R Markdown Introduction 27Sep2021   Part 1

Why R Markdown?

R Markdown allows you to perform literate programming.

"**Literate programming** is a programming paradigm introduced by Donald Knuth in which a computer program is given an explanation of its logic in a natural language, such as English, interspersed with snippets of macros and traditional source code, from which compilable source code can be generated.[1] The approach is used in scientific computing and in data science routinely for reproducible research and open access purposes.[2] Literate programming tools are used by millions of programmers today."

Source: https://en.wikipedia.org/wiki/Literate_programming

Literate programming is very suitable to academic research. With R Markdown not only can you perform literate programming in RStudio, but you can also generate journal-suitable pdf files to share with your colleagues. In essence you can create your data analysis and your research paper (or book) in the same environment, i.e., an RStudio project. Furthermore, your data analysis can be reproduced with ease.

FYI regarding Donald Knuth from Wikipedia:

"**Donald Ervin Knuth** (/kəˈnuːθ/[3] *kə-NOOTH*; born January 10, 1938) is an American computer scientist, mathematician, and professor emeritus at Stanford University. He is the 1974 recipient of the ACM Turing Award, informally considered the Nobel Prize of computer science.[4] Knuth has been called the "father of the analysis of algorithms".[5] "

Source: https://en.wikipedia.org/wiki/Donald_Knuth

The Great News

It is easy to get started with literate programming using RStudio. RStudio makes it straightforward to use R Markdown to create a literate program.   This literate program will contain your reproducible research and will also generate your finished research paper with a click of a button.

R Markdown Basics

R Markdown allows you to generate a research paper or book in PDF, HTML, or Word format. This is done automatically from your code and data that you write within RStudio.

R Markdown files end with the file extension Rmd (as opposed to R script files that end with the file extension R).

The Rmd file is just a plain text file, and it allows you to combine five important parts of your research.

1) The R code that shows how you did your study.

2) The results of your R code, e.g., the tables and charts it produces along with the output from your model, for example a multiple regression model.

3) Your write-up that discusses what you did and why, as well as the results that you have discovered.

4) The ability to generate with a click of a button, your final report, book, or research article.

5) Reproducibility! Just give your colleagues a copy of your zipped RStudio project and they can quickly run and evaluate your code and work. Or they can make changes and create their own version of the research that you started!

So how does it work?

1) You will create a plain text .Rmd file. This file will contain blocks of R code. These blocks of code are called chunks. You will also add text (non-R code)
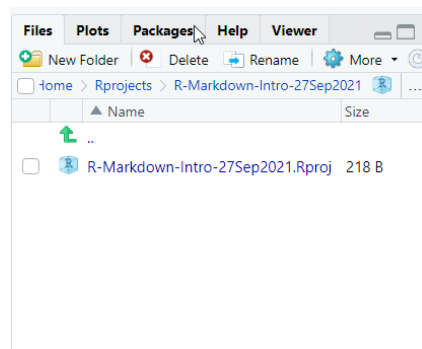
2) The R package knitr will convert the .Rmd file into a Markdown file with extension .md and then the R package markdown can convert the .md file into a PDF, HTML, or Word file.

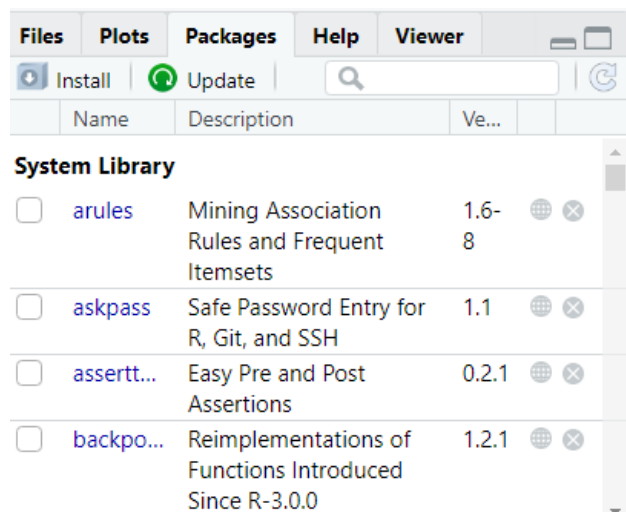**So, let's start with a new RStudio project called R-Markdown-Intro-27Sep2021**
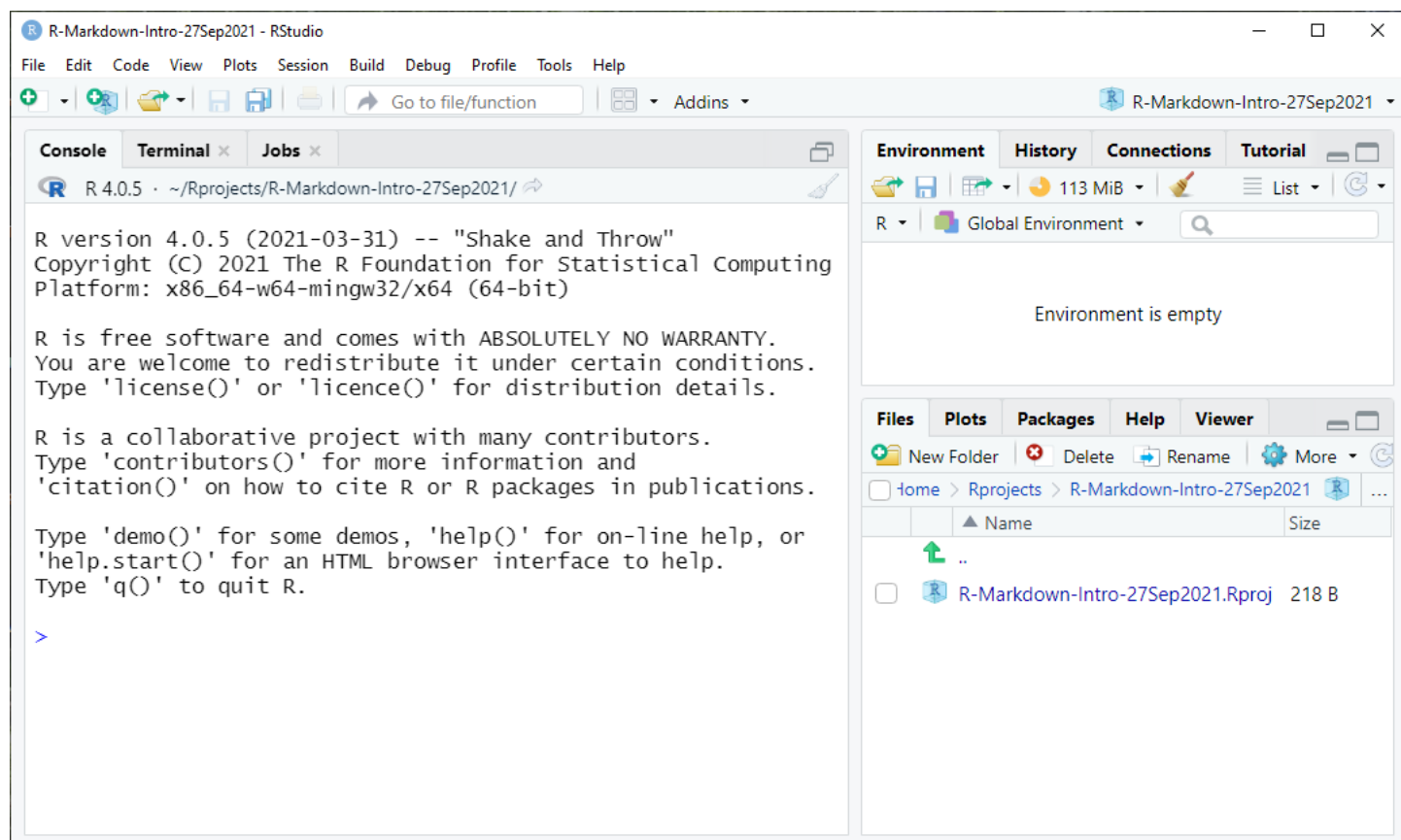
You can install the packages knitr, rmarkdown, and markdown from within RStudio.

