Introduction to R

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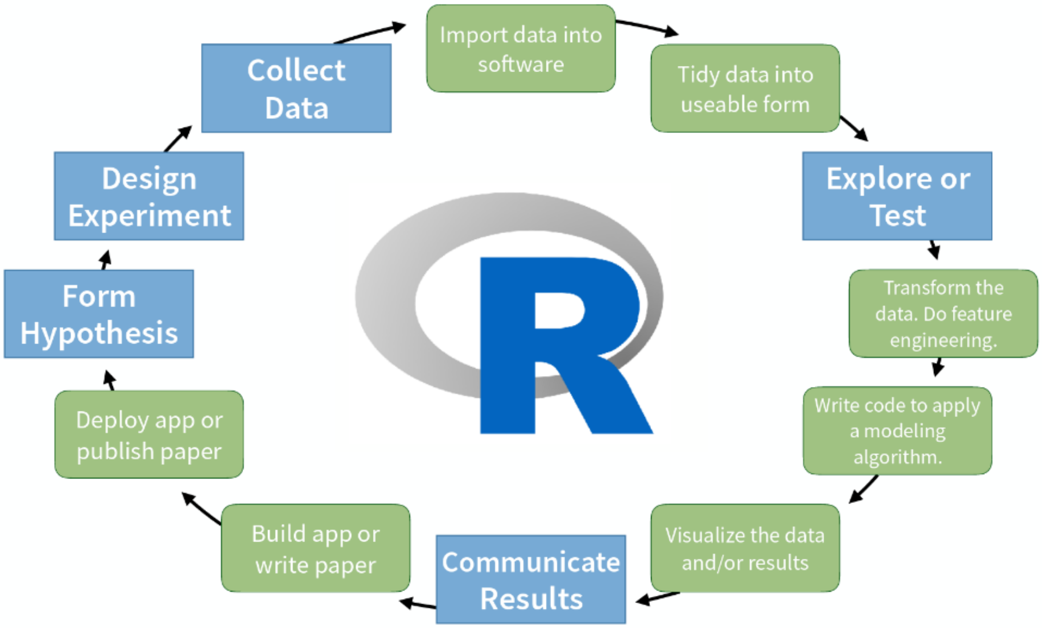
Contents borrowed and modified from UVA's Data Science Essentials in R series and RStudio's Master the Tidyverse workshop.

Installation

Instructions for how to install and/or update R, RStudio, and the `tidyverse` package can be found here.

