

R Markdown for reproducible analysis

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06 May, 2022

What is R Markdown

R Markdown (.Rmd) is an authoring format that enables easy creation of dynamic documents, presentations, and reports from R. It combines the core syntax of markdown (an easy to write plain text format) with embedded R code chunks that are run so their output can be included in the final document. R Markdown documents are fully reproducible (they can be automatically regenerated whenever underlying R code or data changes)." – [RStudio documentation](#).

Why R Markdown?

for Open Science

- Transparency
- Availability
- Accessibility
- Collaboration

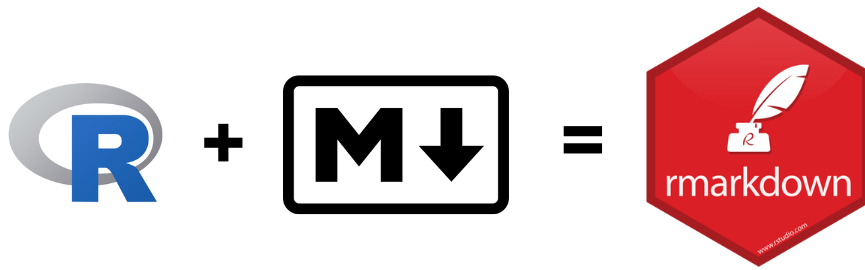
Why R Markdown?

for your work

There are many advantages to using R Markdown in your work:

- Human readable
- Simple syntax
- A Reminder for Your Future Self
- Easy to Modify
- Flexible export formats
- Easy to share

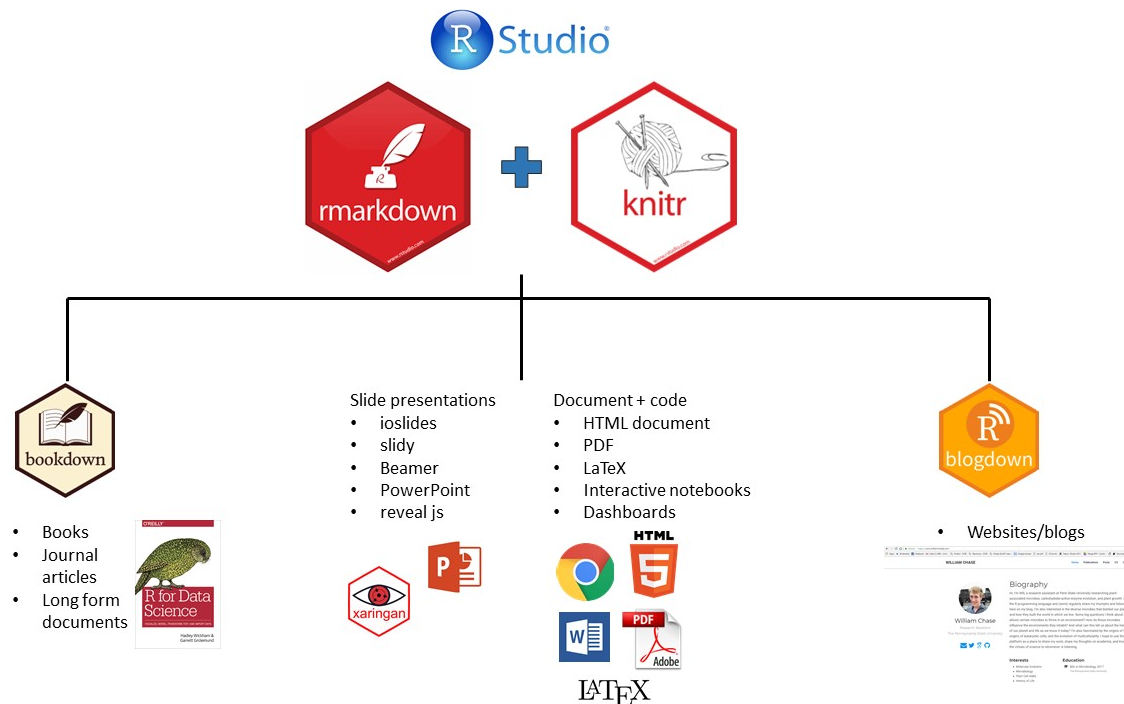
R + Markdown



How it works

Output formats

Write a single `.Rmd` file and then use it to render finished output in a variety of formats



