R Markdown Workshop

The Basics

Presented by Emi Tanaka

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These slides are viewed best by Chrome and occasionally need to be refreshed if elements did not load properly. See here for PDF.

19th Nov 2019 @ SSA Vic | Melbourne, Australia

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Lecturer in Statistics
The University of Sydney

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About your instructor

- I'm moving to Monash University starting January 2020
- I teach R at university courses as well as use it daily for research and hobby
- If you ever wonder who answers those stackoverflow questions, I'm one of those magic fairies

Introduce yourself to someone you don't know!

03:00

What you can do with R Markdown?

These **slides** are made using R Markdown.

What you can do with R Markdown?

R Markdown Workshop

Reproducible Reports

Emi Tanaka

19th November 2019

The following are texts from Xie (2013) Dynamic Graphics and Reporting for Statistics. *PhD Thesis*.

Dynamic reporting

Statistics as a scientific discipline has a dynamic nature, which can be observed in many statistical algorithms and theories as well as in data analysis. For example, asymptotic theories in statistics are inherently dynamic: they describe how a statistic or an estimator behaves as the sample size increases. Data analysis is almost never a static process. Instead, it is an iterative process involving cleaning, describing, modeling, and re-cleaning the data. Reports may end up being re-written due to changes in the data and analysis.

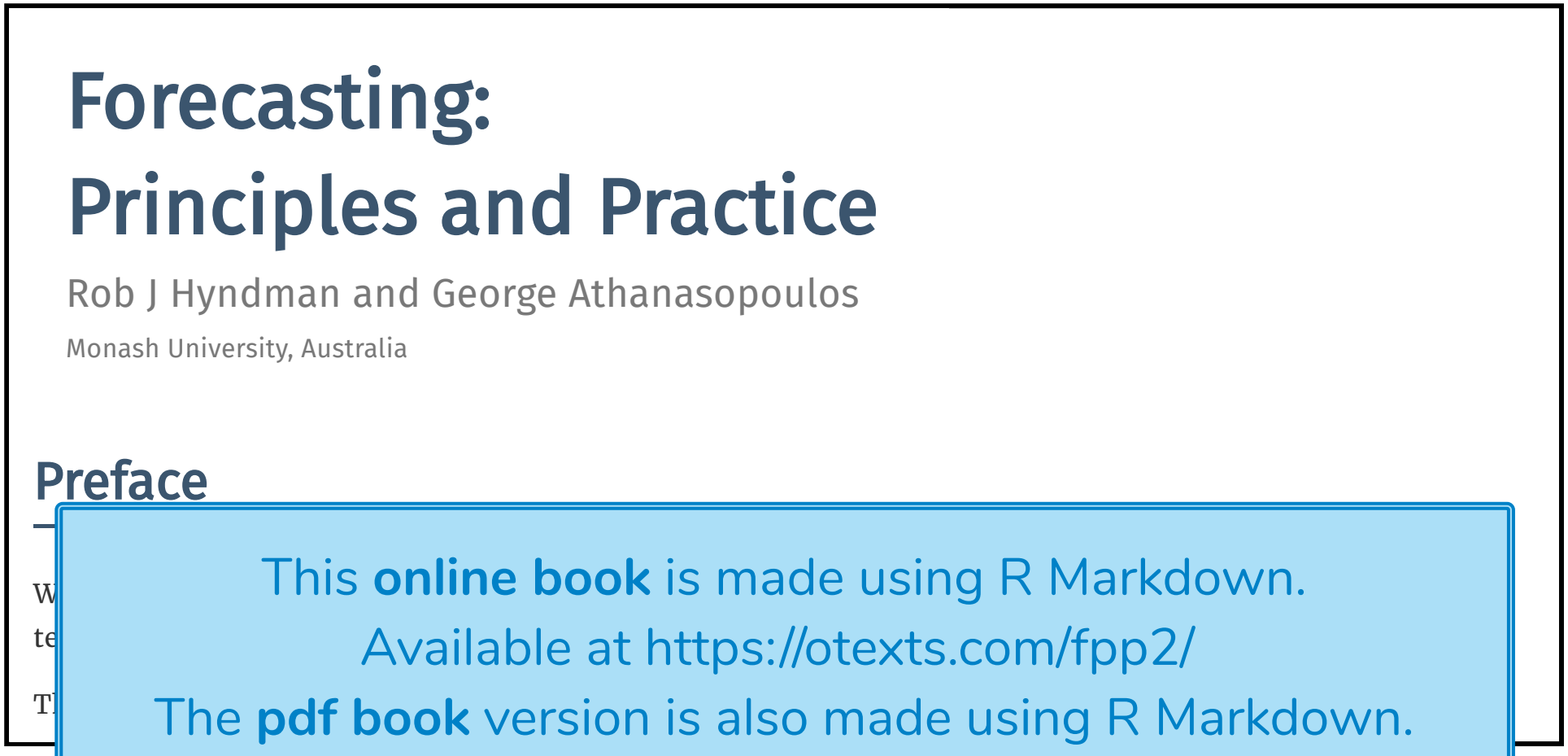
A
e

This **dynamic report** is made using R Markdown.

What you can do with R Markdown?

This **manuscript** is made using R Markdown.

What you can do with R Markdown?



