

**Kano Independence Research Centre Trust (KIRCT) in collaboration with National Agency for the Control of Aids (NACA) organized a Training for Government Staff on R Programming, introducing Technology System.**



PRE-WORKSHOP SURVEY

# R and RStudio

# What is R?

- R is a freely available language and environment for statistical computing and graphics, which provides a wide variety of statistical and graphical techniques: linear and nonlinear modelling and statistical tests as well as time series analysis, classification, clustering, etc.
- R is maintained by an international team of developers who make the language available through the web page of The Comprehensive R Archive Network. (<https://cran.r-project.org/>)
- Like other programming languages: Learning R involves writing code, similar to languages like C++ or Python. However, R's syntax is designed to be intuitive for statistical tasks, making it easier to learn for those with a background in statistics or data analysis.

# What is RStudio?

- RStudio is an application like Microsoft Word that helps you write in R programming language, implement the orders in the code, **and output the results**
- Whether you use Windows, Mac, or Linux, RStudio's interface will look and feel the same. You must install R before you can install RStudio
- RStudio helps you use the version of R that resides on your computer, but it doesn't come with a version of R on its own. It is just a facilitator.
- Think of R as the engine and RStudio as the driver. You need R installed first for RStudio to work and interpret your code.

# How to Download and Install R? *For Windows*

1. To install R on Windows, go to <https://cran.r-project.org/> and click on the “Download R for Windows” link.



CRAN  
Mirrors  
What's new?  
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About R  
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Packages  
Other

Documentation  
Manuals  
FAQs  
Contributed

The Comprehensive R Archive Network

### 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.

#### Source Code for all Platforms

Windows and Mac users most likely want to download the precompiled binaries listed in the upper box, not the source code. The sources have to be compiled before you can use them. If you do not know what this means, you probably do not want to do it!

- The latest release (2020-06-22, Taking Off Again) [R-4.0.2.tar.gz](#), read [what's new](#) in the latest version.
- Sources of [R alpha and beta releases](#) (daily snapshots, created only in time periods before a planned release).
- Daily snapshots of current patched and development versions are [available here](#). Please read about [new features and bug fixes](#) before filing corresponding feature requests or bug reports.
- Source code of older versions of R is [available here](#).
- Contributed extension [packages](#)

#### Questions About R

- If you have questions about R like how to download and install the software, or what the license terms are, please read our [answers to frequently asked questions](#) before you send an email.

What are R and CRAN?

R is 'GNU S', a freely available language and environment for statistical computing and graphics which provides a wide variety of statistical and graphical techniques: linear and nonlinear modelling, statistical tests, time series analysis, classification, clustering, etc. Please consult the [R project homepage](#) for further information.

CRAN is a network of ftp and web servers around the world that store identical, up-to-date, versions of code and documentation for R. Please use the CRAN [mirror](#) nearest to you to minimize network load.

Submitting to CRAN

CRAN submission is offline from Aug 14 to Aug 24, 2020 (CRAN team vacation and maintenance week). This year's winter break will be from Dec 18, 2020 to Jan 4, 2021.

To "submit" a package to CRAN, check that your submission meets the [CRAN Repository Policy](#), and then use the [web form](#).

If this fails, upload to <ftp://CRAN.R-project.org/incoming>, and send an email to [CRAN-submissions@R-project.org](mailto:CRAN-submissions@R-project.org) following the policy. Please do not attach submissions to emails, because this will clutter up the mailboxes of half a dozen people.

Note that we generally do not accept submissions of precompiled binaries due to security reasons. All binary distribution listed above are compiled by selected maintainers, who are in charge for all binaries of their platform, respectively.

# How to Download and Install R? *For Windows*

2. It will take you now to the page shown below. Then click on the “base” link.



[CRAN](#)  
[Mirrors](#)  
[What's new?](#)  
[Task Views](#)  
[Search](#)

[About R](#)  
[R Homepage](#)  
[The R Journal](#)

[Software](#)  
[R Sources](#)  
[R Binaries](#)  
[Packages](#)  
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[Documentation](#)  
[Manuals](#)  
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## R for Windows

Subdirectories:

[base](#)

[contrib](#)

[old contrib](#)

[Rtools](#)

Binaries for base distribution. This is what you want to [install R for the first time](#).

