Creating Reproducible Analyses: Introduction to RMarkdown

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Slides adapted from David Keyes (@dgkeyes), inspired by Danielle Navarro (@djnavarro) and Paul Campbell (@paulcampbell91)

Art by @allison_horst

What is RMarkdown?

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Authoring framework for data science.

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You can:

1. Write, save, and run code
2. Generate high-quality reports that can be shared with an audience

RMarkdown Interface

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- Share your analyses and results with your lab in a variety of formats (e.g., PDF, HTML, Word)
- Build interactive applications (e.g., Shiny)
- Write journal articles
- Make slides for presentations (like this one!)
- Create websites or blogs
- and more!

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You can alternate between text and code within the same document

```
#you don't need to use hashtags for text (outside of a chunk)
```

You can also visualize what your code will look like once it's knitted!

RMarkdown Overview

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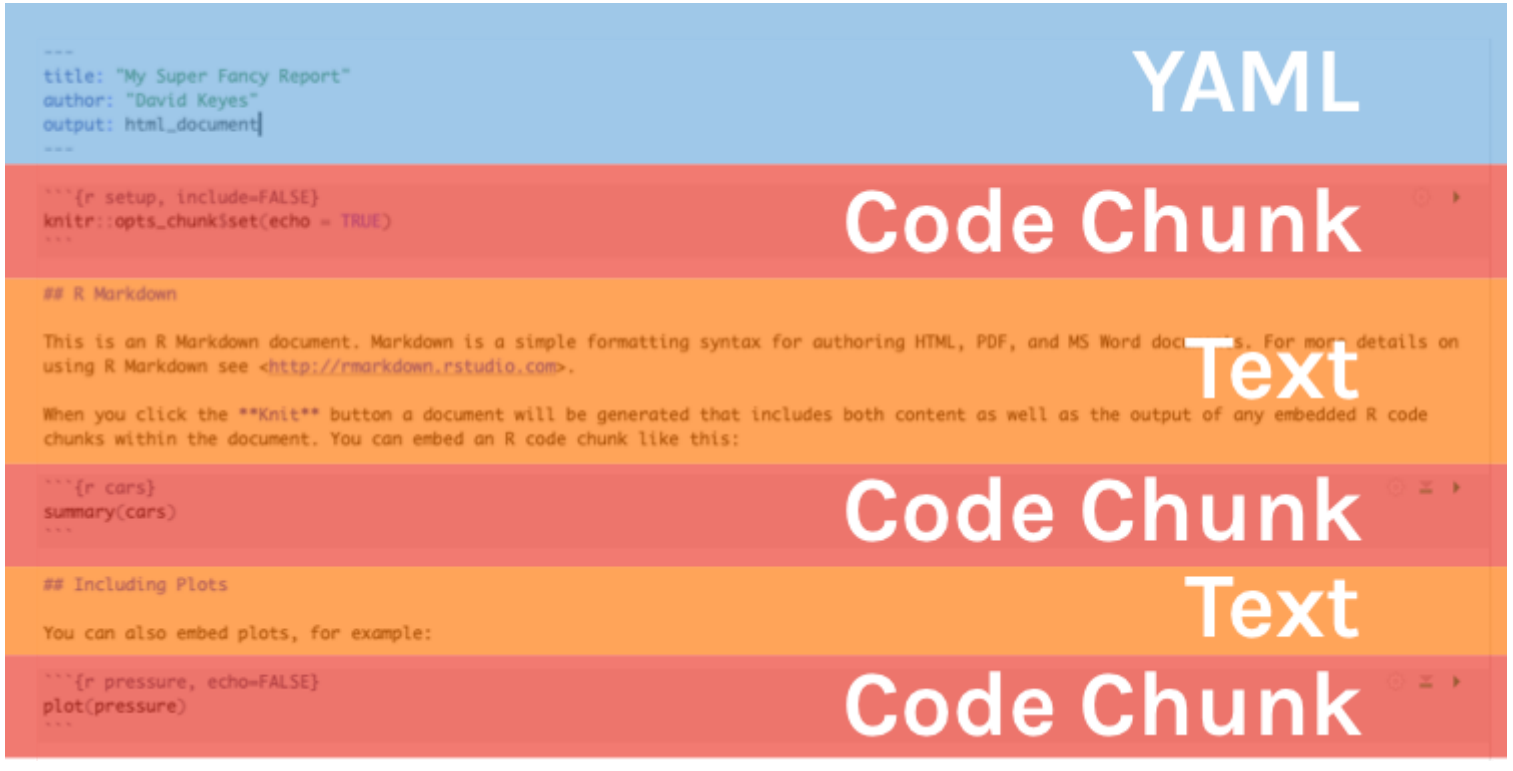
Every RMarkdown document has the following:



YAML

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date: "07/18/2020"
output: word_document
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Where you add title, author, date, output options, etc.

