



Week 12: *Reproducible Reporting*

🏛️ EMSE 4571: Intro to Programming for Analytics

👤 John Paul Helveston

📅 April 14, 2022

Quiz 7 (last one!)

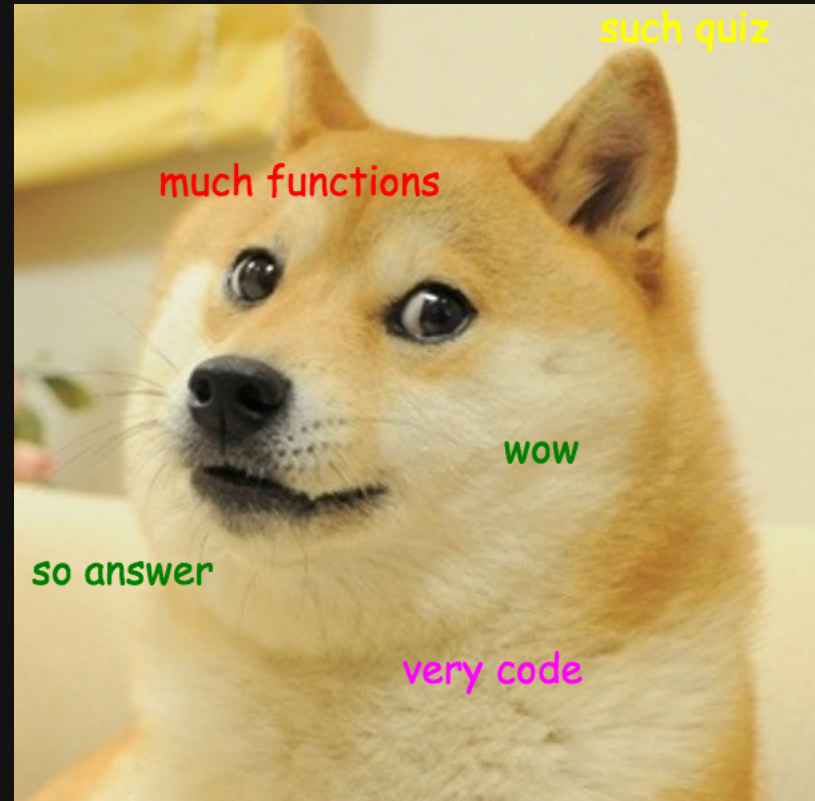
05:00

Go to `#class` channel in Slack for quiz link

Open RStudio first!

Rules:

- You may use your notes and RStudio
- You may **not** use any other resources (e.g. the internet, your classmates, etc.)



(You should always cite your sources)

A bunch of today's slides are adapted from the brilliant [Alison Presmanes Hill](#)

 [@apreshill](#)

Check out her [RMarkdown slide deck](#)



