

Introduction to R Markdown

*Building interactive and reproducible
reports in minutes*

Yan-holtz.com/teaching

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

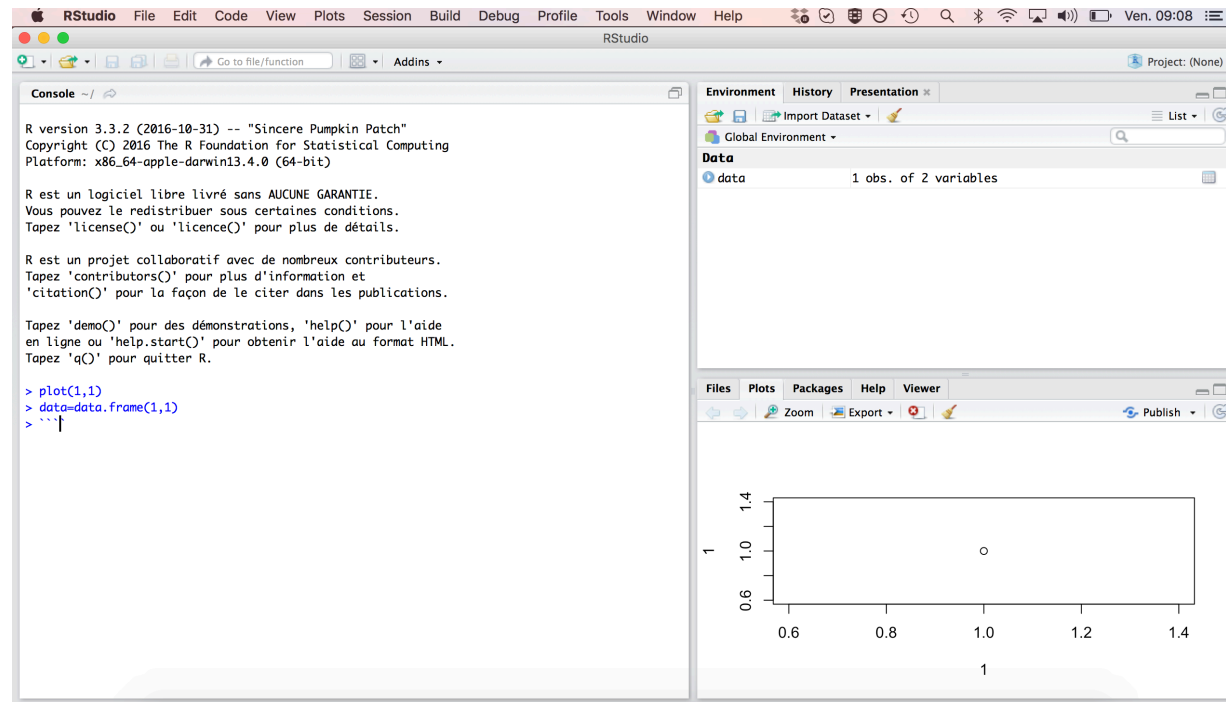
And much more..

