Data Analysis in R

Orientation to R Studio

Michael E DeWitt Jr

2018-09-06 (updated: 2018-09-06)

Our mission

- Introduce R as a programming language and `<<data science>>` environment
- Introduce R Studio as an IDE
- Get you working on your use cases quickly

A little bit about R

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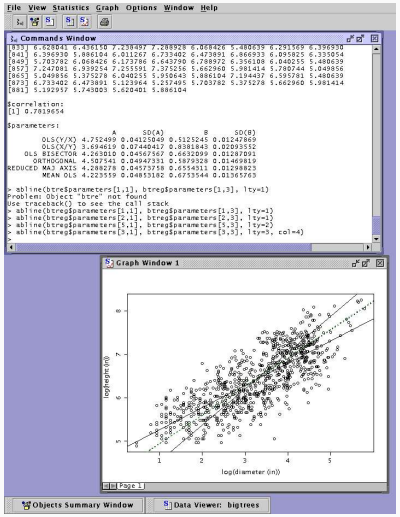
- Developed out of the statistics department
- Non-standard methods were needed
- Solution: Develop programming language and environment designed explicitly for **interactive** data analysis using the best available computation methods and flexible enough to meet new use cases!

If you can do something well, then have



S was then sold to the open market as S

Later distributed as S-Plus

Bought by TIBCO

After S, R?

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- Common Problem: `$A$`, `$-plus`, `$TATA`, `$P$$`
- Solution: Develop an **open source** implementation of S!
- Allow for new methods to be adopted and shared through **packages** *

[*] Packages are ways of collecting, documenting and sharing R (or other language) scripts that have been pre-written. They can be installed and then run as new functions extending base-R

CRAN Established

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- It has been extended into webpage generation, documentation, dashboards, etc

Why not R?

