

# Introduction to R Markdown

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*Or how to boost reproducibility in  
your research projects*

[bit.ly/2SxJFIV](https://bit.ly/2SxJFIV)

# What

“ An R Markdown (.Rmd) file is a record of your research. It contains the **code** that a scientist needs to reproduce your work along with the **narration** that a reader needs to understand your work. “

# Why

- Efficiency
- Reproducibility
- Interactivity
- Automation
- Notebook

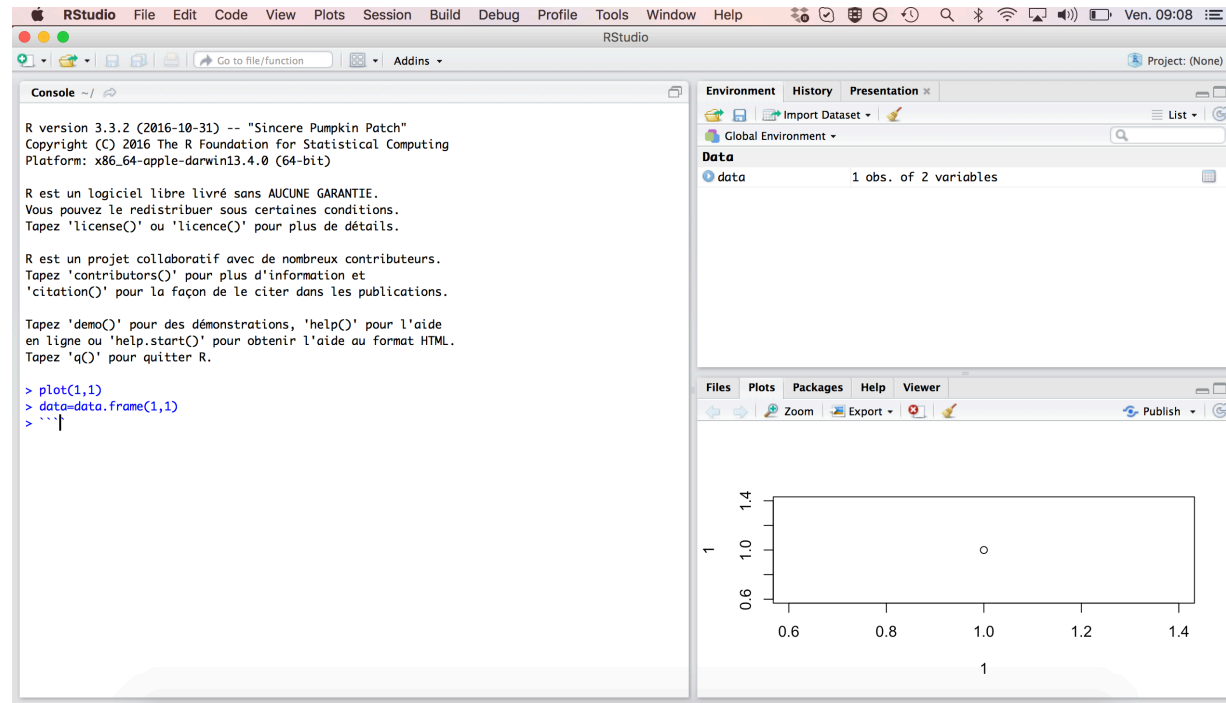
*And much more..*

# Most Basic Document

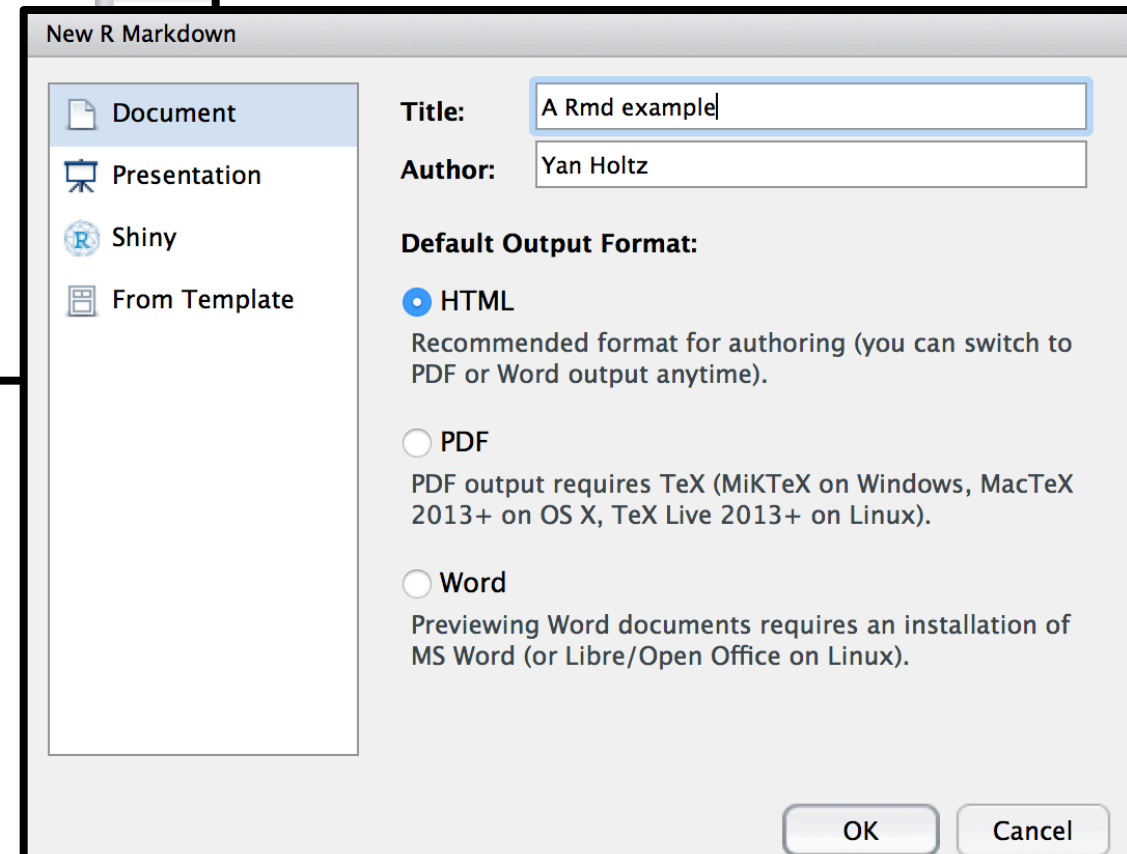
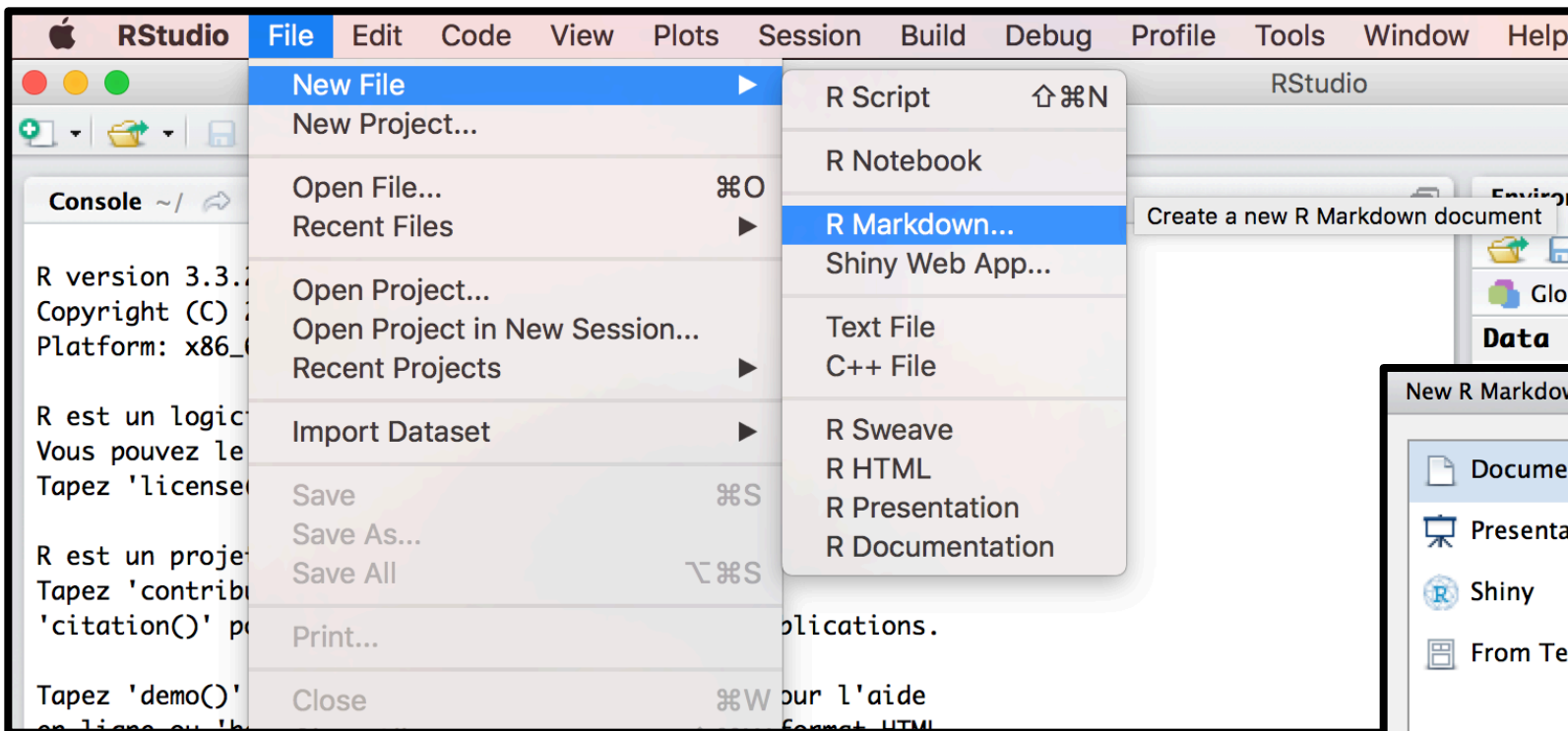
---

