

Reproducible science workshop: Module6

Markdown

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2021/10/1 (updated: 2022-06-27)

Credits

- Garrett Grolemund [RStudio webinar](#)



- Ulrik Lyngs [workshop material](#)



R MARKDOWN

we're getting the BAND BACK TOGETHER.

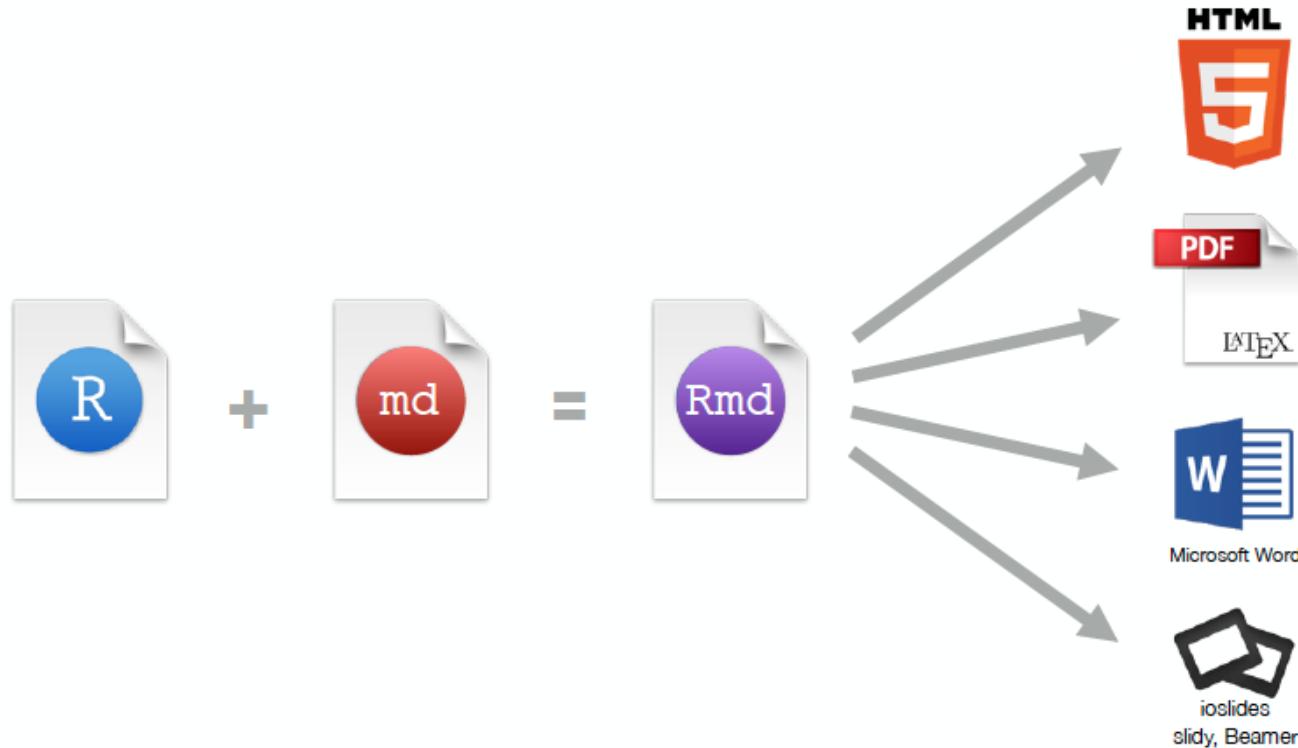


HORST '19

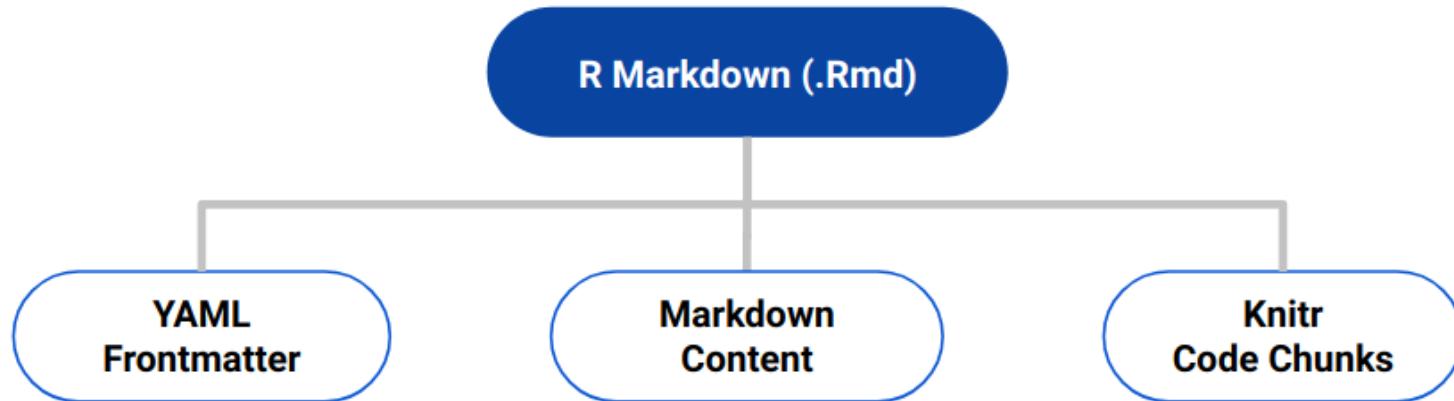
Literate programming

- A programming paradigm introduced by Donald E. Knuth
- Treat program as literature meant to be understandable to human beings
- Makes it easy to comment code, and share your analyses/thoughts with collaborators
- Move away from writing programs in the manner and order imposed by the computer
- Focus instead on the logic and flow of human thought and understanding
- Single document to integrate data analysis (executable code) with textual documentation, linking data, code, and text