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- Syntax is *not* consistent between packages

```
# From randomForest
rf_1 <- randomForest(x, y, mtry = 12, ntree = 2000, importance = TRUE)

# From ranger
rf_2 <- ranger(
  y ~ .,
  data = dat,
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- R **can** be slower than some other languages
- Performs calculations *in-memory* (e.g. data < RAM)

R Studio

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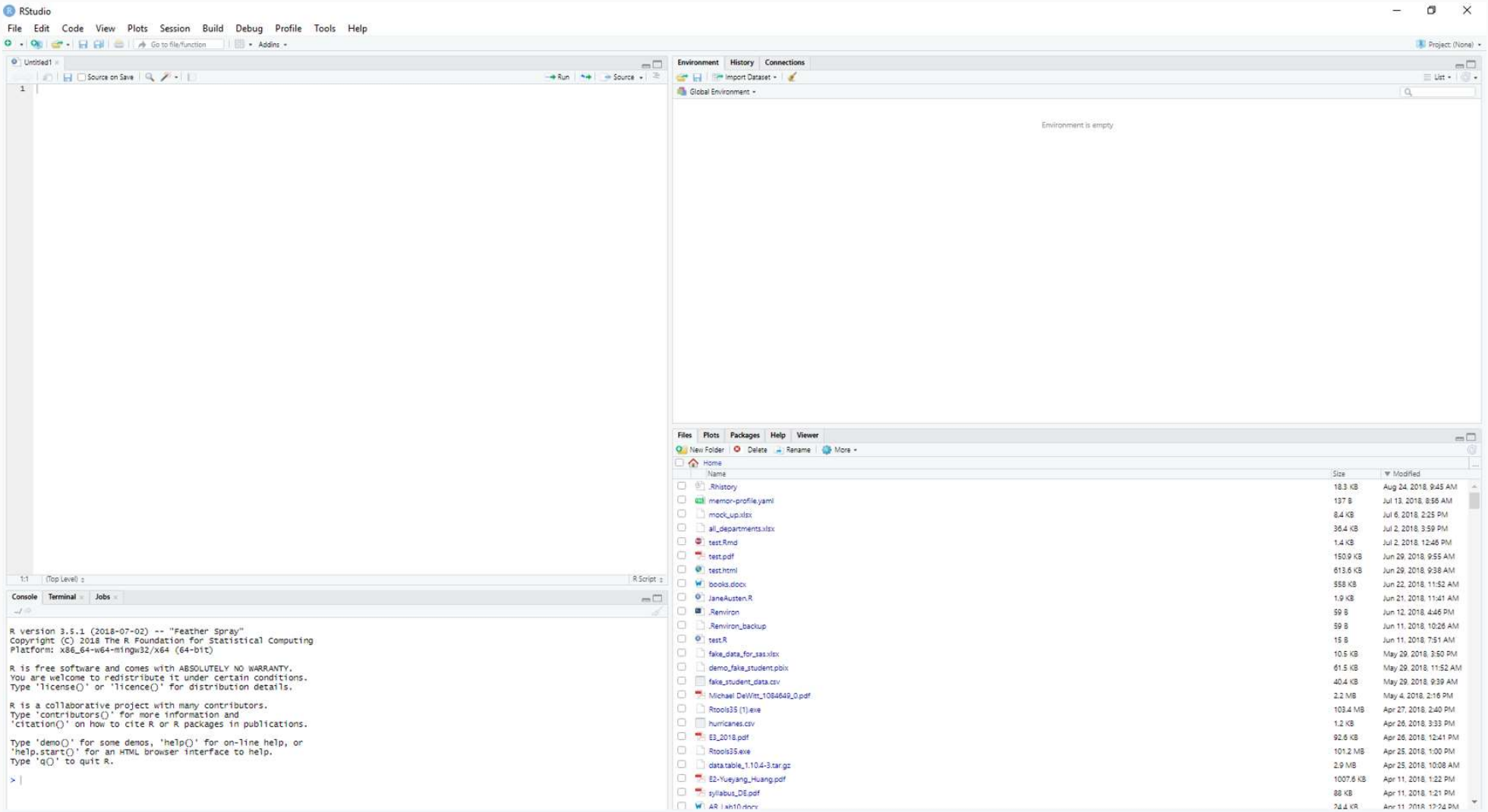