Click on **Packages**:

Then your installed packages are displayed (note that an unchecked box means that the package is not loaded into your current R session).

Next

Check to see if the packages knitr, rmarkdown, and markdown are installed.

If they are not there, then they can be installed from within RStudio by clicking install and searching for the package (e.g., type knitr into the search box).

You can add the packages to your R coding session with:

library(knitr)

library(rmarkdown)

library(markdown)

or by just clicking the checkbox by the installed package from within RStudio.

So knitr is installed but not loaded:
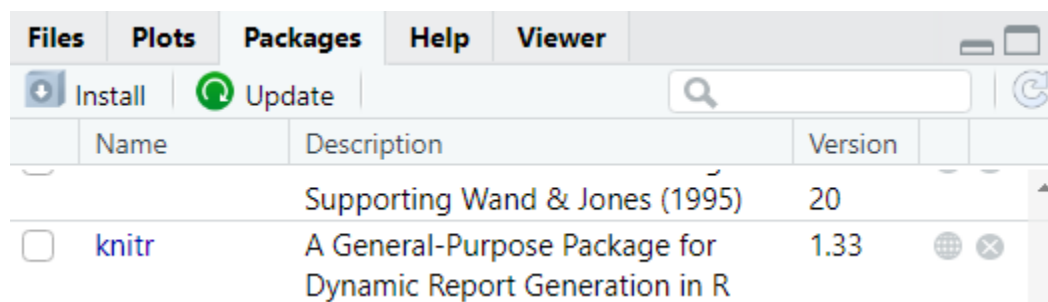
Check the box to load knitr (do this for rmarkdown and markdown as well).

After checking the box, RStudio adds the line of code

library(knitr)

