RMarkdown Flexibility

Anatomy of .Rmd

1. **Document Information**

2. **Formatted Text**

3. **Code Chunks**

Today

All the different parameters you can add to your code chunks and document information (aka yaml header) for added flexibility.

Absolutely, 100% do **NOT** memorize *any* of this!

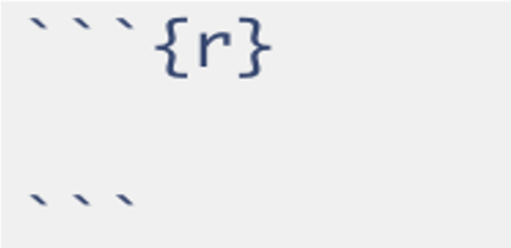
Parameter

A parameter is the thing that goes within the curly brackets `{ }` at the top of a code chunk. Some useful ones we will cover:

- Programming languge (necessary)
- Name of chunk (strongly encouraged)
- Echo
- Include
- Eval
- Message/Warning
- Figure parameters

What programming language?

- Default is R (obviously)
- But it can be different…

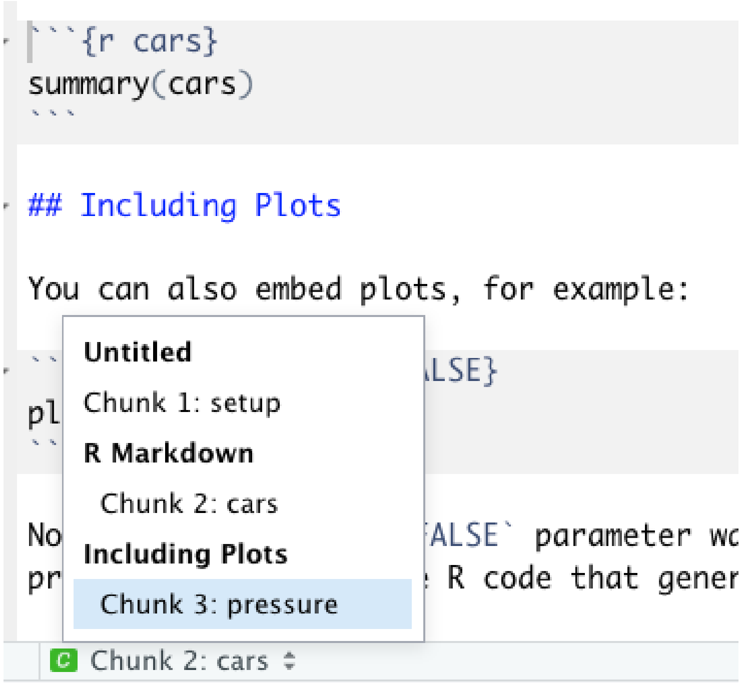


~~~
```{r}

```
~~~

~~~
```{python}

```
~~~

Name of chunk

- No comma (`,`) after the programming language parameter
- Name your chunk something that you will remember and makes sense!
    - Do **not** include spaces in the name
    - Do **not** include special characters like `#`, `$`, `%`, etc.
    - Dashes (`-`) and underscores (`_`) are OK
- Naming your chunk should help you navigate your document



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

Including Plots

You can also embed plots, for example:

``   LSE}
pl
``

No   ALSE` parameter wo
pr   R code that gener
```
```

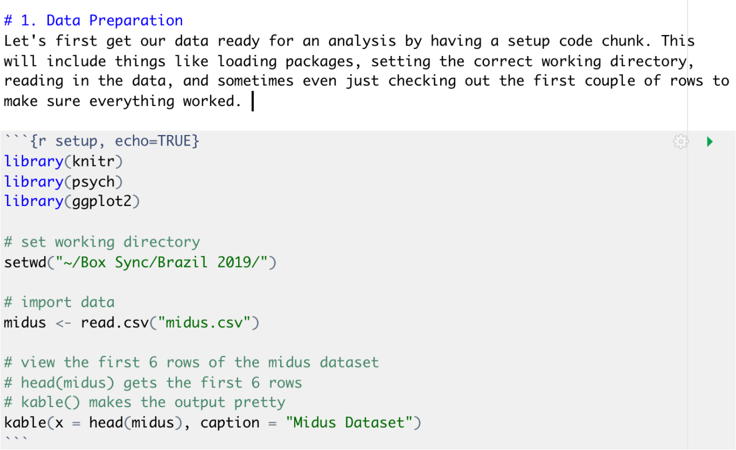
The echo parameter

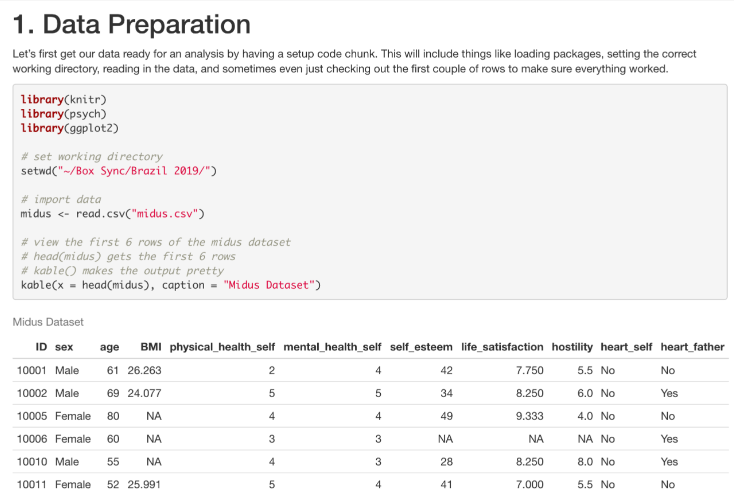
The `echo` parameter refers to if the code in the chunk should show up in your output document.

- If you want your code to appear, `echo = TRUE` (this is the default behavior)
- If you only the *OUTPUT* of the code to appear (not the code itself), set `echo = FALSE`

All the code will be run and executed no matter what!

echo = TRUE



~~~
# 1. Data Preparation
Let's first get our data ready for an analysis by having a setup code chunk. This
will include things like loading packages, setting the correct working directory,
reading in the data, and sometimes even just checking out the first couple of rows to
make sure everything worked.

```{r setup, echo=TRUE}
library(knitr)
library(psych)
library(ggplot2)

# set working directory
setwd("~/Box Sync/Brazil 2019/")

# import data
midus <- read.csv("midus.csv")

# view the first 6 rows of the midus dataset
# head(midus) gets the first 6 rows
# kable() makes the output pretty
kable(x = head(midus), caption = "Midus Dataset")
~~~
~~~



1. Data Preparation

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```r
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~~~
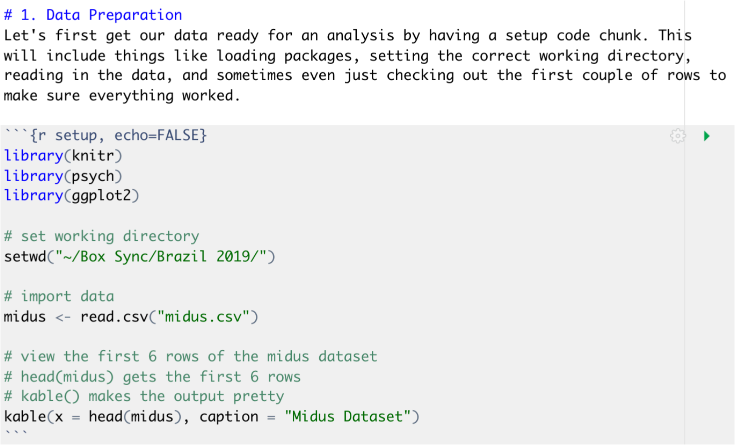