Features of R

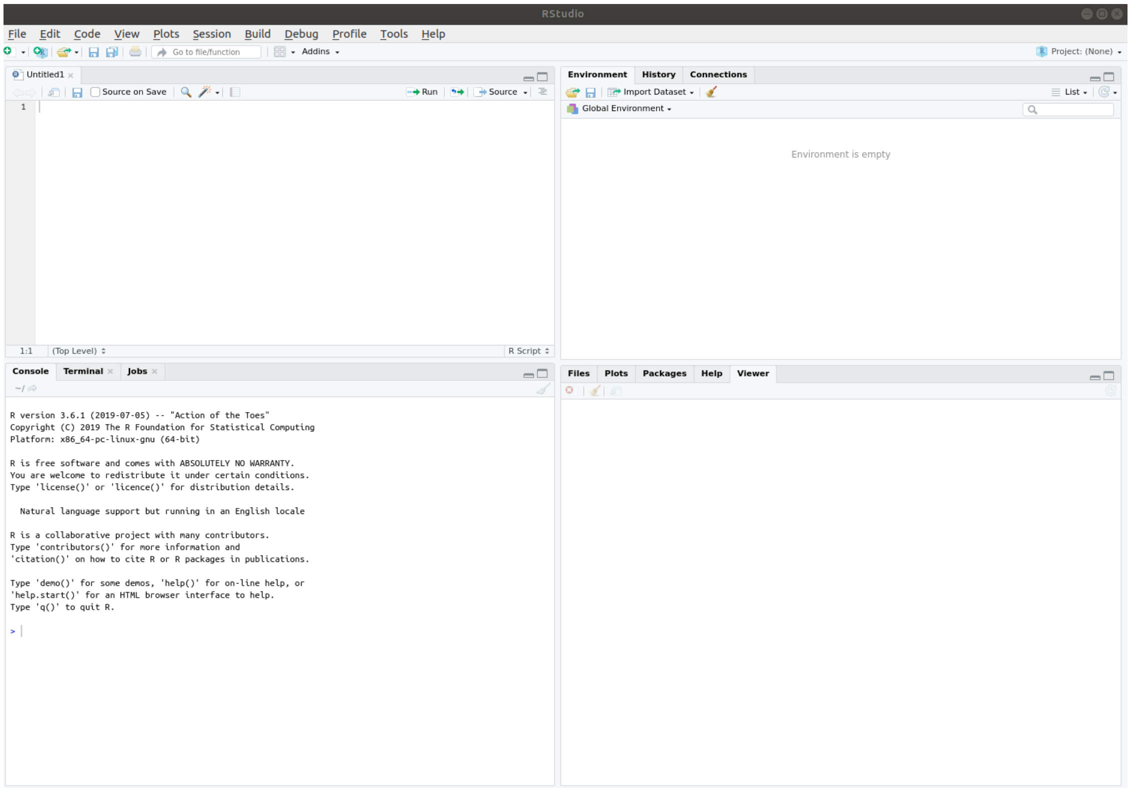
- R is free!
- R is everywhere, and has an active user base. This is useful because you can find a lot of people in various disciplines using R in blogs, forums, Stack Overflow, etc., and you can often find help online there.
- R is flexible! Since R is open source, the active R user base implements new methods as libraries in R quickly. Over 10,000 packages are available.
- R is cool! It is highly regarded for its:
  - Graphical functionality. See gplot2,ggplot extensions.
  - Interactive web functionality. See shiny.
  - Reproducible output, such as documents, presentations, and dashboards. See markdown.
  - Easy integration with other open-source or data science applications, such as Sublime Text, Jupyter Notebooks, GitHub, etc.


Import data into software
Tidy data into useable form
Explore or Test
Transform the data. Do feature engineering.
Write code to apply a modeling algorithm.
Visualize the data and/or results
Communicate Results
Build app or write paper
Deploy app or publish paper
Form Hypothesis
Design Experiment
Collect Data
R

Orientation to R and RStudio

We recommend that you use R with RStudio. R is the base statistical computing environment. RStudio is an “Interactive Development Environment” makes it easy to use R. It does things like auto-complete, syntax highlighting, and is generally much easier to use. After you install R and RStudio, you only need to run RStudio. RStudio shows four panes by default. The two most important are the Console (bottom left) and the Script Editor (top left).