R Markdown workflow



Structure of a R Markdown document



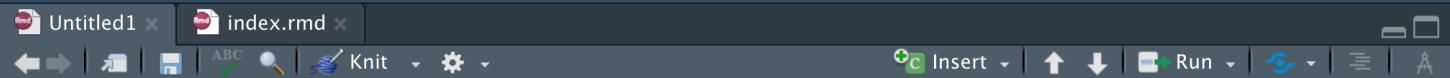
<https://yongfu.name/2019-fju-rmd-talk/slides/#1>

Demo

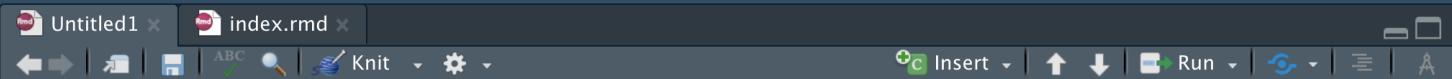
Open RStudio

Create a new Rmd file

Identify 3 components (frontmatter, content, chunks)



```
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 code chunk to prevent printing of the  
R code that generated the plot
```



```
1 ---  
2 title: "Untitled"  
3 author: "Olivier Gimenez"  
4 date: "10/24/2020"  
5 output: html_document  
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17  
18 ```{r cars}  
19 summary(cars)  
20```  
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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
```

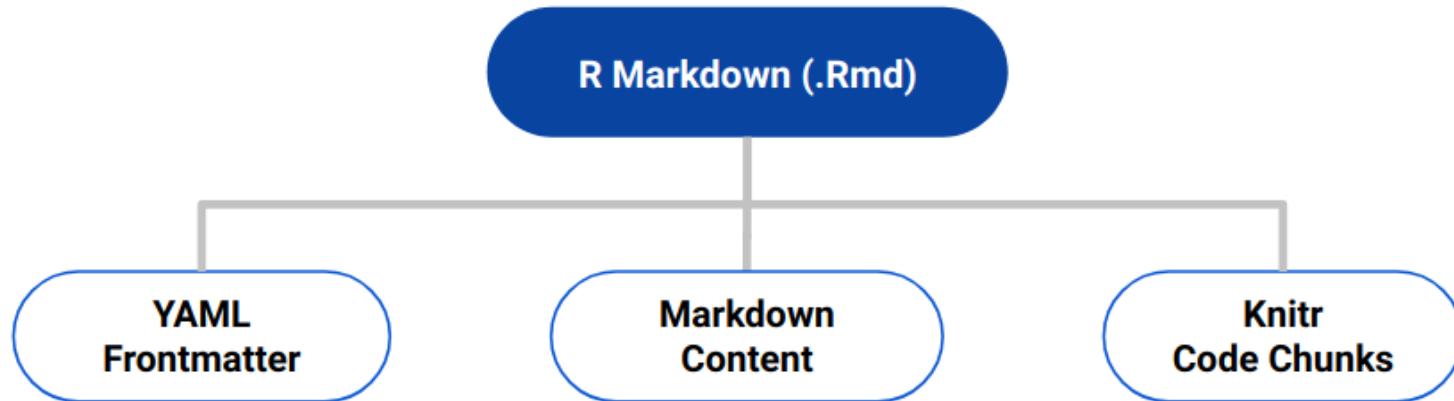
Front matter

Chunk

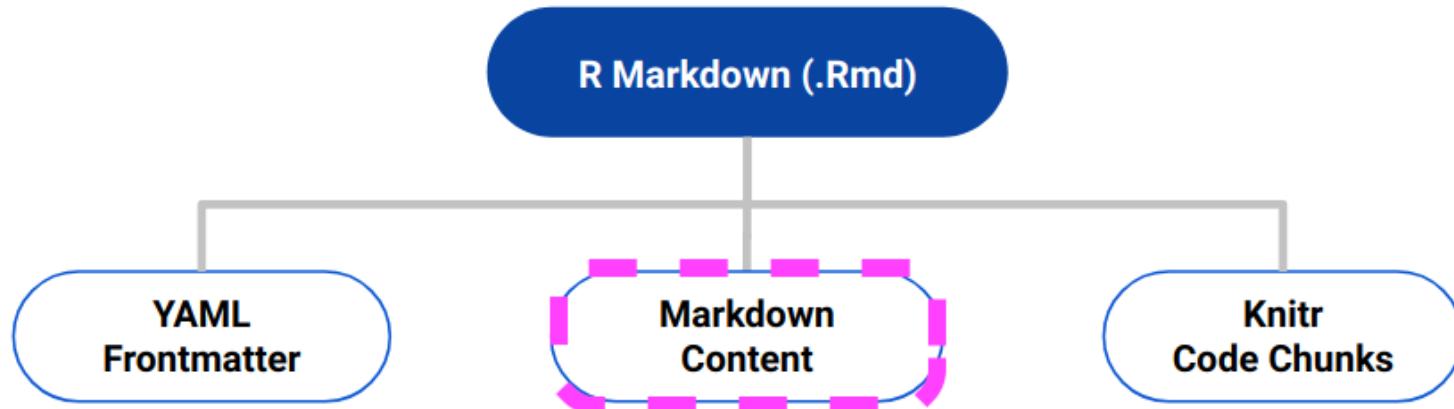
Content

Chunk

Structure of a R Markdown document



Structure of a R Markdown document



Format your text with Markdown

What is Markdown?

- A way to write stuff
- Mostly plain words, with some formating

```
# Say Hello  
To my little  
friend, markdown.
```

Markdown is

- * easy to use
- * simple
- * fun?



Say Hello

To my little friend, markdown.
Markdown is

- *easy* to use
- **simple**
- fun?

