

Efficient and reproducible research with R Markdown

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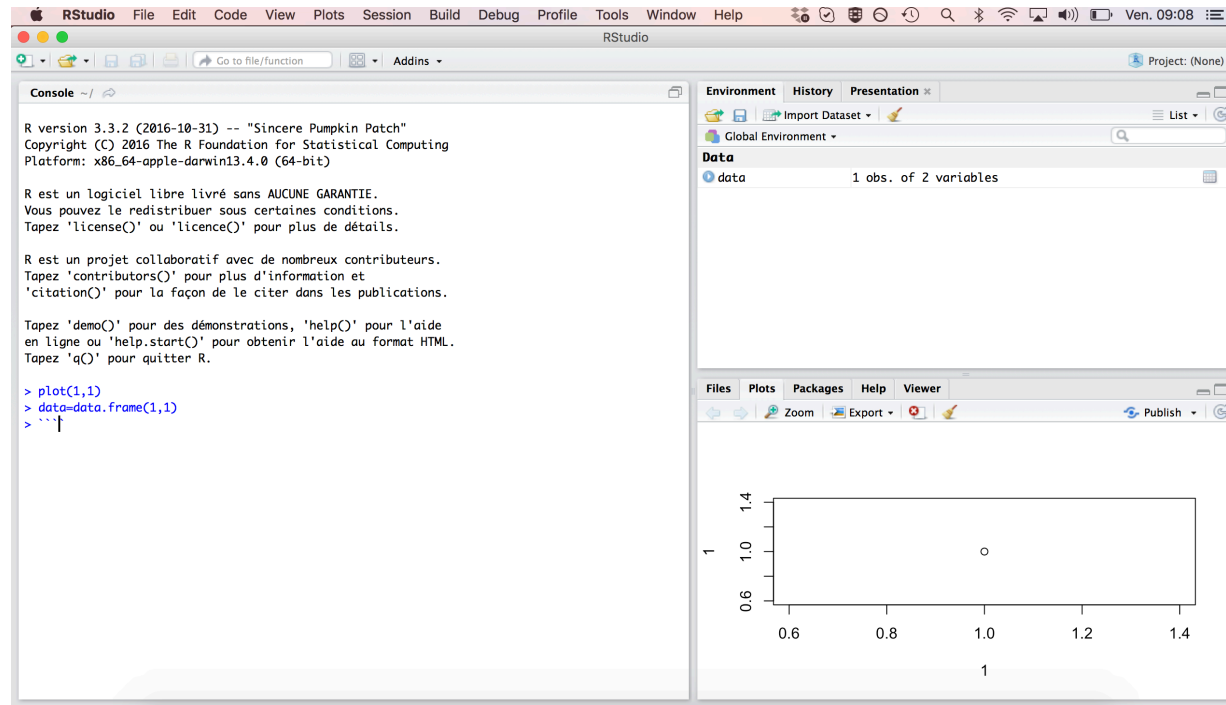
Brisbane, Australia, March 2018

A few resources:

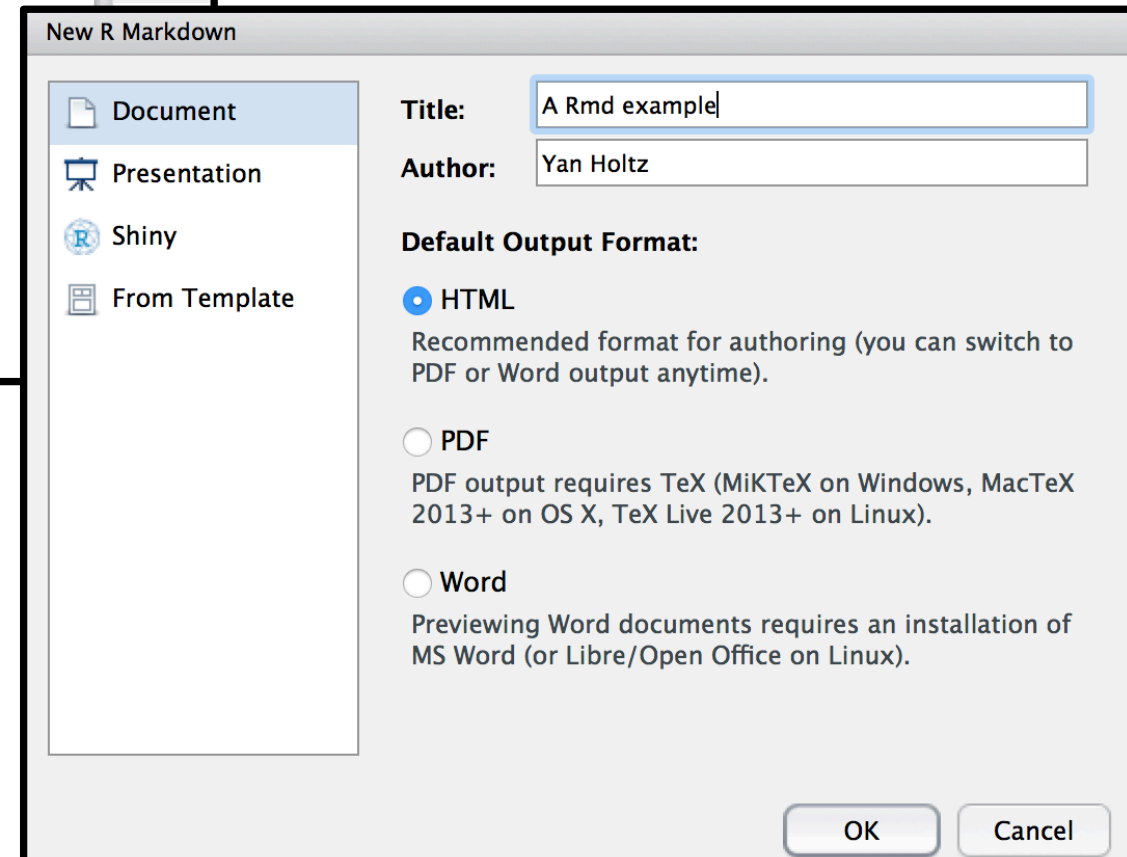
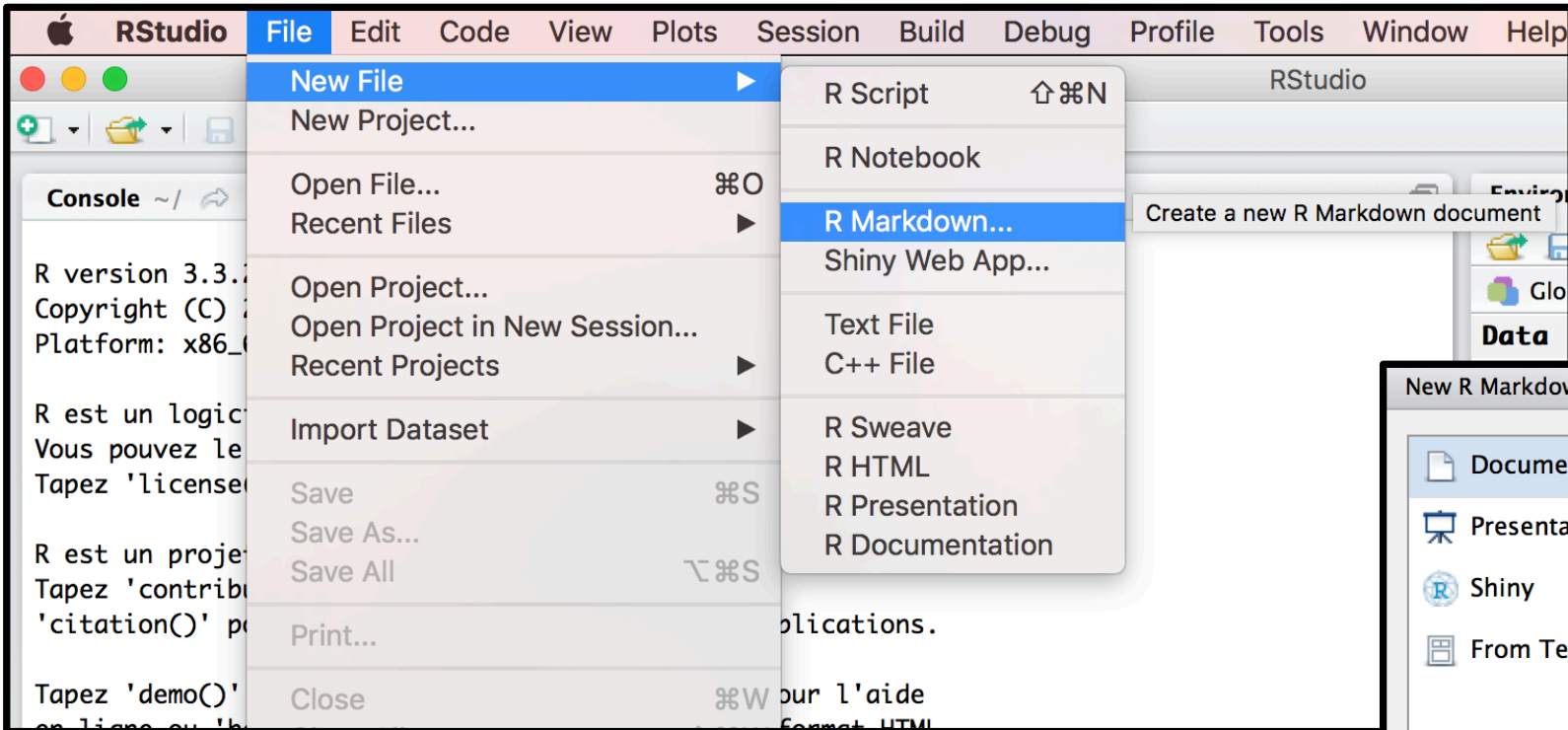
- The R Markdown [website](#)
- The R Markdown [cheat sheet](#)
- This presentation
- The [PCTG template](#)