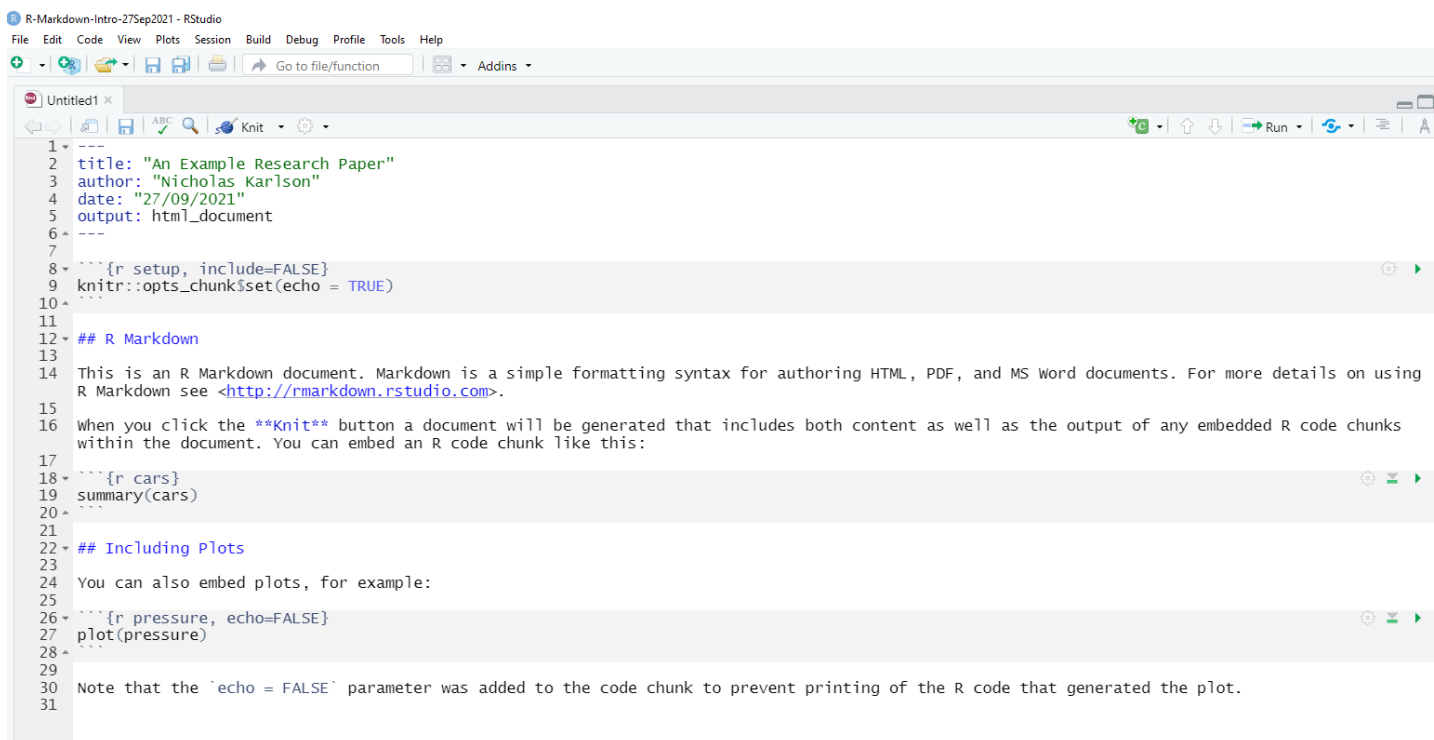**Once this is done then from the RStudio menu…**
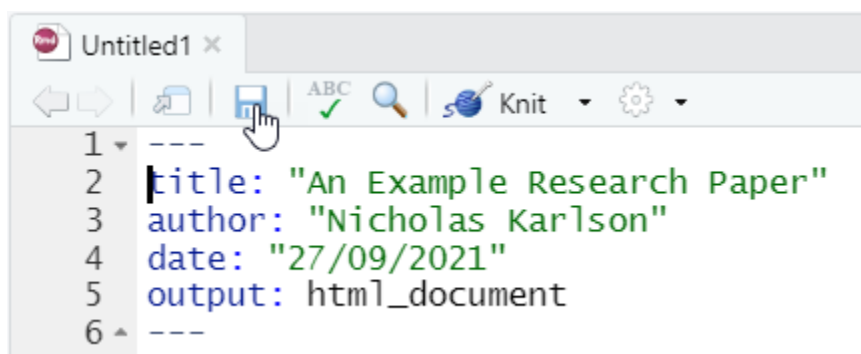
Click on File -> New File -> R Markdown
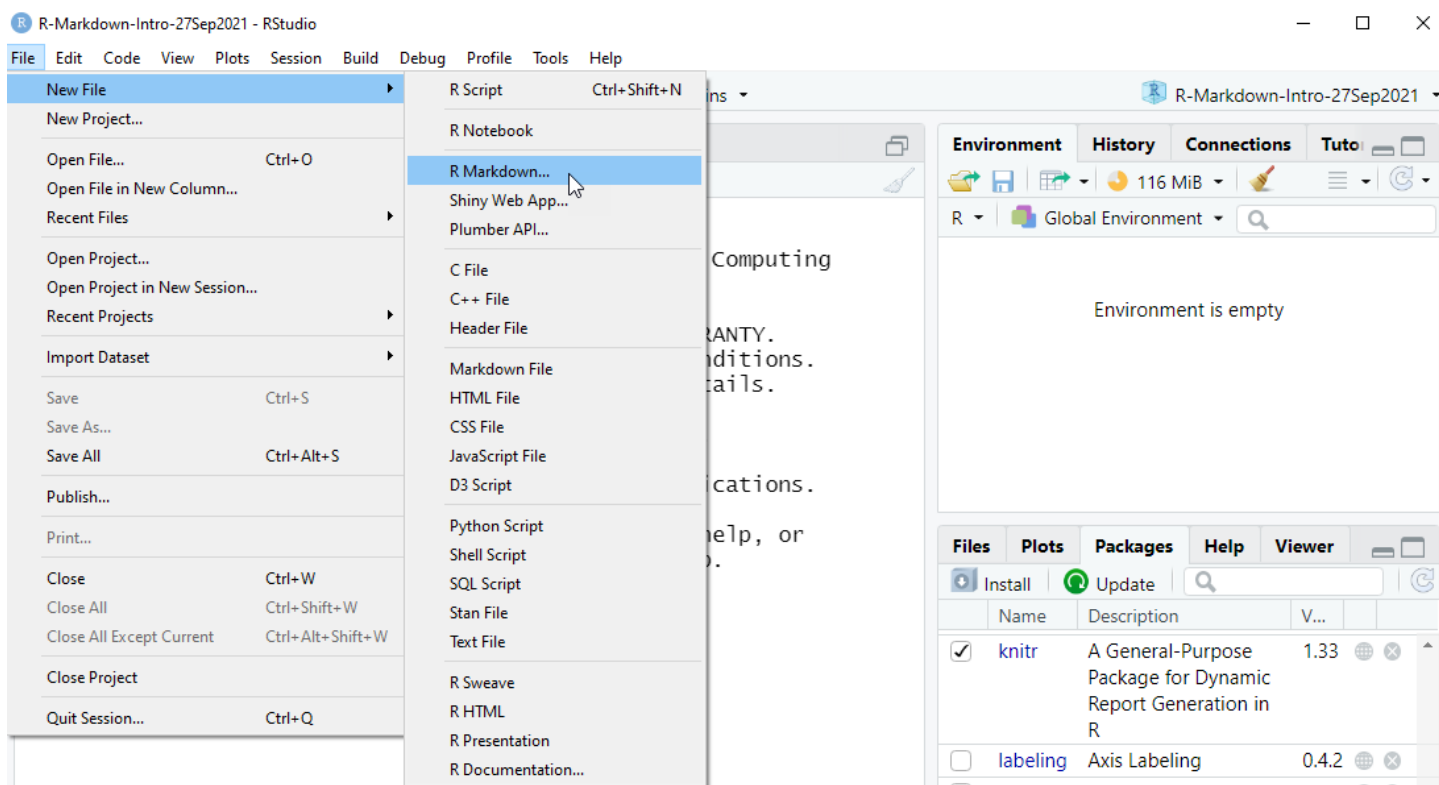
