

Reproducible science workshop: Module6

Markdown

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Updated on 2023-11-12 (created on 2021-09-13)

Credits

- Garrett Grolemund [RStudio webinar](#)



- Ulrik Lyngs [workshop material](#)



R MARKDOWN

we're getting the BAND BACK TOGETHER.

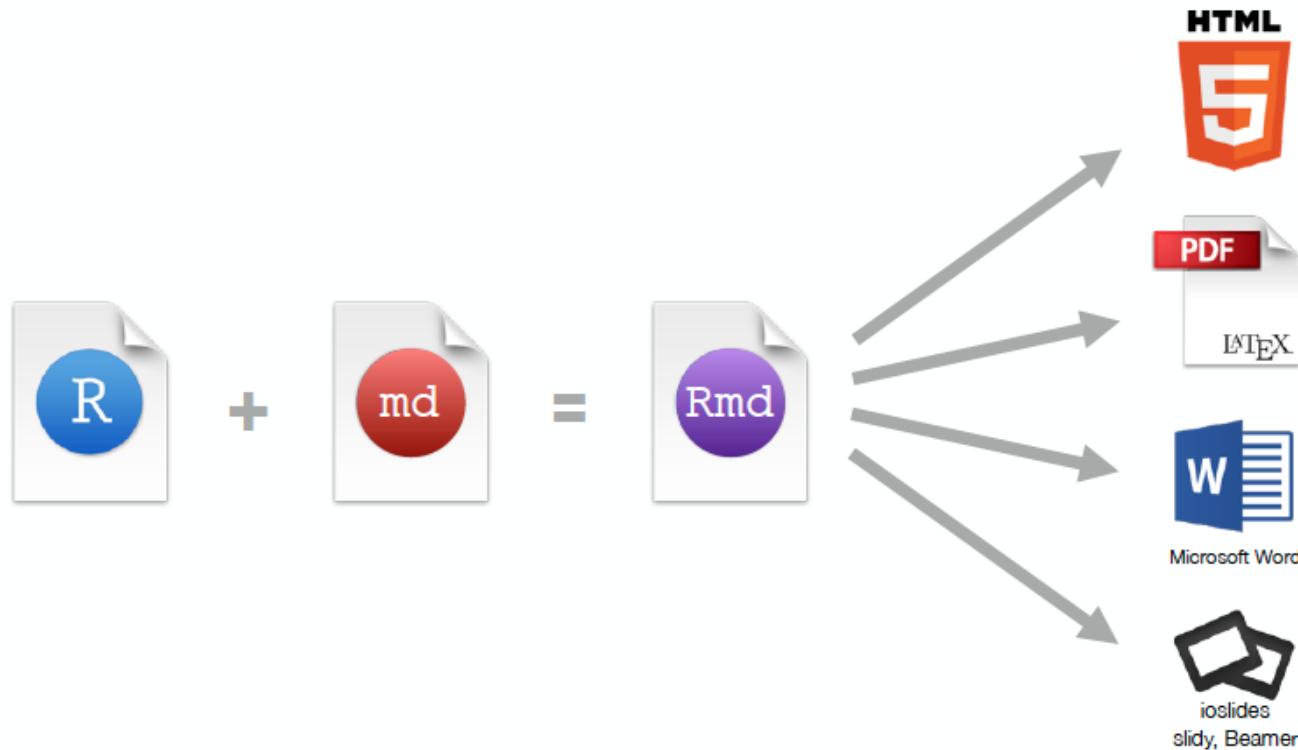


HORST '19

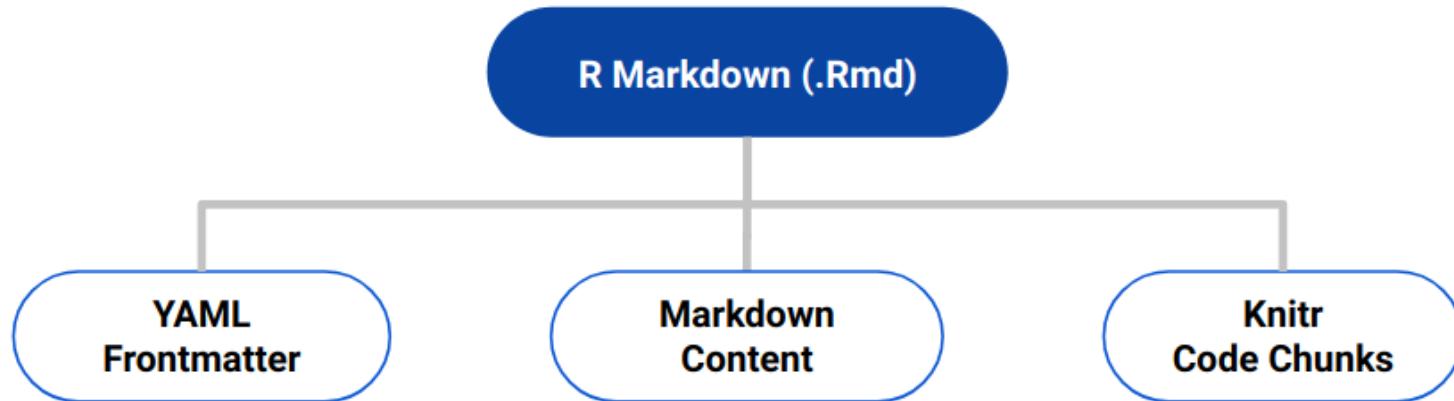
Literate programming

- 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



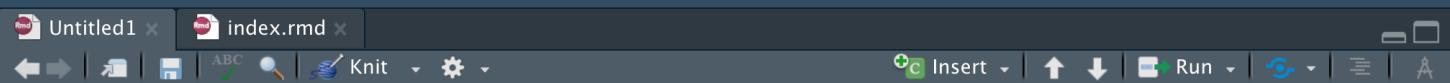
<https://yongfu.name/2019-fju-rmd-talk/slides/#1>