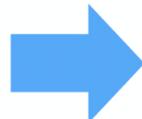
Websites that use Markdown

- GitHub <https://github.com/>
- StackOverflow <https://stackoverflow.com/>
- HackMD <https://hackmd.io>
- Many more

Headers

- Use # to create headers
- Multiple #'s create lower level headers

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



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

Text

- Text is rendered as plain text

Add two spaces at
the end of a line to
start a new line

Text
italics
bold
'code'



Text
italics
bold
code

Lists

- Use asterisks to make bullet points
- Use numbers to make numbered lists
- Use 4 spaces or 1 tab for indentation

Bullets

- * bullet 1
- * bullet 2

Numbered list

1. item 1
2. item 2



Bullets

- bullet 1
- bullet 2

Numbered list

1. item 1
2. item 2

Hyperlinks

- To add a hyperlink, put your text between brackets
- Then place the URL between parentheses

This is a
[link](www.git.com).



This is a link.

Equations

- Write equations with Latex syntax

According to
Einstein,
 $E=mc^2$



According to
Einstein, $E = mc^2$

Equation blocks

According to Einstein,

$\$\$E=mc^{\{2\}}\$\$$



According to Einstein,

$$E = mc^2$$

Images

- Use a link preceded by an ! to insert an image
- The link text should be
 - a URL if the image is hosted online
 - a file path if the image is saved on your computer

Tables

header A	header B
data	data

Table:title

- A bit of a hassle...
- Use a [generator of Tables for Markdown](#)
- Wait for next section to learn how to generate tables from R

R Markdown Reference Guide

<https://rstudio.com/wp-content/uploads/2015/03/rmarkdown-reference.pdf>



R Markdown Reference Guide

Learn more about R Markdown at rmarkdown.rstudio.com

Learn more about Interactive Docs at shiny.rstudio.com/articles

Contents:

1. **Markdown Syntax**
2. Knitr chunk options
3. Pandoc options

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

Becomes

Plain text

End a line with two spaces to start a new paragraph.