This is what RStudio looks like when you first open it:



```
R version 3.6.1 (2019-07-05) -- "Action of the Toes"
Copyright (C) 2019 The R Foundation for Statistical Computing
Platform: x86_64-pc-linux-gnu (64-bit)

R is free software and comes with ABSOLUTELY NO WARRANTY.
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

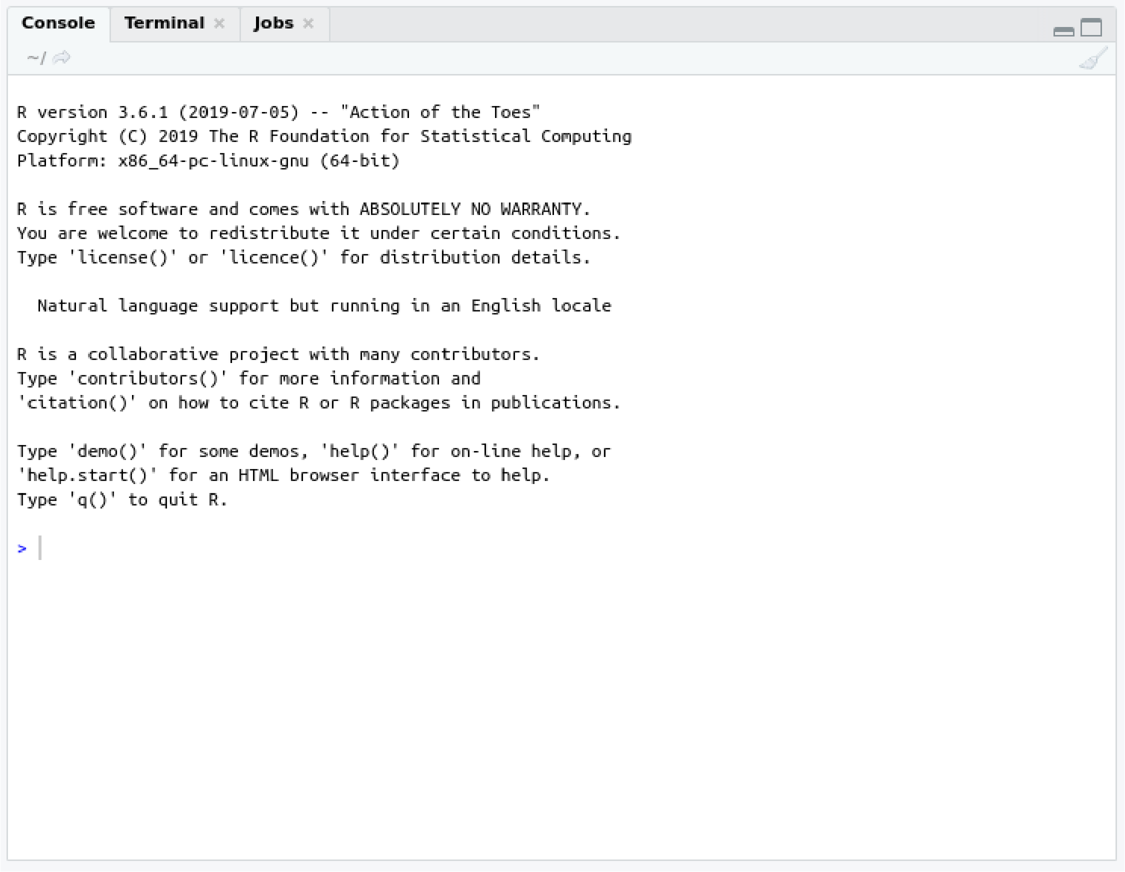
R is a collaborative project with many contributors.
Type 'contributors()' for more information and
'citation()' on how to cite R or R packages in publications.

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.

>
```

Console (bottom left)

The console pane allows you to quickly and immediately execute R code. You can experiment with functions here, or quickly print data for viewing. Type next to the > and press Enter to execute.