Binaries of contributed CRAN packages (for R  $\geq$  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.

Binaries of contributed CRAN packages for outdated versions of R (for R  $<$  2.13.x; managed by Uwe Ligges).

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.

# How to Download and Install R? *For Windows*

3. Next, click the first link at the top of the new page which shows the download link for the most current version of R. The latest version of R as of December 2023 was 4.3.2. But this could have been updated and changed. Therefore, we click on the link “Download R 4.3.2 for Windows”.

A screenshot of a web page showing a download link for R 4.3.2 for Windows. The link is highlighted with a red box and reads "Download R-4.3.2 for Windows (79 megabytes, 64 bit)". Below the link are two smaller links: "README on the Windows binary distribution" and "New features in this version".

[Download R-4.3.2 for Windows \(79 megabytes, 64 bit\)](#)  
[README on the Windows binary distribution](#)  
[New features in this version](#)

- The link downloads an installer program, which installs the most up-to-date version of R for Windows.
- Run this downloaded installer program.
- Follow the installation wizard prompts.
- The wizard will install R into your ‘program files’ folder, and will place a shortcut in your **Start menu**.
- Note that you’ll need to have all of the appropriate administration privileges to be able to install new software on your machine.



# How to Download and Install R? *For Mac*

1. To install R on a Mac, click the “Download R for Mac” link.



[CRAN](#)  
[Mirrors](#)  
[What's new?](#)  
[Task Views](#)  
[Search](#)

[About R](#)  
[R Homepage](#)  
[The R Journal](#)

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[Manuals](#)  
[FAQs](#)  
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## The Comprehensive R Archive Network

### Download and Install R

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- [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.

### Source Code for all Platforms

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- The latest release (2020-06-22, Taking Off Again) [R-4.0.2.tar.gz](#), read [what's new](#) in the latest version.
- Sources of [R alpha and beta releases](#) (daily snapshots, created only in time periods before a planned release).
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- Contributed extension [packages](#)

### Questions About R

- If you have questions about R like how to download and install the software, or what the license terms are, please read our [answers to frequently asked questions](#) before you send an email.



# How to Download and Install R? *For Mac*

2. Next, click on the R-4.3.2 package link (or the package link for the most current release of R).

For Apple silicon (M1/M2) Macs:

[R-4.3.2-arm64.pkg](#)

SHA1-hash: 7636e994ad00ed405972c73e9960ce4e55399d4  
(ca. 92MB, notarized and signed)

For older Intel Macs:

[R-4.3.2-x86\\_64.pkg](#)

SHA1-hash: 3d68ea6698add258bd7a4a5950152f4072eee8b2  
(ca. 94MB, notarized and signed)

**R 4.3.2** binary for macOS 11 (**Big Sur**) and higher, signed and notarized packages.

Contains R 4.3.2 framework, R.app GUI 1.80, Tcl/Tk 8.6.12 X11 libraries and Texinfo 6.8. 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.

macOS Ventura users: there is a known bug in Ventura preventing installations from some locations without a prompt. If the installation fails, move the downloaded file away from the *Downloads* folder (e.g., to your home or Desktop)

An installer will download to guide you through the installation process, which is very easy. The installer lets you customize your installation, but the defaults will be suitable for most users.