Open R studio:

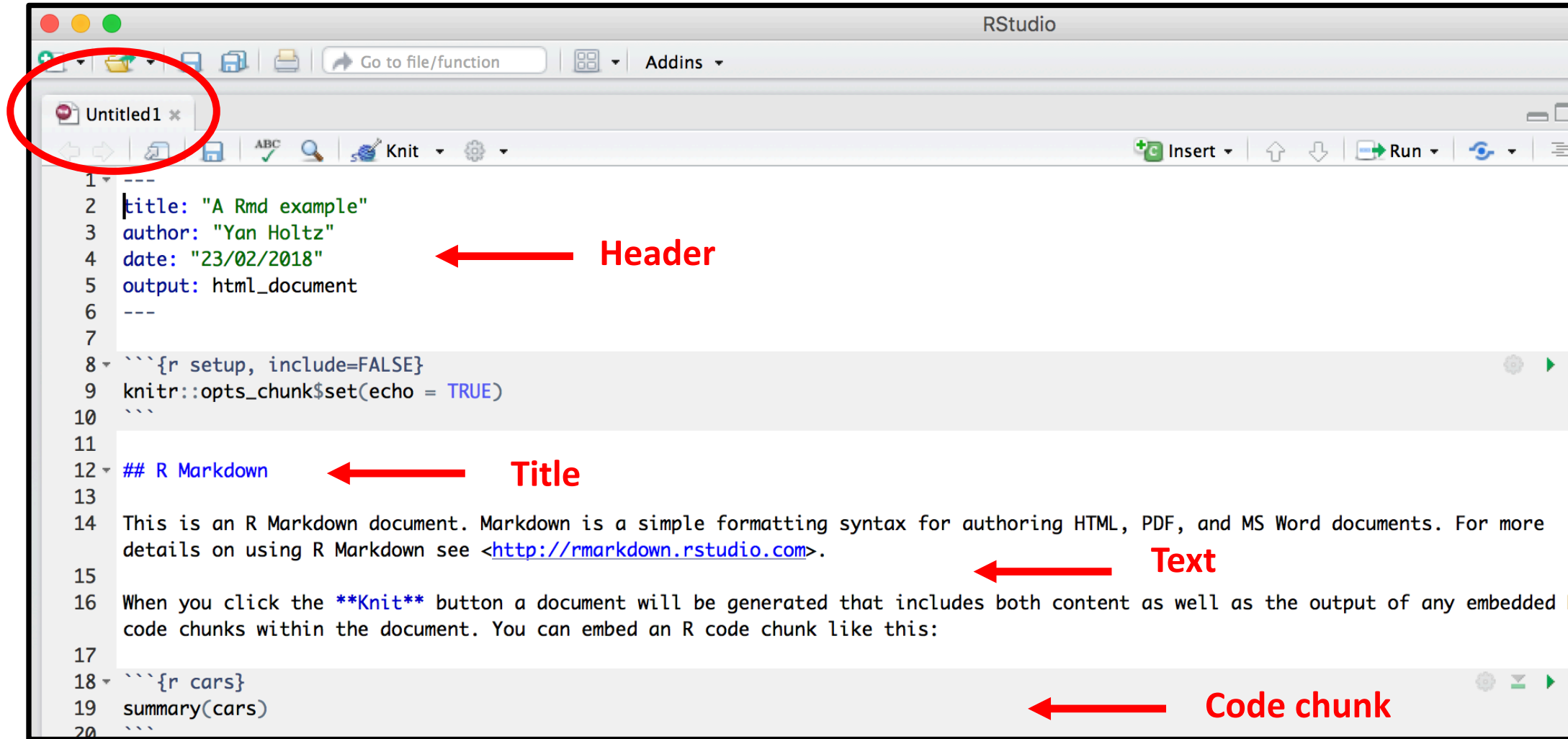
- User Friendly environment
- Auto completion
- Run a line of code with Cmd + Enter