Week 12: *Reproducible Reporting*

1. Why RMarkdown?

2. Metadata and output formats

BREAK

3. Text

4. Code chunks

Week 12: *Reproducible Reporting*

1. Why RMarkdown?

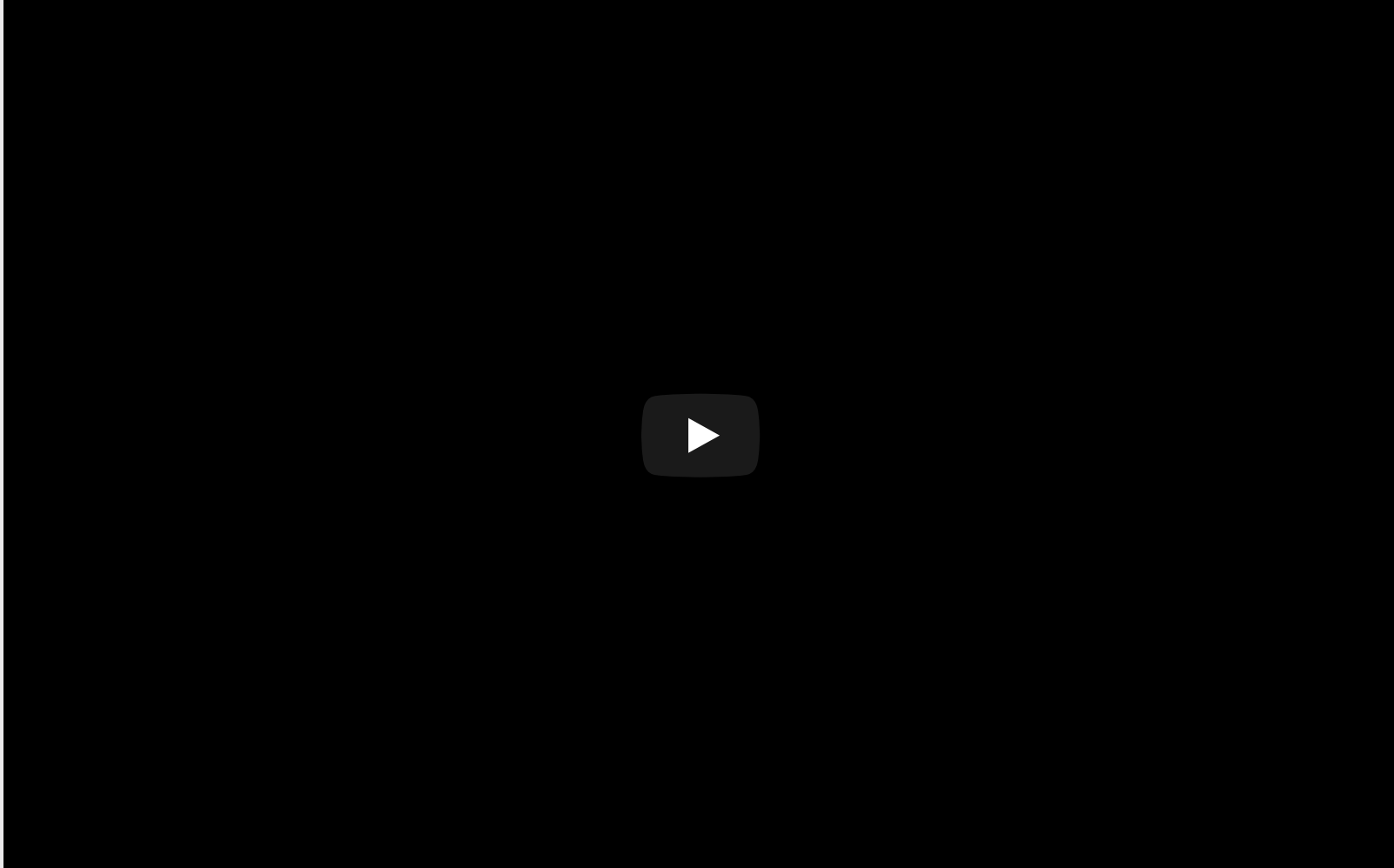
2. Metadata and output formats

BREAK

3. Text

4. Code chunks

The horrors of a non-reproducible workflow



RMarkdown to the rescue!



"Literate programming"

Treat programs as a
"literature" understandable
to **human beings**



Week 12: *Reproducible Reporting*

1. Why RMarkdown?

2. Metadata and output formats

BREAK

3. Text

4. Code chunks

R markdown

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

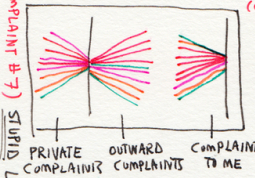


DEAR DATA - WEEK 07

A WEEK OF COMPLAINTS*

AND GENERAL GRUMPINESS

HOW TO READ IT: (I ~~THREW~~ TREW DOWN MY PENS WHEN FINISHED)



TYPE OF COMPLAINT:

- WEATHER
- HUSBAND
- ANIMALS
- FAMILY
- SOCIETY!
- THE WORLD TODAY
- ACQUAINTANCES!
- STRANGERS
- MY APPEARANCE
- FRIENDS
- WORK
- HEALTH
- HUNGER
- MYSELF
- TECHNOLOGY/MEDIA
- MONEY
- INANIMATE OBJECTS
- TRANSPORT

ALL COMPLAINTS IN CHRONOLOGICAL ORDER EXCEPT 'COMPLAINTS TO ME' BECAUSE (COMPLAINT #1) I MESSED UP THE ORDER + BY THAT TIME I HAD ALREADY SPENT 1.5 HOURS ON THIS... ARGH! AND (COMPLAINT #2) THIS PART OF THE DRAWING IS NOT SYMMETRICAL WHICH BOTHERS ME!

MAIN STATS	
PRIVATE COMPLAINTS:	67
OUTWARD COMPLAINTS:	100
COMPLAINTS TO ME:	43
# OF PEOPLE WHO COMPLAINED TO ME:	5
# OF PEOPLE I COMPLAINED TO:	10
* SECOND MOST COMPLAINTS ABOUT MY HUSBAND	

* THIS PEN (COMPLAINT #3) LEAKED + SMUDGED MY DRAWING + GOT ALL OVER MY HANDS!
 * AND A WEEK OF COMPLAINTS ABOUT HOW I F*CKED UP THIS DRAWING! (COMPLAINT #5)

FROM: S POSAVEC

LONDON
UK



TO: GEORGIA LUPI

BROOKLYN, NY 11249
USA

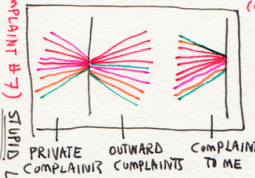
DELIVERED BY
 HAND (SPECIAL NYC
 DELIVERY!)

