

# R Markdown for reproducible analysis

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# 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

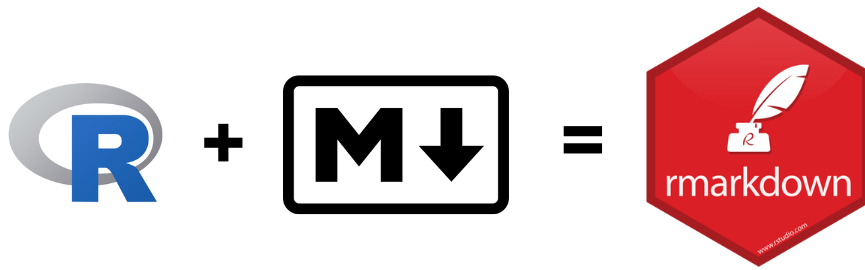
# Why R Markdown?

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

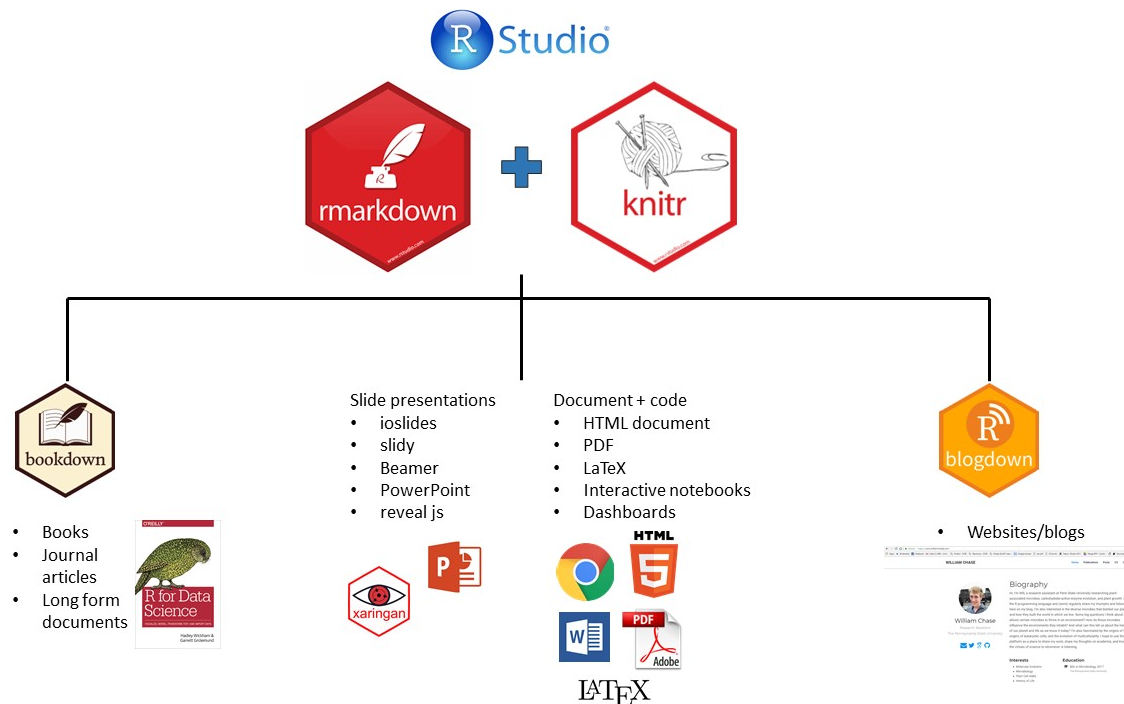
# R + Markdown



# 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

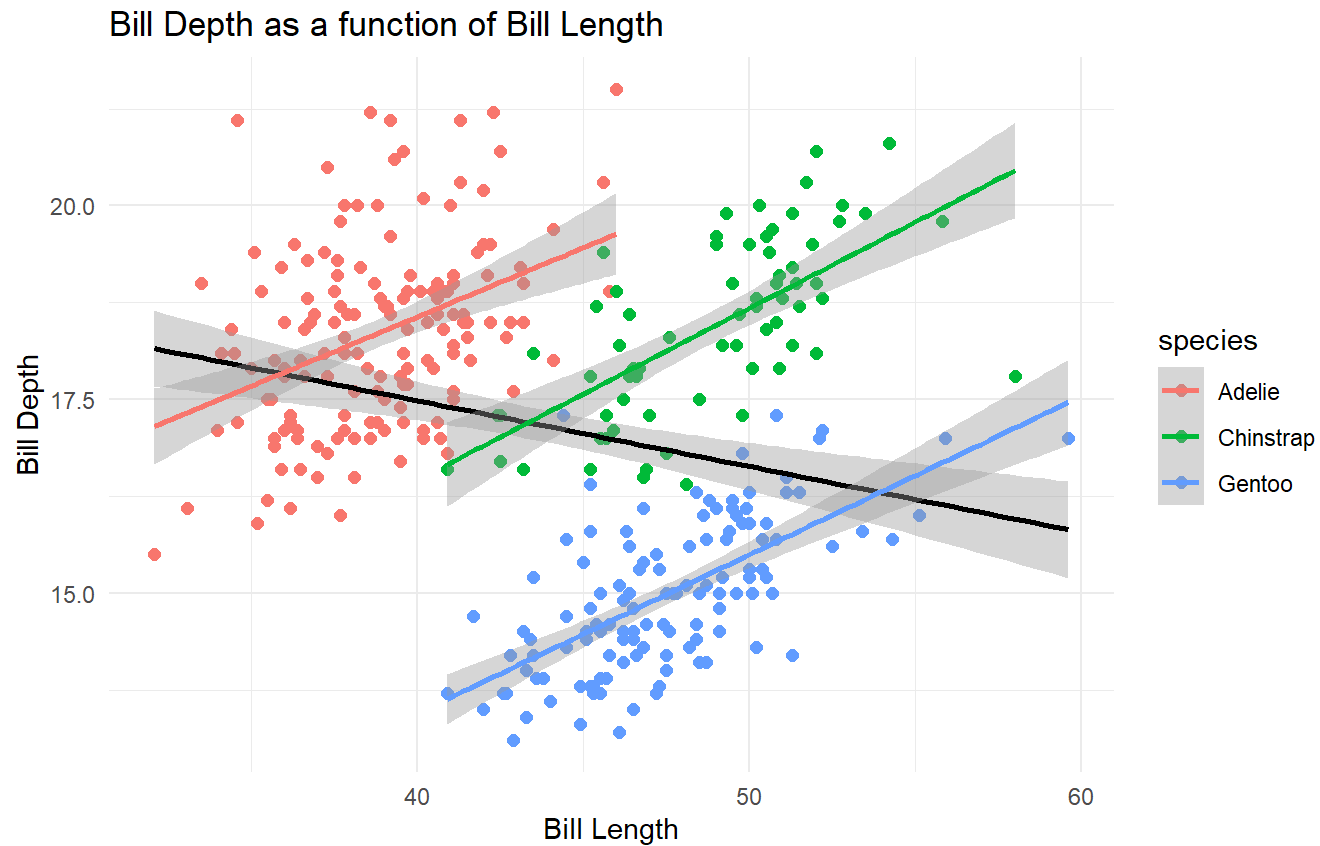
| Characteristic    | Adelie, N = 152 <sup>1</sup> | Chinstrap, N = 68 <sup>1</sup> | Gentoo, N = 124 <sup>1</sup> |
|-------------------|------------------------------|--------------------------------|------------------------------|
| bill_length_mm    | 38.8 (36.8, 40.8)            | 49.5 (46.3, 51.1)              | 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)               |

<sup>1</sup>Median (IQR)