Forecasting:
Principles and Practice

Rob J Hyndman and George Athanasopoulos

Monash University, Australia

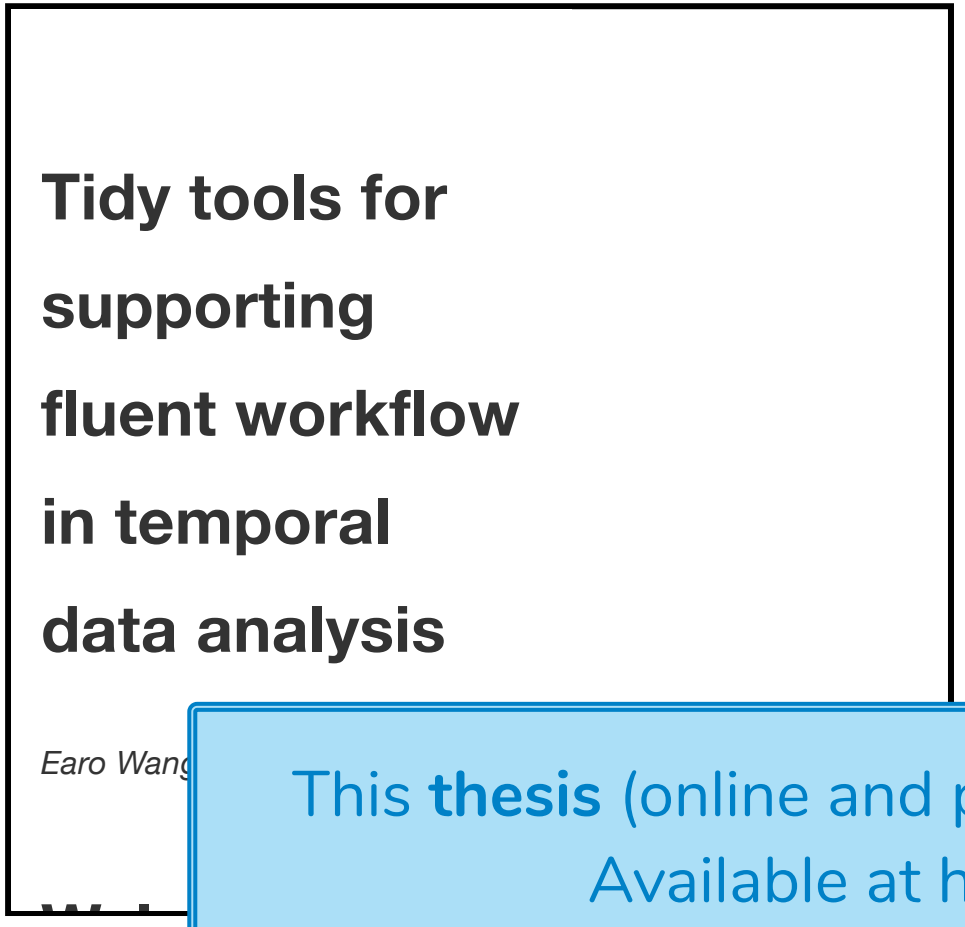
Preface

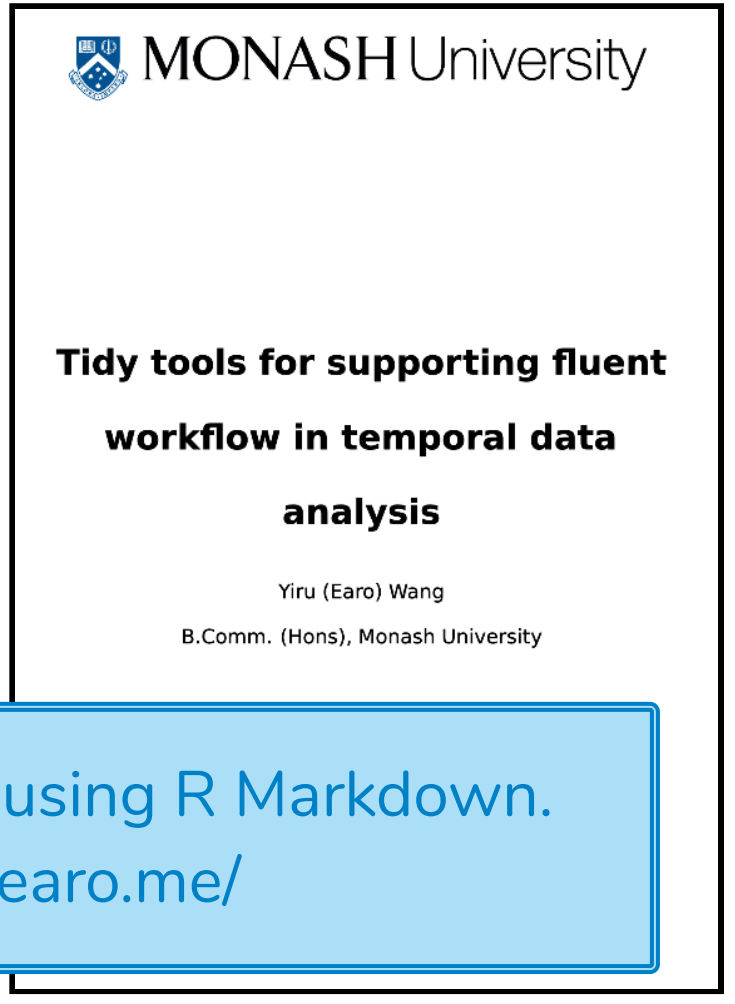
W
te

T

This **online book** is made using R Markdown.
Available at https://otexts.com/fpp2/
The **pdf book** version is also made using R Markdown.

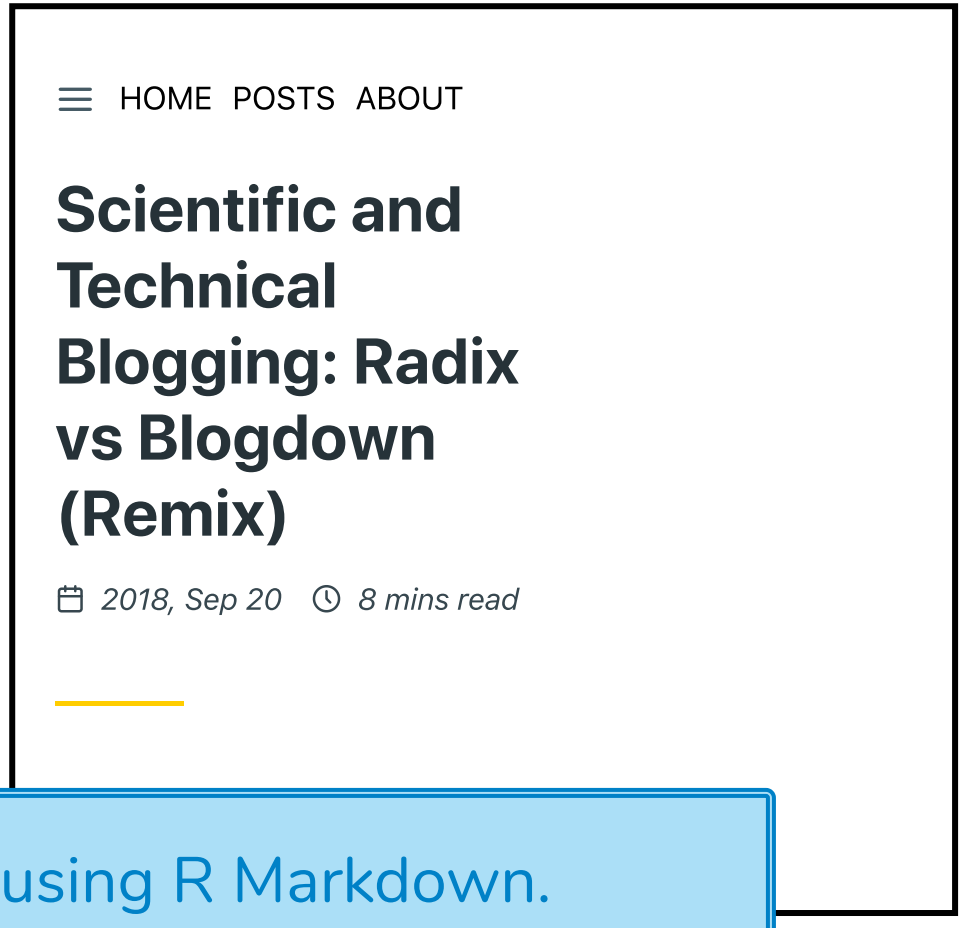
What you can do with R Markdown?





This **thesis** (online and pdf) is made using R Markdown.
Available at https://thesis.earo.me/

What you can do with R Markdown?

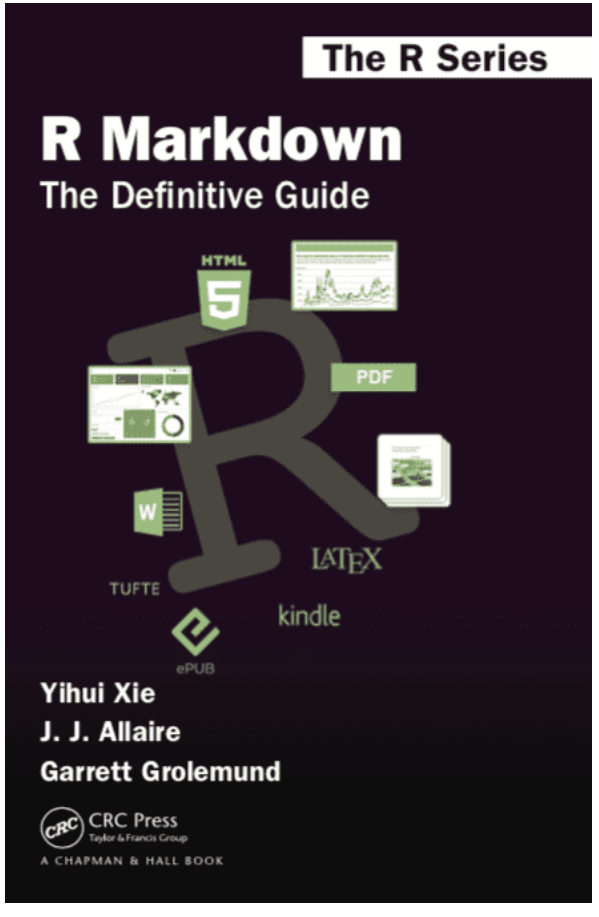


These **blog posts** are made using R Markdown.

