

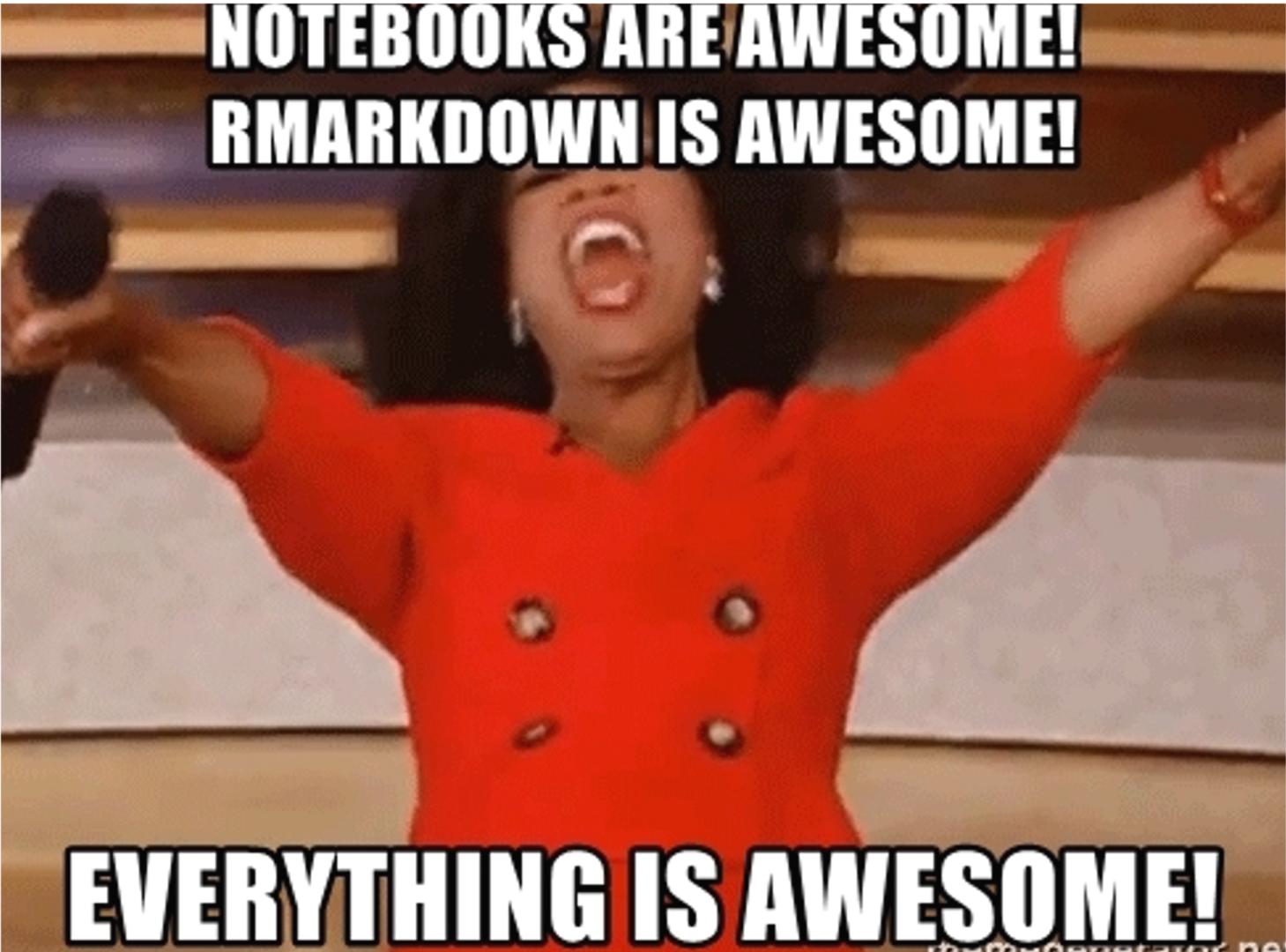
R you ready?

**IntRo to RStudio and R Markdown
for open data and reproducibility**

**Unit 6:
Code chunks in R Markdown**

Mason A. Wirtz





NOTEBOOKS ARE AWESOME!
RMarkdown IS AWESOME!

EVERYTHING IS AWESOME!

meme-generator.net

R Markdown: What is it?

