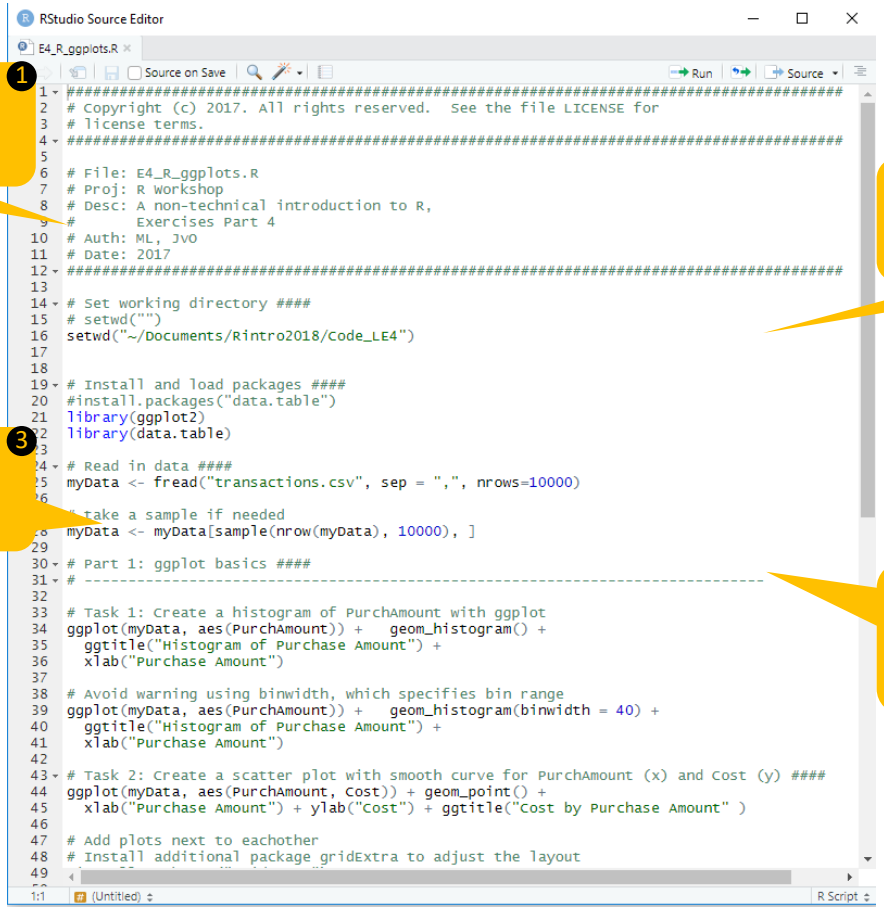
Understanding and creating code notebooks

Extensive data science with R scripts become challenging quickly

1 Comments in your script tend to be terse or non-existent




```
################################################################################
# Copyright (c) 2017. All rights reserved.  See the file LICENSE for
# license terms.
################################################################################

# File: E4_R_ggplots.R
# Proj: R Workshop
# Desc: A non-technical introduction to R,
#       Exercises Part 4
# Auth: ML, JvO
# Date: 2017
################################################################################

# Set working directory ####
# setwd("")
setwd("~/Documents/Rintro2018/Code_LE4")


# Install and load packages ####
#install.packages("data.table")
library(ggplot2)
library(data.table)

# Read in data ####
myData <- fread("transactions.csv", sep = ",", nrows=10000)

# Take a sample if needed
myData <- myData[sample(nrow(myData), 10000), ]

# Part 1: ggplot basics ####
# -----------------------------------------------------------------------------

# Task 1: Create a histogram of PurchAmount with ggplot
ggplot(myData, aes(PurchAmount)) +   geom_histogram() +
  ggtitle("Histogram of Purchase Amount") +
  xlab("Purchase Amount")

# Avoid warning using binwidth, which specifies bin range
ggplot(myData, aes(PurchAmount)) +   geom_histogram(binwidth = 40) +
  ggtitle("Histogram of Purchase Amount") +
  xlab("Purchase Amount")

# Task 2: Create a scatter plot with smooth curve for PurchAmount (x) and Cost (y) ####
ggplot(myData, aes(PurchAmount, Cost)) + geom_point() +
  xlab("Purchase Amount") + ylab("Cost") + ggtitle("Cost by Purchase Amount" )

# Add plots next to eachother
# Install additional package gridExtra to adjust the layout
```