What you can do with R Markdown?

Possibilities are endless...

- Microsoft Word document (.doc, .docx)
- Open Document Text (.odt)
- Rich text format (.rtf)
- Power point slides (.ppt, .pptx)
- Posters (as .html or .pdf)
- Resume (as .html or .pdf)
- Interactive R Notebooks (.html)
- Markdown documents (.md)
- Dashboard (.html)



Check out Xie et al. (2018) R Markdown: The Definite Guide.

Schedule

Time	Activity
1:30PM - 3.00PM	📄 *Session 1: R Markdown Basics*
3.00PM - 3.30PM	☕ *Afternoon Tea*
3.30PM - 4.30pm	📖 *Session 2: Reproducible Reports*
4.30PM - 5.00pm	🦋 *Session 3: Pretty Presentations*

Get Started

Find slides at

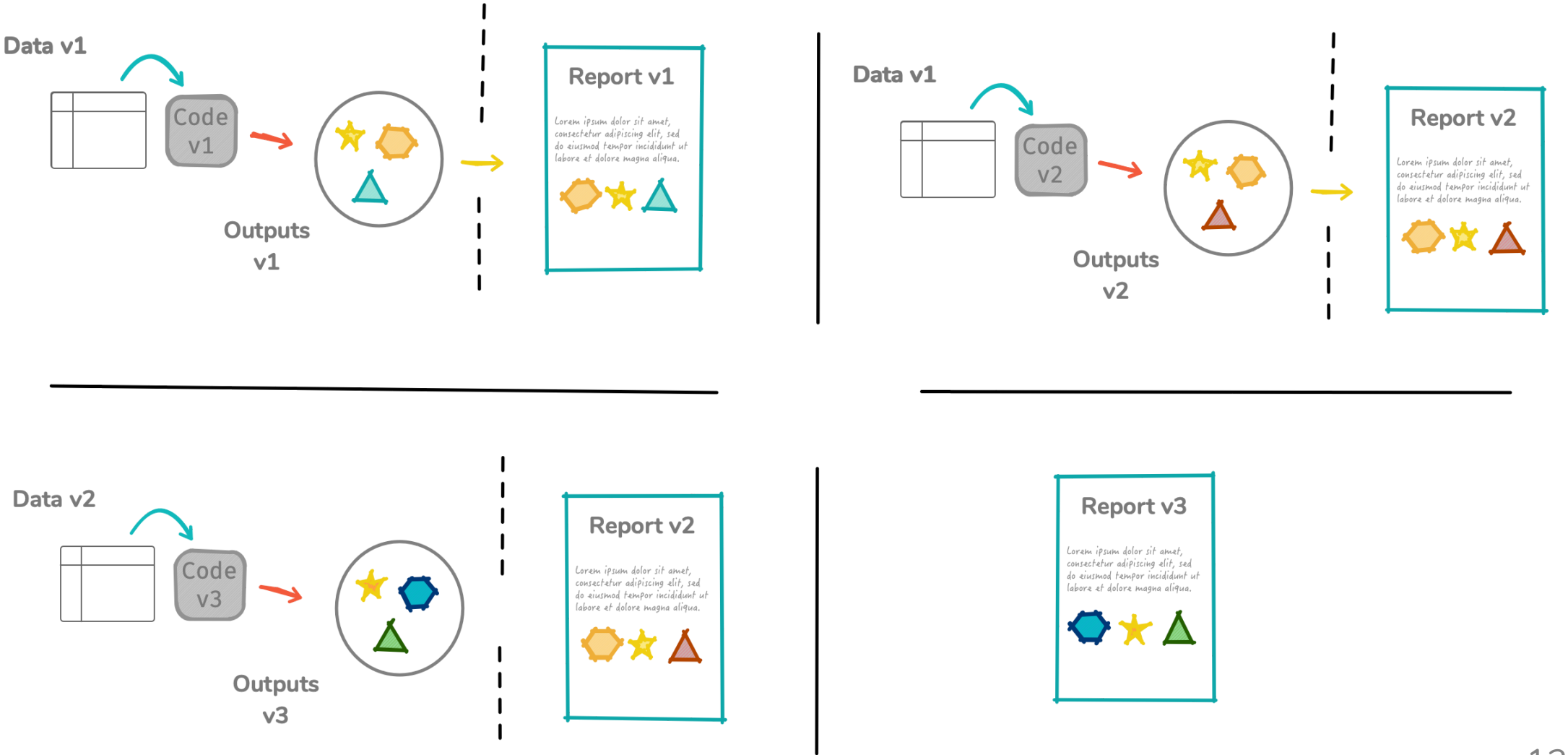
https://rmd-ssavic-2019.netlify.com/

Open

http://bit.ly/rmd-ssavic-2019

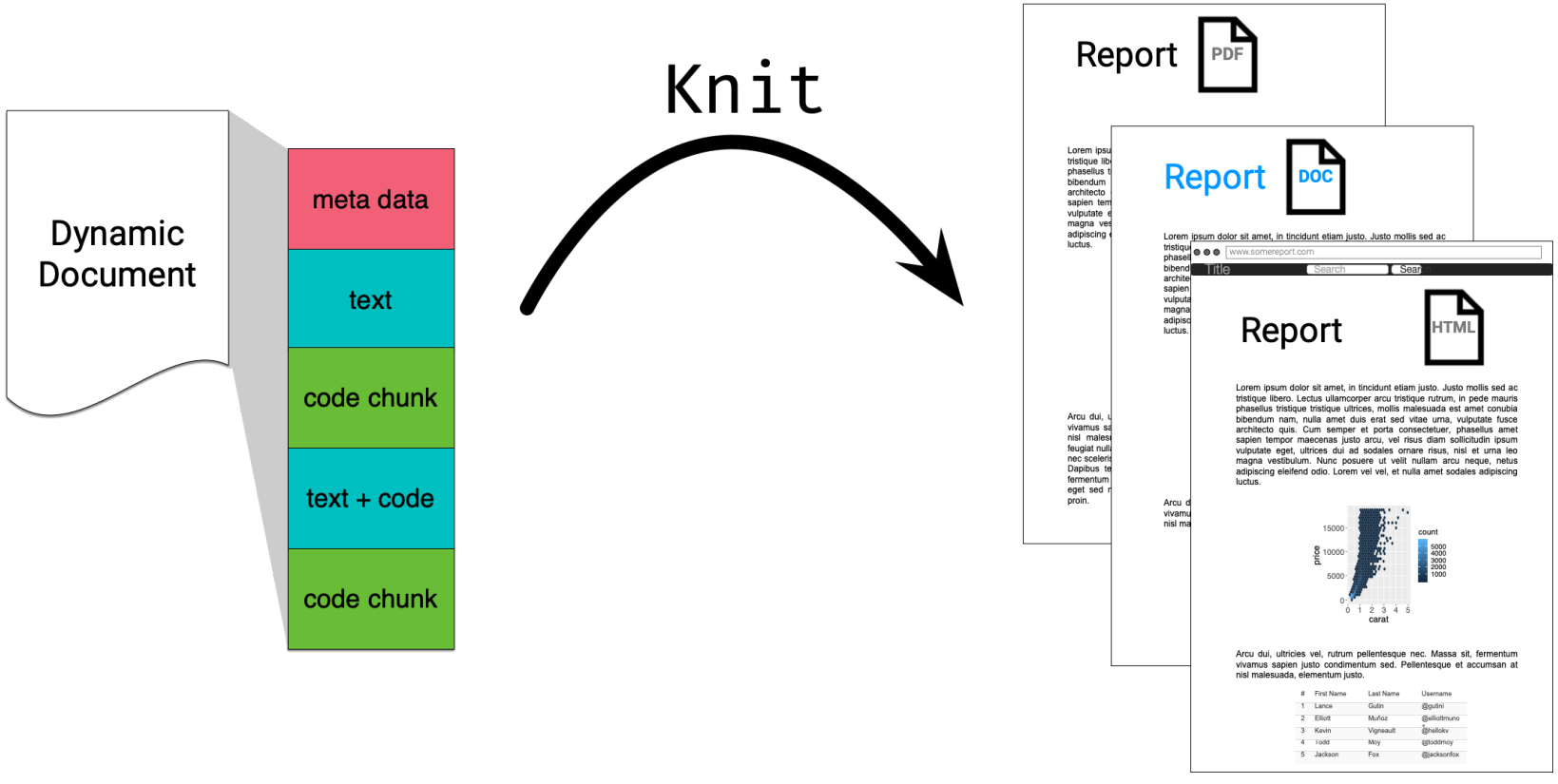
and save a permanent copy to your RStudio Cloud account for the R exercises.