Most Basic Document

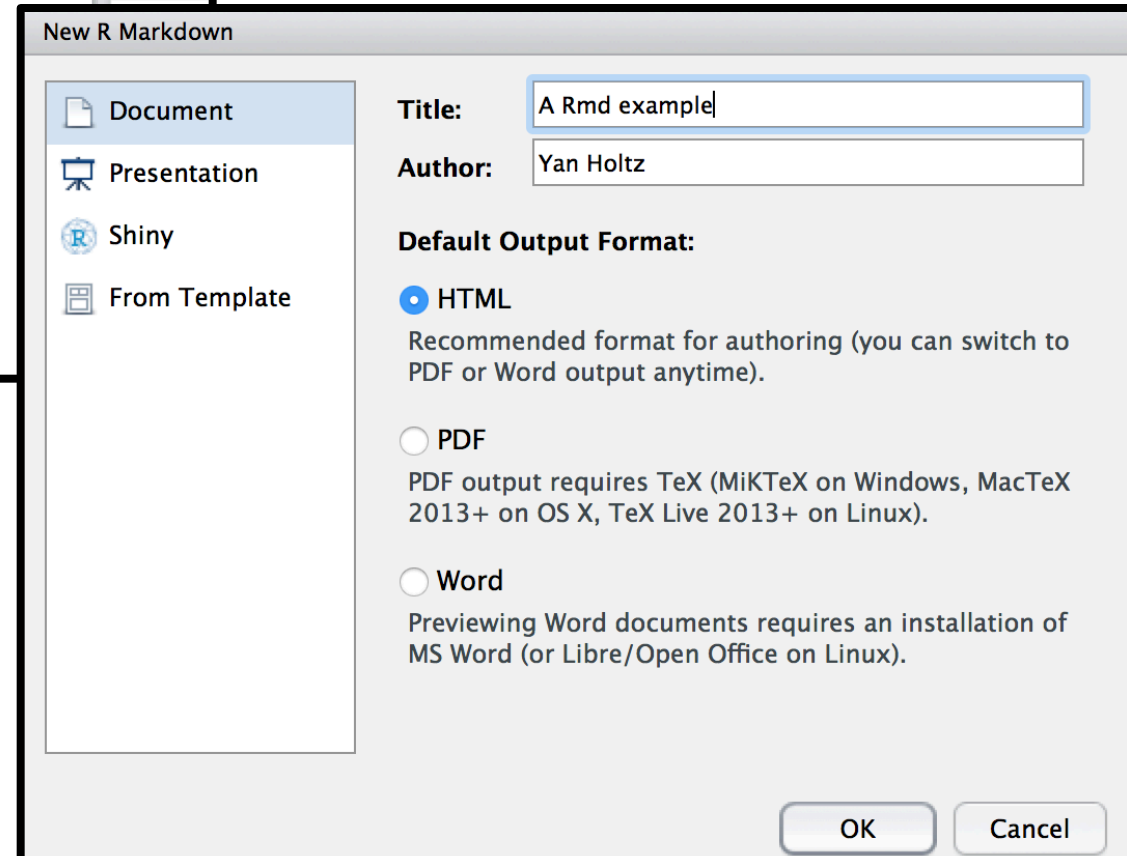
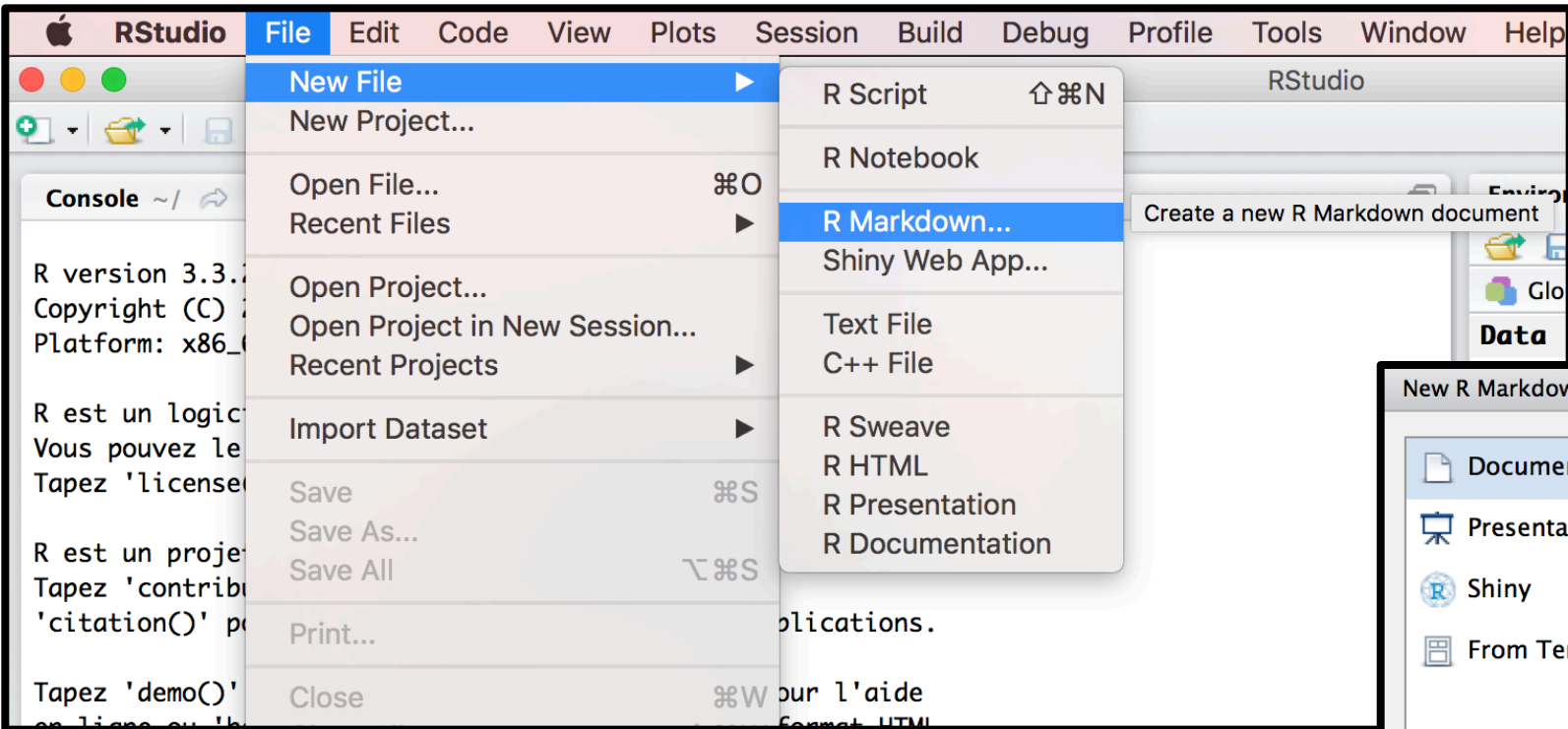


1 - Open R studio:

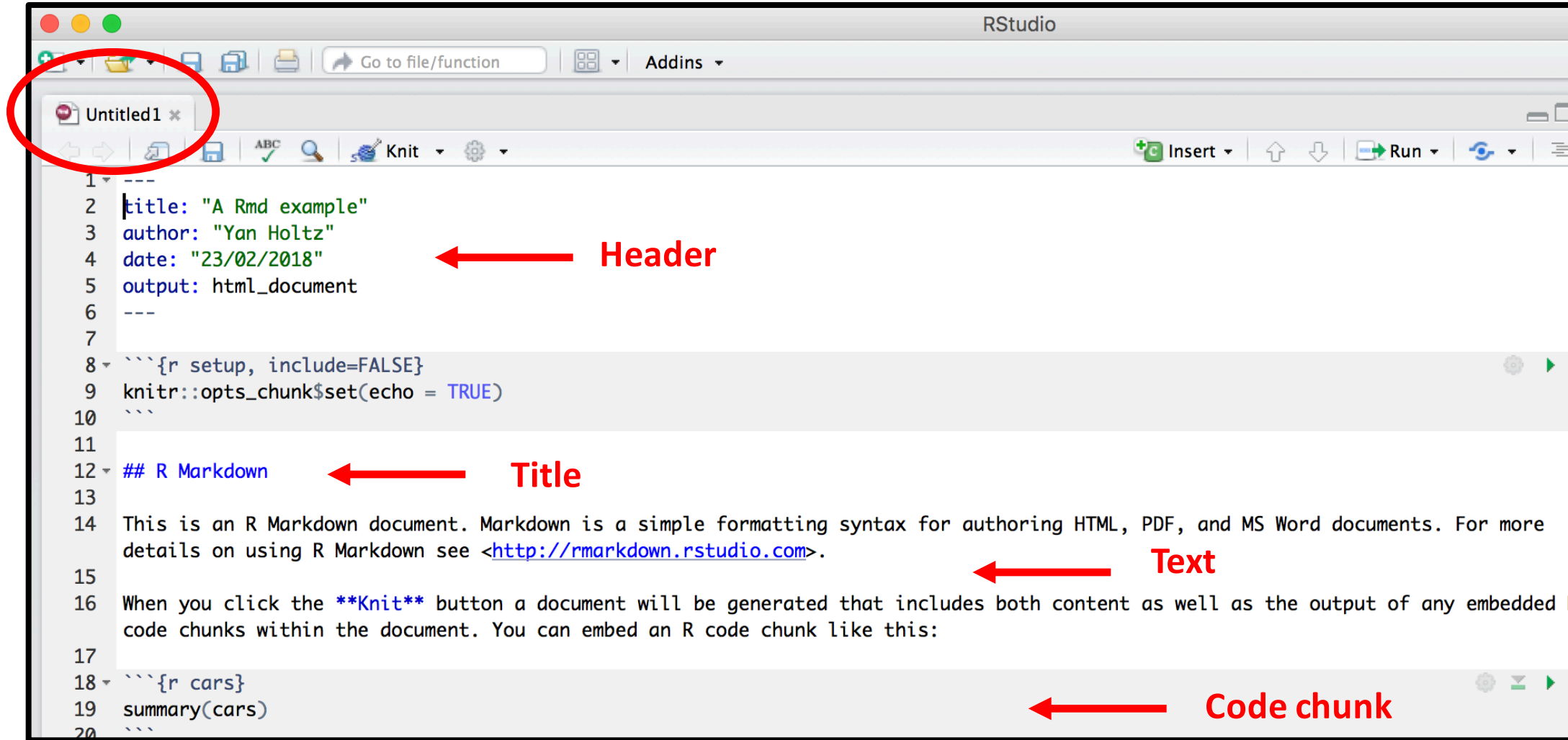
- User Friendly environment
- Auto completion
- Run a line of code with Cmd + Enter



2 - Open a .Rmd file:



Anatomy of a .Rmd file:



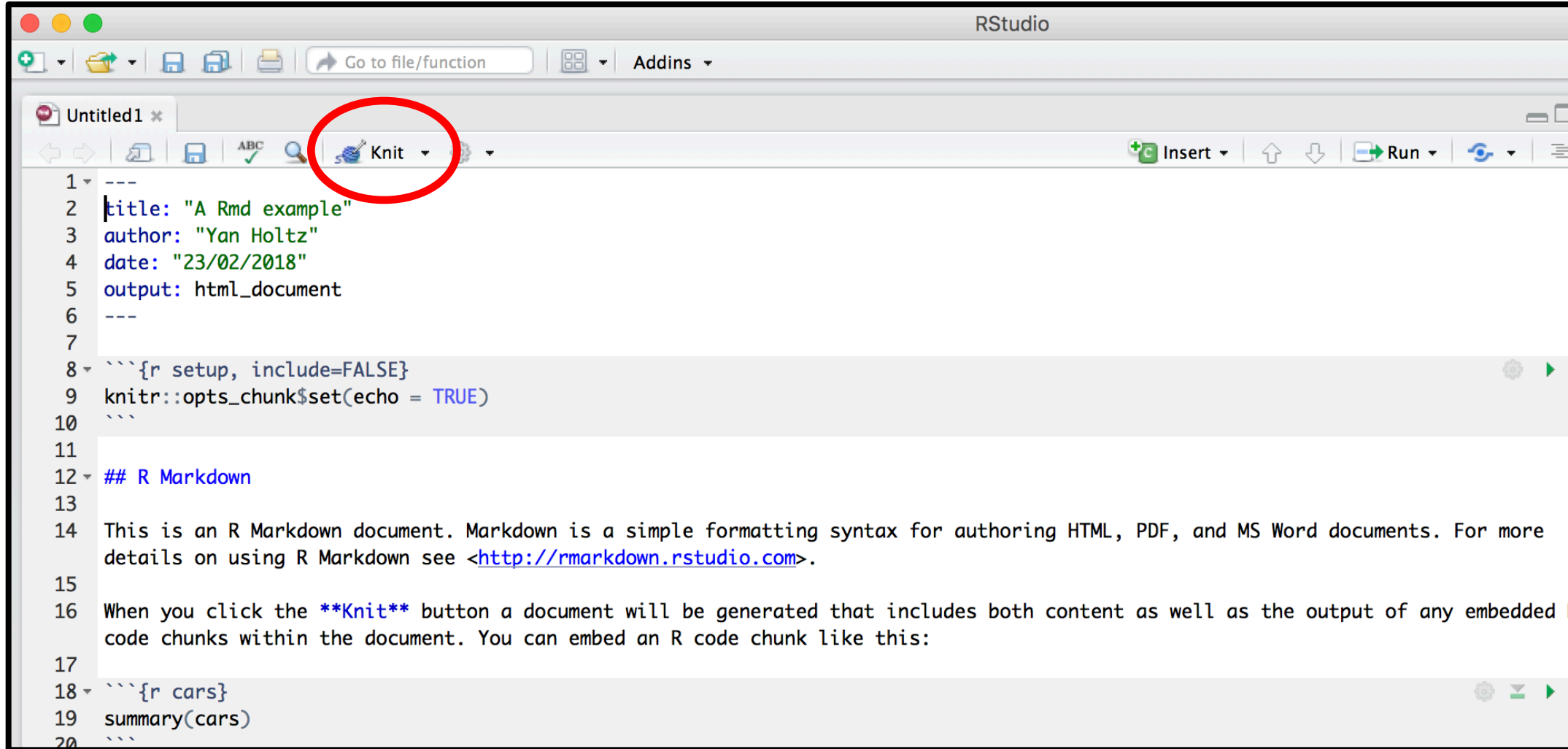
The image shows a screenshot of the RStudio interface with an R Markdown file open. The file content is as follows:

```
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 include:

- A red circle around the top toolbar.
- A red arrow pointing to the header section (lines 2-5) labeled "Header".
- A red arrow pointing to the title line (line 12) labeled "Title".
- A red arrow pointing to the main text paragraph (lines 14-16) labeled "Text".
- A red arrow pointing to the R code chunk (lines 18-22) labeled "Code chunk".

3 - Knit the .Rmd file:

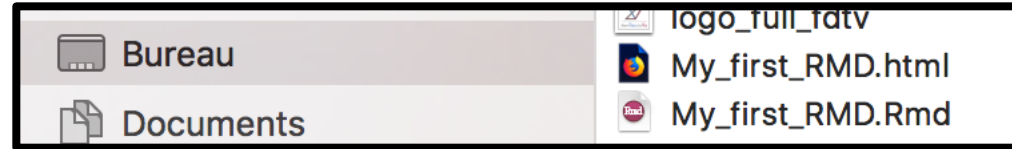


The screenshot shows the RStudio interface with a .Rmd file open. The Knit button in the toolbar is circled in red. The file content is as follows:

```
1 ---
2 title: "A Rmd example"
3 author: "Yan Holtz"
4 date: "23/02/2018"
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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

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 text



Customize the text

R Markdown cheat sheet

bit.ly/1SuNTo9

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**
superscript²
~~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 chunk options



