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MAKING PREPARATIONS: SOFTWARE INSTALLATION AND PROJECT SETUP

1.1 INTRODUCTION

R is known across the world as a powerful, free software for creating graphs, analyzing data, and writing reports and papers. Just like getting ready for a physical journey, before you embark on the journey of learning R, you need to make some necessary preparations. For your R learning journey to go smoothly, you need to install the necessary software and set up some project folders to hold the files you generate—programs, data, figures, and so on. This chapter will walk you through these preparations.

Through this chapter, you as first-time R users will accomplish the following objectives:

1. Download and install R on your machine
2. Download and install RStudio on your machine
3. Set up an RStudio project and relevant folders

1.2 HOW TO DOWNLOAD AND INSTALL R FOR WINDOWS

Depending on what kind of computer you use, the software installation differs.

If your computer uses a Windows operating system, please take the following steps:

- Navigate to <https://cran.r-project.org/>
- Select **Download R for Windows** (as shown below).

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](#)
- [Download R for \(Mac\) OS X](#)
- [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.

- On the new page, you will be directed to the following page (see below), and in the row that says **base**, select **install R for the first time**.

R for Windows

Subdirectories:

base	Binaries for base distribution. This is what you want to install R for the first time .
contrib	Binaries of contributed CRAN packages (for R >= 2.13.x; managed by Uwe Ligges). There is also information on third party software available for CRAN Windows services and corresponding environment and make variables.
old.contrib	Binaries of contributed CRAN packages for outdated versions of R (for R < 2.13.x; managed by Uwe Ligges).
Rtools	Tools to build R and R packages. This is what you want to build your own packages on Windows, or to build R itself.

Please do not submit binaries to CRAN. Package developers might want to contact Uwe Ligges directly in case of questions / suggestions related to Windows binaries.

You may also want to read the [R FAQ](#) and [R for Windows FAQ](#).

Note: CRAN does some checks on these binaries for viruses, but cannot give guarantees. Use the normal precautions with downloaded executables.

- Select **Download R 3.4.3 for Windows**, as shown below. It is important to note that R is constantly improving and updating to newer versions, which explains why the website lists many different versions, and why the version **Download R 3.4.3 for Windows** listed here is definitely not the most current at the time you are reading this book and downloading R. At the time of writing, the most current version is “R 3.4.3,” but when you download R, it will most likely be a higher and more recent version (say, **Download R 3.5.0 for Windows**). So when you download R for the first time, always make sure to select its most current version.

Once you select the most current version, the program file will either begin to download at the bottom of your browser or will prompt you to save it somewhere (you can simply save it onto your desktop).

R-3.4.3 for Windows (32/64 bit)

[Download R 3.4.3 for Windows](#) (62 megabytes, 32/64 bit)

[Installation and other instructions](#)

[New features in this version](#)


- For installation, you can either follow the prompted directions once the file is downloaded or double click the downloaded file to start the installation process. The process is extremely straightforward.

Since installation can sometimes be a little confusing, you are better off choosing the default choice unless you know you want an alternative arrangement. Also, if you are prompted for a choice between yes or no, you should always choose yes so that the installation will continue.

1.3 HOW TO DOWNLOAD AND INSTALL R FOR MAC

Many people prefer Mac machines over computers that run Windows. If you are a Mac fan, you can download and install R onto your Mac through the following steps:

- As with Windows, navigate to <https://cran.r-project.org/>
- When looking at the main page, select **Download R for (Mac) OS X**.
- You will be guided to a page of a different look than the one for Windows. On this page, under the section heading **Files:**, select the first (i.e., latest) software version listed on the left, such as **R-3.5.0.pkg** (the most current version as of writing). Once you click the package, it will start downloading.



R for Mac OS X

This directory contains binaries for a base distribution and packages to run on Mac OS X (release 10.6 and above). Mac OS 8.6 to 9.2 (and Mac OS X 10.1) are no longer supported but you can find the last supported release of R for these systems (which is R 1.7.1) [here](#). Releases for old Mac OS X systems (through Mac OS X 10.5) and PowerPC Macs can be found in the [old](#) directory.

Note: CRAN does not have Mac OS X systems and cannot check these binaries for viruses. Although we take precautions when assembling binaries, please use the normal precautions with downloaded executables.