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> 
```

Console Practice

You can use R like a calculator. Try typing 2+5 into the console.

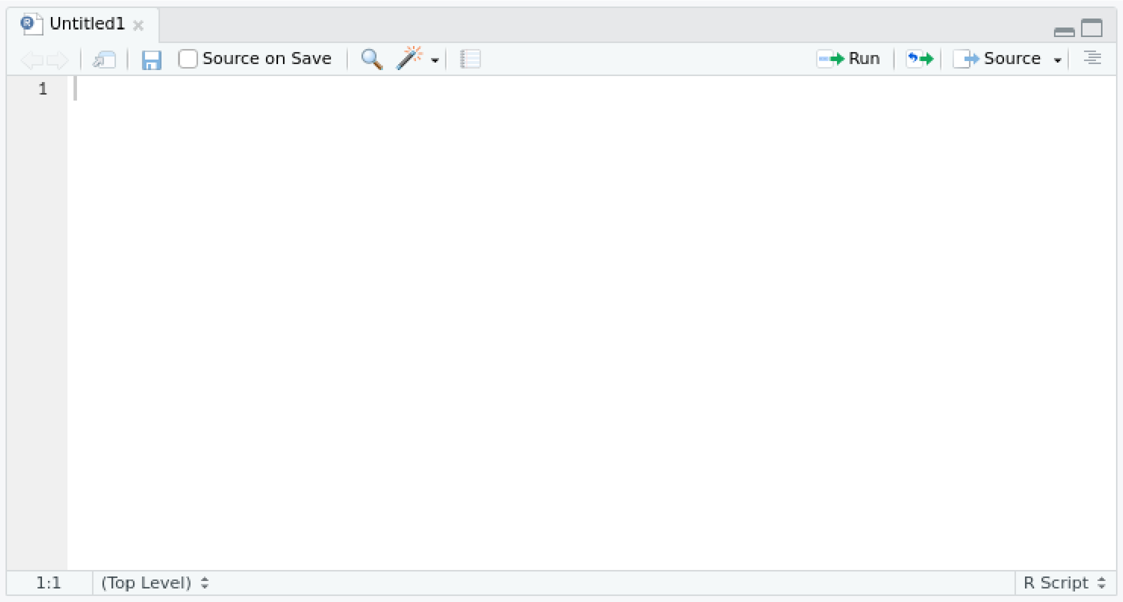
```
2+8
#> [1] 10
```

Here, the plus sign is the **operator**. Operators are symbols that represent some sort of action. Of course, it would be silly if we only used R as a calculator. To use R more fully, we need to understand **objects**, **functions**, and **indexing** - which we will learn about as we go.

For now, think of *objects as nouns* and *functions as verbs.*

Script Editor (top left)

In contrast to the Console, which quickly runs code, the Script Editor does not automatically execute code. The Script Editor allows you to save the code essential to your analysis. You can re-use that code in the moment, refer back to it