Demo

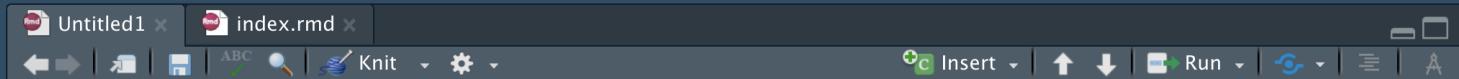
Open RStudio

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  
6 ---  
7  
8 ```{r setup, include=FALSE}  
9 knitr::opts_chunk$set(echo = TRUE)  
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12 ## R Markdown  
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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
```

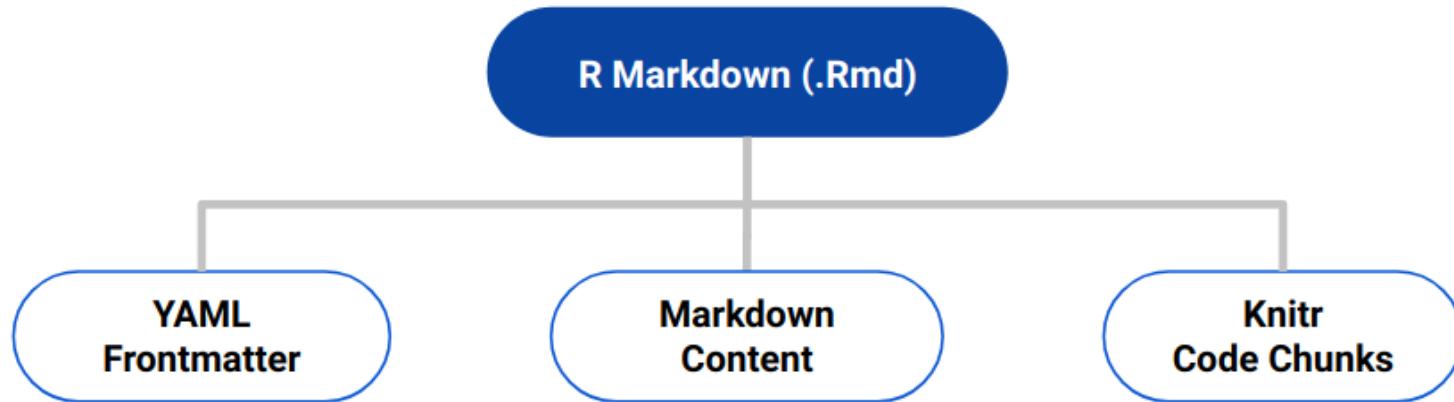
Front matter

Chunk

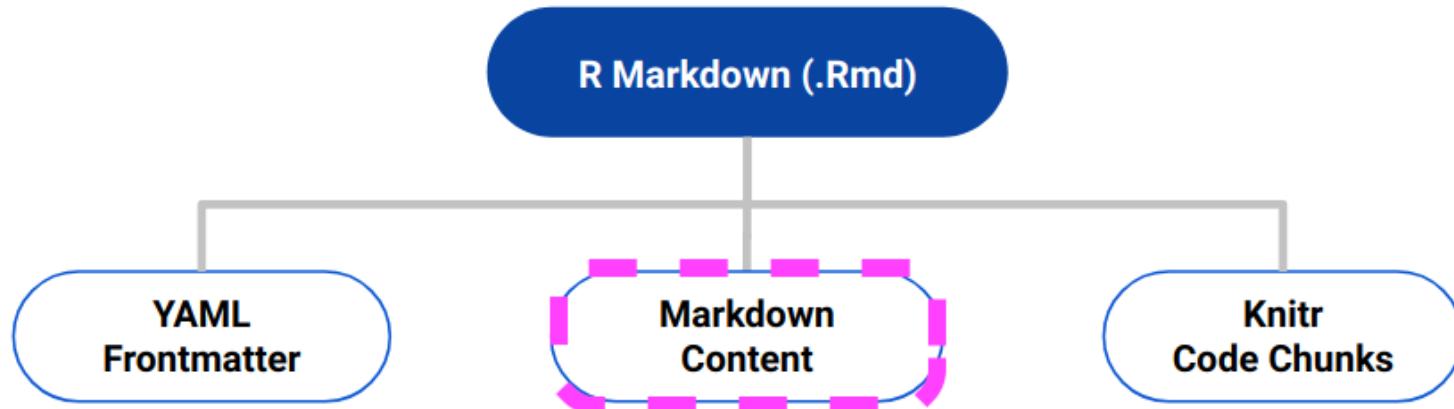
Content

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).

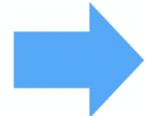


This is a link.

Equations

- Write equations with Latex syntax

According to
Einstein,
 $E=mc^2$

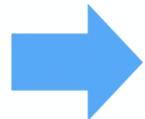


According to