italics and *italics*

bold and **bold**

superscript²

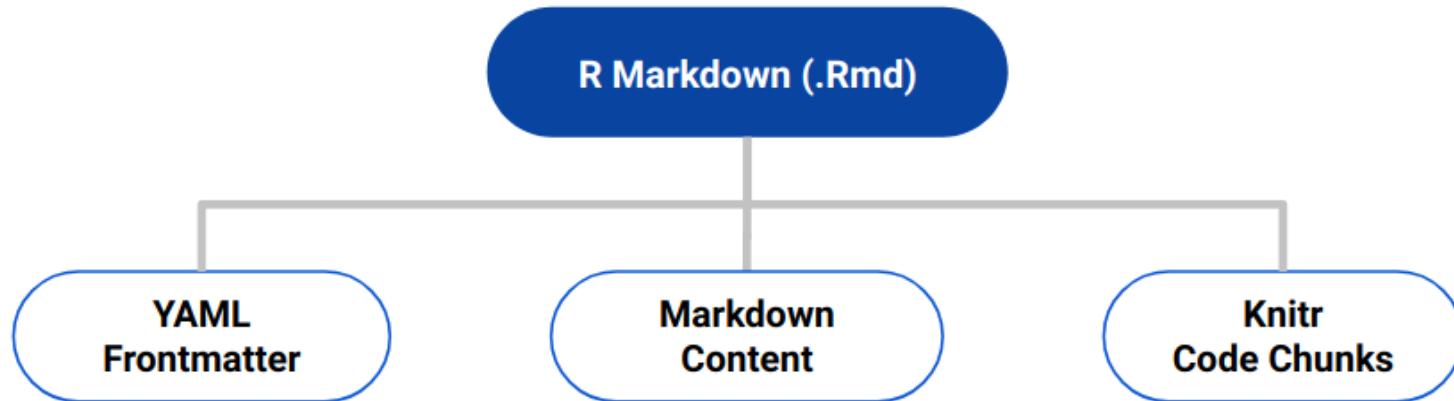
strikethrough

link

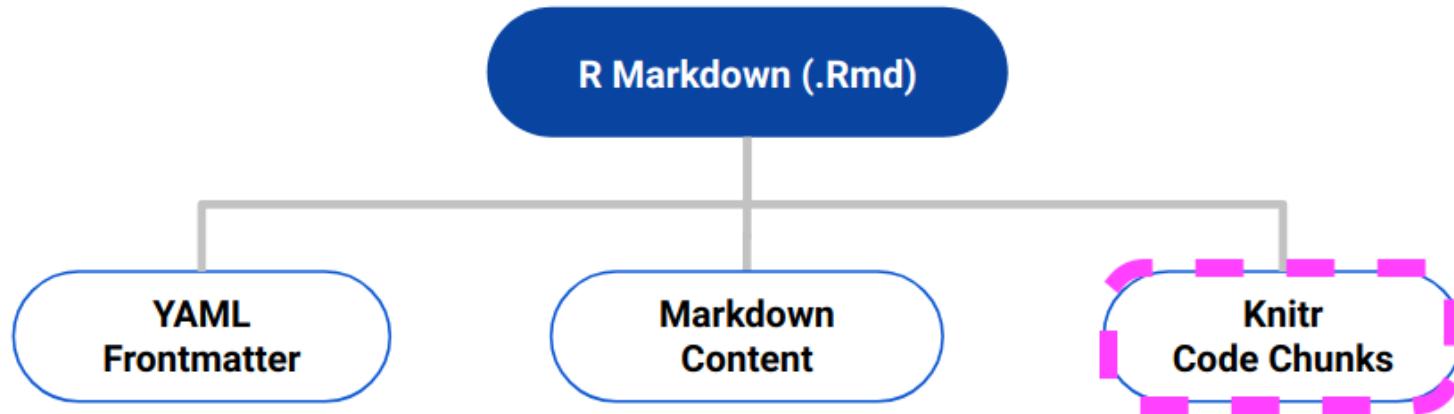
Header 1

Header 2

Structure of a R Markdown document



Structure of a R Markdown document



Code, figures and tables

Embed code

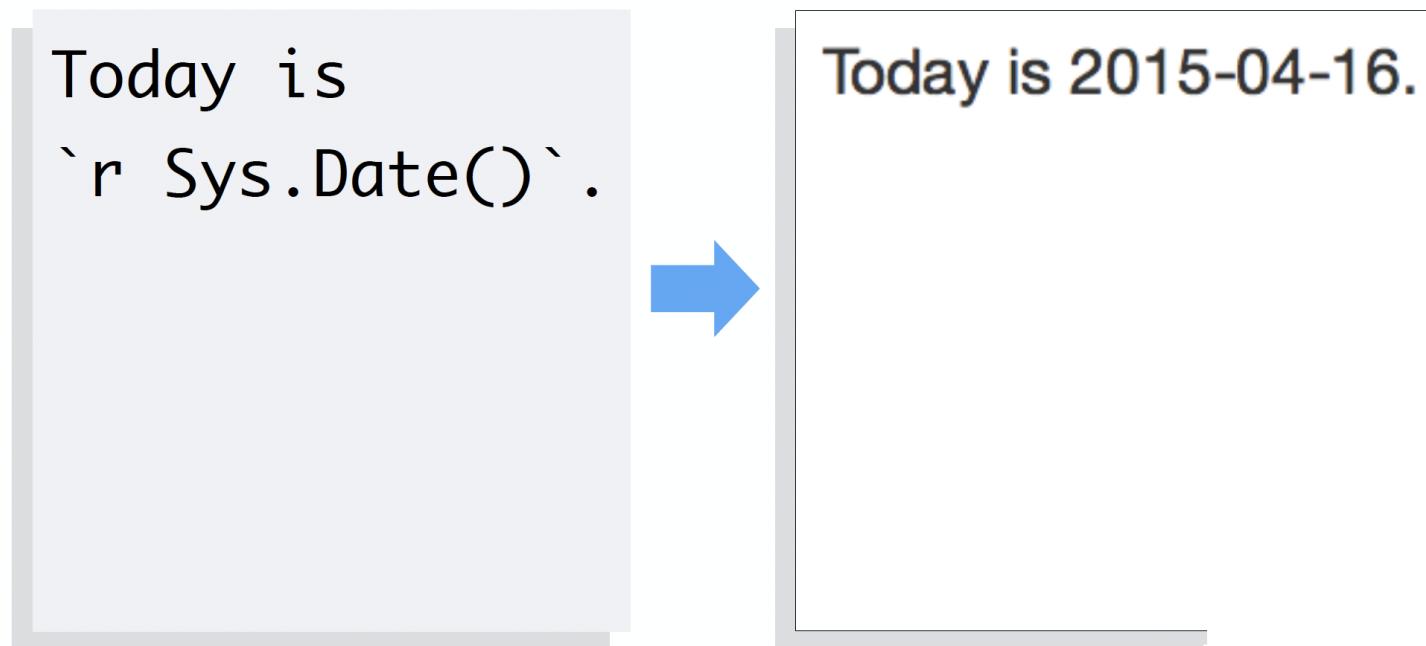
- Insert chunk of R code
- R Markdown runs code and includes results.

```
```{r}  
some code
```