Midus Dataset

| ID | sex | age | BMI | physical_health_self | mental_health_self | self_esteem | life_satisfaction | hostility | heart_self | heart_father |
|---:|:---|---:|---:|---:|---:|---:|---:|---:|:---|:---|
| 10001 | Male | 61 | 26.263 | 2 | 4 | 42 | 7.750 | 5.5 | No | No |
| 10002 | Male | 69 | 24.077 | 5 | 5 | 34 | 8.250 | 6.0 | No | Yes |
| 10005 | Female | 80 | NA | 4 | 4 | 49 | 9.333 | 4.0 | No | No |
| 10006 | Female | 60 | NA | 3 | 3 | NA | NA | NA | No | Yes |
| 10010 | Male | 55 | NA | 4 | 3 | 28 | 8.250 | 8.0 | No | Yes |
| 10011 | Female | 52 | 25.991 | 5 | 4 | 41 | 7.000 | 5.5 | No | No |

# echo = FALSE



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~~~
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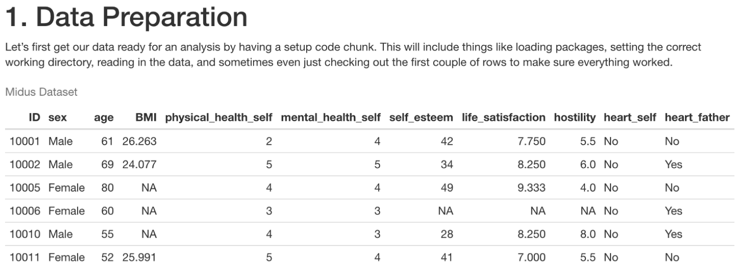

1. Data Preparation

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Midus Dataset

ID	sex	age	BMI	physical_health_self	mental_health_self	self_esteem	life_satisfaction	hostility	heart_self	heart_father
10001	Male	61	26.263	2	4	42	7.750	5.5	No	No
10002	Male	69	24.077	5	5	34	8.250	6.0	No	Yes
10005	Female	80	NA	4	4	49	9.333	4.0	No	No
10006	Female	60	NA	3	3	NA	NA	NA	No	Yes
10010	Male	55	NA	4	3	28	8.250	8.0	No	Yes
10011	Female	52	25.991	5	4	41	7.000	5.5	No	No
```

The `include` parameter

`include` is very similar to `echo` except *both* the code AND the output will not be shown.

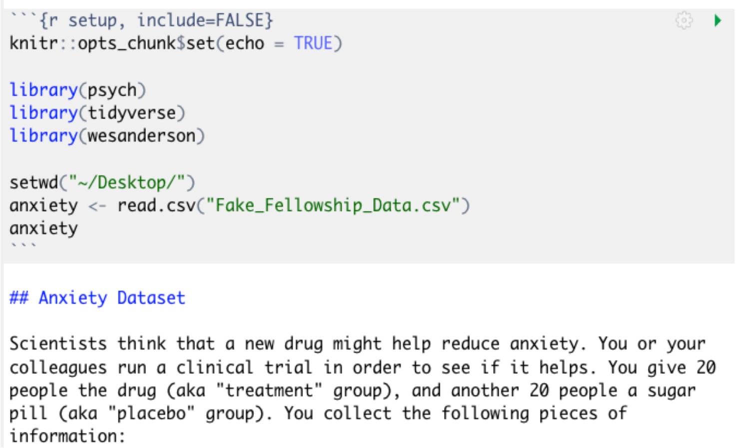
- All code will be run and executed!

At the top of each .Rmd, it is helpful to have a code chunk, usually called `setup`. It's a great place to:

- import your dataset (`read.csv`)
- load the necessary packages (`library()`)
- set options that will apply to the entire document (later slides)
- etc...

For the most part, the people you send this file to do not need to see any of the above 👆. So it's a good place to use `include = FALSE`.

The `include` parameter



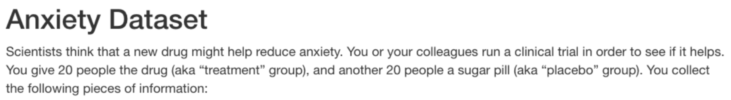
~~~
```{r setup, include=FALSE}
knitr::opts_chunk$set(echo = TRUE)

library(psych)
library(tidyverse)
library(wesanderson)

setwd("~/Desktop/")
anxiety <- read.csv("Fake_Fellowship_Data.csv")
anxiety
```

## Anxiety Dataset

Scientists think that a new drug might help reduce anxiety. You or your
colleagues run a clinical trial in order to see if it helps. You give 20
people the drug (aka "treatment" group), and another 20 people a sugar
pill (aka "placebo" group). You collect the following pieces of
information:
~~~



Anxiety Dataset

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The `eval` parameter

- Should the code run at all?
- Default is `TRUE`
- This is sometimes nice when you're trying to teach a concept or explain how something works.

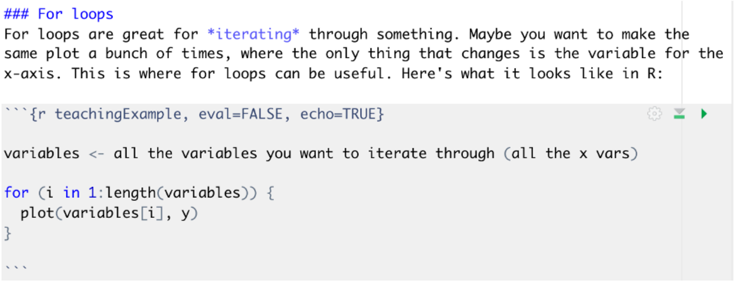

~~~
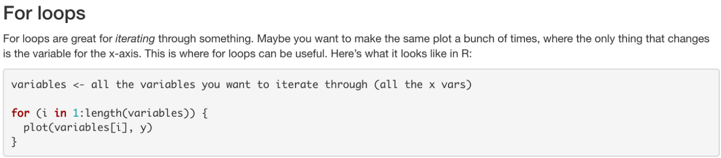
### For loops
For loops are great for *iterating* through something. Maybe you want to make the
same plot a bunch of times, where the only thing that changes is the variable for the
x-axis. This is where for loops can be useful. Here's what it looks like in R:

```{r teachingExample, eval=FALSE, echo=TRUE}

variables <- all the variables you want to iterate through (all the x vars)

for (i in 1:length(variables)) {
  plot(variables[i], y)
}

~~~
```



For loops

For loops are great for *iterating* through something. Maybe you want to make the same plot a bunch of times, where the only thing that changes is the variable for the x-axis. This is where for loops can be useful. Here's what it looks like in R:

```
variables <- all the variables you want to iterate through (all the x vars)

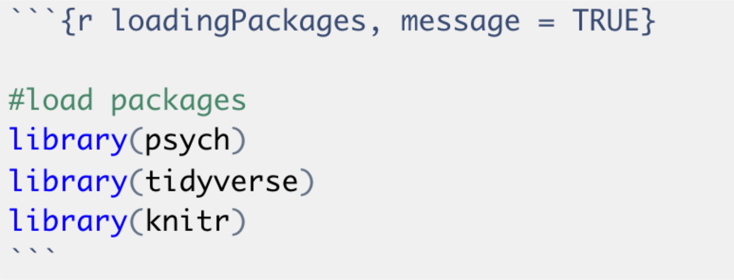
for (i in 1:length(variables)) {
  plot(variables[i], y)
}
```
```