As of 2016/03/01 package binaries for R versions older than 2.12.0 are only available from the [CRAN archive](#) so users of such versions should adjust the CRAN mirror setting accordingly.

R 3.5.0 "Joy in Playing" released on 2018/04/24

Important: since R 3.4.0 release we are now providing binaries for OS X 10.11 (El Capitan) and higher using non-Apple toolkit to provide support for OpenMP and C++17 standard features. To compile packages you may have to download tools from the [tools](#) directory and read the corresponding note below.

Please check the MD5 checksum of the downloaded image to ensure that it has not been tampered with or corrupted during the mirroring process. For example type

```
md5 R-3.5.0.pkg
```

in the *Terminal* application to print the MD5 checksum for the R-3.5.0.pkg image. On Mac OS X 10.7 and later you can also validate the signature using

```
pkgutil --check-signature R-3.5.0.pkg
```

Files:

R-3.5.0.pkg
MD5-hash: 414029c9c9f706d3d04baa887ceffbc4
SHA1-
hash: 6e90d38892bb366630ac30c223a898e8af84df7
(ca. 74MB)

R 3.5.0 binary for OS X 10.11 (El Capitan) and higher, signed package.
Contains R 3.5.0 framework, R.app GUI 1.70 in 64-bit for Intel Macs, Tcl/Tk 8.6.6 X11 libraries and Texinfo 5.2. The latter two components are optional and can be omitted when choosing "custom install", they are only needed if you want to use the `tcltk` R package or build package documentation from sources.

Note: the use of X11 (including `tcltk`) requires [XQuartz](#) to be installed since it is no longer part of OS X. Always re-install XQuartz when upgrading your macOS to a new major version.

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- Once the download is complete, click on the file to finish the installation.

1.4 DOWNLOADING AND INSTALLING RSTUDIO

R is a great, free software, but admittedly, it is not very fancy or user-friendly on its own. RStudio, another free software, makes the use of R a lot easier because it provides an integrated development environment (IDE) for R. For first time R users, it is best that you start learning R through R Studio. Since this book targets first time R users, RStudio will be used throughout. Once you feel comfortable working in RStudio, there is little difficulty for you to transition to R. Finally, it is important to note that for RStudio to work, you need to install R first.






To download and install RStudio onto your computer, please take the following steps:

- Navigate to <https://rstudio.com/products/rstudio/download>.
- Scroll to the **All Installers** section on the web page and you should see the following list of installers.

All Installers

Linux users may need to import RStudio's public code-signing key prior to installation, depending on the operating system's security policy.

RStudio 1.2 requires a 64-bit operating system. If you are on a 32 bit system, you can use an older version of RStudio.

OS	Download	Size	SHA-256
Windows 10/8/7	 RStudio-1.2.5019.exe	149.82 MB	7c6a943c
macOS 10.12+	 RStudio-1.2.5019.dmg	126.88 MB	00cf7d64
Ubuntu 14/Debian 8	 rstudio-1.2.5019-amd64.deb	96.93 MB	a0f43062
Ubuntu 16	 rstudio-1.2.5019-amd64.deb	104.91 MB	24fad367
Ubuntu 18/Debian 10	 rstudio-1.2.5019-amd64.deb	106.04 MB	e819293c
Fedora 19/Red Hat 7	 rstudio-1.2.5019-x86_64.rpm	120.26 MB	c4fb97ce
Fedora 28/Red Hat 8	 rstudio-1.2.5019-x86_64.rpm	120.89 MB	06ed9379
Debian 9	 rstudio-1.2.5019-amd64.deb	106.39 MB	cd8a2413
SLES/OpenSUSE 12	 rstudio-1.2.5019-x86_64.rpm	99.04 MB	87190f72
OpenSUSE 15	 rstudio-1.2.5019-x86_64.rpm	107.09 MB	e4929a16