This produces the following dialog box (fill in title, author, select HTML, click OK).
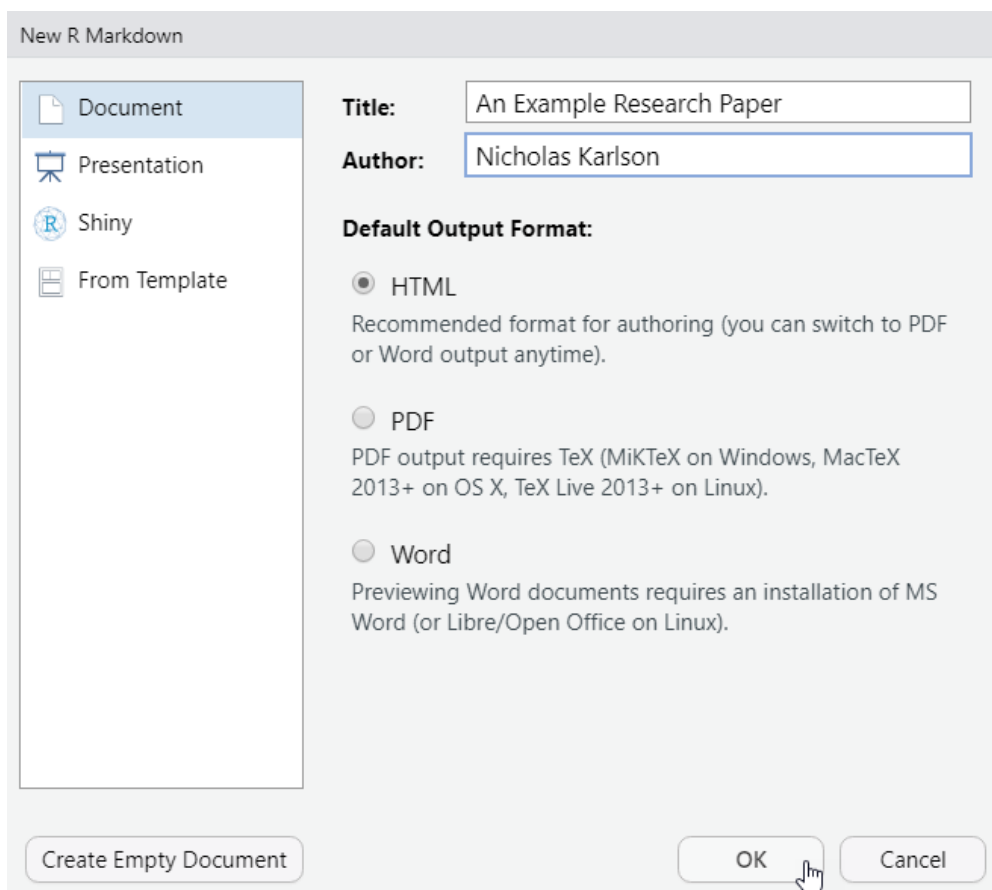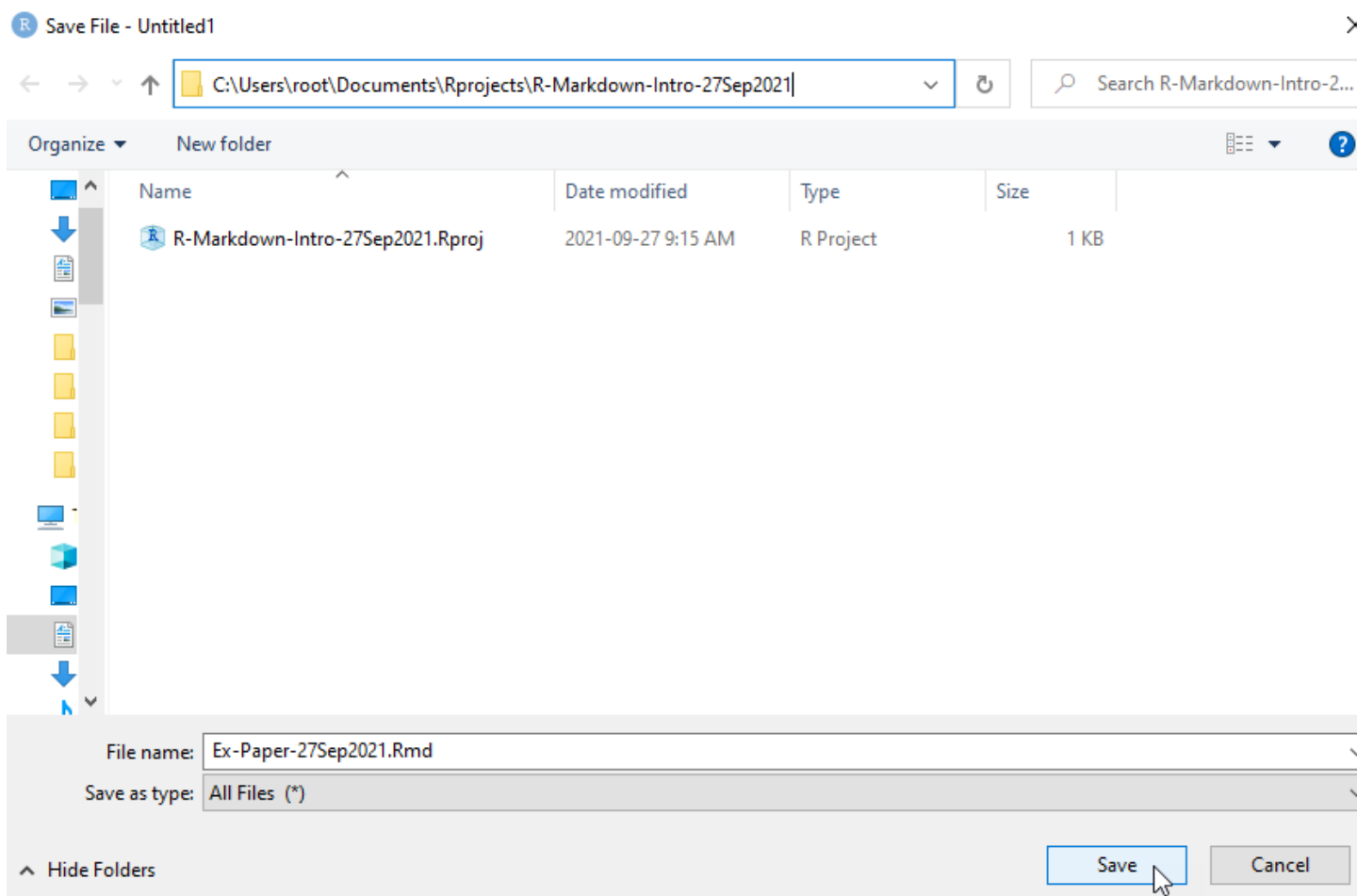
After clicking OK, a new Rmd file is created.