Einstein, $E = mc^2$

Equation blocks

According to Einstein,

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



According to Einstein,

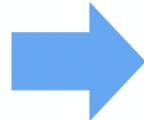
$$E = mc^2$$

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

``

The RStudio logo.



The RStudio logo.

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

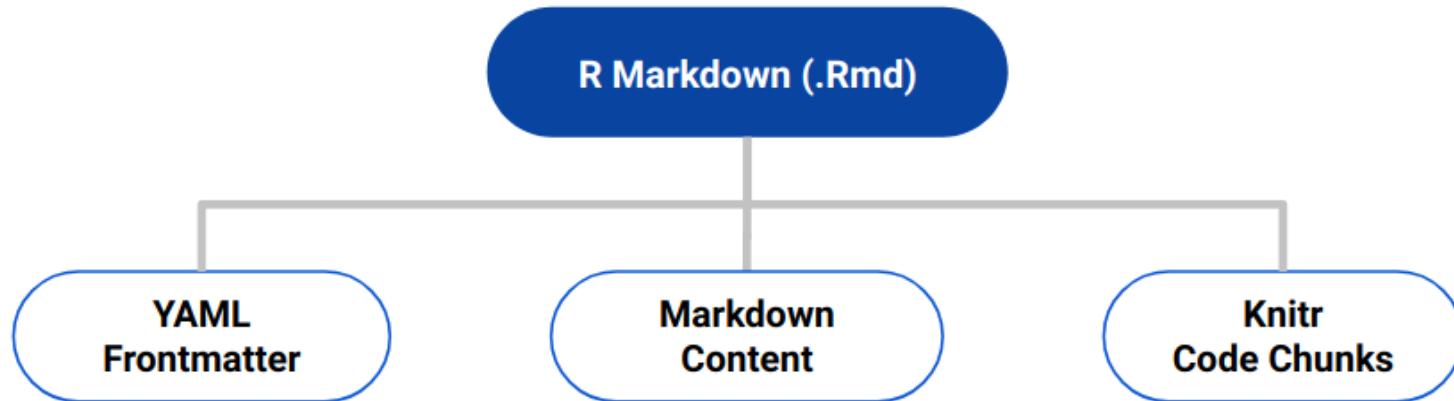
strikethrough

link

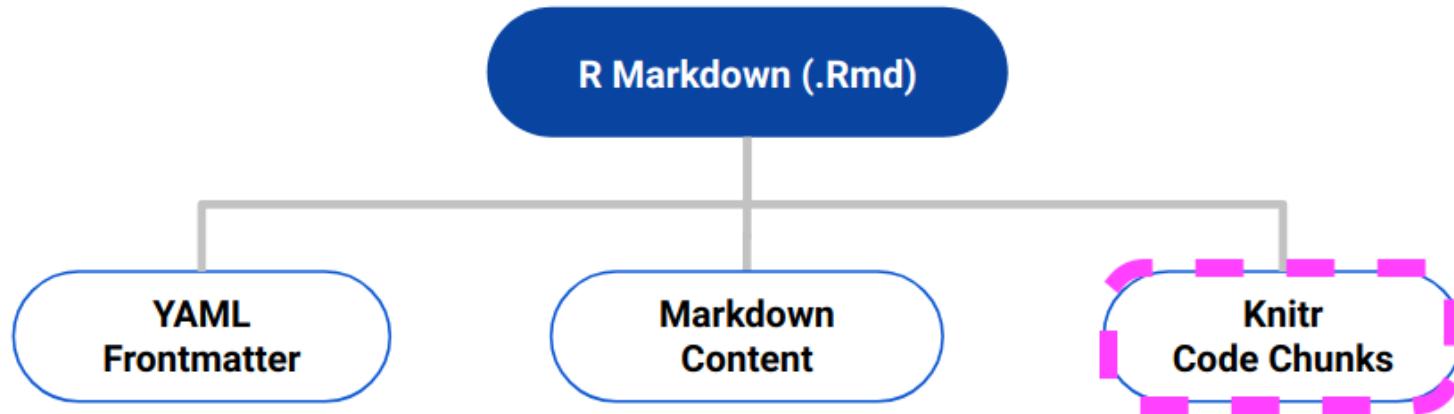
Header 1

Header 2

Structure of a R Markdown document



Structure of a R Markdown document



Code, figures and tables

Embed code

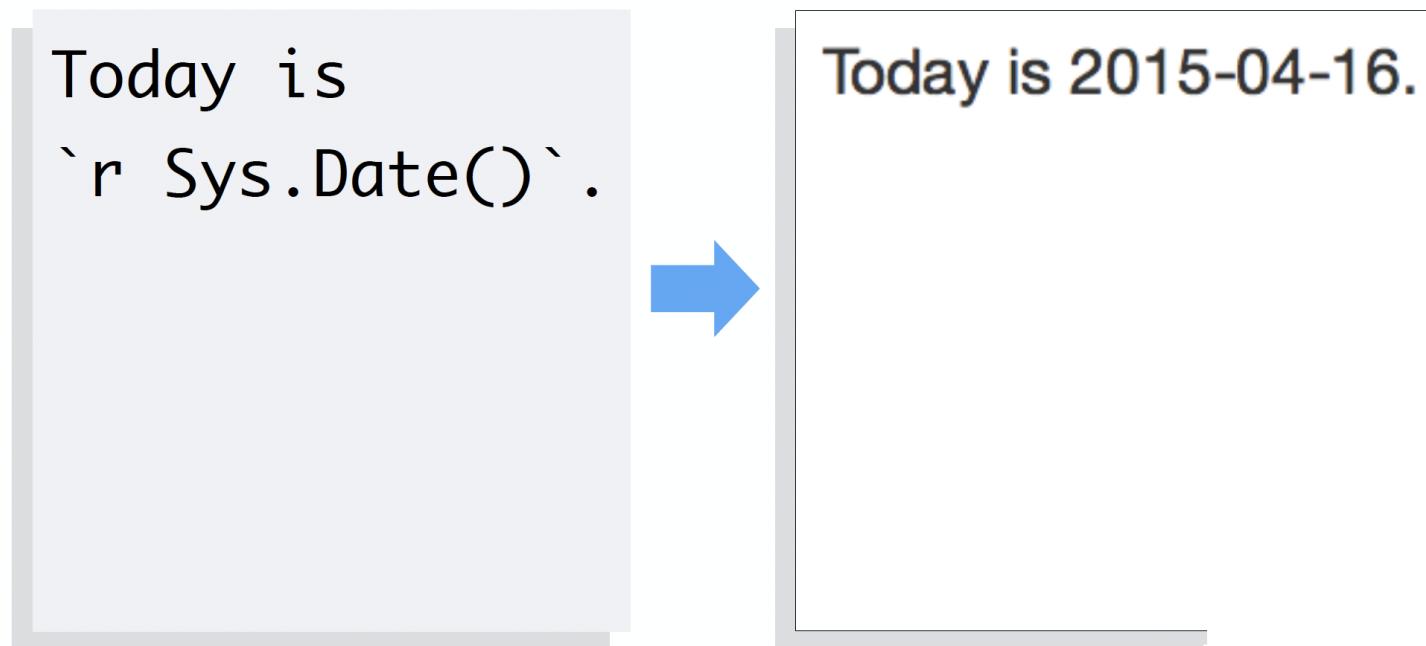
- Insert chunk of R code
- R Markdown runs code and includes results.

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

