Kickstart with R:Your Gateway to Data Science

IOC-R Week1

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Unlock the Power of Your Data with 

Welcome to R!

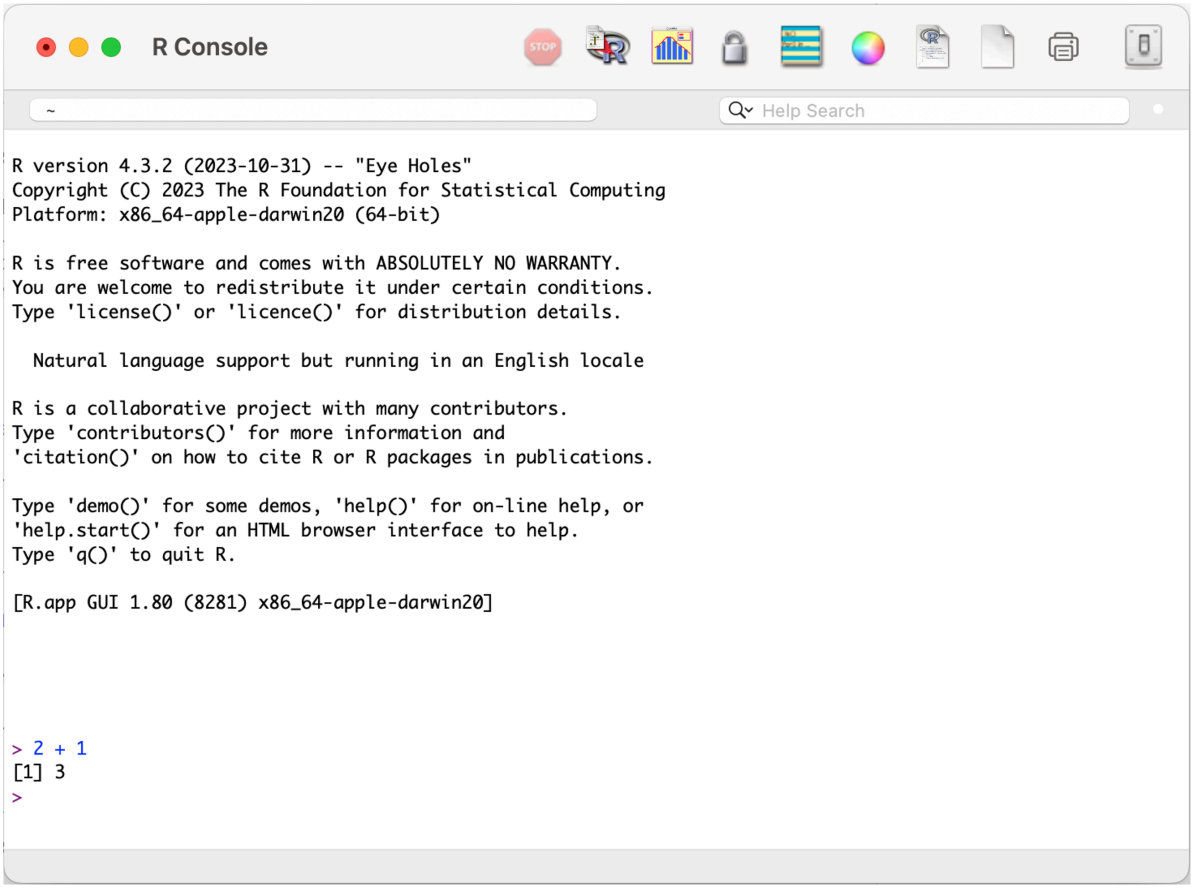
Why R?

- Biologist friendly!
- Free and open-source
- Supported by a huge community

What you can do with R?

- Analyze your data
- Visualize your findings
- Automate your workflow
- Share reproducible research