# R studio

# What is RStudio?

- Rstudio is an integrated development environment for R
  - Environment that allows you to interact with R software
  - Rstudio is user friendly
    - Allows you to see multiple windows in the same screen (ie., see all processes and functionalities) as we will see in subsequent
- **You have to install R first, before installing R studio**
  - Because R studio uses R in the background and in its absence it will not be usable
- Moving forward, we will be using the R studio interface as our environment where we will write our code and view results/output, other processes etc.
- The next slides will show you how to install R Studio,

# Downloading Rstudio

- Step 1: Go to [rstudio.com](https://rstudio.com), click on 'download'



## Put data into production with Posit Connect

Deploy all the work you create in R & Python with Posit Connect, including Shiny, Streamlit, Bokeh, and Dash applications. Quarto documents. Jupyter Notebooks. Models. Reports. Dashboards. Even APIs. With customizable access controls and authentication options that make IT happy.

[GET STARTED](#)[CONTACT SALES](#)

After clicking 'download', you will be taken to a page where, if you scroll down, there will be options.

**Step 2: Select the option 'RStudio Desktop' Free version. Click 'download' on that option**

The screenshot displays the Posit website's pricing page for RStudio Desktop. The navigation bar at the top includes the Posit logo, menu items for PRODUCTS, SOLUTIONS, LEARN & SUPPORT, EXPLORE MORE, and PRICING, a search icon, and a 'DOWNLOAD RSTUDIO' button. Two pricing cards are shown side-by-side. The left card is for 'RStudio Desktop' (Open Source Edition, AGPL v3) and is labeled 'Free'. It features a blue 'DOWNLOAD' button, which is highlighted with a red rectangular box. A red arrow points from the text above to this button. The right card is for 'RStudio Desktop Pro' (Posit Licensing Agreement) and is labeled 'Professional' at the top. It shows a price of '\$1,045 Per Year' and a blue 'BUY NOW' button. Both cards list features such as 'Syntax highlighting, code completion, and smart indentation' and 'Execute R code directly from the source editor'.

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DOWNLOAD RSTUDIO

Professional

RStudio Desktop  
Open Source Edition (AGPL v3)

Free

DOWNLOAD

✓ Syntax highlighting, code completion, and smart indentation

✓ Execute R code directly from the source editor

RStudio Desktop Pro  
Posit Licensing Agreement

\$1,045 Per Year

BUY NOW

✓ Syntax highlighting, code completion, and smart indentation

✓ Execute R code directly from the source editor

# Downloading R studio- Windows

After clicking 'download', you will be taken to a page where there will be options.

Step 3: For those using Windows OS, select 'Download RStudio for Windows'

The screenshot shows the Posit website's download page for RStudio Desktop. The navigation bar includes 'posit', 'PRODUCTS', 'SOLUTIONS', 'LEARN & SUPPORT', 'EXPLORE MORE', and 'PRICING'. The main heading is 'RStudio Desktop'. Below it, a paragraph describes the IDE. A second paragraph offers an alternative to downloading. The page is divided into two sections: '1: Install R' and '2: Install RStudio'. The '2: Install RStudio' section is highlighted with a red box and contains a blue button labeled 'DOWNLOAD RSTUDIO DESKTOP FOR WINDOWS'. Below the button, technical details are provided: 'Size: 215.66 MB | SHA-256: 93C7F307 | Version: 2023.12.0+369 | Released: 2024-01-10'. The '1: Install R' section has a blue button labeled 'DOWNLOAD AND INSTALL R'.

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DOWNLOAD

## RStudio Desktop

Used by millions of people weekly, the RStudio integrated development environment (IDE) is a set of tools built to help you be more productive with R and Python.

Don't want to download or install anything? Get started with RStudio on [Posit Cloud for free](#). If you're a professional data scientist looking to download RStudio and also need common enterprise features, don't hesitate to [book a call with us](#).

### 1: Install R

RStudio requires R 3.3.0+. Choose a version of R that matches your computer's operating system.

DOWNLOAD AND INSTALL R

### 2: Install RStudio

DOWNLOAD RSTUDIO DESKTOP FOR WINDOWS

Size: 215.66 MB | [SHA-256: 93C7F307](#) | Version: 2023.12.0+369 | Released: 2024-01-10

# Downloading R studio- Mac OS

Step 3: For those using Mac OS, scroll down and select 'macOS 12+'

## All Installers and Tarballs

RStudio requires a 64-bit operating system.

