

# **Dynamic documents in R**

**reproducible research with R  
Markdown**

**2020-08-22**

# Rmarkdown

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



Artwork by @allison\_horst

# R Markdown



**Authoring framework: code and text in same document**

**Reproducible: re-run your analysis**

**Flexible: Output to different formats easily**



## Your turn 1

Create a new R Markdown file. Go to File > New File > R Markdown. Press OK. Save the file and press the "Knit" button above.

The screenshot shows an RStudio interface with the following components:

- Left Panel (Code Editor):** Displays an R Markdown file named "1-example.Rmd". The code includes YAML metadata at the top, followed by plain text and a code chunk.
- YAML Metadata:** The first few lines of the file are:

```
1 ---  
2 title: "Viridis Demo"  
3 output: html_document  
4 ---
```
- Plain text:** The text from line 10 onwards describes the purpose of the code:

```
10 The code below demonstrates two color palettes in the  
11 [viridis](https://github.com/sjmgarnier/viridis) package. Each  
12 plot displays a contour map of the Maunga Whau volcano in  
13 Auckland, New Zealand.  
14  
15 ## Viridis colors  
16  
17  
18 ## Magma colors  
19  
20  
21 image(volcano, col = viridis(200), option = "A")  
22  
23
```
- Code chunk:** The code chunk starts at line 15, which contains the R command `image(volcano, col = viridis(200))`.

# R Markdown

Prose

Code

Metadata



# R Markdown

**Prose = Markdown**

Code

Metadata



# Basic Markdown Syntax

\*italic\*    \*\*bold\*\*

\_italic\_    \_\_bold\_\_

# Basic Markdown Syntax

```
# Header 1  
## Header 2  
### Header 3
```

# Basic Markdown Syntax

- \* Item 1
- \* Item 2
  - + Item 2a
  - + Item 2b
- 1. Item 1
- 2. Item 2

# Basic Markdown Syntax

`http://example.com`

`[linked phrase](http://example.com)`

# Basic Markdown Syntax



![optional caption text] ([figures/img.png](#))

# Basic Markdown Syntax

\$equation\$

\$\$ equation \$\$

# Basic Markdown Syntax

superscript^2^

~~strikethrough~~

## Your turn 2

Do the ten-twenty minute tutorial on  
markdown at

<https://commonmark.org/help/tutorial>.

Let us know if you need help!

## Your turn 3

Use Markdown syntax to stylize the text from the [Gapminder website](#) below. Experiment with bolding, italicizing, making lists, etc.

# R Markdown

Prose

**Code = R code chunks**

Metadata



## Code chunks

```
```{r select_example, echo = FALSE}
gapminder %>%
  select(year, country)
````
```

## Code chunks

fences (3  
backticks)

```
{r select_example, echo = FALSE}  
gapminder %>%  
  select(year, country)
```

## Code chunks

chunk name

```
```{r select_example, echo = FALSE}  
gapminder %>%  
  select(year, country)  
```
```

chunk  
arguments

# Chunk options

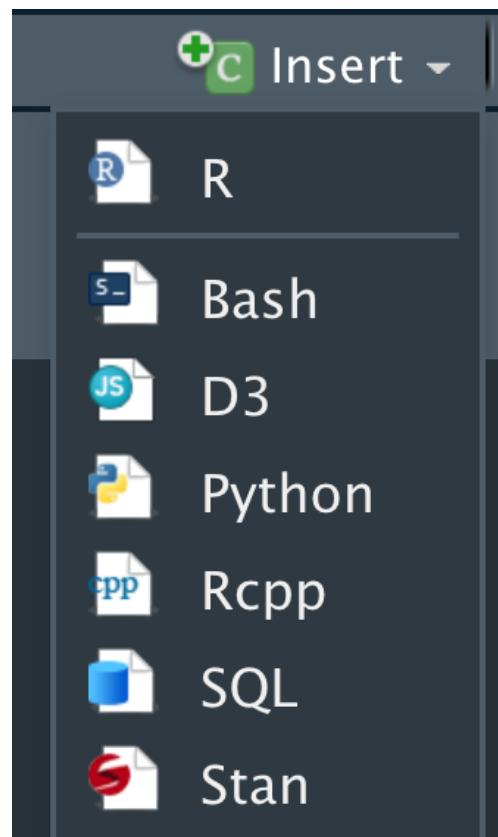
| Option                            | Effect                                       |
|-----------------------------------|--|
| <code>include = FALSE</code>      | run the code but don't print it or results   |
| <code>eval = FALSE</code>         | don't evaluate the code                      |
| <code>echo = FALSE</code>         | run the code and output but don't print code |
| <code>message = FALSE</code>      | don't print messages (e.g. from a function)  |
| <code>warning = FALSE</code>      | don't print warnings                         |
| <code>fig.cap = "Figure 1"</code> | caption output plot with "Figure 1"          |

See the [knitr web page](#)