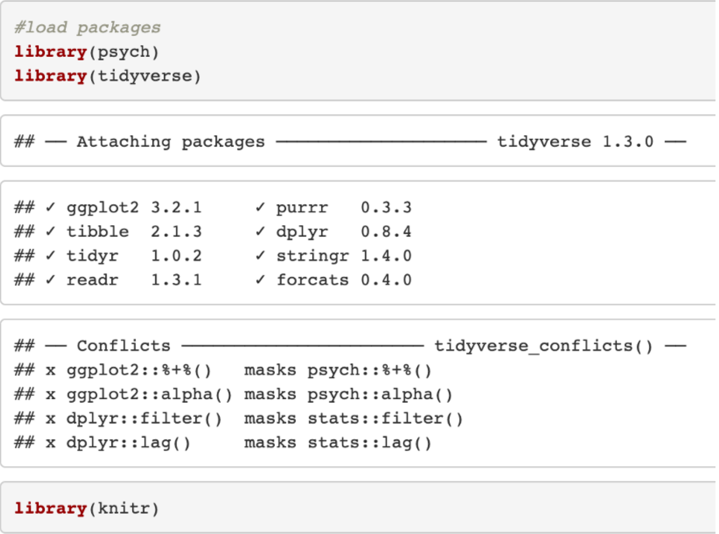
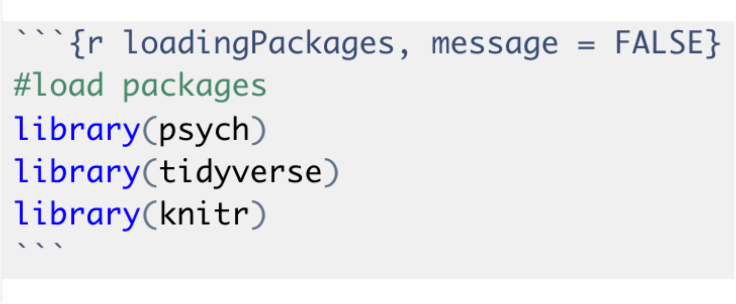
# Messages & Warnings

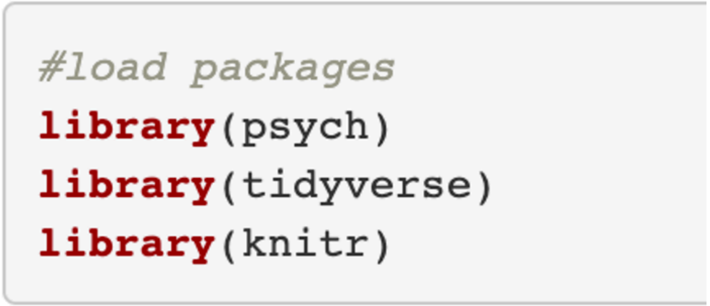
- Sometimes functions will result in code that shows you *non-error* messages or warnings in the console. Examples:
    - When you load a package `ggplot::alpha is masked by psych::alpha`
    - `removed any NA`
- These are fine for personal use, but if you're sharing your codde, they don't need to see these things
- The default behavior of RMarkdown is to show you the messages and warnings
- To change, add `message = FALSE` and `warnring = FALSE` parameters

Note, it's hard to tell the difference between messages and warnings, so I usually do both

# message = TRUE



~~~
```{r loadingPackages, message = TRUE}

#load packages
library(psych)
library(tidyverse)
library(knitr)
```
~~~



```
#load packages
library(psych)
library(tidyverse)
```

```
## ── Attaching packages ──────────────────── tidyverse 1.3.0 ──
```

```
## ✓ ggplot2 3.2.1     ✓ purrr   0.3.3
## ✓ tibble  2.1.3     ✓ dplyr   0.8.4
## ✓ tidyr   1.0.2     ✓ stringr 1.4.0
## ✓ readr   1.3.1     ✓ forcats 0.4.0
```

```
## ── Conflicts ────────────────────── tidyverse_conflicts() ──
## x ggplot2::%+%()   masks psych::%+%()
## x ggplot2::alpha() masks psych::alpha()
## x dplyr::filter()  masks stats::filter()
## x dplyr::lag()     masks stats::lag()
```

```
library(knitr)
```