The Rmd file that is created for you is called Untitled1.Rmd, so go ahead and save it as Ex-Paper-27Sep2021.Rmd
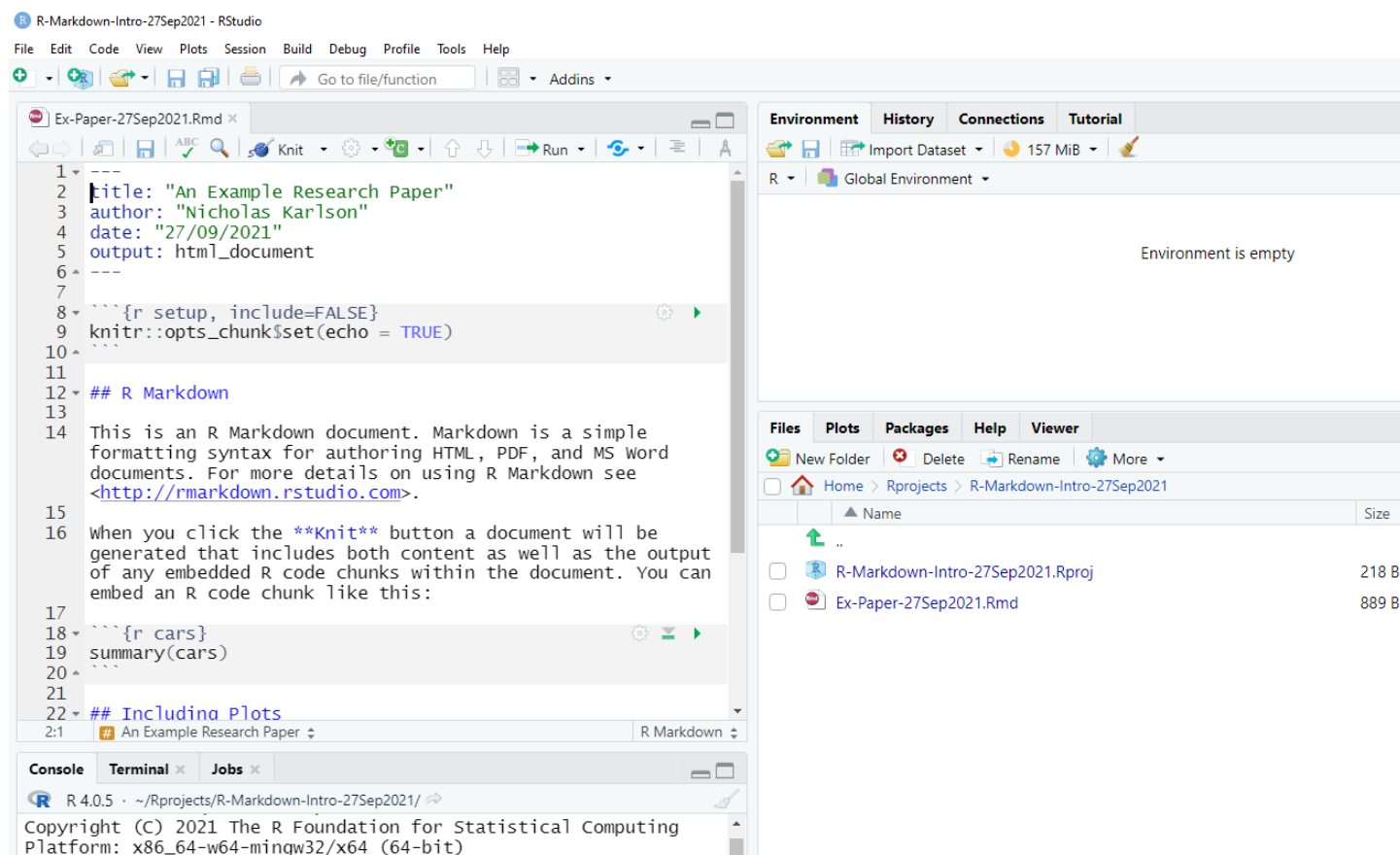