Latterplot

Connected Scatter plot

Bubble plot

RANKING

parallel plot

Lollipop plot

Wordcloud

Pie plot

Boxplot

Doughnut plot

Barplot

OF A WHOLE

Venn diagram

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

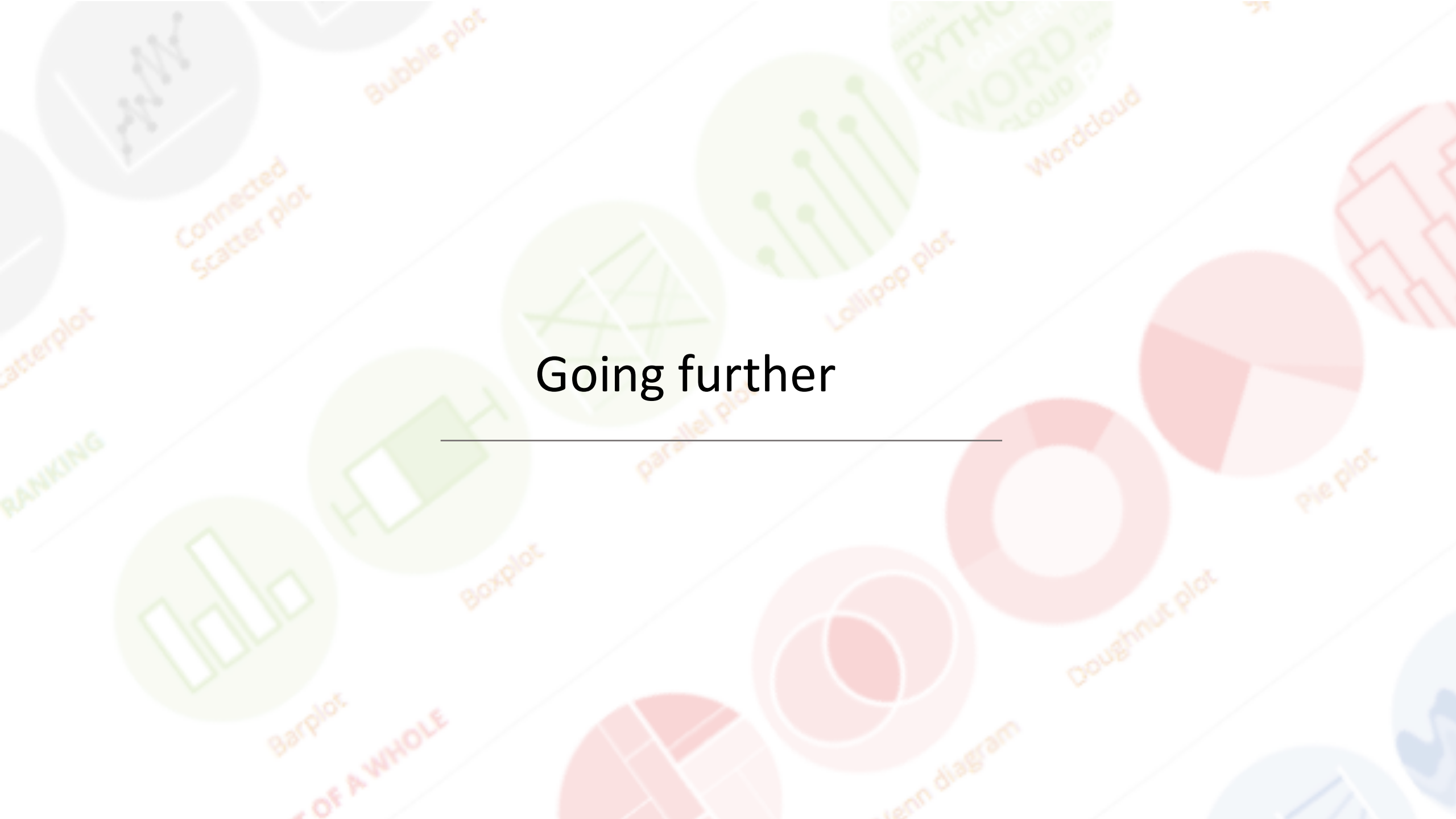
This is an R Markdown document. Markdown is a simple formatting syntax for authoring HTML, PDF, and MS Word documents. For more details on using R Markdown see <http://rmarkdown.rstudio.com>.

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

Going further



Scatterplot

Connected Scatter plot

Bubble plot

RANKING

Going further

parallel plot

Lollipop plot

Wordcloud

Pie plot

Barplot

Boxplot

Doughnut plot

PART OF A WHOLE

Venn diagram

Stacked bar plot

Line plot

Insert a table: the DT library

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

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" value="2.751 - 5.424"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
6	160	110	3.9	2.875			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 2 3 4 5 Next

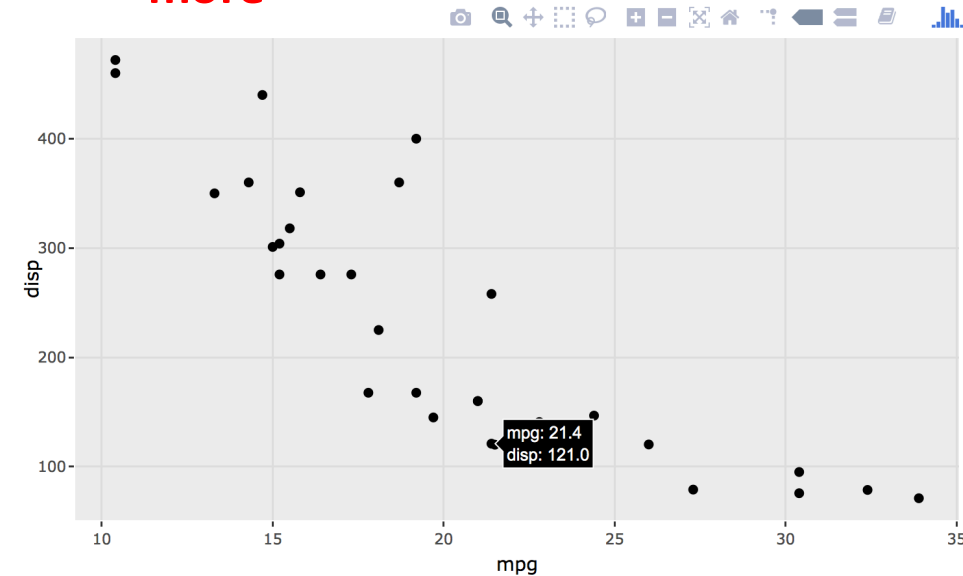
Use Interactive charts

```
```{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
```
```