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MAIN STATS

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TOP COMPLAINER:	MY DAD
TOP COMPLAINED TO:	MY HUSBAND

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 * AND A WEEK OF COMPLAINTS ABOUT HOW I F*CKED UP THIS DRAWING! (COMPLAINT #5)

FROM: S POSAVEC
 LONDON
 UK



TO:
GEORGIA LUPI
 BROOKLYN, NY 11249
 USA

DELIVERED BY
 HAND (SPECIAL NYC DELIVERY!)

metadata

metadata: YAML

YAML
Ain't
Markup
Language

```
---  
key: value  
---
```



Output options

Save output options in your YAML

```
---  
title: Your title here  
author: Your name here  
output: html_document  
---
```

```
---  
title: Your title here  
author: Your name here  
output:  
  html_document:  
    toc: true  
    toc_float: true  
    theme: flatly  
---
```



demo - RStudio

demo.Rmd

```
1 ---
2 title: A quick RMarkdown demo
3 subtitle: A summary of just a few features
4 author: John Helveston
5 output:
6   html_document:
7     toc: true
8     toc_float: true
9     theme: flatly
10 ---
11
12 ```{r setup, include=FALSE}
13 knitr::opts_chunk$set(
14   warning = FALSE,
15   message = FALSE,
16   fig.retina = 3)
17
18 # Import libraries
19 library(tidyverse)
20 library(here)
21 # This is an example of loading data within a code chunk
22 birds <- read_csv(here('data', 'wildlife_impacts.csv'))
23 bears <- read_csv(here('data', 'bear_killings.csv'))
24 ```
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authoring HTML, PDF, and MS Word documents. For more details on using R
Markdown see [rmarkdown.rstudio.com](http://rmarkdown.rstudio.com).|
29
30 When you click the Knit button a document will be generated that includes
```

Console Jobs

~/Downloads/demo/

```
R is free software and comes with ABSOLUTELY NO WARRANTY.
You are welcome to redistribute it under certain conditions.
Type 'license()' or 'licence()' for distribution details.

Natural language support but running in an English locale

R is a collaborative project with many contributors.
Type 'contributors()' for more information and
'citation()' on how to cite R or R packages in publications.

Type 'demo()' for some demos, 'help()' for on-line help, or
'help.start()' for an HTML browser interface to help.
Type 'q()' to quit R.

> |
```

Files Plots Packages Help Viewer

New Folder Delete Rename More

Home > Downloads > demo

Name	Size	Modified
..		
.Rhistory	356 B	Nov 30, 2020, 10:38 AM
data		
demo.html	1.2 MB	Nov 30, 2020, 10:36 AM
demo.Rmd	1.5 KB	Nov 30, 2020, 11:00 AM
notes.Rproj	205 B	Nov 30, 2020, 10:59 AM

28:215 R Markdown

Environment History Connections Tutorial

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The image shows the RStudio interface with two main panes. The left pane displays the source R Markdown code, and the right pane shows the rendered HTML output.

Source Code (Left Pane):

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Handwritten note: A red bracket groups lines 5 through 9, with the text "metadata = YAML" written in red next to it.

Rendered Output (Right Pane):

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Files Pane (Bottom):

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The screenshot displays the RStudio interface with a document titled 'demo.Rmd' on the left and its rendered HTML output on the right. The R Markdown source code includes a YAML header for metadata, a knitr chunk for options, library loading, data reading, and a main text block. The rendered output shows the title, subtitle, author, and a section for 'output' with HTML document options. A file explorer at the bottom shows the generated files.

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QuickTime Player File Edit View Window Help

demo - RStudio

demo.Rmd x

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Console R Markdown x Jobs x

--/Downloads/demo/

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5:8 A quick RMarkdown demo - R Markdown

Environment History Connections Tutorial

A quick RMarkdown demo

File | /Users/jhelvy/Downloads/demo/demo.html

Blackboard P4A Lab

R Markdown
Plots

A quick RMarkdown demo

A summary of just a few features

John Helveston

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Useful tools

- Quick markdown reference guide: <https://commonmark.org/help/>
- Quick demo guide: <https://markdown-it.github.io/>
- Online table converter: <http://www.tablesgenerator.com>

Link to data source of final practice today

<https://github.com/rfordatascience/tidytuesday/tree/master/data/2018/2018-10-16>

Plots

Using ggplot

Here is an example of how to make a plot with ggplot2:

```
bears %>%  
  count(month) %>%  
  ggplot() +
```

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File | /Users/jhelvy/Downloads/demo/demo.html

