run all chunks above a specific chunk using this button:

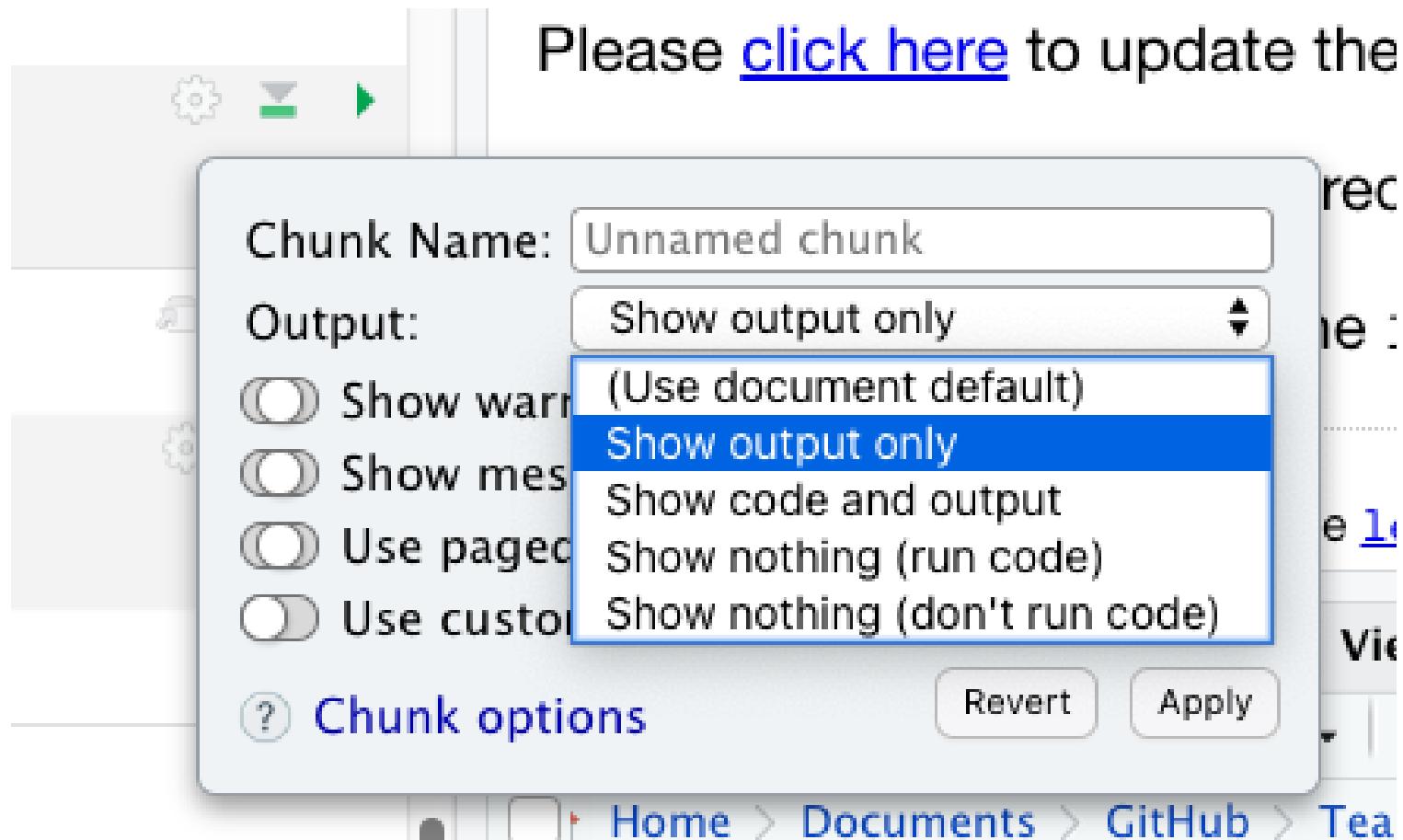


Chunk settings



Chunk settings

You can specify if a chunk will be seen in the report or not.



Errors

R studio can help you find issues in your code. Note that sometimes the error occurs earlier than RStudio thinks.



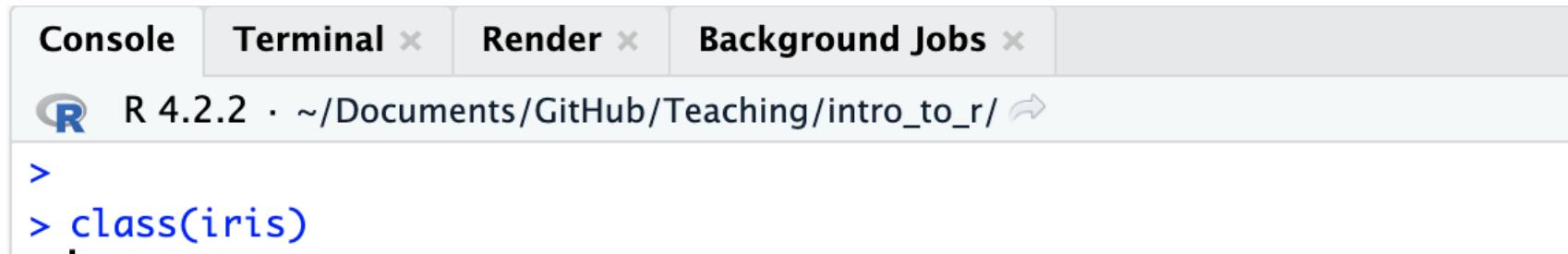
A screenshot of the RStudio IDE interface. The code editor shows the following R code:

```
305 print(x, ...)  
306 - {r}  
✖ 307 print(x))  
308 ...  
3 unexpected token ')'  
3 unexpected end of document
```

The line "print(x))" is highlighted with a red error indicator (a red circle with a white exclamation mark) and a yellow box. The error message "unexpected token ')' and "unexpected end of document" is displayed in a tooltip-like box below the code. The top right corner of the window shows standard RStudio icons for settings, file, and run.

Recap of where code goes

- you can test code in the console



The screenshot shows the RStudio interface with the 'Console' tab selected. The top bar includes tabs for 'Console', 'Terminal x', 'Render x', and 'Background Jobs x'. Below the tabs, the R logo and session information 'R 4.2.2 · ~/Documents/GitHub/Teaching/intro_to_r/' are displayed. The main console area shows the following R code:

```
>
> class(iris)
```

- you can save code in a chunk in the editor (Markdown file)

```
## R Markdown
```

Code does not go here and instead goes within the grey chunks like this:

```
```{r}
summary(cars)
```

```



Summary

- RStudio makes working in R easier
- the Editor (top) is for static code like scripts or R Markdown documents
- The console is for testing code (bottom) - best to save your code though!
- R markdown documents are really helpful for lots of reasons!
- R code goes within what is called a chunk (the gray box with a green play button)
- Code chunks can be modified so that they show differently in reports
- **Objects** (like nouns) are data or variables.

[Workshop Website](#)