```
```
```

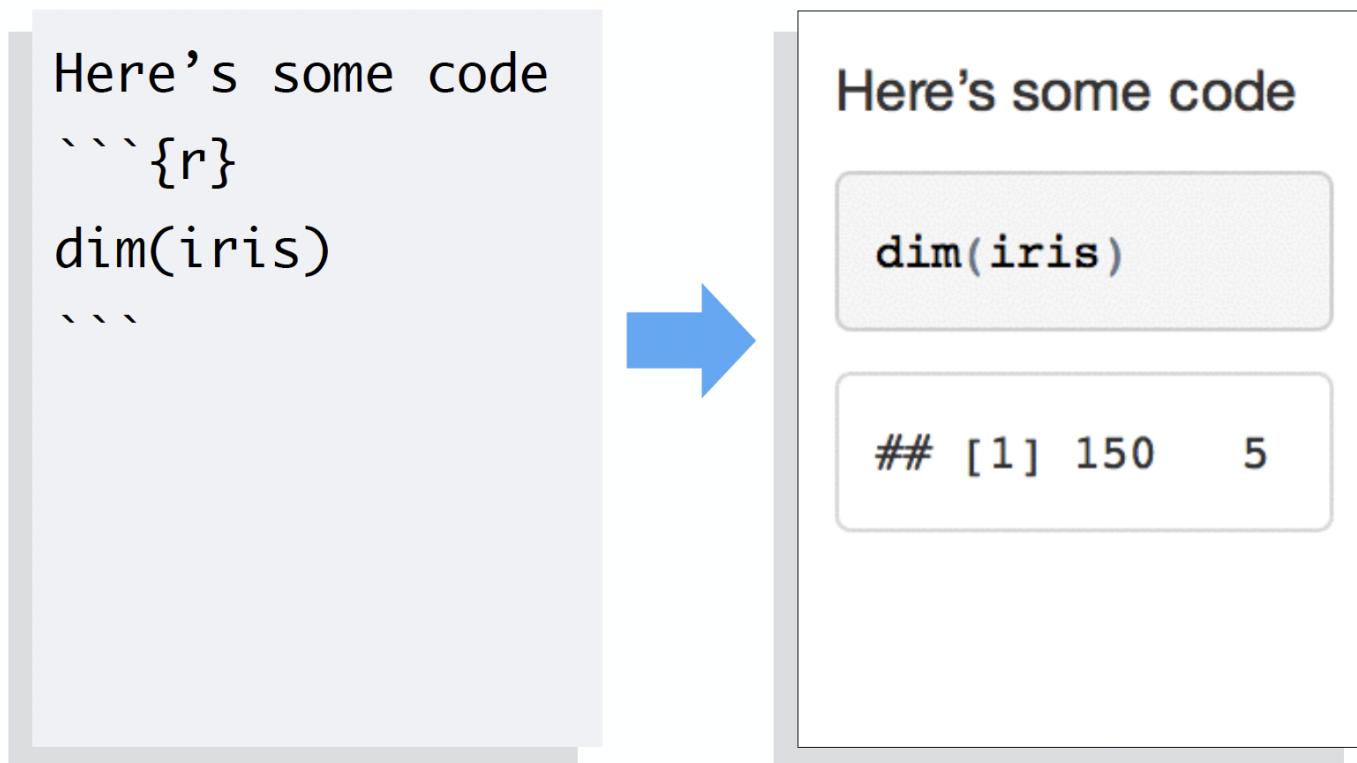
Inline code

- 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)
```
```



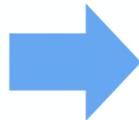
Here's some code

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

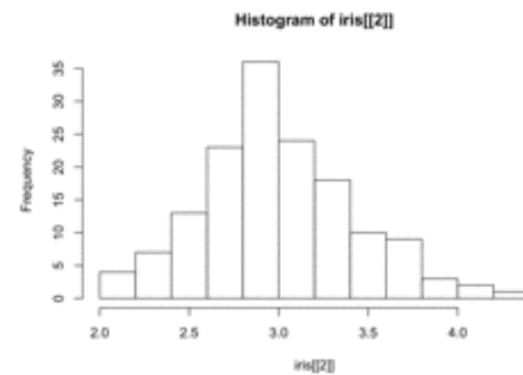
echo

- 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

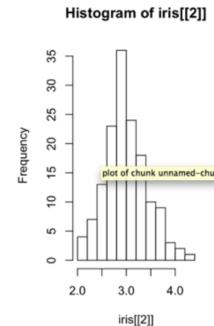
- Specify dimension of plots (in inches) with `fig.width` and `fig.height`
- Separate multiple arguments with commas.

Here's a plot

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



Here's a plot



message

message= TRUE

- message = TRUE allows messages to appear in output

```
library(ape)
```

```
##  
## Attaching package: 'ape'  
  
## The following object is masked from 'package:dplyr':  
##  
##     where
```

message

message= FALSE

- message = FALSE prevents messages appearing in output

```
library(ape)
```

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>



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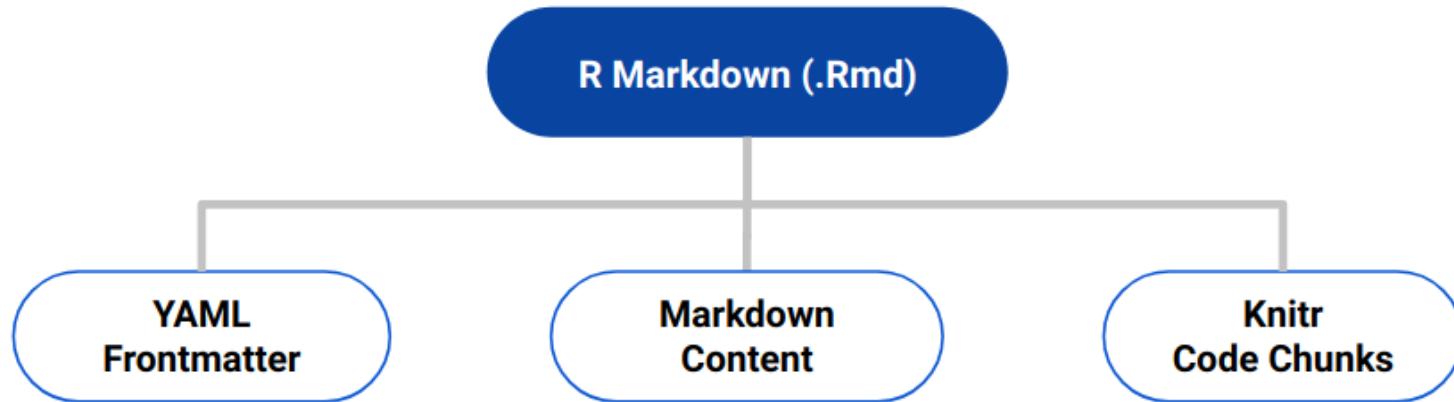
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Contents:

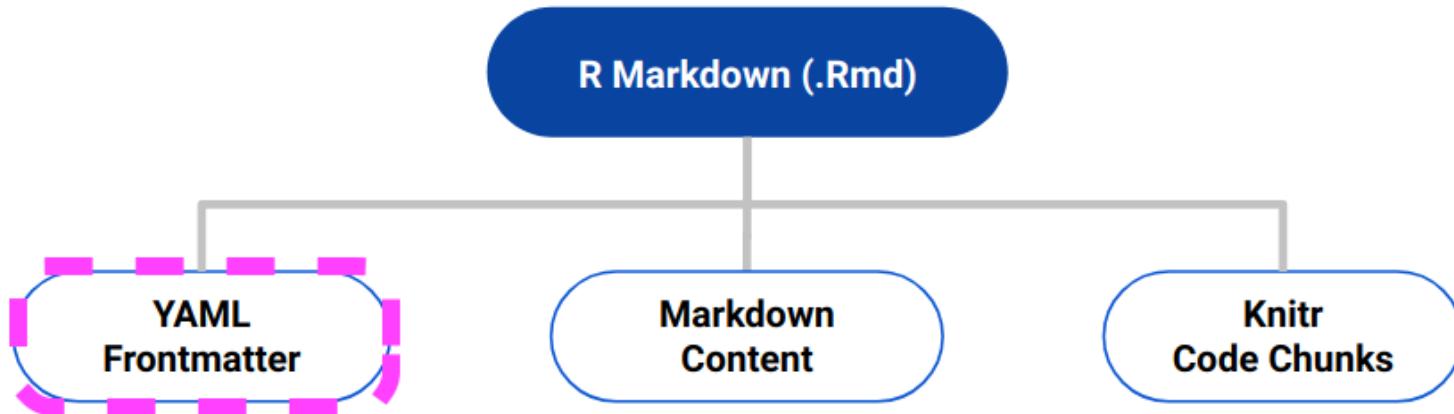
1. Markdown Syntax
- 2. Knitr chunk options**
3. Pandoc options

| 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

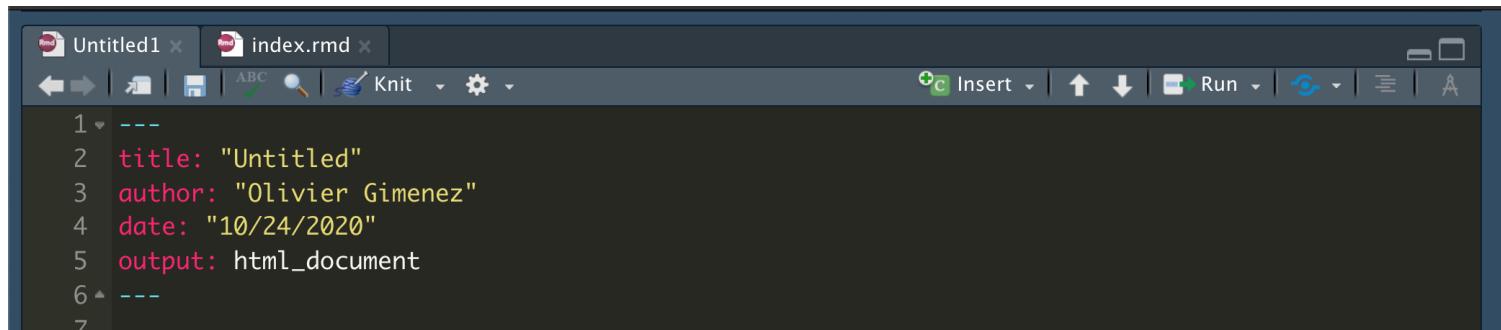


YAML Yet Another Markup Language

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. The code in the editor is:

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

The interface includes a toolbar with icons for back, forward, search, and knit, along with standard window controls.

Output formats

Untitled

Olivier Gimenez

10/25/2020

R Markdown

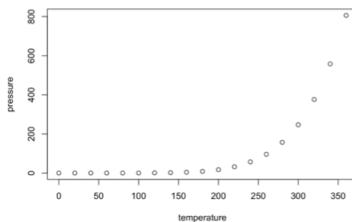
This is an R Markdown document. Markdown is a simple formatting syntax for authoring HTML, PDF, and MS Word documents. For more details on using R Markdown see <http://rmarkdown.rstudio.com>.

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

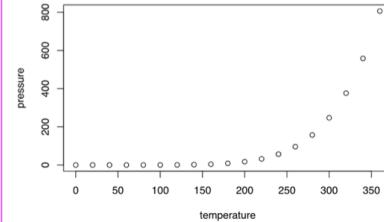
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## #> Mean   :15.4  Mean   : 42.98
## #> 3rd Qu.:19.0  3rd Qu.: 56.00
## #> Max.  :25.0  Max.  :120.00
```

Including Plots



pdf

Untitled

Olivier Gimenez

10/25/2020

R Markdown

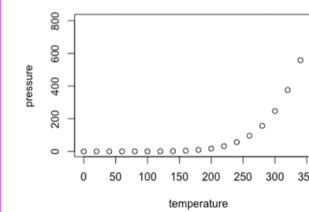
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## #> Mean   :15.4  Mean   : 42.98
## #> 3rd Qu.:19.0  3rd Qu.: 56.00
## #> Max.  :25.0  Max.  :120.00
```