Open a .Rmd file:



Anatomy of a .Rmd file:



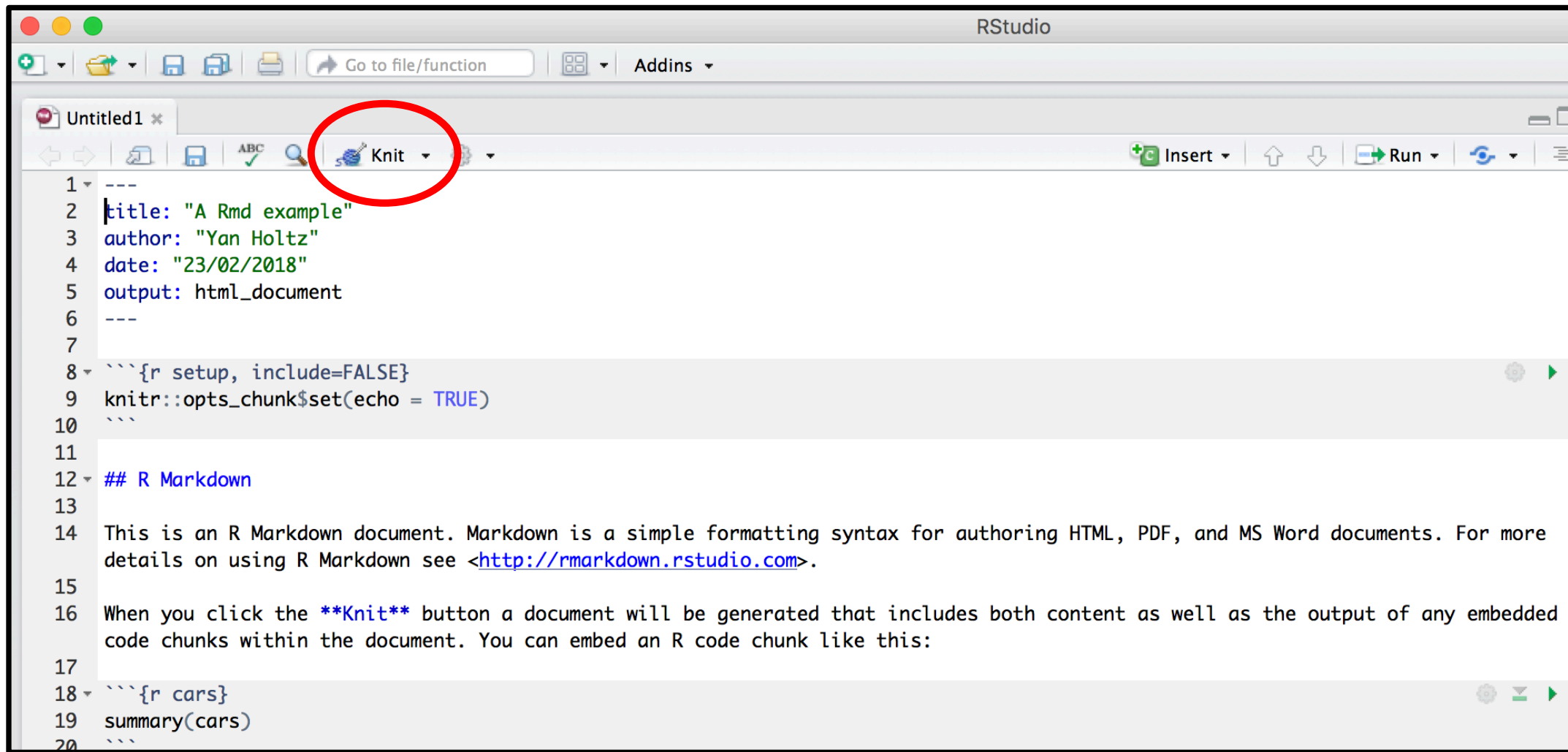
The screenshot shows the RStudio interface with an R Markdown file named 'Untitled1'. The file content is as follows:

```
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 icons (File, Edit, View, etc.).
- A red arrow points to the header section (lines 2-5), labeled **Header**.
- A red arrow points to the title line (line 12), labeled **Title**.
- A red arrow points to the text paragraph (lines 14-16), labeled **Text**.
- A red arrow points to the code chunk (lines 18-22), labeled **Code chunk**.

Knit the .Rmd file:



.HTML output is ready !

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



← .html
← .rmd

A Rmd example

Yan Holtz

23/02/2018

R Markdown

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>.

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)
```

```
##      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
```