later, or publish it for replication. When writing scripts do your future self a favor and use lots of comments! Preface comments with a hashtag: '#'. Good to know: R script files end with ".R"



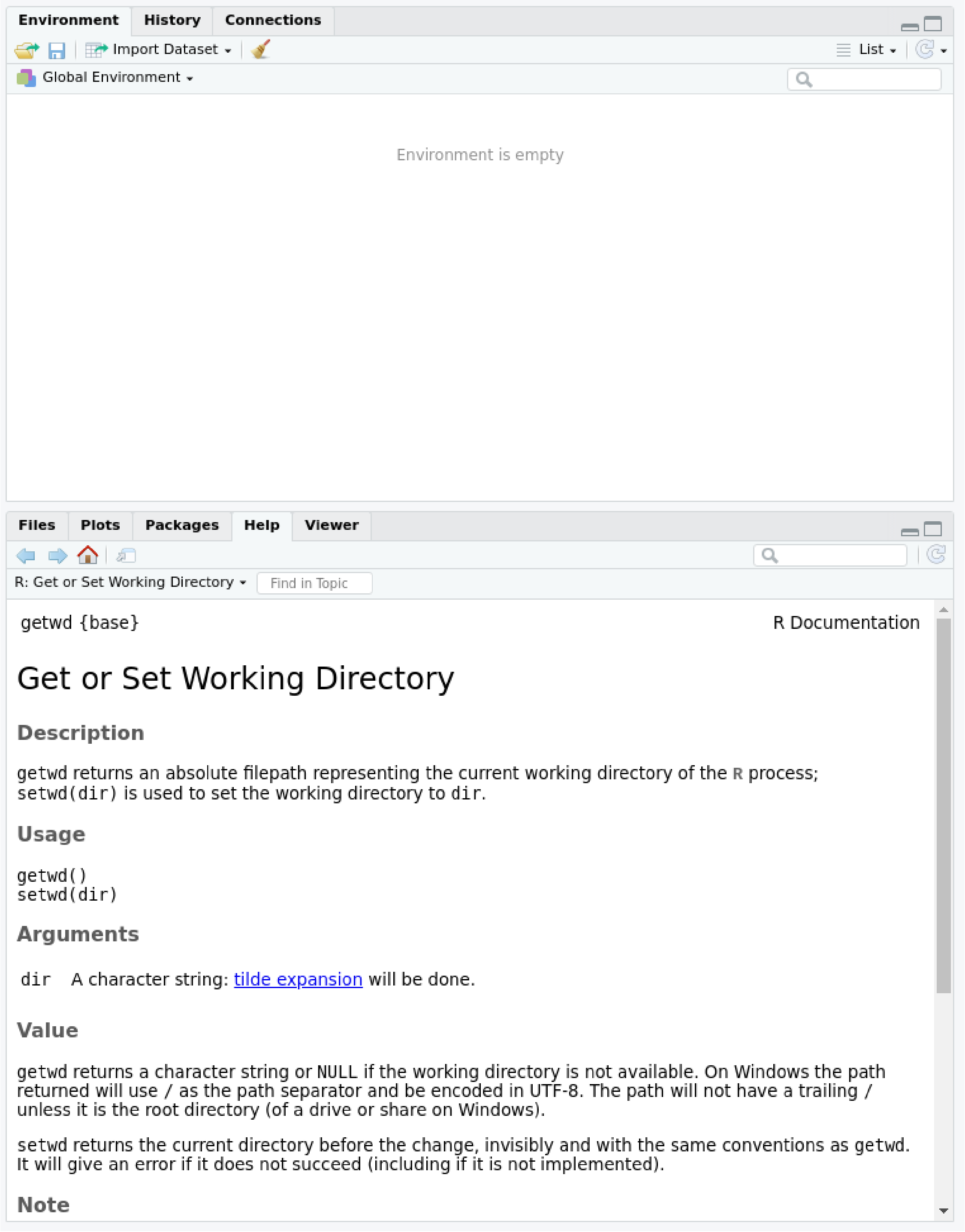
Running commands from a script

To run code from a script, insert your cursor on a line with a command, and press CTRL+Enter/CMD+Enter.

Or highlight some code to only run certain sections of the command, then press CTRL+Enter/CMD+Enter to run.

Alternatively, use the Run button at the top of the pane to execute the current line or selection.

Other Panes



getwd {base} R Documentation

Get or Set Working Directory

Description

getwd returns an absolute filepath representing the current working directory of the R process; setwd(dir) is used to set the working directory to dir.

Usage

