

# 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

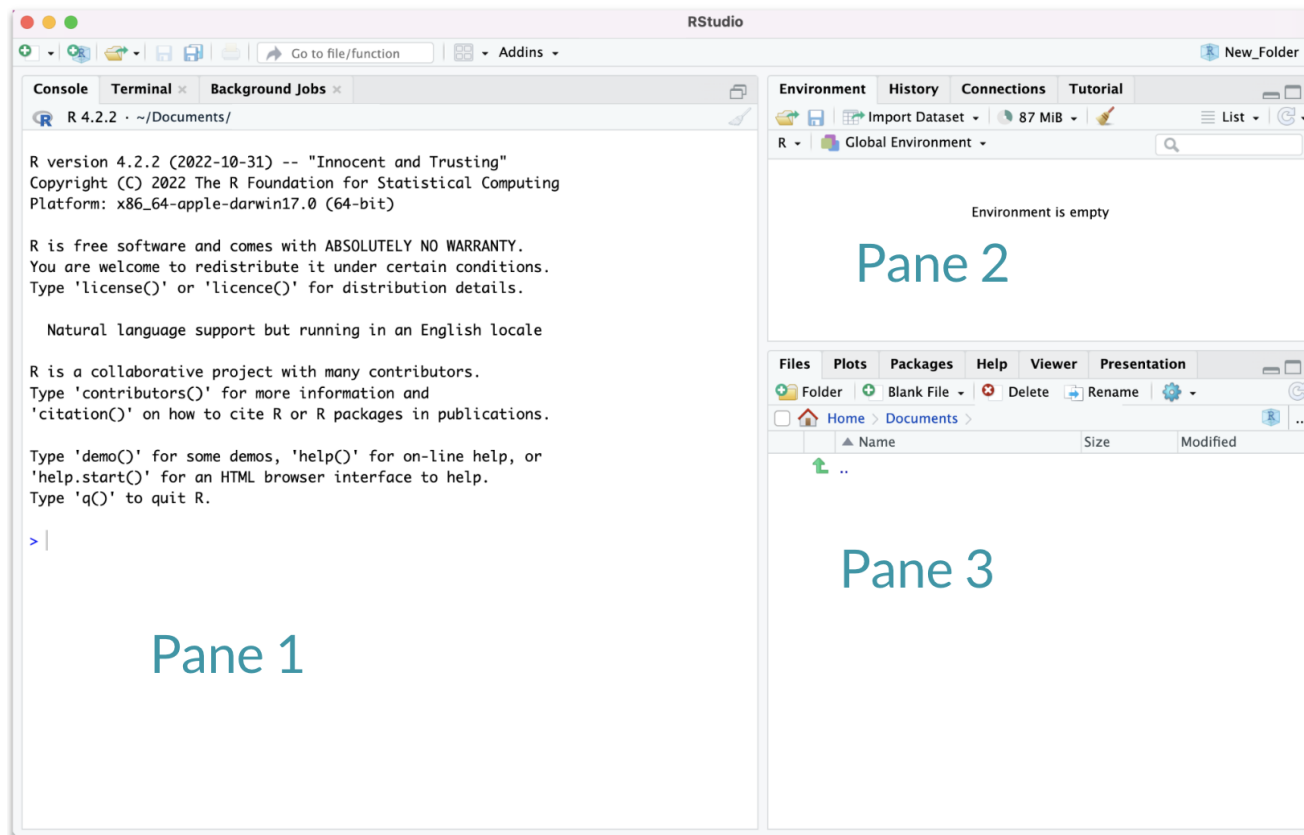
- Syntax highlighting, code completion, and smart indentation
- Easily manage multiple working directories and projects

## More information

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

# RStudio

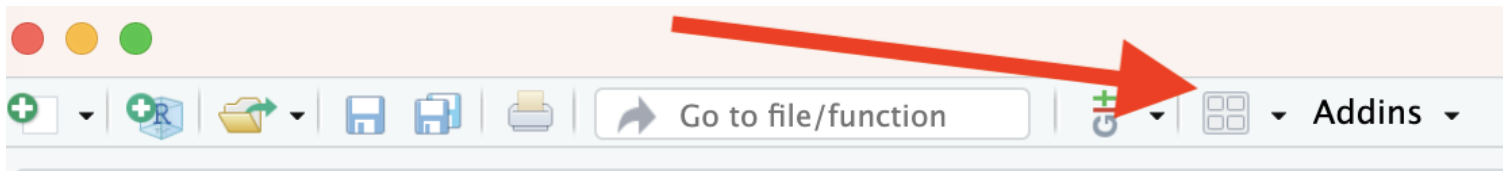
First it is important to be familiar with the layout. When you first open RStudio, you will see 3 panes.



# 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

Options

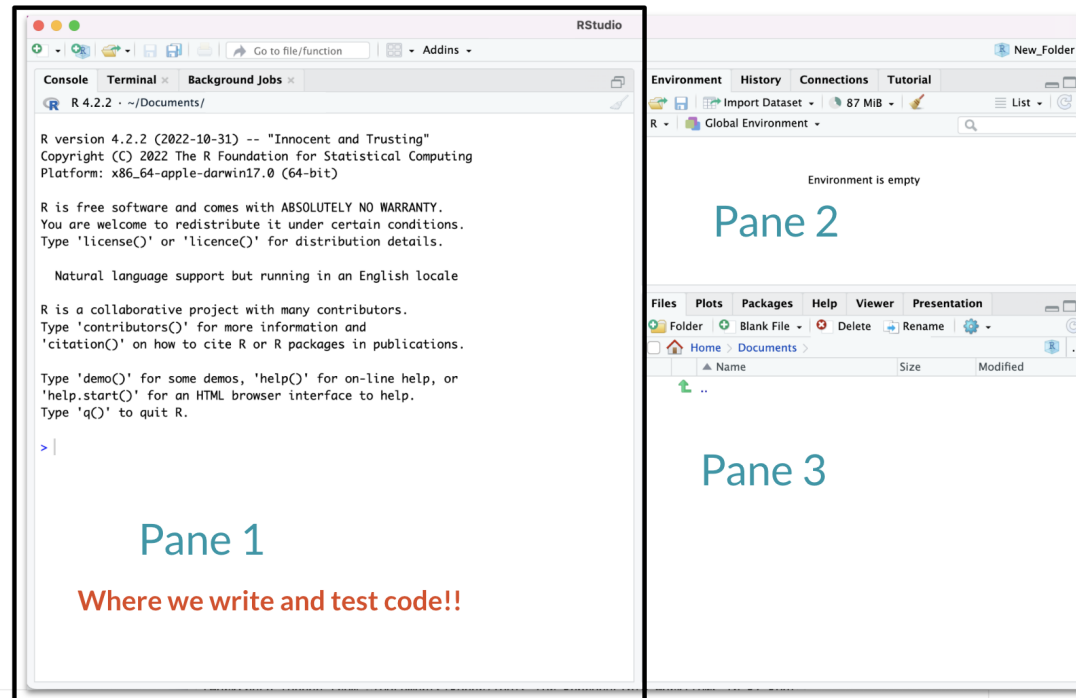
Choose the layout of the panels in RStudio by selecting from the controls in each panel. Add up to three additional Source Columns to the left side of the layout. When a column is removed, all saved files within the column are closed and any unsaved files are moved to the main Source Pane.