Before R Markdown (and Sweave)



R Markdown in a nutshell

R Markdown integrates **text** + `code` in one source document with ability to knit *to many output formats* (via Pandoc).

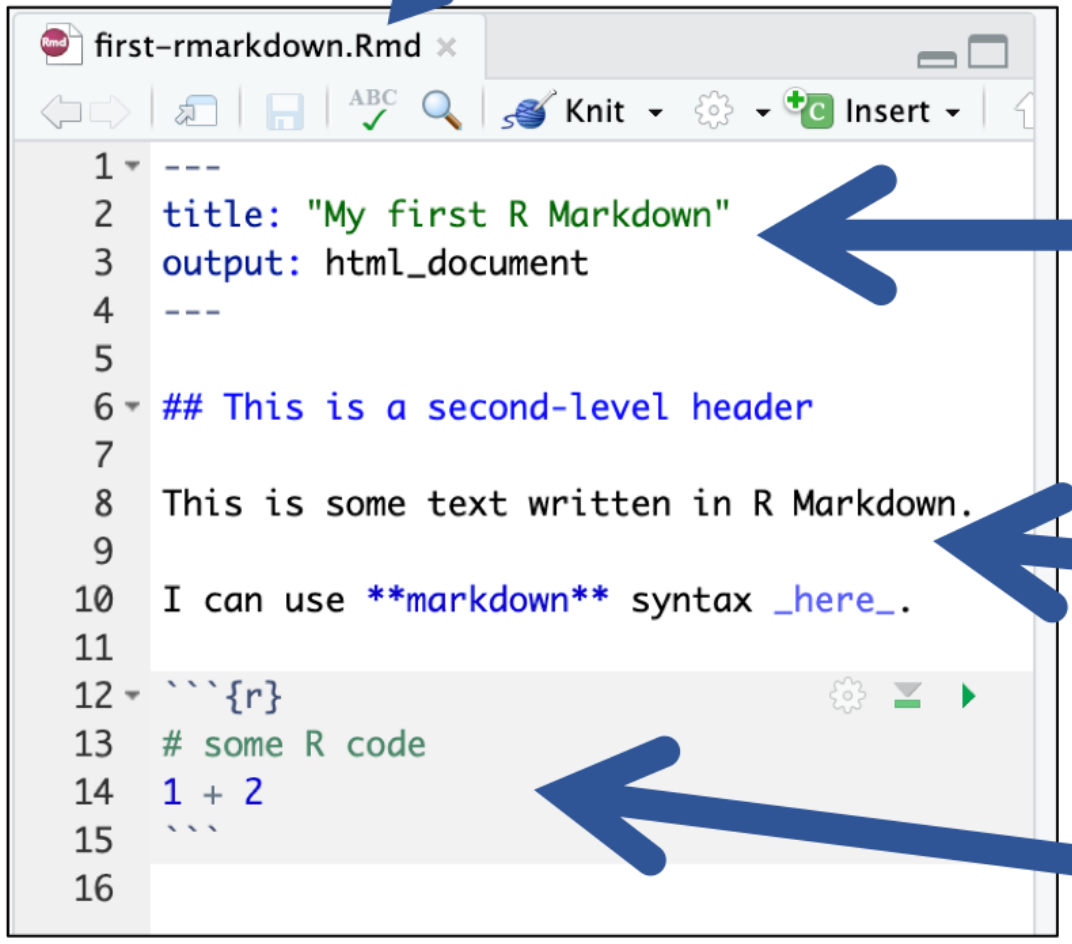


🔍 Open and inspect the file

`first-rmarkdown.Rmd`

R Markdown Basics

File extension is Rmd



YAML: meta data fenced by ---

Text can use markdown

Code chunk: fenced by ```

Knitting: Rmd → md → html

Output file name matches Rmd file name

first-rmarkdown.Rmd

Knit Insert

```
1  ---
2  title: "My first R Markdown"
3  output: html_document
4  ---
5
6  ## This is a second-level header
7
8  This is some text written in R Markdown.
9
10 I can use **markdown** syntax _here_.
11
12 ```{r}
13 # some R code
14 1 + 2
15 ```
16
```

first-rmarkdown.html

My first R Markdown

This is a second-level header

This is some text written in R Markdown.