Add Code and Results

```
```{r table2}
penguins %>%
 select(species, bill_length_mm:flipper_length_mm) %>%
 gtsummary::tbl_summary(by = species, missing = "no") %>%
 gtsummary::modify_caption("Flipper/Bill size by Species") %>%
 gtsummary::as_flex_table()

```
```

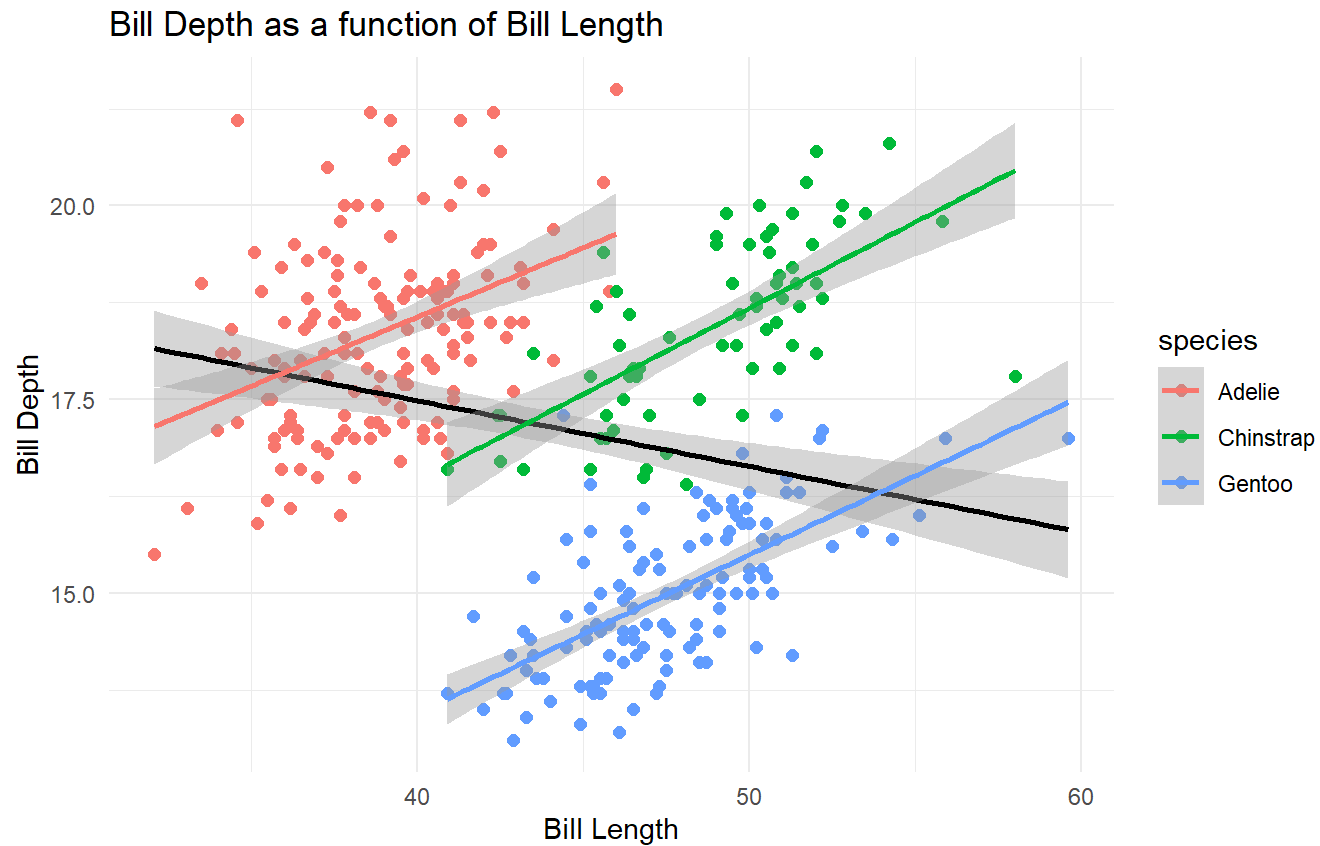
Flipper/Bill size by Species

| Characteristic | Adelie, N = 152 ¹ | Chinstrap, N = 68 ¹ | Gentoo, N = 124 ¹ |
|-------------------|------------------------------|--------------------------------|------------------------------|
| bill_length_mm | 38.8 (36.8, 40.8) | 49.5 (46.3, 51.1) | 47.3 (45.3, 49.5) |
| bill_depth_mm | 18.40 (17.50, 19.00) | 18.45 (17.50, 19.40) | 15.00 (14.20, 15.70) |
| flipper_length_mm | 190 (186, 195) | 196 (191, 201) | 216 (212, 221) |

¹Median (IQR)

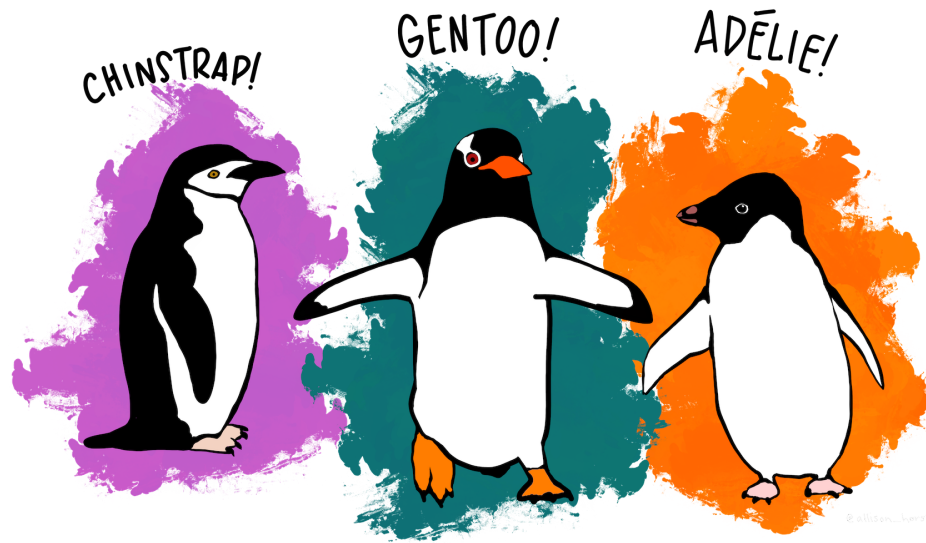
Add Text and reference to Plots

in Figure @ref(fig:corr-plot) we see examples of plotting in R.



Correlation Plot

Embed a picture



Artwork by @allison_horst

Embed a Youtube video

Introducing R Markdown Notebooks



Parameterised reports

Will show live in a while

```
---  
title: My Document  
output: html_document  
params:  
  days:  
    label: "Number of Previous Days"  
    value: 90  
    input: slider  
    min: 30  
    max: 360  
  region:  
    label: "Region:"  
    value: Europe  
    input: select  
    choices: [North America, Europe, Asia, Africa]  
---
```

Use it for

Reproducible data analysis

0:00 / 1:24



[NYT interactive Rmakrdown document](#)

Use it for Writing papers/articles

Use the Pagedown Package

See an example here

The screenshot displays the RStudio interface with an R Markdown file open. The left pane shows the source code, and the right pane shows the rendered HTML output.