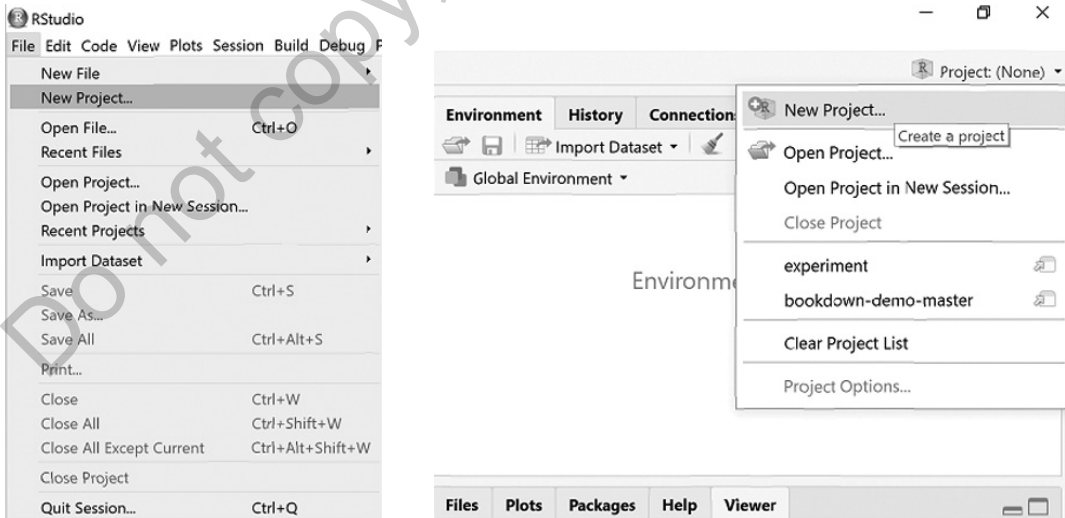
- From the list of installers, select and download the appropriate version for your computer operating system.
- For installation, double click the downloaded file and follow the prompted instructions. *When prompted, please agree to allow the program to make changes to your computer, and use the recommended default settings.*

1.5 SETTING UP A PROJECT IN RSTUDIO

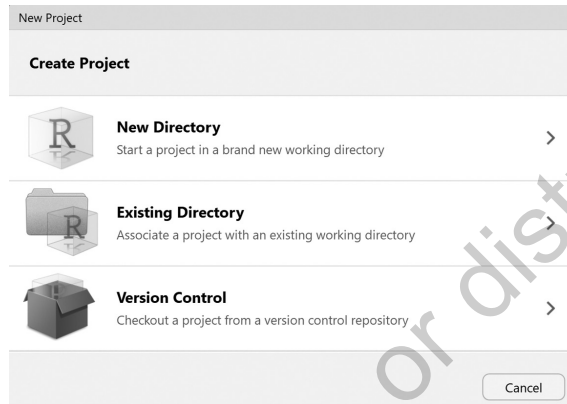
RStudio provides a nice feature that allows users to set up their project within RStudio. The project resides in a working directory of your choice, just as if you were building a house for a family at a chosen address. Then you can create individual folders to hold data, code, output, and report, just as if you can carve your house into different rooms—bedrooms, bathrooms, kitchen, living room, and so on. The advantage of doing so is clear: Not only you can find your stuff quickly, but everyone else also knows where stuff is placed. This is valuable, especially when you work on a big project with lots of files and many collaborators.

1.5.1 Create an RStudio Project

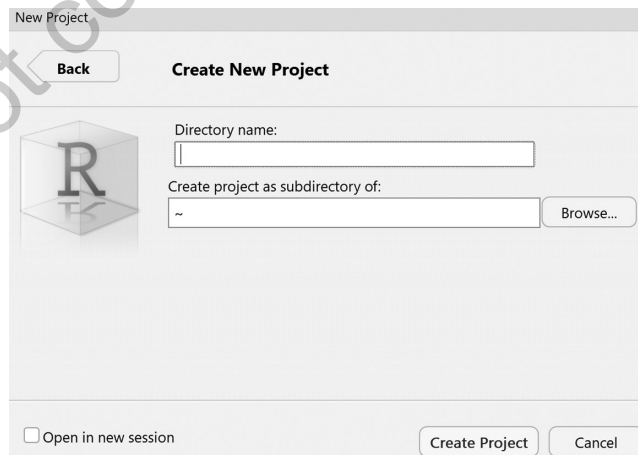
You can create an RStudio project in either one of two ways: select **File, New Project . . .**, as shown in the left image below, or click on the **Project: (None)** in the upper right area of the image to the right below and then select **New Project . . .**