I can use **markdown** syntax *here*.

```
# some R code
1 + 2
```

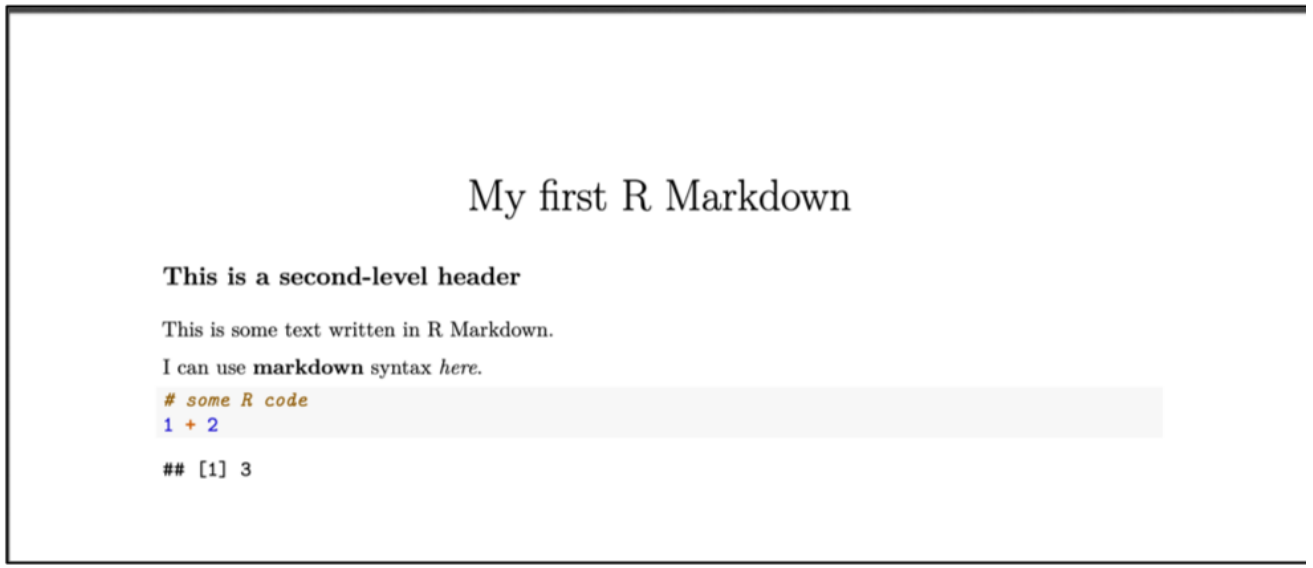
```
## [1] 3
```

Knitting: Rmd → md → pdf

first-rmarkdown.Rmd

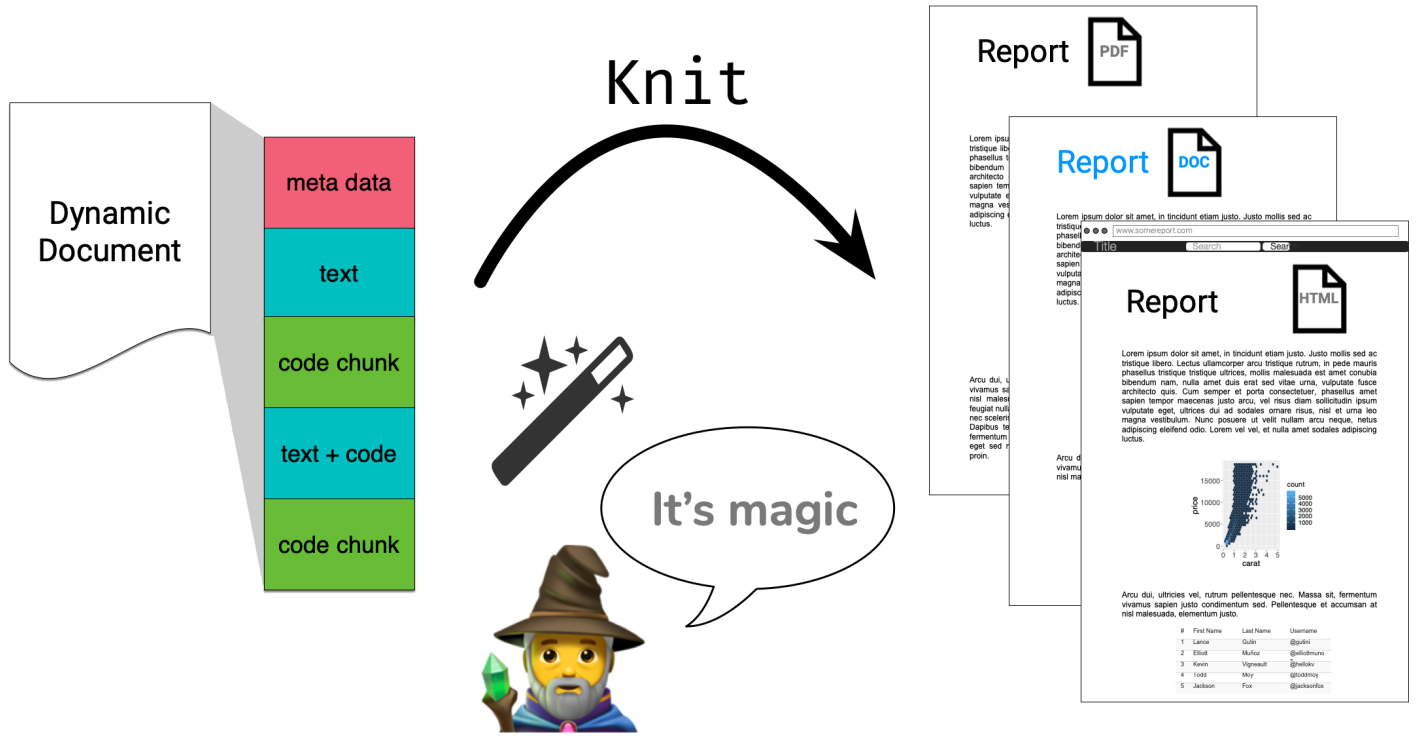
```
1  ---
2  title: "My first R Markdown"
3  output: pdf_document
4  ---
5
6  ## This is a second-level header
7
8  This is some text written in R Markdown.
9
10 I can use **markdown** syntax _here_.
11
12 ```{r}
13 # some R code
14 1 + 2
15 ```
16
```

first-rmarkdown.pdf



pdf output

How does it all work?



R Markdown under the hood: html_document

knitr 📦 does the hard work of converting Rmd 🗋 → md 🗋

Rmd 🗋

````
---
title: "My Report"
output: html_document
---

# Hello

```{r}
1 + 1
```
````

md 🗋

````
---
title: "My Report"
output: html_document
---

# Hello

```r
1 + 1
```


```

## [1] 2
```
````

R Markdown under the hood: html_document

Then rmarkdown 📦 prepares md 🗋 for pandoc to convert to html 🗋.

md 🗋

````
---
title: "My Report"
output: html_document
---

# Hello

```r
1 + 1
```


```

## [1] 2
```
````

html 🗋

```
<body>
<div class="container-fluid main-container">
<div class="fluid-row" id="header">
<h1 class="title toc-ignore">My Report</h1>
</div>
<div id="hello" class="section level1">
<h1>Hello</h1>
<pre class="r"><code>1 + 1</code></pre>
<pre><code>## [1] 2</code></pre>
</div>
</div>
</body>
```

⚠ This html file is missing some elements due to restriction of space.

R Markdown under the hood: pdf_document

Same as before: knitr 📦 converts Rmd 🗋 → md 🗋

Rmd 🗋

````
---
title: "My Report"
output: pdf_document
---

# Hello

```{r}
1 + 1
```
````

md 🗋

````
---
title: "My Report"
output: pdf_document
---

# Hello

```r
1 + 1
```


```

## [1] 2
```
````

R Markdown under the hood: pdf_document

Then `rmarkdown` 📦 prepares `md` 🗋 for `pandoc` to convert to `tex` 🗋→ pdf 🗋.

`md` 🗋

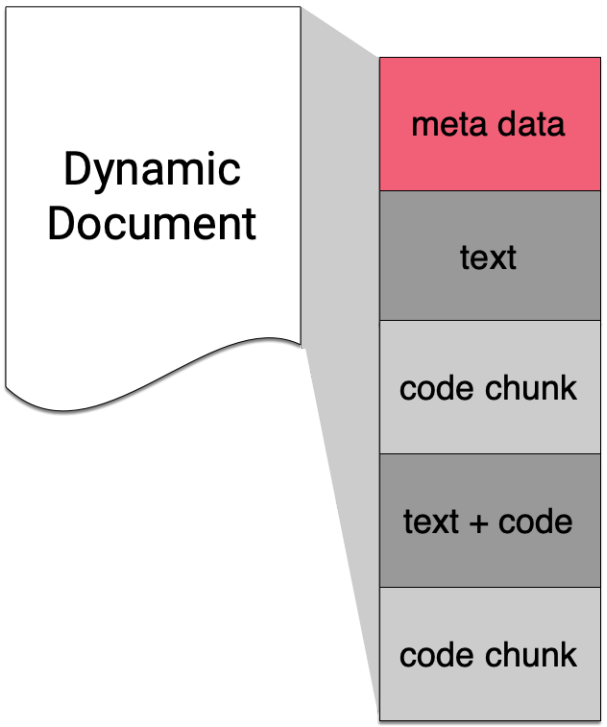
````
---
title: "My Report"
output: html_document
---

# Hello

```r
1 + 1
```


```

## [1] 2
```
````

`tex` 🗋

```
\begin{document}
\maketitle
\hypertarget{hello}{%
\section{Hello}\label{hello}}
\begin{Shaded}
\begin{Highlighting}[]
\DecValTok{1} \OperatorTok{+}\StringTok{ }\DecValTok{1}
\end{Highlighting}
\end{Shaded}
\begin{verbatim}
## [1] 2
\end{verbatim}
\end{document}
```

⚠ This tex document is missing elements before `\begin{document}` due to restriction of space.