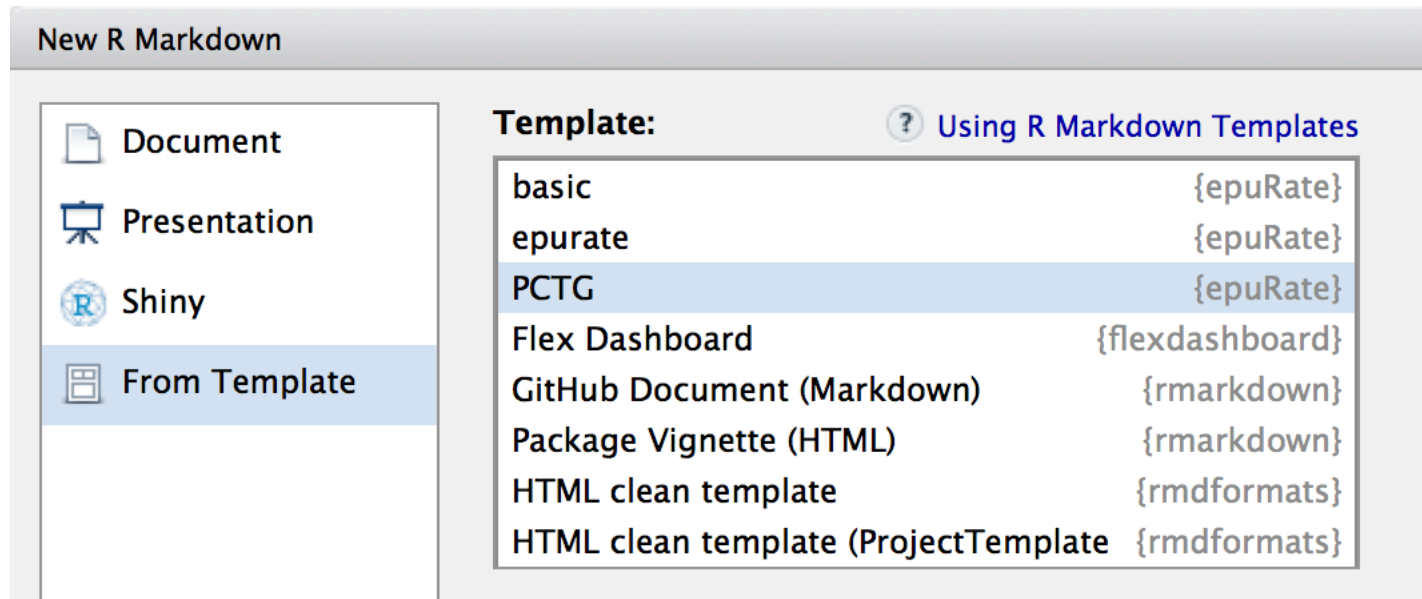
Result: zoom / hover / export .. And more



Use a template

- The PCTG template: www.github.com/holtzy/epuRate

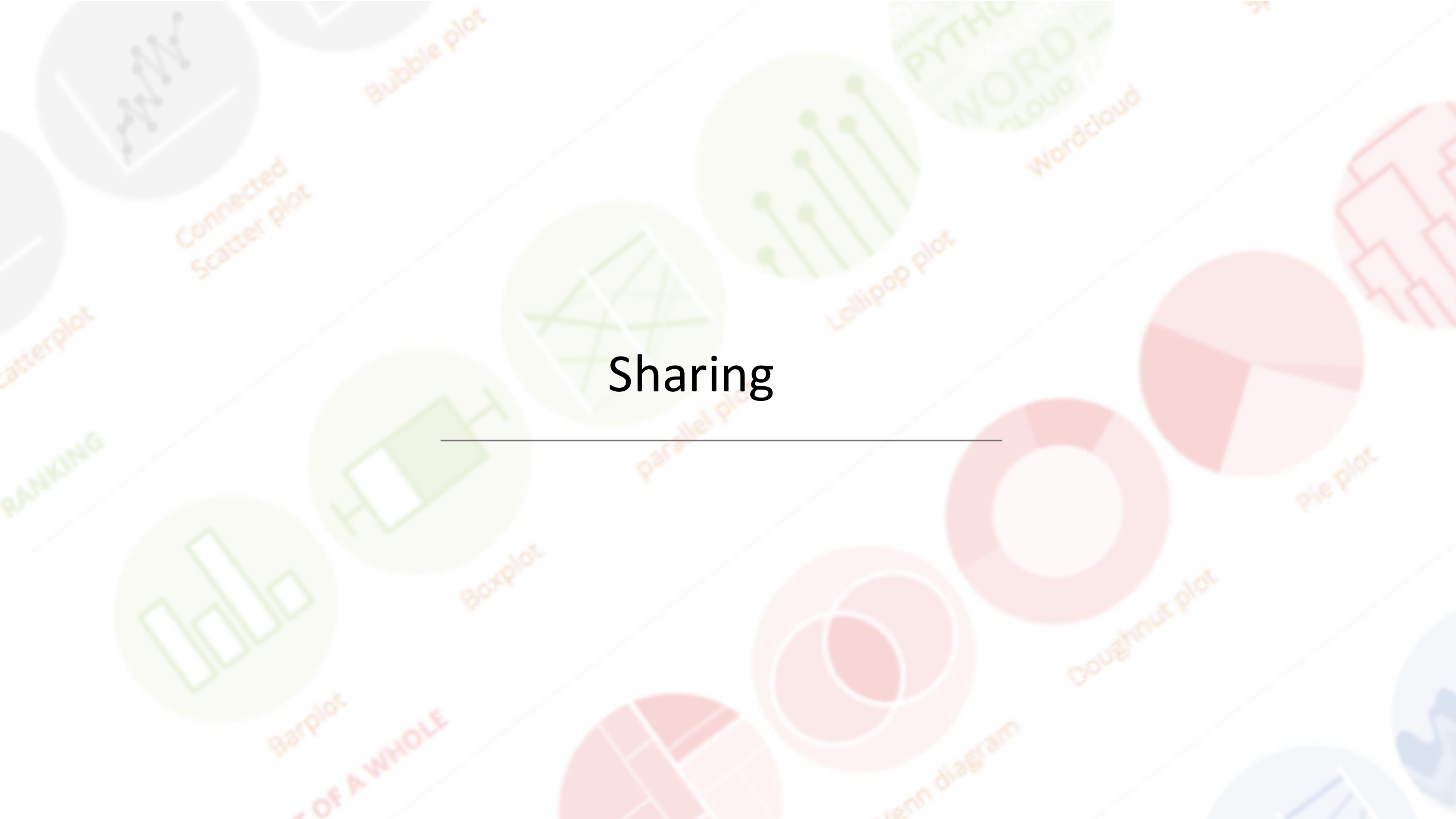
```
library(devtools)
install_github("holtzy/epuRate")
library(epuRate)
```