Coding language that allows for text-to-HTML conversion

Easy-to-read and easy-to-write plain text format

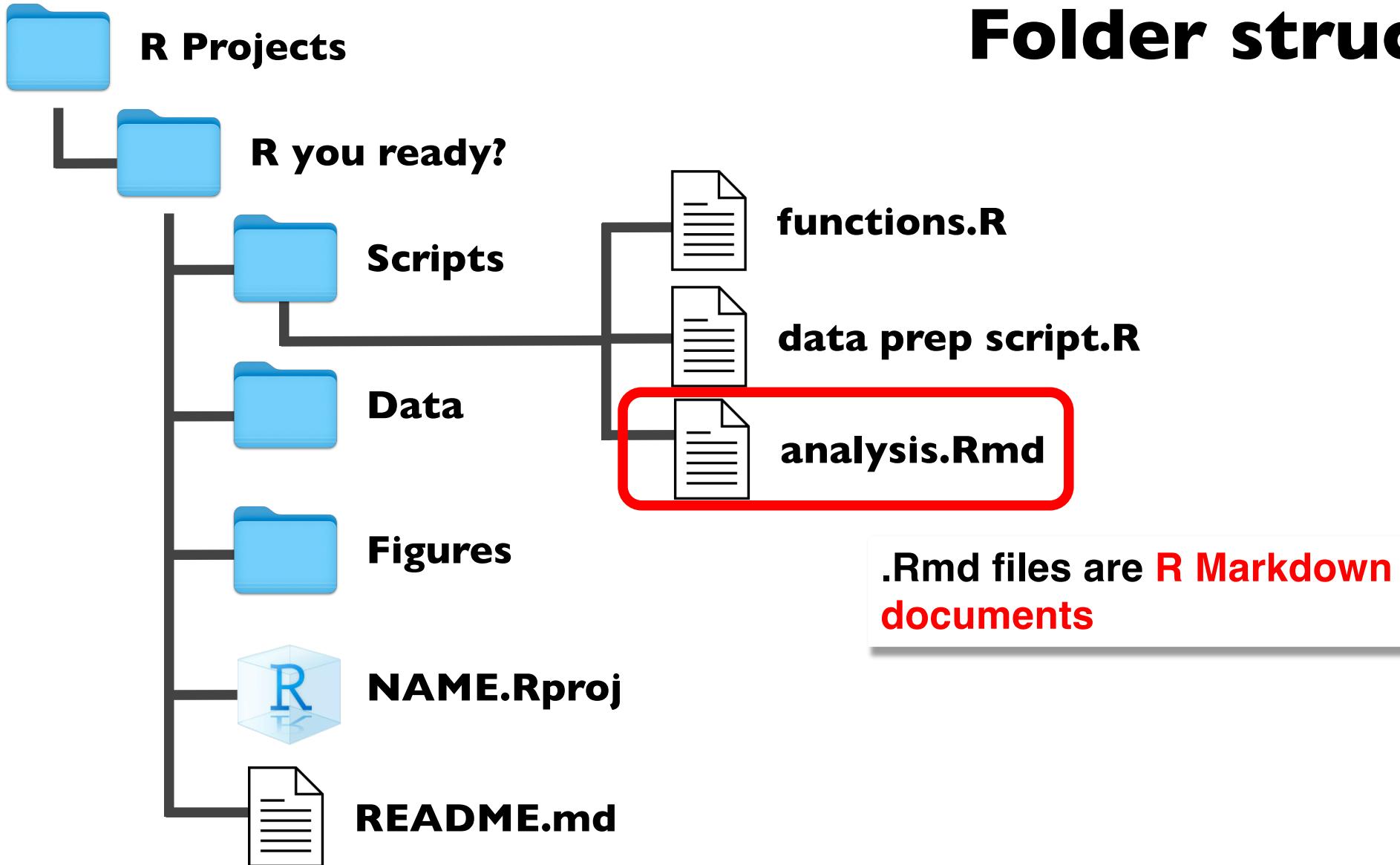
**Can create R Markdown documents (HTML, Word, PDF),
websites, Markdown books, etc.**

Websites → <https://rstudio.github.io/distill/website.html>

Books → <https://bookdown.org/yihui/bookdown/>

Documents → <https://bookdown.org/yihui/rmarkdown/>

Folder structure



```
Untitled1 x index.rmd x
Front matter
1 ---  
2 title: "Untitled"  
3 author: "Olivier Gimenez"  
4 date: "10/24/2020"  
5 output: html_document  
6 ---  
7  
8 ```{r setup, include=FALSE}  
9 knitr::opts_chunk$set(echo = TRUE)  
10```  
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  
16 When you click the **Knit** button, a chunk of the same name will be processed. You can set  
that in the chunk options.  
17  
18  
19  
20  
21  
22 ## Including Plots  
23  
24 You can also embed plots, for example:  
25  
26 ```{r pressure, echo=FALSE}  
27 plot(pressure)  
28```  
29  
30 Note that the `echo = FALSE` parameter was added to the code chunk to prevent printing  
R code that generated the plot.  
31
```