 Add Column |  Remove Column

Panel	Content
Source	<ul style="list-style-type: none"><li><input checked="" type="checkbox"/> Environment</li><li><input checked="" type="checkbox"/> History</li><li><input type="checkbox"/> Files</li><li><input type="checkbox"/> Plots</li><li><input checked="" type="checkbox"/> Connections</li><li><input type="checkbox"/> Packages</li><li><input type="checkbox"/> Help</li><li><input checked="" type="checkbox"/> Build</li><li><input type="checkbox"/> VCS</li></ul>
Console	<ul style="list-style-type: none"><li><input type="checkbox"/> Environment</li><li><input type="checkbox"/> History</li><li><input checked="" type="checkbox"/> Files</li><li><input checked="" type="checkbox"/> Plots</li><li><input type="checkbox"/> Connections</li><li><input checked="" type="checkbox"/> Packages</li><li><input checked="" type="checkbox"/> Help</li><li><input type="checkbox"/> Build</li><li><input checked="" type="checkbox"/> VCS</li></ul>

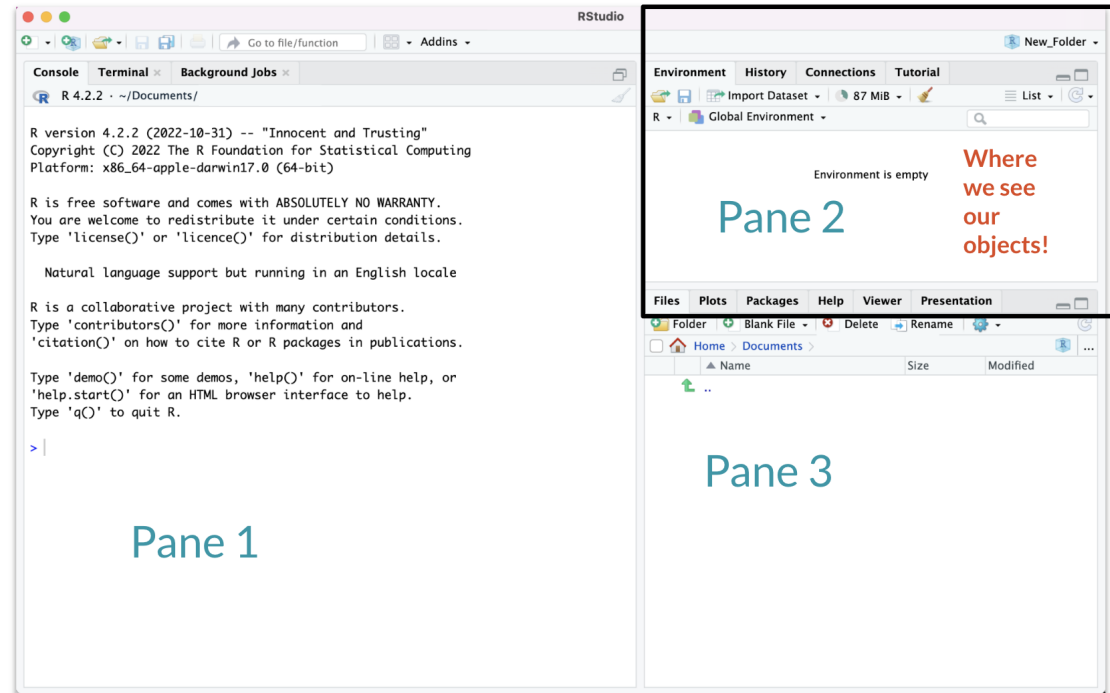
OK Cancel Apply

# Pane 1 (Left side) for writing code



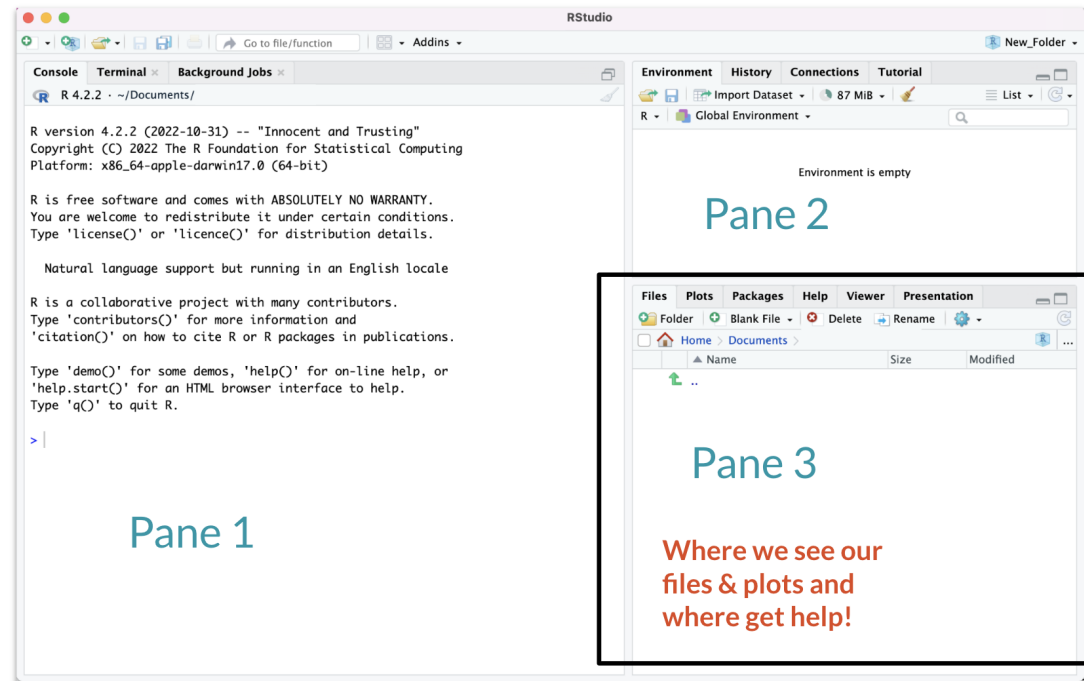
# Pane 2 - where objects will be

More on this in a moment!