Specify how you want your knitted file to look (e.g., do you want a table of contents? do you want your code to be visible? etc.)

Text

```
---
title: "My Super Fancy Report"
author: "David Keyes"
output: html_document
---

```{r setup, include=FALSE}
knitr::opts_chunk$set(echo = TRUE)
```

R Markdown

This is an R Markdown document. Markdown is a simple formatting syntax for authoring HTML, PDF, and MS Word documents. For more details on using R Markdown see <http://rmarkdown.rstudio.com>.

When you click the **Knit** button a document will be generated that includes both content as well as the output of any embedded R code chunks within the document. You can embed an R code chunk like this:

```{r cars}
summary(cars)
```

Including Plots

You can also embed plots, for example:

```{r pressure, echo=FALSE}
plot(pressure)
```
```

Text

Text

Text

Markdown

```
Text with **some words in bold**
and *some words in italics*
```

Text

Markdown

```
Text with **some words in bold**
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Output

Text with **some words in bold** and *some words in italics*

Headers

Markdown

```
# First-Level Header

## Second-Level Header

### Third-Level Subheader
```

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First-Level Header

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Lists

Markdown

```
- Bulleted list item
- Bulleted list item

1. Numbered list item
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- This is great for writing papers!

Code Chunk

They start with three backticks and {r} and end with three backticks.

```
```{r}
ggplot(data,aes(dwt,dht, color = ded_lbls)) +
  geom_point() + scale_color_viridis_d(option = "inferno") +
  labs (title = "Fathers' weight vs height based on education level",
        x = "Weight (pounds)",
        y = "Height (inches)",
        color = "Education levels") +
  theme_classic()

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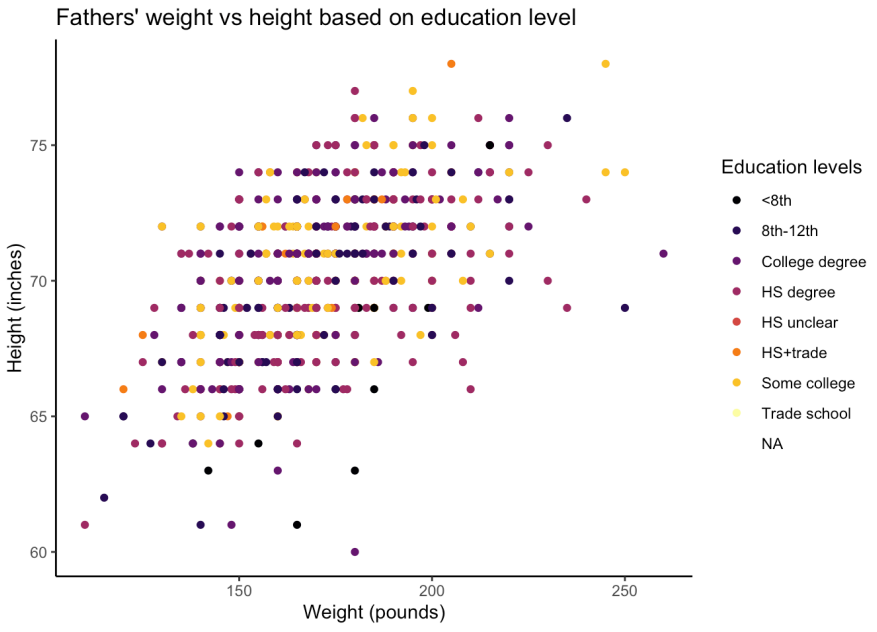

Insert a Code Chunk: Button

Insert a Code Chunk: Keyboard Shortcut

Windows

control+alt+i

Insert a Code Chunk: Keyboard Shortcut

Windows

control+alt+i

Mac

command+option+i

Chunk Options

Other options that we won't discuss today:

- **`warning`** (show any warnings that R throws)
- **`message`** (show any messages that R sends)
- **`fig.width`** (default figure width)
- **`fig.height`** (default figure height)
- **`echo`** (show the R code in the knitted report)
- and many more …