- Syntax highlighting, auto-complete, visual exploration, integration with version control systems and more!

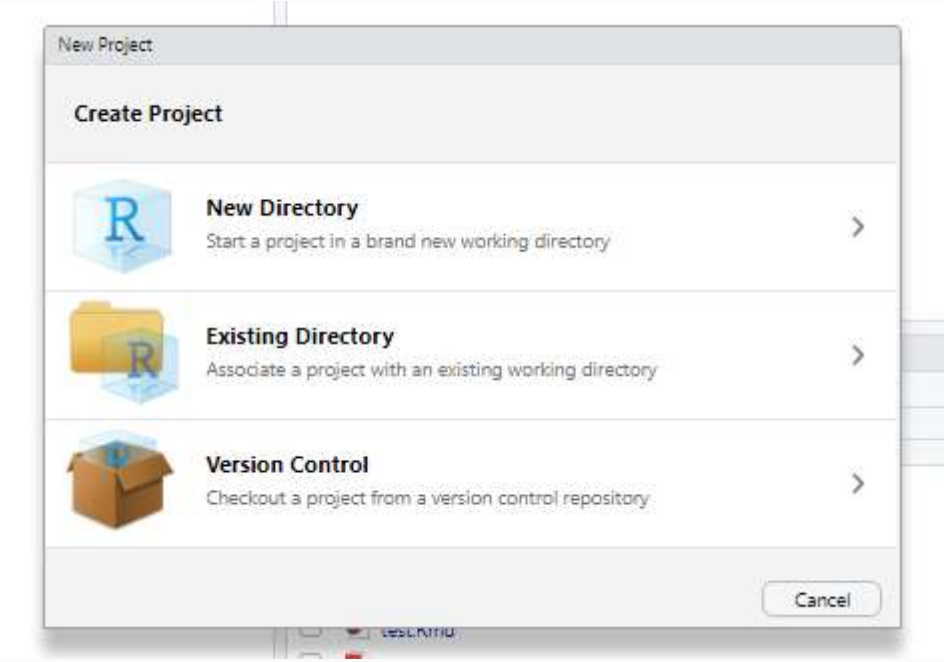
So Let's Explore it

Press CTRL + SHIFT + N or CMD + SHIFT + N to create a new script



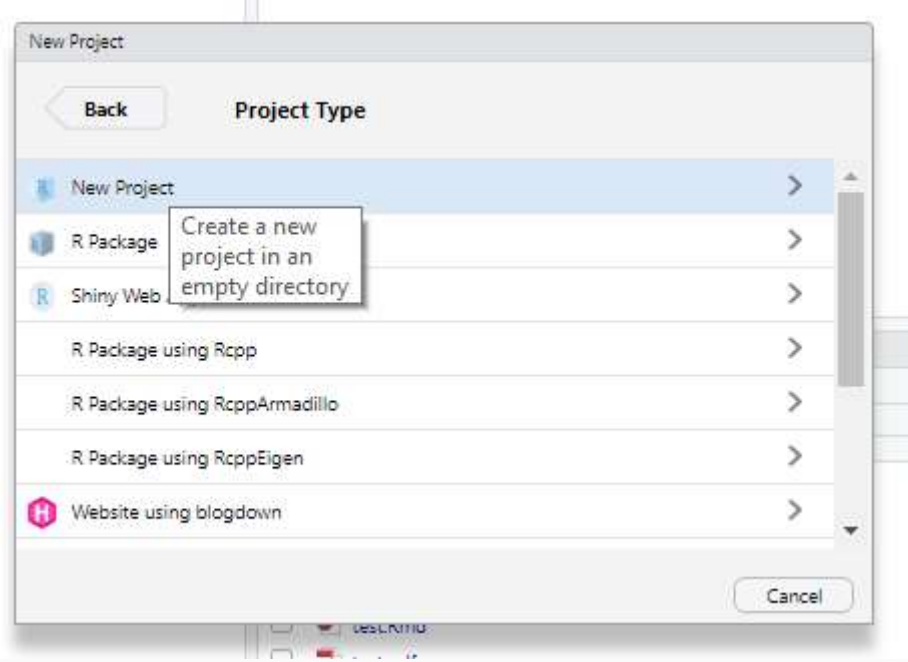
Start a new project

We want to start a new project



Put the project in a new directory (typically the default)

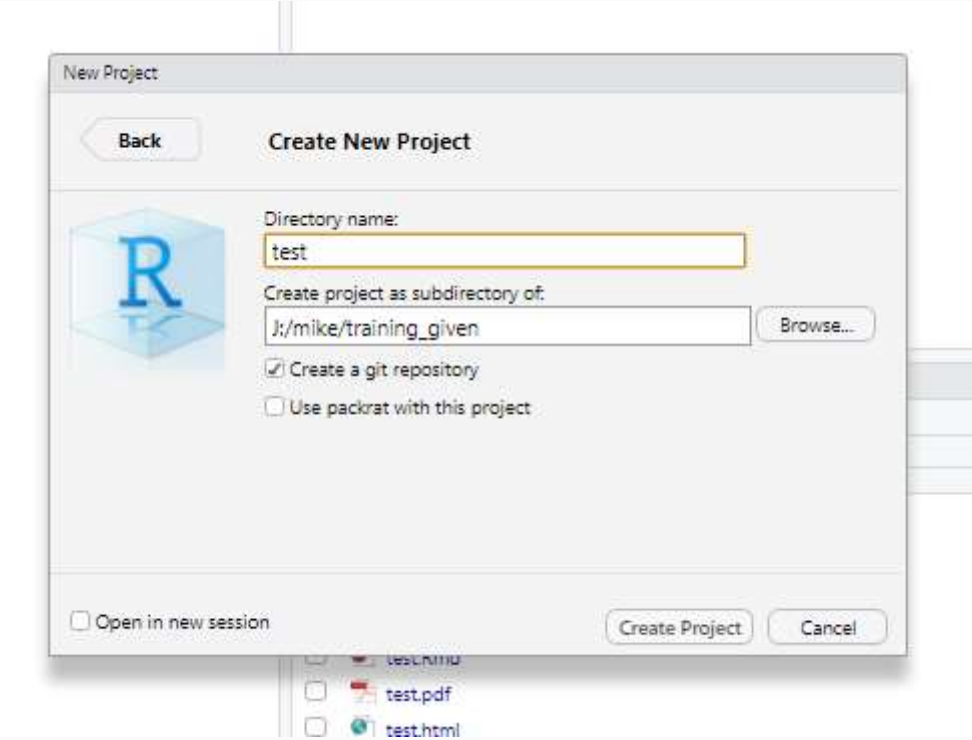
Create a new project



We would like a new project (other items are for more advanced topics)