The R Console

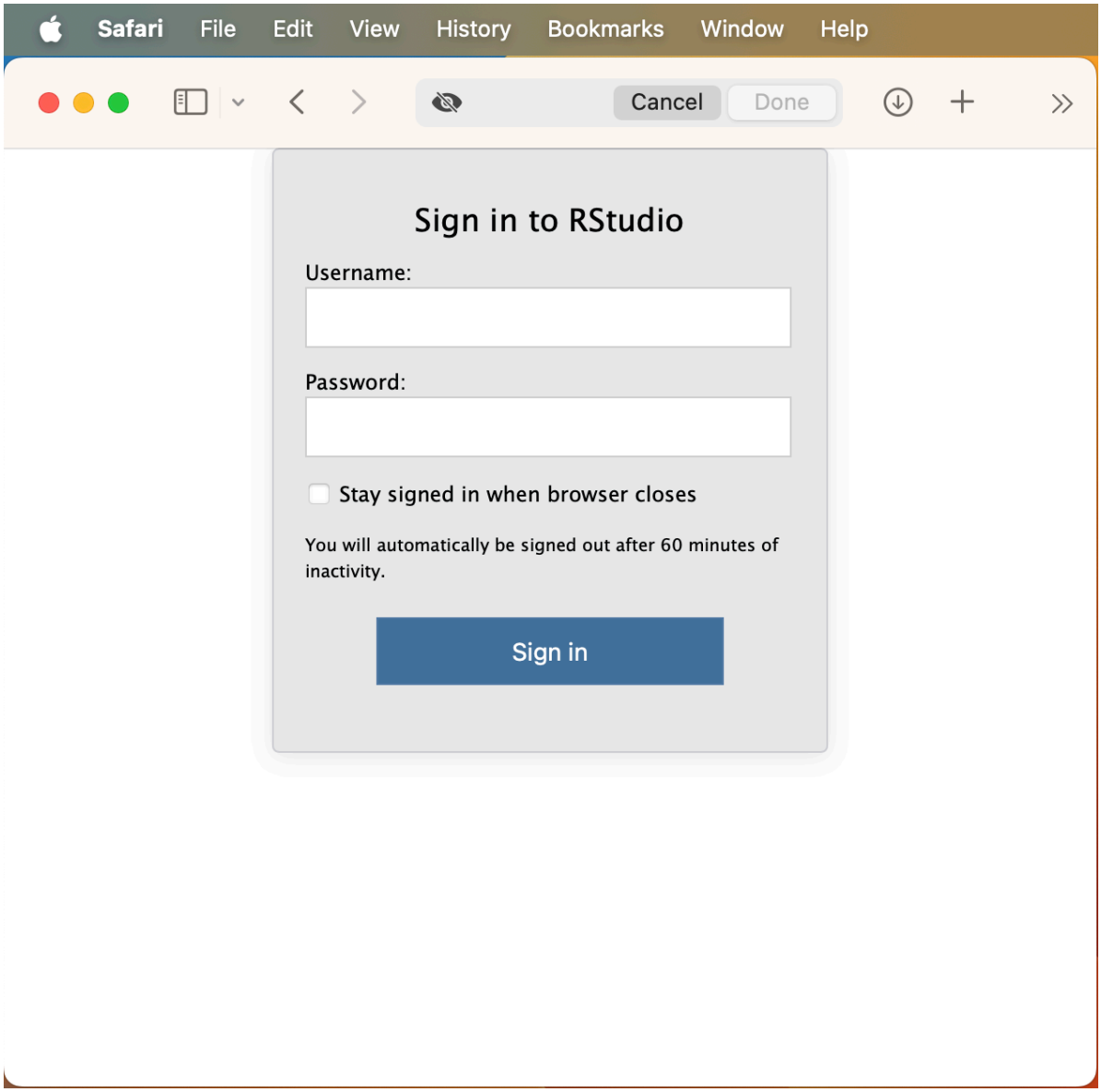


Type a command after the prompt ">" and type "Enter" to execute it.