message = FALSE



~~~
```{r loadingPackages, message = FALSE}
#load packages
library(psych)
library(tidyverse)
library(knitr)
~~~
```



```
#load packages
library(psych)
library(tidyverse)
library(knitr)
```
```

Figures

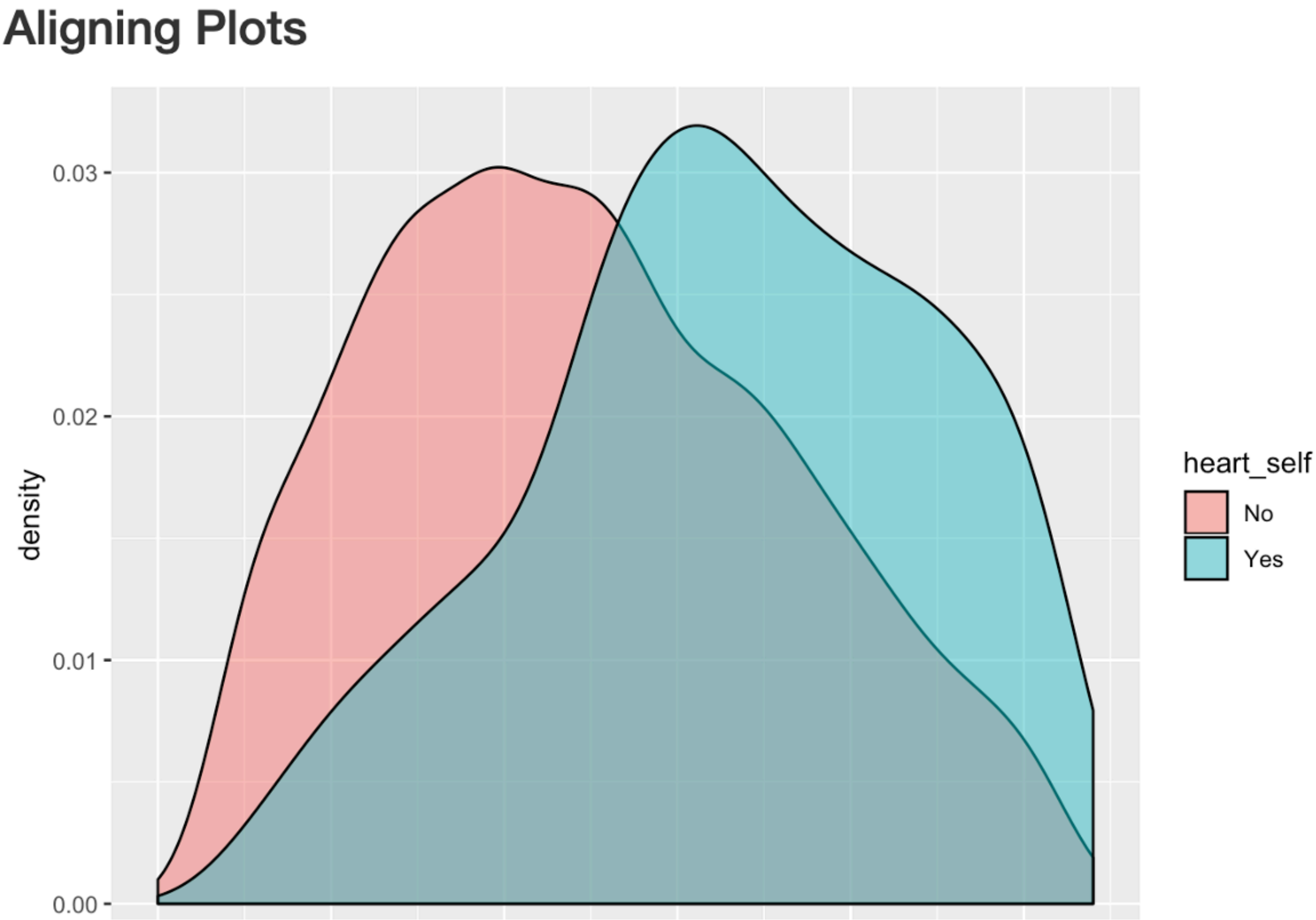
How big do you want your figures to be on the page?

- can modify with `fig.width` & `fig.height`
- default is 7x7 inches, but you might want to make that smaller if you want to see 2 next to each other

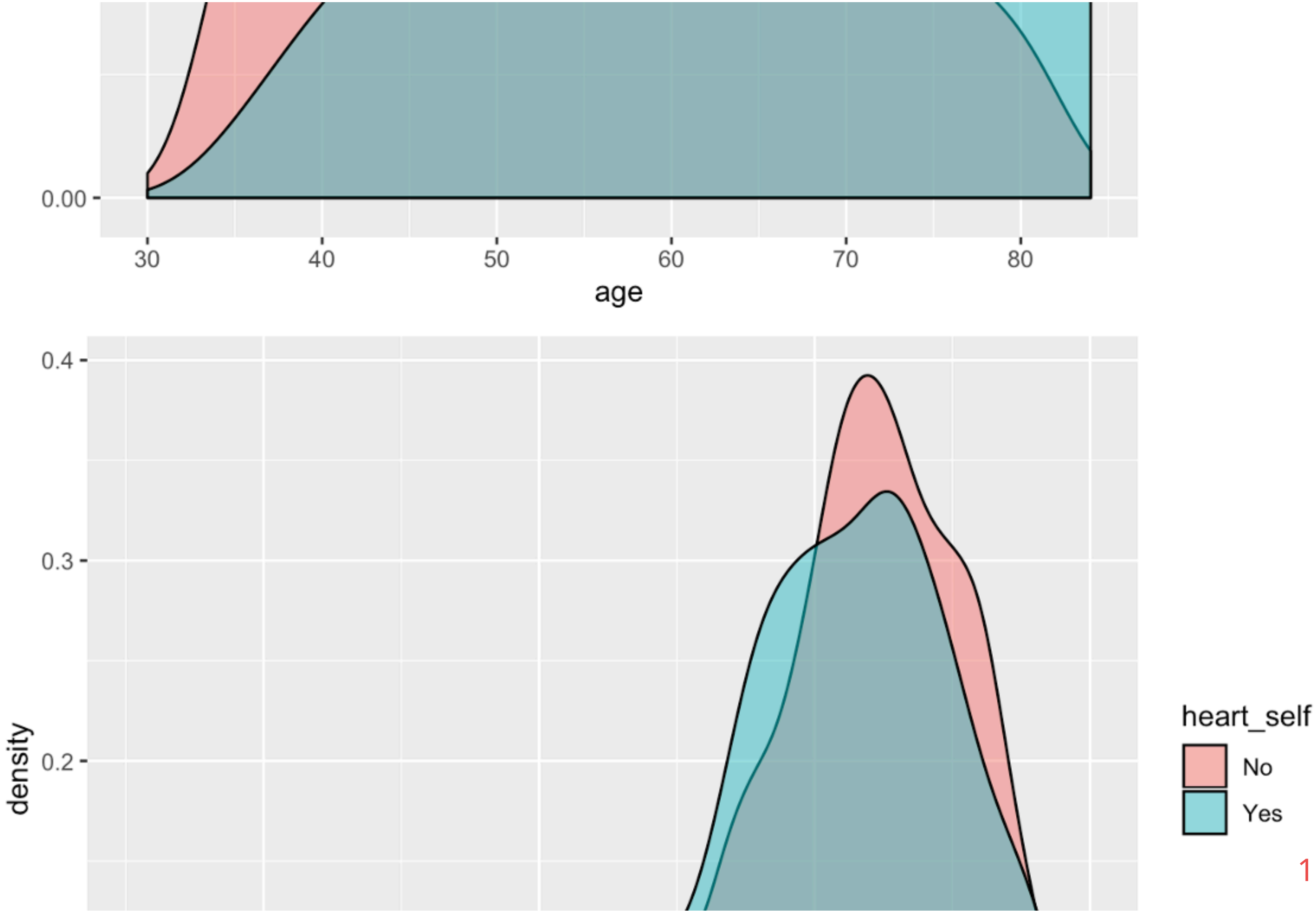
How do you want your figures to be aligned on the page?

- right? left? lenter?
- can modify with `fig.align`
- default is to not make any adjustments at all

Problem with Figures



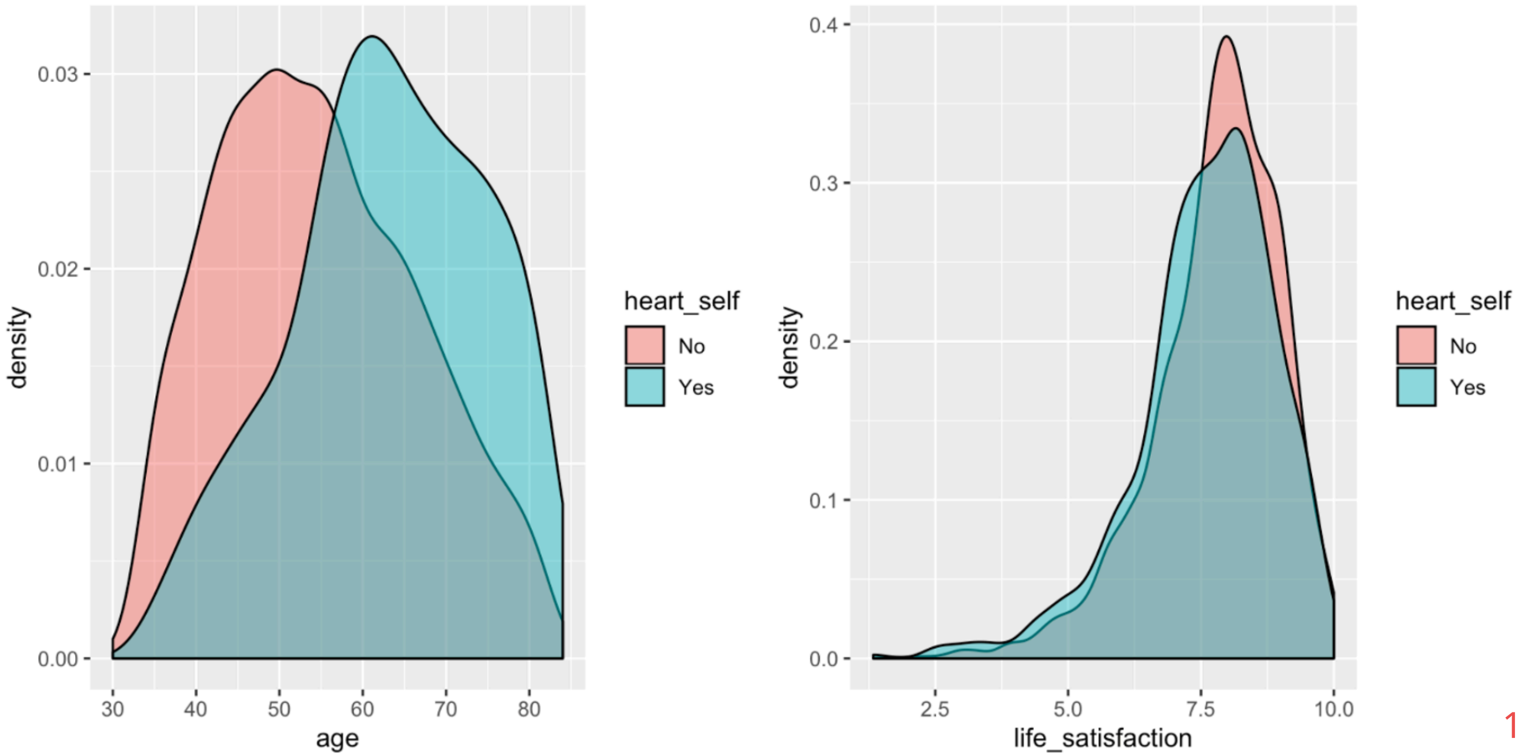
Problem with Figures



Solution to Figures

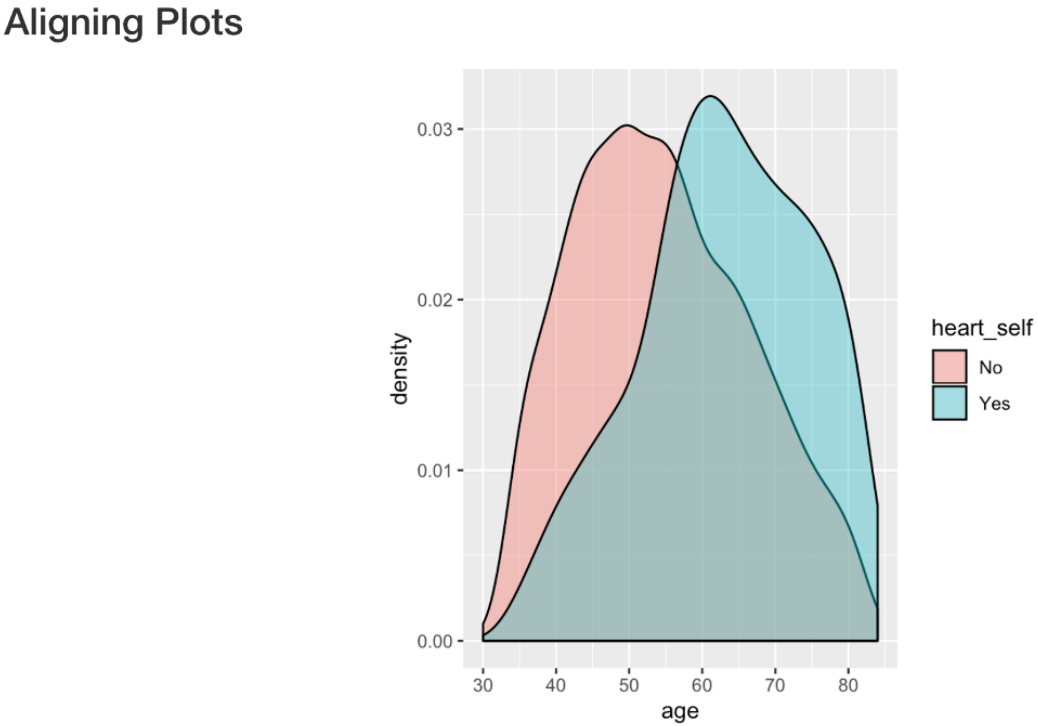
~~~
### Aligning Plots
```{r plots, echo=FALSE, fig.height=4.5, fig.width=4.5}
~~~