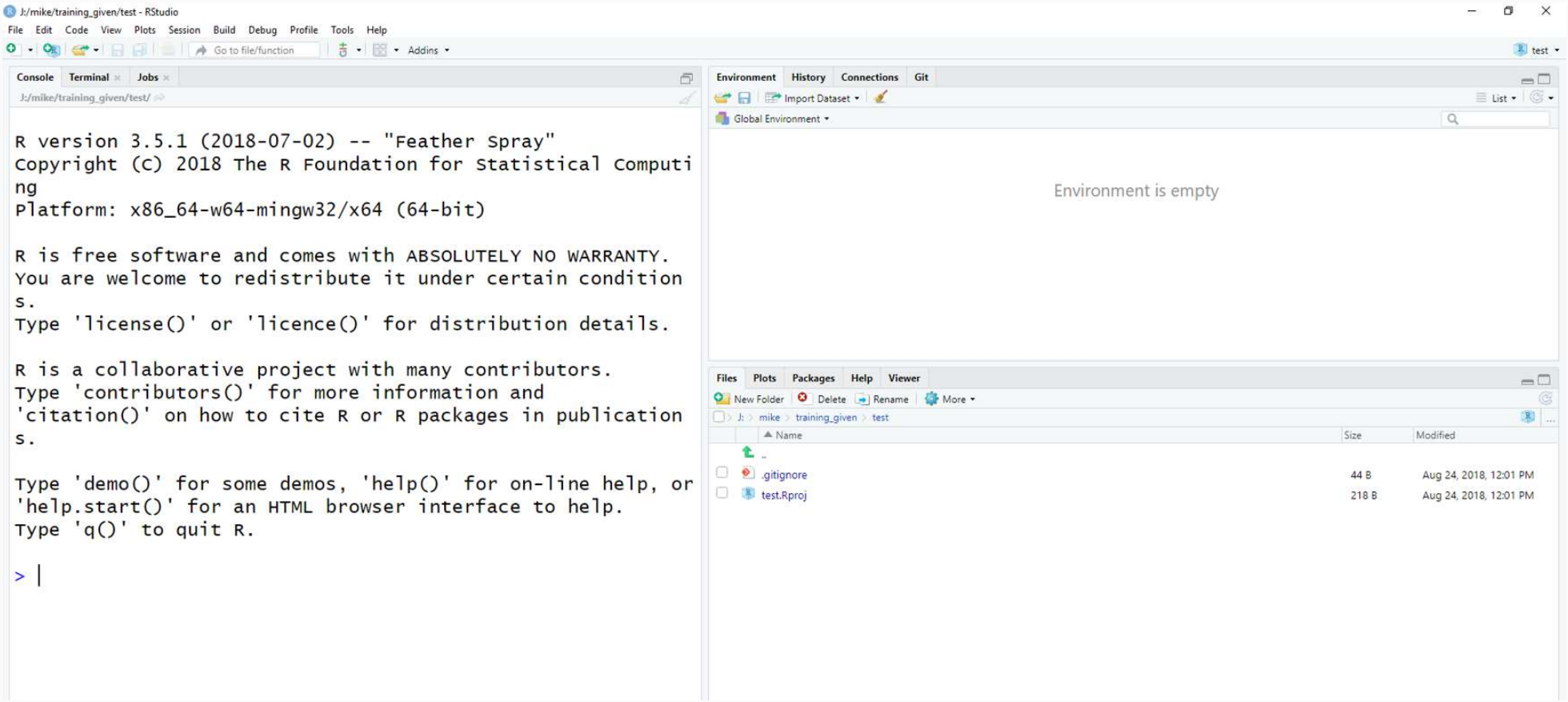
Name it

Name the new project and place it in whatever directory works for you



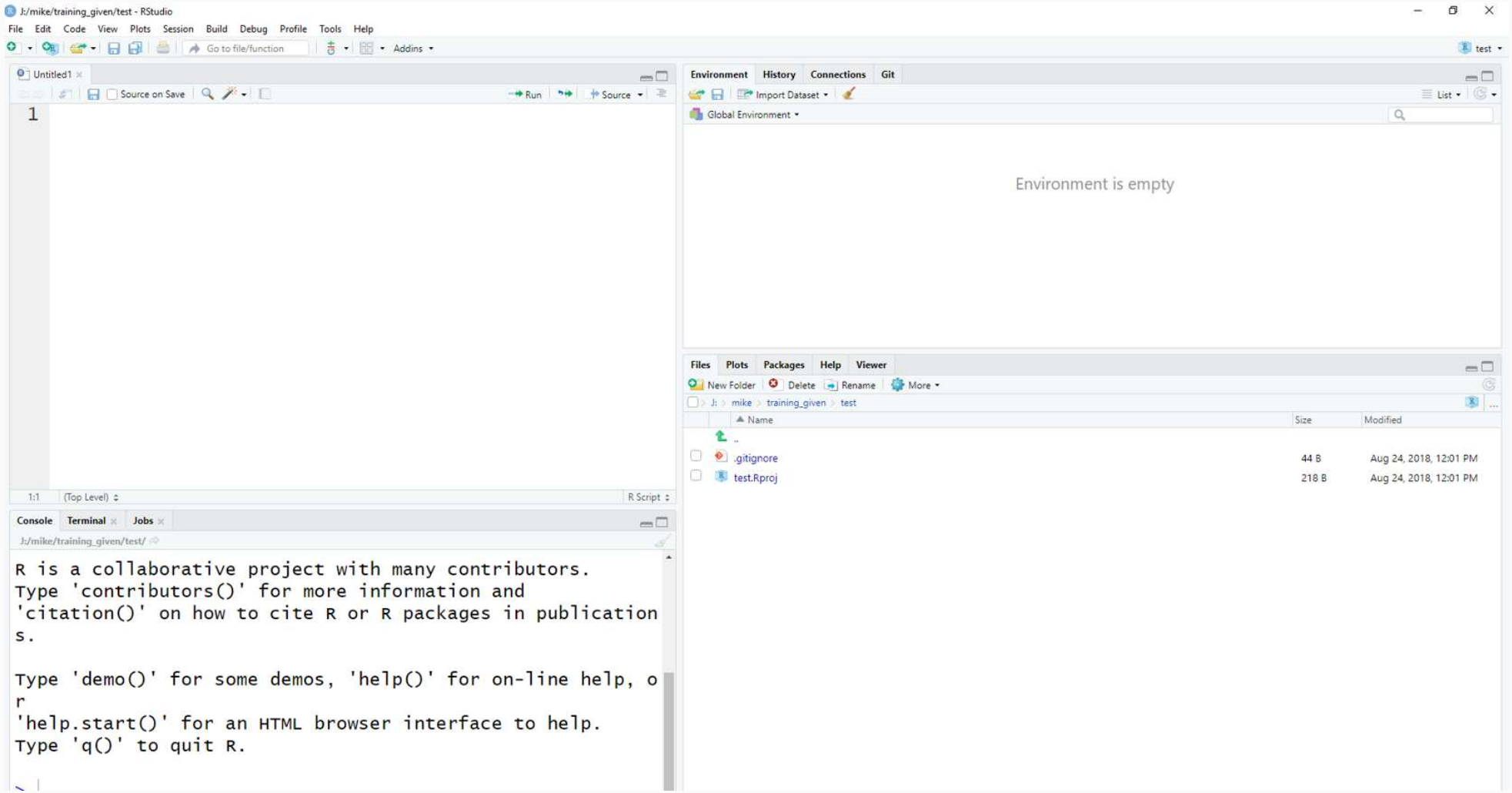
Ta Da!

This should be your starting point for each new project

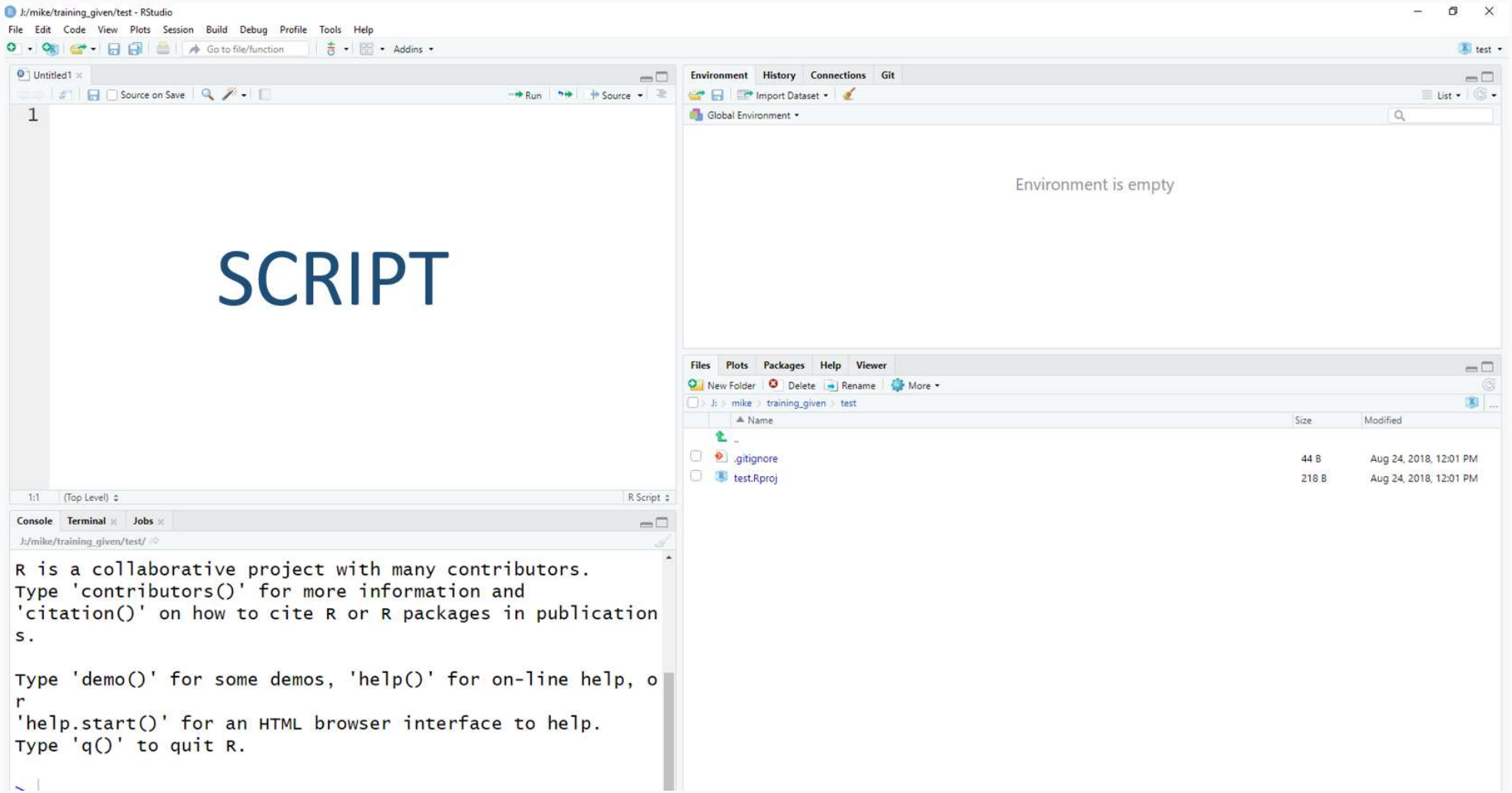


Now open a new scripting pane

`CRTL+N` or `CMD+N` to open a new script



Scripting Pane



Scripting Pane (Where the magic happens)

Generally you want to write all of your code here in either:

- Rmarkdown document (.Rmd)
- R script (.R)