Linux users may need to import [Posit's public code-signing key](#) prior to installation, depending on the operating system's security policy.

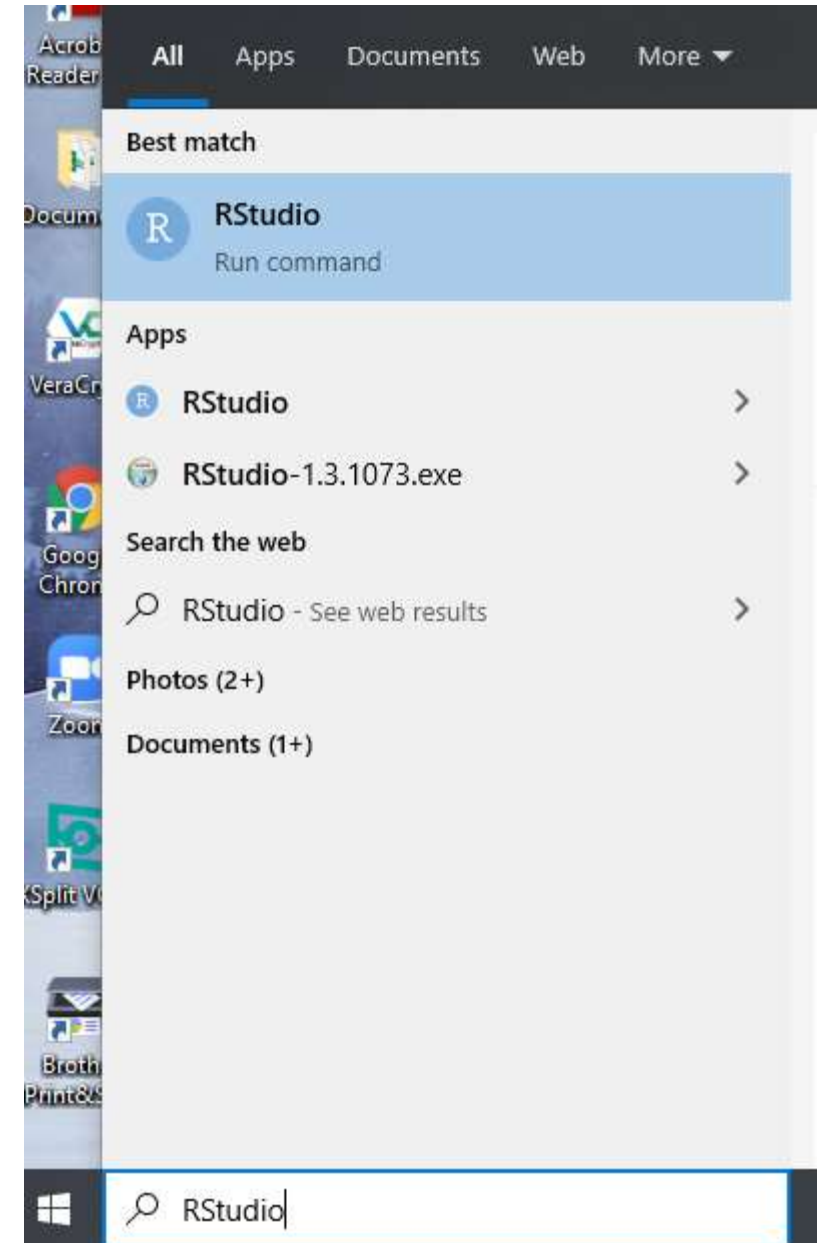
OS	Download	Size	SHA-256
Windows 10/11	<a href="#">RSTUDIO-2023.12.0-369.EXE ±</a>	215.66 MB	<a href="#">93C7F307</a>
macOS 12+	<a href="#">RSTUDIO-2023.12.0-369.DMG ±</a>	383.32 MB	<a href="#">4EF11127</a>
Ubuntu 20/Debian 11	<a href="#">RSTUDIO-2023.12.0-369-AMD64.DEB ±</a>	149.24 MB	<a href="#">01246DBC</a>