Meta data with YAML



YAML - YAML Ain't Markup Language

Basic format

```
---
key: value
---
```

Example

```
---
title: "R Markdown Workshop"
subtitle: "The Basics"
author: "Emi Tanaka"
date: "`r Sys.Date()`"
output: html_document
---
```

There must be a space after ":"!

Default (minimal) html output

```
<!DOCTYPE html>
<html xmlns="http://www.w3.org/1999/xhtml">

<head>
<meta name="author" content="Emi Tanaka" />
<meta name="date" content="2019-11-19" />
<title>R Markdown Workshop</title>
</head>

<body>
<h1 class="title toc-ignore">R Markdown Workshop</h1>
<h3 class="subtitle">The Basics</h3>
<h4 class="author">Emi Tanaka</h4>
<h4 class="date">2019-11-19</h4>
</body>
</html>
```

output

R Markdown Workshop

The Basics

Emi Tanaka

2019-11-19

html meta data

Default html template add special YAML key values to file automatically

YAML structure

- White spaces indicate structure in YAML - don't use tabs though!
- Same as R, you can comment lines by starting with #.
- YAML is case sensitive.
- A key can hold multiple values.

```
key:
  - value1
  - value2

key: [value1, value2]
```

YAML with multiple key values

```yaml
---
title: "R Package & R Markdown Workshop"
author:
  - "Damjan Vukcevic"
  - "Emi Tanaka"
output: html_document
---
```

output

R Package & R Markdown Workshop

Damjan Vukcevic

Emi Tanaka

output

html raw file

```html
<body>
<h1 class="title toc-ignore">R Package & R Markdown Workshop</h1>
<h4 class="author">Damjan Vukcevic</h4>
<h4 class="author">Emi Tanaka</h4>
</body>
```

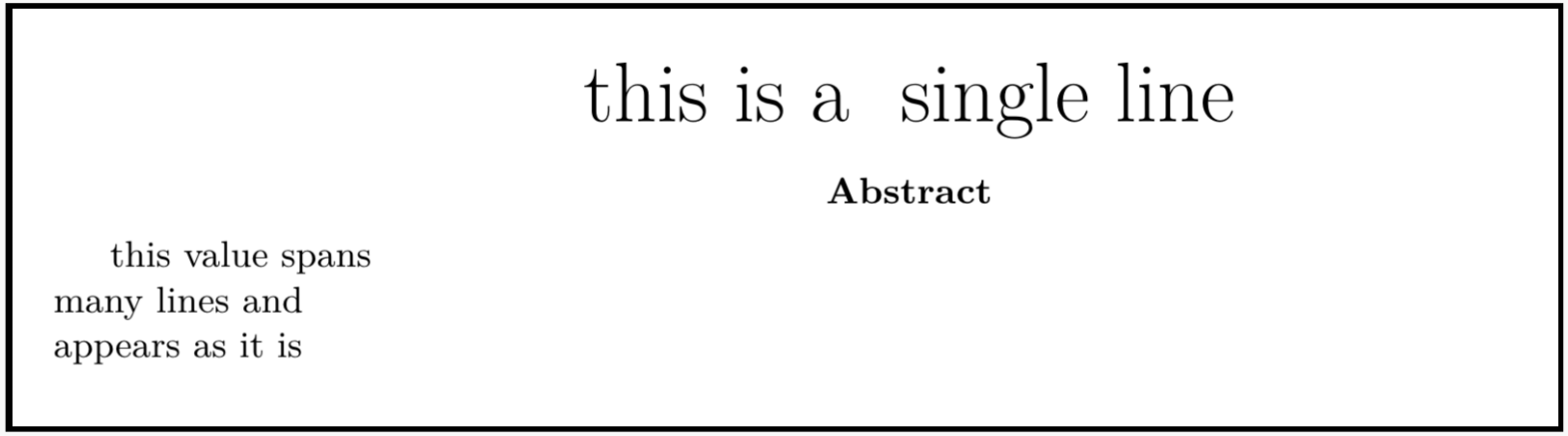
Values spanning multiple lines

```
---
title: >
  this is a\
  single line\

abstract: |
  this value spans\
  many lines and\
  appears as it is\

output: pdf_document
---
```

output



🔍 Open and inspect the file

`second-rmarkdown.Rmd`

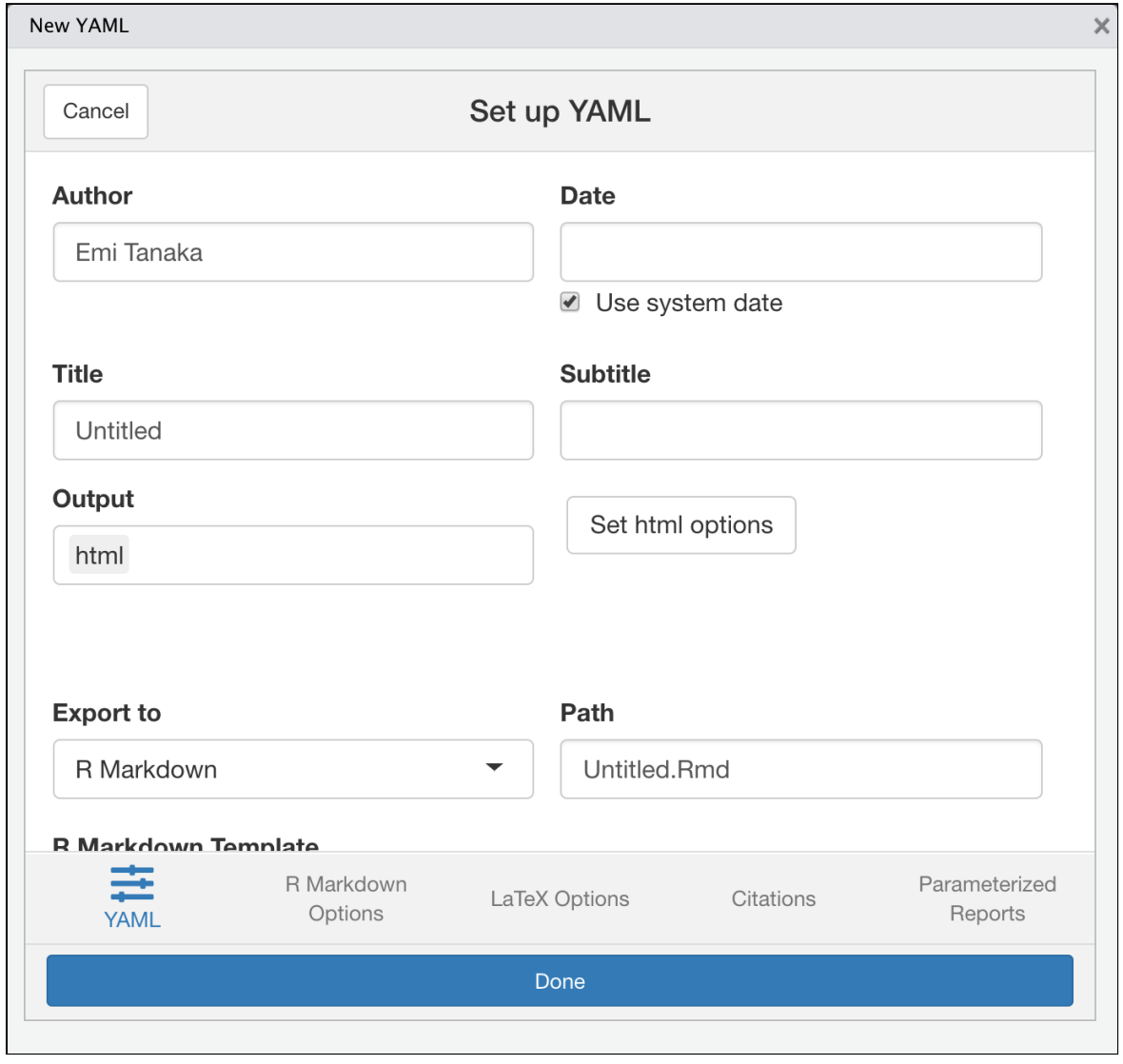
key can contain keys

```
---
output:
  html_document:
    toc: true
    toc_float: true
    code_download: true
    code_folding: "hide"
---
```

What does each of the above keys do?