Aligning Plots



Solution to Figures

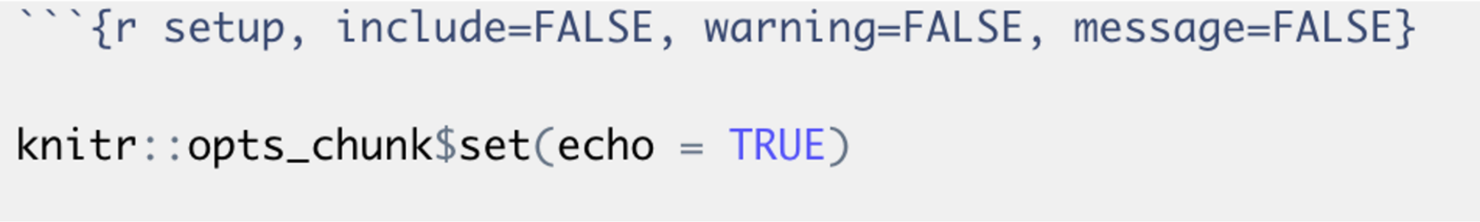
~~~
### Aligning Plots
```{r plots, fig.height=4.5, fig.width=4.5, echo = FALSE, fig.align='center'}
~~~



Aligning Plots

Parameters

- If you want to modify each individual code chunk, put the parameter within the curly brackets `{ }` (like we've been talking about)
- If you want to apply that same parameter to the *entire* document:
    - Have a setup chunk (this is good practice anyways)
    - Inside the setup chunk, you'll write something like this:



~~~
```{r setup, include=FALSE, warning=FALSE, message=FALSE}

knitr::opts_chunk$set(echo = TRUE)
~~~

You'll want to look it up for the exact parameter, but it usually starts with `knitr::opts_chunk`

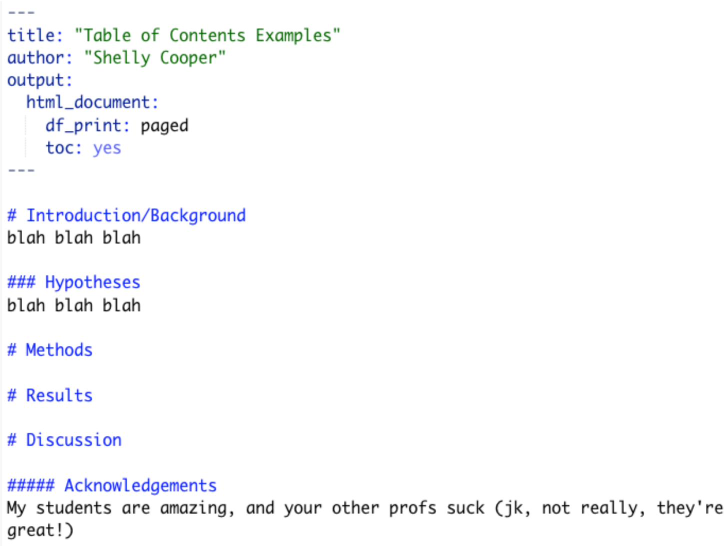
Other things

- Table of contents
- Code folding
- Inline code
- Equations
- Running code in RMarkdown
- Variables & environment
- Output file types

Table of Contents

- The Table of Conents is based on Markdown headers (`#`)
- You specify if you want one at all in the YAML header
- It will show headers 1 (`#`) through 3 (`###`) by default
- If you want to modify this, you can do so with `toc_depth`

Table of Contents - default



```
---
title: "Table of Contents Examples"
author: "Shelly Cooper"
output:
  html_document:
    df_print: paged
    toc: yes
---

# Introduction/Background
blah blah blah

### Hypotheses
blah blah blah

# Methods

# Results

# Discussion

##### Acknowledgements
My students are amazing, and your other profs suck (jk, not really, they're
great!)
```