supplementary material for your publications/theses

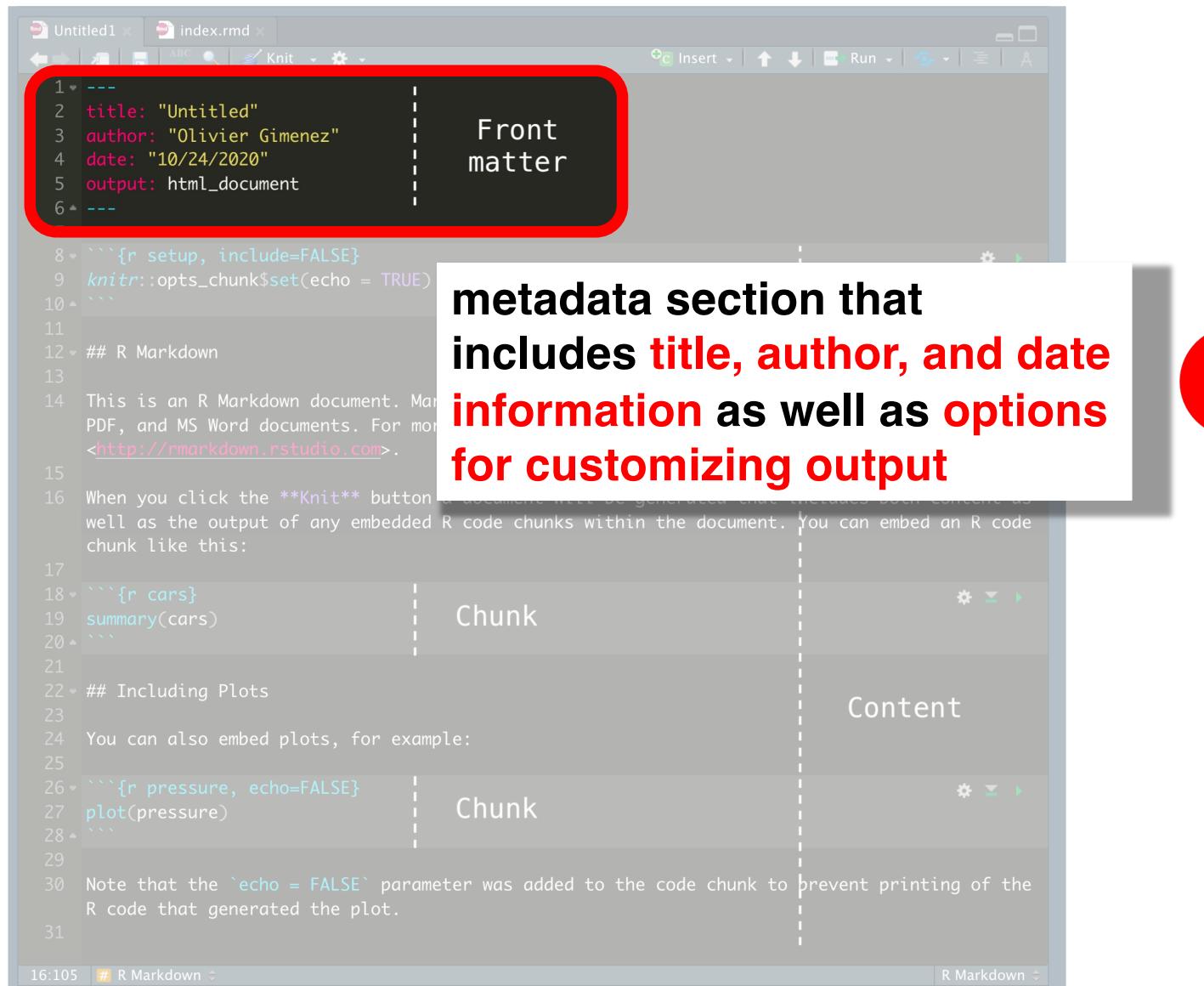
keep a thorough record of your analysis

GROUP your code into CHUNKS

RECORD what you have DONE!!!!

render the R Markdown into easy-to-read documents





The screenshot shows an RStudio interface with an R Markdown file open. The code editor displays the following content:

```
1 ---  
2 title: "Untitled"  
3 author: "Olivier Gimenez"  
4 date: "10/24/2020"  
5 output: html_document  
6 ---  
  
8 ```{r setup, include=FALSE}  
9 knitr::opts_chunk$set(echo = TRUE)  
10```  
11  
12 ## R Markdown  
13  
14 This is an R Markdown document. You can embed an R code chunk like this:  
15  
16 When you click the **Knit** button, a document will be generated that includes both content as  
well as the output of any embedded R code chunks within the document. You can embed an R code  
chunk like this:  
17  
18 ```{r cars}  
19 summary(cars)  
20```  
21  
22 ## Including Plots  
23  
24 You can also embed plots, for example:  
25  
26 ```{r pressure, echo=FALSE}  
27 plot(pressure)  
28```  
29  
30 Note that the `echo = FALSE` parameter was added to the code chunk to prevent printing of the  
R code that generated the plot.  
31
```

A red rounded rectangle highlights the first six lines of code, which define the document's metadata. A black callout bubble with a white border and a red border contains the text "Front matter". Below the code editor, a large white box with a black border contains the following text:

**metadata section that
includes title, author, and date
information as well as options
for customizing output**

A red circle with a white question mark is positioned to the right of the explanatory text.



The screenshot shows an RStudio interface with an R Markdown document titled "index.rmd". The code is organized into three main sections:

- Front matter**: Lines 1-6, containing YAML metadata.
- Chunk**: Lines 8-10, containing global settings for the R Markdown script.
- Content**: Lines 12-31, containing the main text and code chunks of the document.

A red box highlights the global settings chunk (lines 8-10). A white callout box with a red border and a question mark icon points to this area with the text: "global settings to be applied to the R Markdown script".

```
1 ---  
2 title: "Untitled"  
3 author: "Olivier Gimenez"  
4 date: "10/24/2020"  
5 output: html_document  
6 ---  
7  
8 ```{r setup, include=FALSE}  
9 knitr::opts_chunk$set(echo = TRUE)  
10```  
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  
16 When you click the **Knit** button  
well as the output of any embedded  
chunk like this:  
17  
18 ```{r cars}  
19 summary(cars)  
20```  
21  
22 ## Including Plots  
23  
24 You can also embed plots, for example:  
25  
26 ```{r pressure, echo=FALSE}  
27 plot(pressure)  
28```  
29  
30 Note that the `echo = FALSE` parameter was added to the code chunk to prevent printing of the  
R code that generated the plot.  
31
```



The screenshot shows an RStudio interface with two tabs: "Untitled1" and "index.rmd". The "index.rmd" tab is active, displaying an R Markdown document. The document is organized into three main sections separated by vertical dashed lines:

- Front matter** (lines 1-10): Includes YAML front matter and setup code for knitr.
- Content** (lines 11-31): The main body of the document, which includes R code chunks and descriptive text.
- Content** (lines 32-33): A second R code chunk.