Including Plots

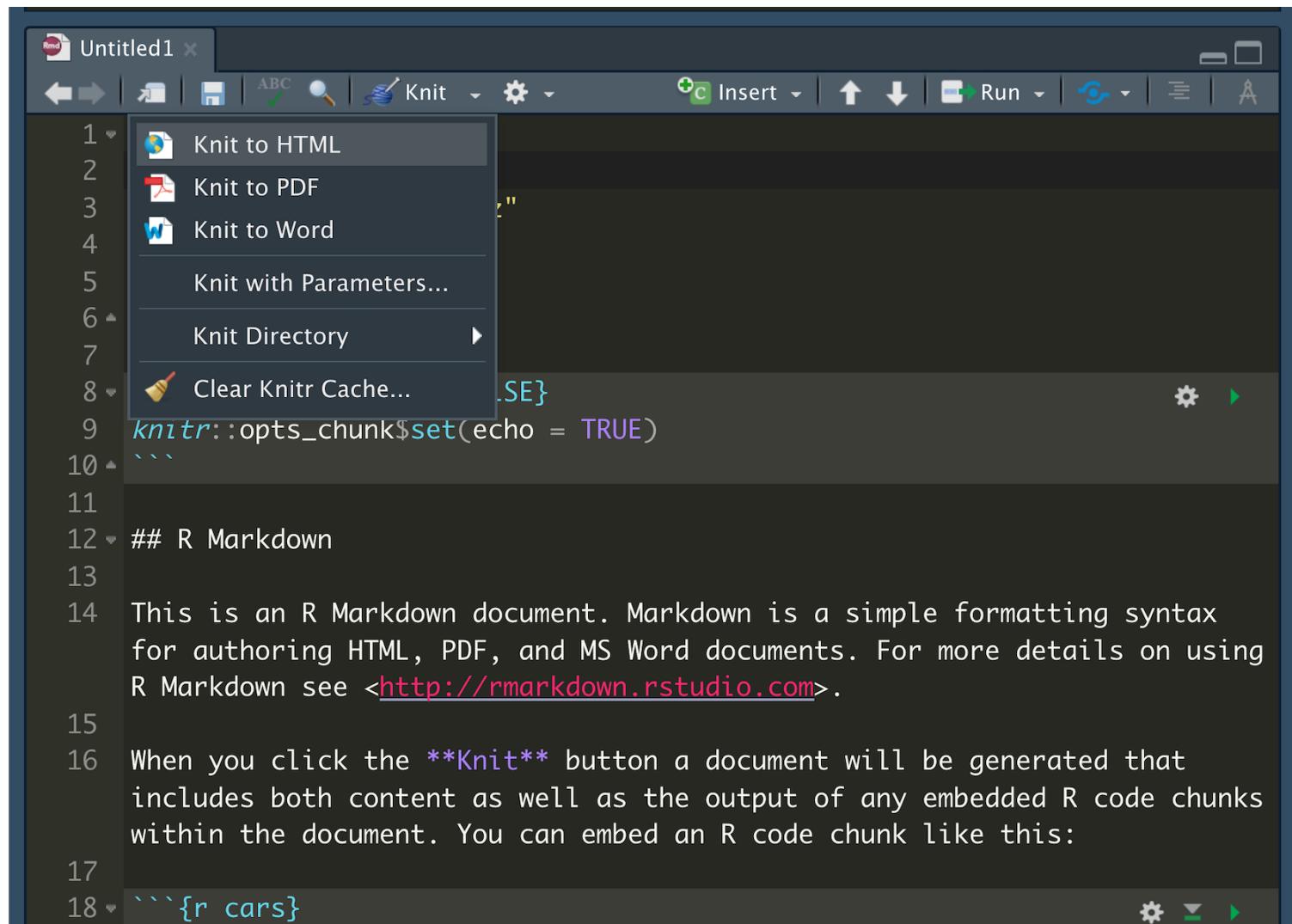


docx

Knit



Output formats



The screenshot shows the RStudio interface with the title bar "Untitled1". The "Knit" button in the toolbar is highlighted. A dropdown menu is open under the "Knit" button, listing options: "Knit to HTML", "Knit to PDF", "Knit to Word", "Knit with Parameters...", "Knit Directory", and "Clear Knitr Cache...". The "Knit to HTML" option is currently selected. Below the dropdown, the R Markdown code editor displays the following content:

```
1 Knit to HTML
2 Knit to PDF
3 Knit to Word
4 Knit with Parameters...
5 Knit Directory
6 Clear Knitr Cache...
7
8 knitr::opts_chunk$set(echo = TRUE)
9 ``
10
11
12 ## R Markdown
13
14 This is an R Markdown document. Markdown is a simple formatting syntax
15 for authoring HTML, PDF, and MS Word documents. For more details on using
16 R Markdown see <http://rmarkdown.rstudio.com>.
17
18 When you click the **Knit** button a document will be generated that
19 includes both content as well as the output of any embedded R code chunks
20 within the document. You can embed an R code chunk like this:
21
22 ``{r cars}
```

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 (People's advice: use [Zotero](#), my own advice use [Mendeley](#))

```
@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

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

This...

Blah blah [@Shea2014;
@Lottridge2012].

@Shea2014 says blah.

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also @Wu2016, ch. 1].

turns into this...

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

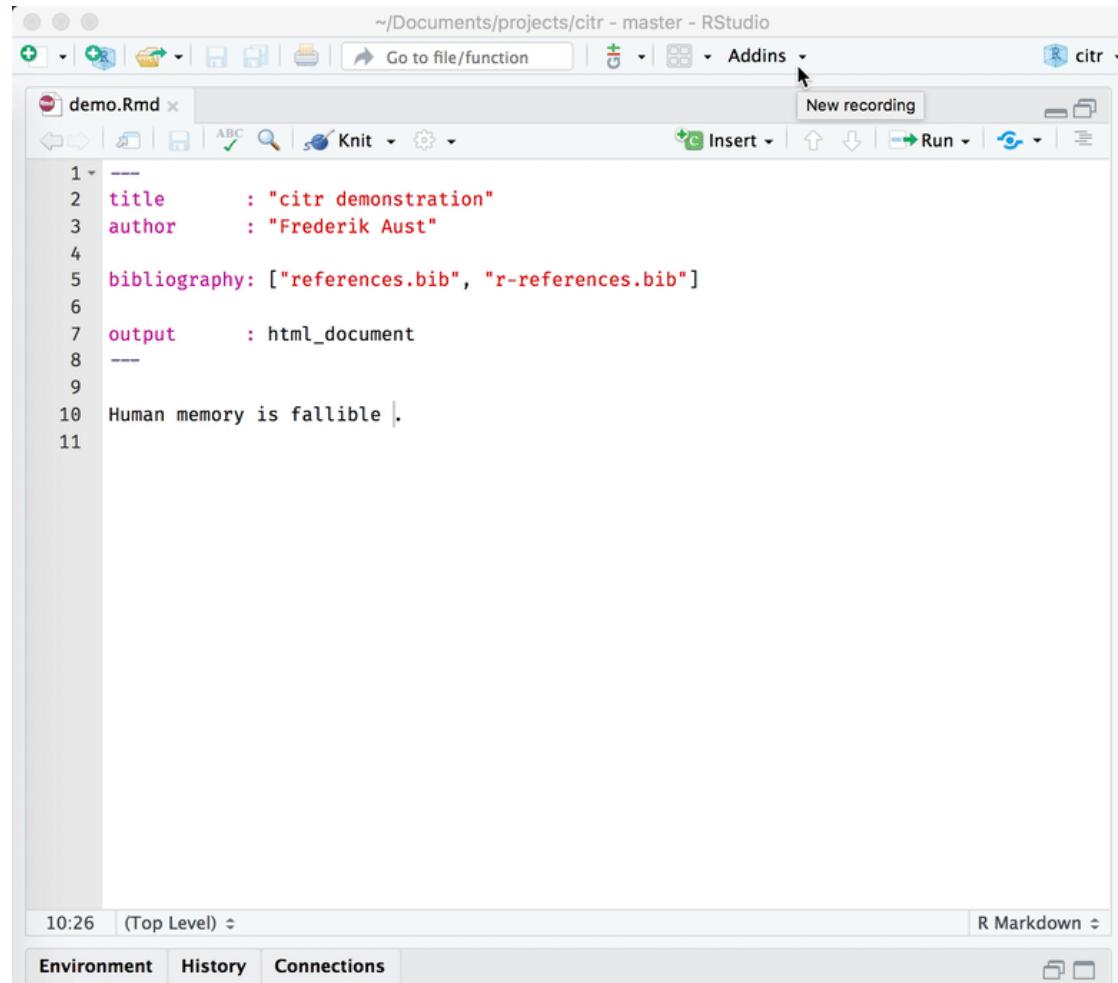
Shea et al. (2014) says blah.

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.

A screenshot of the RStudio interface. The title bar says "~/Documents/projects/citr - master - RStudio". The main window shows an R Markdown file named "demo.Rmd" with the following content:

```
1 ---  
2 title      : "citr demonstration"  
3 author     : "Frederik Aust"  
4  
5 bibliography: ["references.bib", "r-references.bib"]  
6  
7 output      : html_document  
8 ---  
9  
10 Human memory is fallible |.  
11
```

The toolbar has various icons for file operations, search, and knit. The "Addins" button is highlighted with a cursor. The status bar at the bottom left shows "10:26 (Top Level)" and "R Markdown".

1 ---
2 title : "citr demonstration"
3 author : "Frederik Aust"
4
5 bibliography: ["references.bib", "r-references.bib"]
6
7 output : html_document
8 ---
9
10 Human memory is fallible |.
11

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**

| 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

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 the NYT API, which is a derivative of the news service now used. All credit belongs to the original author(s) and publisher(s). The highlights, analysis and visualizations are independently derived approaches that can be used to the benefit of the public.

[Another Visualizer from NYT](#)

Content available via the NYT API or a copy of the original. Content is no longer available at the original URL. Instead, we've created a new URL for the same content using the `rstudio::render_markdown()` command and reusing the URL from the original source. It is important to note that this is a copy of the original content, and is not the original content.



A Pandoc Markdown Article Starter and Template*

Steven Y. Miller | [Connecticut](#)

This document generates an article-like 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 `analysis.Rmd` can be generated within R with the `quarto` package.