This way you can save your code and submit it to R!

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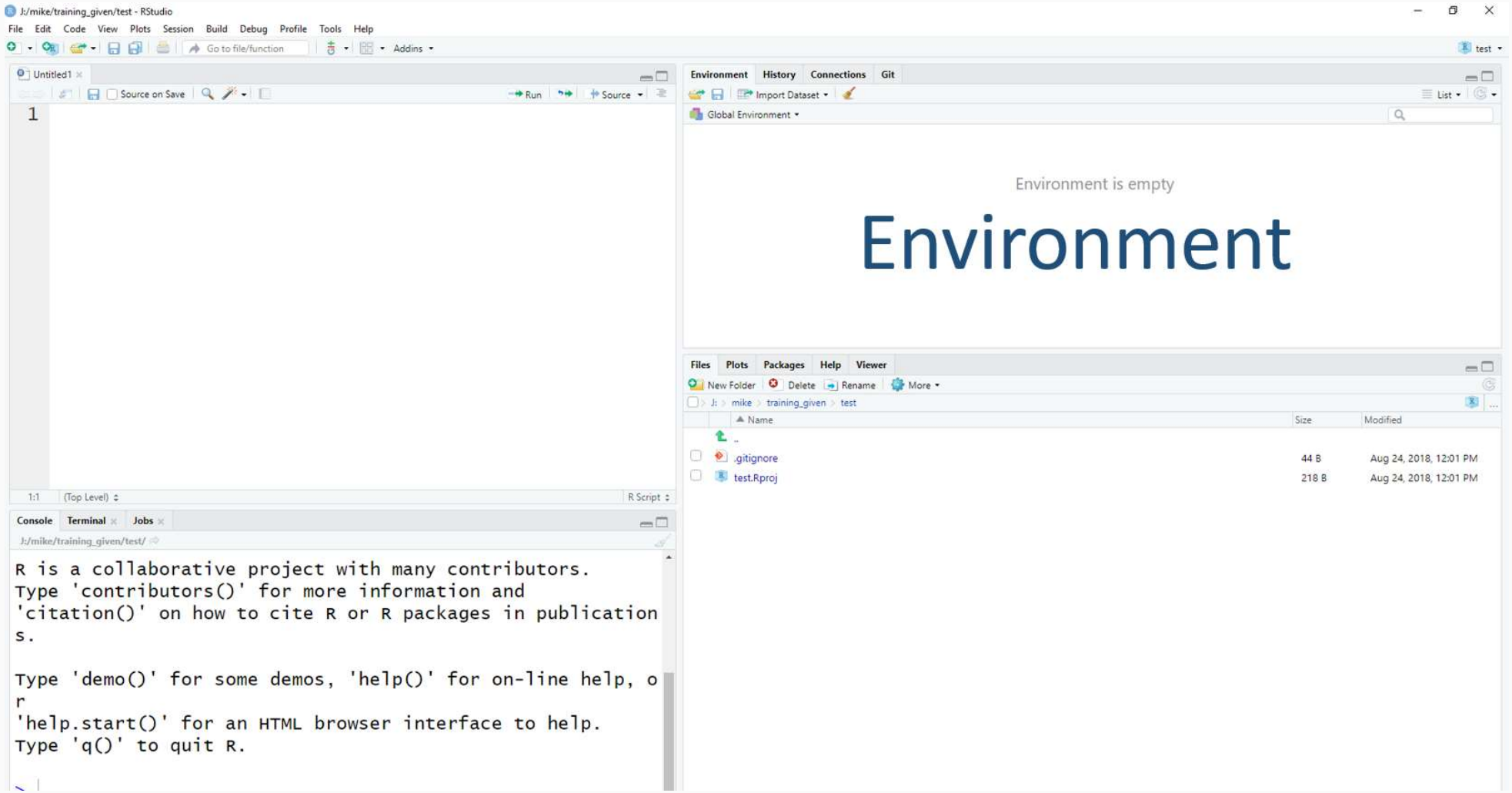
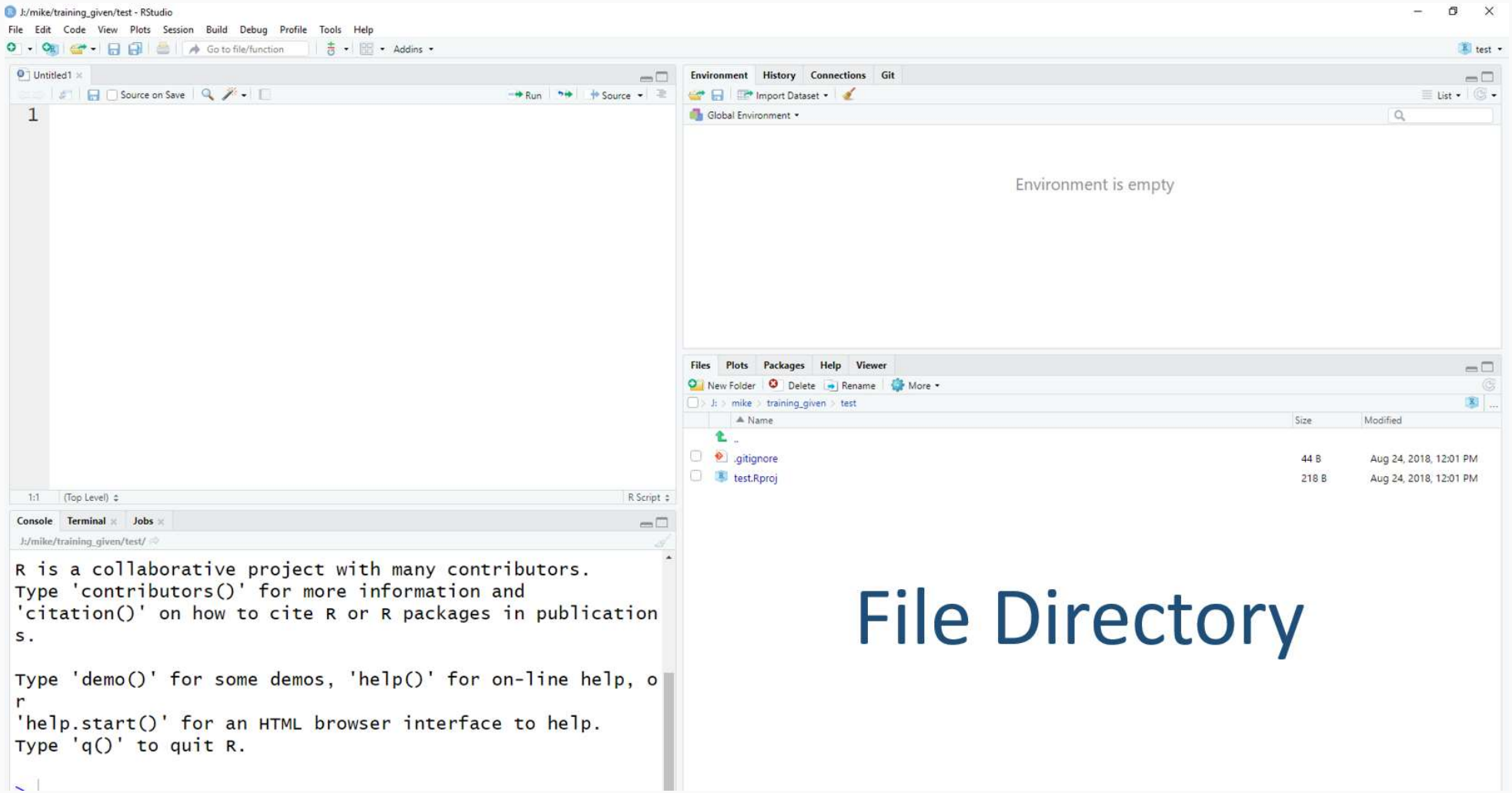
You can send the script to R using the `CRTL + ENTER` / `CMD + ENTER` Shortcut

Environment Pane

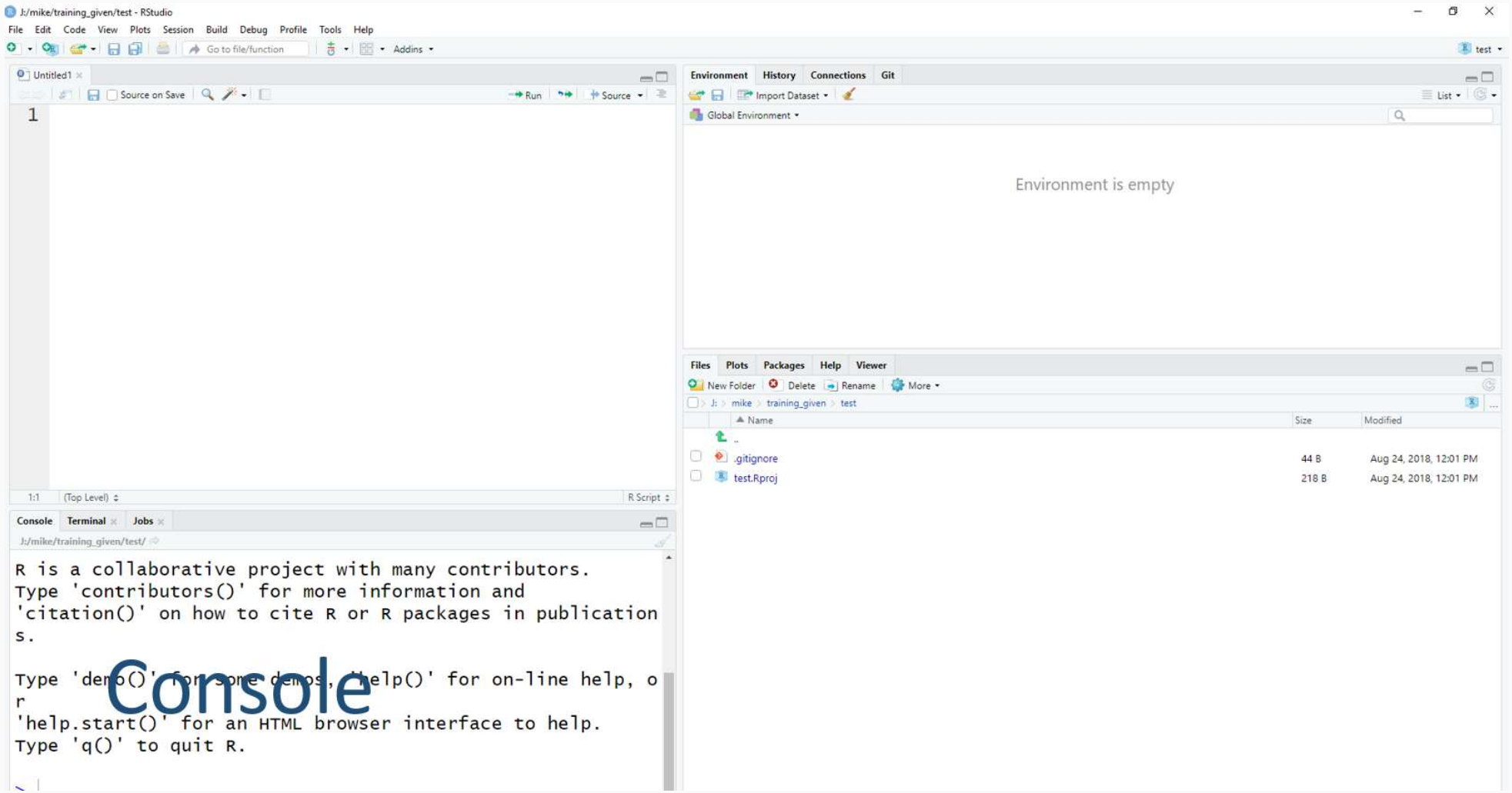
This is where you will find objects that are `in-memory` or available to call



File Directory Pane



Console Pane



Console

The console is the heart of R and the best calculator in the world