A red oval highlights the first section (Front matter and Content). Labels "Front matter", "Content", and "Content" are placed next to their respective sections. The RStudio toolbar at the top includes icons for back/forward, search, knit, and run.

```
1 ---  
2 title: "Untitled"  
3 author: "Olivier Gimenez"  
4 date: "10/24/2020"  
5 output: html_document  
6 ---  
7  
8 ```{r setup, include=FALSE}  
9 knitr::opts_chunk$set(echo = TRUE)  
10 ```  
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  
16 When you click the **Knit** button a document will be generated that includes both content as well as the output of any embedded R code chunks within the document. You can embed an R code chunk like this:  
17  
18 ```{r cars}  
19 summary(cars)  
20 ```  
21  
22 ## Including Plots  
23  
24 You can also embed plots, for example:  
25  
26 ```{r pressure, echo=FALSE}  
27 plot(pressure)  
28 ```  
29  
30 Note that the `echo = FALSE` parameter was added to the c  
R code that generated the plot.  
31
```



Add **content** to your markdown document (e.g. descriptions, explicit info, etc.)



Untitled1 x index.rmd x

Front matter

```
1 ---  
2 title: "Untitled"  
3 author: "Olivier Gimenez"  
4 date: "10/24/2020"  
5 output: html_document  
6 ---  
7  
8 ```{r setup, include=FALSE}  
9 knitr::opts_chunk$set(echo = TRUE)  
10```  
11  
12 ## R Markdown  
13  
14 This is an R Markdown document. Markdown is a simple way to write  
PDF, and MS Word documents. For more information on Markdown, see  
http://rmarkdown.rstudio.com.  
15  
16 When you click the **Knit** button a document will be generated that includes both content as  
well as the output of any embedded R code chunks within the document. You can embed an R code  
chunk like this:
```

Chunk

```
18 ```{r cars}  
19 summary(cars)  
20```  
21  
22 ## Including Plots  
23  
24 You can also embed plots, for example:  
25  
26 ```{r pressure, echo=FALSE}  
27 plot(pressure)  
28```  
29  
30 Note that the `echo = FALSE` parameter was added to the code chunk to prevent printing of the  
R code that generated the plot.  
31
```

Content

Chunk

16:105 # R Markdown R Markdown



```
Untitled1 x index.rmd x
Front matter
1 --
2 title: "Untitled"
3 author: "Olivier Gimenez"
4 date: "10/24/2020"
5 output: html_document
6 ---
7
8 ```{r setup, include=FALSE}
9 knitr::opts_chunk$set(echo = TRUE)
10 ```
11
12 ## R Markdown
13
14 This is an R Markdown document. Markdown is a simple
15 language that you can use to write both documents and code.
16 PDF, and MS Word documents. For more information about
17 rmarkdown.rstudio.com.
18
19
20 ```{r cars}
21 summary(cars)
22
23
24 ## Including Plots
25
26 You can also embed plots, for example:
27
28 ```{r pressure, echo=FALSE}
29 plot(pressure)
30
31 Note that the `echo = FALSE` parameter was added to the code chunk to prevent printing of the
32 R code that generated the plot.
```

Add code chunks (= sections of code that are run in the final document) to your markdown document



Chunk

Content

echo = FALSE, only include OUTPUT

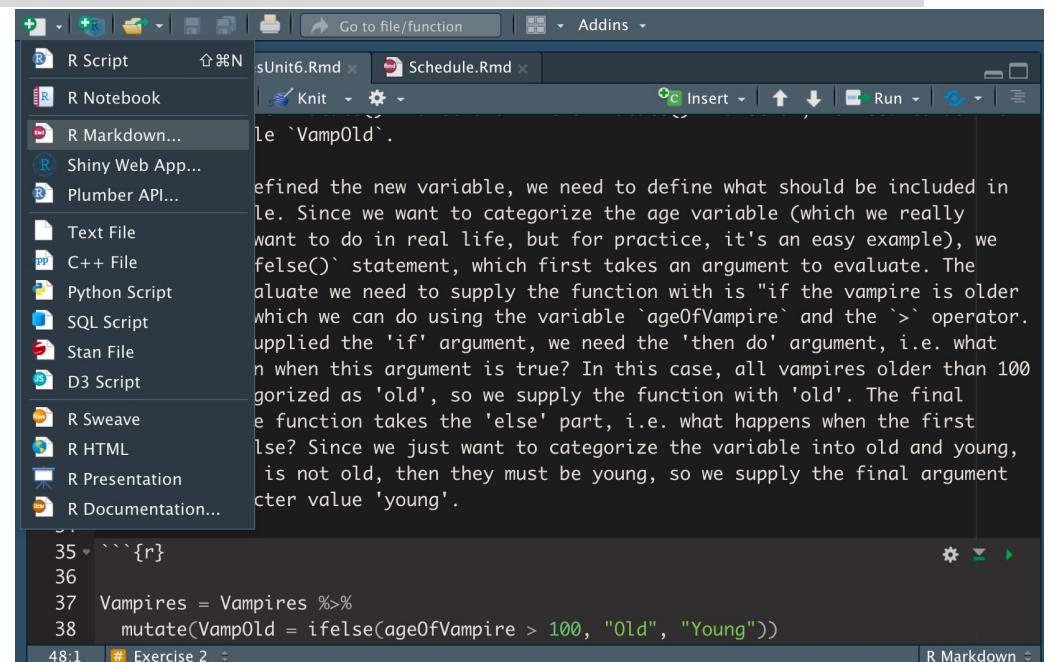


Install R Markdown

Everyone, go ahead and type in the following code:

```
> install.packages("rmarkdown")
```