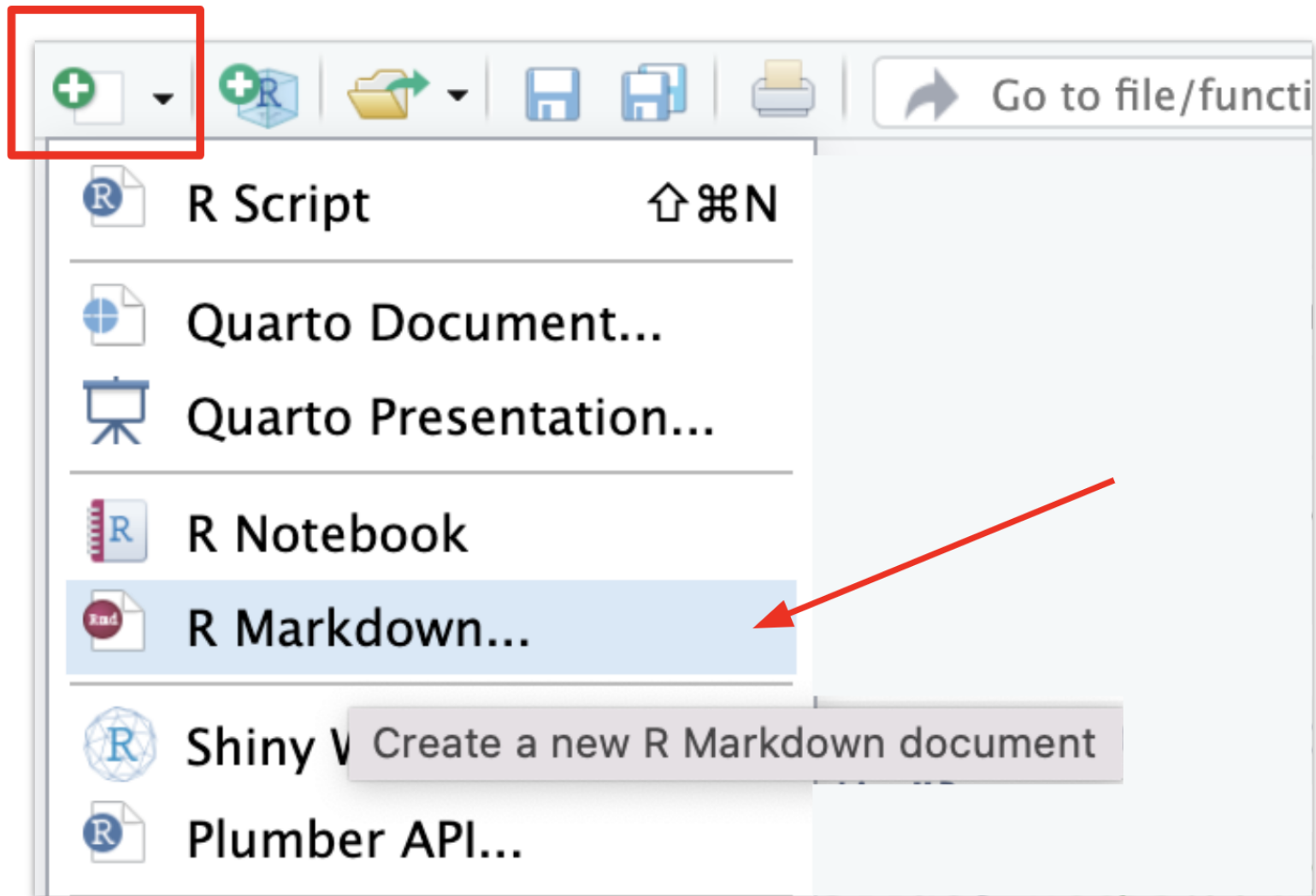


# Pane 3 - where we get help and see plots



## 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:**

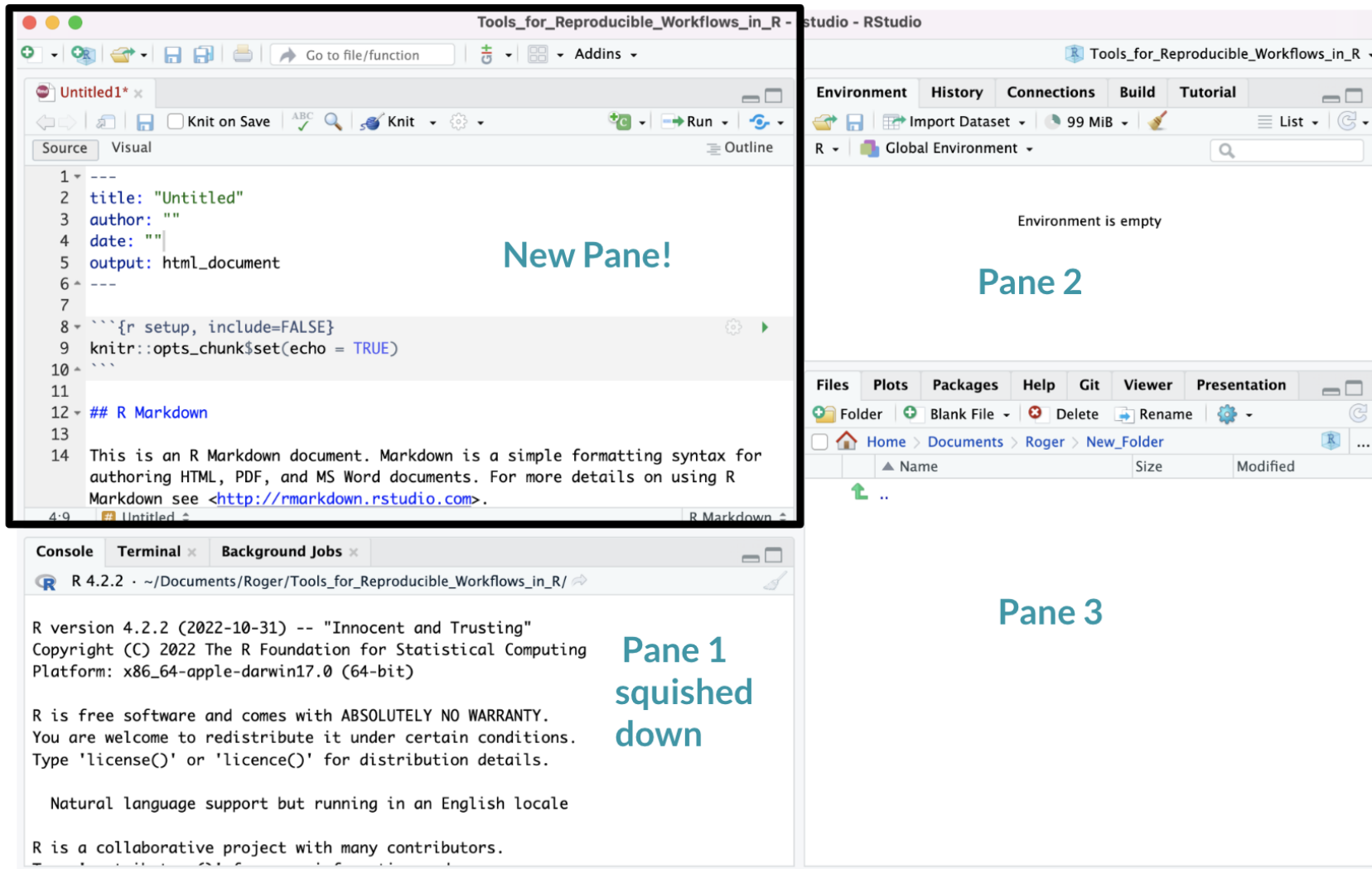
**HTML**  
Recommended format for authoring (you can switch to PDF or Word output anytime).

**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.



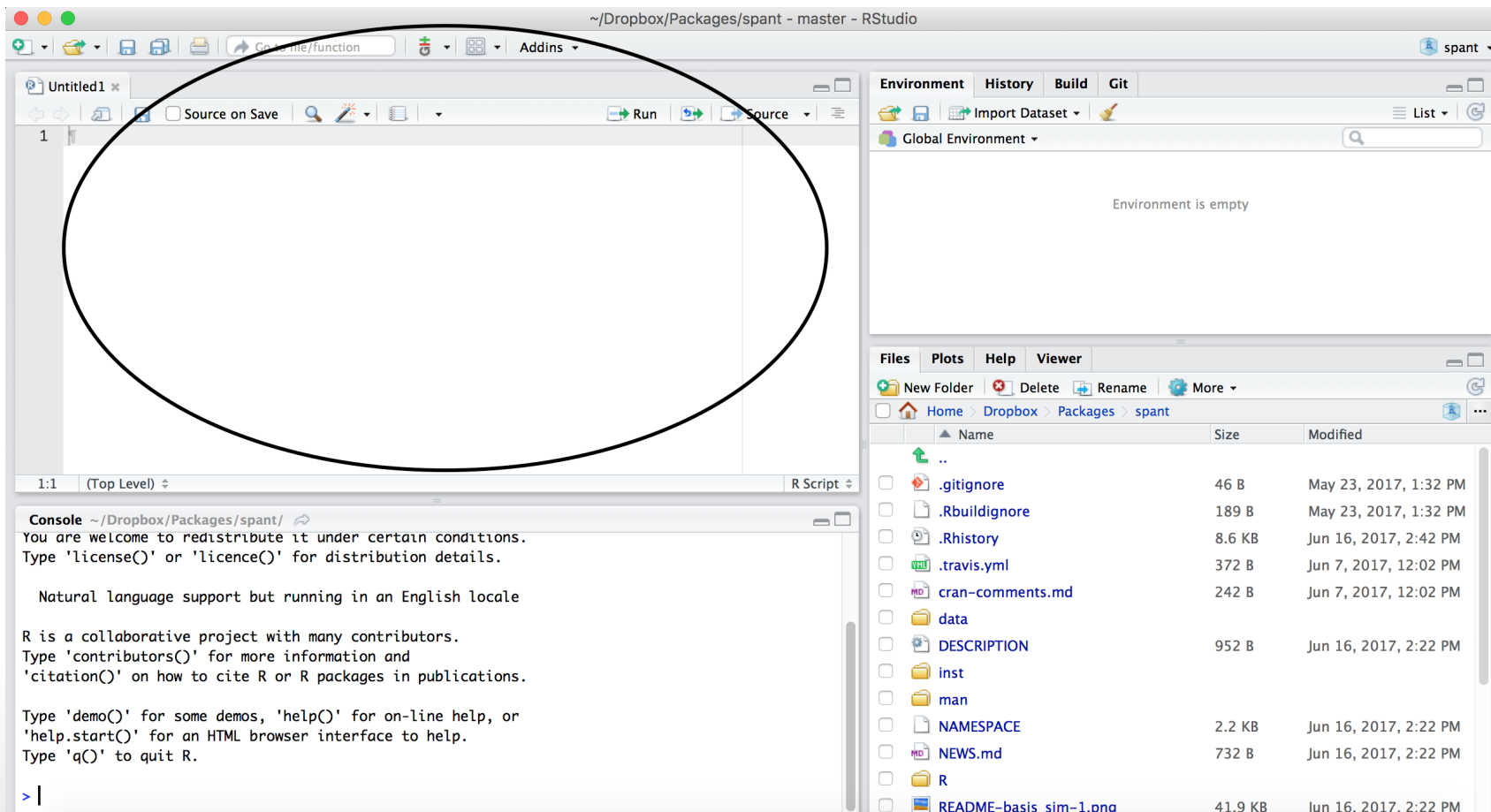
## Working with R in R Studio - 2 major panes:

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

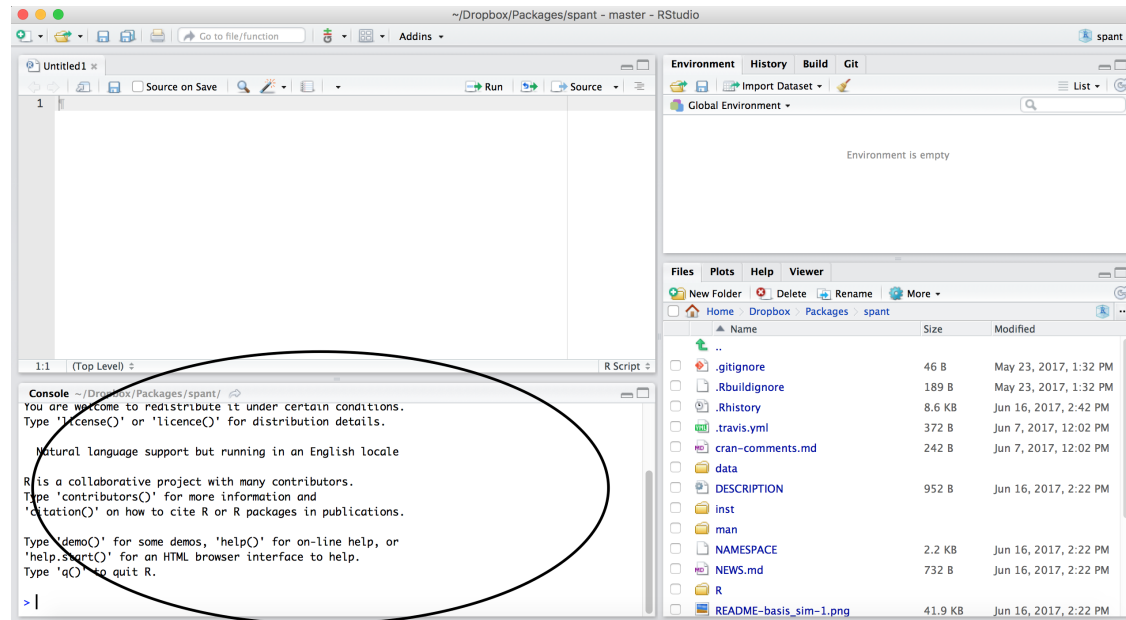
# Source / Editor

- 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

# 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
- Cursors of shared users
- Re-run previous code
- Source with or without Echo
- Show file outline
- Multiple cursors/column selection with **Alt + mouse drag**.
- Code diagnostics that appear in the margin. Hover over diagnostic symbols for details.
- Syntax highlighting based on your file's extension
- Tab completion to finish function names, file paths, arguments, and more.
- Multi-language code snippets to quickly use common blocks of code.
- Jump to function in file
- Change file type

**R Support**

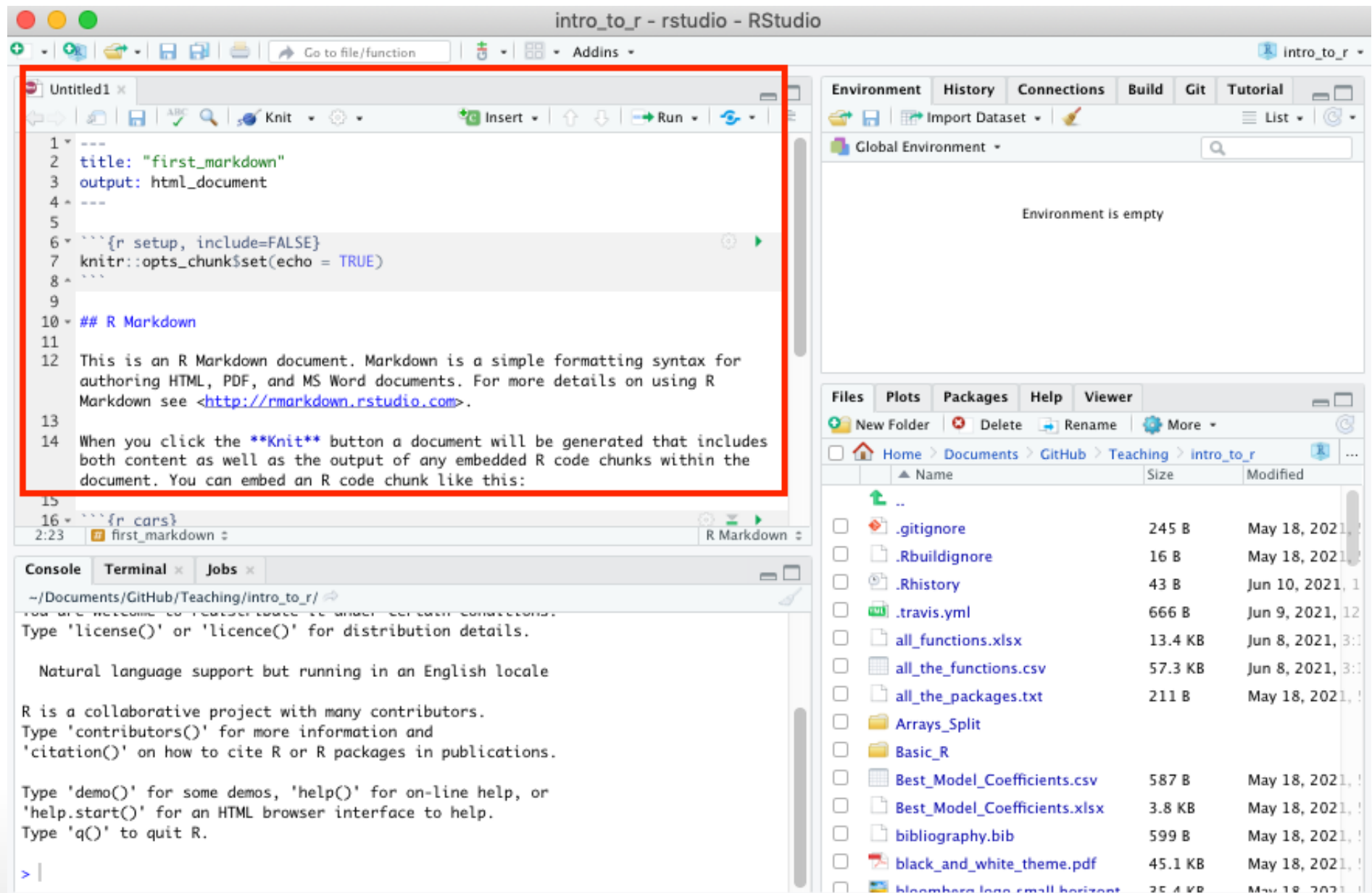
- Import data with wizard
- History of past commands to run/copy
- Display .RPres slideshows **File > New File > R Presentation**
- Load workspace
- Save workspace
- Delete all saved objects
- Search inside environment
- Choose environment to display from list of parent environments
- Display objects as list or grid
- Displays saved objects by type with short description
- View in data viewer
- View function source code
- Create folder
- Upload file
- Delete file
- Rename file
- Change directory
- Path to displayed directory
- A file browser keyed to your working directory. Click on file or directory name to open.
- Working Directory
- Maximize, minimize panes
- Press **↑** to see command history
- Drag pane boundaries

```
1 # Good Start...|
2
3
4
5
6 "P0030001"
7 "P0030002"
8 "P0030003"
9 "P0030004"
10
11
12 get_digit <-function() {
13   ("num" %% (10 ^ n))
14   %/% (10 ^ (n - 1))
15 }
16
17 fo
18   for {snippets}
19   foo {,GlobalEnv}
20   force {base}
21
22
23
24
25
26
27
28
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```

```
> Foo(1)
[1] 2
> Foo <- function(x) x + 1
> Foo(2)
[1] 3
> Foo(1)
[1] 2
```

# 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 file named "intro\_to\_r" open. The editor window displays an R Markdown document with the following content:

```
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
13 authoring HTML, PDF, and MS Word documents. For more details on using R
14 Markdown see <http://rmarkdown.rstudio.com>.
15
16 When you click the Knit button a document will be generated that includes
17 both content as well as the output of any embedded R code chunks within the
18 document. You can embed an R code chunk like this:
19
20 ```{r cars}
21 
```

The console window shows the R startup message:

```
~/Documents/GitHub/Teaching/intro_to_r/
You are welcome to redistribute this under certain conditions.
Type 'license()' or 'licence()' for distribution details.