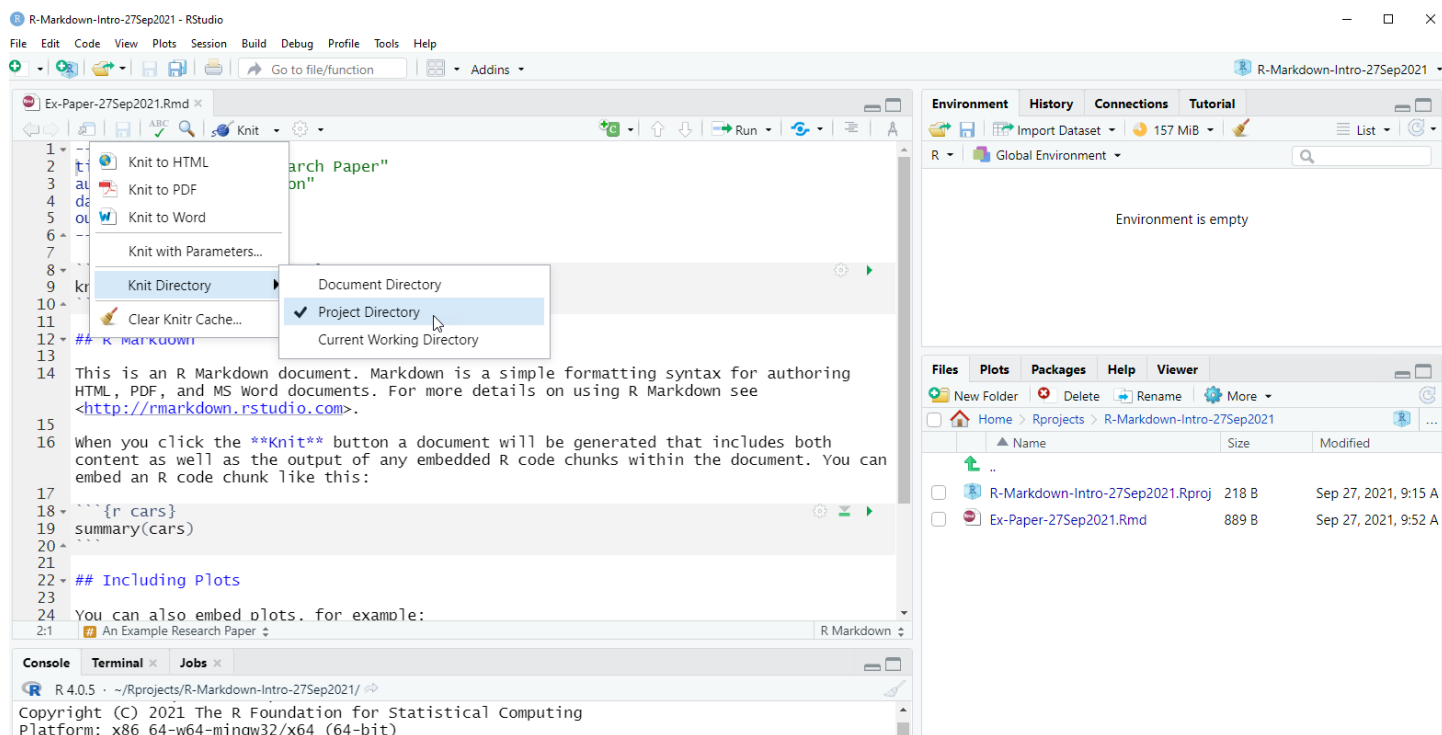**After clicking "Save" icon…**

Click on Save…

And look at the Files window to see your Rmd file (located In the RStudio project's directory with the Rproj file).
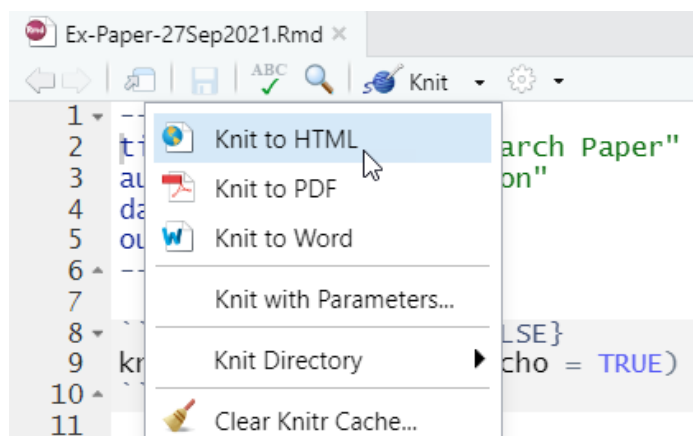

Let's see what we have now with the basic RStudio template. Click on Knit to create the HTML document…

Have the HTML go to the project directory…

Now select Knit to HTML

And it worked...

Your HTML page comes up in a separate viewer and you can see the files have been created to the project directory:

You can go to your project directory and open the html file in a web browser by clicking on the html file:

An Example Research Paper

Nicholas Karlson

27/09/2021

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:

Copy and paste into a Word doc and then save as a PDF...