Rstudio

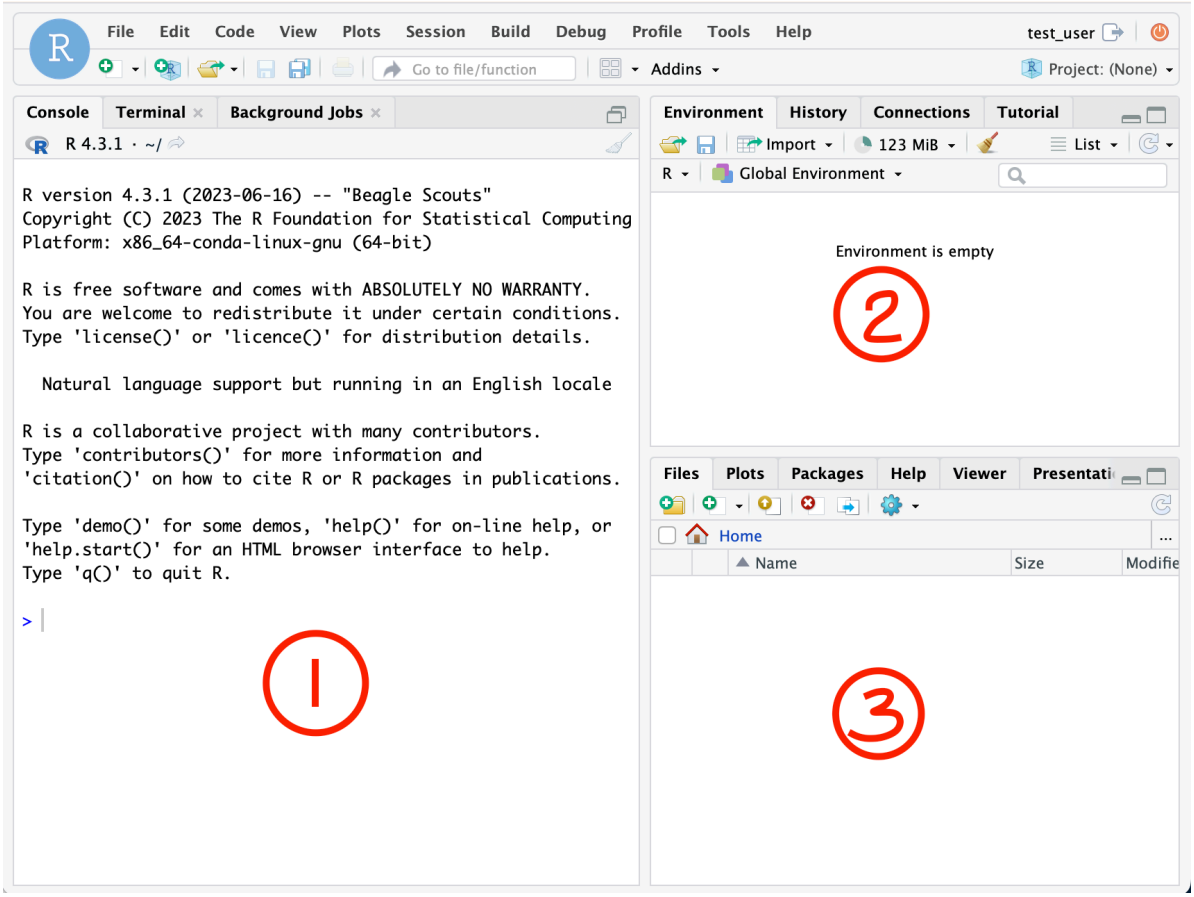
Rstudio Login

Connect to your RStudio server account.



Rstudio IDE

Integrated Development Environment (IDE)



1. Console: where R "talks back" to you.
2. Environment/History: tracks your variables and past commands.
3. Files/Plots/Packages: managing your files, viewing graphs, or installing tools.

Rstudio cheat sheet (and French version)

Everything you need in one organized window. Save your work as a script, RStudio includes many useful features which let us code easily. notebook, show results

Getting Started in R

- Create a new file[1]: *File -> New File -> R Script*
- Basic commands[2]:

[1]Shortcut to create new file: press *Shift + Ctrl + N* (Windows) or *Shift + Cmd + N* (Mac)
[2]Shortcut to run code: highlight it and press *Ctrl + Enter* (Windows) or *Cmd + Enter* (Mac)

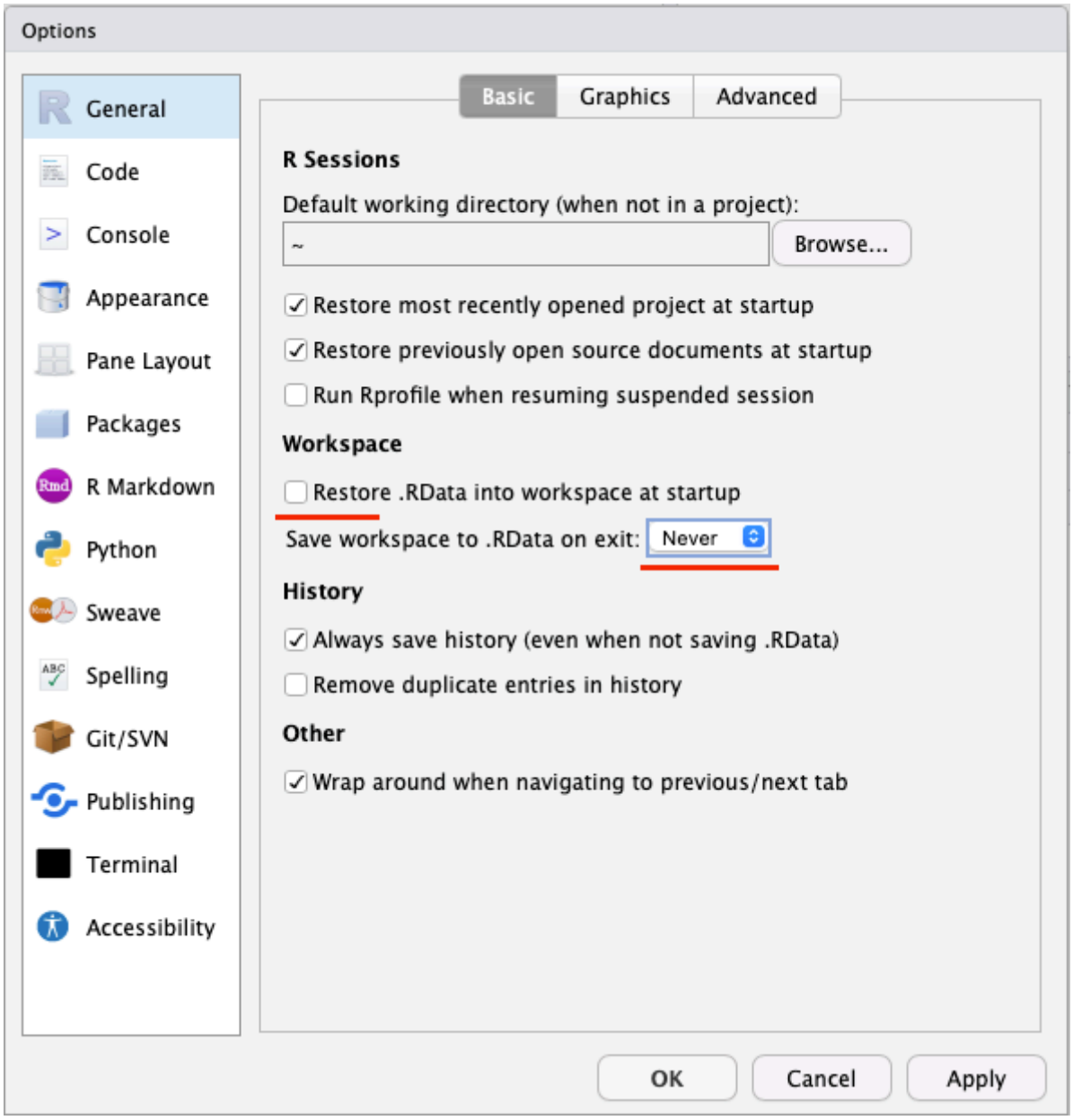
```r
# Math with R:
2 + 2    # Yes, R can do math!
sqrt(16) # Square root.

# Create a variable:
x <- 5 # Now x is 5. You can reuse it!

# Inspect your environment:
## Look at the "Environment" pane, do you see your x?
ls()

# Load a package:
library(stats)

# Get help of a function (documentation):
?mean

# Quit RStudio properly
q()
```