# 1 - Open R studio:

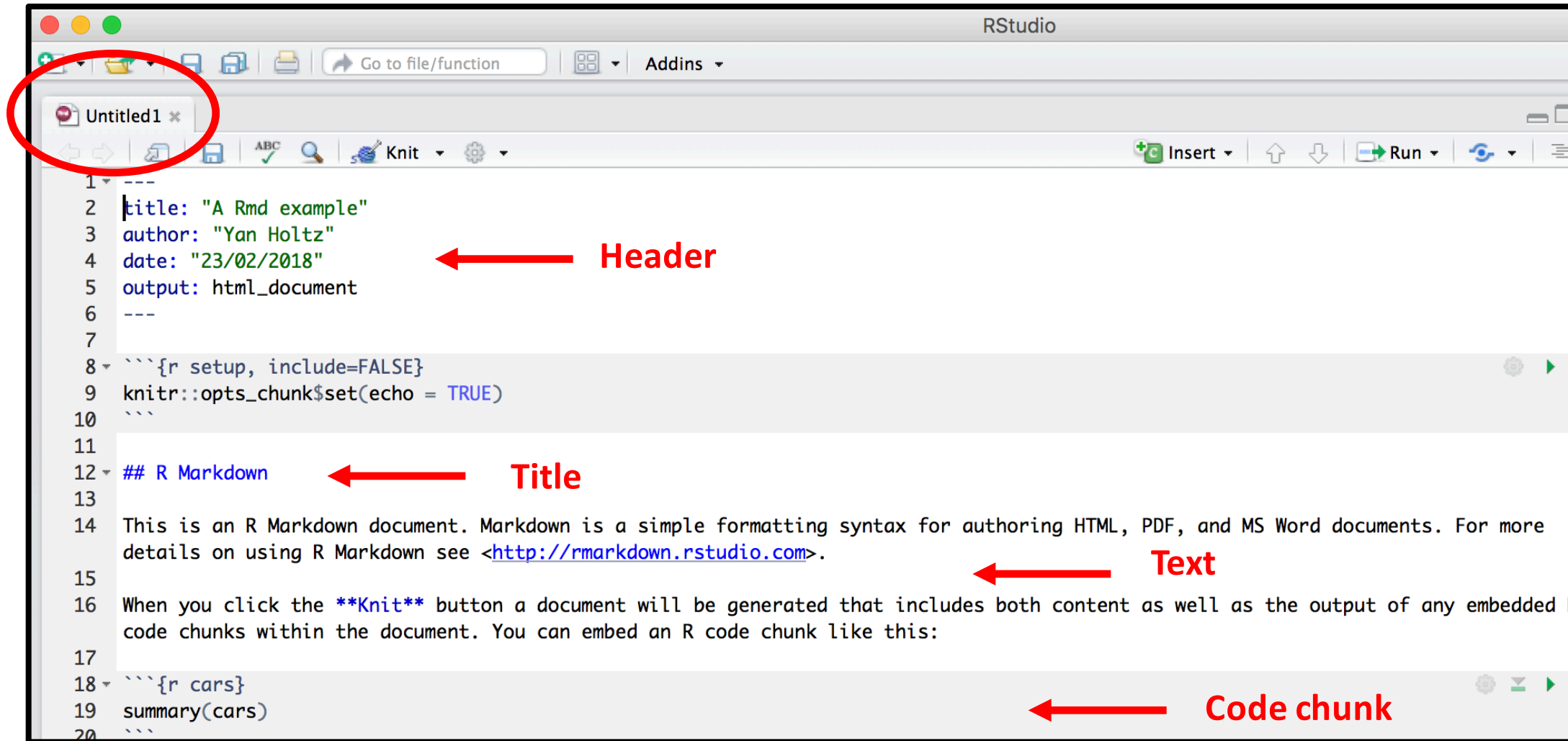
- User Friendly environment
- Auto completion
- Run a line of code with Cmd + Enter