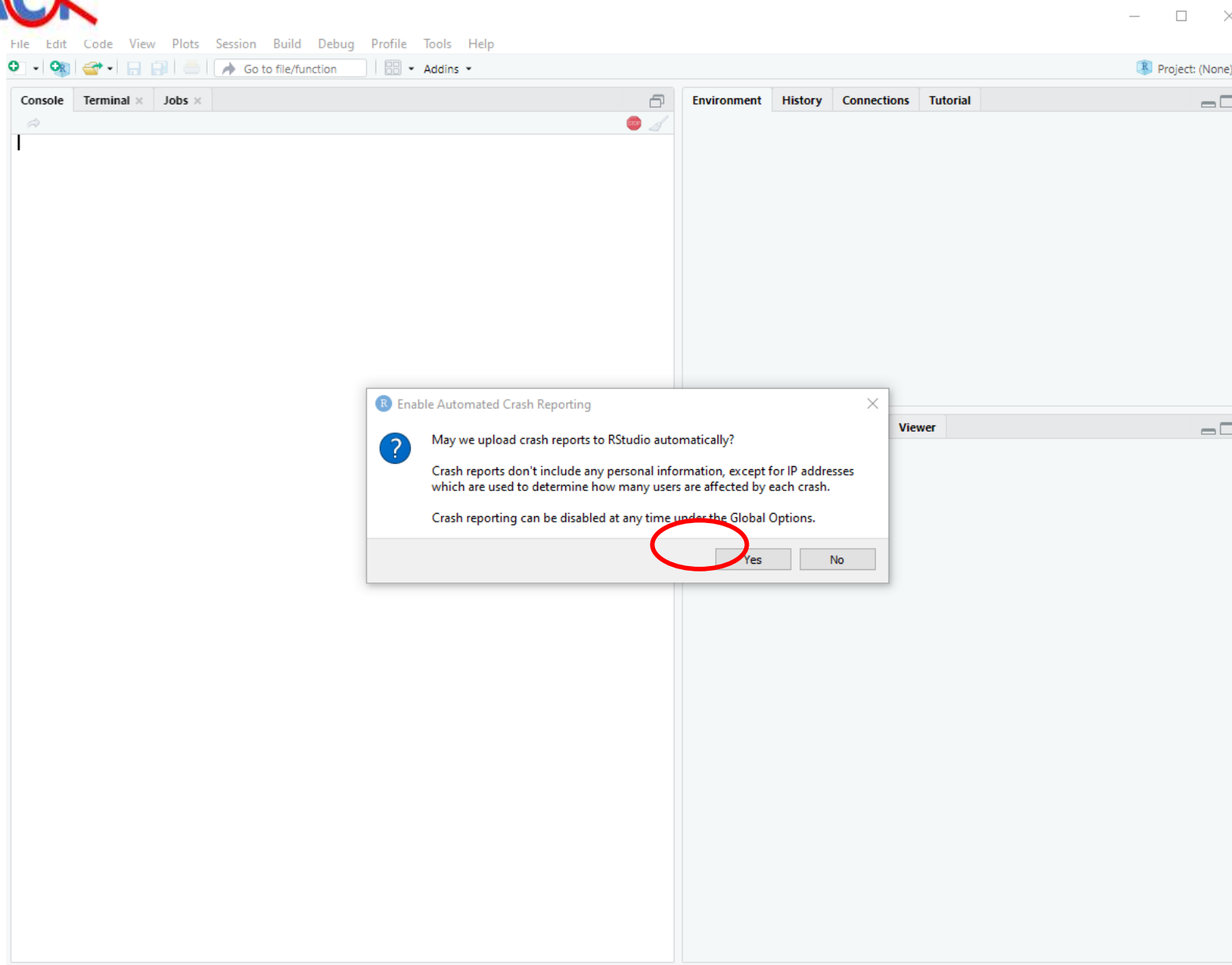
## Step 4: Installing RStudio

- Regardless of the operating system you are using, observe the following:
  - An installer will download to guide you through the installation process, which is very easy. The installer lets you customize your installation, but the defaults will be suitable for most users.
- On successful installation, you will receive a message that says 'RStudio has been successfully installed'.
- When you click on the 'start' menu, you will be able to access the Rstudio environment as shown in the next slide.