[Keynote](#) [pdf](#) [code](#) [template](#) [R](#)

Introduction

Academic writing, especially in political science, is an oxymoron. The American Journal of Political Theory (AJPT) demands a rigorously “drew your work” – according to which academic writing is tentatively accepted for publication if the journal editor finds that the idea adds value during that production of the article shown to the community. The *editorial* section of AJPT then represents the first trial of the manuscript. Pending successful publication, the manuscript moves toward publication. The JPSV might be at the top of this hierarchy, and it would be the most aggressive requiring political science journals, but other journals in one field have lagged; the print *Duke Law & Medicine Quarterly (DLMQ)* sometimes. Thus, as a law professor, requires updating with new (possibly copyrighted) published articles before those directions issued by the editorial or its referees like *Chemistry*.

Below are workflow instructions to the LaTeX compilation as well. Political science, for the



Get ▲

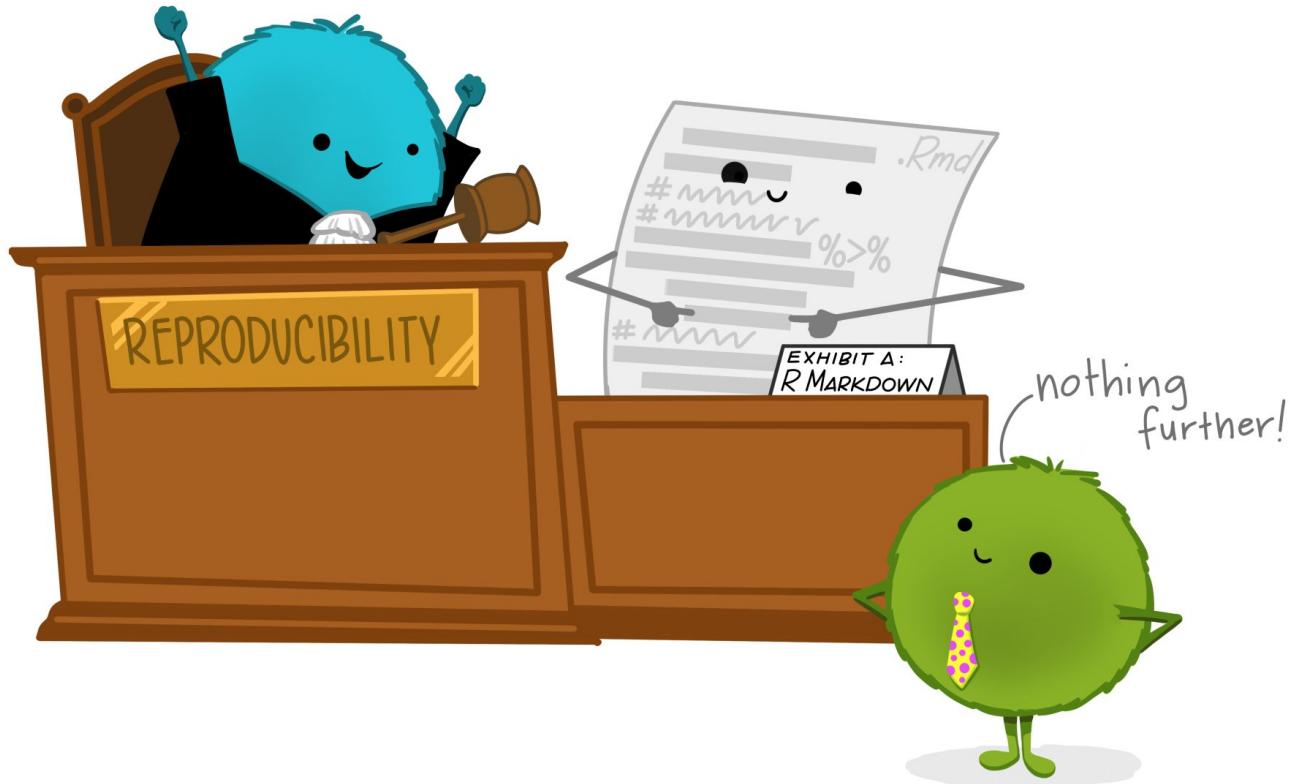
R Markdown gallery <https://rmarkdown.rstudio.com/gallery.html>

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

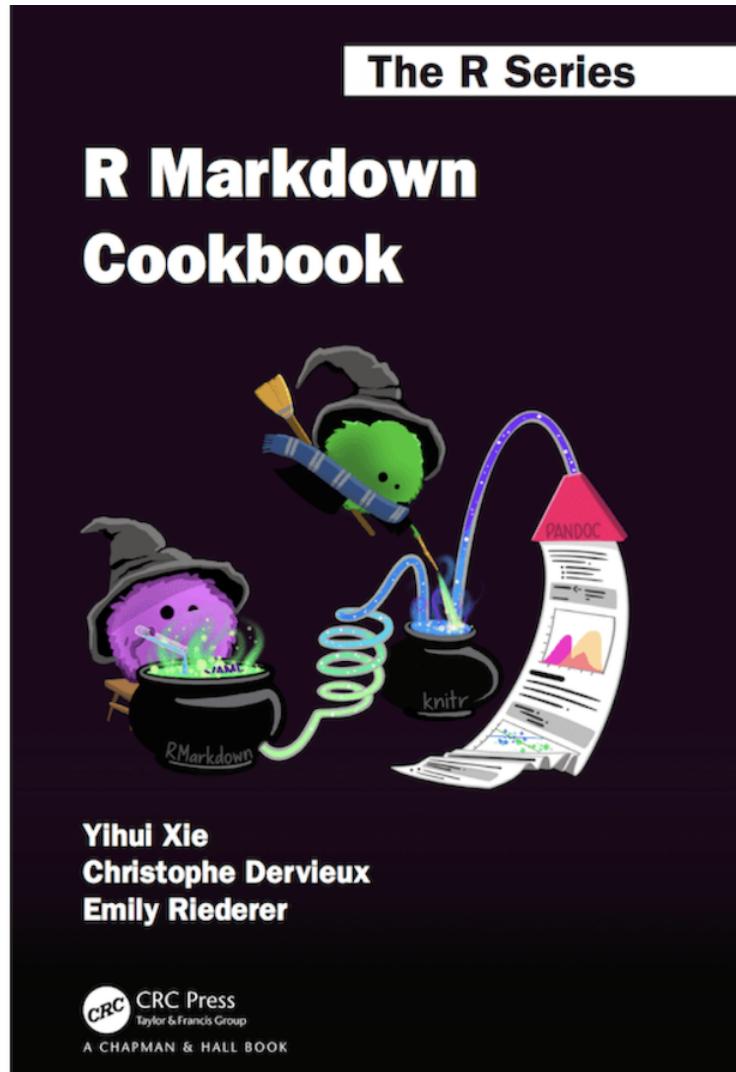
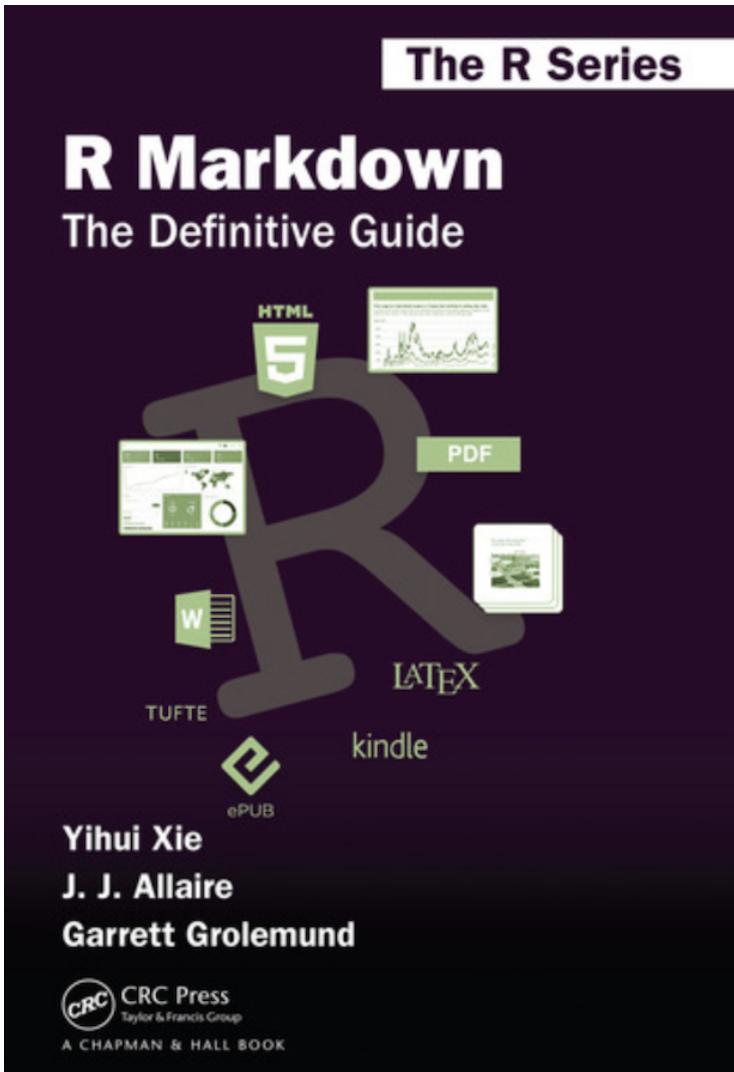
- How to work with Word using `redoc`: generate a Word document, revise the Word document, and convert the revised Word document back to R Markdown
- How to collaborate on Rmd documents with [Google Drive](#).



@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.