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font
+ = theme
color

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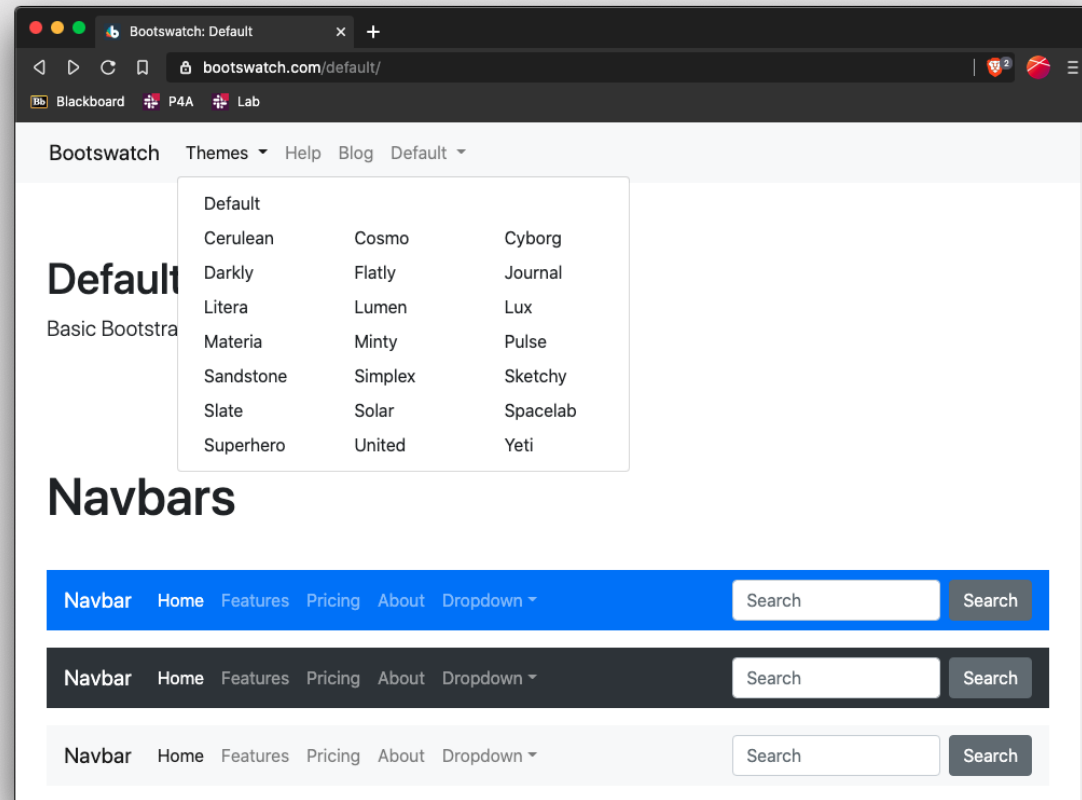
```
bears %>%
  count(month) %>%
  ggplot() +
```

toc:
toc_float:



font
+ = theme
color

Preview bootswatch themes



Quick check-in

How do you use only the **default** output options?

(a)

```
----  
output: html_document()  
----
```

(b)

```
----  
output: html_document  
----
```

How do you add an output **option** to a format in your YAML?

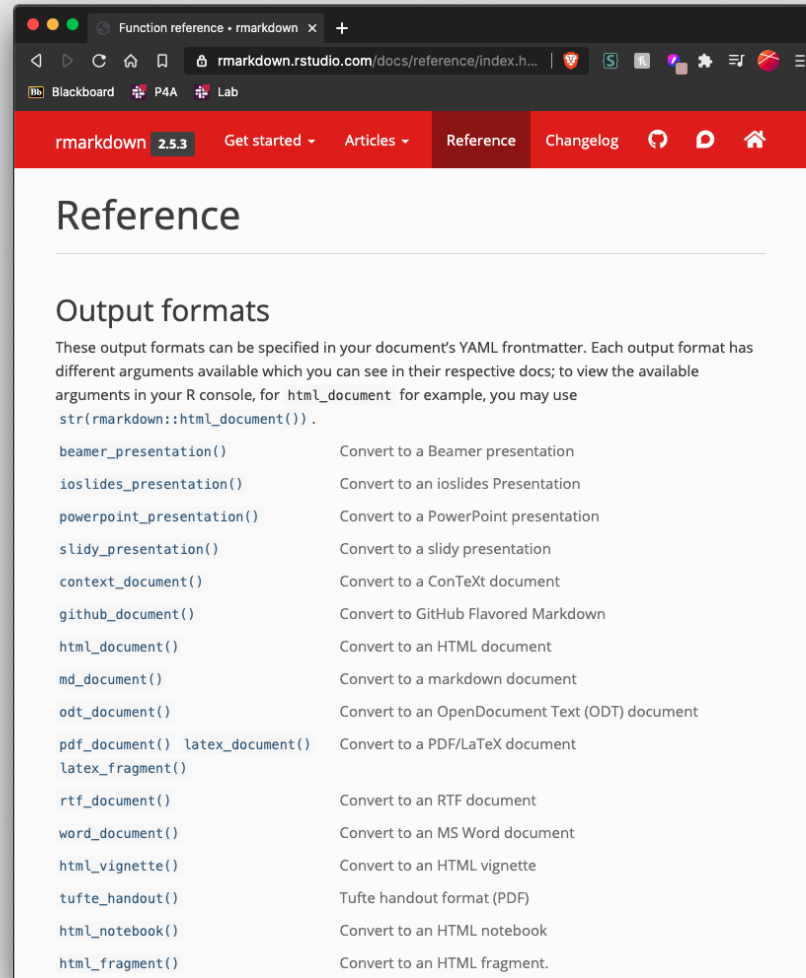
(a)

```
----  
output:  
  html_document:  
    toc: true  
----
```