Source Code (Left Pane):

```
1 ---
2 author:
3   - name: Yihui Xie
4     affiliation: RStudio
5     address: |
6       First line
7       Second line
8     email: <name@company.com>
9     url: <http://rstudio.com>
10   - name: Romain Lesur
11 title: |
12   [HTML]{.proglang} and [CSS Paged Media]{.proglang} for
13   Scientific Publications with the [pagedown]{.pkg}
14   [R]{.proglang} Package
15 shorttitle: "[pagedown]{.pkg}: Paginate the [HTML]{.proglang}
16   Output of [R Markdown]{.pkg} with [CSS]{.proglang} for Print"
17 abstract: |
18   Use the paged media properties in [CSS]{.proglang} and the
19   [JavaScript]{.proglang} library [Paged.js]{.pkg} to split the
20   content of an [HTML]{.proglang} document into discrete pages.
21   Each page can have its page size, page numbers, margin boxes,
22   and running headers, etc. Applications of this package
23   include books, letters, reports, papers, business cards,
24   resumes, and posters.
25 # at least one keyword must be supplied
26 keywords:
27   - "[HTML]{.proglang}"
28   - "[CSS]{.proglang}"
29   - "[markdown]{.proglang}"
30   - scientific publication
31   - literate programming
32 links-to-footnotes: true
33 paged-footnotes: true
34 link-citations: true
35 bibliography: index.bib
36 output:
37   pagedown::jss_paged:
38     self_contained: false
39 ---
40 # Introduction
41
42 When talking about PDF and printing, we often think of tools
43 like  $\LaTeX$  and Microsoft Word. When talking about
44 [HTML]{.proglang} and [CSS]{.proglang}, we may have never
45 imagined their possible off-screen use such as printing to
46 PDF.
47
48 Can we print a book with [HTML]{.proglang} and
49 [CSS]{.proglang}? W3C published [the first working
50 draft](https://www.w3.org/1999/06/WD-css3-page-19990623) on
51 "Paged Media Properties for [CSS]{.proglang}(3)". which was
```

Rendered Output (Right Pane):

The rendered output is a journal page for "Journal of Statistical Software". It includes a title, authors (Yihui Xie, RStudio and Romain Lesur), an abstract, keywords, and an introduction.

Title: Journal of Statistical Software

Volume/Issue: MMMMM YYY, Volume VV, Issue II. doi: 10.18637/jss.v000.i00

Authors: Yihui Xie, RStudio; Romain Lesur

Abstract: Use the paged media properties in CSS and the JavaScript library Paged.js to split the content of an HTML document into discrete pages. Each page can have its page size, page numbers, margin boxes, and running headers, etc. Applications of this package include books, letters, reports, papers, business cards, resumes, and posters.

Keywords: HTML, CSS, markdown, scientific publication, literate programming.

1. Introduction

When talking about PDF and printing, we often think of tools like \LaTeX and Microsoft Word. When talking about HTML and CSS, we may have never imagined their possible off-screen use such as printing to PDF.

Can we print a book with HTML and CSS? W3C published the first working draft¹ on "Paged Media Properties for CSS(3)", which was last updated in 2013. Although the working draft has been there for nearly two decades, it is still not common to see authors write or print books with HTML and CSS. The main reason is that the W3C specs are still in the draft mode, so most web browsers