## 2 - Open a .Rmd file:



# Anatomy of a .Rmd file:



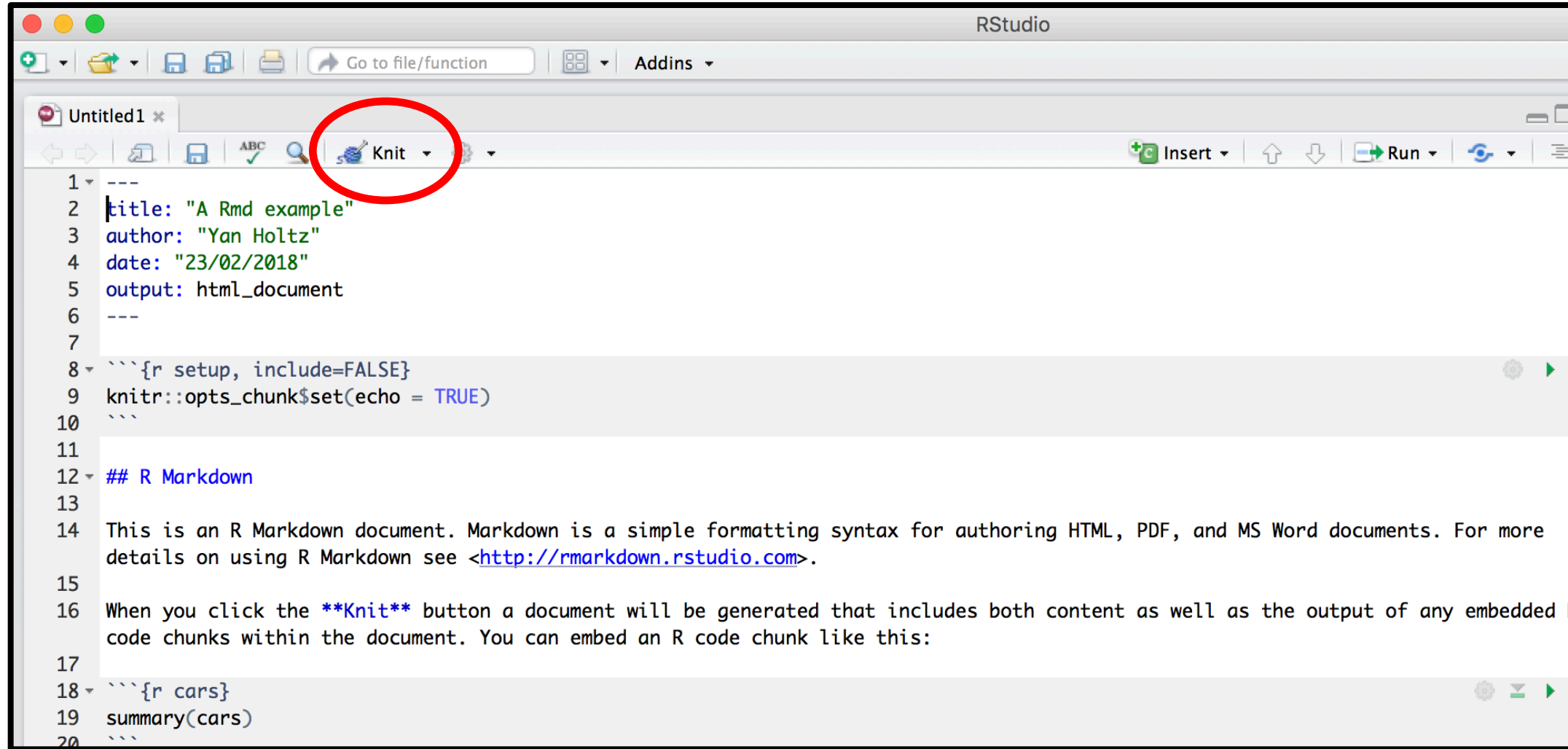
The screenshot shows the RStudio interface with an R Markdown file named 'Untitled1'. The file content is as follows:

```
1 ---
2 title: "A Rmd example"
3 author: "Yan Holtz"
4 date: "23/02/2018"
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
15 details on using R Markdown see <http://rmarkdown.rstudio.com>.
16
17 When you click the Knit button a document will be generated that includes both content as well as the output of any embedded
18 code chunks within the document. You can embed an R code chunk like this:
19
20 ```{r cars}
21 summary(cars)
22 ```
```

Annotations in the image:

- A red circle highlights the top toolbar area.
- A red arrow points to the header section (lines 2-5) with the label **Header**.
- A red arrow points to the title line (line 12) with the label **Title**.
- A red arrow points to the text paragraph (lines 14-16) with the label **Text**.
- A red arrow points to the code chunk (lines 18-22) with the label **Code chunk**.

# 3 - Knit the .Rmd file:

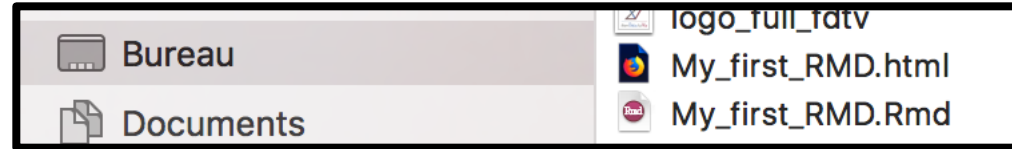


The screenshot shows the RStudio interface with a file named 'Untitled1' open. The 'Knit' button, represented by a blue document icon with a pencil, is circled in red in the top toolbar. The editor window contains the following R Markdown code:

```
1 ---
2 title: "A Rmd example"
3 author: "Yan Holtz"
4 date: "23/02/2018"
5 output: html_document
6 ---
7
8 ```{r setup, include=FALSE}
9 knitr::opts_chunk$set(echo = TRUE)
10 ```
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12 ## R Markdown
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14 This is an R Markdown document. Markdown is a simple formatting syntax for authoring HTML, PDF, and MS Word documents. For more
15 details on using R Markdown see <http://rmarkdown.rstudio.com>.
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17 When you click the **Knit** button a document will be generated that includes both content as well as the output of any embedded
18 code chunks within the document. You can embed an R code chunk like this:
19
20 ```{r cars}
21 summary(cars)
22 ```
```

# 4 - .HTML output is ready

- Have a look to your current directory
- Open the .html in a browser



.html

.rmd

## A Rmd example

*Yan Holtz*

23/02/2018

header

### R Markdown

Title

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>.

