

Efficient and reproducible research with R Markdown

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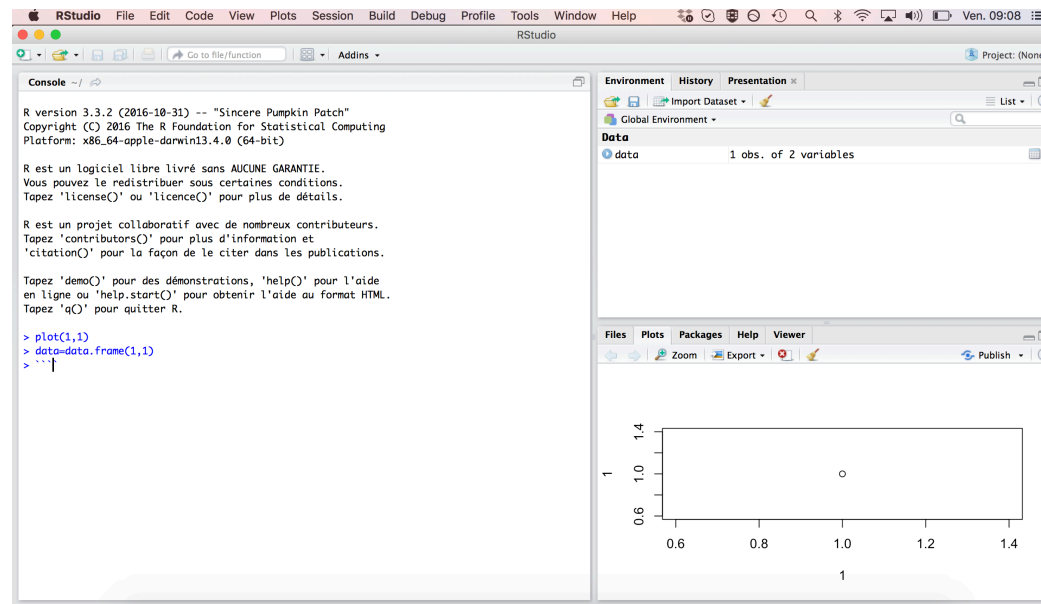
Brisbane, Australia, March 2018

A few resources:

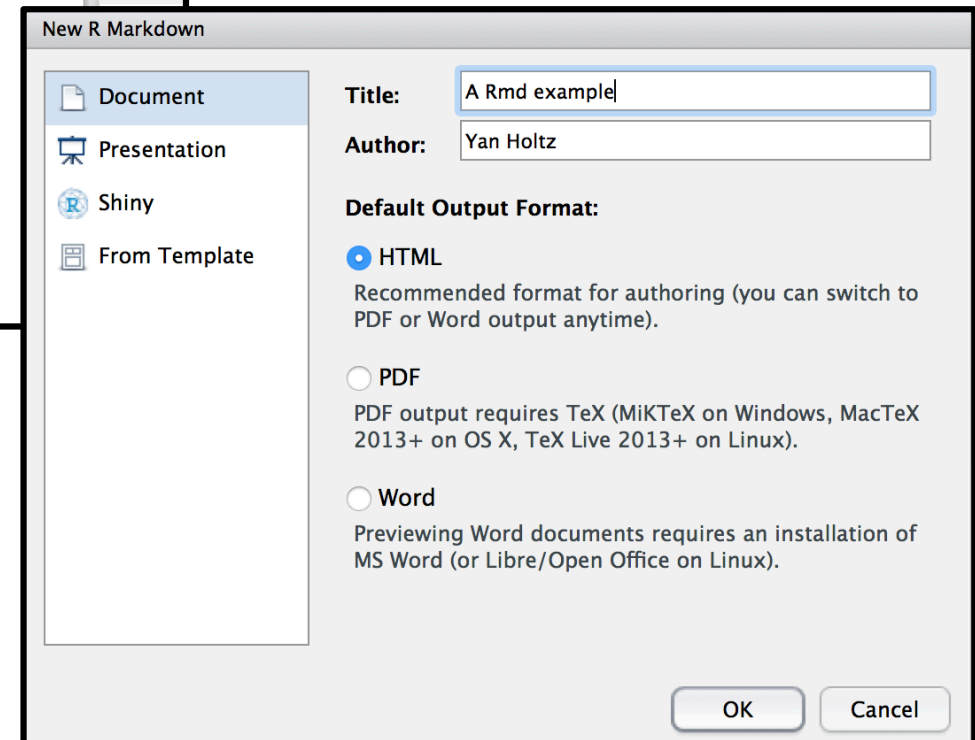
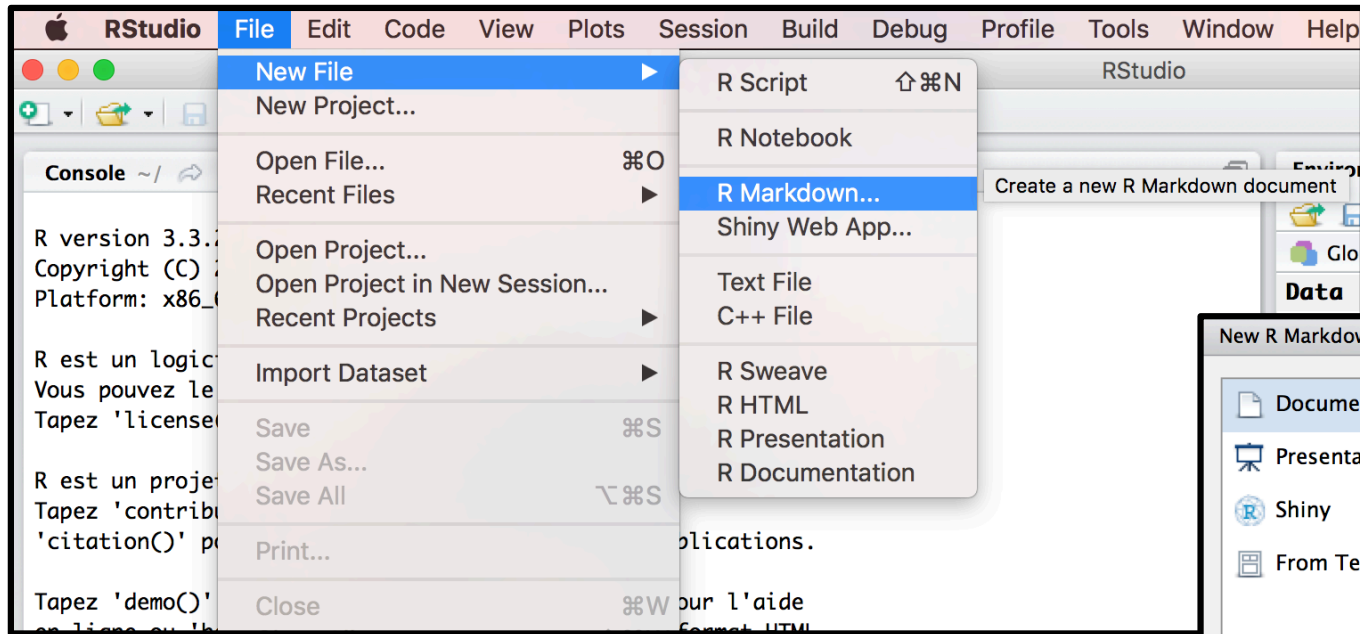
- The R Markdown [website](#)
- The R Markdown [cheat sheet](#)
- This presentation
- The [PCTG template](#)

Open R studio:

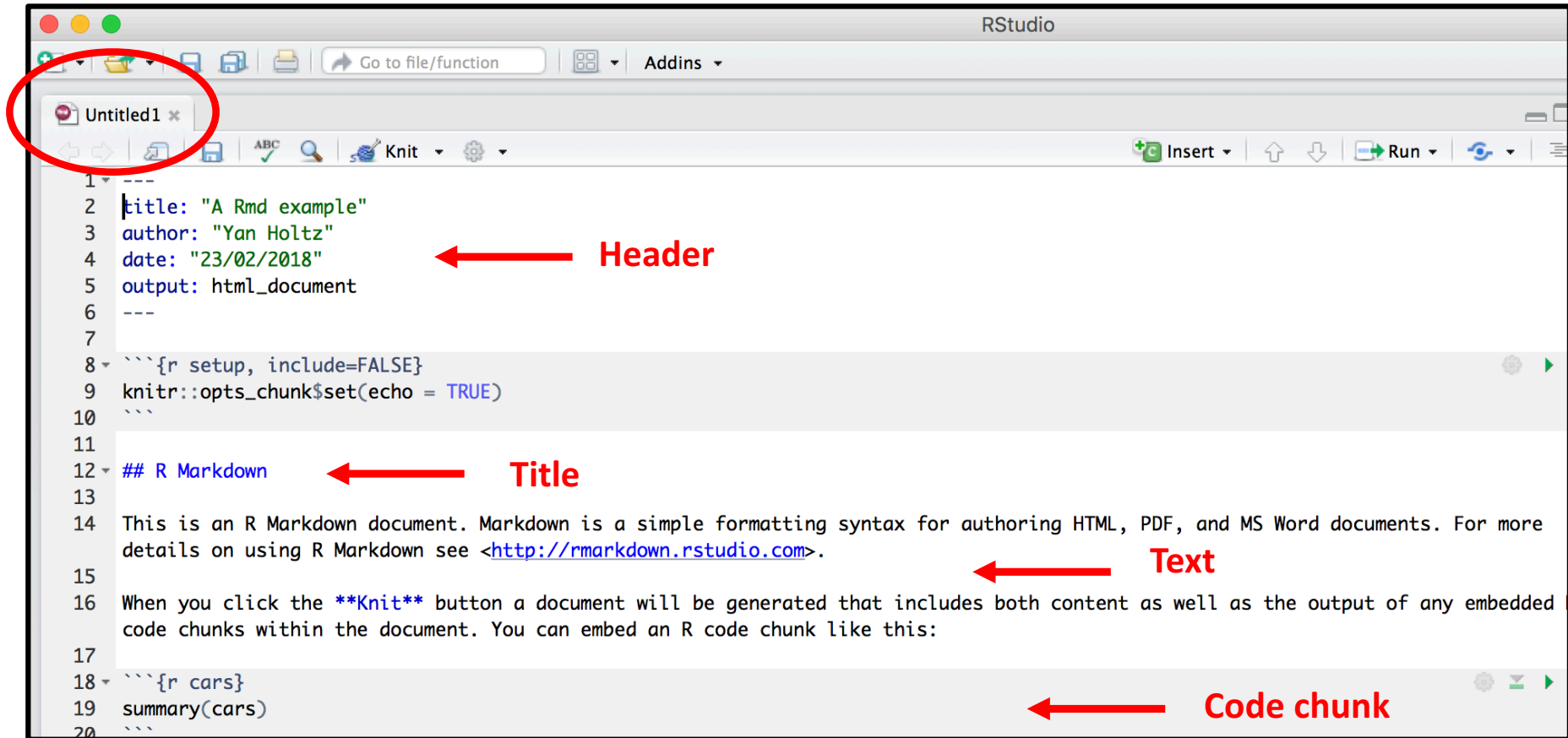
- User Friendly environment
- Auto completion
- Run a line of code with Cmd + Enter



Open a .Rmd file:



Anatomy of a .Rmd file:



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

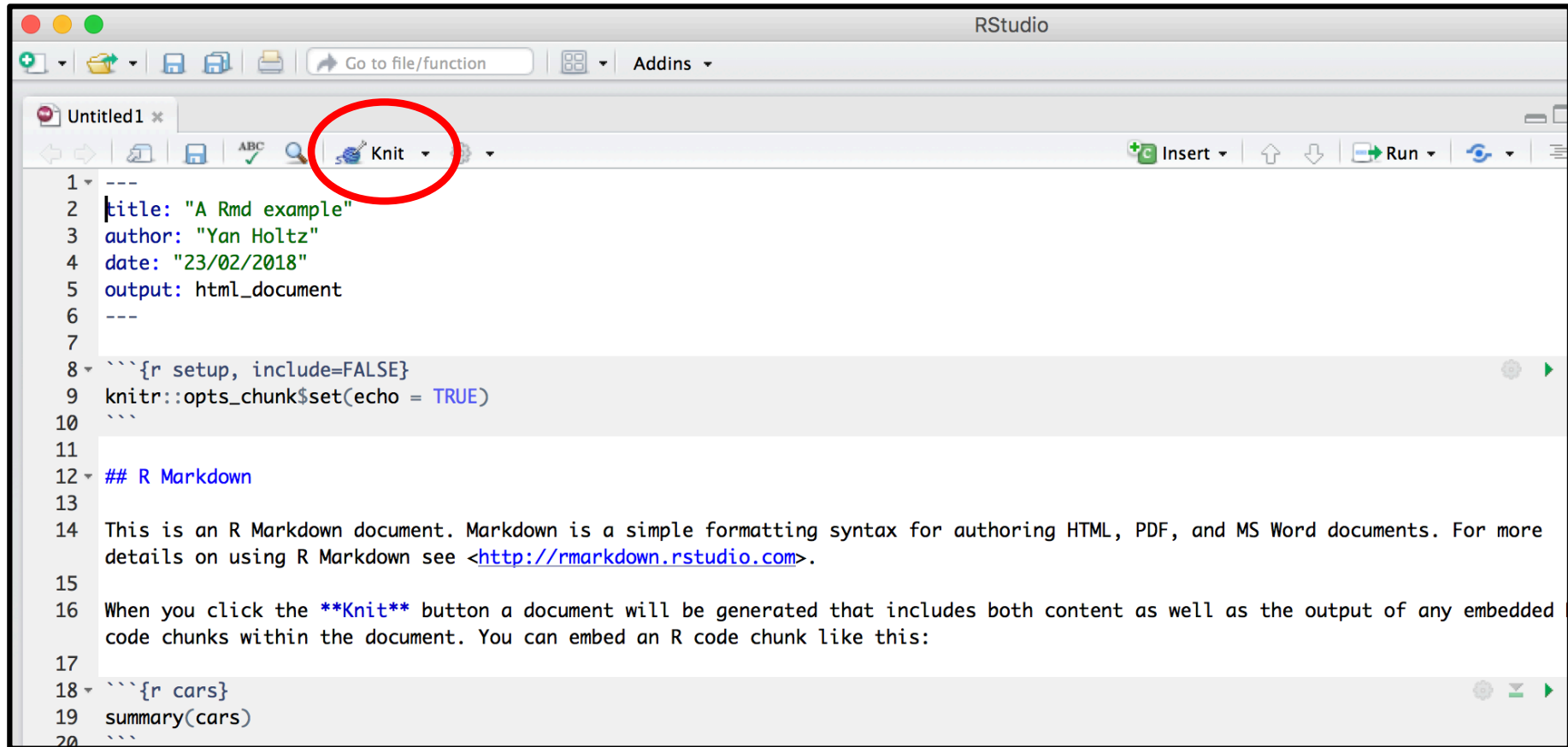
```
1 ---
2 title: "A Rmd example"
3 author: "Yan Holtz"
4 date: "23/02/2018"
5 output: html_document
6 ---
7
8 ```{r setup, include=FALSE}
9 knitr::opts_chunk$set(echo = TRUE)
10 ```
11
12 ## R Markdown
13
14 This is an R Markdown document. Markdown is a simple formatting syntax for authoring HTML, 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 point to the following parts of the file:

- Header**: Points to the YAML front-matter (lines 2-5).
- Title**: Points to the `## R Markdown` heading (line 12).
- Text**: Points to the paragraph of text starting with "This is an R Markdown document..." (lines 14-15).
- Code chunk**: Points to the R code chunk starting with ````{r cars}` (line 18).

A red circle highlights the top toolbar of RStudio, specifically the icons for creating a new file, opening a file, saving, and printing.

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	becomes
Plain text End a line with two spaces to start a new paragraph. <i>*italics*</i> and <i>_italics_</i> **bold** and __bold__ superscript^2^ ~~strikethrough~~ [link](www.rstudio.com)	Plain text End a line with two spaces to start a new paragraph. <i>italics</i> and <i>italics</i> bold and bold superscript ² strikethrough link
# Header 1	Header 1
## Header 2	Header 2
### Header 3	Header 3
#### Header 4	Header 4
##### Header 5	Header 5
##### Header 6	Header 6
endash: -- emdash: --- ellipsis: ... inline equation: $A = \pi * r^2$ image:	endash: – emdash: — ellipsis: ... inline equation: $A = \pi * r^2$ image: 
horizontal rule (or slide break): ***	horizontal rule (or slide break): <hr/>
> block quote	block quote
* unordered list * item 2 + sub-item 1 + sub-item 2	<ul style="list-style-type: none">• unordered list• item 2<ul style="list-style-type: none">◦ sub-item 1◦ sub-item 2
1. ordered list 2. item 2 + sub-item 1 + sub-item 2	<ol style="list-style-type: none">1. ordered list2. item 2<ul style="list-style-type: none">◦ 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:

```
## R code chunk example  
plot(1:10)
```

400

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:

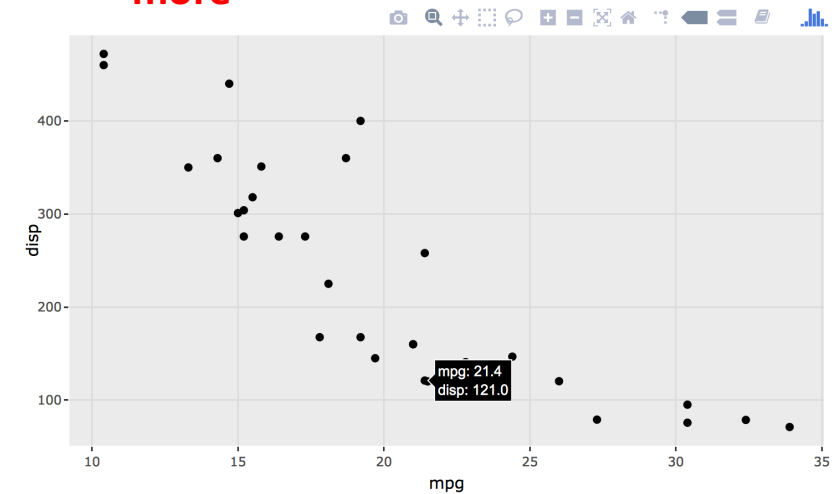
| mpg | cyl | disp | hp | drat | wt | qsec | vs | am | gear |
|--------------------------------|----------------------------------|----------------------------------|----------------------------------|------------------------------------|------------------------------------|--------------------------------|--------------------------------|-----