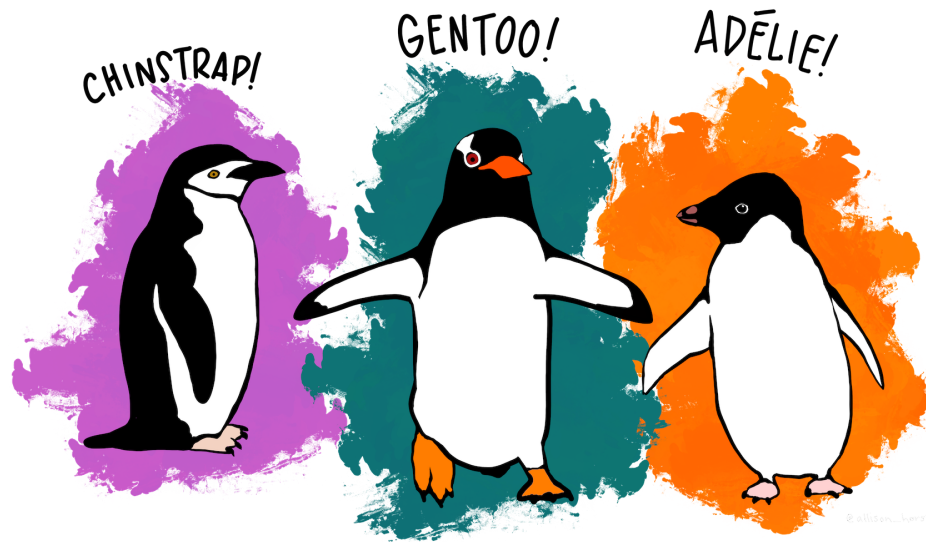
# Add Text and reference to Plots

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 shows a journal page for "Journal of Statistical Software". It includes a cover image, the journal title, volume and issue information, and the authors' names (Yihui Xie and Romain Lesur). The page contains an abstract and an introduction section.

**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 draft<sup>1</sup> 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

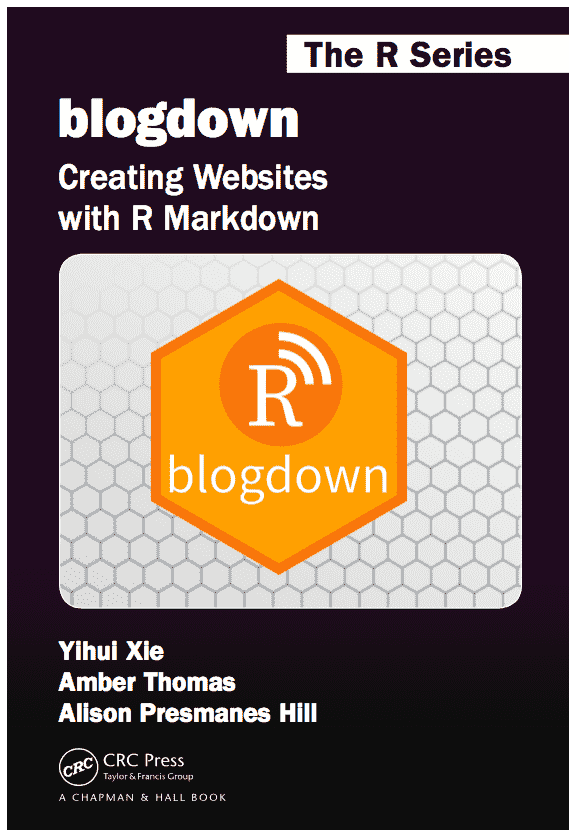
[Bookdown book.](#)  
It's free





# 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>                    |
| <b>**bold**</b> and <b>__bold__</b>                  | <b>bold</b> and <b>bold</b>                          |
| superscript^2^                                       | superscript <sup>2</sup>                             |
| ~~strikethrough~~                                    | <del>strikethrough</del>                             |
| [link](www.rstudio.com)                              | <a href="#">link</a>                                 |
| # Header 1   | <b>Header 1</b>                                      |
| ## Header 2  | <b>Header 2</b>                                      |
| ### Header 3   | <b>Header 3</b>                                      |
| #### Header 4  | <b>Header 4</b>                                      |
| ##### Header 5                                       | <b>Header 5</b>                                      |
| ##### Header 6                                       | <b>Header 6</b>                                      |
| 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}<br/>paste("Hello", "World!")<br/>```</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!")<br/><br/>## [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}<br/>paste("Hello", "World!")<br/>```</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