An Example Research Paper

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27/09/2021

R Markdown

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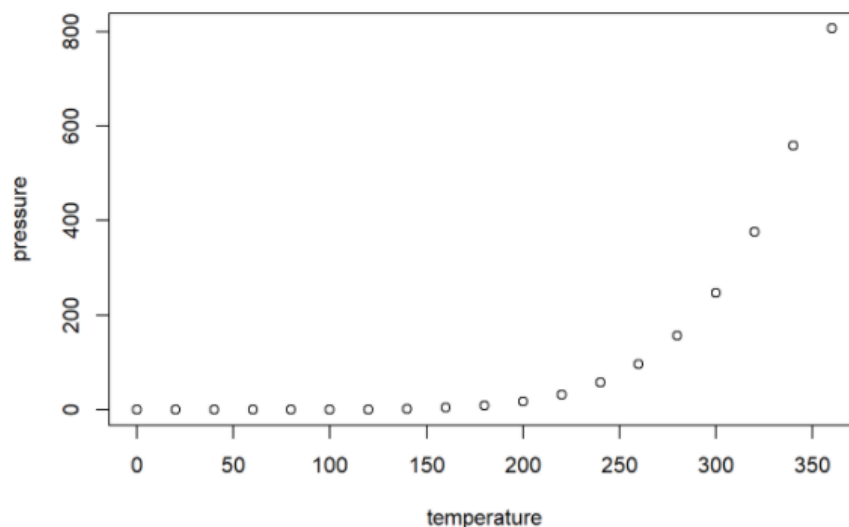
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## Max.   :25.0   Max.   :120.00
```

Including Plots

You can also embed plots, for example:

Paste into Word Doc, then save as "Ex-Paper-1012am-27Sep2021"
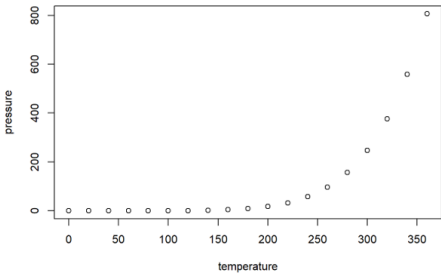
An·Example·Research·Paper¶

Nicholas·Karlson¶

27/09/2021¶

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:¶

Note·that·the·echo·=·FALSE·parameter·was·added·to·the·code·chunk·to·prevent·printing·of·the·R· code·that·generated·the·plot.¶