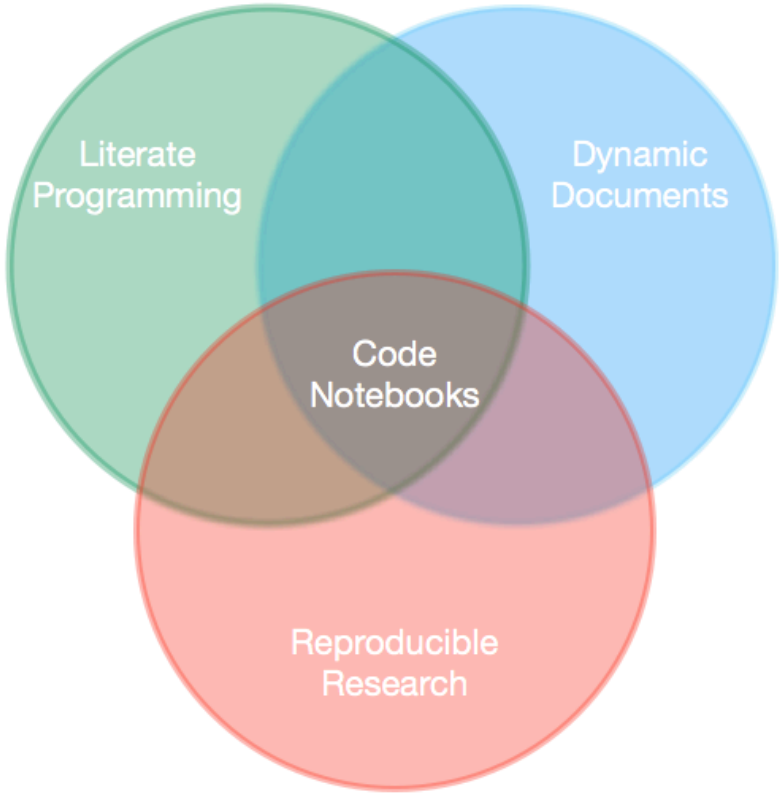
2 Intermediate results are not immediately accessible

3 Coworkers spend a lot of time reading your comments

4 You struggle to find the right plot in your output folder, because there are so many

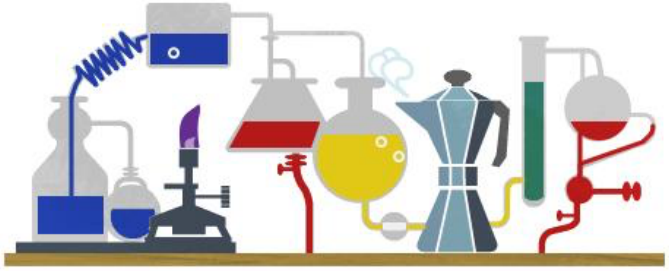
Scripts for data science can become messy quickly.

Code notebooks are a tool to report your code and results and make them publicly available