Use it for Authoring books

<https://bookdown.org/>

0:00 / 1:14



Use it for Authoring books

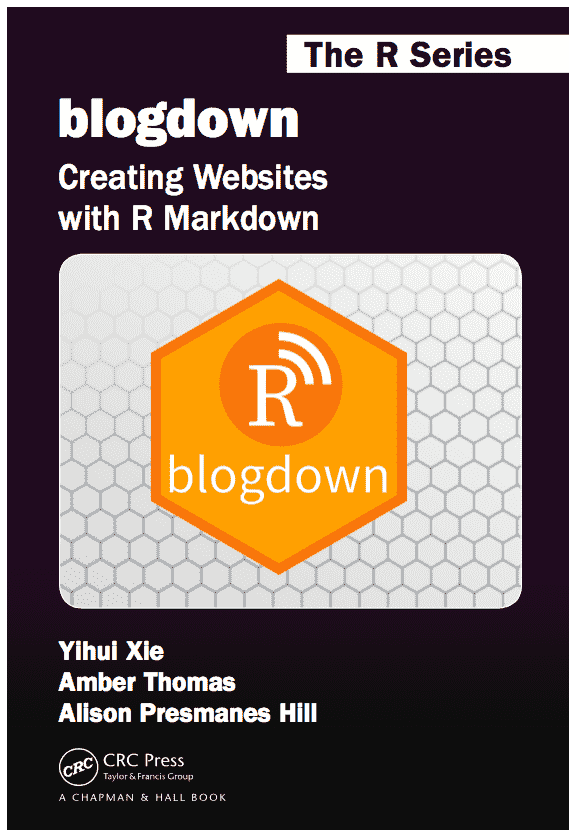
Technical documentation and instructions

[Bookdown book.](#)
It's free



Use it for Creating websites

Technical documentation and instructions in the [Blogdown book](#).
It's free



Use it for Creating websites

More tools (and simpler)

- [Distill for R Markdown](#)

New Project

Back


Project Type

R Package using RcppEigen


>

R Package using RcppParallel

>

 Website using blogdown

>

 Book Project using bookdown

>

R Package using devtools

>

Distill Blog

>

Distill Website

>

Cancel


Syntax 1/3

Get the full reference guide [at R Studio website](#)

| Syntax | Becomes |
|--|--|
| Plain text | Plain text |
| End a line with two spaces to start a new paragraph. | End a line with two spaces to start a new paragraph. |
| <i>*italics*</i> and <i>_italics_</i> | <i>italics</i> and <i>italics</i> |
| **bold** and __bold__ | bold and bold |
| superscript ^{^2^} | superscript ² |
| ~~strikethrough~~ | strikethrough |
| [link](www.rstudio.com) | 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: -- | endash: – |
| emdash: --- | emdash: — |
| ellipsis: ... | ellipsis: … |

Syntax 2/3

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

| Table Header | Second Header |
|--------------|---------------|
| Table Cell | Cell 2 |
| Cell 3 | Cell 4 |

inline equation: $A = \pi * r^2$



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

| Table Header | Second Header |
|--------------|---------------|
| Table Cell | Cell 2 |
| Cell 3 | Cell 4 |

Syntax 3/3

| Syntax | Becomes |
|--|---|
| <p>Make a code chunk with three back ticks followed by an <code>r</code> 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 <code>r</code> in braces. End the chunk with three back ticks:</p> <pre>paste("Hello", "World!")

[1] "Hello World!"</pre> |
| <p>Place code inline with a single back ticks. The first back tick must be followed by an <code>R</code>, like this <code>`r paste("Hello", "World!")`</code>.</p> | <p>Place code inline with a single back ticks. The first back tick must be followed by an <code>R</code>, like this Hello World!.</p> |
| <p>Add chunk options within braces. For example, <code>`echo=FALSE`</code> 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> |

Learn more about chunk options at <http://yihui.name/knitr/options>

Resources - Authoring Rmarkdown

Courses/Workshops

All these are with slides/code/data/examples and structured. Also, FREE

- [Earth Data Analytics](#) (very good)
- [RMarkdown course ISGlobal](#)
- [Osaka City University](#)
- [Emi Tanaka](#)
- [Advanced R Markdown Workshop](#)
- [Alison Hill-1](#) (Very good)
- [Alison Hill-2](#)