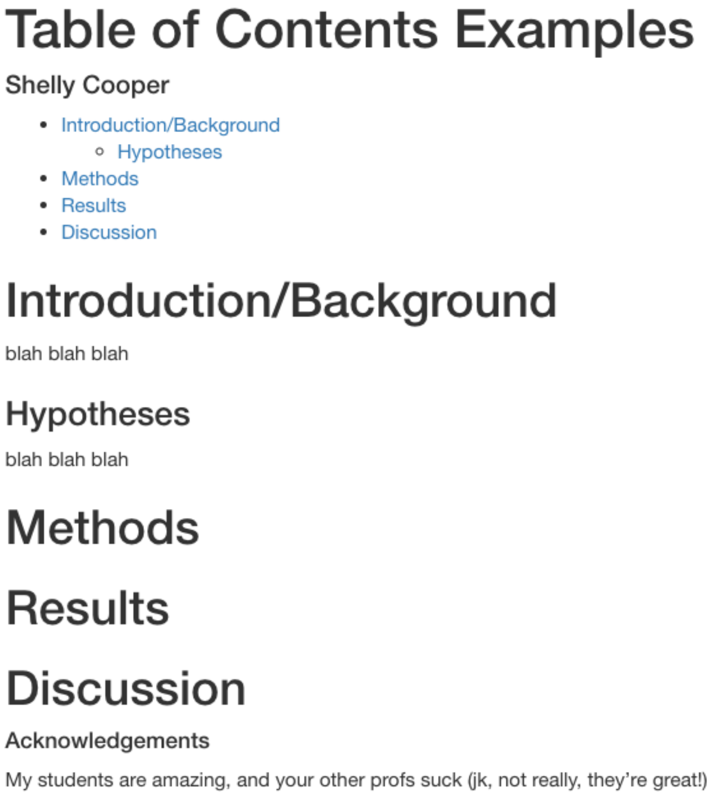


Table of Contents Examples

Shelly Cooper

- Introduction/Background
    - Hypotheses
- Methods
- Results
- Discussion

Introduction/Background

blah blah blah

Hypotheses

blah blah blah

Methods

Results

Discussion

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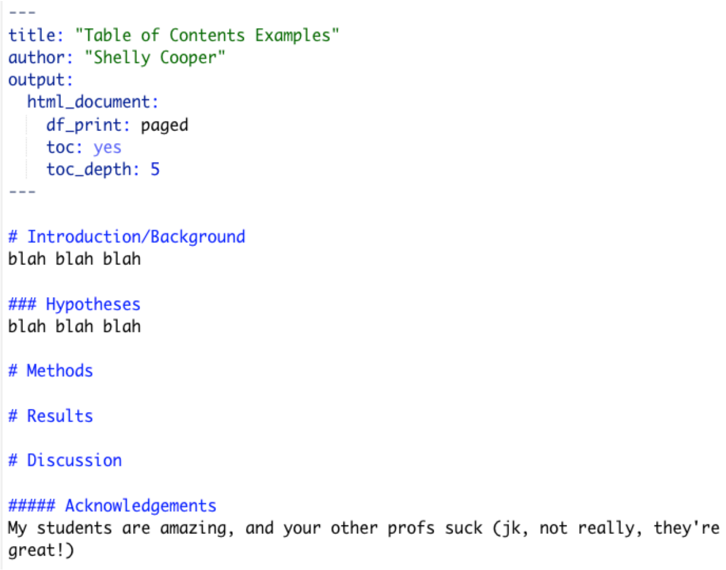
Table of Contents - `toc_depth: 5`



```
---
title: "Table of Contents Examples"
author: "Shelly Cooper"
output:
  html_document:
    df_print: paged
    toc: yes
    toc_depth: 5
---

# Introduction/Background
blah blah blah

### Hypotheses
blah blah blah

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# Results

# Discussion

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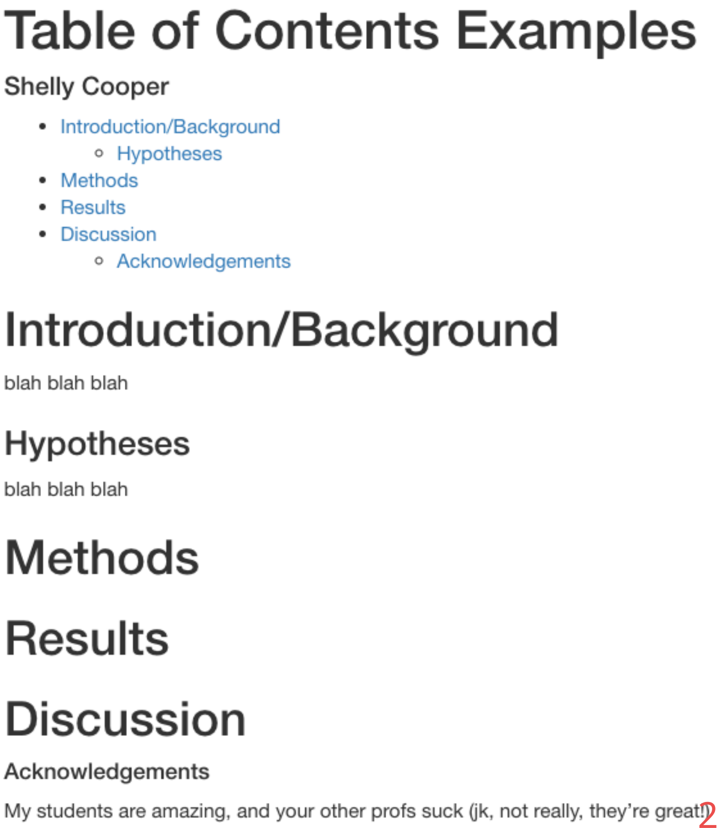

Table of Contents Examples

Shelly Cooper

- Introduction/Background
    - Hypotheses
- Methods
- Results
- Discussion
    - Acknowledgements

Introduction/Background

blah blah blah

Hypotheses

blah blah blah

Methods

Results

Discussion

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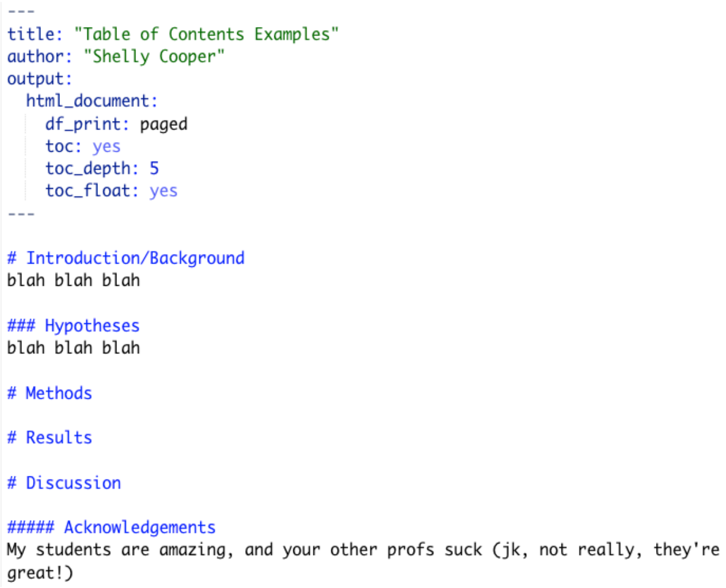
Table of Contents - HTML Only!

- If your output file is an HTML file, you can have the Table of Contents float down the side of your screen while you scroll!
- Use `toc_float` in the YAML header



```
---
title: "Table of Contents Examples"
author: "Shelly Cooper"
output:
  html_document:
    df_print: paged
    toc: yes
    toc_depth: 5
    toc_float: yes
---

# Introduction/Background
blah blah blah

### Hypotheses
blah blah blah

# Methods

# Results

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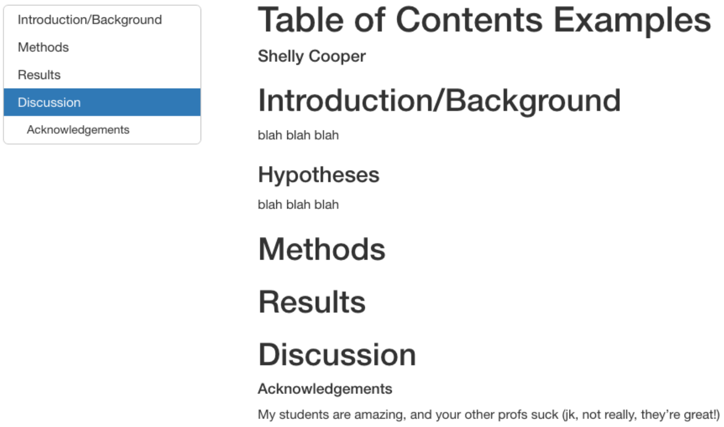

Table of Contents Examples

Shelly Cooper

Introduction/Background

blah blah blah

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blah blah blah

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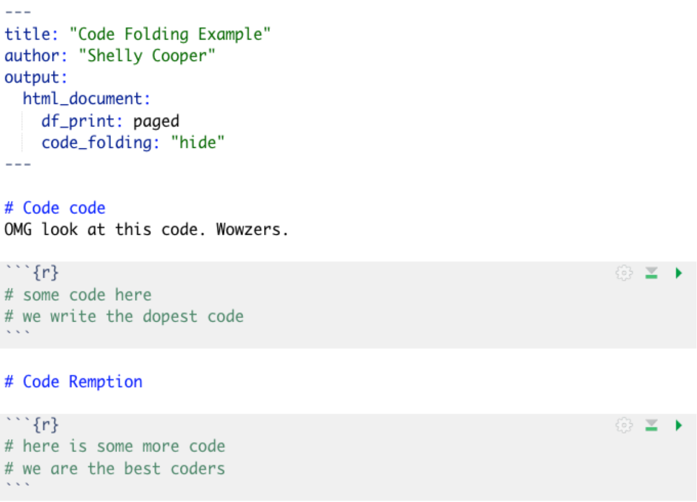
Code Folding - HTML Only!