```
```
```

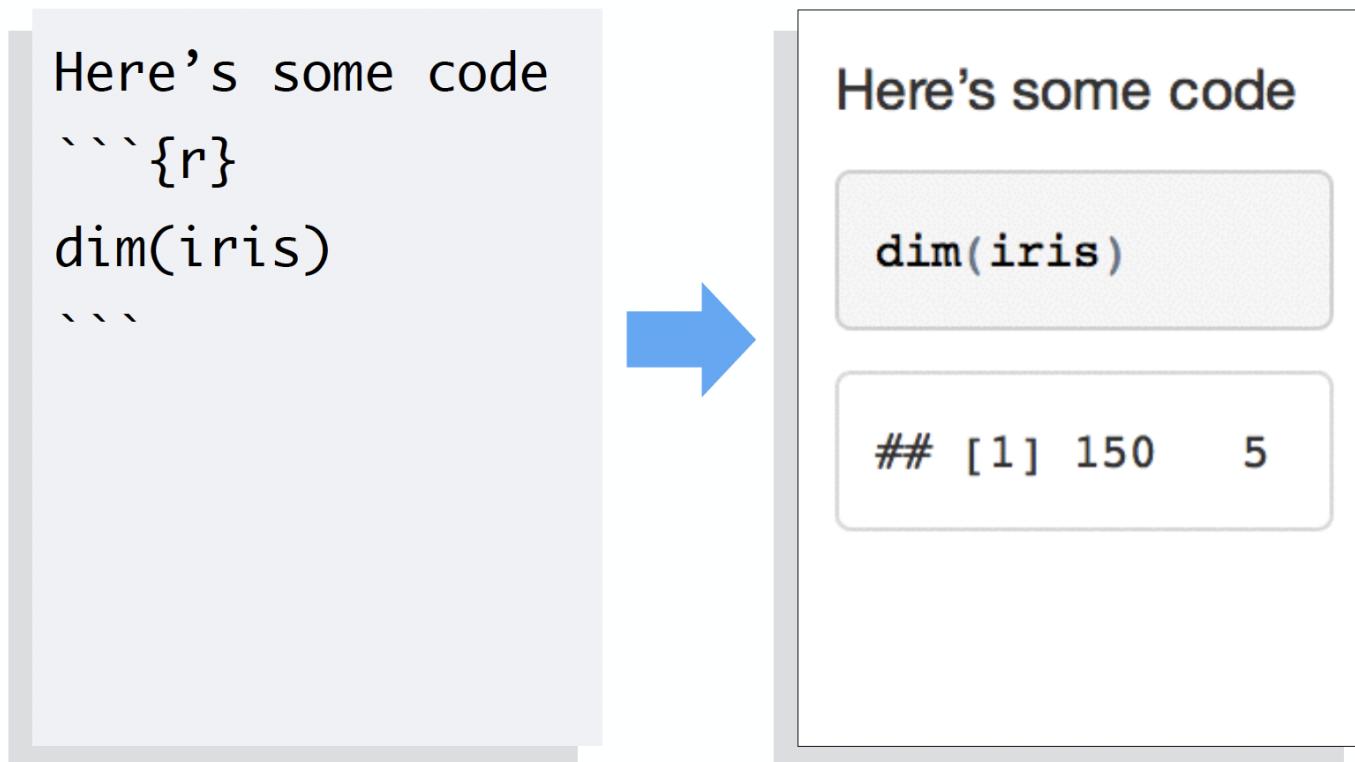
Inline code

- Place code in a sentence with
- R Markdown replaces code with results



Chunk options

- By default, R markdown includes both code and results



echo

- Add options between brackets after r.
- echo = FALSE hides code.

```
Here's some code  
```{r echo=FALSE}  
dim(iris)
```
```



Here's some code

```
## [1] 150 5
```

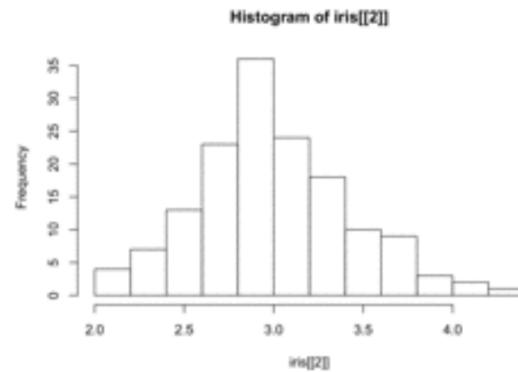
echo

- Add options between brackets after r.
- echo = FALSE hides code.

```
Here's a plot  
```{r echo=FALSE}  
hist(iris[[2]])
```
```



Here's a plot



eval

- eval = FALSE prevents code from being run
- No results is displayed, only code

Here's some code

```
```{r eval=FALSE}  
dim(iris)
```
```



Here's some code

```
dim(iris)
```

fig.height, fig.width

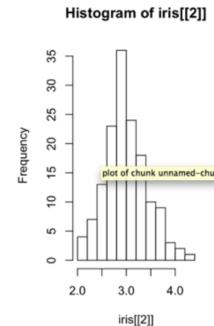
- Specify dimension of plots (in inches) with `fig.width` and `fig.height`
- Separate multiple arguments with commas.

Here's a plot

```
```{r echo=FALSE, fig.width=3, fig.height=5}
hist(iris[[2]])
```
```



Here's a plot



message

- message = FALSE prevents messages from appearing in output

```
Here's some code  
```{r message=FALSE}  
library(forecast)
```
```



```
Here's some code  
library(forecast)
```

Default chunk options

- Repeating chunk options can be painful
- If you have `echo = FALSE` in every single chunk, how to set the default chunk option to `echo = FALSE` ?
- Use `knitr::opts_chunk$set(echo = FALSE)`
- You may overwrite the default for each chunk
- For chunk options, check out <https://yihui.name/knitr/options/>

Cache time-consuming code chunks

- When you time-consuming calculations (simulations, Bayes stuff), and/or a looooong document
- Use `cache = TRUE` in all chunks or the chunk that takes long to compile
- Skip execution if executed before and nothing has changed since then
- If you do modifications to the cached chunk(s), previous cache will be automatically invalidated, and new cache is built

Including tables

```
# cars is a built-in-to-R data set of cars
# and their stopping distances
cars %>%
  head(5) %>%
  knitr::kable(format = "html", caption = "A kable table")
```

| A kable
table | |
|------------------|------|
| speed | dist |
| 4 | 2 |
| 4 | 10 |
| 7 | 4 |
| 7 | 22 |
| 8 | 16 |

- The `kable` package is often used with the `kableExtra` package
- A number of other packages are available for making pretty tables, see rmarkdown.rstudio.com

R Markdown Reference Guide

<https://rstudio.com/wp-content/uploads/2015/03/rmarkdown-reference.pdf>



R Markdown Reference Guide

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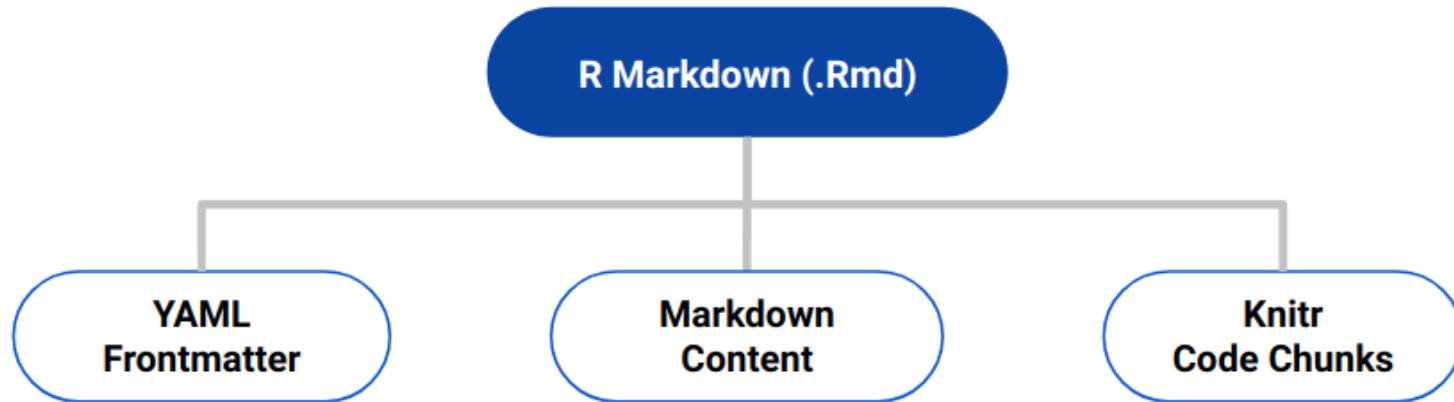
Learn more about Interactive Docs at shiny.rstudio.com/articles