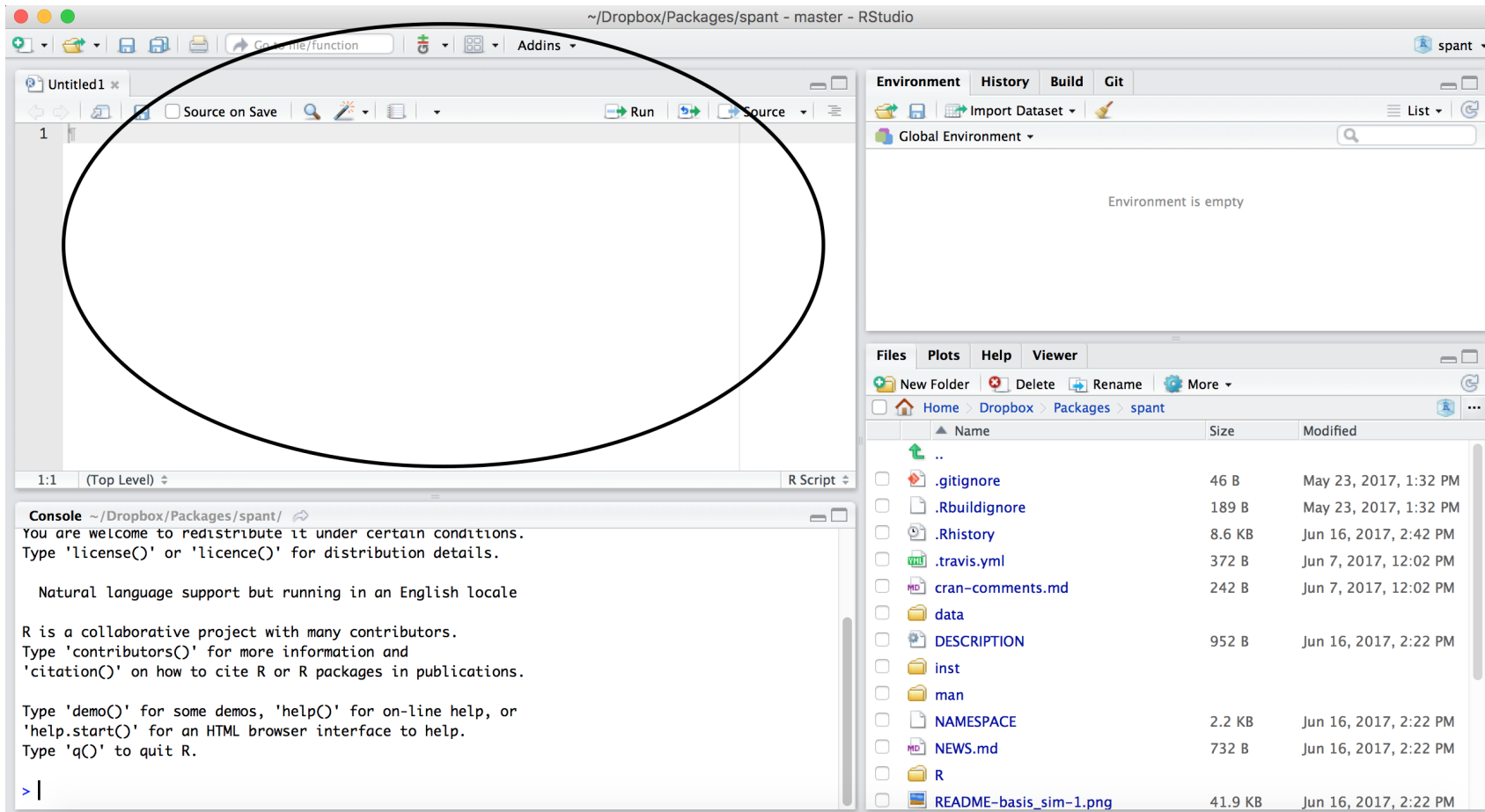
Natural language support but running in an English locale

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.

> |
```

# Recall that a script was just empty



The screenshot shows the RStudio interface with the following components:

- Script Editor:** A single line of code is present, which is empty. This area is circled in black.
- Environment:** Displays "Global Environment" and "Environment is empty".
- Files:** A file browser showing the directory structure of the project. The files and folders listed are:

Name	Size	Modified
..		
.gitignore	46 B	May 23, 2017, 1:32 PM
.Rbuildignore	189 B	May 23, 2017, 1:32 PM
.Rhistory	8.6 KB	Jun 16, 2017, 2:42 PM
.travis.yml	372 B	Jun 7, 2017, 12:02 PM
cran-comments.md	242 B	Jun 7, 2017, 12:02 PM
data		
DESCRIPTION	952 B	Jun 16, 2017, 2:22 PM
inst		
man		
NAMESPACE	2.2 KB	Jun 16, 2017, 2:22 PM
NEWS.md	732 B	Jun 16, 2017, 2:22 PM
R		
README-basis_sim-1.png	41.9 KB	Jun 16, 2017, 2:22 PM

**Console:** Shows the R startup message:

```
~/Dropbox/Packages/spant/
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.