```
4+6
```

```
## [1] 10
```

If you type directly the output will be printed, but *not* saved

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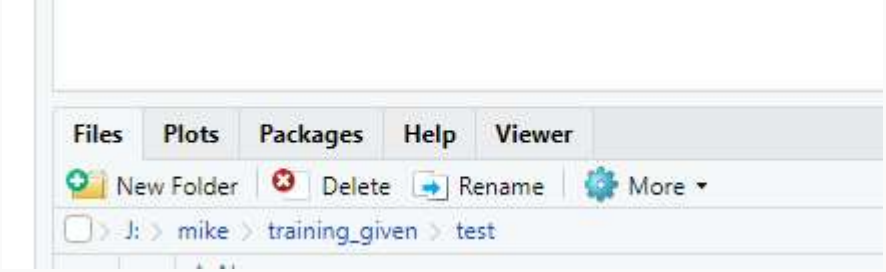
To save you need to use the assignment operator `<-` to store the object in memory

```
my_output <- 4+6
my_output
```

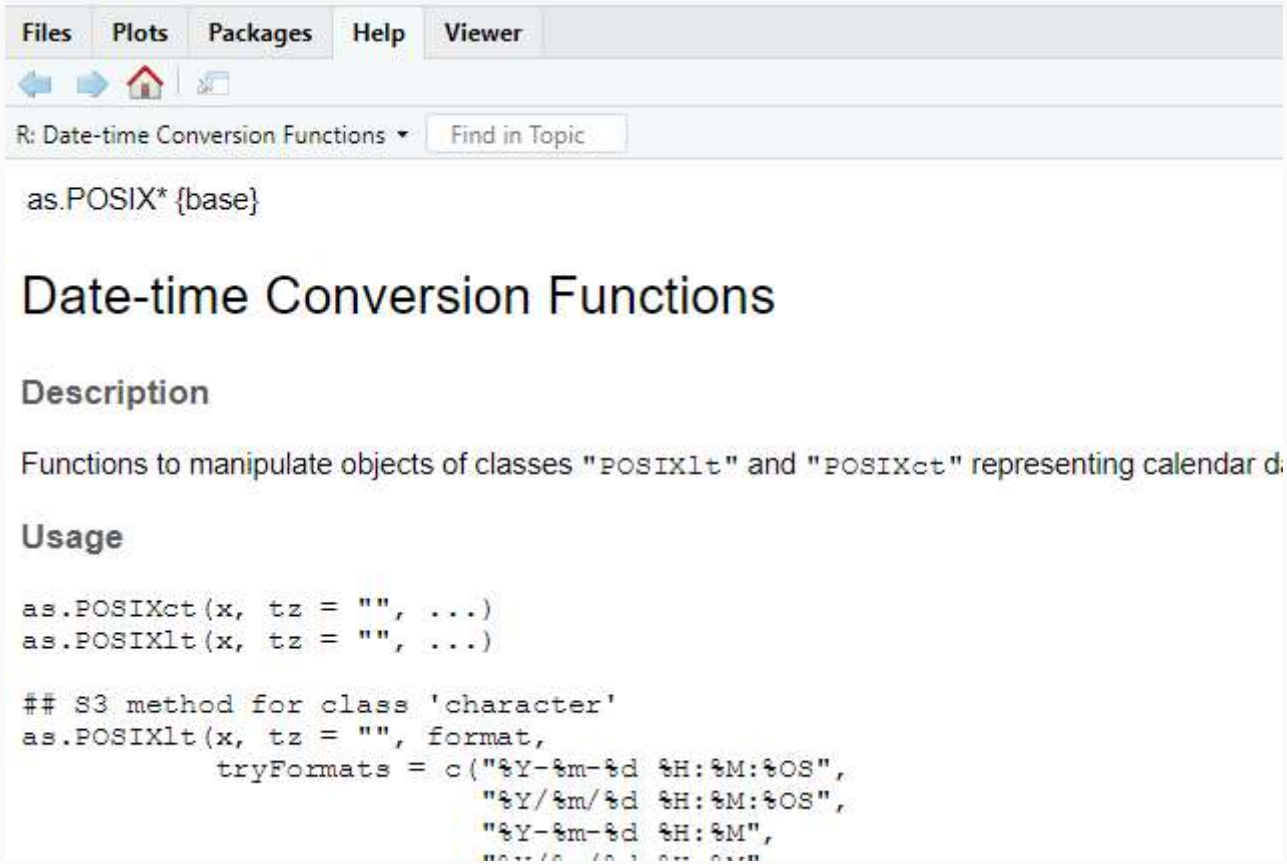
```
## [1] 10
```

Additional Tabs



Additional tabs contain other objects include files, plots, packages, and viewer

Help!



A handy feature is the searchable help pane where you can get information on functions

Additional Help

You can also use the console to help you *find help*

To call the help file for a particular function:

```
??lm
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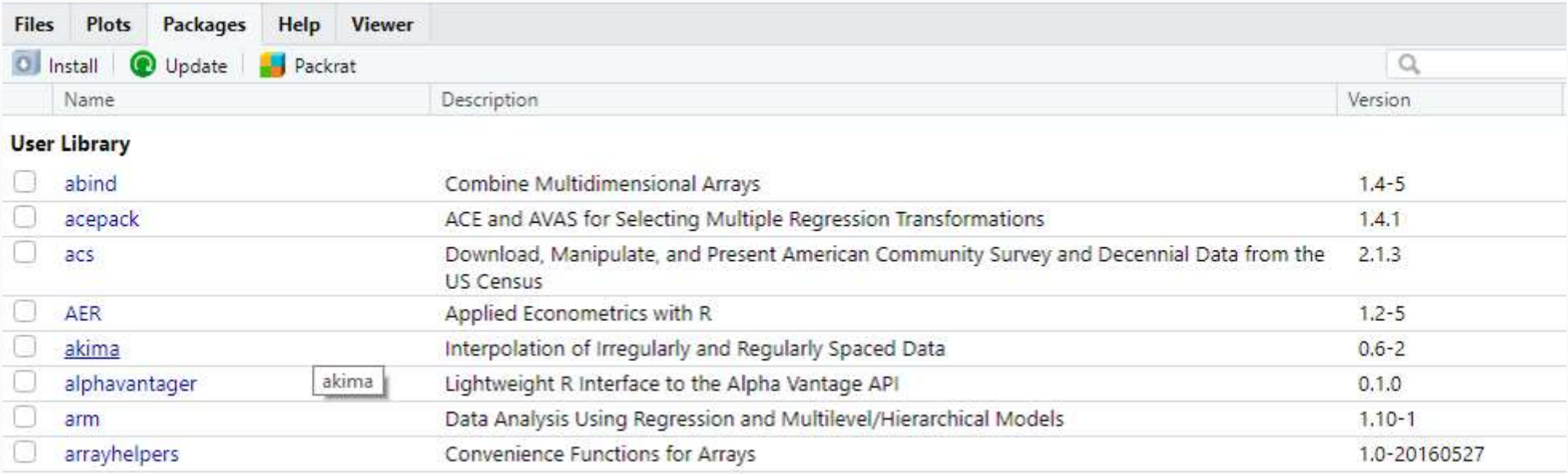
For a function that you can't quite remember...

```
apropos("glm")
```

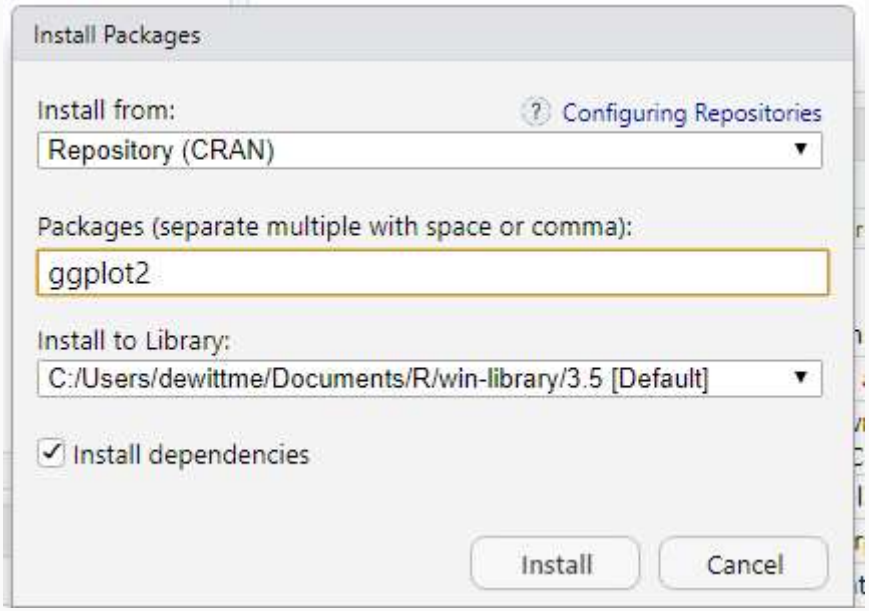
```
## [1] "glm"           "glm.control"   "glm.fit"       "predict.glm"
## [5] "residuals.glm" "summary.glm"
```