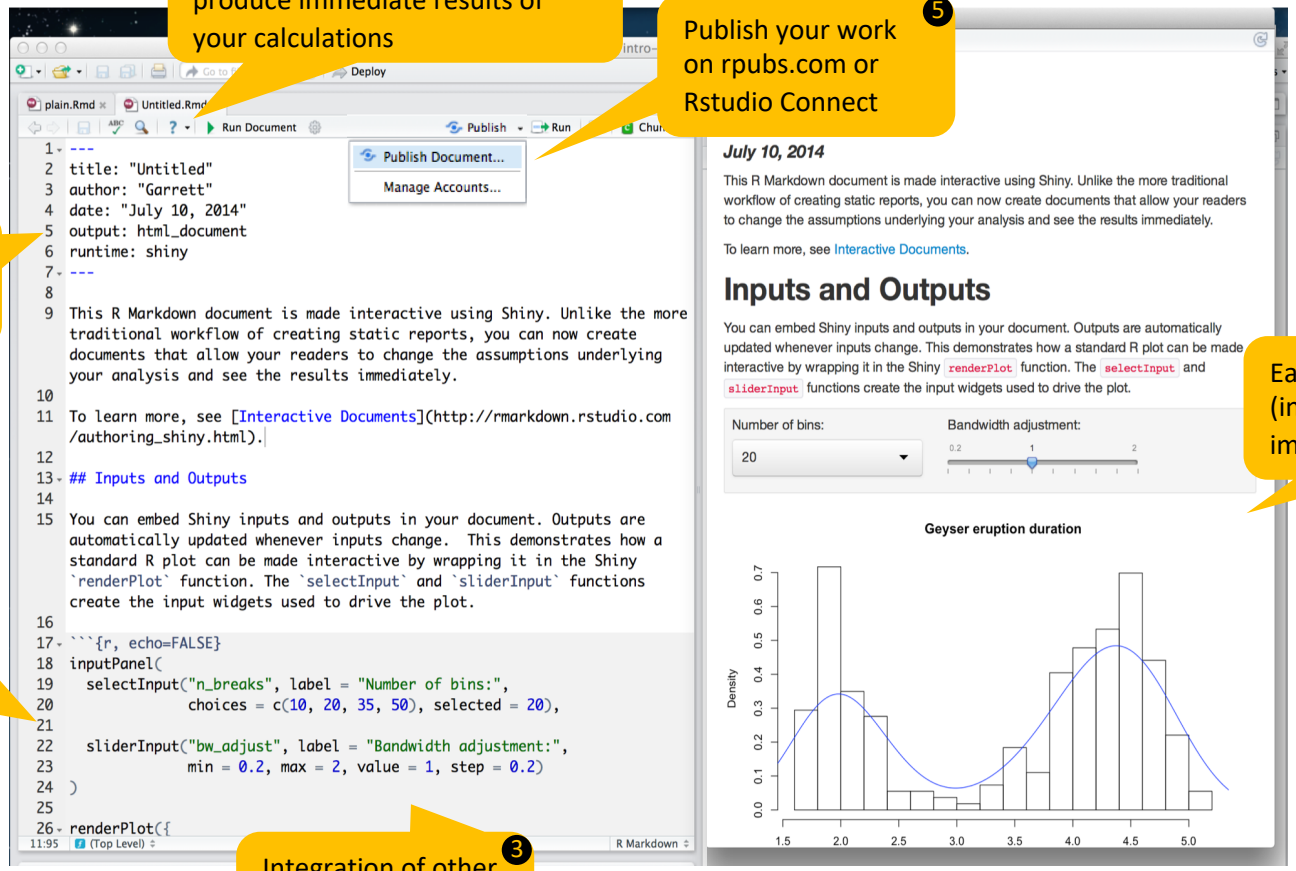


Code notebooks help you to:

- Divide your code into manageable chunks.
  - Execute small chunks of code one by one.
  - Evaluate and store preliminary results.
- Take notes along the process in rich text format (paragraphs, equations, tables, …).
- Present and discuss your results and code chunks with colleagues.



What do you get out of code notebooks?
Example: R Notebook



Notebooks versus regular programming scripts

Activity	Scripts	Notebooks
Building a narrative	**Comments** are available to describe code.	**Rich text** is available to describe the process and conclusion
Manage output	Output is available in the console or environment.	**Output is embedded** in a single document. Code and output may be divided into separate **code chunks**.
Creating a final report	**Creating a report is a separate** and time-consuming **step**.	**Instant report possible**. Reports are publishable as HTML, PDF, …)

1. Allows very descriptive and reproducible documentation
2. Immediate update of output and report
3. Easy sharing possible

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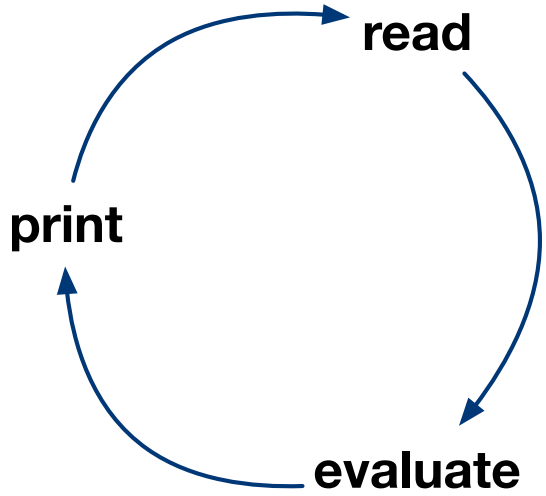
Notebooks are based on the read-eval-print loop (REPL) technique

The notebook user-interface is developed on the **concept of interactive computing:**

1. User input
2. Input is evaluated
3. Result is printed and notebook is ready for next input



There are **two main features**:

- Store the last output for reuse
- Ability to save input and later reload and re-evaluate

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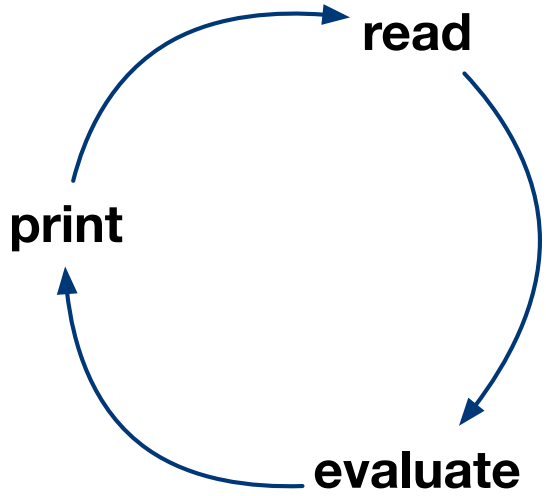

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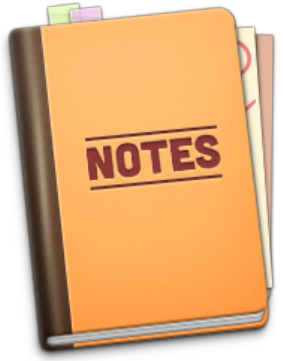
There are many different notebooks, which mostly support multiple programming languages

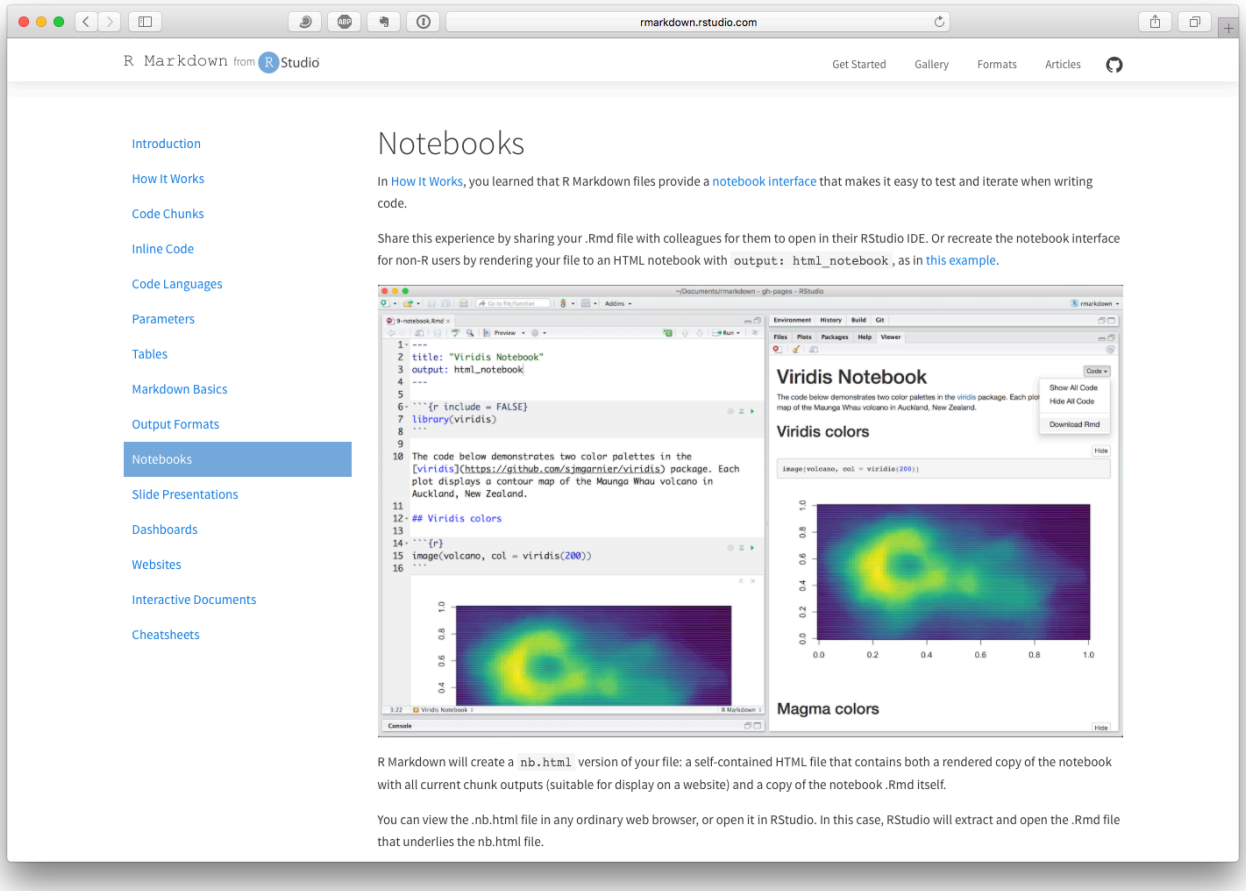
- Jupyter (e.g. used by Google Colab; R, Python; around 40 different languages)
- R Notebooks (R, Python; around 8 different languages)
- Beaker (R, Python; around 17 different languages)
- Zeppelin (R, Python, around 20 different languages)