Type in RStudio in windows search bar and open RStudio



R studio interface (next slides)



Just in case you see this window pop-up, please select "Yes"

This will allow for storage of crash reports (ie., computer generating a ticket/reporting to RStudio about the incident).

The screenshot displays the RStudio interface with four main panels:

- Source:** Contains R code for creating a ggplot2 scatter plot. The code is:
 

```
1 library(ggplot2)-
2 mpg_plot ← ggplot(mpg, aes(x = displ, y = hwy)) +
3   geom_point(aes(colour = class))-
4 -
5 mpg_plot|
6 ↑
```
- Environment:** Shows the current environment with a table:
 

Name	Type	Len...	Size	Value
mpg_plot	gg	9	29.1...	List of 9
- Console:** Shows the execution of the code from the source editor:
 

```
> library(ggplot2)
> mpg_plot ← ggplot(mpg, aes(x = displ, y = hwy)) +
+   geom_point(aes(colour = class))
>
> mpg_plot
> |
```
- Output:** Displays a scatter plot of highway mileage (hwy) versus engine displacement (displ), colored by vehicle class. A legend on the right identifies the classes: 2seater (red), compact (yellow), midsize (green), minivan (teal), pickup (cyan), subcompact (purple), and suv (pink).

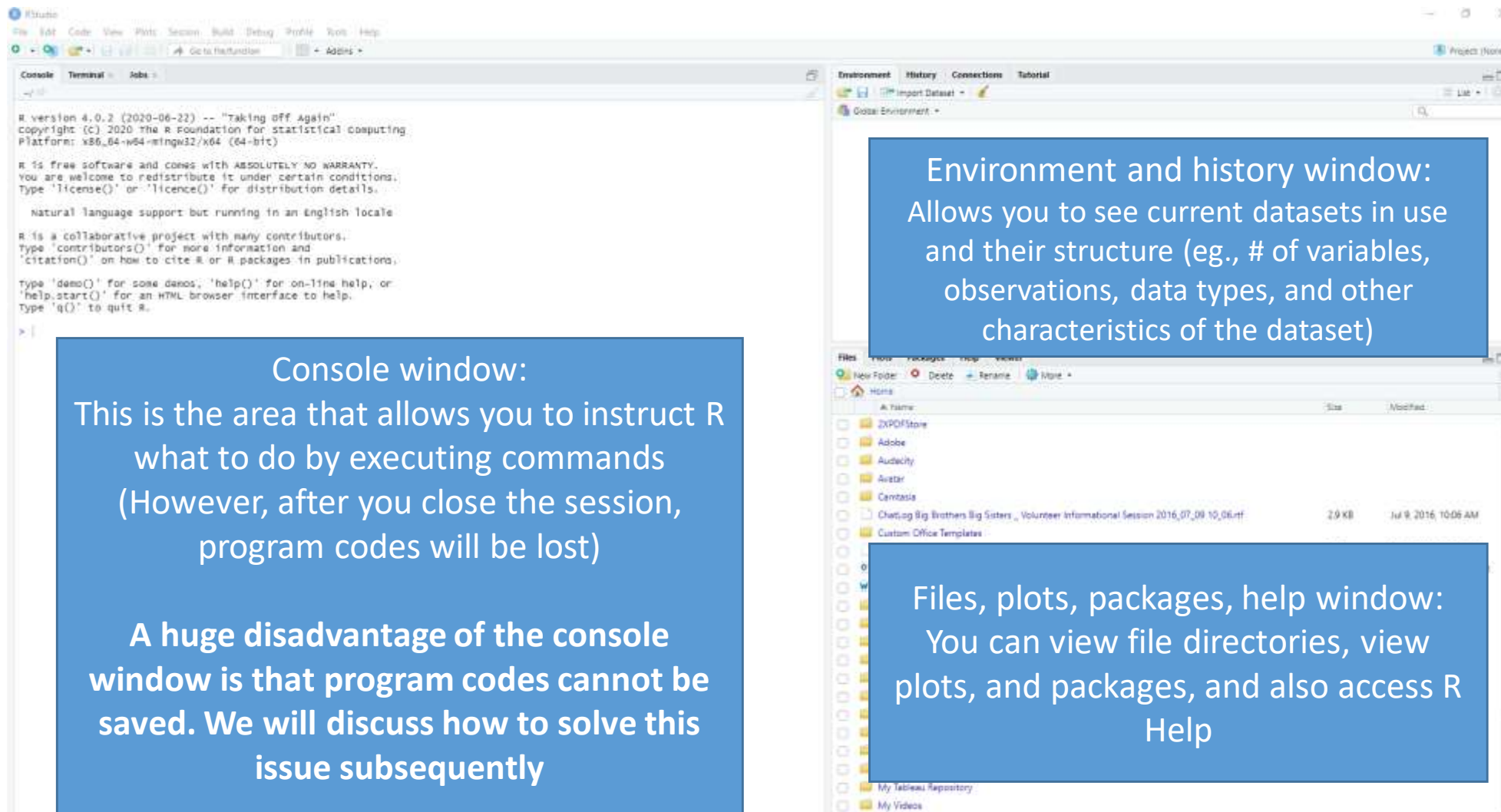
**Source**

**Environments**

**Console**

**Output**

You are now in the RStudio environment, where you will see 3 RStudio windows as shown in the image below



**Console window:**  
 This is the area that allows you to instruct R what to do by executing commands (However, after you close the session, program codes will be lost)

**A huge disadvantage of the console window is that program codes cannot be saved. We will discuss how to solve this issue subsequently**

**Environment and history window:**  
 Allows you to see current datasets in use and their structure (eg., # of variables, observations, data types, and other characteristics of the dataset)

**Files, plots, packages, help window:**  
 You can view file directories, view plots, and packages, and also access R Help

# The fourth window

- There is a fourth window that we will discuss in the next slide and it is called:

**'Source' Window**



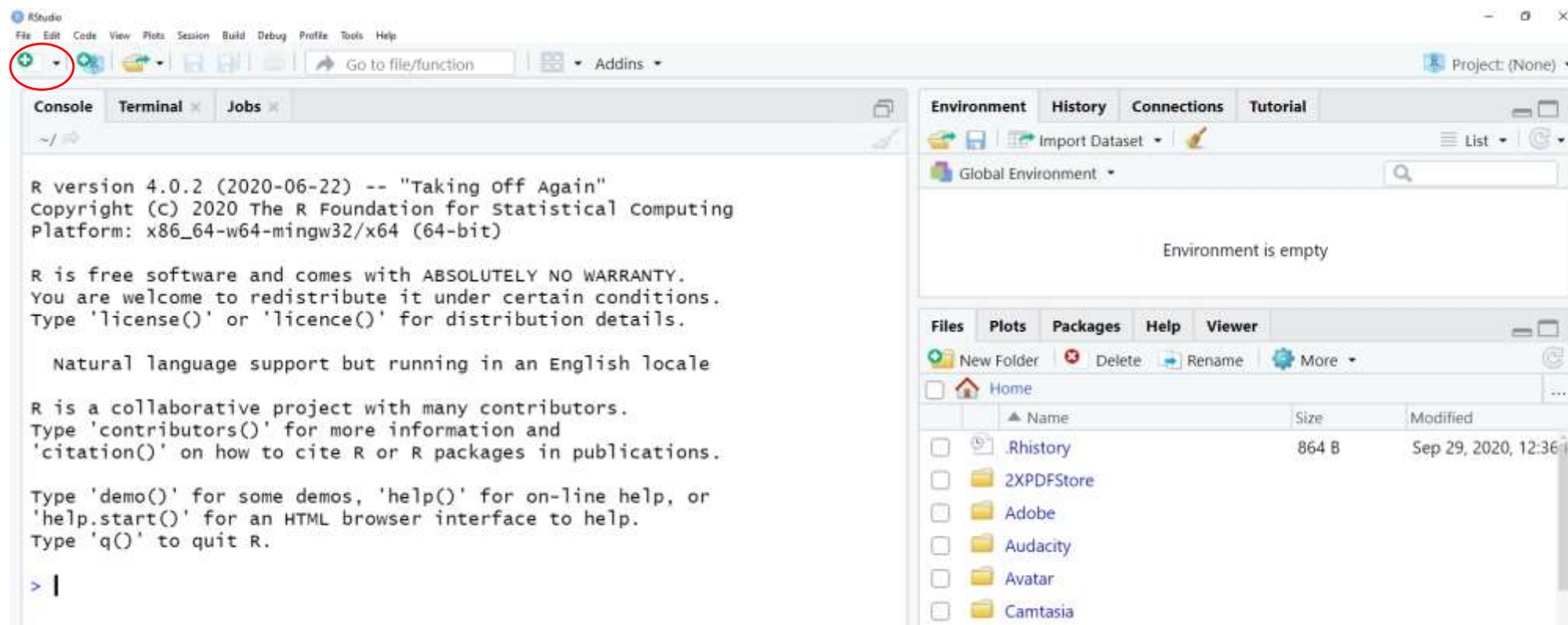
# Open 'Source' Window

- As we stated earlier, the written codes in the console window do not get preserved or saved. We can solve that using the 'source' window.
- The **source window** is like a writing notepad where you write your code similar to an editor.
- You write your code in the source window then select 'run' to execute the code.

# Explaining R jargons

- You will hear people talking about ‘R scripts’. This is simply a collection of all of the codes you have written or created in the ‘source’ window.
- When you have saved the program codes, you will notice that these are saved under a file designated with ‘.R’ extension
- In the next slide, we will show the following:
  - How to create a new file which automatically opens the source window

Click on “new file” to open a new RScript



The screenshot shows the RStudio interface. The top menu bar includes File, Edit, Code, View, Plots, Session, Build, Debug, Profile, Tools, and Help. The toolbar contains various icons, with the 'New File' icon (a green plus sign) circled in red. A red arrow points from the text on the left to this icon. The main console area displays the R startup message, including the version (4.0.2), copyright information, and instructions for using the software. The right-hand pane shows the Environment tab, which is currently empty, and the Files tab, which displays a file explorer view of the home directory.

```
R version 4.0.2 (2020-06-22) -- "Taking off Again"
Copyright (C) 2020 The R Foundation for statistical computing
Platform: x86_64-w64-mingw32/x64 (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.

> |
```

Name	Size	Modified
.Rhistory	864 B	Sep 29, 2020, 12:36
2XPDFStore		
Adobe		
Audacity		
Avatar		
Camtasia		

The screenshot displays the RStudio environment. The main source window is empty, with a blue text box overlaid on it. The environment pane on the right shows 'Global Environment' and 'Environment is empty'. The console at the bottom shows the R startup message.

Now you have the 'source' window also known as "R script".

```

R version 4.0.2 (2020-06-22) -- "Taking Off Again"
Copyright (C) 2020 The R Foundation for Statistical Computing
Platform: x86_64-w64-mingw32/x64 (64-bit)

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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.

> |
  
```

# Summary

- In this lecture you learned about:
  - Downloading and installing R and RStudio
  - RStudio windows
- We will now show you how to perform basic functions in RStudio.

# References

<https://bookdown.org/ndphillips/YaRrr/the-four-rstudio-windows.html>