OR
open an R Markdown document → this should automatically install the package



The screenshot shows the RStudio environment with the following details:

- File Menu:** R Script, R Notebook, R Markdown..., Shiny Web App..., Plumber API..., Text File, C++ File, Python Script, SQL Script, Stan File, D3 Script, R Sweave, R HTML, R Presentation, R Documentation..
- Document Tab:** SUnit6.Rmd x, Schedule.Rmd x
- Toolbar:** Go to file/function, Addins, Knit, Insert, Run, etc.
- Code Editor:** The code editor contains R code and explanatory text. The explanatory text discusses defining a new variable `VampOld` and using an `ifelse` statement to categorize vampires based on age. It mentions using the `>` operator to evaluate the condition and the `then do` argument to define the value for old vampires. It also notes the use of the `else` part for vampires not categorized as old.
- Console:** The console shows the following R code:

```
35: ````{r}
36
37 Vampires = Vampires %>%
38   mutate(VampOld = ifelse(ageOfVampire > 100, "Old", "Young"))
```
- Status Bar:** 48:1 # Exercise 2 R Markdown

The screenshot shows an RStudio interface with several tabs at the top: _site.yml, ExercisesUnit6.Rmd, Schedule.Rmd, and Untitled1. The Untitled1 tab is active, displaying an R Markdown document. The code consists of the following:

```
1 ---  
2 | title: "Untitled"  
3 | author: "Mason A. Wirtz"  
4 | date: "2/22/2022"  
5 | output: html_document  
6 ---  
7  
8 ``{r setup, include=FALSE}  
9 knitr::opts_chunk$set(echo = TRUE)  
10 ``  
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  
16 When you click the **Knit** button a document will be generated that includes the output of any embedded R code chunks within the document. You can also embed plots, for example:  
17  
18 ``{r cars}  
19 summary(cars)  
20 ``  
21  
22 ## Including Plots  
23  
24 You can also embed plots, for example:  
25  
26 ``{r pressure, echo=FALSE}  
27 plot(pressure)  
28 ``  
29  
30 Note that the `echo = FALSE` parameter was added to the code chunk to prevent printing of the R code that generated the plot.  
31
```

Red arrows point from the explanatory text in lines 14-16 and line 24 to the corresponding code chunks in lines 18 and 26.

Headings: Organize your document according to chapters

Code chunks: organize your code in chunks (1 topic/analysis → 1 code chunk)

Code chunks: only plot the output

```
example.Rmd x
ABC 🔎 Knit HTML ⚙️ ↗ ↘
1 # Header 1
2
3 This is an R Markdown document. Markdown is a
4 simple formatting syntax for authoring webpages.
5 Use an asterisk mark to provide emphasis, such
6 as *italics* or **bold**.
7 Create lists with a dash:
8
9 - Item 1
10 - Item 2
11 - Item 3
12
13 ``
14 Use back ticks to
15 create a block of code
16 ``
17
18 Embed LaTeX or MathML equations,
19 $\frac{1}{n} \sum_{i=1}^n x_i$
```

20 Or even footnotes, citations, and a
bibliography. [^1]

21 [^1]: Markdown is great.

~/Desktop/example.html

example.html | Open in Browser | Find

Header 1

This is an R Markdown document. Markdown is a simple formatting syntax for authoring web pages.

Use an asterisk mark to provide emphasis, such as *italics* or **bold**.

Create lists with a dash:

- Item 1
- Item 2
- Item 3

Use back ticks to
create a block of code

Embed LaTeX or MathML equations, $\frac{1}{n} \sum_{i=1}^n x_i$

Or even footnotes, citations, and a bibliography.¹

1. Markdown is great. ↫

https://rmarkdown.rstudio.com/authors_quick_tour.html#Markdown_Basics

The screenshot shows the RStudio interface with two panes. The left pane displays the R Markdown source code, and the right pane shows the generated HTML output. A red box highlights the first two sections of the R Markdown code, which correspond to the first two sections of the rendered HTML.

example.Rmd

```
1 # Header 1
2
3 This is an R Markdown document. Markdown is a
4 simple formatting syntax for authoring webpages.
5
6 Use an asterisk mark to provide emphasis, such
7 as *italics* or **bold**.
8
9 - Item 1
10 - Item 2
11 - Item 3
12
13 ``
14 Use back ticks to
15 create a block of code
16 ``
17
18 Embed LaTex or MathML equations,
19 $\frac{1}{n} \sum_{i=1}^n x_i$ 
20
21 Or even footnotes, citations, and a
22 bibliography. [^1]
23
24 [^1]: Markdown is great.
```

example.html

Header 1

This is an R Markdown document. Markdown is a simple formatting syntax for authoring web pages.