Including Plots

You can also embed plots, for example:

← header

← Title

← Text

← Code

← Code
result

Customize the text

R Markdown cheat sheet

syntax

Plain text
End a line with two spaces to start a new paragraph.
italics and *_italics_*
****bold**** and **__bold__**
superscript^{^2^}
~~~~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



# 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               |

# 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

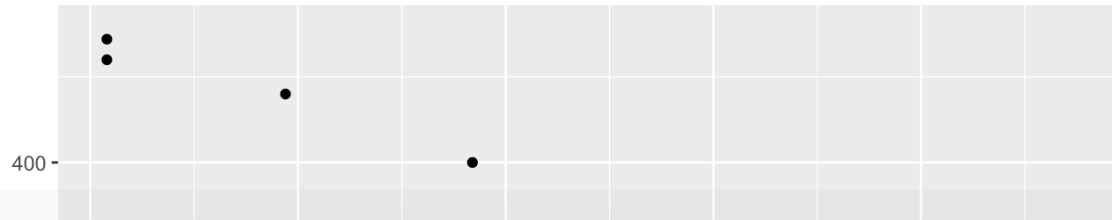
## 1 R Markdown

### 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

# 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                | <div><div></div><div>2.751</div><div>5.424</div></div> |                      | 1                    | 4                    | 4                    |
| 6                    | 258                  | 110                  | 3.08                 | 3.215                |                                                        |                      | 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

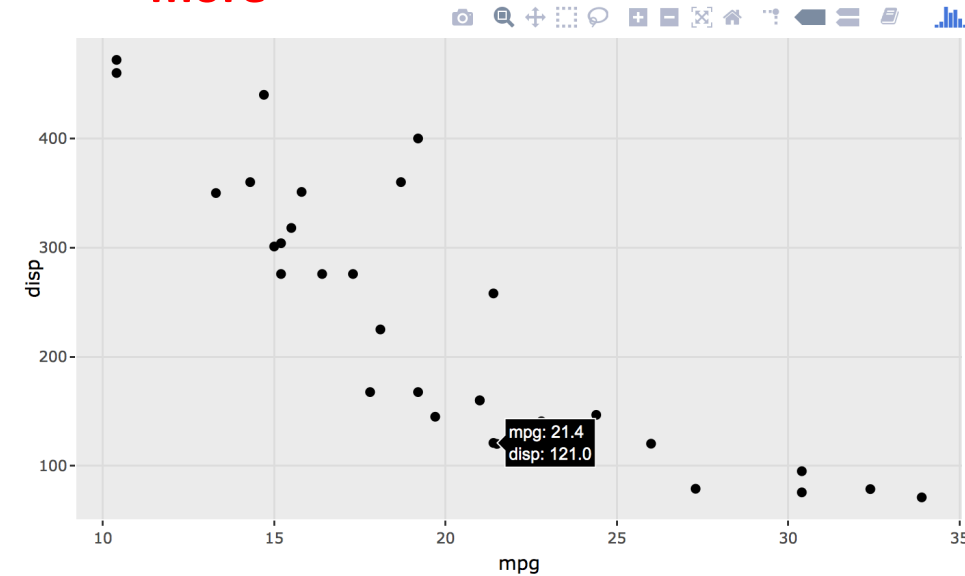
# Use Interactive graphics