Some Configuration

Go to *Tools -> Global Options...*

Under the *General* tab:

- Uncheck the box "Restore .RData..."
- Set "Save workspace to .RData on exit" to **Never**.

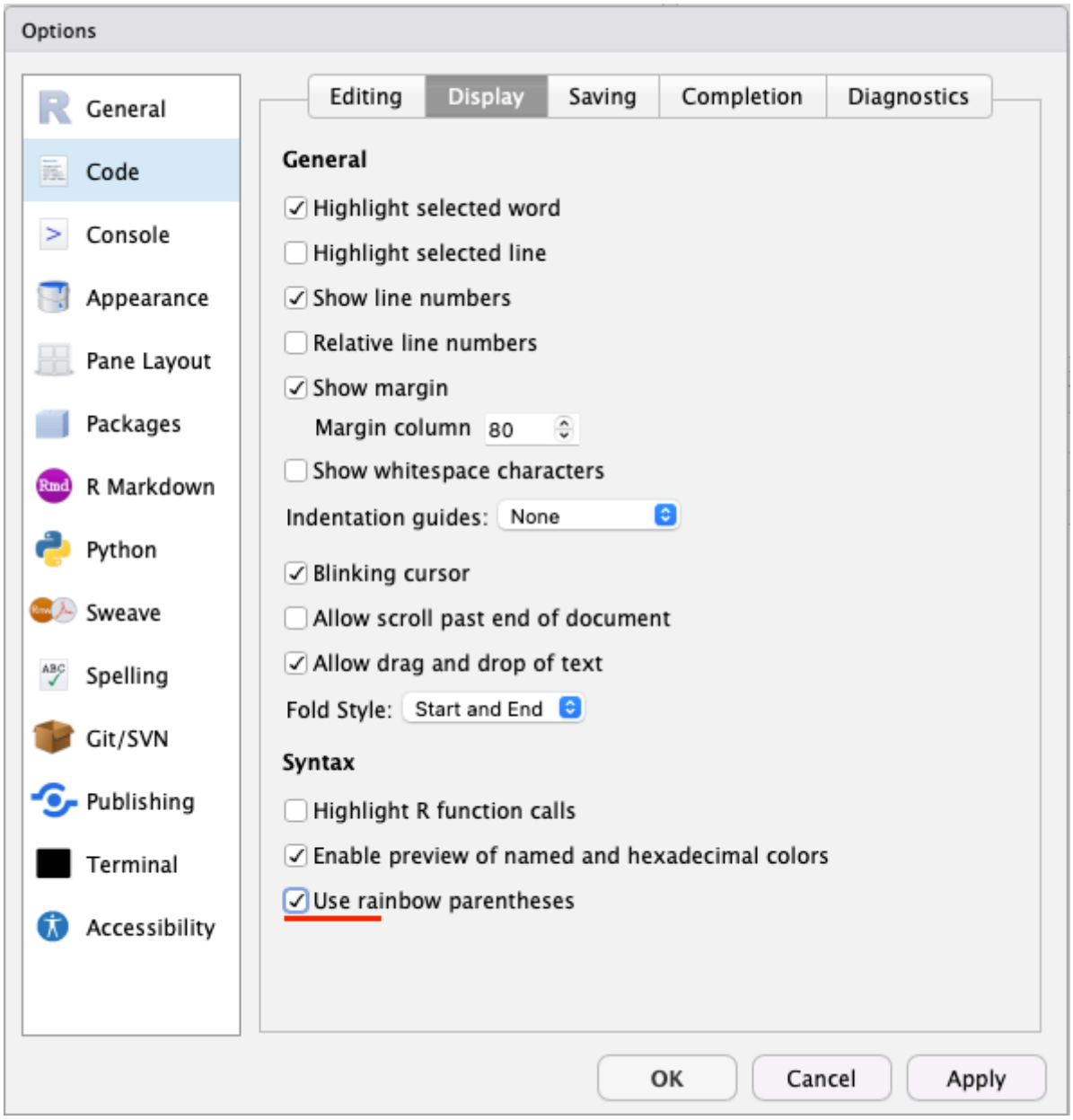


Some Configuration

Go to *Tools -> Global Options...*

Under the *Code* tab:

In the *Display* panel, check the box "Use rainbow parentheses"



Some Configuration

Go to *Tools -> Global Options...*

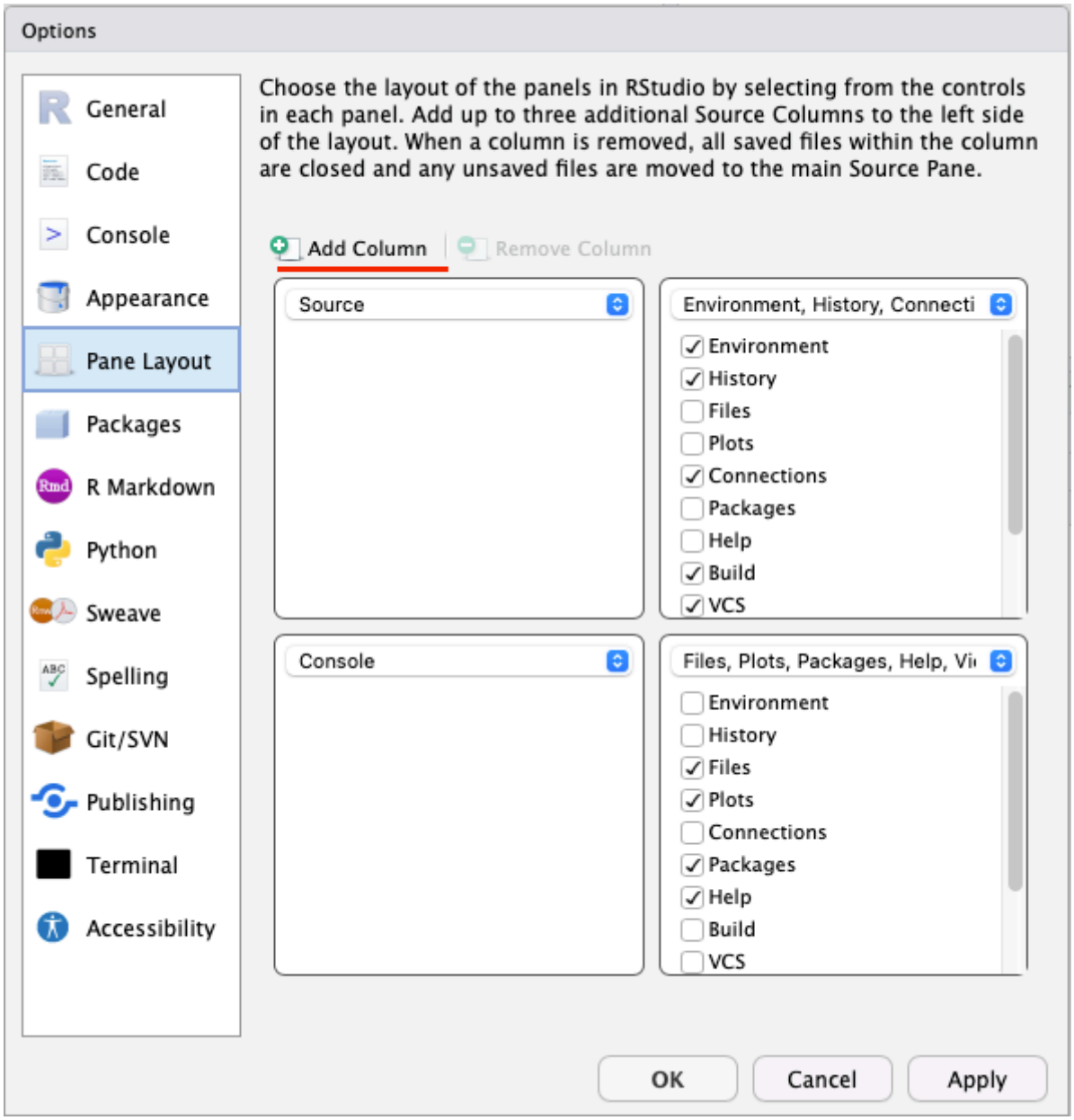
- Under the *Appearance* tab:

You can select a theme for you RStudio, e.g., the "Cobalt" for a dark theme.

- Under the *Pane Layout* tab:

You can arrange the four panels as you prefer.

In addition, click "Add Column" lets you open an extra "Source" code column, allowing you to view your scripts side by side!



Setting Up an R Project

Create an R Project

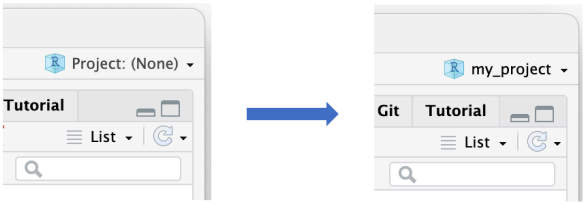
An R project keeps everything for your project in **one working directory** and helps R to know where to look for your files.