➢ Which one to pick depends on the requirements of the programming project and your personal preference. We pick to present R notebooks due to its integration into R Studio.

http://beakernotebook.com, https://zeppelin.apache.org, http://jupyter.org, http://jupyter.org

Using R Notebooks in R Studio is very convenient



http://rmarkdown.rstudio.com/lesson-10.html

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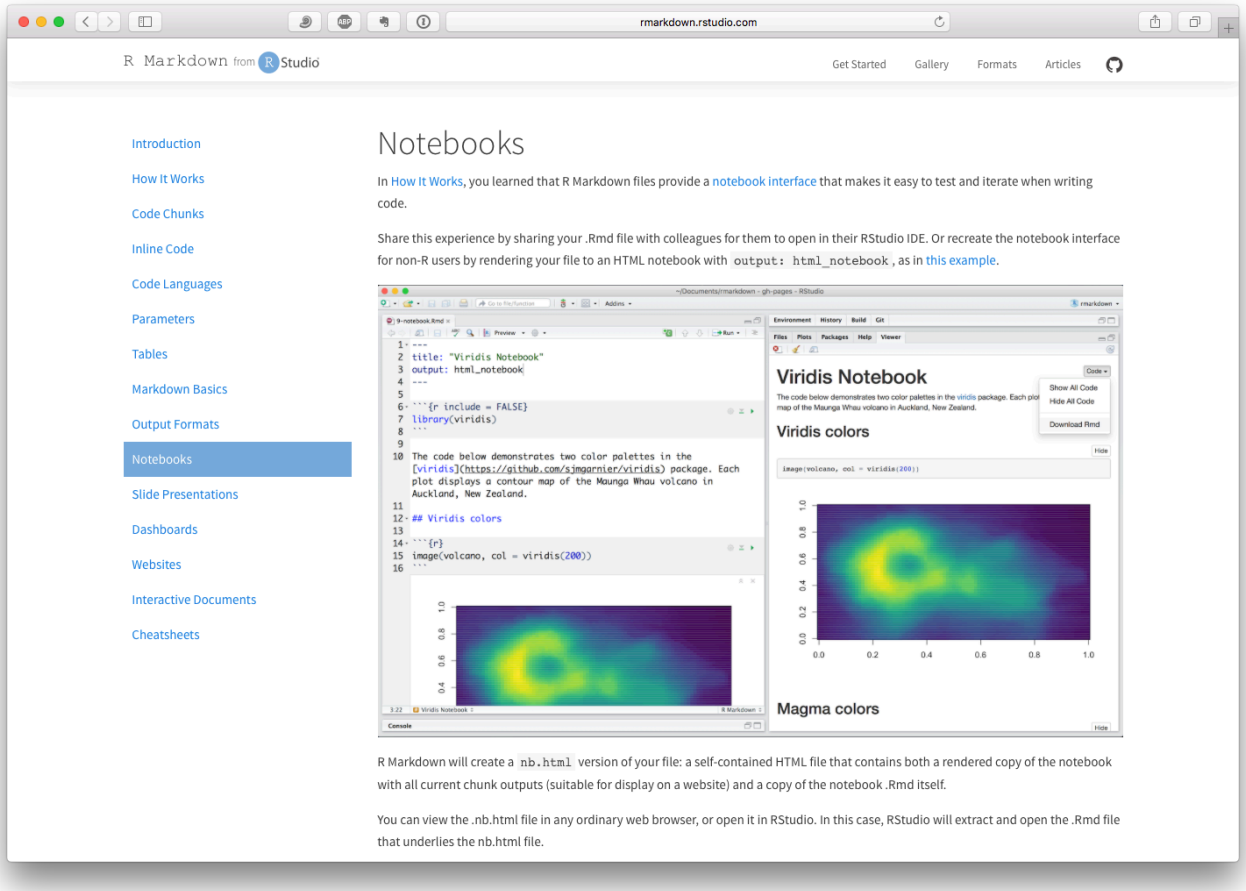