Use an asterisk mark to provide emphasis, such as *italics* or **bold**.

Create lists with a dash:

- Item 1
- Item 2
- Item 3

Use back ticks to create a block of code

Embed LaTex or MathML equations, $\frac{1}{n} \sum_{i=1}^n x_i$

Or even footnotes, citations, and a bibliography.¹

1. Markdown is great. ↵

Block-level elements

First-level

Second-level

Third-level

Inline formatting

italics

bold

https://rmarkdown.rstudio.com/authors_quick_tour.html#Markdown_Basics

The screenshot shows the RStudio interface with two panes. The left pane displays the R Markdown file 'example.Rmd' with the following content:

```

1 # Header 1
2
3 This is an R Markdown document. Markdown is a
4 simple formatting syntax for authoring webpages.
5 Use an asterisk mark to provide emphasis, such
6 as *italics* or **bold**.
7
8 Create lists with a dash:
9
10 - Item 1
11 - Item 2
12 - Item 3
13
14 Use back ticks to
15 create a block of code
16
17
18 Embed LaTex or MathML equations,
19 $\frac{1}{n} \sum_{i=1}^n x_i$  

20
21 Or even footnotes, citations, and a
22 bibliography. [^1]
23
24 [^1]: Markdown is great.

```

The right pane shows the generated HTML file 'example.html' with the following content:

Header 1

This is an R Markdown document. Markdown is a simple formatting syntax for authoring web pages.

Use an asterisk mark to provide emphasis, such as ***italics*** or ***bold***.

Create lists with a dash:

- Item 1
- Item 2
- Item 3

Use back ticks to create a block of code

Embed LaTex or MathML equations, $\frac{1}{n} \sum_{i=1}^n x_i$

Or even footnotes, citations, and a bibliography.¹

1. Markdown is great. ↵

Unordered lists

- **Item 1**
- **Item 2**
- **Item 3**
 - **Item 3.1**
 - **Item 3.2**

Ordered lists

1. **Item 1**
2. **Item 2**
3. **Item 3**

https://rmarkdown.rstudio.com/authors_quick_tour.html#Markdown_Basics

chunks.Rmd x

ABC Knit HTML Chunks

1 R Code Chunks

2 =====

3

4 With R Markdown, you can insert R code

5 chunks including plots:

6 ````{r qplot, fig.width=4, fig.height=3,`

7 `message=FALSE}`

8 `# quick summary and plot`

9 `library(ggplot2)`

10 `summary(cars)`

11 `qplot(speed, dist, data=cars) +`

12 `geom_smooth()`

13 `...`

RStudio: Preview HTML

Preview: ~/chunks.html | Save As | Publish

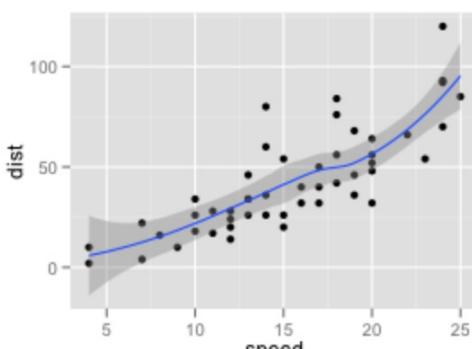
R Code Chunks

With R Markdown, you can insert R code chunks including plots:

```
# quick summary and plot
library(ggplot2)
summary(cars)
```

```
##      speed          dist
## Min.   : 4.0   Min.   : 2
## 1st Qu.:12.0   1st Qu.: 26
## Median :15.0   Median : 36
## Mean   :15.4   Mean   : 43
## 3rd Qu.:19.0   3rd Qu.: 56
## Max.   :25.0   Max.   :120
```

```
qplot(speed, dist, data = cars) + geom_smooth()
```



https://rmarkdown.rstudio.com/authoring_quick_tour.html#Markdown_Basics

chunks.Rmd x

ABC Knit HTML Chunks

```

1 R Code Chunks
2 -----
3
4 With R Markdown, you can insert R code
5 chunks including plots:
6
7 ````{r qplot, fig.width=4, fig.height=3,
8   message=FALSE}
9
10 library(ggplot2)
11 summary(cars)
12 qplot(speed, dist, data=cars) +
13   geom_smooth()
14
15 ````
```

R Code Chunks

With R Markdown, you can insert R code chunks including plots:

```
# quick summary and plot
library(ggplot2)
summary(cars)
```

	speed	dist
## Min. :	4.0	Min. : 2
## 1st Qu.:	12.0	1st Qu.: 26
## Median :	15.0	Median : 36
## Mean :	15.4	Mean : 43
## 3rd Qu.:	19.0	3rd Qu.: 56
## Max. :	25.0	Max. :120