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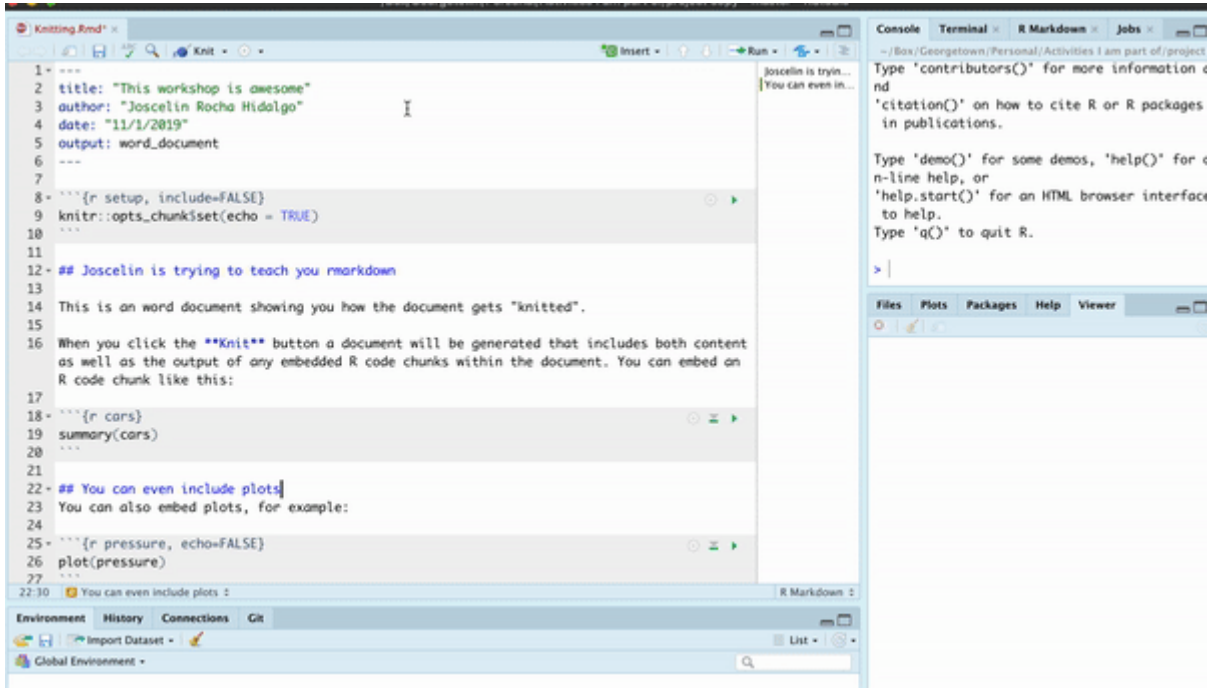
Options at the individual chunk level **override** global chunk options.

Knitting (aka Export)



Your RMarkdown won't knit if you have errors in your code. Knit early and often to identify errors!

Writing Reproducible Code

(adapted from Harvard WiP Crash Course in R by Kirsten Morehouse)

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Reproducible = When you send someone your code and data, they can 100% reproduce your results, without getting errors (or divergent results)

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- Save any models you've run.
- Clear your environment and try running everything again. Bonus if you run your code on a new machine.

Share your code

Info to include:

- README file
  - What should users expect to see in your repo?
- Instructions for reproducing your results (make sure to include the R script and data names, as well as the order in which the scripts shoudl be run)
- Data + Codebook
- Analysis script (bonus points for data cleaning script, too!)
- Saved models

Your Turn

1. Create a new RMarkdown file, setting the default output format as Word.
    - File > New File > R Markdown...
2. Save your RMarkdown file as report.Rmd.
3. Go into the YAML and change the title to “My 2022 Report.”
4. Change the output format to HTML by changing `output: word_document` to `output: html_document`.
5. Add the following first-level header: "Introduction"

03:00

Your Turn

6. Add this text (note the bold and italics) below the introduction header: "My name is (write your name here). I am the most **amazing** human being. You've *never* met someone like me. Please hire me!"
7. Add the following second-level header: "Reasons Why I am the Best"
8. Add the following list of reasons:

```
- Because I say so
- Because it is true
- Why would I lie?
```

9. Create a chunk using a shortcut
10. Calculate 2 + 2 and save the result as a variable called "my_var"
11. Print "my_var" using print()
12. Knit and reopen the report.html file

05:00

More Resources

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