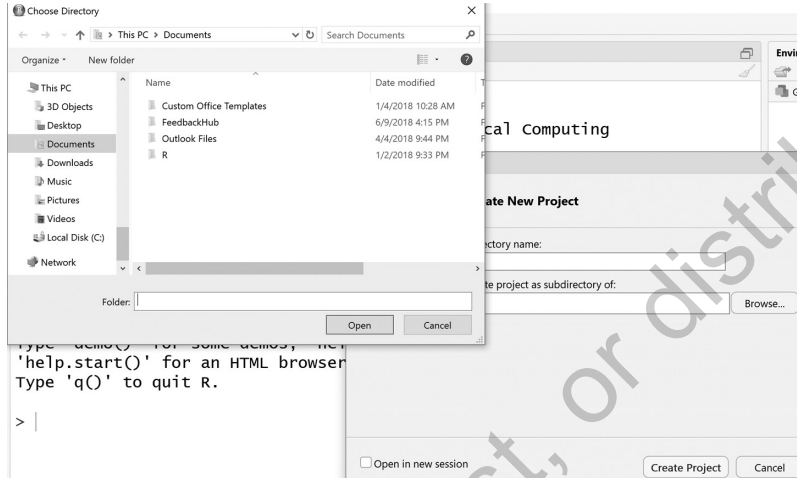
Once you select **New Project . . .**, you will be prompted to choose where to place your project, that is, under what directory or address, as shown below. You may choose to create your RStudio project either as a new directory or within an existing one. Since this is the first time you are using R, choose a brand new directory for your project.



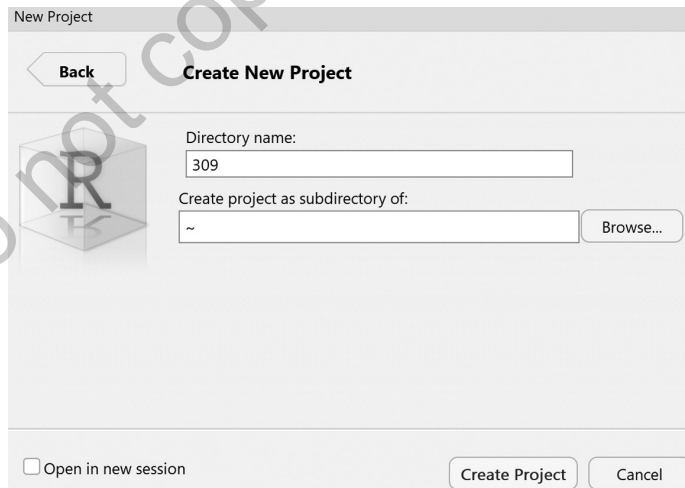
Once you select **New Directory**, you will be prompted to choose a project type: Once again, choose **New Project**. Then, you will be prompted to enter a directory name for your project and specify a directory path under which you will create your project.



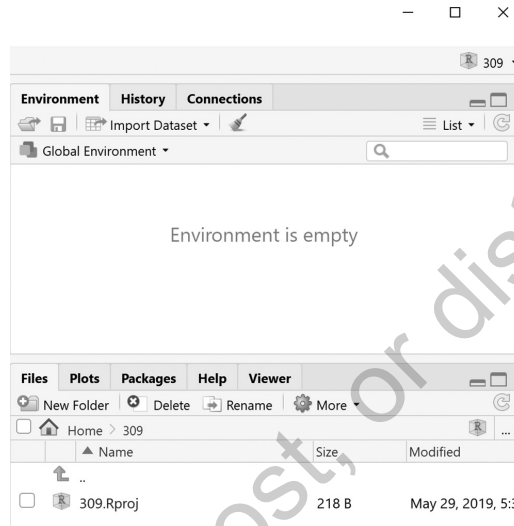
When you click on **Browse**, a **Choose Directory** window will pop up. If you do not make any change (i.e., click **Cancel**), the default path will be used, and in this example, it is “This PC/Documents,” as shown in the image below; if you do not want to use the default directory, you can select the folder you prefer, then click **Open** in the **Choose Directory** window, and the one you have chosen will be entered automatically.



Suppose in this example, you adopt the default directory path, and the full path then does not need to appear, as shown below. Next, you need to enter the directory name for your project. Suppose you want to use a course number as your project name and your course number is 309, then enter 309 in the directory name as shown below.