```
```{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**



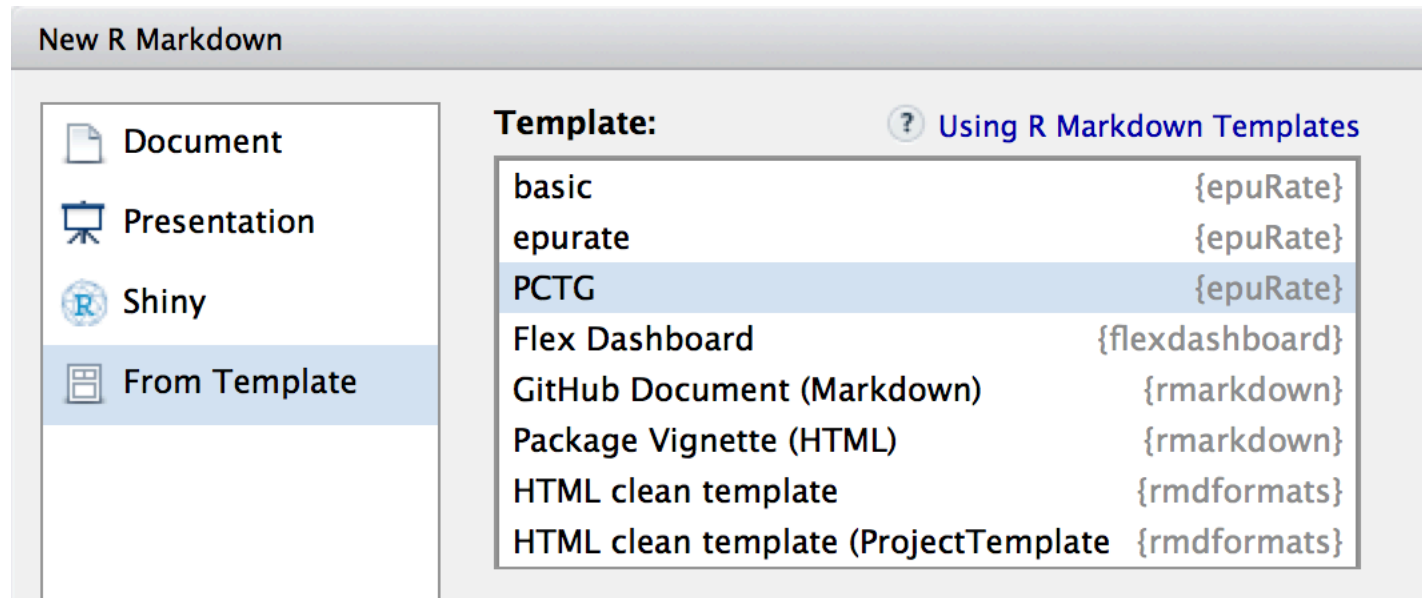
# A note on interactivity

- Interactivity = javascript
- The HTML widgets wrap javascript in R function
- See <http://www.htmlwidgets.org>
- Large topic, needs **another tutorial (?)**

# 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)
```