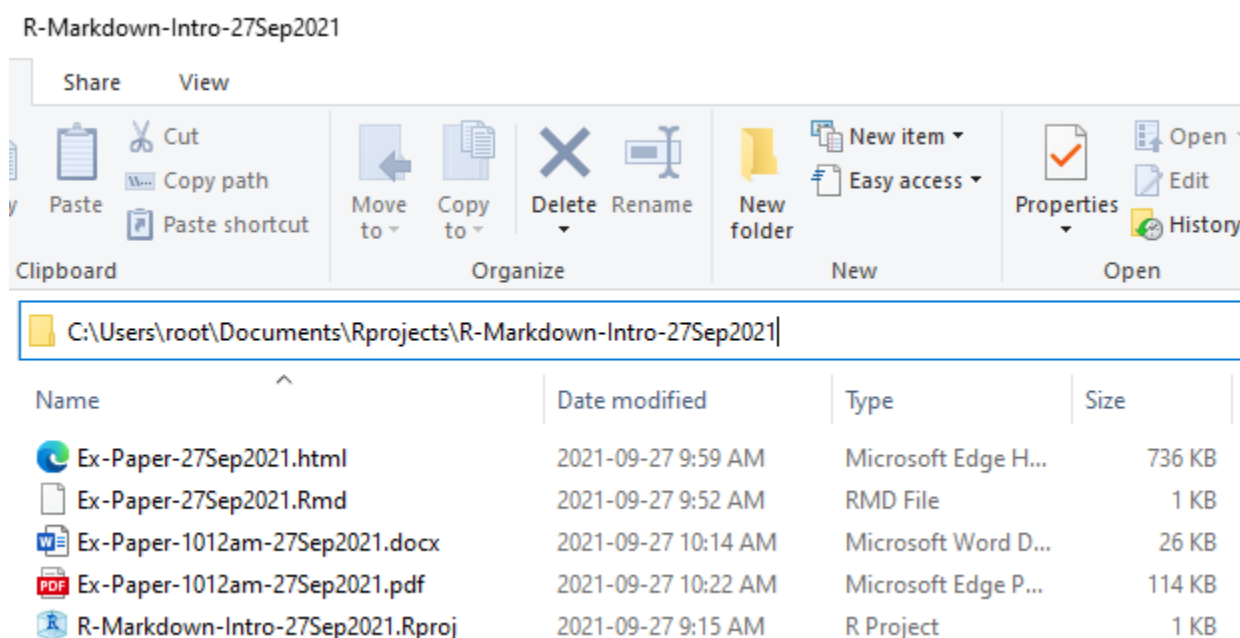**The saved Word doc:**
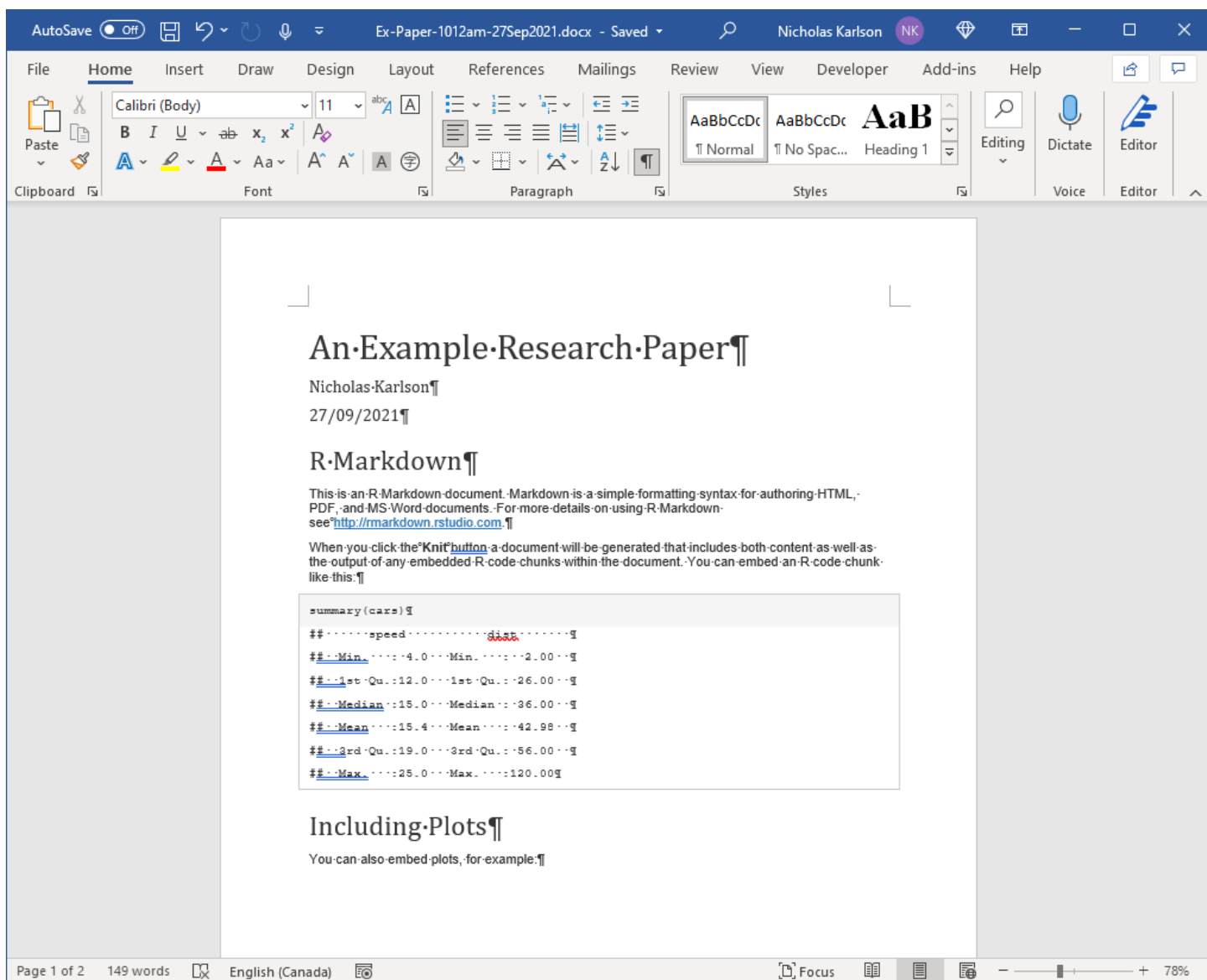
Now

 1) export it as a PDF

2) place both the Word doc and the PDF file in the RStudio project directory

3) upload all of this to my GitHub account where it can be downloaded and the results reproduced.

4) This ends Part 1 of an introduction to R Markdown (more parts to be announced on EDSS)
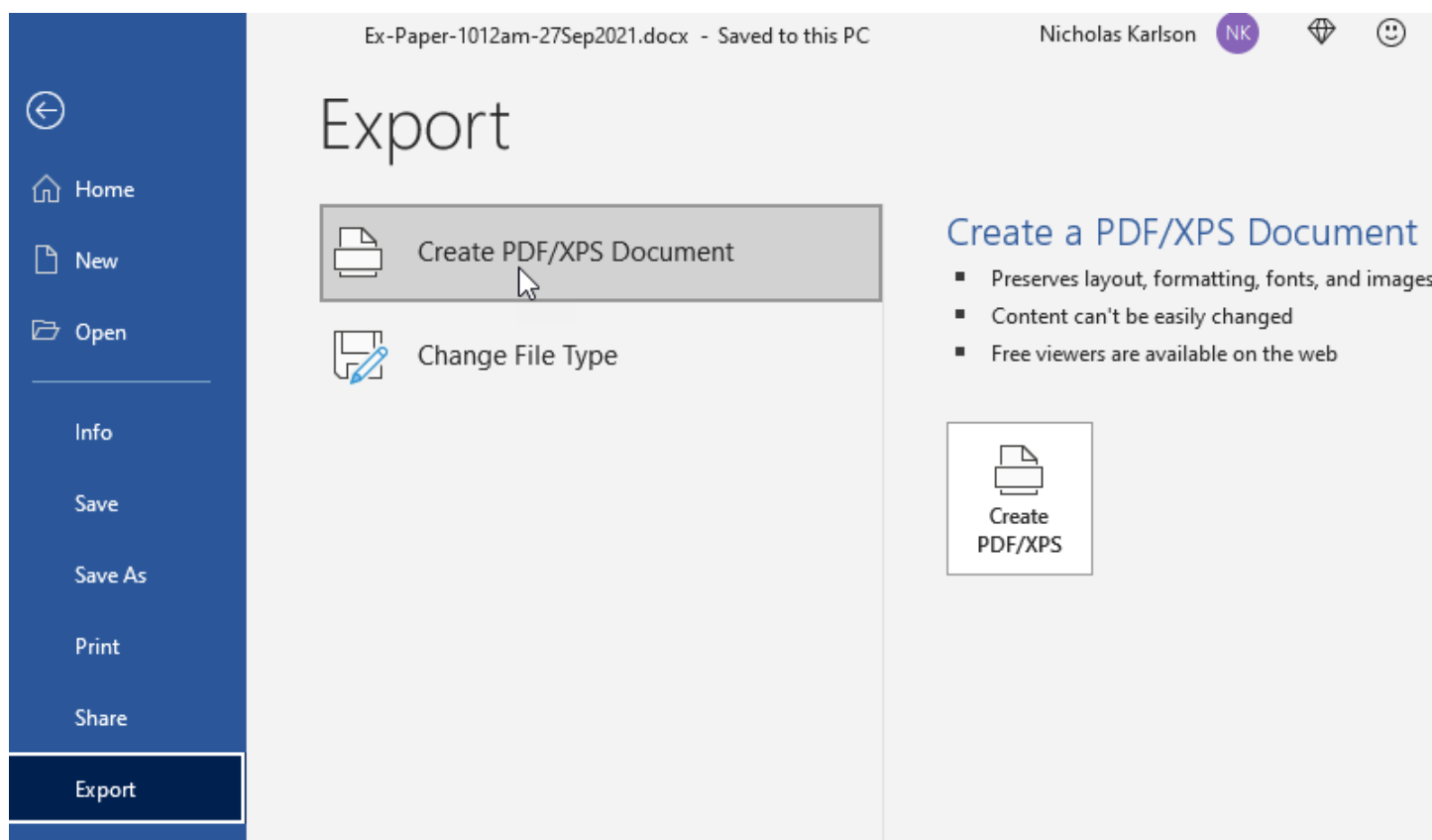
After exporting, put docx and pdf file in project directory:

You can see it is now in the RStudio project by looking at the RStudio files window…
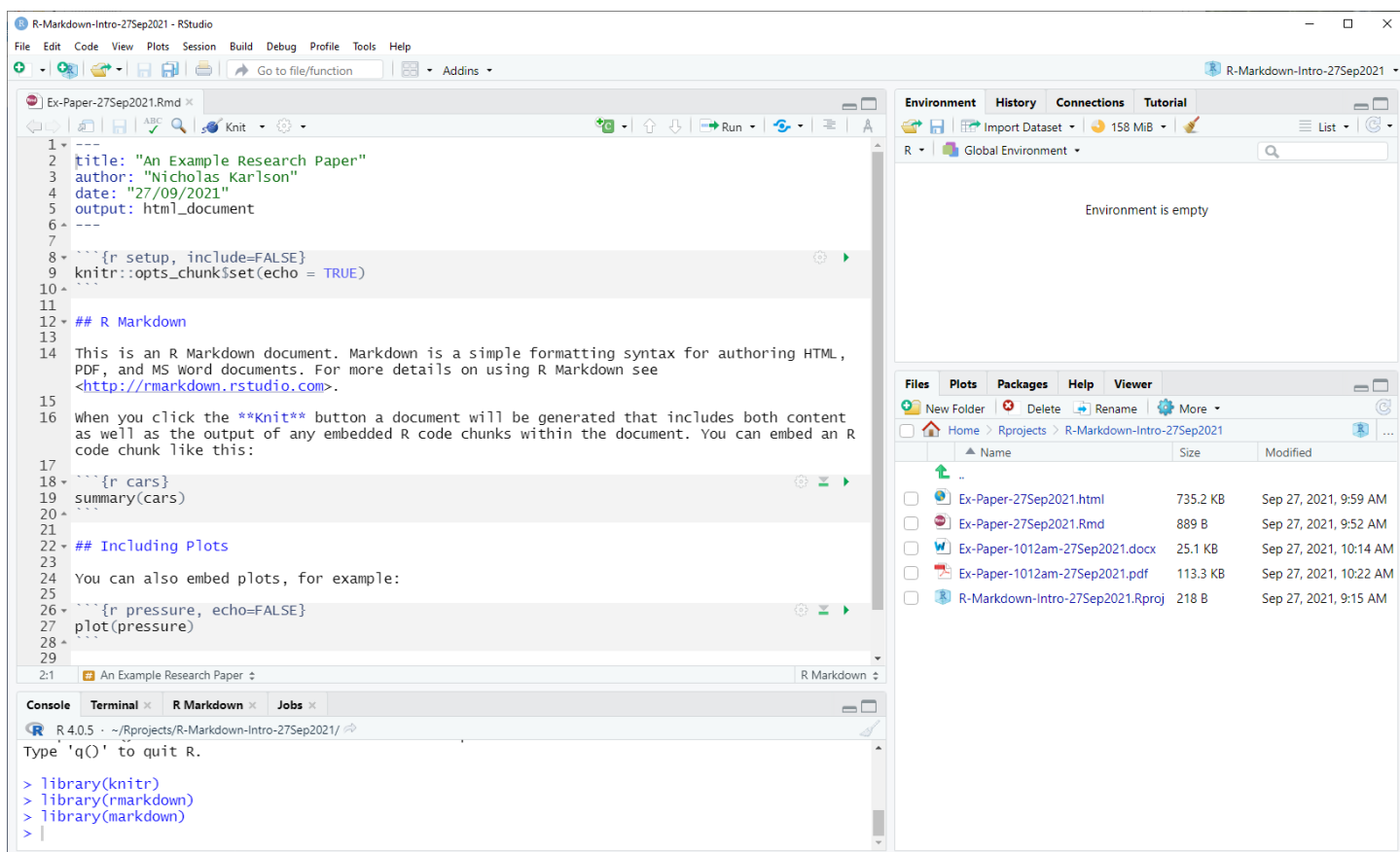
This project should be my GitHub site (the URL is below).

https://github.com/nicholaskarlson