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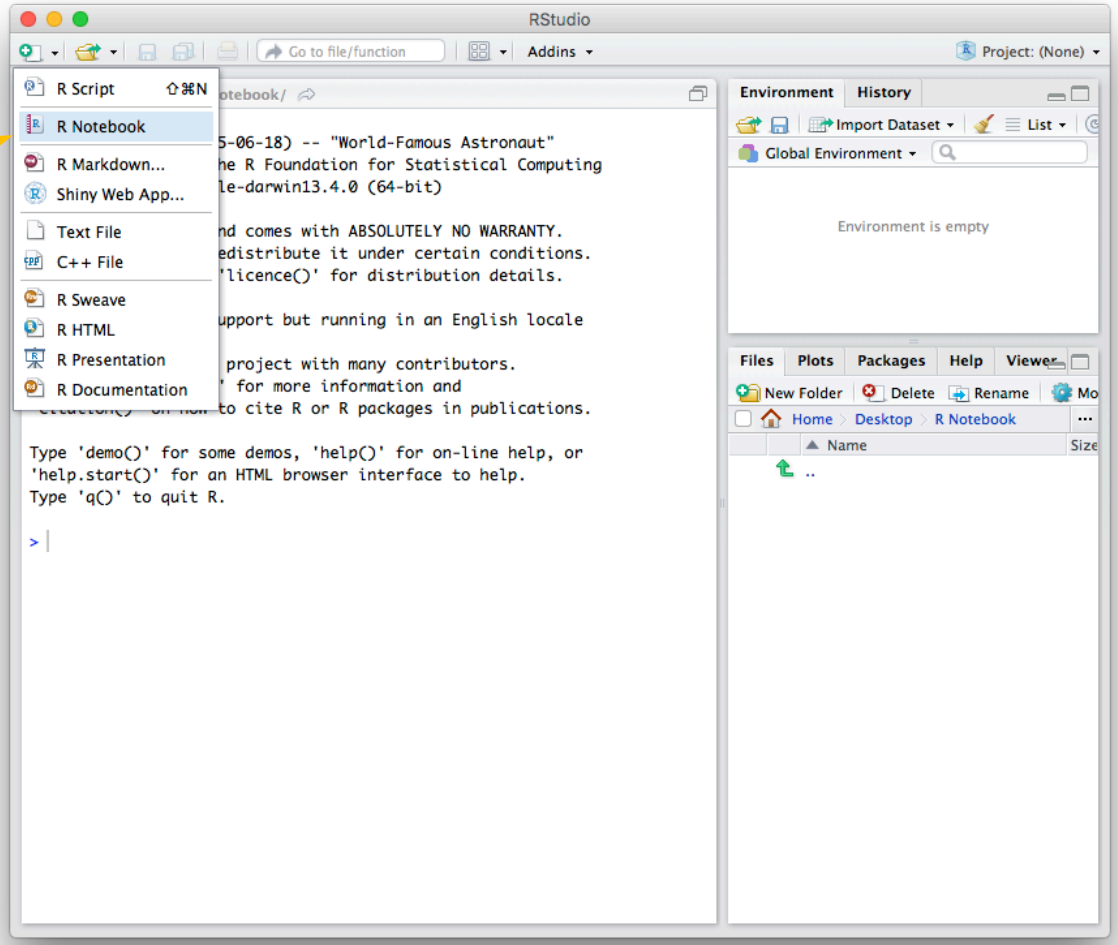
Create your first R Notebook