Package Viewer



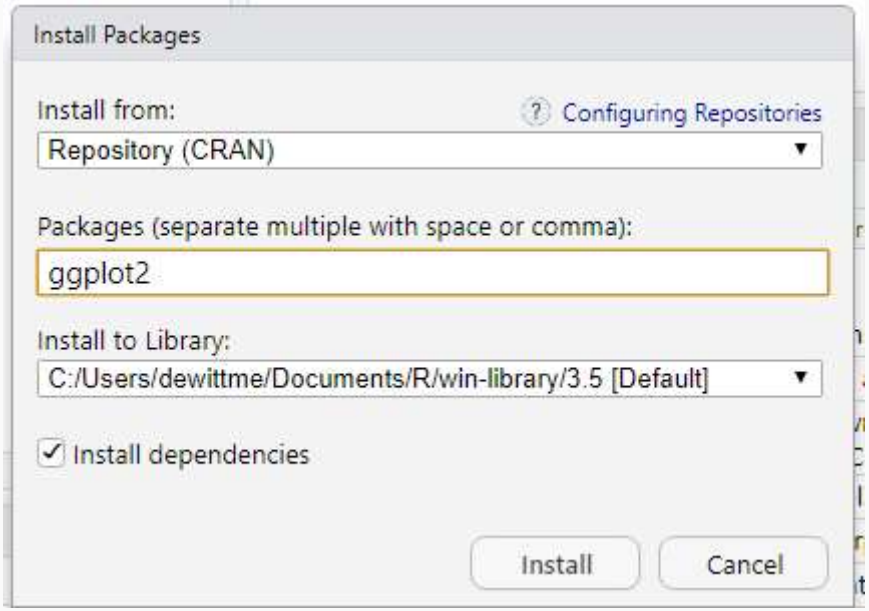
The package viewer allows you to see your install packages (with links to the function descriptions)

Package Install



You can install packages from `cran` using the package install feature

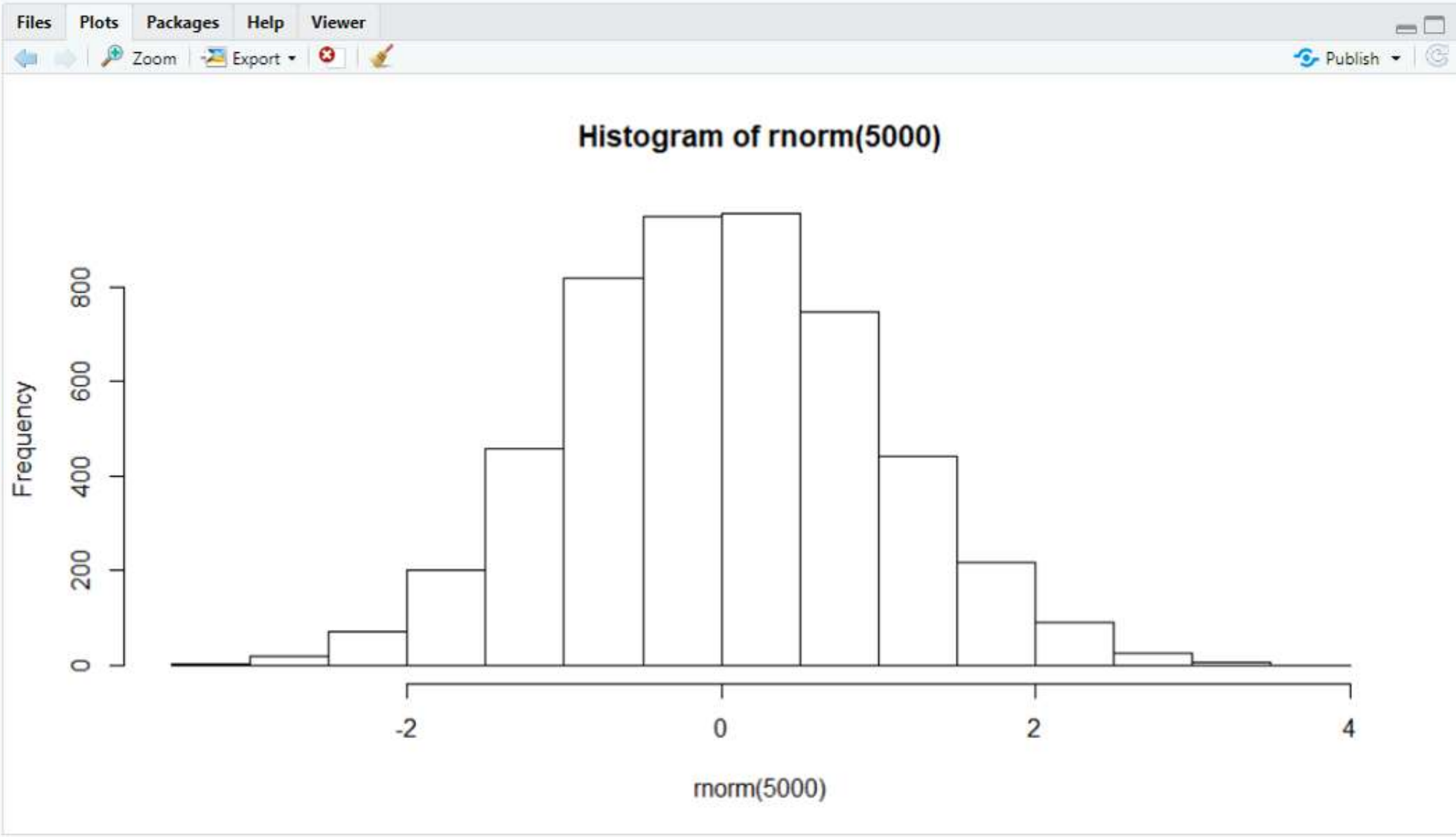
Package Install



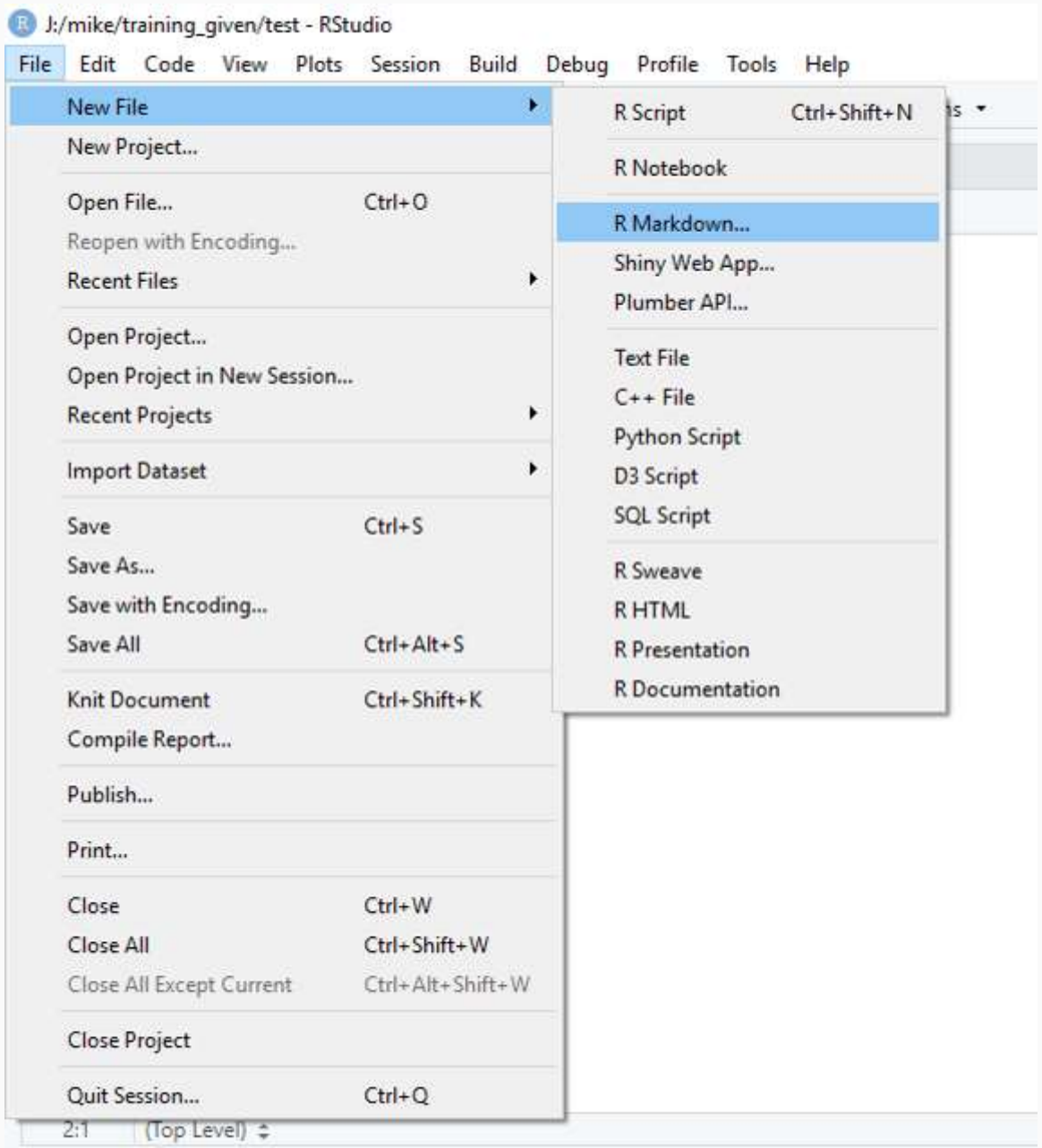
You can install packages from `cran` using the package install feature