Contents:

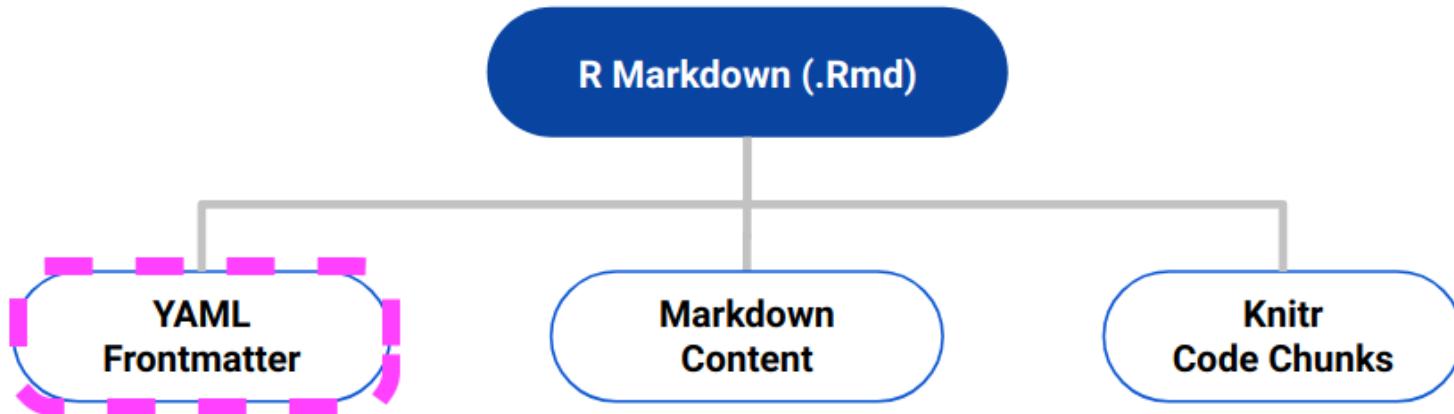
1. Markdown Syntax
- 2. Knitr chunk options**
3. Pandoc options

| Syntax | Becomes |
|---|---|
| <p>Make a code chunk with three back ticks followed by an r in braces. End the chunk with three back ticks:</p> <pre>```{r} paste("Hello", "World!") ```</pre> | <p>Make a code chunk with three back ticks followed by an r in braces. End the chunk with three back ticks:</p> <pre>paste("Hello", "World!")</pre>
<pre>## [1] "Hello World!"</pre> |
| <p>Place code inline with a single back ticks. The first back tick must be followed by an R, like this `r paste("Hello", "World!")`.</p> | <p>Place code inline with a single back ticks. The first back tick must be followed by an R, like this Hello World!.</p> |
| <p>Add chunk options within braces. For example, `echo=FALSE` will prevent source code from being displayed:</p> <pre>```{r eval=TRUE, echo=FALSE} paste("Hello", "World!") ```</pre> | <p>Add chunk options within braces. For example, <code>echo=FALSE</code> will prevent source code from being displayed:</p> <pre>## [1] "Hello World!"</pre> |

Structure of a R Markdown document



Structure of a R Markdown document

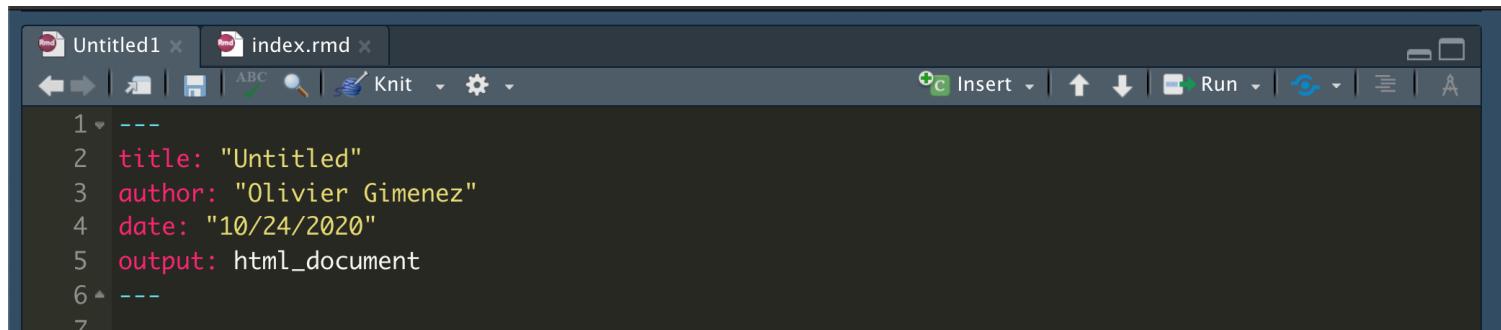


YAML Yet Another Markup Language

YAML in brief

- Contains the metadata of the document
- Starts and ends by three dashes
- Comes first in the document

Simplest example



The screenshot shows the RStudio interface with two tabs open: "Untitled1" and "index.rmd". The "index.rmd" tab is active, displaying the following R Markdown code:

```
1 ---  
2 title: "Untitled"  
3 author: "Olivier Gimenez"  
4 date: "10/24/2020"  
5 output: html_document  
6 ---  
7
```

The code includes YAML front matter with fields for title, author, date, and output type. The "output" field is set to "html_document". The code editor has a dark theme with syntax highlighting for R code.