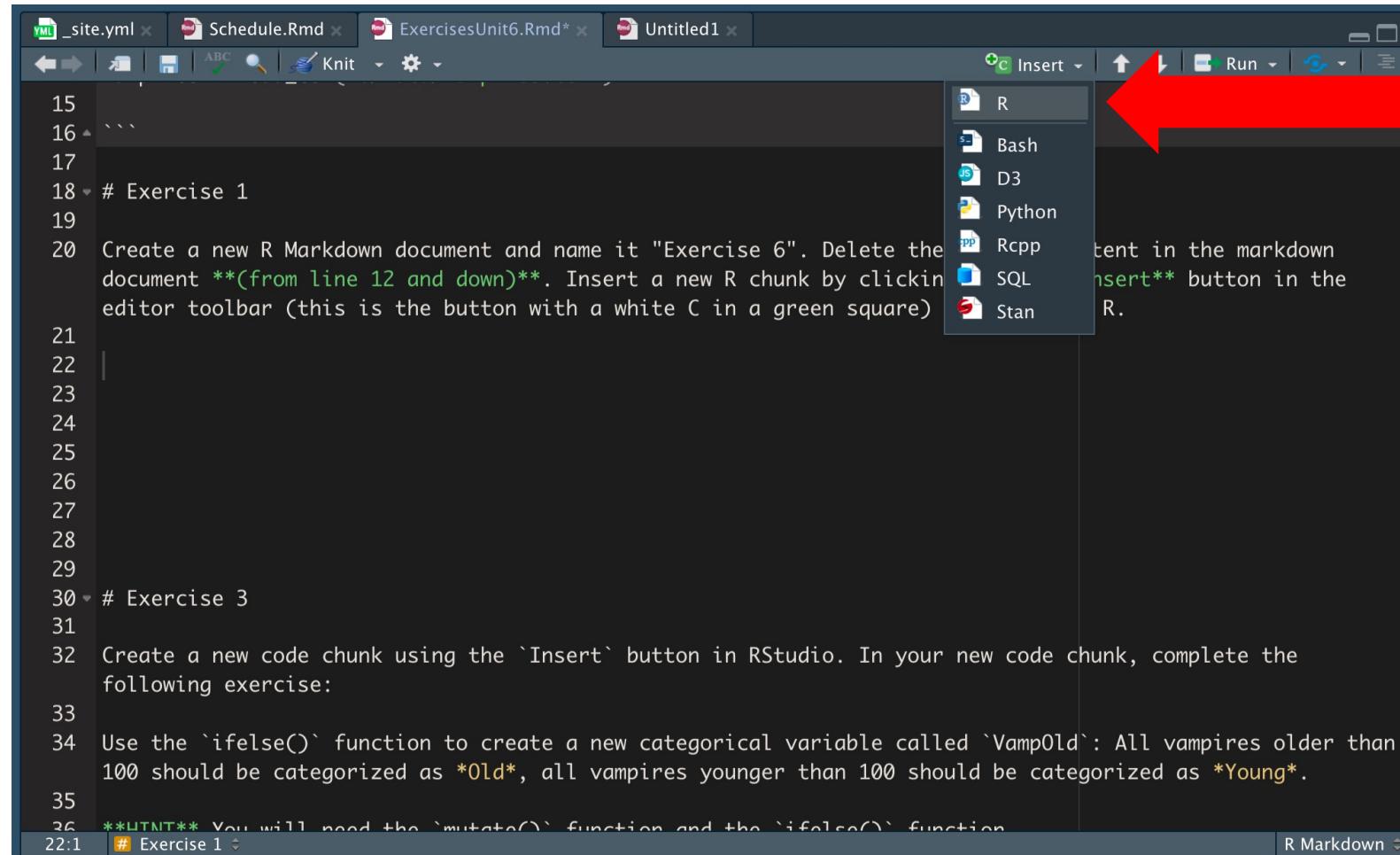
```
qplot(speed, dist, data = cars) + geom_smooth()
```

Chunk options

- **eval**: whether to evaluate code chunk
- **echo**: whether to echo source code
- **include**: whether to include a code chunk
- **fig.width / fig.height**: output size of plots in output document
- **out.width / out.height**: output size of plots in output document, using scaling (e.g. `out.width = 80%`)
- See (<https://bookdown.org/yihui/rmarkdown/r-code.html>) for more options

