

Dynamic documents in R

reproducible research with R Markdown

2020-09-22

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



knitting

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:

- YAML Metadata:** A section labeled "YAML Metadata" containing the following YAML code:

```
1 ---  
2 title: "Viridis Demo"  
3 output: html_document  
4 ---
```
- Plain text:** A section labeled "Plain text" containing the following text:

```
6 ```{r include = FALSE}  
7 library(viridis)  
8 ...  
9  
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:** A section labeled "Code chunk" containing the following code chunk:

```
6 / 51
```

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

superscript²

~~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

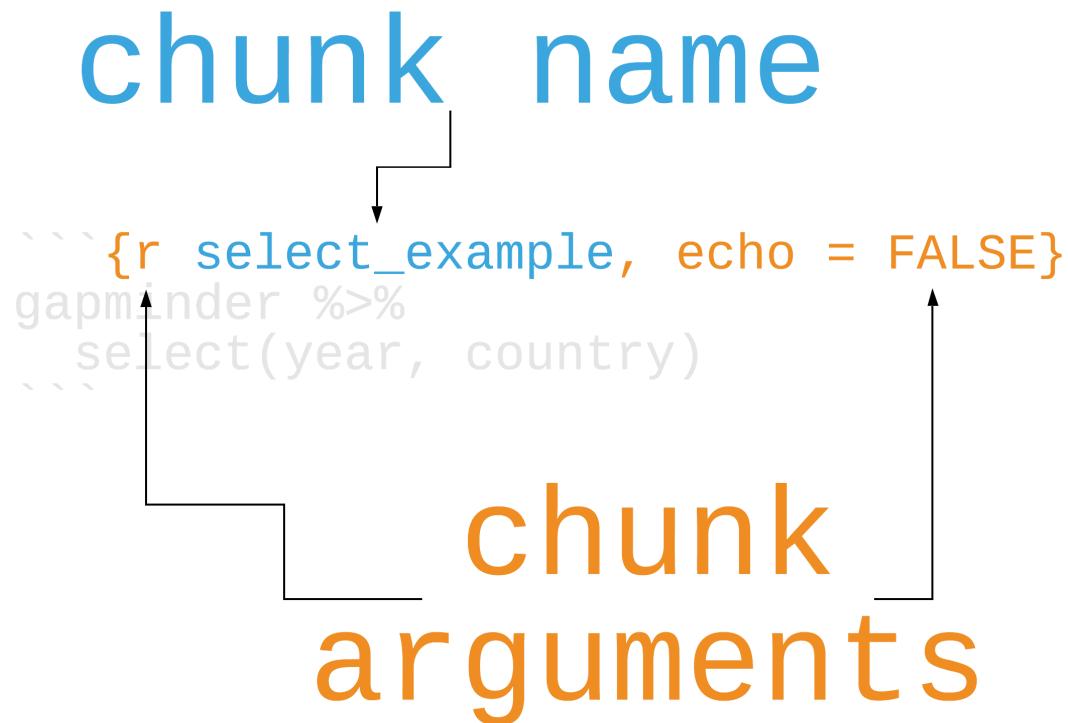
```
```{r select_example, echo = FALSE}
gapminder %>%
 select(year, country)
```
```

Code chunks

fences (3
backticks)

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

Code chunks



Chunk options

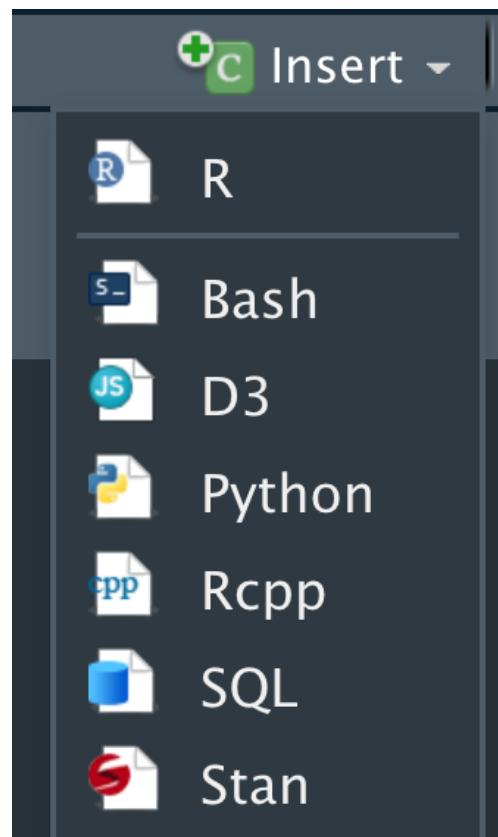
| Option | Effect |
|-----------------------------------|--|
| <code>include = FALSE</code> | run the code but don't print it or results |
| <code>eval = FALSE</code> | don't evaluate the code |
| <code>echo = FALSE</code> | run the code and output but don't print code |
| <code>message = FALSE</code> | 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](#)

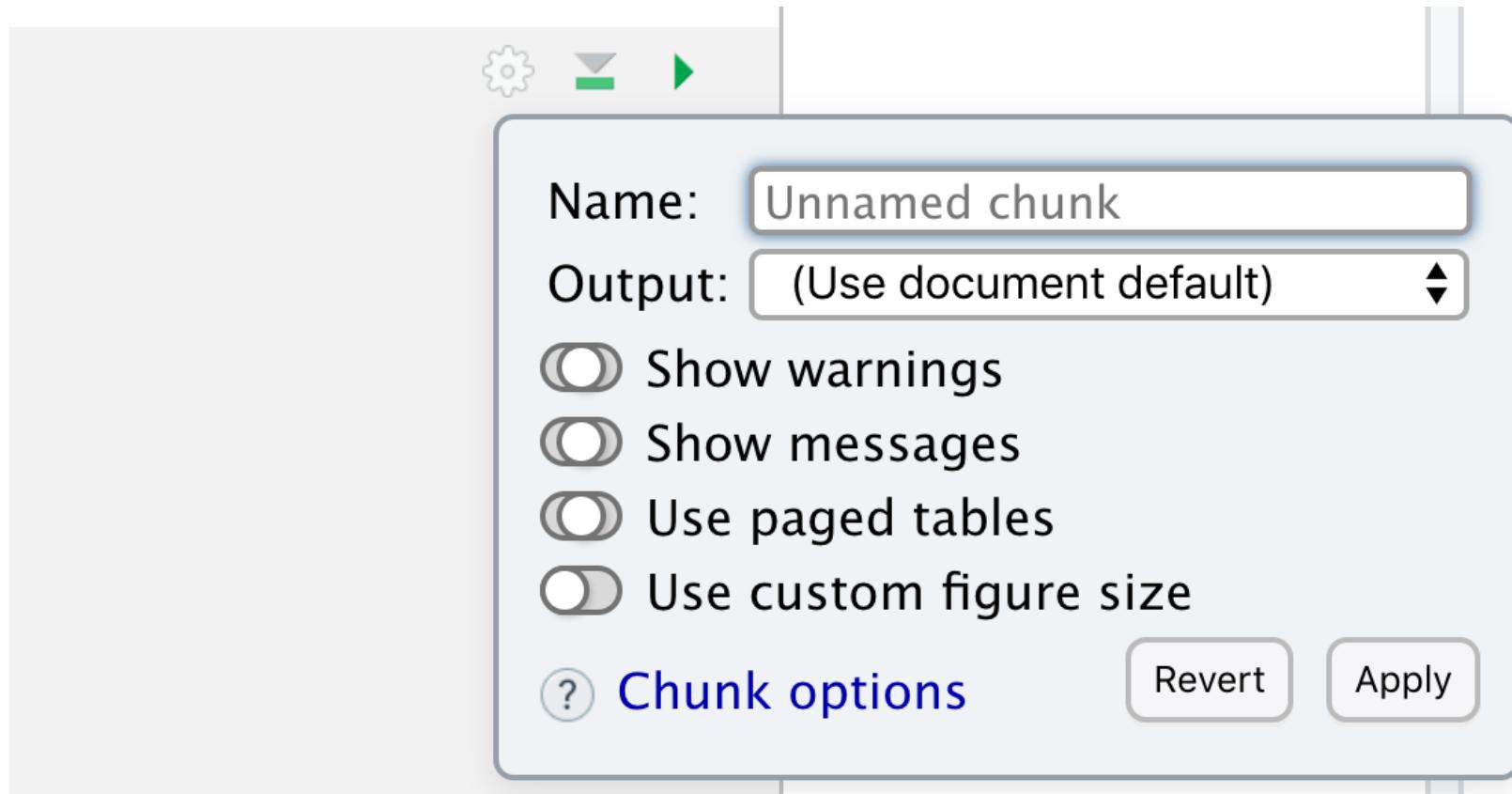
Engines

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

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

The diagram illustrates the use of backticks in R. A large orange bracket labeled "backticks" spans the entire line of code. Inside the backticks, the character "r" is highlighted in orange, and the word "max" is highlighted in blue. A bracket labeled "+ r" is positioned above the "r" character. Below the code, the text "any R code" is written in blue. Arrows point from the "backticks" label to the opening and closing backticks, and from the "+ r" label to the "r" character.

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
```