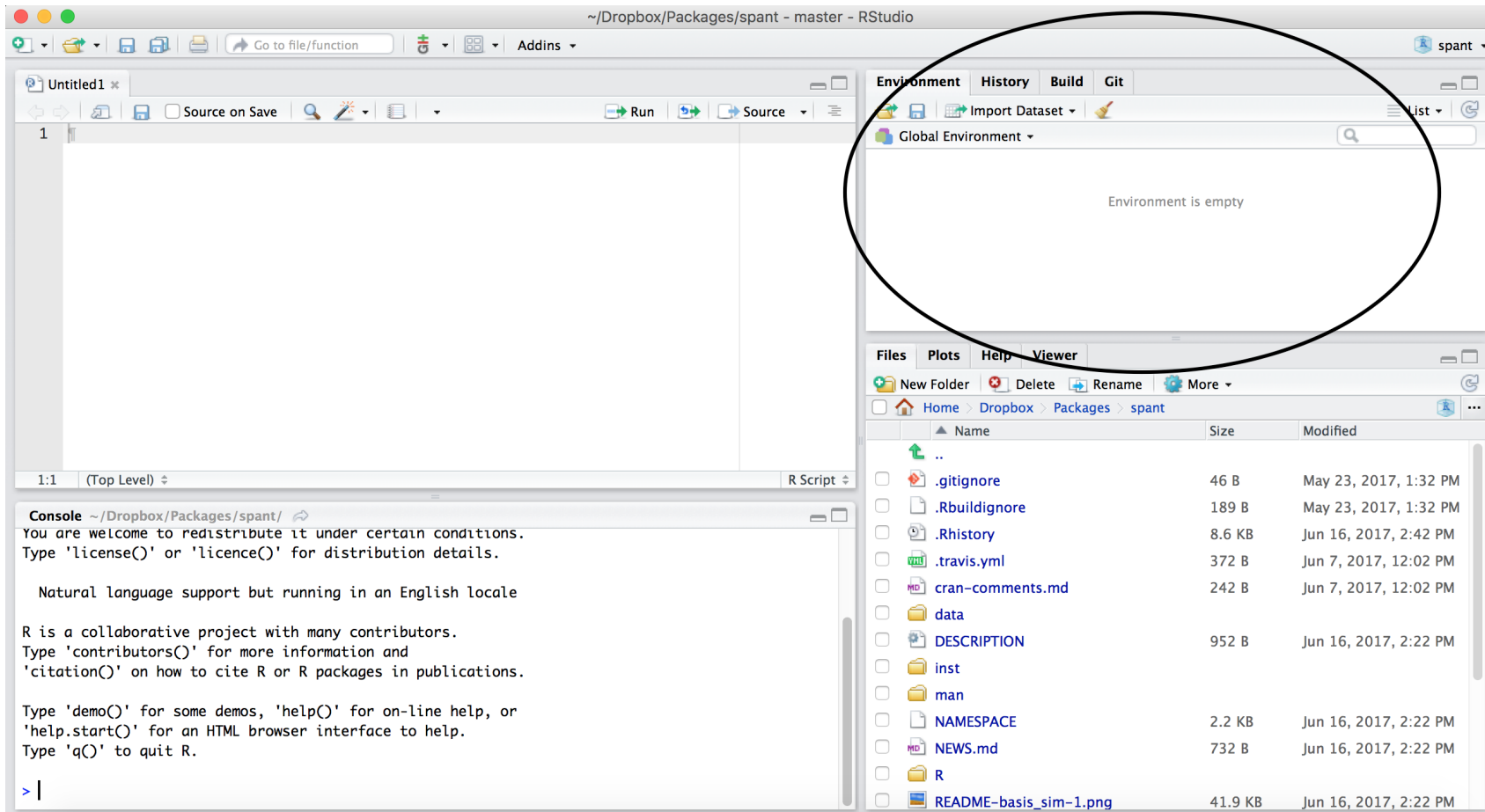
> |
```

## 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 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



The screenshot shows the RStudio interface with the following components:

- Environment pane:** Located at the top right, it displays "Global Environment" and "Environment is empty". This pane is circled in black.
- Files pane:** Located at the bottom right, it shows a file explorer view of the project directory. The files listed are:

Name	Size	Modified
..		
.gitignore	46 B	May 23, 2017, 1:32 PM
.Rbuildignore	189 B	May 23, 2017, 1:32 PM
.Rhistory	8.6 KB	Jun 16, 2017, 2:42 PM
.travis.yml	372 B	Jun 7, 2017, 12:02 PM
cran-comments.md	242 B	Jun 7, 2017, 12:02 PM
data		
DESCRIPTION	952 B	Jun 16, 2017, 2:22 PM
inst		
man		
NAMESPACE	2.2 KB	Jun 16, 2017, 2:22 PM
NEWS.md	732 B	Jun 16, 2017, 2:22 PM
R		
README-basis_sim-1.png	41.9 KB	Jun 16, 2017, 2:22 PM
- Console:** Located at the bottom left, it displays the R startup message:

```
~/Dropbox/Packages/spant/
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
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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.

> |
```

## 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 of 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!**

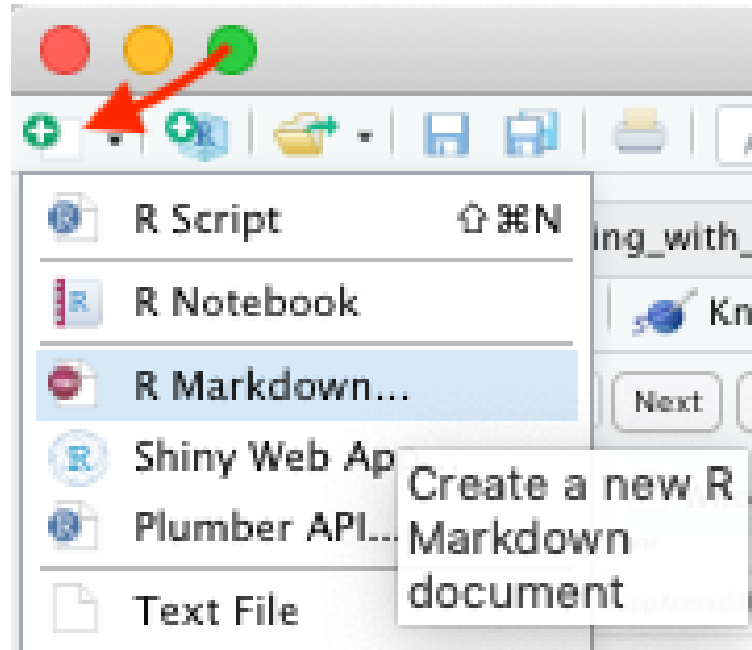
## R Markdown file

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

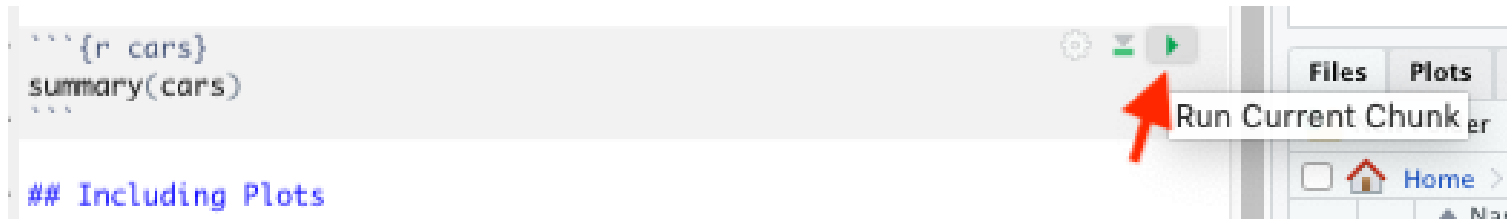
Go to File → New File → R Markdown or click the green add file button.



# Code chunks

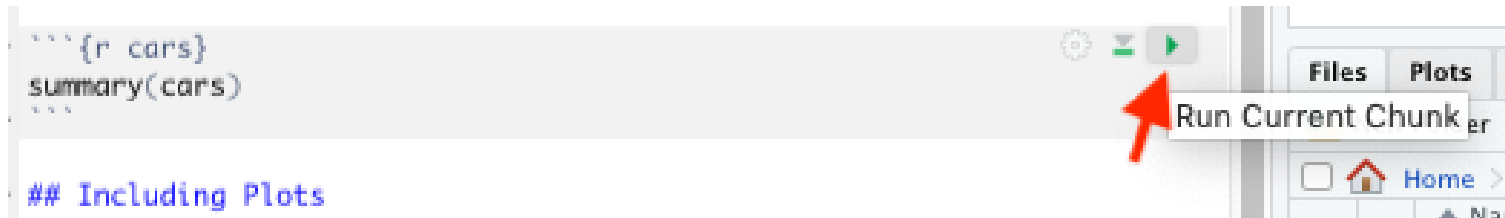
Within R Markdown files are code “chunks”.

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



## Run code in a chunk

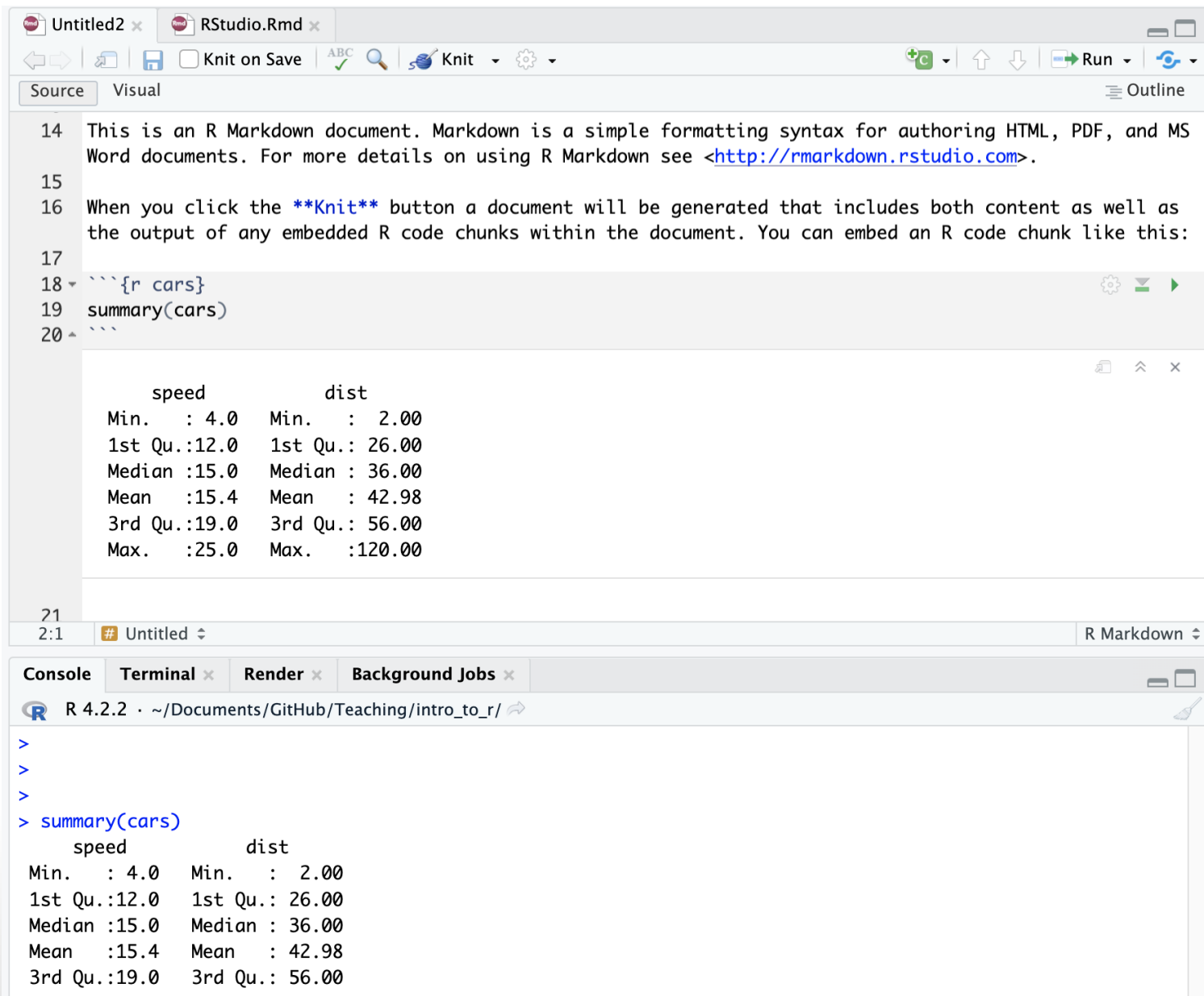
Clicking the run (play) button runs the code in the chunk.



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. The top pane displays the source code of an R Markdown document. The code includes a text block followed by an R code chunk. The code chunk contains the following R code:

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

The output of the R code chunk is displayed in a preview window below the code:

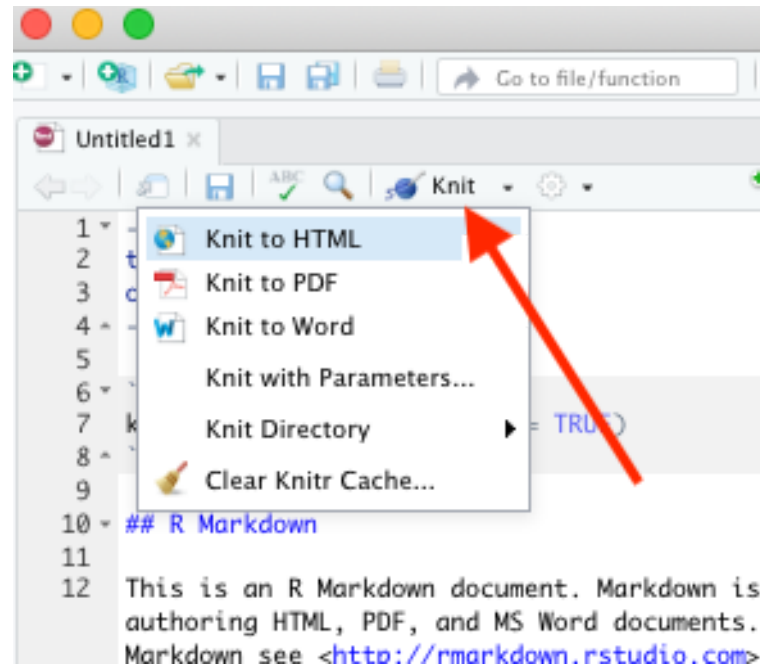
speed	dist
Min. : 4.0	Min. : 2.00
1st Qu.:12.0	1st Qu.: 26.00
Median :15.0	Median : 36.00
Mean :15.4	Mean : 42.98
3rd Qu.:19.0	3rd Qu.: 56.00
Max. :25.0	Max. :120.00

The bottom pane shows the R console with the following output:

```
>
>
>
> 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
```

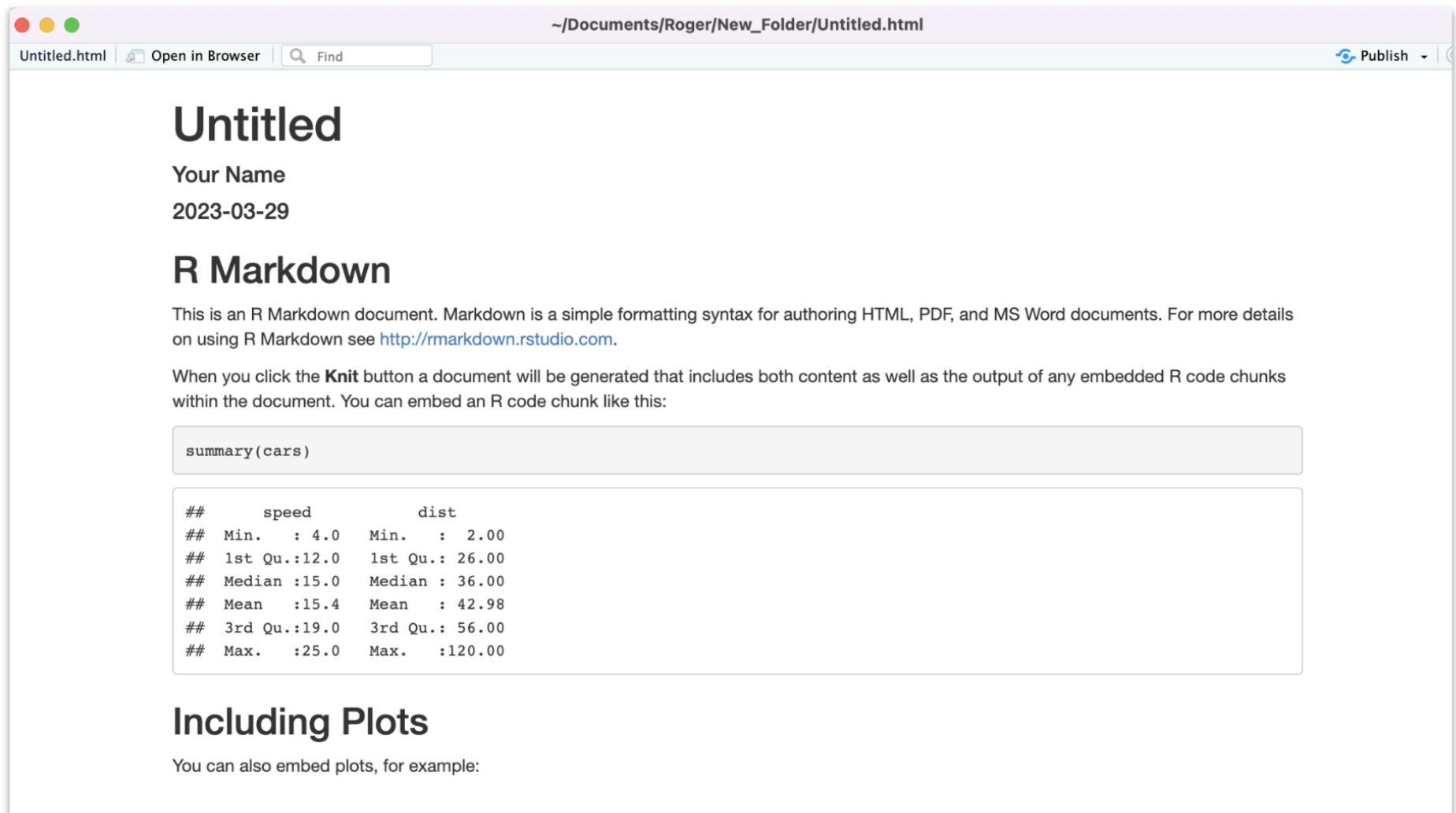
# Knit file to html

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 web browser window with the address bar displaying `~/Documents/Roger/New_Folder/Untitled.html`. The browser tab is labeled `Untitled.html` and includes an `Open in Browser` button and a search field. A `Publish` button is visible in the top right corner. The main content of the page is as follows:

## 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

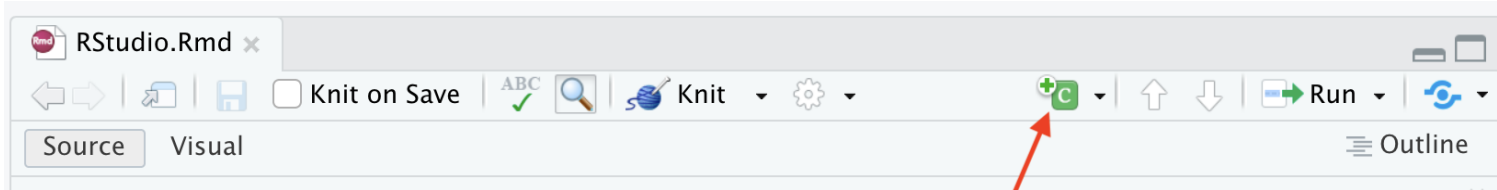
You can also embed plots, for example:



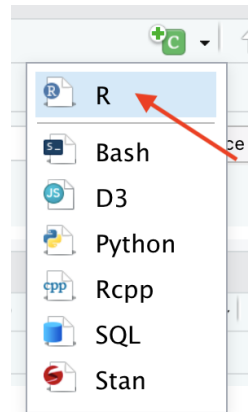
# Create Chunks

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:

```
``{r, out.width = "80%", echo = FALSE, fig.align='center'}  
knitr::include_graphics("images/chunk.png")  
``
```



# Chunk settings

Please [click here](#) to update the s

Chunk Name:

Output:

Show warnings

Show messages

Use paged tables

Use custom figure size

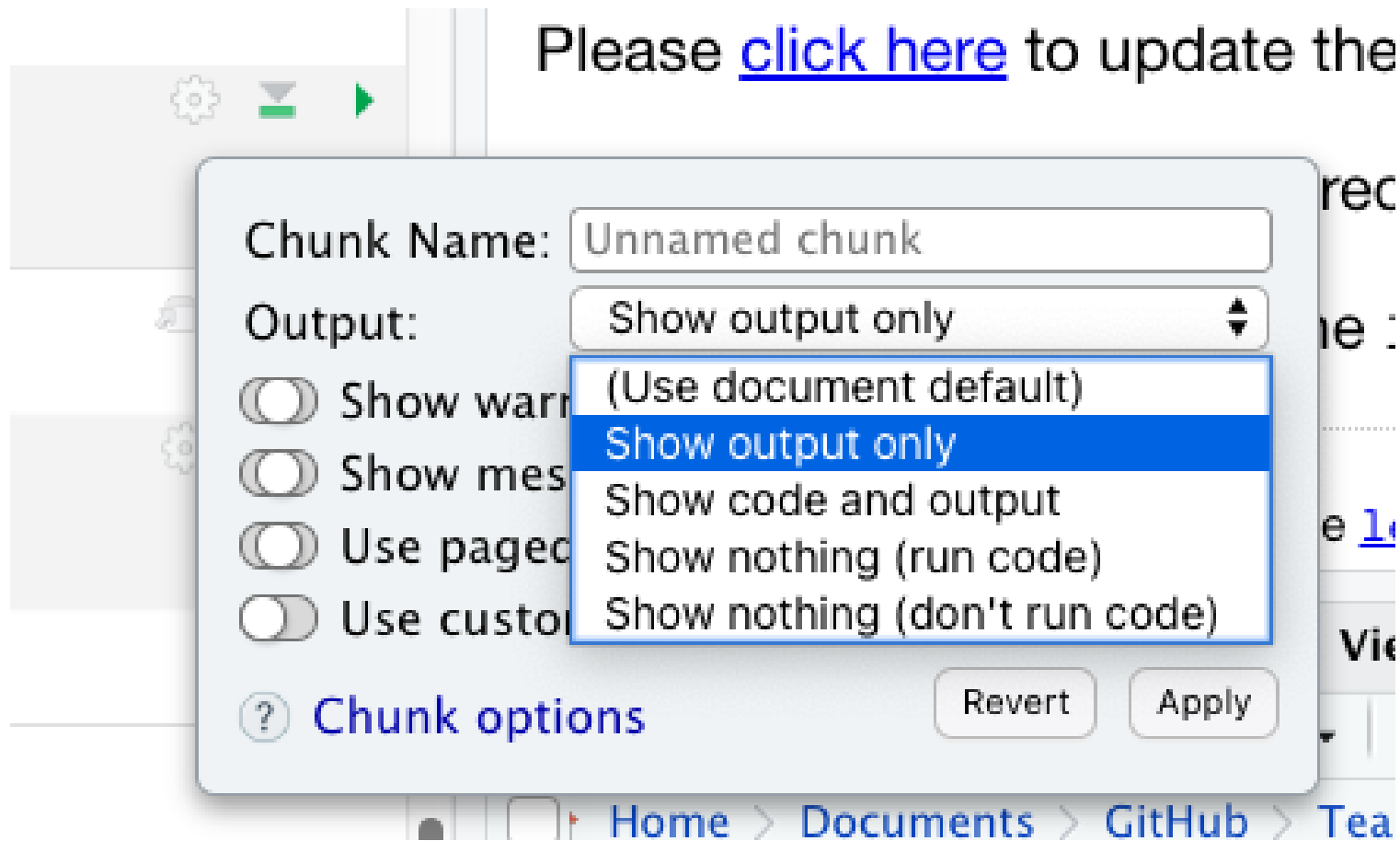
[? Chunk options](#)

Home > Documents > GitHub > Teach

## Chunk settings

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

Please [click here](#) to update the



# Errors

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

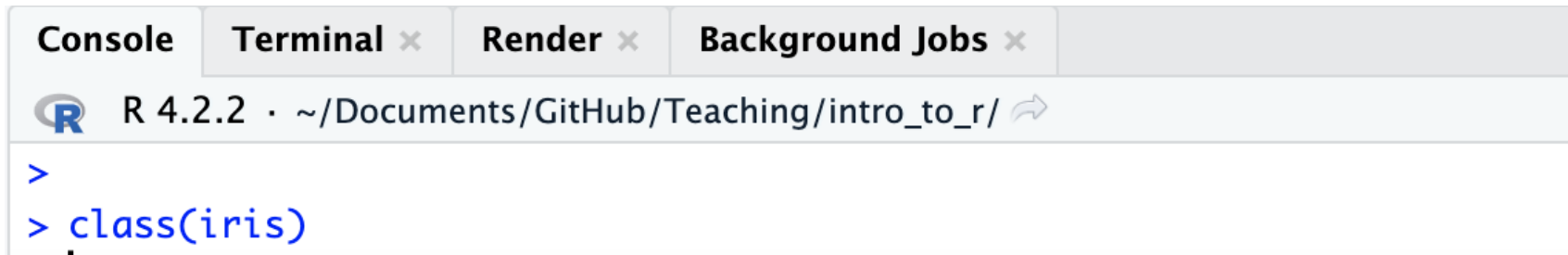


The screenshot shows a snippet of R code in a text editor. Line 305 contains `print(x, ...)` with a yellow highlight. Line 306 contains `{r}`. Line 307 contains `print(x))|` and is marked with a red 'x' icon. A tooltip box is open over line 307, displaying the error message: `unexpected token ')'` and `unexpected end of document`. The code editor interface includes a settings gear icon, a dropdown arrow, and a green run button on the right side.

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

## Recap of where code goes

- you can test code in the console



The screenshot shows an R console window with the following elements:

- Tabbed interface with tabs: Console, Terminal x, Render x, Background Jobs x.
- Header bar: R 4.2.2 · ~/Documents/GitHub/Teaching/intro\_to\_r/ ↗
- Input prompt: >
- Code being entered: > 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](#)