- Give the person you are sharing the document with the option of looking at your code
- Add `code_folding: "hide"` to the YAML header



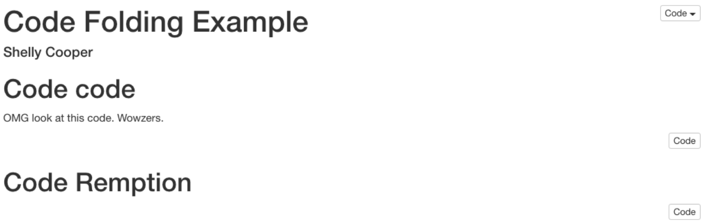
~~~
---
title: "Code Folding Example"
author: "Shelly Cooper"
output:
  html_document:
    df_print: paged
    code_folding: "hide"
---

# Code code
OMG look at this code. Wowzers.

```{r}
# some code here
# we write the dopest code
~~~

Code Remption

```{r}
# here is some more code
# we are the best coders
```
```



Code Folding Example

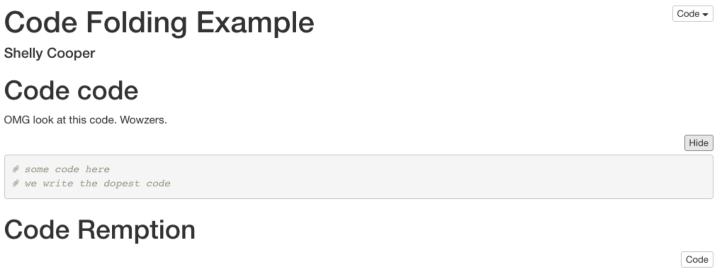
Shelly Cooper

Code code

OMG look at this code. Wowzers.

Code Remption
```

Code Folding - HTML Only!



Code Folding Example

Shelly Cooper

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Code Remption

Code Folding Example

Shelly Cooper

Code code

OMG look at this code. Wowzers.

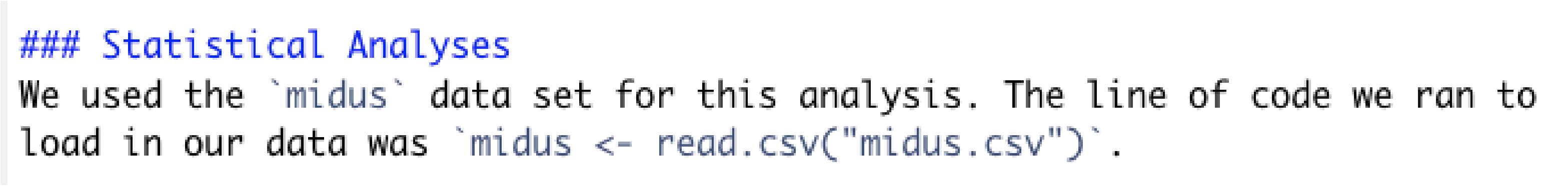
```
# some code here
# we write the dopest code
```

Code Remption

```
# here is some more code
# we are the best coders
```

Inline Code

- Sometimes you want to acknowledge that something is code in formatted text. Ex: I am formatted text, but `this` is `code`.
- This is called "inline code"
- Wrap the text within single backtics



```
### Statistical Analyses
We used the `midus` data set for this analysis. The line of code we ran to
load in our data was `midus <- read.csv("midus.csv")`.
```

Statistical Analyses

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Inline Code

- You can also run some R code the same way
- This is helpful when:
  - You stored a value that you'd like to share
  - You want to show someting in a way your audience will like (e.g., rounding a number)
- This is NOT great for lots of code! Meant to be a quick thing.

~~~
# Methods

```{r}
iris <- iris

meanPetalLength <- mean(iris$Petal.Length)
meanPetalLength
~~~

Results
We saw that the average petal length was `r round(x = meanPetalLength,
digits = 1)`. We have no idea if this is reasonable or not because we don't
know anything about flowers.
```

Methods

```
iris <- iris

meanPetalLength <- mean(iris$Petal.Length)
meanPetalLength
```

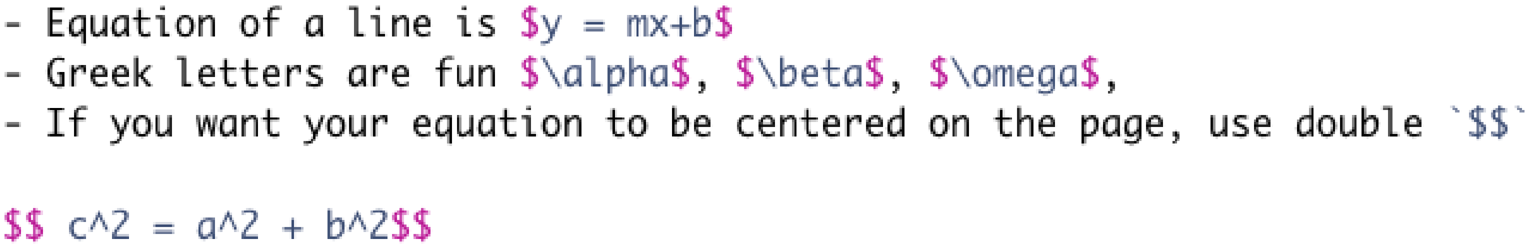
```
## [1] 3.758
```

Results

We saw that the average petal length was 3.8. We have no idea if this is reasonable or not because we don't know anything about flowers.
```