------------------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



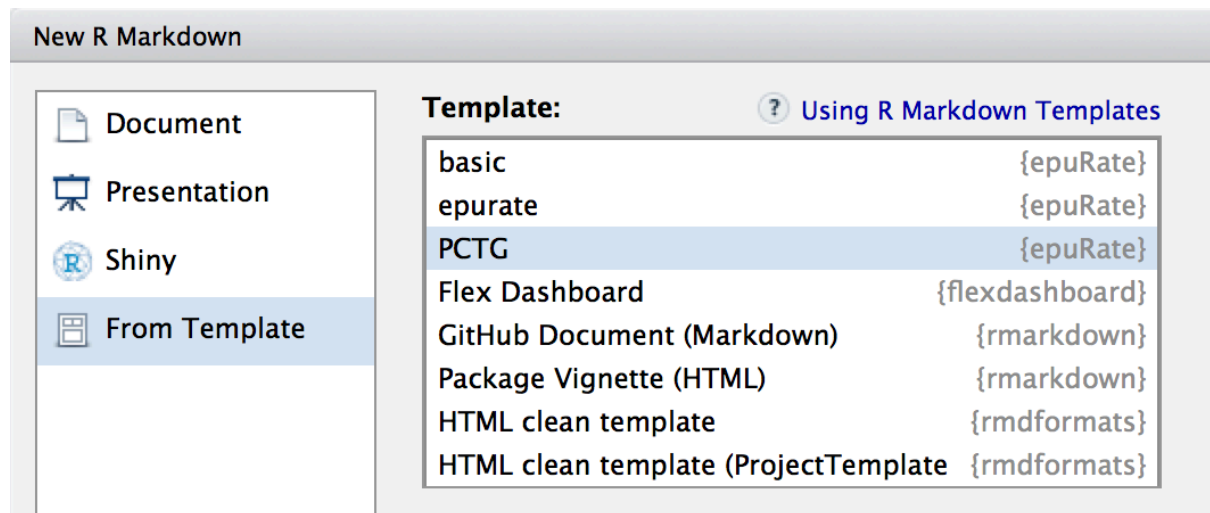
A note on interactivity

- 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

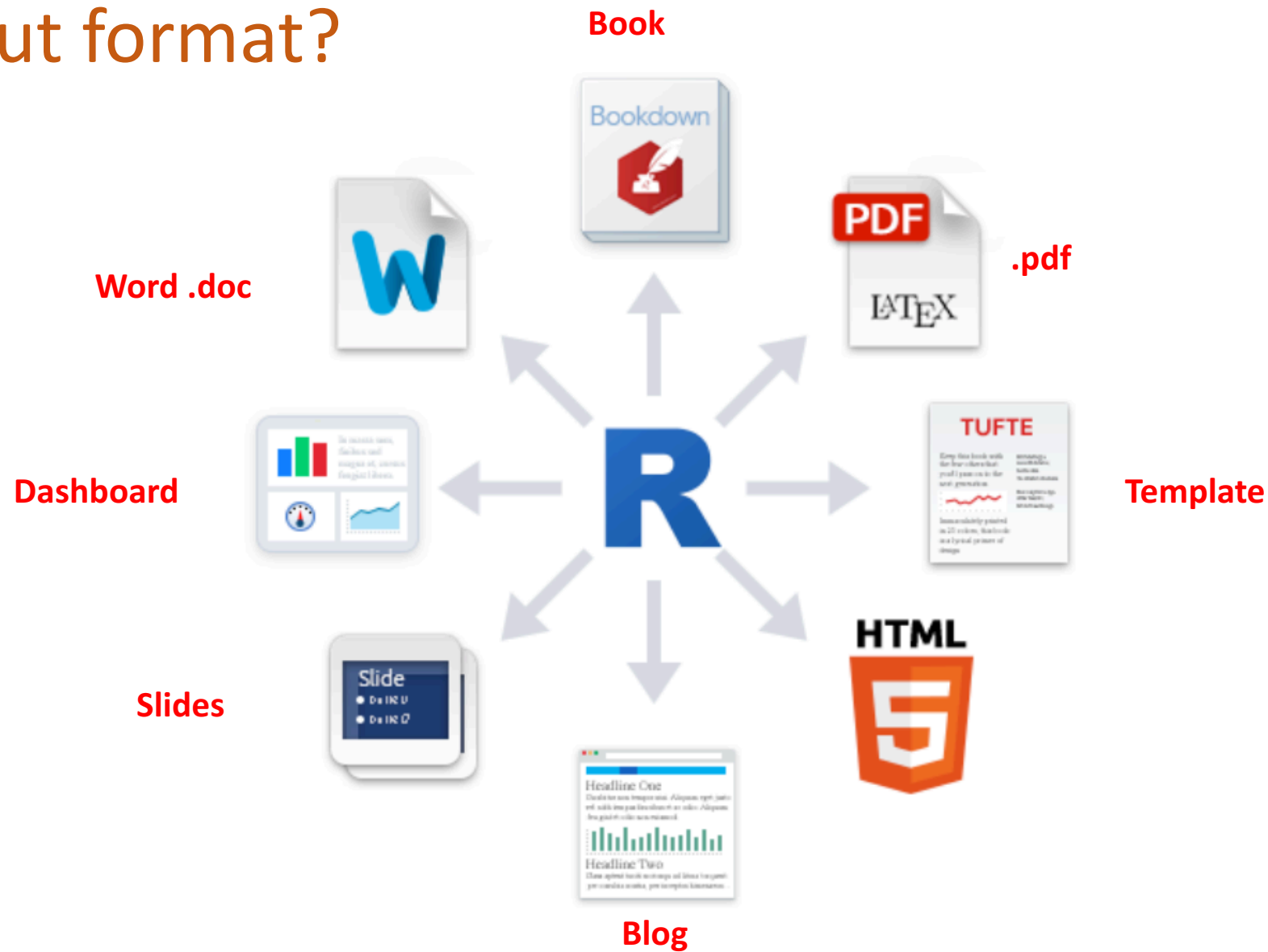
```
library(devtools)
install_github("holtzy/epuRate")
library(epuRate)
```



Pimp my .Rmd

- 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



- Website

An example: my bioinfo pipeline:

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