Output formats

Untitled

Olivier Gimenez

10/25/2020

R Markdown

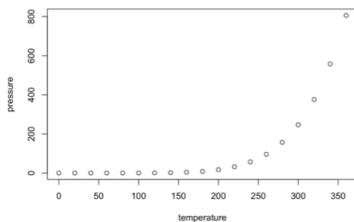
This is an R Markdown document. Markdown is a simple formatting syntax for authoring HTML, PDF, and MS Word documents. For more details on using R Markdown see <http://rmarkdown.rstudio.com>.

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



html

Untitled

Olivier Gimenez

10/25/2020

R Markdown

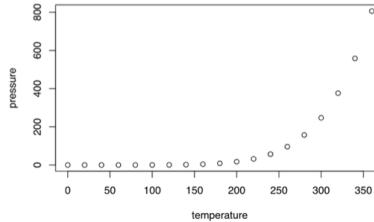
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```

Including Plots



pdf

Untitled

Olivier Gimenez

10/25/2020

R Markdown

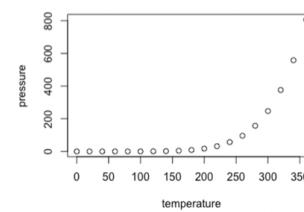
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## #> Median :15.0 Median : 36.00
## #> Mean   :15.4   Mean  : 42.98
## #> 3rd Qu.:19.0 3rd Qu.: 56.00
## #> Max.  :25.0  Max.  :120.00
```

Including Plots



docx

Knit

Output formats

Appearance and style

- In HTML output, you can use theme or a custom `.css` style sheet
- theme options (bootswatch.com) : “cerulean”, “journal”, “flatly”, “darkly”, “readable”, “spacelab”, “united”, “cosmo”, “lumen”, “paper”, “sandstone”, “simplex”, “yeti”
- You may also use LaTeX templates with R Markdown, and write [reproducible scientific paper](#)
- You can also [use Word templates in R Markdown](#) (see also [this short video](#))

Managing bibliography

1. Put references in a plain text file with the extension **.bib**, in **BibTex** format (my advice: use **Zotero**)

```
@article{Shea2014,  
  author = {Shea, Nicholas and Boldt, Annika},  
  journal = {Trends in Cognitive Sciences},  
  pages = {186–193},  
  title = {{Supra-personal cognitive control}},  
  volume = {18},  
  year = {2014},  
  doi = {10.1016/j.tics.2014.01.006},  
}
```

2. Reference this file in your YAML header