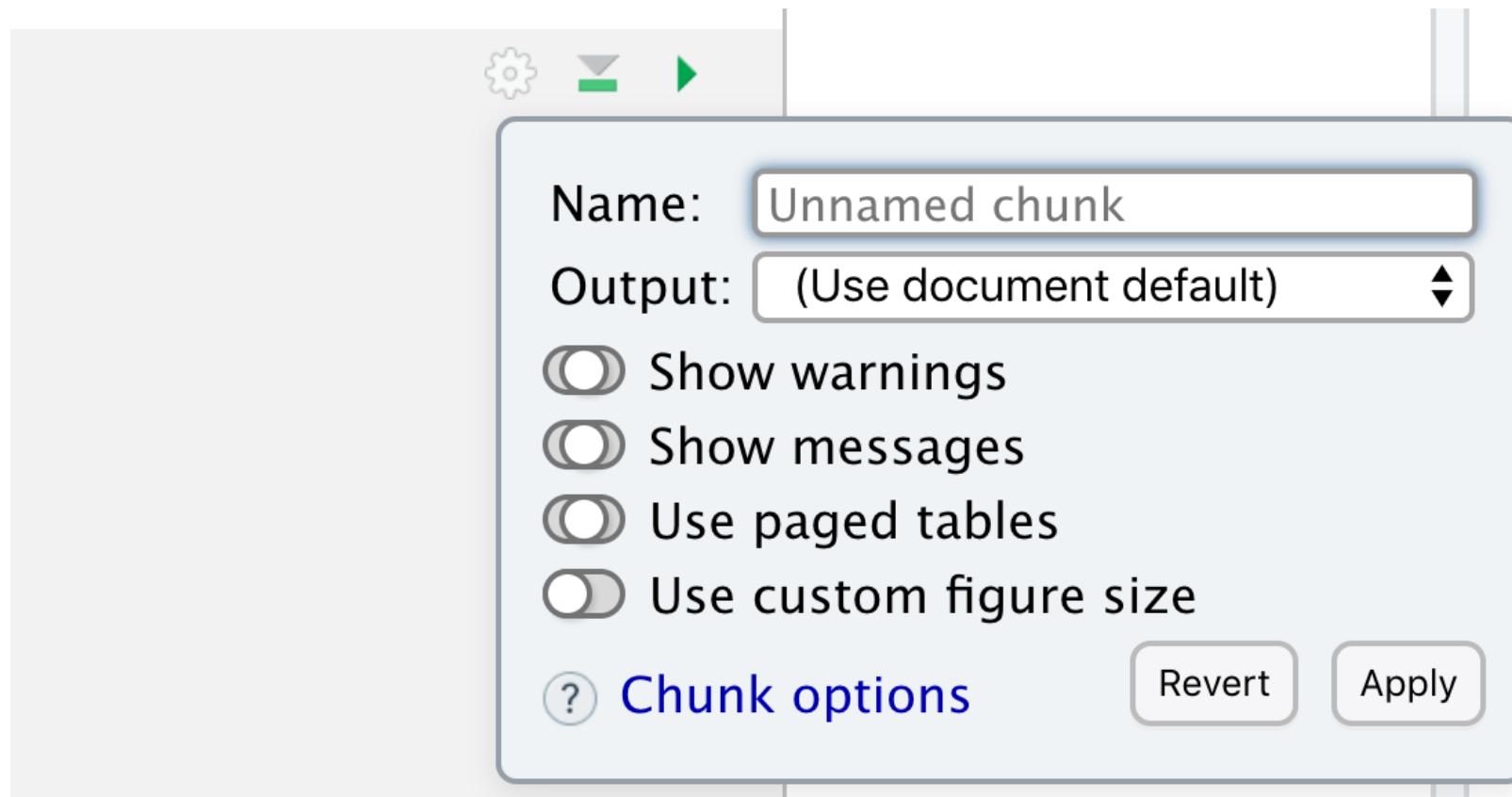
# Engines

52! Including **Python, Julia, C++, SQL, SAS, and Stata**

**Insert code chunks with cmd/ctrl +  
alt/option + I**



# Edit code chunk options



## Your turn 4 (open exercises.Rmd)

Create a code chunk. You can type it in manually, use the keyboard short-cut (Cmd/Ctrl + Option/Alt + I), or use the "Insert" button above. Put the following code in it:

```
gapminder %>%
  slice(1:5) %>%
  knitr::kable()
```

**Knit the document**

## Your turn 5

**Add echo = FALSE to the code chunk above and re-knit**

**Remove echo = FALSE from the code chunk and move it to knitr::opts\_chunk\$set() in the setup code chunk. Re-knit. What's different about this?**

**Make sure to remove knitr::opts\_chunk\$set(echo = FALSE)**

# Inline Code

Lore*m ipsum dolor sit  
amet, consetetur  
sadipscing  
`r max(gapminder\$year)`  
elitr, sed diam nonumy  
eirmod tempor invidunt*

## Inline Code

backticks  
+ r  
`r max(gapminder\$year)`  
any R code

## Your turn 6

**Remove eval = FALSE so that R Markdown evaluates the code.**

**Use summarize() and n\_distinct() to get the the number of unique years in gapminder and save the results as n\_years.**