Text

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:

```
summary(cars)
```

Code

```
##      speed      dist
##  Min.   : 4.0    Min.   : 2.00
## 1st Qu.:12.0    1st Qu.: 26.00
##  Median :15.0    Median : 36.00
##   Mean  :15.4    Mean   : 42.98
## 3rd Qu.:19.0    3rd Qu.: 56.00
##   Max.  :25.0    Max.   :120.00
```

Code  
result

### Including Plots

You can also embed plots, for example:





Customize text

---

# Customize the text


## R Markdown cheat sheet

[bit.ly/1SuNTo9](https://bit.ly/1SuNTo9)

### syntax

Plain text  
End a line with two spaces to start a new paragraph.  
*\*italics\** and `_italics_`  
**\*\*bold\*\*** and `__bold__`  
superscript<sup>^2^</sup>  
~~~~strikethrough~~~~  
[\[link\]\(www.rstudio.com\)](#)

# Header 1  
## Header 2  
### Header 3  
#### Header 4  
##### Header 5  
##### Header 6

endash: --  
emdash: ---  
ellipsis: ...  
inline equation:  $A = \pi * r^2$   
image:   
horizontal rule (or slide break):  
\*\*\*  
> block quote


\* unordered list  
\* item 2  
+ sub-item 1  
+ sub-item 2

1. ordered list  
2. item 2  
+ sub-item 1  
+ sub-item 2

### becomes

Plain text  
End a line with two spaces to start a new paragraph.  
*italics* and *italics*  
**bold** and **bold**  
superscript<sup>2</sup>  
~~strikethrough~~  
[link](#)

Header 1  
Header 2  
Header 3  
Header 4  
Header 5  
Header 6

endash: –  
emdash: —  
ellipsis: ...  
inline equation:  $A = \pi * r^2$   
image:   
horizontal rule (or slide break):

block quote

• unordered list  
• item 2  
◦ sub-item 1  
◦ sub-item 2

1. ordered list  
2. item 2  
◦ sub-item 1  
◦ sub-item 2

## Code chunks option

---

# Anatomy of a Code chunk:

R, bash,  
python?

Optional:  
chunk name

Chunk  
options

Run all  
previous  
chunks

Run this  
chunk

```
17
18 ```{r cars, eval=TRUE, warning=FALSE}
19 # Load a library
20 library(tidyverse)
21
22 # make a plot
23 mtcars %>%
24   ggplot( aes(x=mpg, y=disp)) +
25   geom_point()
26 ```
```

Comment your code



# Code chunk options:

| option                  | default  | effect                                                    |
|-------------------------|----------|-----------------------------------------------------------|
| <code>eval</code>       | TRUE     | Whether to evaluate the code and include its results      |
| <code>echo</code>       | TRUE     | Whether to display code along with its results            |
| <code>warning</code>    | TRUE     | Whether to display warnings                               |
| <code>error</code>      | FALSE    | Whether to display errors                                 |
| <code>message</code>    | TRUE     | Whether to display messages                               |
| <code>tidy</code>       | FALSE    | Whether to reformat code in a tidy way when displaying it |
| <code>results</code>    | "markup" | "markup", "asis", "hold", or "hide"                       |
| <code>cache</code>      | FALSE    | Whether to cache results for future renders               |
| <code>comment</code>    | "###"    | Comment character to preface results with                 |
| <code>fig.width</code>  | 7        | Width in inches for plots created in chunk                |
| <code>fig.height</code> | 7        | Height in inches for plots created in chunk               |

Do not always run the whole document

→ R Markdown document is a Notebook !!

Header

---

# Anatomy of the header:

```
---  
title: "A Rmd example"  
author: "Yan Holtz"  
date: "23/02/2018"  
output:  
  html_document:  
    toc: TRUE  
    code_folding: "hide"  
    number_sections: TRUE  
---
```

## A Rmd example

*Yan Holtz*

*23/02/2018*

- 1 R Markdown
  - 1.1 Sub1
  - 1.2 Sub2
- 2 Including Plots

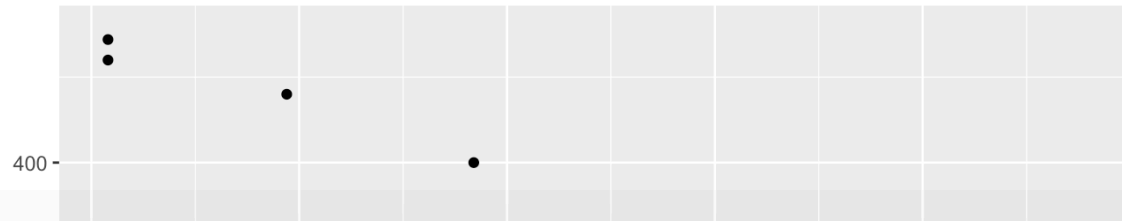
## 1 R Markdown

### 1.1 Sub1

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>.

### 1.2 Sub2

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:



Code ▾

Code



Going further

---

# Insert a table: the DT library