Later we will install packages from other sources like github

Plots

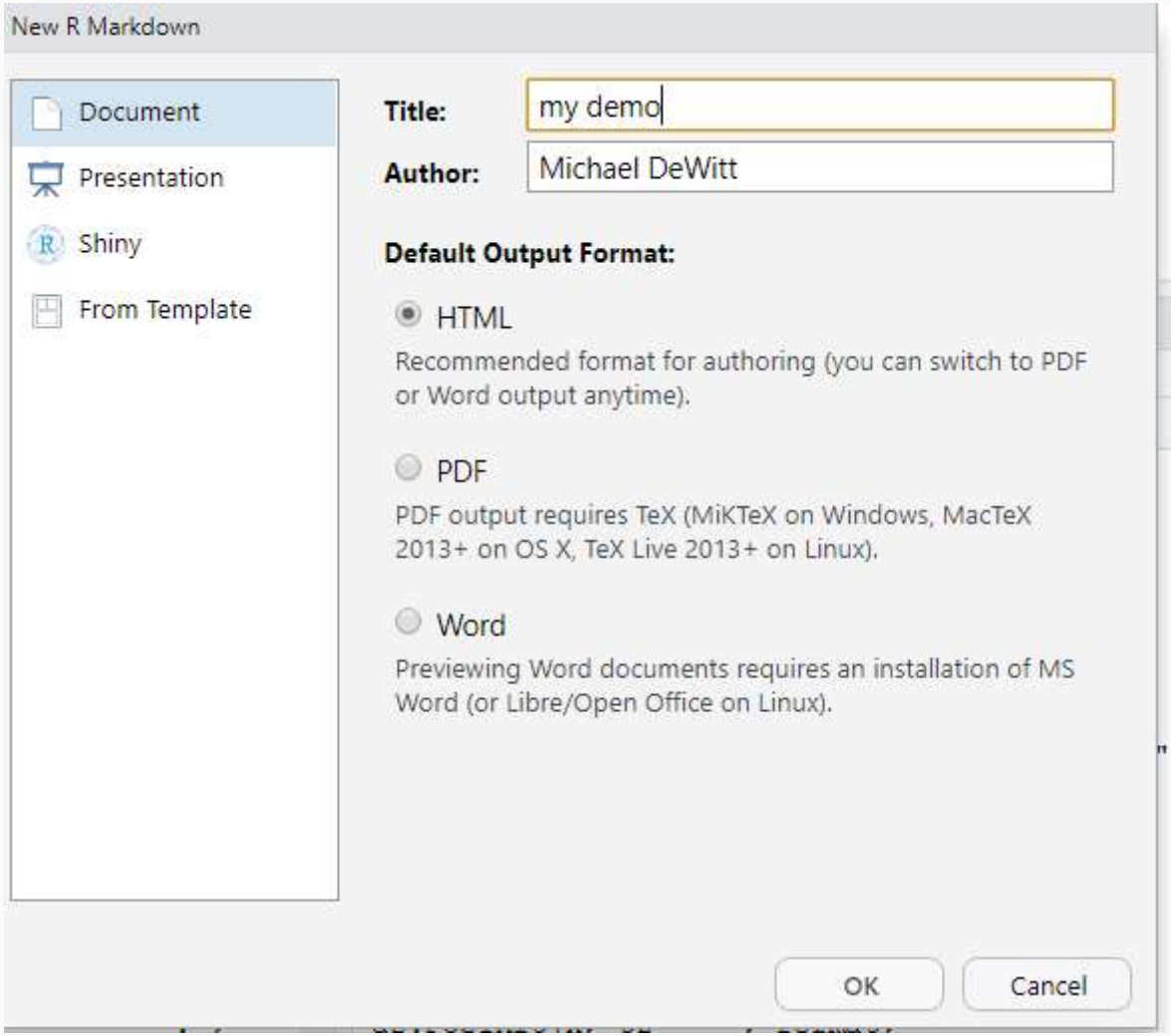

Files
Plots
Packages
Help
Viewer
Zoom
Export
Publish
Histogram of rnorm(5000)
Frequency
0
200
400
600
800
-2
0
2
4
rnorm(5000)

Creating a new file



New Rmarkdown

Markdown documents are a way to weave text and code into the same documents



Rmarkdown Example File

Untitled1* Untitled2

Knit Insert Run

```
---
title: "my demo"
author: "Michael DeWitt"
date: "8/24/2018"
output: html_document
---

```{r setup, include=FALSE}
knitr::opts_chunk$set(echo = TRUE)
```

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:

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

Parts of an Rmarkdown Document - YAML

The YAML header block is separated by three _ symbols

```
---
title: "Untitled"
author: "Michael DeWitt"
date: "9/5/2018"
output: html_document
---
```

Parts of an Rmarkdown Document - YAML

The YAML header block is separated by three `_` symbols

```
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title: "Untitled"
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date: "9/5/2018"
output: html_document
---
```

Specifies to `pandoc` how to convert the document and into what format to render the document

- html_output = html
- pdf_output = pdf
- word_output = Microsoft Word

Parts of an Rmarkdown Document - Code

Code chunks can be inserted with `CTRL + ALT + I` or `CMD + ALT + I`

```
fit <- lm(mpg ~ disp + wt, data = mtcars)
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Or running the code line by line

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The rest of the Rmarkdown is plain text

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Rmarkdown also provides ways to add some additional formatting

Rmarkdown Markup

Formatting

`# # Header 1`

`## ## Header 2`

`*italics*` or `_italics_` for *italics*

`**bold**` or `__bold__` for **bold**

`-` or `*` for bullets

- Bullet 1
- Bullet 2
  - Bullet 2a

`1` for numbered lists

1 Item 1

2 Item 2

`$\int_{a}^bx^2dx$` for $\LaTeX$ e.g. $\int_a^b x^2 dx$

Knit it!

Rmarkdown to html!

Check out the gallery at https://rmarkdown.rstudio.com/gallery.html

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My way isn't always the best way (always alternatives)