Resources - Authoring Rmarkdown

Tips/ Cookbooks

- [Rmarkdown Cookbook](#)
- [Rmakrdown for scientists](#)
- [Yan Holtz](#)
- [Keith McNulty](#)

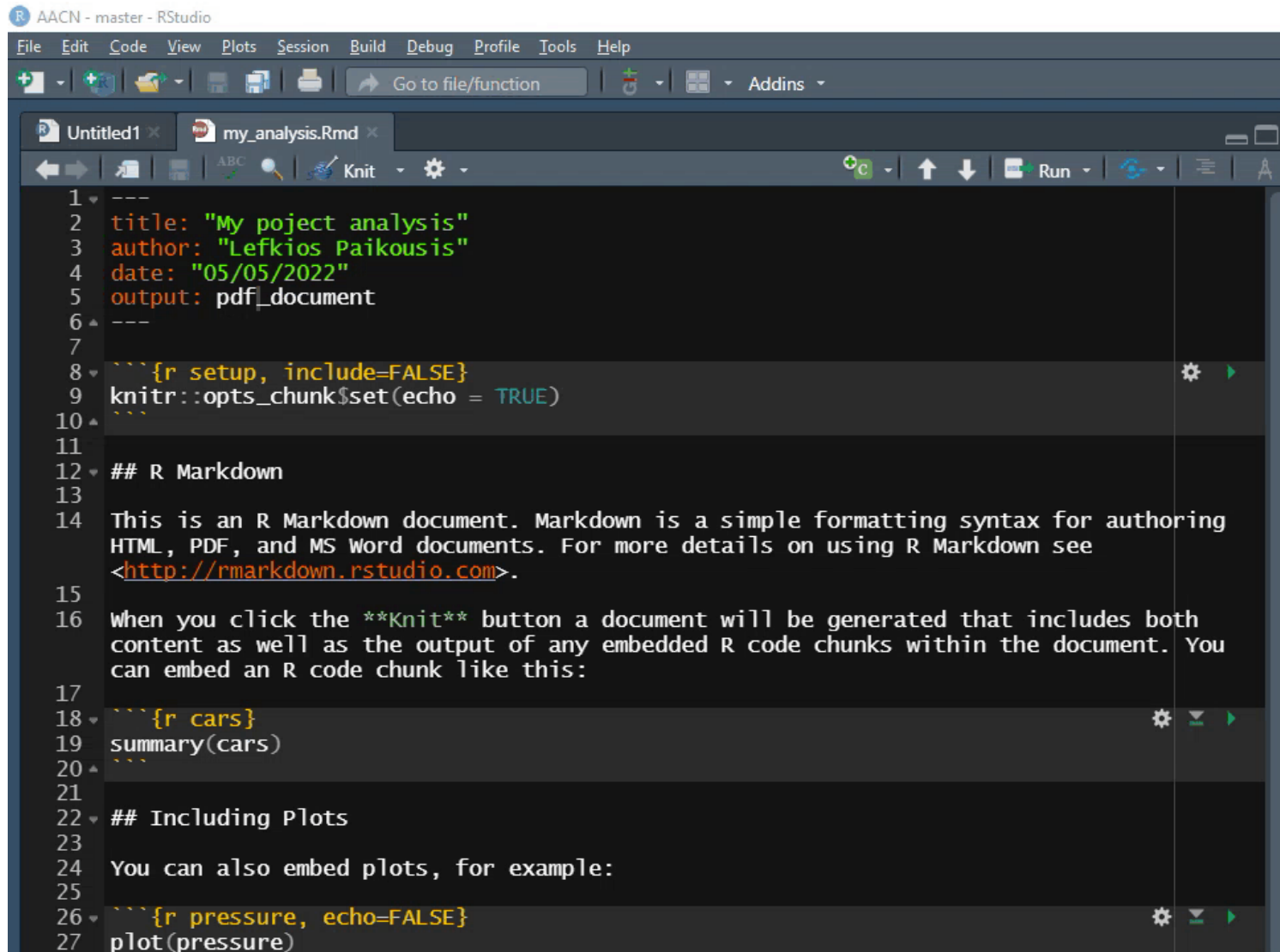
Resources

Websites with Rmarkdown

- [Distill for R Markdown](#)
- [The Distillery](#) (really usefull)
- [Alison hill](#)
- [Tom Mock](#)
- [Yuzar](#)
- [Distill CSS defaults](#)
- [Mike Frank](#)
- [Showcase of Rmarkdown distill websites](#)

Need more help?

Help > Cheatsheets > R MarkdownCheatSheet



The screenshot shows the RStudio interface with the 'my_analysis.Rmd' file open. The editor displays an R Markdown document with the following content:

```
1 ---
2 title: "My poject analysis"
3 author: "Lefkios Paikousis"
4 date: "05/05/2022"
5 output: pdf_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
15 HTML, PDF, and MS Word documents. For more details on using R Markdown see
16 <http://rmarkdown.rstudio.com>.
17
18 When you click the Knit button a document will be generated that includes both
19 content as well as the output of any embedded R code chunks within the document. You
20 can embed an R code chunk like this:
21
22 ```{r cars}
23 summary(cars)
24 ```
25
26 ## Including Plots
27
28 You can also embed plots, for example:
29
30 ```{r pressure, echo=FALSE}
31 plot(pressure)
```

Need more help?

Cheatsheet

rmarkdown : : CHEAT SHEET

What is rmarkdown?