The diagram illustrates a key-value pair within a YAML configuration file. The word "key" is highlighted in orange and positioned above the colon in the line "title: "Annual report"". The word "value" is highlighted in blue and positioned below the colon in the same line. A bracket on the left side of the colon groups "key" and "value". Another bracket on the right side of the colon groups the entire line "title: "Annual report"".

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

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

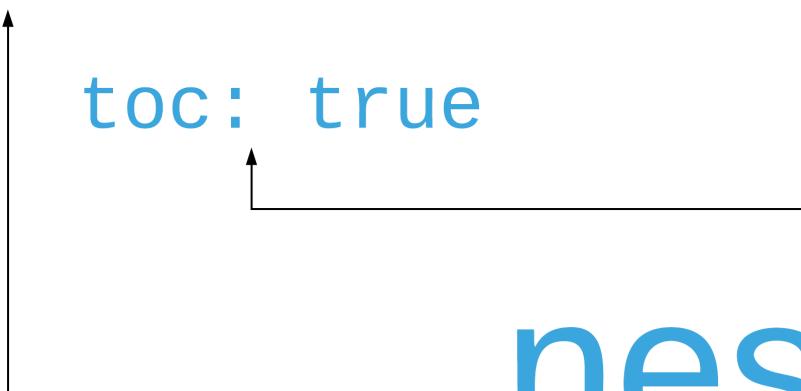
```
author: Malcolm Barrett
```

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

```
output: ← 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 |
|---------------------------|---------------------|
| html_document() | HTML |
| pdf_document() | PDF |
| word_document() | Word .docx |
| odt_document() | .odt |
| rtf_document() | .rtf |
| md_document() | Markdown |
| slidy_presentation() | Slidy Slides (HTML) |
| beamer_presentation() | Beamer Slides (PDF) |
| ioslides_presentation() | ioslides (HTML) |
| powerpoint_presentation() | 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

Bibliographies and citations

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.