04:00

ymlthis 📦

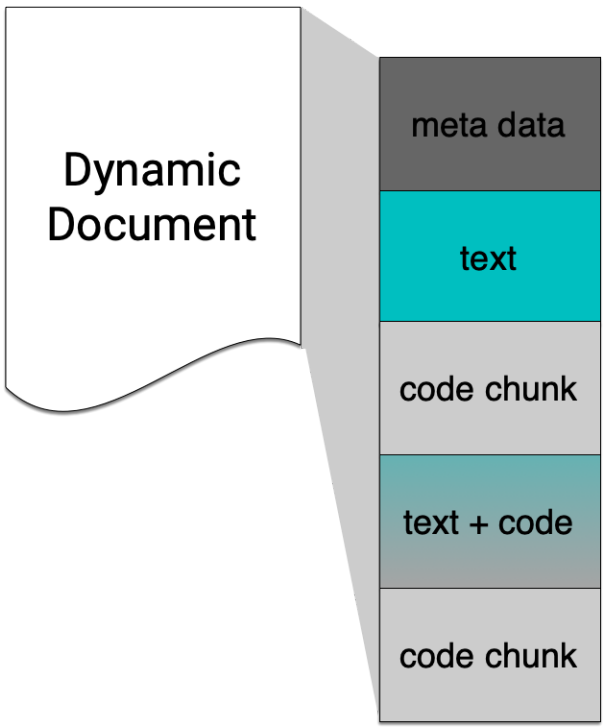


- If you installed `ymlthis` then go to RStudio > Addins > YMLTHIS
- It will launch a shiny app with various YAML options
- See also helper functions at https://ymlthis.r-lib.org/

🔧 Open and inspect the file

`challenge-01-yaml.Rmd`

Text


Dynamic Document
meta data
text
code chunk
text + code
code chunk

Text in Markdown: Headers

text

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

output

Header 1

Header 2

Header 3

Header 4

Header 5

Header 6

Go to RStudio > Help > Markdown Quick Reference

Text in Markdown: Formatting

text

```
**This text is bold**

__This text is also bold__

*This text is italic*

_This text is also italic_

**_You can combine both_**
```

output

This text is bold

This text is also bold

This text is italic

This text is also italic

You can combine both

Go to RStudio > Help > Markdown Quick Reference

Text in Markdown: Lists

text

```
1. Breakfast
   * Cereal
   * Milk
1. Lunch
   * Pizza
* Tissue box
   * Soft
   * Hard
* Soy sauce
```

output

1. Breakfast
    - Cereal
    - Milk
2. Lunch
    - Pizza
- Tissue box
    - Soft
    - Hard
- Soy sauce

Go to RStudio > Help > Markdown Quick Reference

Markdown: lightweight markup language

Focus on writing - add flair later

markdown

```
# Section
Bla bla.
Then **bold**.
```

html

```
<h1>Section</h1>
Bla bla.
Then <b>bold</b>.
```

latex

```
\section{Section}
Bla bla.
Then \textbf{bold}.
```

docx

Section

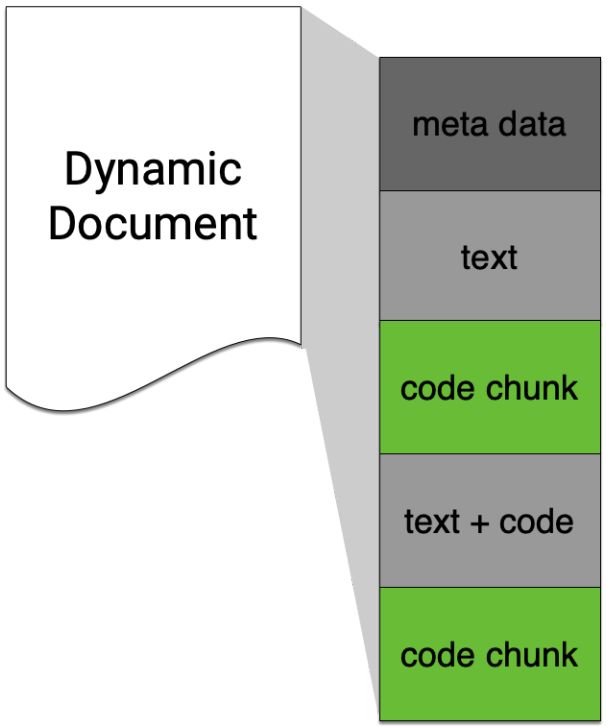
Bla bla.
Then **bold**.

🔧 Open and go through:

`challenge-02-table.Rmd`

05:00

Code chunk

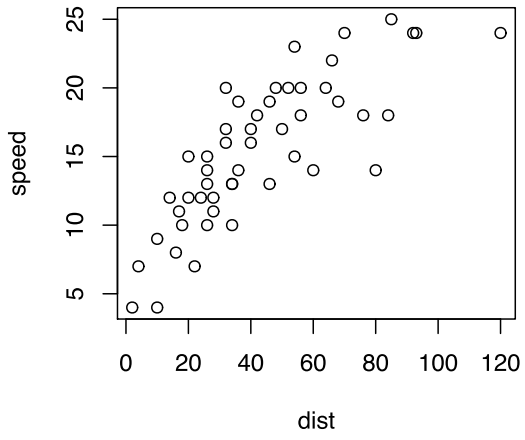
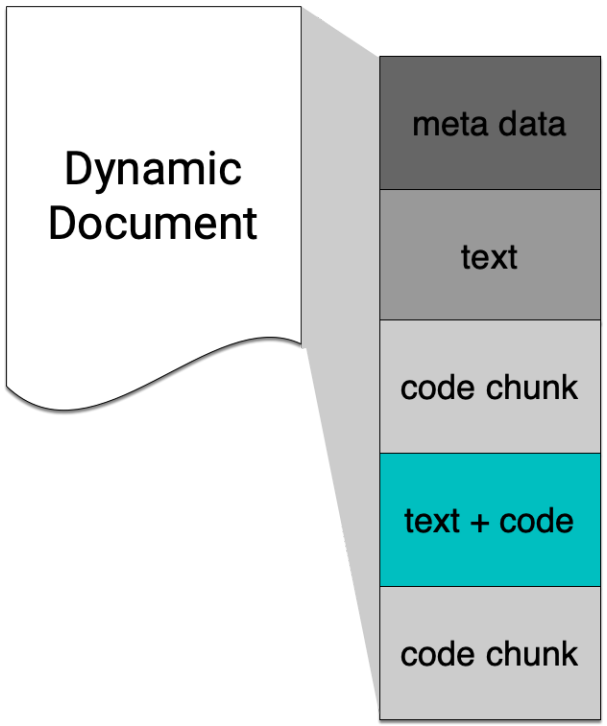
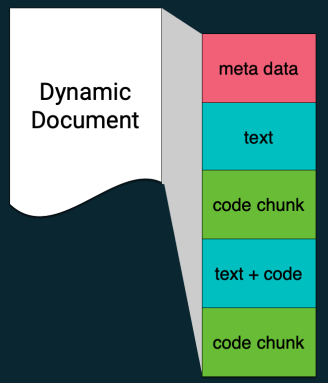
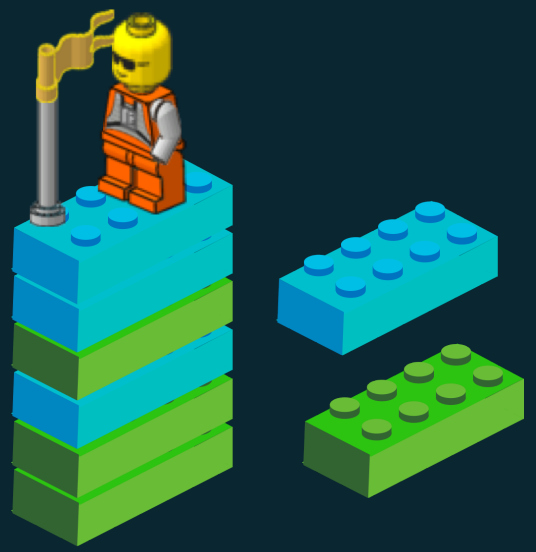