(b)

```
----  
output:  
  html_document(toc=true)  
----
```

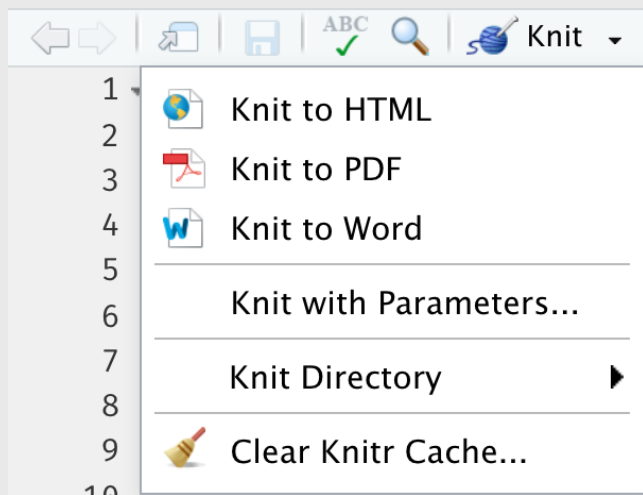
Output formats





Knit to multiple outputs

```
rmarkdown::render("notes.Rmd", output_format = "all")
```



```
---  
title: Your title here  
author: Your name here  
output:  
  html_document:  
    toc: true  
    toc_float: true  
    theme: flatly  
  word_document: default  
  pdf_document: default  
---
```


Quick check-in

How do you add another output **format** to your YAML?

(a)

```
----  
output:  
  html_document: default  
  word_document: default  
----
```

(b)

```
----  
output:  
  html_document()  
  word_document()  
----
```

How do you now add output **options** to your YAML?

(a)

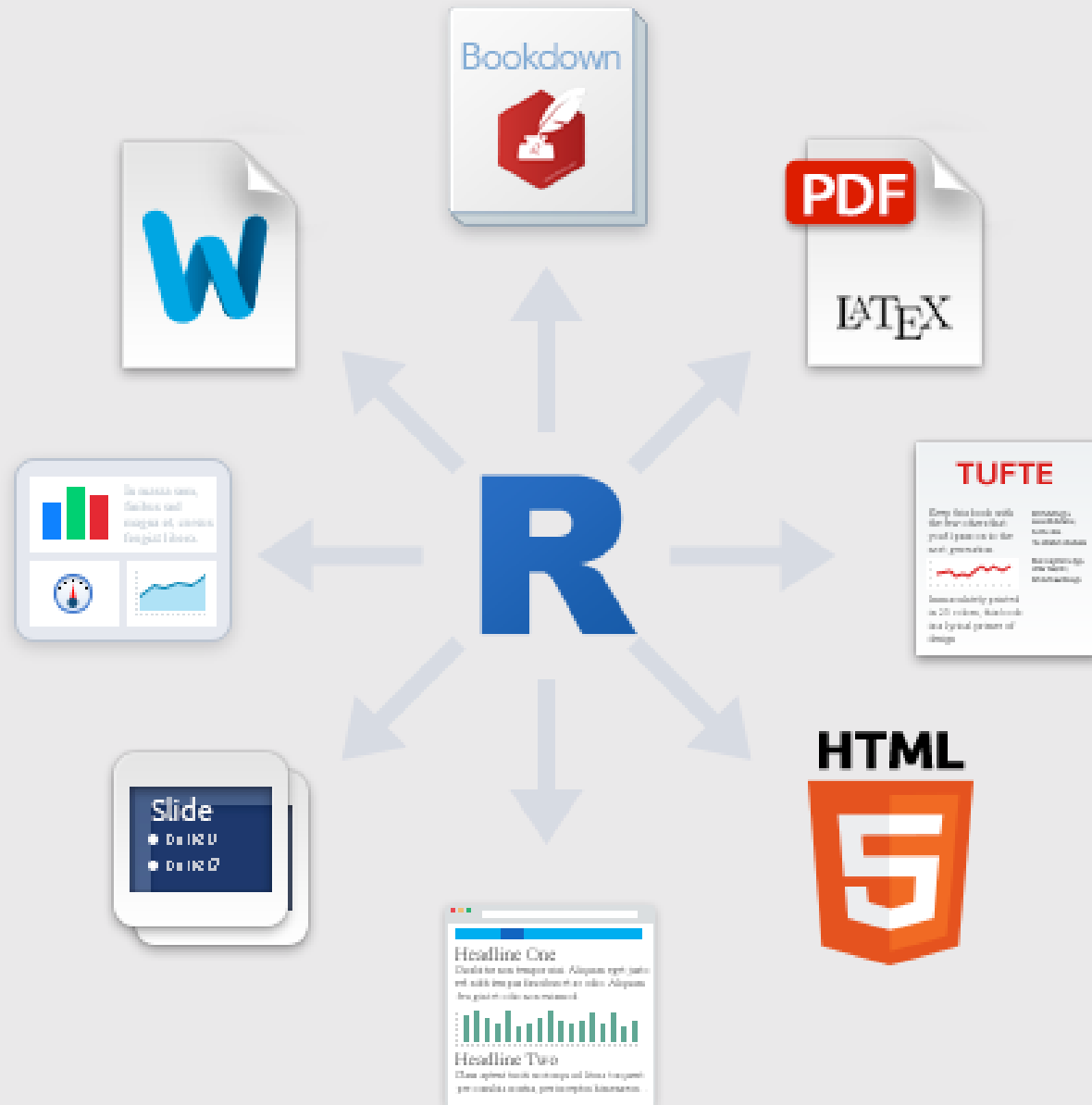
```
----  
output:  
  html_document:  
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----
```