Steps

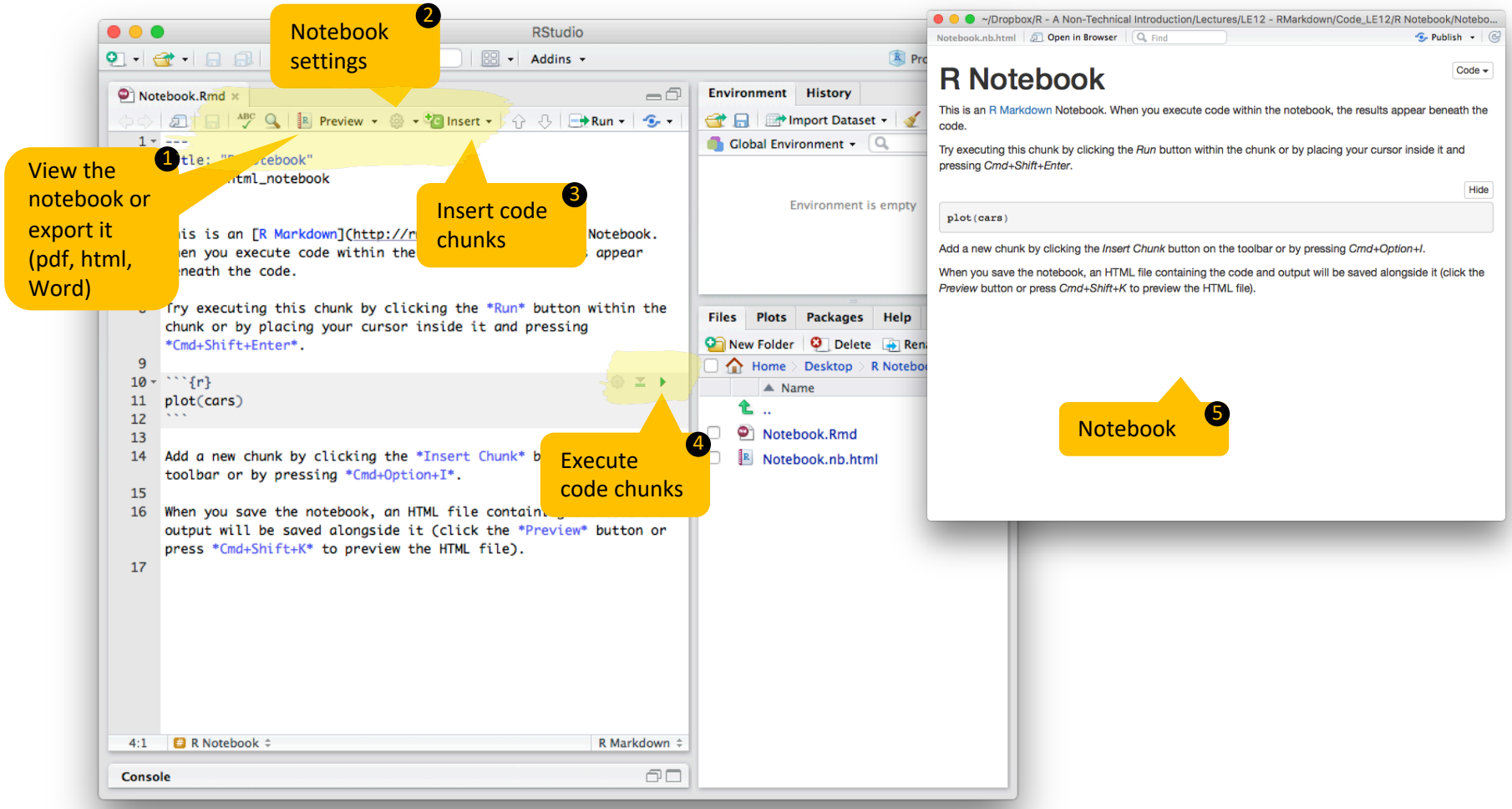
1. **Create a new R Notebook**
2. Create Content
   - Add text elements as Markdown syntax
   - Add code elements in any supported program language
   - Use LaTeX in your R Notebook

Create your first R Notebook

Click on "New" and select "R Notebook"



Main components of an R Notebook



Elements of an R Notebook

There are three types of content in an R Notebook:

- **YAML header (basic information)**

```
1  ---
2  title: "R Notebook"
3  output: html_notebook
4  ---
```

1 The YAML ("Yet another Markup Language") header is optional and surrounded by ---

- **Inline text**

```
11
12 ## R Markdown
13
14 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>.
15
```

2 Inline text helps you structuring your document

- **R code chunks**

```
18 ```{r cars}
19 summary(cars)
20 ```
```

3 Code chunks include your R calculations and are surrounded by ```