. . .

1. In RStudio, go to *File -> New Project*
2. Choose *New Directory* and click *New Project*
3. Set a folder name (e.g., `my_project`) and select where to save it.
4. Click *Create Project*

. . .

You'll notice RStudio restarts, and now your project is set up!



An R Project is a way to keep everything for your work (scripts, data, outputs) in one place. Think of it like a special folder where RStudio automatically knows where to look for your files. It helps avoid problems with messy file paths.

Understanding File Paths

A **path** tells your computer where to find files.

. . .

- **Absolute path**, starts from the very top of your computer's folder
  - E.g.:
    - In real-life: France, Paris, 9 Quai St Bernard, Building B, office 725
    - On Linux/Mac: `/home/test_user/my_project/data/myfile.csv`
    - On Windows: `C:\Users\test_user\my_project\data\myfile.csv`

. . .

- **Relative path**, starts from your working directory (folder)

  - E.g.:
    * Building B, office 725
    * `data/myfile.csv` or `data\myfile.csv` (Windows)

computer's file system -> a country files -> offices in a building

A Well Organized Folder

Tree structure:

```
my_project                # Your working directory
   my_project.Rproj     # The R project configuration file
   README.md            # A short introduction of the project
   data                 # Raw data files
       raw_count.tsv
   scripts              # Your R code files
       01-analysis.R
       02-figures.R
   outputs              # Results, e.g., graphs, reports
```

example of bad home organisation: pillow in kitchen and microoven in the bathroom The trunk is the main folder (your R Project). Branches are subfolders for scripts, data, and output, ect. By building a clear structure, you'll: Always know where to find things. Save time when coding in R or sharing your project with others. Avoid messy files scattered everywhere.

Where Are You?

```
my_project                # Your working directory
   my_project.Rproj     # The R project configuration file
   README.md            # A short introduction of the project
   data                 # Raw data files
       raw_count.tsv
   scripts              # Your R code files
       01-analysis.R
       02-figures.R
   outputs             # Results, e.g., graphs, reports
```

```
getwd() # Get working directory
[1] "/home/test_user/my_project"
```

. . .

What are the absolute and relative paths of the script "02-figures.R"?

. . .