**Use inline code to describe the data set in the text below the code chunk and re-knit.**

# R Markdown

Prose

Code

**Metadata = YAML**



# YAML Metadata

```
---
author: Malcolm Barrett
title: Quarterly Report
output:
  html_document: default
  pdf_document:
    toc: true
---
```

```
title: "Annual report"  
author: Malcolm Barrett  
date: "`r Sys.Date()`"  
output:  
  pdf_document:  
    toc: true
```

```
title: "Annual report"  
author: Malcolm Barrett  
date: "r Sys.Date()"  
output:  
pdf_document:  
  toc: true
```

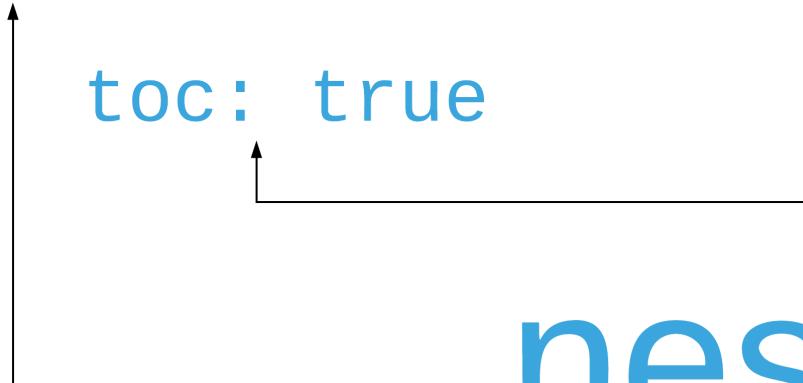
key value

```
title: "Annual report"  
author: Malcolm Barrett  
date: "`r Sys.Date()`"
```

output: ← **top level**

`pdf_document:`

`toc: true`



**nested**

```
title: "Annual report"
```

```
author: Malcolm Barron
```

```
date: " `r Sys.Date() ` "
```

```
output:
```

```
pdf_document:
```

```
  toc: true
```

# output function

```
output
```

# arguments

```
title: "Annual report"  
author: Malcolm Barrett  
date: "`r Sys.Date()`"  
output:  
  pdf_document:  
    toc: true
```

**pdf\_document(toc = TRUE)**

# Output formats

| Function                               | Outputs             |
|--|---------------------|
| <code>html_document()</code>           | HTML                |
| <code>pdf_document()</code>            | PDF                 |
| <code>word_document()</code>           | Word .docx          |
| <code>odt_document()</code>            | .odt                |
| <code>rtf_document()</code>            | .rtf                |
| <code>md_document()</code>             | Markdown            |
| <code>slidy_presentation()</code>      | Slidy Slides (HTML) |
| <code>beamer_presentation()</code>     | Beamer Slides (PDF) |
| <code>ioslides_presentation()</code>   | ioslides (HTML)     |
| <code>powerpoint_presentation()</code> | Powerpoint Slides   |

## Your turn 7

**Set figure chunk options such as dpi, fig.width, and fig.height. Run knitr::opts\_chunk\$get() in the console to see the defaults.**

**Change the YAML header above from output: html\_document to another output type like pdf\_document or word\_document.**

**Add your name to the YAML header using author: Your Name.**

# ymlthis

check out the `ymlthis` package for tools  
and documentation for working with  
`YAML`

<https://r-lib.github.io/ymlthis/>

# Parameters

```
---  
params:  
  param1: x  
  param2: y  
  data: df  
---
```

```
params$param1  
params$param2  
params$data
```

## Your turn 8

**Change the params option in the YAML header to use a different continent. Re-knit**

```
gapminder %>%
  filter(continent == params$continent) %>%
  ggplot(aes(x = year, y = lifeExp, group = country, color = country)
  geom_line(lwd = 1, show.legend = FALSE) +
  scale_color_manual(values = country_colors) +
  theme_minimal(14) +
  theme(strip.text = element_text(size = rel(1.1))) +
  ggtitle(paste("Continent:", params$continent))
```

# Bibliographies and citations

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**Bibliography files: .bib, End Note, others**

# Bibliographies and citations

Bibliography files: .bib, End Note, others

Citation styles: .csl

# Bibliographies and citations

Bibliography files: .bib, End Note, others

Citation styles: .csl

[@citation-label]

# Including bibliography files in YAML

```
---
```

```
bibliography: file.bib
```

```
csl: file.csl
```

```
---
```

## Your turn 9

**Cite the Causal Inference book in text below in the format [@citation-label]. The label for the citation is hernan\_causal\_2019**

**Add the American Journal of Epidemiology CSL to the YAML using csl: aje.csl**

**Check out the `citr` package for  
easy citation insertion and `.bib`  
management**

# **Make cool stuff in R Markdown!**

**bookdown**

**blogdown**

**these slides!**

# Resources

**R Markdown:** A comprehensive but friendly introduction to R Markdown and friends. Free online.

**R for Data Science:** A comprehensive but friendly introduction to the tidyverse. Free online.

**R Markdown for Scientists:** R Markdown for Scientists workshop material.