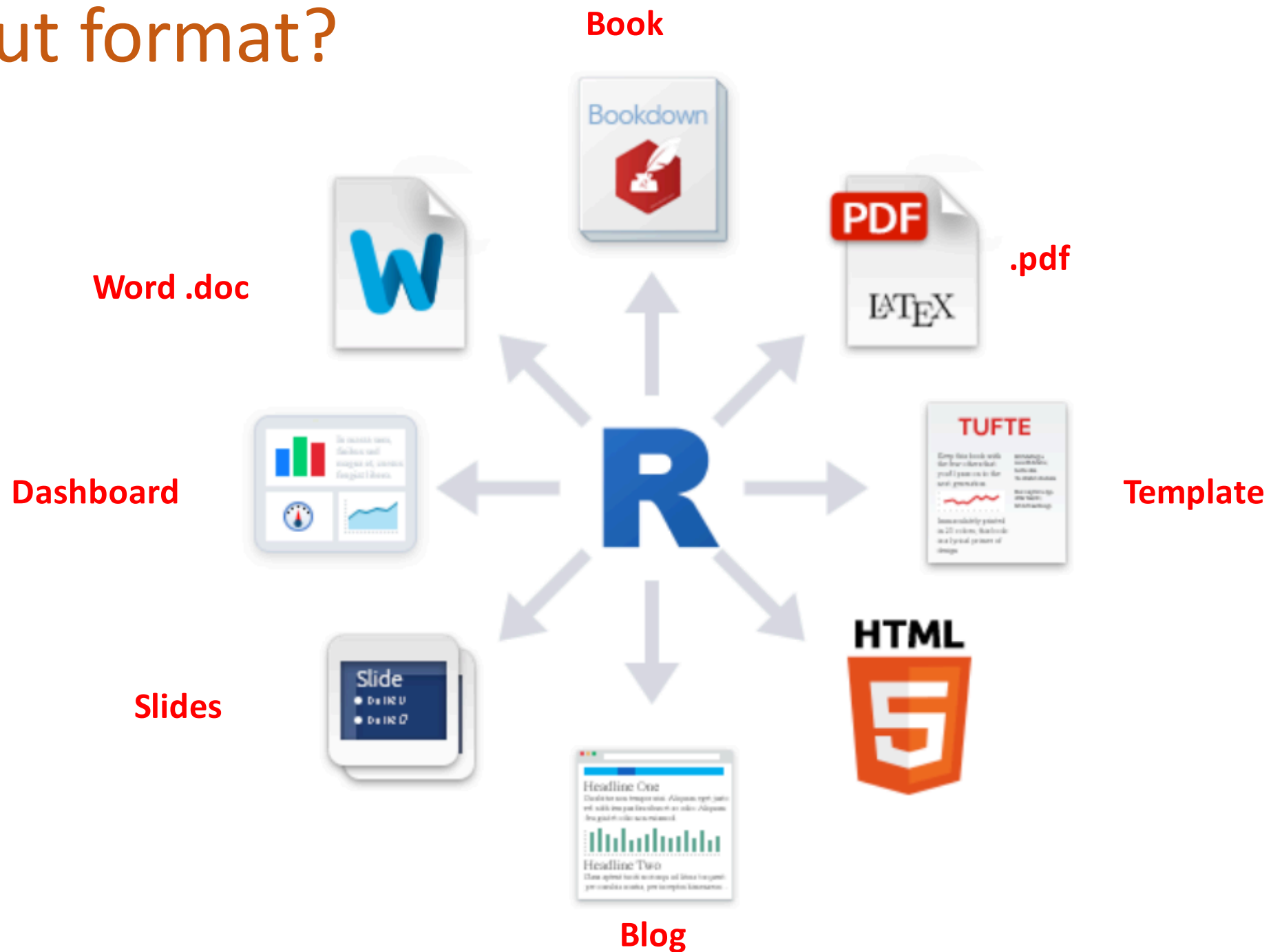
Pimp my .Rmd

- holtzy.github.io/Pimp-my-rmd/
- Everything is possible
- Use CSS and HTML code
- Add header and footer
- More

Sharing



Output format?



Share your analysis

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

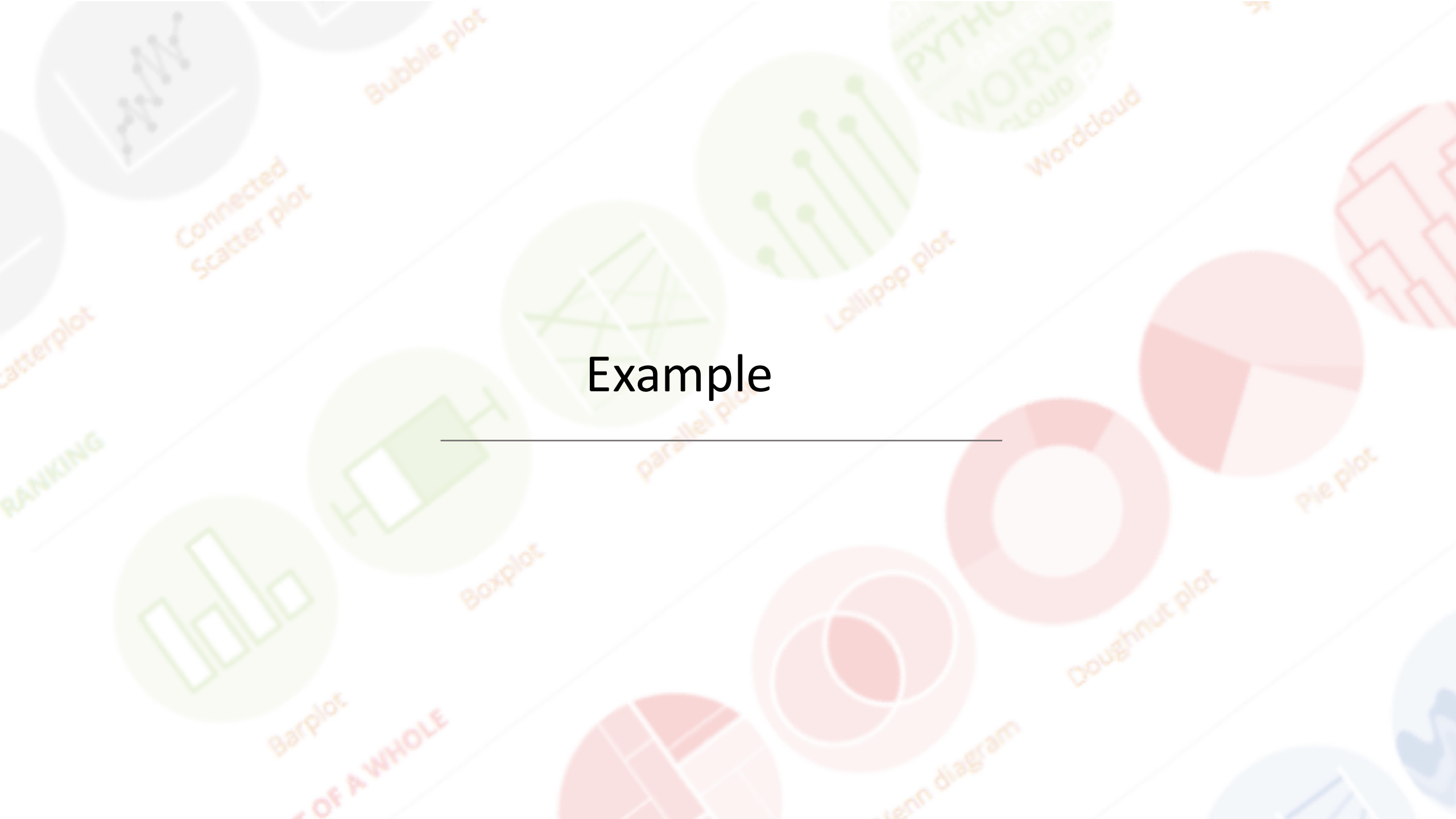


- Github: www.github.com



- 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

Cheat Sheet:

bit.ly/2AZySd9

Pimp my rmd:

bit.ly/2QDX7Hz



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[@R_Graph_Gallery](https://twitter.com/R_Graph_Gallery)



github.com/holtzy