```
---  
title: "Citation test"  
bibliography: example.bib  
output: html_document  
---
```

Citations

3. In your text, citations go inside brackets and separated by semicolons

This...

Blah blah [@Shea2014;
@Lottridge2012].

turns into this...

Blah blah (Shea et al. 2014; Lottridge et al. 2012).

Citations

3. In your text, citations go inside brackets and separated by semicolons

This...

Blah blah [@Shea2014;
@Lottridge2012].

@Shea2014 says blah.

Blah blah [see @Shea2014, pp. 33-35;
also @Wu2016, ch. 1].

turns into this...

Blah blah (Shea et al. 2014; Lottridge et al. 2012).

Shea et al. (2014) says blah.

Blah blah (see Shea et al. 2014, 33–35; also Wu 2016, ch. 1).

Citations

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This...

Blah blah [@Shea2014;
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also @Wu2016, ch. 1].

turns into this...

Blah blah (Shea et al. 2014; Lottridge
et al. 2012).

Shea et al. (2014) says blah.

Blah blah (see Shea et al. 2014, 33–
35; also Wu 2016, ch. 1).

- Add e.g `csl: my-style.csl` in the YAML header to change to other formats
- Browse through and download styles at zotero.org/styles

Citations

For an easy way to insert citations, try the `citr` RStudio add-in.

R Markdown Reference Guide

<https://rstudio.com/wp-content/uploads/2015/03/rmarkdown-reference.pdf>



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Contents:

1. Markdown Syntax
2. Knitr chunk options
- 3. Pandoc options**

| Templates | Basic YAML | Template options | Latex options | Interactive Docs |
|-----------------------|----------------------------|-----------------------|-----------------------------|-----------------------|
| html_document | --- | --- | --- | --- |
| pdf_document | title: "A Web Doc" | title: "Chapters" | title: "My PDF" | title: "Slides" |
| word_document | author: "John Doe" | output: | output: pdf_document | output: |
| md_document | date: "May 1, 2015" | html_document: | fontsize: 11pt | slidy_presentation: |
| ioslides_presentation | output: md_document | toc: true | geometry: margin=1in | incremental: true |
| slidy_presentation | --- | toc_depth: 2 | --- | runtime: shiny |
| beamer_presentation | --- | --- | --- | --- |

Rmarkdown

TEXT. CODE. OUTPUT.
(GET IT TOGETHER, PEOPLE.)



What else can we reproduce with R Markdown?

Let's have a tour

R Markdown from R Studio

Get ▲

Gallery

Check out the range of outputs and formats you can create using R Markdown.

Documents

With R Markdown, you write a single .Rmd file and then use it to render finished output in a variety of forms.

Great NYT Interactive -- Now Reusable with rCharts

Disclaimer and Attribution

Content available via this interface, which is a derivative of the original interactive newsroom. All credit belongs to the original author(s) and publisher(s). © The New York Times. This article is published exclusively in an independently-formatted approach by the author(s) to the digital journalism ecosystem.

Another Interactive from NYT

Content available via this interface, which is a copy of the original interactive newsroom. © The New York Times. This article is published exclusively in an independently-formatted approach by the author(s) to the digital journalism ecosystem.



Scott Murrey



The New York Times

Use the [NYT API](#) to reuse this interactive easily. It's now available in JSON and CSV formats.

Link to source

A Pandoc Markdown Article Starter and Template*

Steven Y. Miller

Connectivity

This document generates an article in R Markdown, aspire for its benefits, and presents a sample manuscript template intended for its academic audience. I include basic syntax to R Markdown and a minimal working example of how the `knitr` and `knitcitations` packages can be utilized within R to cite the `knitr` package.

Keynote pending, citations, knitr

Introduction

Academic writing, especially in political science, is an oxymoron. The American Journal of Political Theory (AJPT) demands a rigorously “drier than water” academic style while academic scholars are notoriously scrappy in publications as the journal must hand over the raw code and data that produced the results shown in the manuscripts. The *ajpt* class in AJPT then re-produces the text from the manuscript. Pending successful publication, the manuscript moves toward publication. The *ajpt* copyright at the time of this manuscript, and it is likely the most aggressive requiring political science journals, but other journals in one field have lagged; the print *Duke Law & Politics* demands *double-blind* reviews. Thus, as a bare minimum, requests updating code from open-source generated published articles to one-line directives housed by the author(s) or its services like GitHub.

Below are workflow suggestions to the LaTeX codebase in `ajpt`. Political science, for the

R Markdown

This is an R Markdown
HTML, PDF, and MS Word
[Download](#)

What you click the `Knit`
button for the purpose of an
HTML code block like this:

`shinyapp(yaml)`
or `spinr(yaml)`,
or `MS(yaml)`,
or `Latex(yaml)`,
or `MSWord(yaml)`,
or `PDF(yaml)`,
or `MS(yaml)`,
or `MSWord(yaml)`,
or `PDF(yaml)`,
or `MS(yaml)`,
or `MSWord(yaml)`,
or `PDF(yaml)`.

Including Plots

You can also embed the

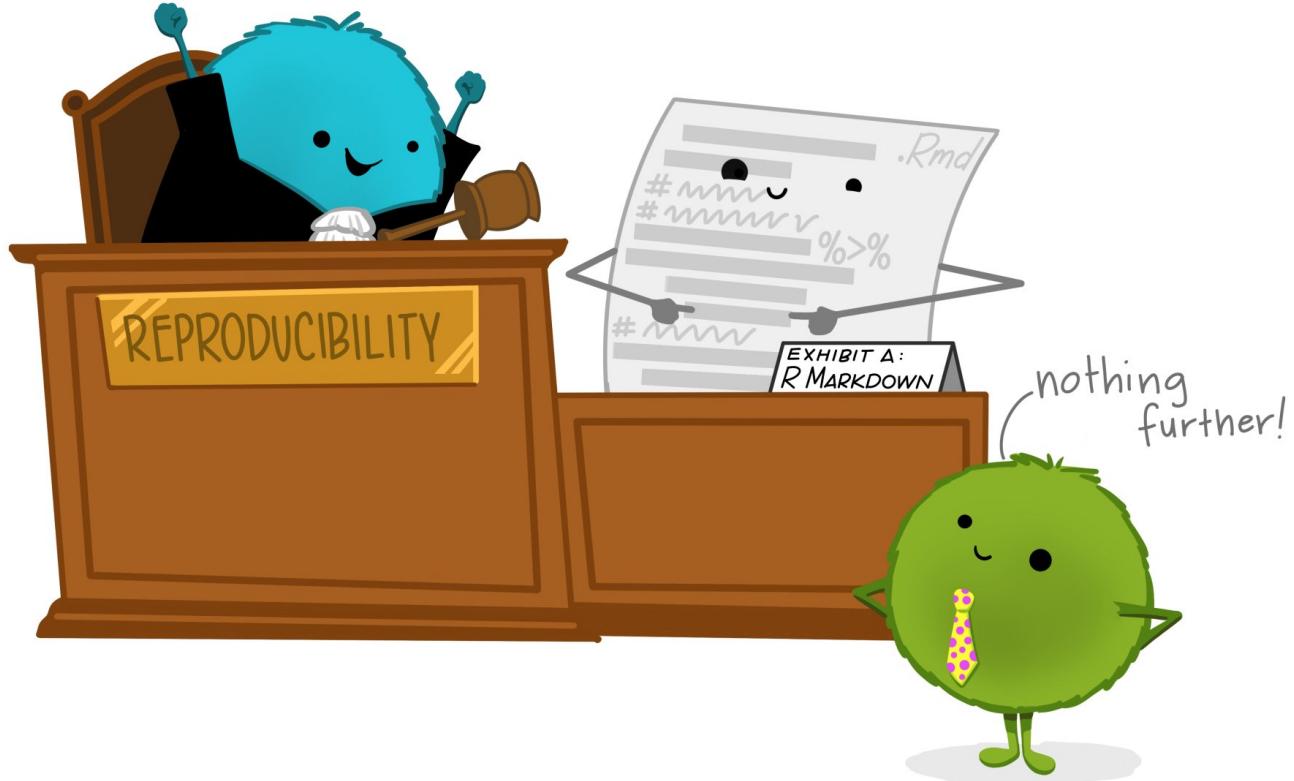
R Markdown gallery <https://rmarkdown.rstudio.com/gallery.html>

Websites

- Use package `blogdown` <https://bookdown.org/yihui/blogdown/>
- Customize with Hugo <https://themes.gohugo.io/>
- Deploy via GitHub pages or Netlify
- See a video tutorial [here](#)

Reproducibility and collective work

- How to work with Word using `redoc`: generate a Word document, revise the Word document, and convert the revised Word document back to R Markdown
- How to collaborate on Rmd documents with [Google Drive](#).



@allison_horst

To go further

Books

Thank you for listening!

Any questions now or email me at dossa@xtbg.org.cn

Slides created via the R package [xaringan](#).

The chakra comes from [remark.js](#), [knitr](#), and R Markdown.