absolute path: `/home/test_user/my_project/scripts/02-figures.R`

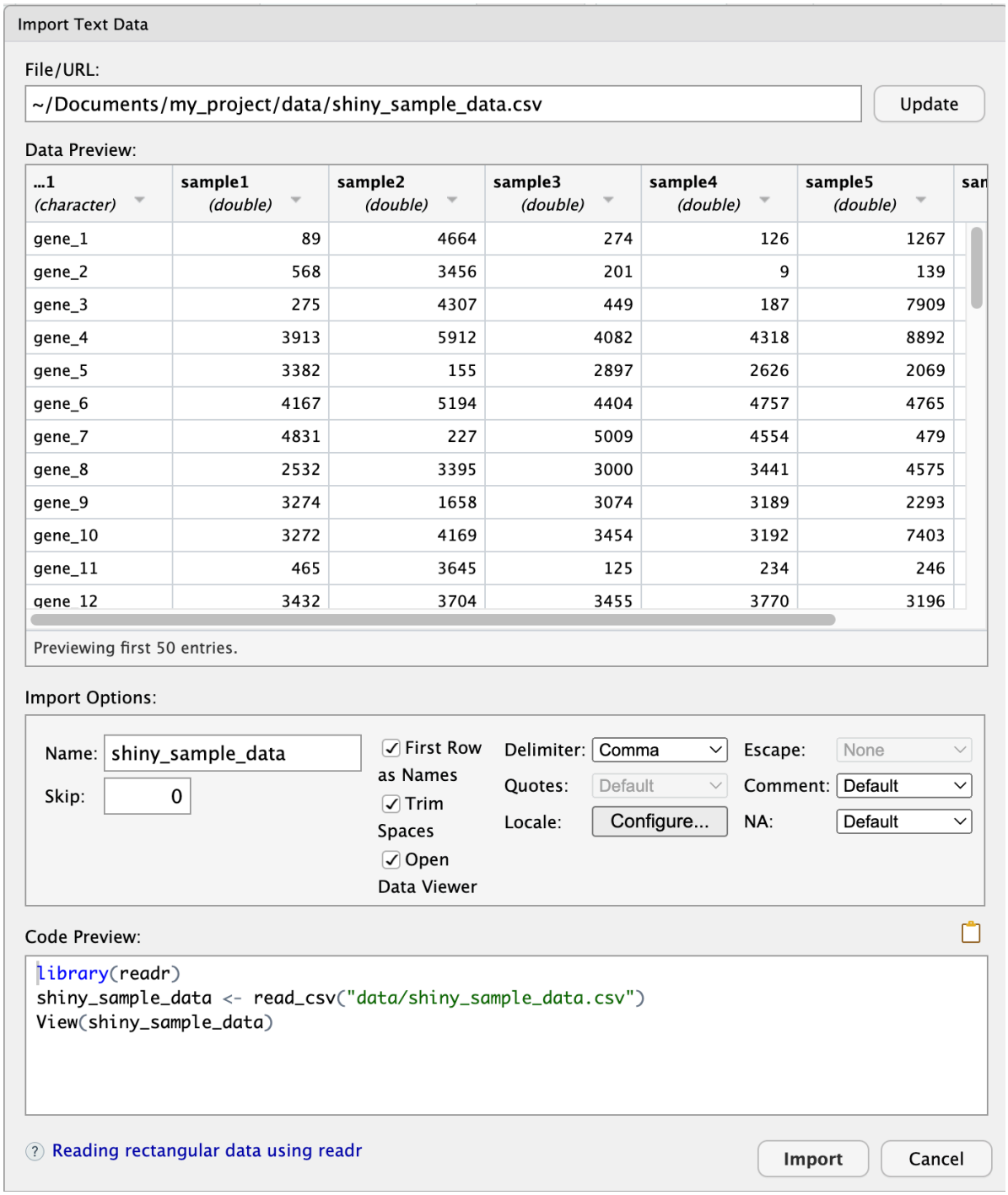
relative path: `scripts/02-figures.R`

. . .

```
file.exists("/home/test_user/my_project/scripts/02-figures.R")
[1] TRUE
file.exists("scripts/02-figures.R")
[1] TRUE
```

Import Dataset

- Supported formats:
  - text files (.txt, .csv, *etc.*)
  - Excel files
  - data from other software (e.g., SAS)
- Click-button methods:
  - From menu bar: *File* -> *Import Dataset* -> Select the format -> Choose your file
  - From the "Environment" pane: click "Import Dataset" -> Select the format -> Choose your file
  - From the "Files" pane: Navigate to your file location -> Click the file and select "Import Dataset"