Dynamic
Document
meta data
text
code chunk
text + code
code chunk

Keyboard shortcut for inserting code chunk

In RStudio .Rmd press

- Mac: ⌘ + ⌥ + i
- PC: Ctrl + Alt + i

to insert a chunk of R code

```
```{r}

```
```

Chunk options: echo & eval

```
```{r, echo = FALSE}
plot(speed ~ dist, cars)
```
```




```
```{r, eval = FALSE}
plot(speed ~ dist, cars)
```
```

```
plot(speed ~ dist, cars)
```

Valid chunk options

- Chunk options must be written in **one line**, i.e. no line break.
- All option values must be **valid R expressions**. Exception is the chunk name. E.g.
  - `fig.path = figures/` is not valid but `fig.path = "figures/"` is valid
  - `eval = true` is not valid but `eval = runif(1) > 0.5` is valid

Chunk names (or labels)

The chunk below is called `plot1`.

````
```{r plot1}
ggplot(cars, aes(dist, speed)) + geom_poin
```
````

All chunks have a label regardless of whether it is explicitly supplied or not.

⚠ Do not include spaces, "_" or punctuation marks in your chunk name!

🔧 Pick your challenge:

`challenge-03-include.Rmd`

`challenge-04-global-option.Rmd`

`challenge-05-figures.Rmd`

`challenge-06-cache.Rmd`

`challenge-07-names.Rmd`

25:00

Inline code


Dynamic
Document
meta data
text
code chunk
text + code
code chunk

Inline R Commands

Text can contain inline R commands where output is `evaluated` but code is not `echoed`.

Text

````
Updated last: `r Sys.Date()`
````

Output

Updated last: 2019-11-15

Text

````
The value of $\pi$ is `r pi`.
````

Output

The value of π is 3.1415927.

Accessing YAML meta data inline

All YAML meta data are stored in `rmarkdown::metadata` as a list.

```
---
title: "R Markdown Workshop"
output: html_document
---
```

```
rmarkdown::metadata$title
```

```
[1] "R Markdown Workshop"
```

All key values of `params` is stored as a list in `params`.

```
---
params:
   data: datav1.csv
output: pdf_document
---
```

```
params$data
```

```
[1] "datav1.csv"
```

Stack your Rmd components as you want but only one YAML piece and it needs to be on the top!





For workflow, you'd probably want to keep your tower's height manageable.

R Markdown is not just for R

````
```{python, echo = FALSE}
a = [1, 2, 3]
a[0]
```
````

```
1
```

````
```{bash, echo = FALSE}
date +%B
```
````

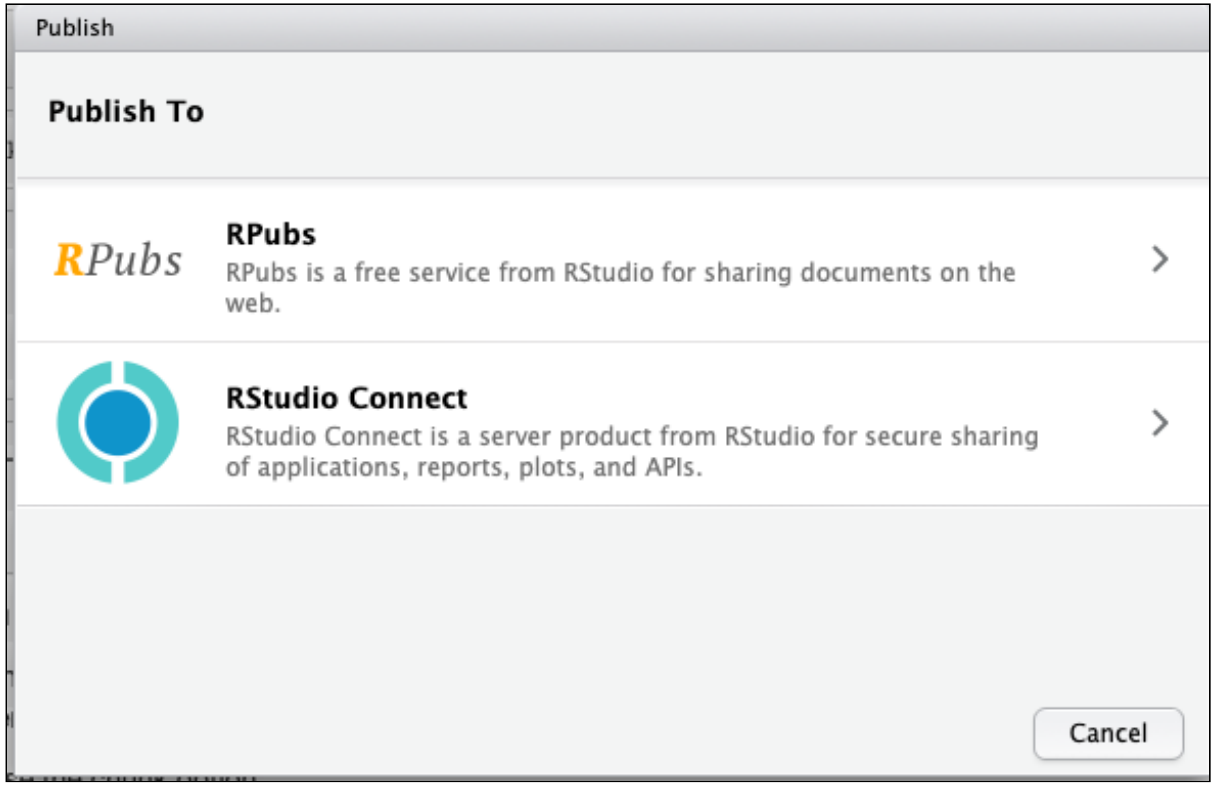
```
November
```

Sharing your html documents

RPubs

After knitting, find this Publish button:

and select RPubs if there is a choice:



Netlify: without Git

- Rename your output html file as `index.html`
- Go to https://app.netlify.com/
- If you are logged in, go to the bottom of Sites to find

- Drag and drop the folder that contains the `index.html`
- 🎉 it's alive!
- You probably want to change the site name - to do this go to site > site settings > change site name.

Netlify: with Git

- Rename your output html file as `index.html`
- Git commit your folder (or html file alone if no dependency)
- Host it on GitHub (my preference), GitLab or Bitbucket
- Go to https://app.netlify.com/ and create a new site from the repo
- 🎉🎉🎉🎉🎉
- Again, you probably want to change the site name - to do this go to site > site settings > change site name.

Happy sharing!

That's it for the basics!

Session Information

```
devtools::session_info()

  - Session info ---------------------------------------------------------
   setting  value
   version  R version 3.6.0 (2019-04-26)
   os       macOS Mojave 10.14.6
   system   x86_64, darwin15.6.0
   ui       X11
   language (EN)
```

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