# Equations

- LaTeX works well in RMarkdown. Really great for equations/matrices
- For an equation, surround with `$`



```
- Equation of a line is $y = mx+b$
- Greek letters are fun $\alpha$, $\beta$, $\omega$,
- If you want your equation to be centered on the page, use double `$$`

$$ c^2 = a^2 + b^2$$
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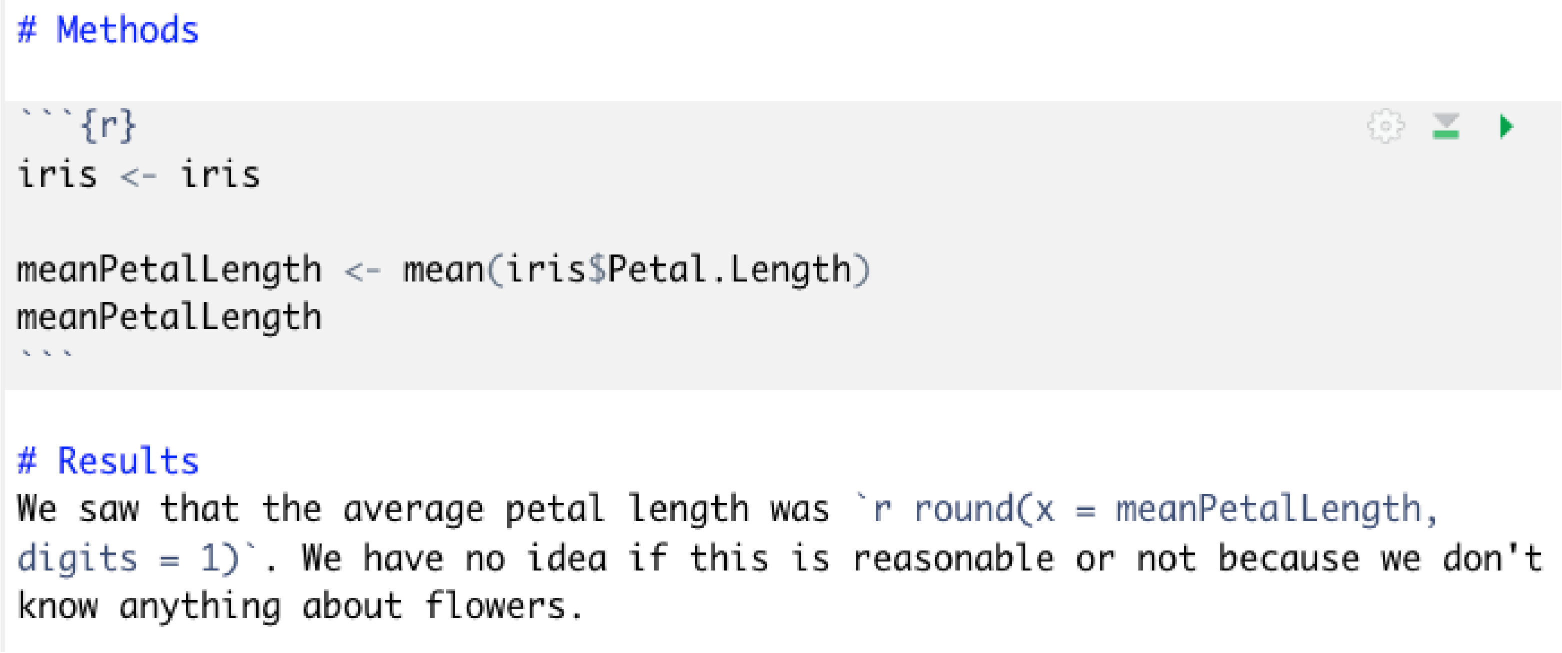
$$c^2 = a^2 + b^2$$

Running Code

- You can run code within a code chunk just like an .R script (go line by line or highlight lots of lines and hit Run)
- OR you can use the green arrow at the top right corner of the code chunk to run all lines within that chunk.



~~~
# Methods

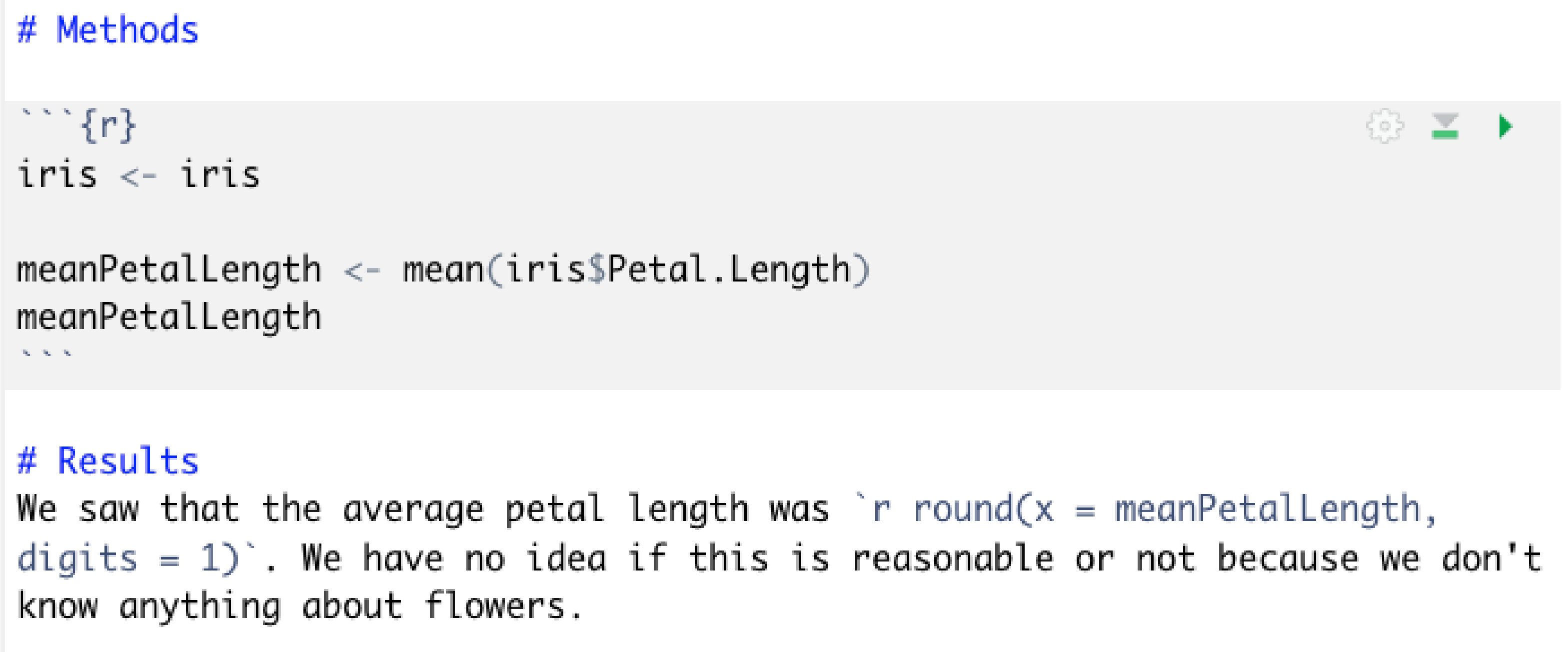
```{r}
iris <- iris

meanPetalLength <- mean(iris$Petal.Length)
meanPetalLength
```

# Results
We saw that the average petal length was `r round(x = meanPetalLength,
digits = 1)`. We have no idea if this is reasonable or not because we don't
know anything about flowers.
~~~

Running Code

- You can also use the other button to run all code chunks *above* the current chunk!
- This is wonderful when you think you're working with the wrong variable, or you screw up your data.frame and want to get it back to how it was



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Reminder!

You **need** to make sure that the variables/datasets you want to work with are imported or created within the .Rmd file!

- When a .Rmd file knits, it starts as though there is NOTHING in your Environment and NONE of the packages are loaded...like a brand new R session
- If you import your data through the GUI, and *don't* put that code into the .Rmd file, when you go to `knit`, it won't find your file and it won't work properly
- The same is true if you make a variable in your Console, but forget to put that code into your .Rmd file

Other file types

- We've mainly been working with HTML files. Other options include Word and PDF (and some more advanced things like slides -- all of the slides in this class were made with RMarkdown!)

- Word Documents
    - This works...OK-ish. The only weird thing is that it will say you can't edit the file after it knits. You need to save it as a new file in order to edit it. But it will usually prompt you to do so.
    - Also, formatting tables in Word is really annoying.

- PDF Documents
    - If you have a Mac, this should work seamlessly
    - If you have a PC, you need to have LaTeX on your computer, which is usually installed with MiKTeX. See the Resources tab for how to do this -- it's very annoying.

Don't forget about R's Cheatsheets!

`Help > Cheatsheets` or Google `RMarkdown cheatsheet`

Also, there are cheatsheets for *a lot* of things, including `dplyr` and `ggplot2`. Again, never memorize anything!