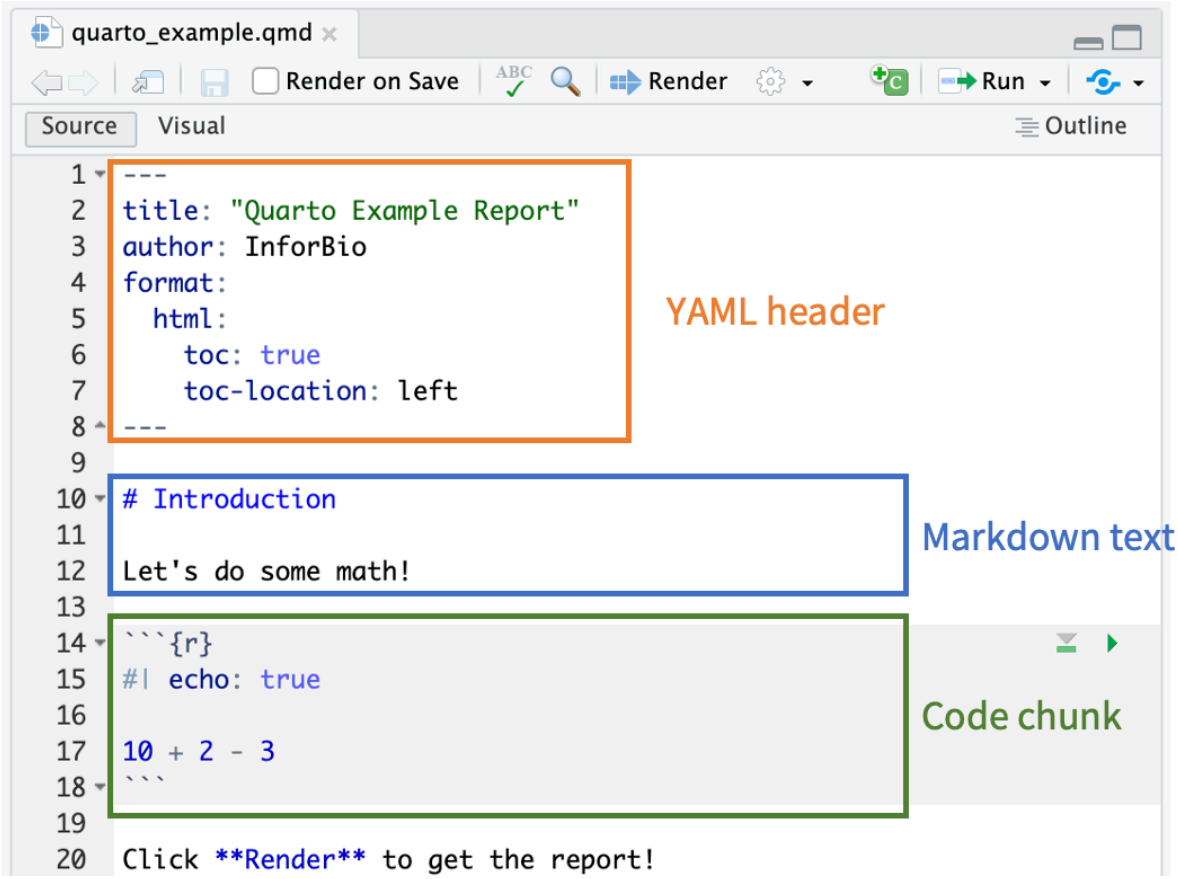

Import Text Data
File/URL:
~/Documents/my_project/data/shiny_sample_data.csv
Update
Data Preview:
...1 (character)
sample1 (double)
sample2 (double)
sample3 (double)
sample4 (double)
sample5 (double)
gene_1 89 4664 274 126 1267
gene_2 568 3456 201 9 139
gene_3 275 4307 449 187 7909
gene_4 3913 5912 4082 4318 8892
gene_5 3382 155 2897 2626 2069
gene_6 4167 5194 4404 4757 4765
gene_7 4831 227 5009 4554 479
gene_8 2532 3395 3000 3441 4575
gene_9 3274 1658 3074 3189 2293
gene_10 3272 4169 3454 3192 7403
gene_11 465 3645 125 234 246
gene_12 3432 3704 3455 3770 3196
Previewing first 50 entries.
Import Options:
Name: shiny_sample_data
Skip: 0
First Row as Names
Trim Spaces
Open Data Viewer
Delimiter: Comma
Quotes: Default
Locale: Configure...
Escape: None
Comment: Default
NA: Default
Code Preview:
library(readr)
shiny_sample_data <- read_csv("data/shiny_sample_data.csv")
View(shiny_sample_data)
Reading rectangular data using readr
Import
Cancel

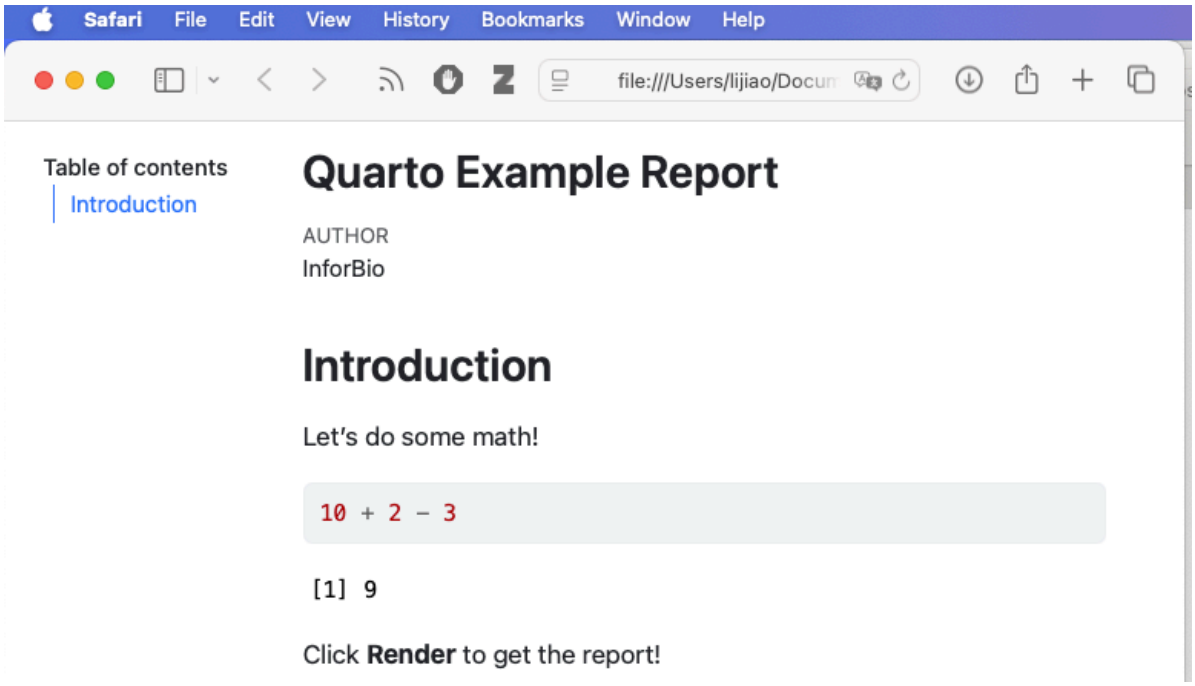
Automated Reporting

Quarto

- Open-source tools for creating dynamic and shareable document.
- Combines narrative text and code (multi-language) in one script (.qmd).
- Supports multiple output formats: .html, .docx, .pptx, .pdf, *etc.*

An Example





Markdown syntax cheat sheet

Need Some Help?

- Google it!
- Ask/discuss your question via Slack.
- AI (like ChatGPT) is your friend , but be careful of false answers! (More details in session 6)

Key points:

- Explain your question step-by-step.
- Share the context.
- Use keywords.
- Try to rephrase the question.

google/forum stack overFlow - what are you trying to do / what did you try? - the warning or error message / your code / your data structure - language name / function or package name / a specific problem - try and iterate

Let's Practice !

Today's Goals

- Get familiar with the RStudio
- Create an R project in RStudio
- Upload and import data file into RStudio
- Generate your first Quarto report