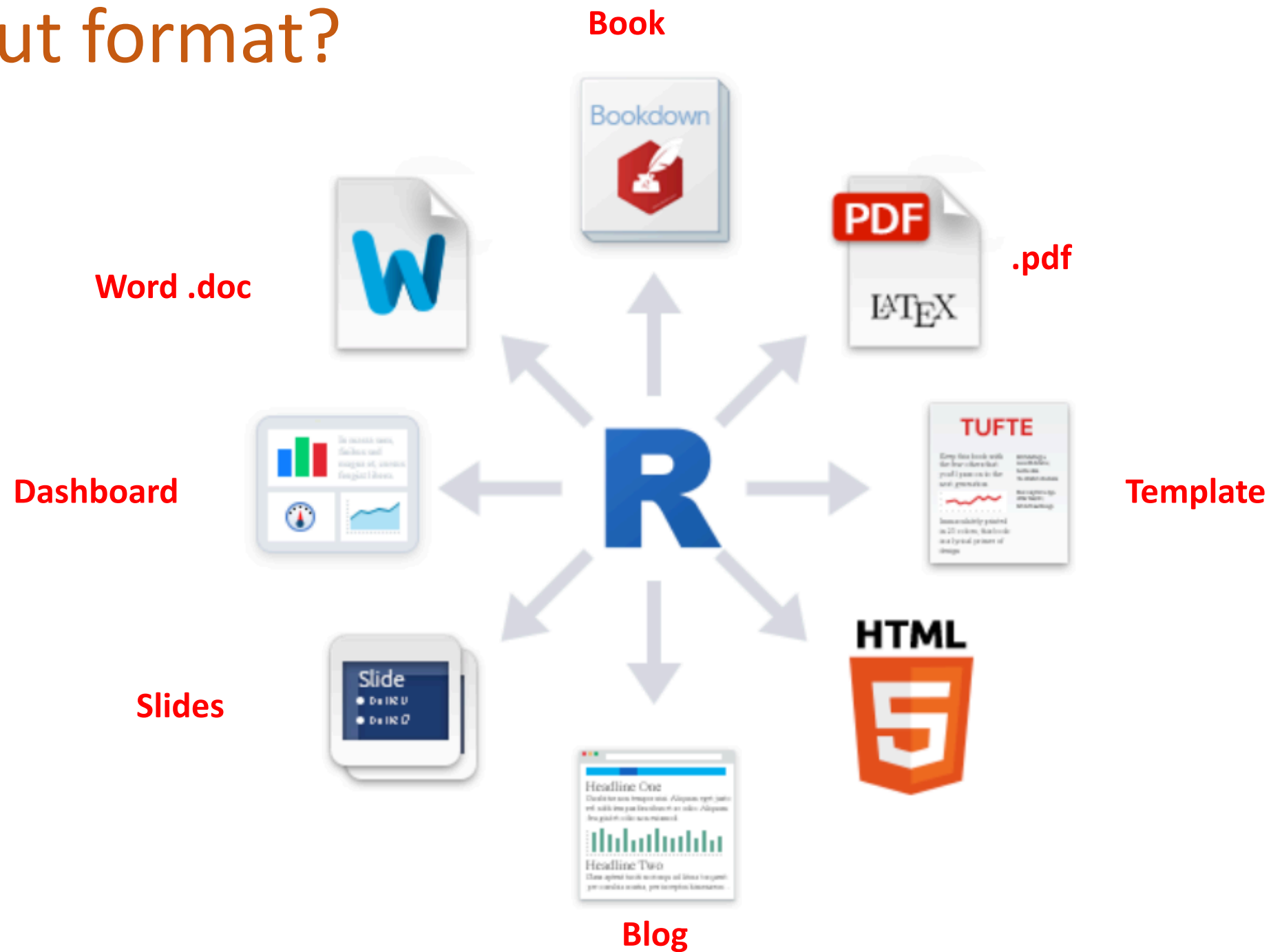


# Pimp my .Rmd

- [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



# Output format?



# Share your analysis

- Mail with colleagues, supervisor
- Publication as a supplementary material
- Github: [www.github.com](https://www.github.com)
- Website



# An example: my bioinfo pipeline:

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