```
```{r}
library(DT)
datatable(mtcars, rownames = FALSE, filter="top", options = list(pageLength = 5, scrollX=T) )
```
```

Data  
frame

Show  entries Search:

| mpg                  | cyl                  | disp                 | hp                   | drat                 | wt                   | qsec                 | vs                   | am                   | gear                 |
|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|
| <input type="text"/> | <input type="text"/> | <input type="text"/> | <input type="text"/> | <input type="text"/> | <input type="text"/> | <input type="text"/> | <input type="text"/> | <input type="text"/> | <input type="text"/> |
| 6                    | 160                  | 110                  | 3.9                  | 2.875                | 2.751                |                      | 1                    | 4                    | 4                    |
| 6                    | 258                  | 110                  | 3.08                 | 3.215                | 5.424                |                      | 0                    | 3                    | 1                    |
| 8                    | 360                  | 175                  | 3.15                 | 3.44                 | 17.02                | 0                    | 0                    | 3                    | 2                    |
| 6                    | 225                  | 105                  | 2.76                 | 3.46                 | 20.22                | 1                    | 0                    | 3                    | 1                    |
| 8                    | 360                  | 245                  | 3.21                 | 3.57                 | 15.84                | 0                    | 0                    | 3                    | 4                    |

Showing 1 to 5 of 23 entries (filtered from 32 total entries) Previous 1 2 3 4 5 Next

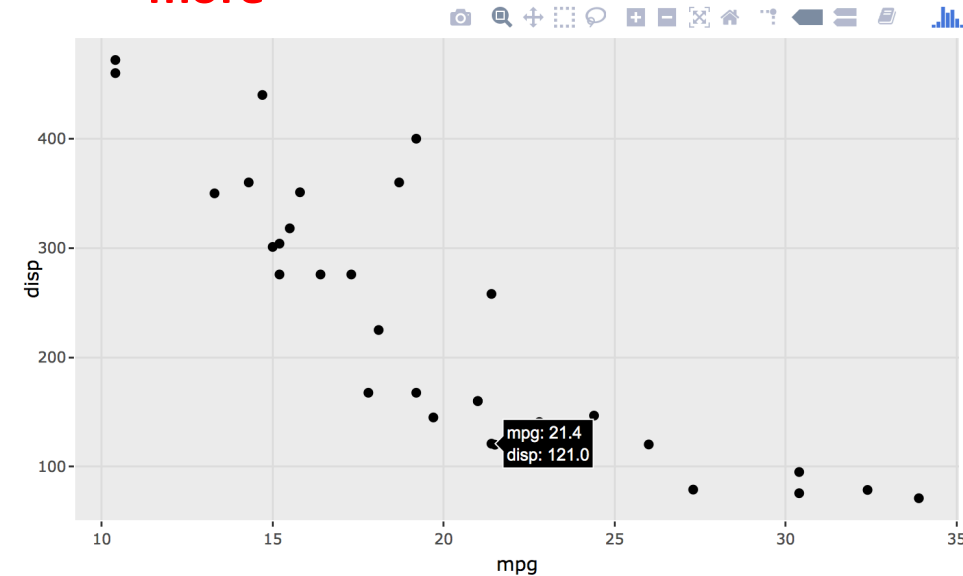
# Use Interactive charts

```
```{r, warning=FALSE, message=FALSE}
# Load a library
library(ggplot2)
library(plotly) ← Plotly library

# make a static plot with ggplot2
p <- mtcars %>%
  ggplot(aes(x=mpg, y=disp)) +
  geom_point() ← Basic ggplot2 graphic

# turn it interactive with plotly
ggplotly(p) ← Ggplotly turn the plot interactive
```
```

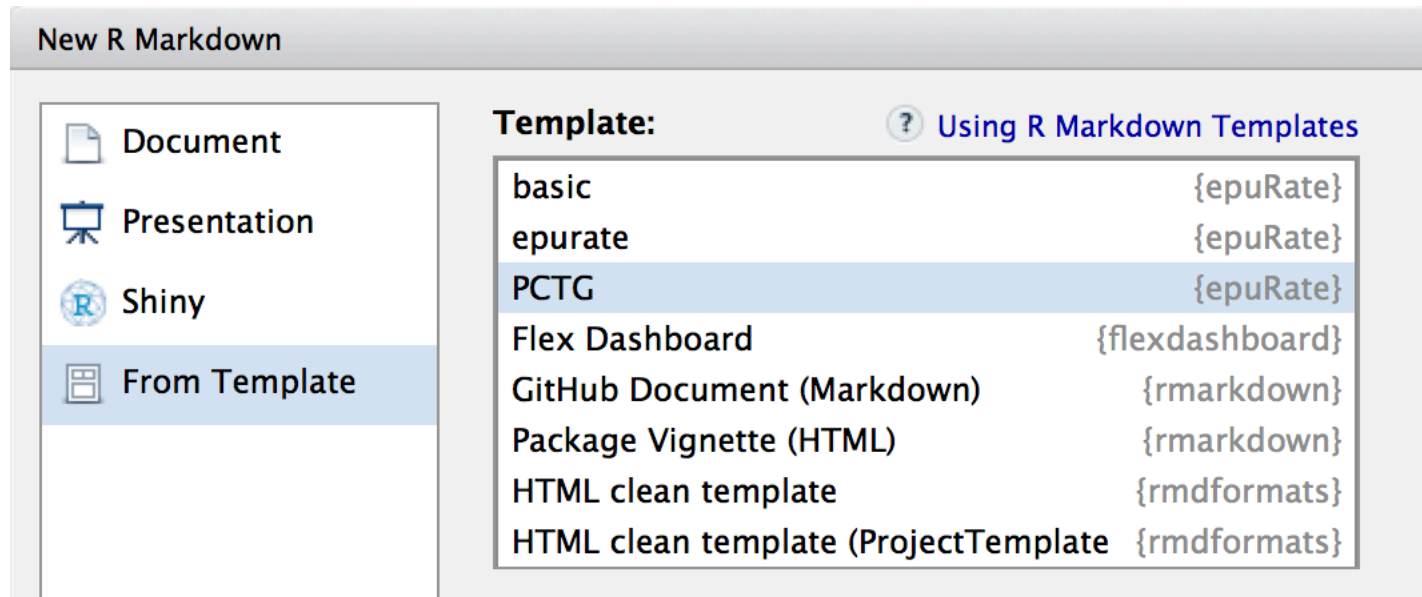
**Result: zoom / hover / export .. And more**



# Use a template

- The PCTG template: [www.github.com/holtzy/epuRate](https://www.github.com/holtzy/epuRate)