(b)

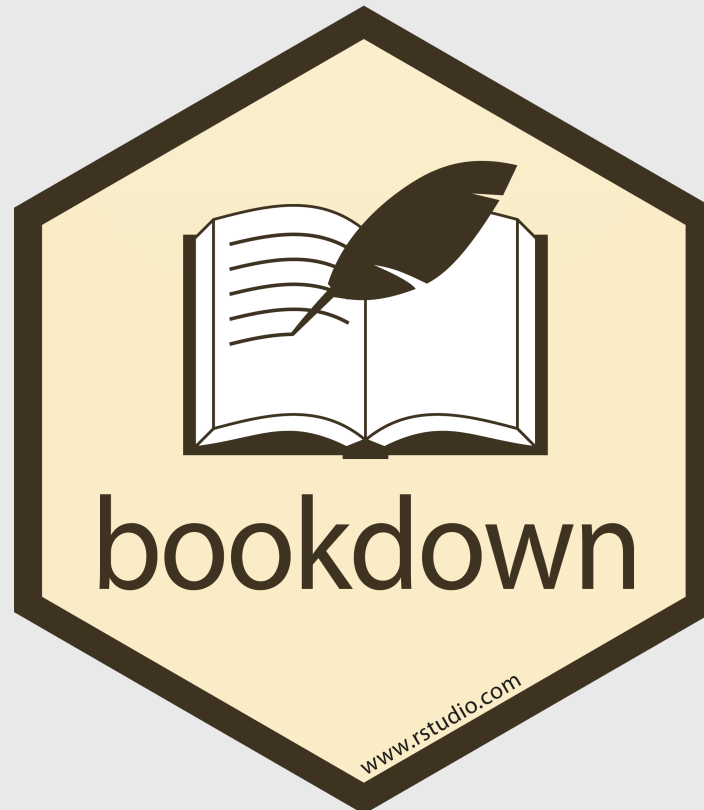
```
----  
output:  
  html_document(toc=true)  
  word_document(default)  
----
```

Built-in output formats





Extension output formats



Distill for R Markdown

Scientific and technical writing, native to the web

AUTHORS

- JJ Allaire
- Rich Iannone
- Alison Presmanes Hill
- Yihui Xie

AFFILIATIONS

- RStudio
- RStudio
- RStudio
- RStudio

PUBLISHED

Sept. 10, 2018

CITATION

Allaire, et al., 2018

Contents

- Installation
- Creating an article
- Figures
- Tables
- Equations
- Citations

Distill for R Markdown is a web publishing format optimized for scientific and technical communication. Distill articles include:

- Reader-friendly typography that adapts well to mobile devices.
- Features essential to technical writing like [LaTeX math](#), [citations](#), and [footnotes](#).
- Flexible figure layout options (e.g. displaying figures at a larger width than the

Use an extension package

```
---  
author: Your name here  
title: Your title here  
output: distill::distill_article  
---
```

```
---  
author: Your name here  
title: Your title here  
output:  
  distill::distill_article:  
    toc: true  
---
```

Quick practice

02:00

Go to your `notes.Rmd` file and knit it to the following outputs:

- `html_document` with a table of contents
- `distill_article` with a table of contents
- `word_document`
- `pdf_document`

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BREAK

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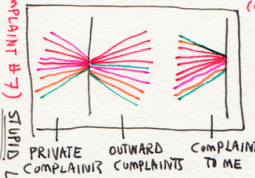
4. Code chunks

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FROM:
S POSAVEC
LONDON
UK



TO:
GEORGIA LUPI

BROOKLYN, NY 11249
USA

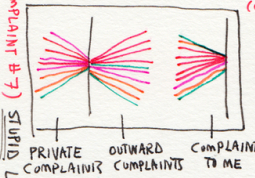
DELIVERED BY
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 - FRIENDS
 - WORK
 - HEALTH
 - HUNGER
 - MYSELF
 - TECHNOLOGY/MEDIA
 - MONEY
 - INANIMATE OBJECTS
 - TRANSPORT

ALL COMPLAINTS IN CHRONOLOGICAL ORDER EXCEPT 'COMPLAINTS TO ME' BECAUSE (COMPLAINT #1) I MESSED UP THE ORDER + BY THAT TIME I HAD ALREADY SPENT 1.5 HOURS ON THIS... AARGH! AND (COMPLAINT #2) THIS PART OF THE DRAWING IS NOT SYMMETRICAL WHICH BOTHERS ME!