- Rmd files** - Develop your code and ideas side-by-side in a single document. Run code as individual chunks or as an entire document.
- Dynamic Documents** - Knit together plots, tables, and results with narrative text. Render to a variety of formats like HTML, PDF, MS Word, or MS Powerpoint.
- Reproducible Research** - Upload, link to, or attach your report to share. Anyone can read or run your code to reproduce your work.

Workflow

1. Open a new **Rmd** file in the RStudio IDE by going to **File > New File > R Markdown**.
2. **Embed code** in chunks. Run code by line, by chunk, or all at once.
3. **Write text** and add tables, figures, images, and citations. Format with Markdown syntax or the RStudio Visual Markdown Editor.
4. **Set output format(s) and options** in the YAML header. Customize themes or add parameters to execute or add interactivity with Shiny.
5. **Save and render** the whole document. Knit periodically to preview your work as you write.
6. **Share your work!**

Embed Code with knitr

CODE CHUNKS

Surround code chunks with ````r` and ````` or use the Insert Code Chunk button. Add a chunk label and/or chunk options inside the curly braces after `r`.

```
```{r chunk-label, include=FALSE}
summary(mtcars)
```
```

SET GLOBAL OPTIONS

Set options for the entire document in the first chunk.

```
```{r include=FALSE}
knitr::opts_chunk$set(message = FALSE)
```
```