```
library(devtools)
install_github("holtzy/epuRate")
library(epuRate)
```

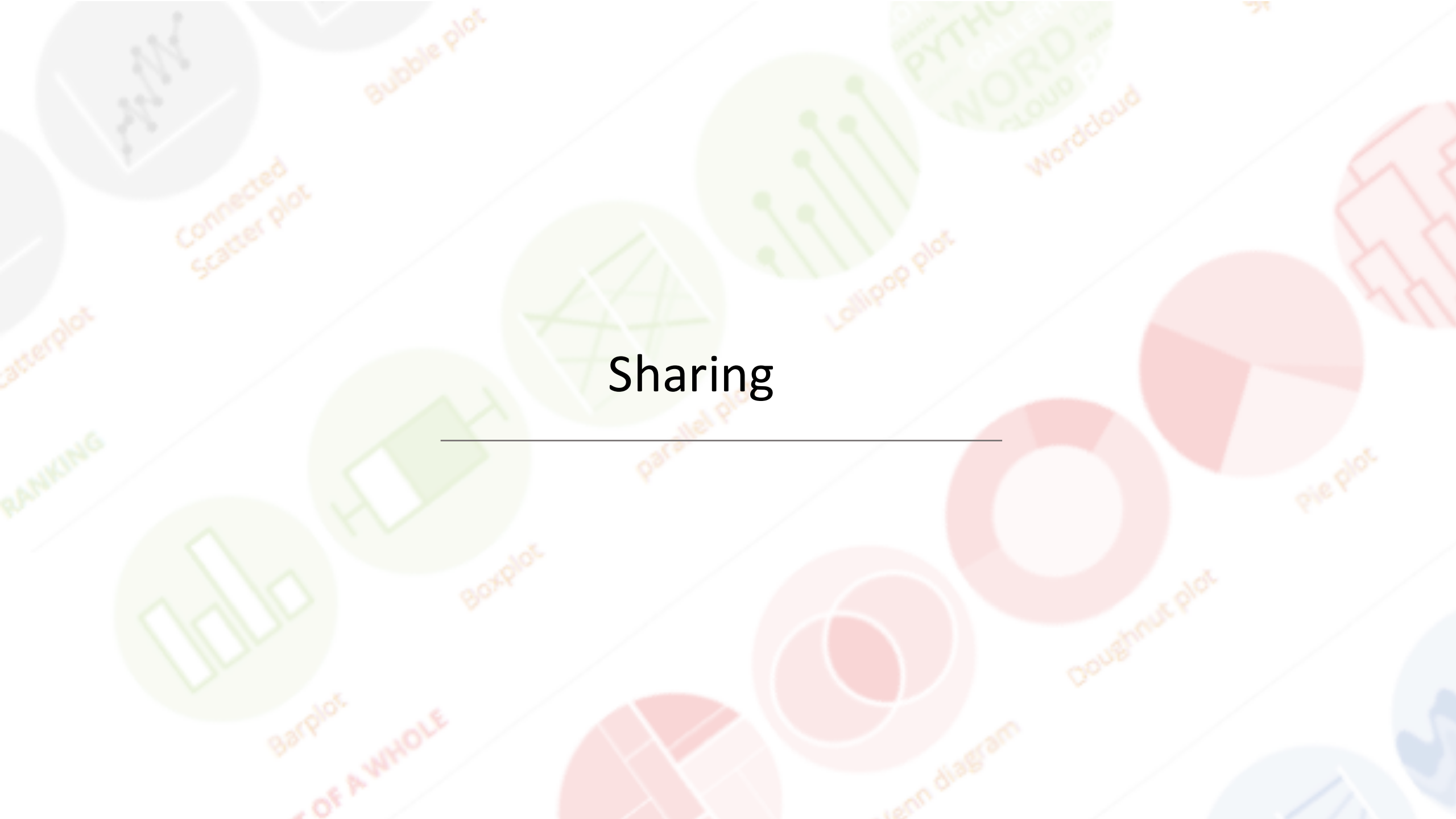


# Pimp my .Rmd

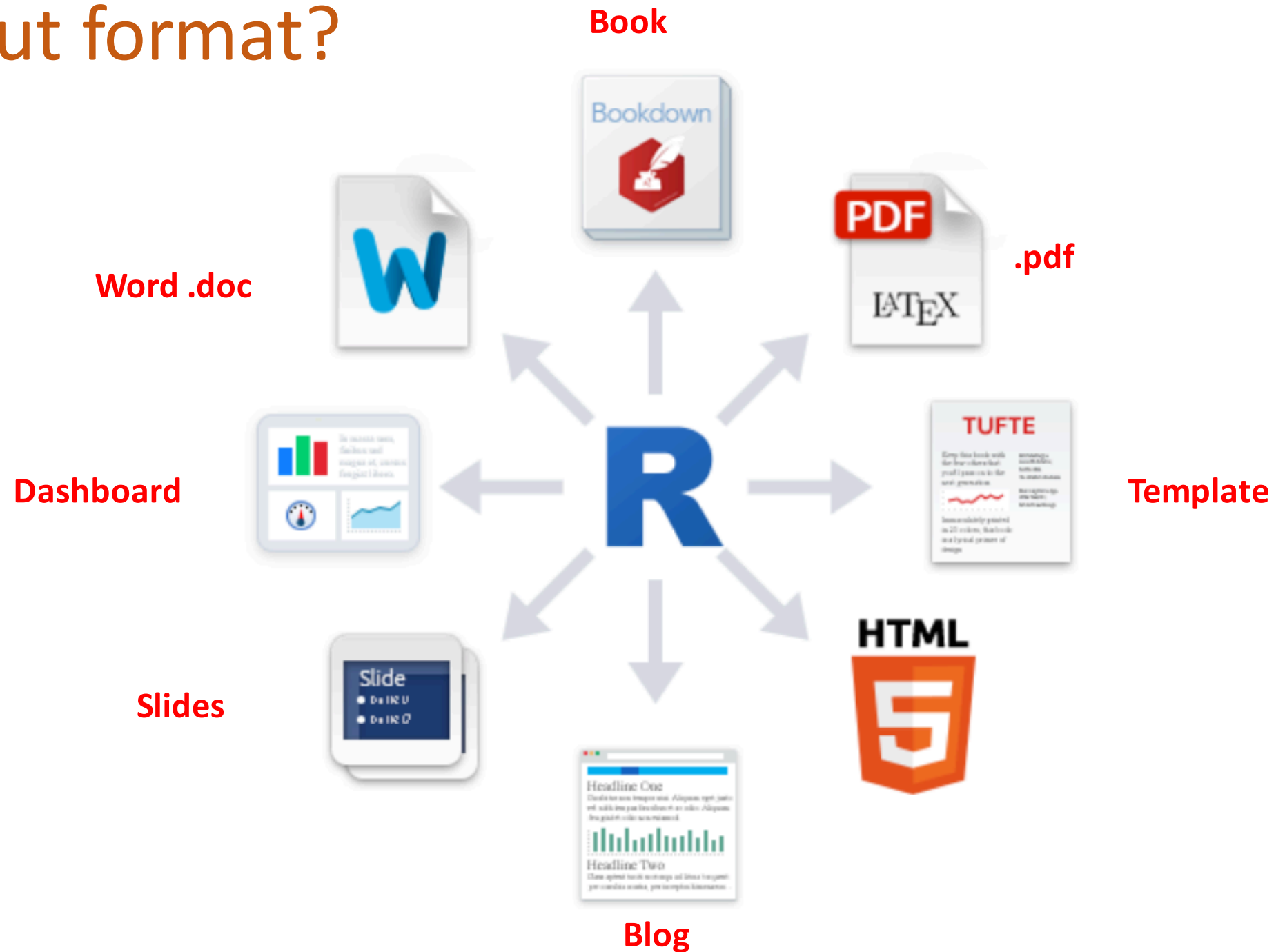
- [holtzy.github.io/Pimp-my-rmd/](https://holtzy.github.io/Pimp-my-rmd/)
- Everything is possible
- Use CSS and HTML code
- Add header and footer
- More

# Sharing

---



# Output format?



# Share your analysis

- Mail with colleagues, supervisor
- Publication as a supplementary material



- Github: [www.github.com](https://www.github.com)



- Website



Example

---

# An example: my bioinfo pipeline:

- Interaction with clusters
- One unique folder
- Several .rmd wrapped in a website
- Shared online

# Thanks

---

Slides:

[bit.ly/2SxJFIV](http://bit.ly/2SxJFIV)

Cheat Sheet:

[bit.ly/2AZySd9](http://bit.ly/2AZySd9)

Pimp my rmd:

[bit.ly/2QDX7Hz](http://bit.ly/2QDX7Hz)



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[www.yan-holtz.com](http://www.yan-holtz.com)



[@R\\_Graph\\_Gallery](https://twitter.com/R_Graph_Gallery)



[github.com/holtzy](https://github.com/holtzy)