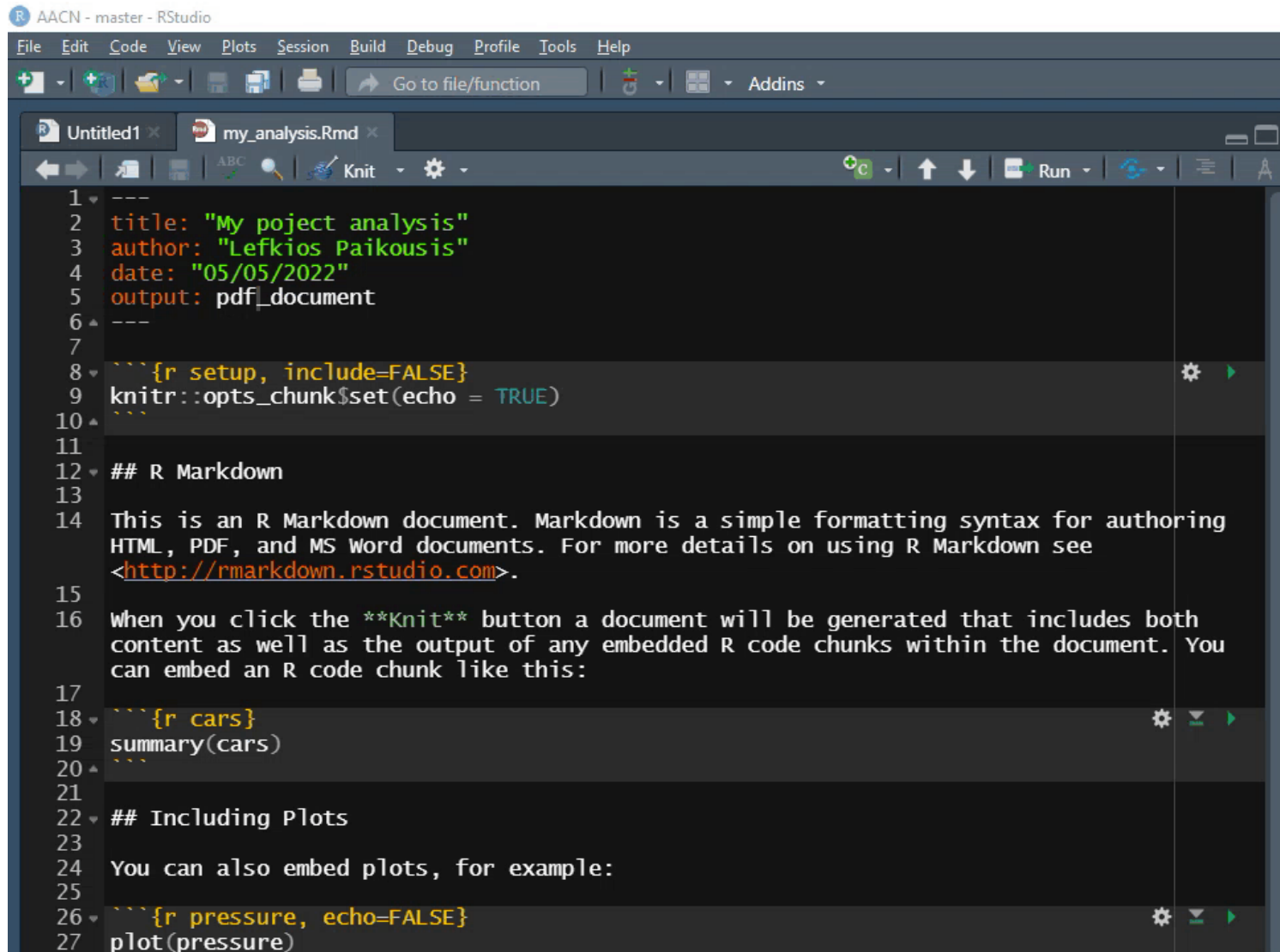
## Websites with Rmarkdown

- [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)
```
```

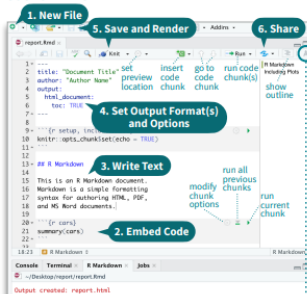
##### INLINE CODE

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

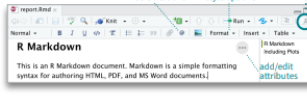
````{r} getRversion() ```` → "Built with 4.1.0"



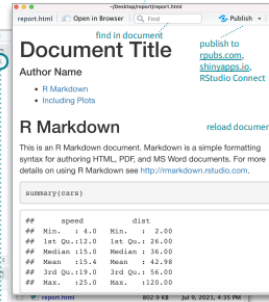
#### SOURCE EDITOR



#### VISUAL EDITOR



#### 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>/subscript<sub>2</sub>  
---strikethrough---  
escaped: \"\_\\  
endash: --, emdash: ---

**Header 1**  
**Header 2**  
**Header 6**  
# Header 1  
## Header 2  
##### Header 6  
- unordered list  
- Item 2 (indent 1 tab)  
- Item 2b  
1. ordered list  
1. Item 2 (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:  $5e^{\frac{1}{2}} + 1 = 0$   
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

Results  
Plots Tables  
text

# Thank you

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You can find the slides at [my Github](#)