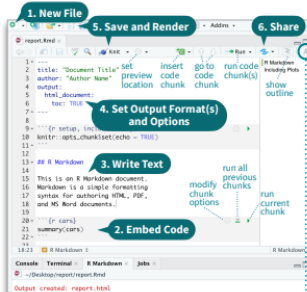
INLINE CODE

Insert ```r <code>` into text sections. Code is evaluated at render and results appear as text.

```Built with `` getRversion() `` -> "Built with 4.1.0"`



#### SOURCE EDITOR



#### VISUAL EDITOR



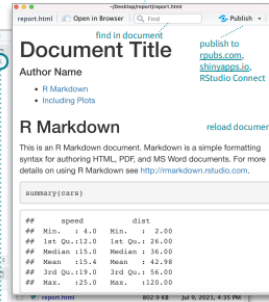
##### OPTION

##### DEFAULT EFFECTS

|            |           |                                                                                |
|------------|-----------|--------------------------------------------------------------------------------|
| echo       | TRUE      | display code in output document                                                |
| error      | FALSE     | TRUE (display error messages in doc)                                           |
| eval       | TRUE      | run code in chunk                                                              |
| include    | TRUE      | include chunk in doc after running                                             |
| message    | TRUE      | display code messages in document                                              |
| warning    | TRUE      | display code warnings in document                                              |
| results    | "markup"  | "asis" (passthrough results)                                                   |
|            |           | "hide" (don't display results)                                                 |
|            |           | "hold" (put all results below all code)                                        |
| fig.align  | "default" | "left", "right", or "center"                                                   |
| fig.alt    | NULL      | alt text for a figure                                                          |
| fig.cap    | NULL      | figure caption as a character string                                           |
| fig.path   | "figure/" | prefix for generating figure file paths                                        |
| fig.width  | 7         | plot dimensions in inches                                                      |
| fig.height | 7         | plot dimensions in inches                                                      |
| out.width  | NULL      | rescales output width, e.g. "75%", "300px"                                     |
| collapse   | FALSE     | collapse all sources & output into a single block                              |
| comment    | "##"      | prefix for each line of results                                                |
| chld       | NULL      | files(s) to knit and then include                                              |
| comment    | NULL      | include or exclude a code chunk when extracting source code with knitr::purl() |
| purl       | TRUE      | include or exclude a code chunk when extracting source code with knitr::purl() |

See more options and defaults by running `str(knitr::opts_chunk$get())`

#### RENDERED OUTPUT



#### Insert Citations

Create citations from a bibliography file, a Zotero library, or from DOI references.

##### BUILD YOUR BIBLIOGRAPHY

- Add BibTeX or CSL bibliographies to the YAML header.
- `title: "My Document"`
- `bibliography: references.bib`
- `link-citations: TRUE`

- If Zotero is installed locally, your main library will automatically be available.
- Add citations by DOI by searching "from DOI" in the Insert Citation dialog.

##### INSERT CITATIONS

- Access the Insert Citations dialog in the Visual Editor by clicking the @ symbol in the toolbar or by clicking **Insert > Citation**.
- Add citations with markdown syntax by typing `[@cite]` or `@cite`.

#### Insert Tables

Output data frames as tables using `kable(data, caption)`.

```
```{r}
data <- faithful[1:4, ]
knitr::kable(data,
  caption = "Table with kable")
```
```

Other table packages include `flextable`, `gt`, and `kableExtra`.

#### Write with Markdown

The syntax on the left renders as the output on the right.

Plain text.  
End a line with two spaces to start a new paragraph.  
Also end with a backslash to make a new line.  
\*italics\* and \*\*bold\*\*  
superscript<sup>2</sup>/<sub>subscript-2</sub>  
---strikethrough---  
escaped: \"\_\\  
endash: --, emdash: ---

**Header 1**  
**Header 2**  
**Header 6**  
unordered list  
- item 2  
- item 2a (indent 1 tab)  
- item 2b  
ordered list  
1. item 2  
1. item 2a (indent 1 tab)  
1. item 2b

[This is a link](link url)  
[This is another link](id)  
At the end of the document:  
[id] link url  
[Caption](image.png)  
or [Caption](id)  
At the end of the document:  
[id] image.png

verbatim code  
multiple lines of verbatim code  
block quotes  
equation:  $5e^6 \cdot 10^3 + 1 = 0$   
equation block:  
$$E = mc^2$$
  
horizontal rule:  
---

| Right | Left | Default | Center |
|-------|------|---------|--------|
| 12    | 32   | 32      | 32     |
| 123   | 123  | 123     | 123    |
| 1     | 1    | 1       | 1      |

HTML Tabs  
# Results (tabset)  
## First text  
## Second text  
## Third text  
## more text



# Thank you

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You can find the slides at <https://github.com/lefkiospaikousis/Conference-May2022>