

Dynamic documents in R

reproducible research with R Markdown

2019-08-15

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.

```
~/Documents/rmarkdown - gh-pages - RStudio
>Addins
```

1-example.Rmd x

1 ---
2 title: "Viridis Demo"
3 output: html_document
4 ---
5
6 ```{r include = FALSE}
7 library(viridis)
8 ...
9
10 The code below demonstrates two color palettes in the
[viridis](<https://github.com/sjmgarnier/viridis>) package. Each
plot displays a contour map of the Maunga Whau volcano in
Auckland, New Zealand.
11
12 ## Viridis colors
13
14 ```{r}
15 image(volcano, col = viridis(200))
16 ...
17
18 ## Magma colors
19
20 ```{r}
21 image(volcano, col = viridis(200, option = "A"))
22 ...
23

Environment History Build Git

Files Plots Packages Help Viewer

YAML Metadata } Plain text } Code chunk

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 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

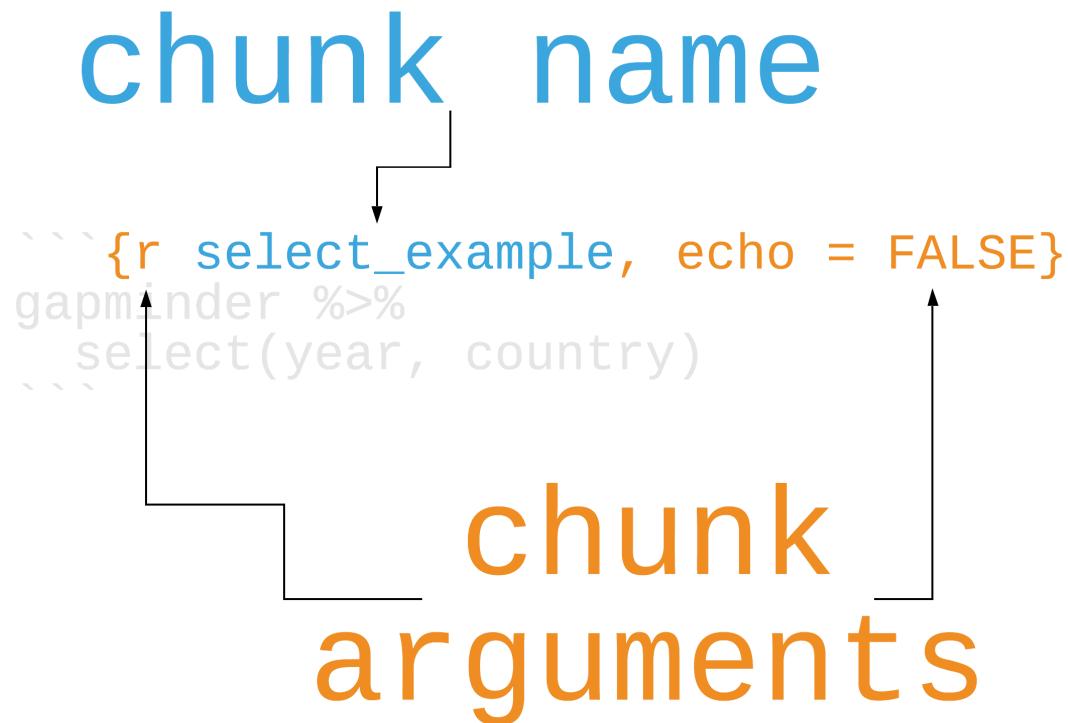
```
```{r select_example, echo = FALSE}
gapminder %>%
 select(year, country)
```
```

Code chunks

fences (3
backticks)

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

Code chunks



Chunk options

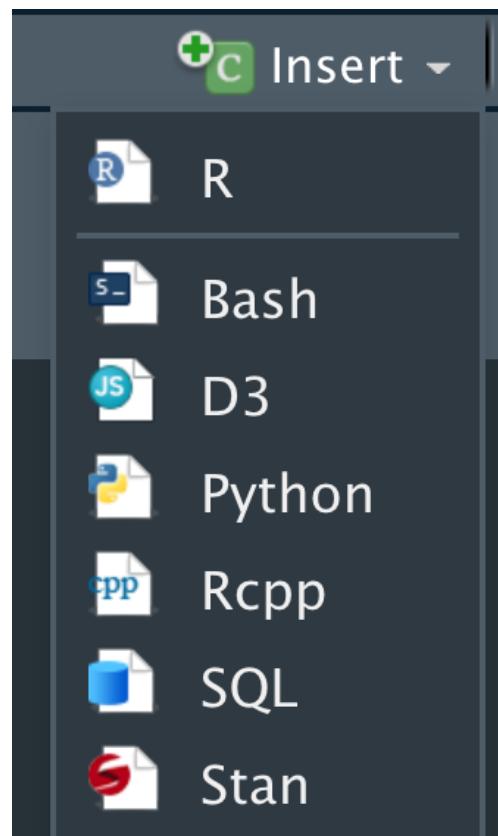
| Option | Effect |
|-----------------------------------|--|
| <code>include = FALSE</code> | run the code but don't print it or results |
| <code>eval = FALSE</code> | don't evaluate the code |
| <code>echo = FALSE</code> | run the code and output but don't print code |
| <code>message = FALSE</code>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