```
getwd()
setwd(dir)
```

Arguments

dir A character string: tilde expansion will be done.

Value

getwd returns a character string or NULL if the working directory is not available. On Windows the path returned will use / as the path separator and be encoded in UTF-8. The path will not have a trailing / unless it is the root directory (of a drive or share on Windows).

setwd returns the current directory before the change, invisibly and with the same conventions as getwd. It will give an error if it does not succeed (including if it is not implemented).

Note

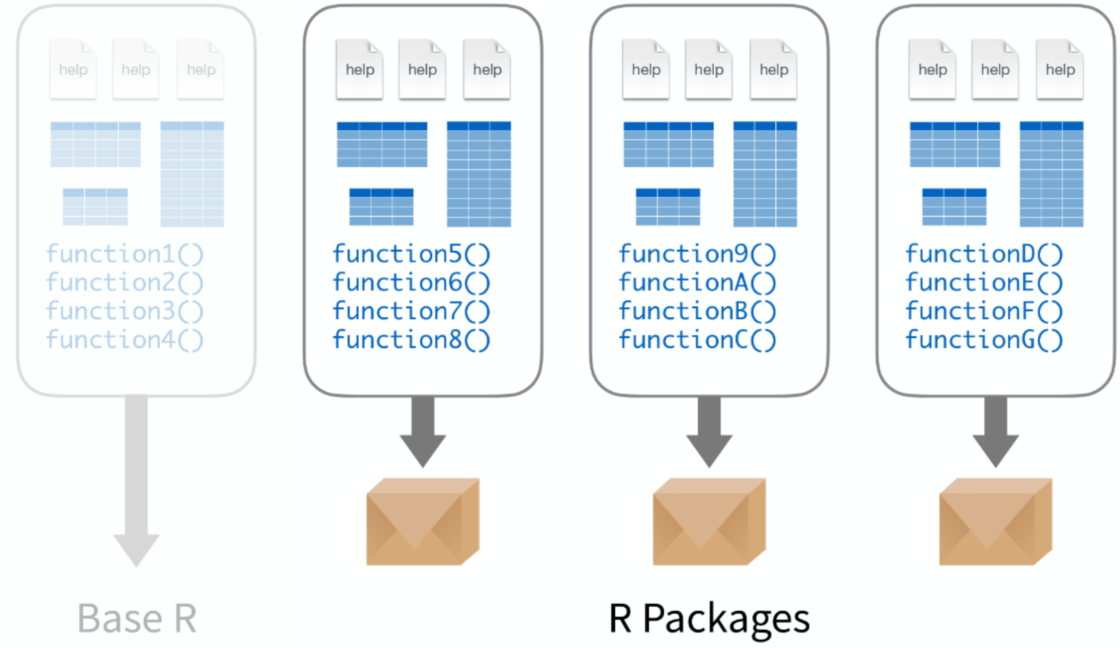
The other panes are on the right of the screen.

- **Environment** (top): Lists all currently defined objects and data sets.
- **History** (top): Lists all commands recently used or associated with a project.
- **Connections** (top): Lists connections to data sources (e.g. Spark).
- **Files** (bottom): Shows the files available to you in your working directory.

- **Plots** (bottom): Graphical output goes here.
- **Packages** (bottom): Lists all installed packages. Packages with checks next to them are currently loaded.
- **Help** (bottom): Find help for R packages and functions. Don't forget you can type ? before a function name in the console to get info in the Help section.
- **Viewer** (bottom): Renders HTML documents (created with RMarkdown).

Using Packages

Packages contain functions, and all functions belong to packages. R comes with about 30 packages ("base R"). There are over 10,000 user-contributed packages; you can discover these packages online. A prevalent collection of packages is the Tidyverse, which includes `ggplot2`, a package for making graphics.

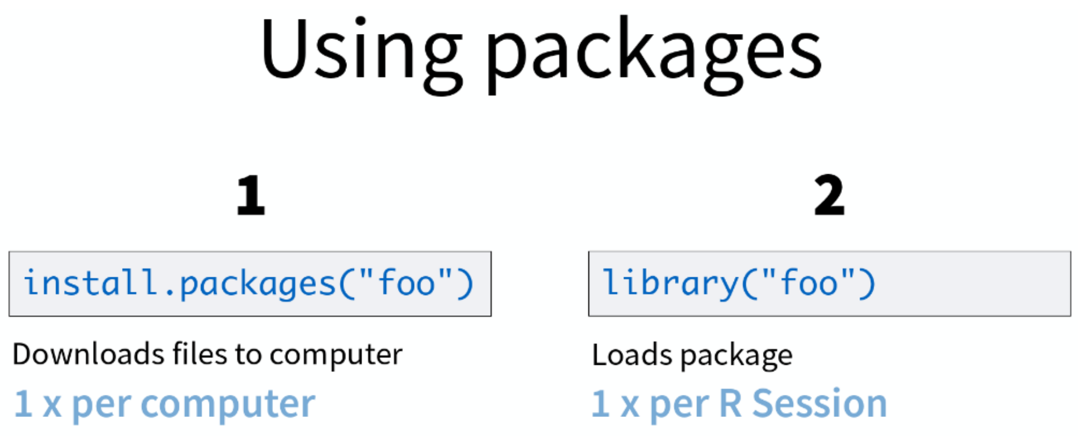


Only install a package once. It will likely install several other packages it depends on. You should have already installed `tidyverse` before the workshop.

You can install packages via point-and-click: `Tools`–> `Install Packages`. Enter `tidyverse` (or a different package name) then click `Install`.

Or you can use this command in the console: `install.packages("tidyverse")`

You must load the package in any new R session where you want to use that package. Loading `tidyverse` will load other depdendent packages, including `ggplot2`.



Using packages

1

```
install.packages("foo")
```

Downloads files to computer

1 x per computer

2

```
library("foo")
```

Loads package

1 x per R Session

View and Change Your Working Directory

The working directory is where R pulls files to work with. This is where your datasets, scripts, etc. live. It can be any folder location. (It doesn't have to be the same folder where you installed R.)

R always has a working directory set. Get your working directory with this command in the console: `getwd()`. You can then set the working directory in the console using `setwd()` (must insert appropriate file path: e.g. "~/Desktop/"). Verify that you have the right directory by using `getwd()` again. Note that you can see the working directory listed at the top of the Console.

You can also set the working directory via point-and-click: `Session` (at the top)–> `Set Working Directory`–> `Choose Directory`

To get your file path:

- **Windows users**: Open File Explorer, navigate to the folder you want to use, and copy the path at the top of the window. Windows users note: the default for Windows is the `\` (backslash) to separate folders in file paths, but R requires `/` (forward-slash).
- **Mac users**: Using Finder, navigate to the folder you want to use, right click on the folder, and select "Copy Path."