Now click **Create Project**, and an RStudio project called **309** will be created as shown below. As you can see, in the upper right corner, the earlier **Project: (None)** icon has turned into **309**; and in the lower panel of the image, the **Files** tab is highlighted, and listed below it is a newly created file called **309.Rproj**. This file helps define the project root and the working directory for R sessions.



1.5.2 Open an RStudio project

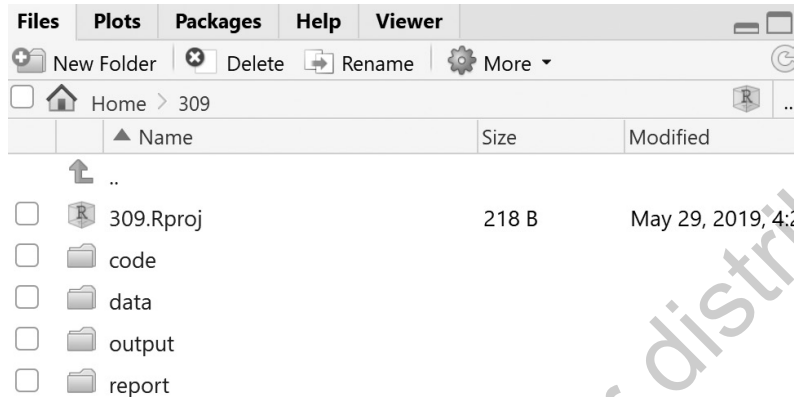
Once you've created an RStudio project, it's easy to get started. Simply click on **File**, and select **Open Project . . .** Or you can click on the earlier **Project: (None)** icon in the upper right corner to select the project you created.

1.6 CREATING FOLDERS UNDER A PROJECT

Creating an RStudio project is a lot like building a house. The project folder, in this case called 309, is the outside structure of your house, while the subfolders are the rooms. The rooms that we are going to create for our house are as follows:

- **code**
- **data**
- **output**
- **report**

To create these folders under Project 309, simply click on the little icon for **New Folder** right below **Files** in the image below. You will be prompted to enter a new folder name. Now, create four folders named (1) code, (2) data, (3) output, and (4) report, respectively, and you will see the following:



The data folder will store all the raw datasets you download and the prepared dataset for analysis. (Under the data folder, you could create two subfolders to hold raw and processed datasets, separately.) You will learn how to download the raw dataset and save the prepared dataset into that folder in Chapter 5.

The code folder stores all your R scripts, or program files, for the purpose of data preparation and data analysis. You will learn how to write stand-alone R scripts or program files in Chapter 4.

The output folder stores all your statistical output such as tables and graphs. You will learn how to save your graphs to that folder in Chapter 3.

The report folder stores your report files, such as homework assignments and papers, which you will create using R Markdown in R. You will learn how to save your created files into that folder in Chapter 2.

1.7 SUMMARY

In this chapter, you learned to make preparations for using R and RStudio. More concretely, you learned

- how to download and install R on your machine;
- how to download and install RStudio;
- how to set up an RStudio project; and
- how to create folders under the project.

Now you are ready to jump into the use of R in the next chapter, in which you will learn how to write an essay using R! You will learn essay writing in R first because first-time R users are likely to be more familiar with writing than coding and programming. This ought to provide an easier beginning to your R learning journey.

1.8 REFERENCES

The instructions for installing R and RStudio are available from the websites for the software, as noted earlier. The section on how to set up an RStudio project draws on some of the following materials.

- Anonymous. (n.d.). *Project-oriented workflow*. Retrieved from <https://www.tidyverse.org/articles/2017/12/workflow-vs-script>
- R Core Team. (2019). *R: A language and environment for statistical computing*. Vienna, Austria: R Foundation for Statistical Computing. Retrieved from <http://www.R-project.org/>
- RStudio: Integrated Development Environment for R (Version 0.96.122) [Computer software]. Boston, MA: RStudio. Retrieved from <http://www.rstudio.org/>
- RStudio Support. (2019). *Using projects*. Retrieved from <https://support.rstudio.com/hc/en-us/articles/200526207-Using-Projects>
- Tran, A. (n.d.). *File organization best practices*. Retrieved from https://andrewbtran.github.io/NICAR/2018/workflow/docs/01-workflow_intro.html