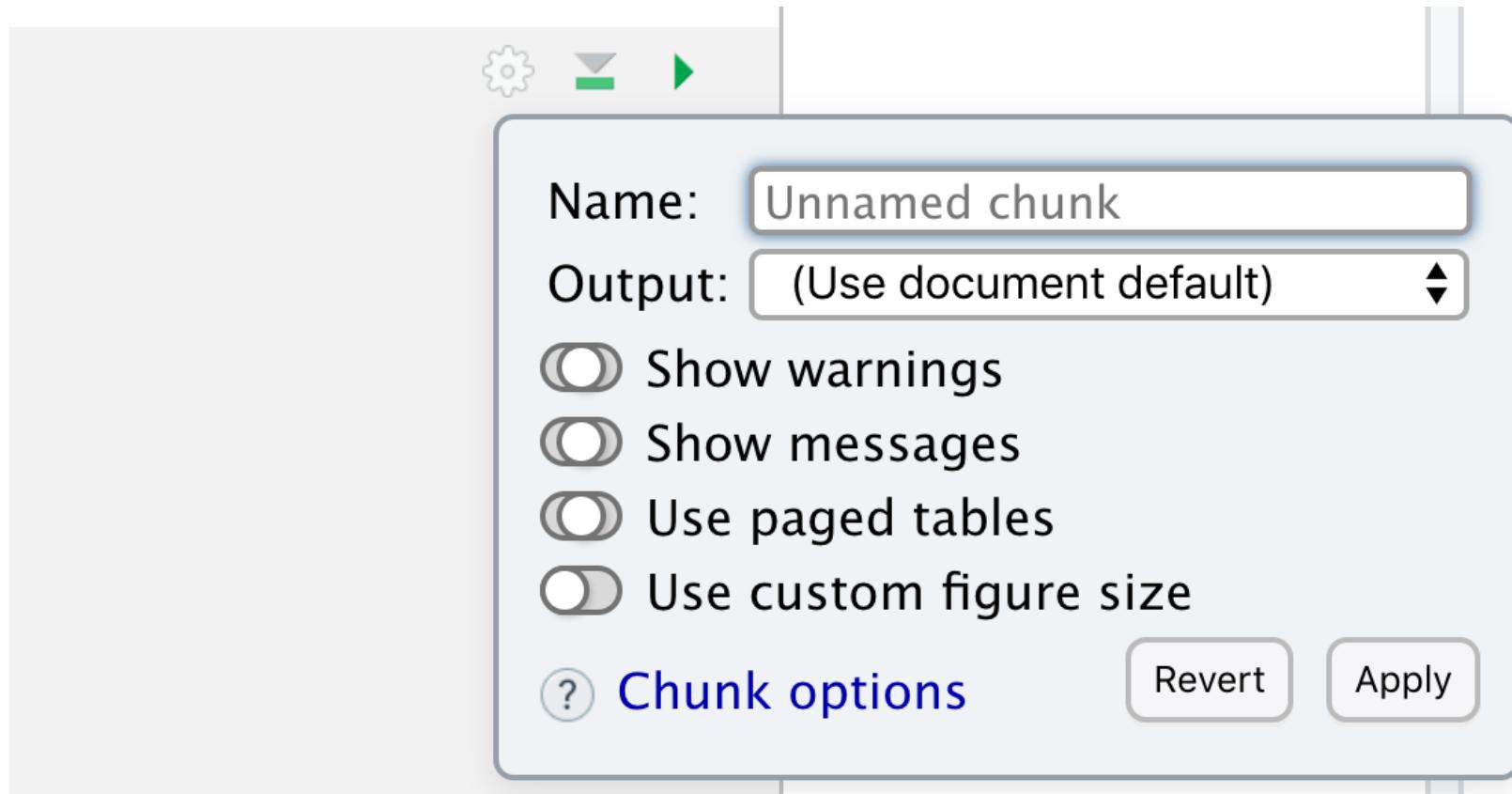
Engines

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

 Lorem 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 function call "max(gapminder\$year)" is highlighted in blue. Two arrows point from the word "backticks" to the opening and closing backticks of the code block. Another arrow points from the word "any R code" to the blue-highlighted portion of the 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
```

A diagram illustrating a key-value pair in a YAML configuration. The word "key" is written in orange and "value" in blue. An arrow points from the top of "key" to the first line of code, and another arrow points from the end of "value" to the closing double quote of the value string.

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

output:

pdf_document:

toc: true

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

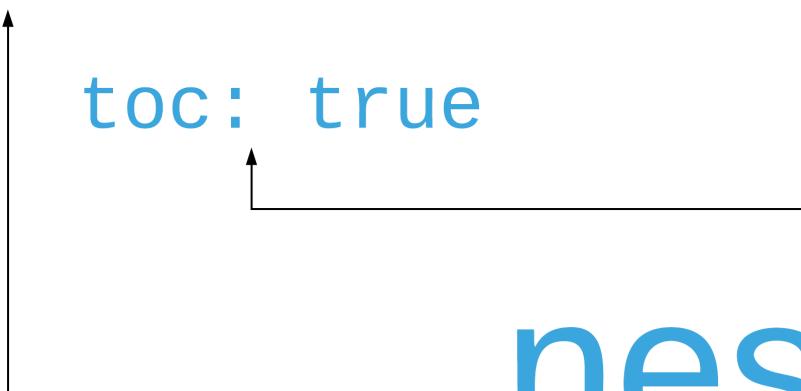
```
author: Malcolm Barrett
```

```
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 |
|--|---------------------|
| <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

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.