https://rmarkdown.rstudio.com/authors_quick_tour.html#Markdown_Basics

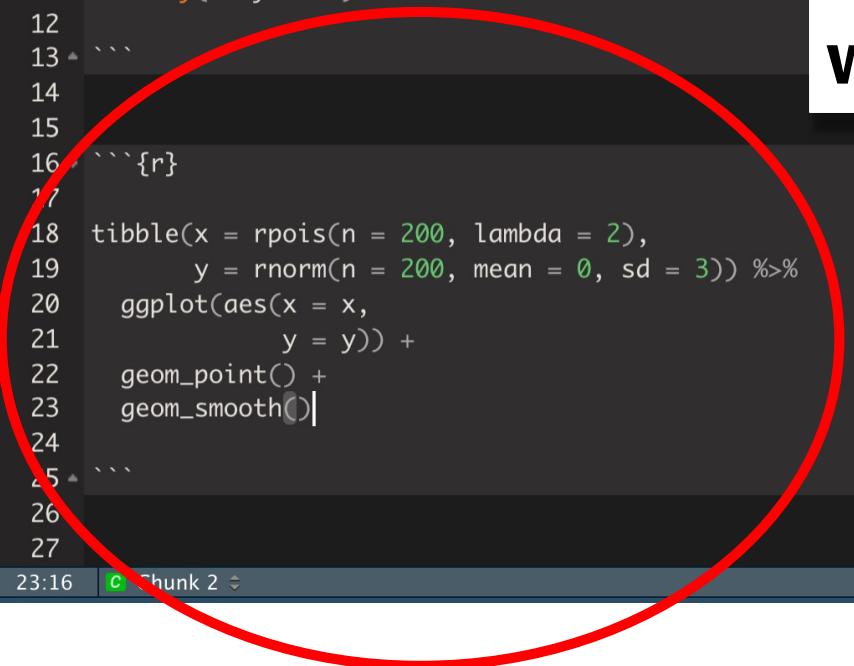
Working with chunks



A screenshot of the RStudio interface. The top menu bar shows tabs for '_site.yml', 'Schedule.Rmd', 'ExercisesUnit6.Rmd*', and 'Untitled1'. The main editor area contains R code with comments explaining exercises. A context menu is open over the code at line 15, with 'Insert' selected. A red arrow points from the text 'Insert a new R chunk by clicking' to the 'Insert' button in the menu. The menu also includes options for Bash, D3, Python, Rcpp, SQL, and Stan.

```
15
16 ```
17
18 # Exercise 1
19
20 Create a new R Markdown document and name it "Exercise 6". Delete the
document **(from line 12 and down)**. Insert a new R chunk by clickin
editor toolbar (this is the button with a white C in a green square)
21
22
23
24
25
26
27
28
29
30 # Exercise 3
31
32 Create a new code chunk using the `Insert` button in RStudio. In your new code chunk, complete the
following exercise:
33
34 Use the `ifelse()` function to create a new categorical variable called `VampOld`: All vampires older than
100 should be categorized as *Old*, all vampires younger than 100 should be categorized as *Young*.
35
36 **LTTNT** You will need the `mutate()` function and the `ifelse()` function
22:1 # Exercise 1 R Markdown
```

Create a new R code chunk

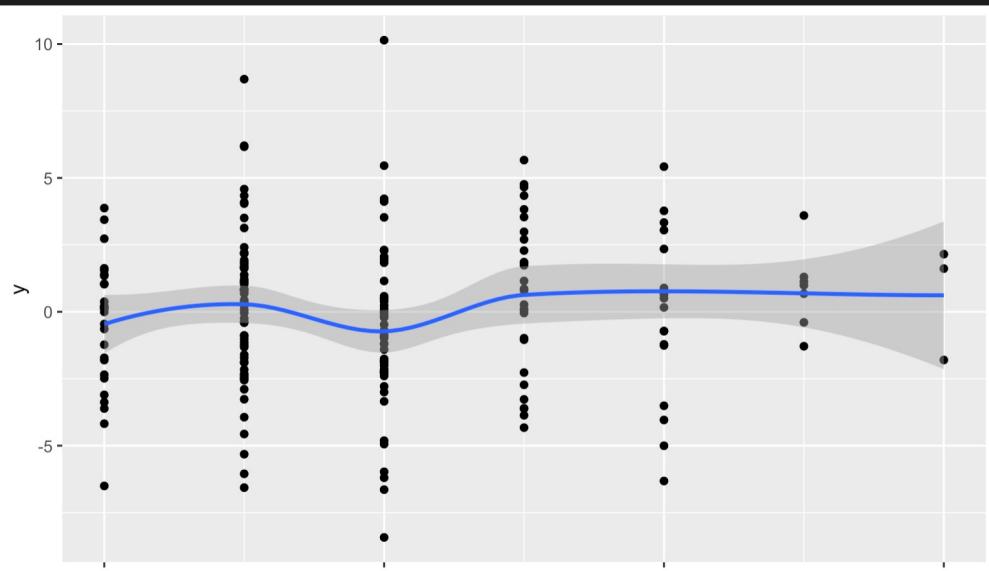


We have a code now, but how do we run it?

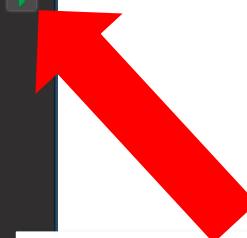
```
2 title: "Untitled"
3 author: "Mason A. Wirtz"
4 date: "2/22/2022"
5 output: html_document
6 ---
7
8 ```{r setup, include=FALSE}
9 knitr::opts_chunk$set(echo = TRUE)
10
11 library(tidyverse)
12
13 ```
14
15
16 ```{r}
17
18 tibble(x = rpois(n = 200, lambda = 2),
19        y = rnorm(n = 200, mean = 0, sd = 3)) %>%
20        ggplot(aes(x = x,
21                    y = y)) +
22        geom_point() +
23        geom_smooth()
```

```
14  
15  
16 ````{r}  
17  
18 tibble(x = rpois(n = 200, lambda = 2),  
19     y = rnorm(n = 200, mean = 0, sd = 3)) %>%  
20 ggplot(aes(x = x,  
21             y = y)) +  
22 geom_point() +  
23 geom_smooth()  
24  
25 ````
```

```geom\_smooth()` using method = 'loess' and formula 'y ~ x'



23:17 C Chunk 2 R Markdown



**We can run each individual code the same way as in an .R document, OR run the WHOLE code chunk**

# R Markdown: A few tips

- Don't put all your R codes into one big R chunk
- Split up your R codes into well-defined small chunks (with names, if possible)
- The code in the .Rmd file must be 'self-contained' (i.e. you can't use datasets imported 'outside' the .Rmd file → include all commands for data import in .Rmd file)
- Use R Markdown for its strengths: Detail your analyses so that YOU and OTHERS understand your thought/analysis process

**LET'S GET OUR HANDS DIRTY**



[makeameme.org](http://makeameme.org)