MAIN STATS	
PRIVATE COMPLAINTS:	67
OUTWARD COMPLAINTS:	100
COMPLAINTS TO ME:	43
# OF PEOPLE WHO COMPLAINED TO ME:	5
# OF COMPLAINTERS:	MY DAD
# OF PEOPLE I COMPLAINED TO:	0
# OF COMPLAINEES:	NOT THIS DRAWING
I COMPLAINED MOST ABOUT:	FAMILY (SORRY MOM + DAD I LOVE YOU!!!)
* SECOND MOST COMPLAINTS ABOUT:	MY HUSBAND (SMART STEVE I LOVE YOU!!!)

* THIS PEN (COMPLAINT #3) LEAKED + SMUDGED MY DRAWING + GOT ALL OVER MY HANDS!
* AND A WEEK OF COMPLAINTS ABOUT HOW I F*CKED UP THIS DRAWING! (COMPLAINT #5)

FROM: S POSAVEC
LONDON
UK



TO:
GEORGIA LUPI
BROOKLYN, NY 11249
USA

DELIVERED BY
HAND (SPECIAL NYC
DELIVERY!)

metadata

text

DEAR DATA - WEEK 07

A WEEK OF COMPLAINTS* AND GENERAL GRUMPINESS

HOW TO READ IT: (I TREW DOWN MY PENS WHEN I FINISHED ALL COMPLAINTS IN CHRONOLOGICAL ORDER EXCEPT 'COMPLAINTS TO ME' BECAUSE (COMPLAINT #1) I MESSED UP THE ORDER + BY THAT TIME I HAD ALREADY SPENT 1.5 HOURS ON THIS... AARGH! AND (COMPLAINT #2) THIS PART OF THE DRAWING IS NOT METRICAL WHICH SUCKS

TYPE OF COMPLAINT:

- WEATHER
- HUSBAND
- ANIMALS
- FAMILY
- SOCIETY!
- THE WORLD TODAY
- ACQUAINTANCES!
- STRANGERS
- MY APPEARANCE
- FRIENDS
- WORK
- HEALTH
- HUNGER
- MYSELF
- TECHNOLOGY/MEDIA
- MONEY
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- TRANSPORT

MAIN STATS

- PRIVATE COMPLAINTS: 67
- OUTWARD COMPLAINTS: 100
- COMPLAINTS TO ME: 43
- # OF PEOPLE WHO COMPLAINED TO ME: 5
- # OF PEOPLE WHO COMPLAINED: MY DAD
- COMPLAINED TO: 10
- I COMPLAINED MOST ABOUT MY FAMILY (SORRY MOM + DAD I LOVE YOU!!!)
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Right now, bookmark this! 🙌

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

(When you have 10 minutes, do this! 🙌)

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

Headers

```
# HEADER 1
```

```
## HEADER 2
```

```
### HEADER 3
```

```
#### HEADER 4
```

```
##### HEADER 5
```

```
##### HEADER 6
```

HEADER 1

HEADER 2

HEADER 3

HEADER 4

HEADER 5

HEADER 6

Text

Childhood ****vaccines****
are one of the
great triumphs
of modern medicine.

Childhood **vaccines**
are one of the
great triumphs
of modern medicine.

Text

Type this...

- normal text
- **italic text**
- ****bold text****
- *****bold italic text*****
- ~~~~strikethrough~~~~
- `code text`

..to get this

- normal text
- *italic text*
- **bold text**
- ***bold italic text***
- ~~strikethrough~~
- code text

Lists

Bullet list:

```
- first item  
- second item  
- third item
```

- first item
- second item
- third item

Numbered list:

```
1. first item  
2. second item  
3. third item
```

1. first item
2. second item
3. third item

Links

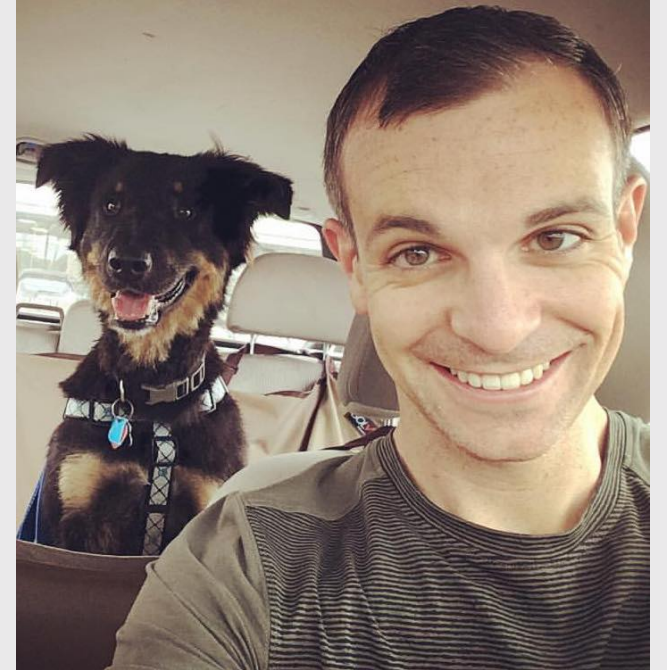
Simple **url link** to another site:

```
[Download R] (http://www.r-project.org/)
```

[Download R](http://www.r-project.org/)

Images

! [] (<https://p4a.seas.gwu.edu/2022-Spring/images/helveston.jpg>)



Local images



Quick check-in

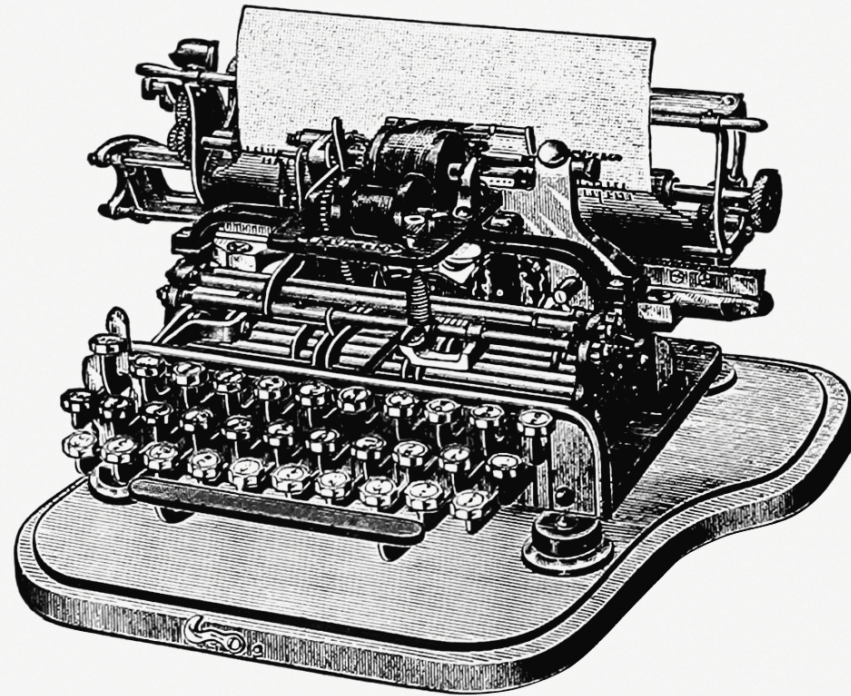
How do you add headers in Markdown?

- a. ! Header
- b. - Header
- c. # Header
- d. 1. Header

What about lists? Bulleted? Numbered?

- a. ! Item 1
- b. - Item 1
- c. # Item 1
- d. 1. Item 1

Markdown tables



Markdown tables

This...

```
| Column 1 | Column 2 |  
|-----|-----|  
| Cell 1, 1 | Cell 2, 1 |  
| Cell 1, 2 | Cell 2, 2 |
```

...produces this

Column 1	Column 2
Cell 1, 1	Cell 2, 1
Cell 1, 2	Cell 2, 2

Markdown tables

This...

Time	Session	Topic
<i>_left_</i>	<i>_center_</i>	<i>_right_</i>
01:00 - 01:50	1	Practice
01:50 - 02:00		**Break**
02:00 - 02:45	2	Class
02:45 - 03:00		**Break**

...produces this

Time	Session	Topic
<i>left</i>	<i>center</i>	<i>right</i>
01:00 - 01:50	1	Practice
01:50 - 02:00		Break
02:00 - 02:45	2	Class
02:45 - 03:00		Break

Break

05:00

Week 12: *Reproducible Reporting*

1. Why RMarkdown?

2. Metadata and output formats

BREAK

3. Text

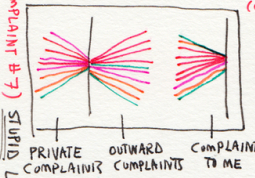
4. Code chunks

DEAR DATA - WEEK 07

A WEEK OF COMPLAINTS*

AND GENERAL GRUMPINESS

HOW TO READ IT: (I ~~THREW~~ TREW DOWN MY PENS WHEN I FINISHED)



(COMPLAINT #7) STUPID LEFT HAND

(COMPLAINT #7) STUPID LEFT HAND SHADOWING

GENERAL

(COMPLAINT #1)

(COMPLAINT #1)

(COMPLAINT #1)

(COMPLAINT #1)

ALL COMPLAINTS IN CHRONOLOGICAL ORDER EXCEPT 'COMPLAINTS TO ME' BECAUSE (COMPLAINT #1) I MESSED UP THE ORDER + BY THAT TIME I HAD ALREADY SPENT 1.5 HOURS ON THIS... ARGH! AND (COMPLAINT #2) THIS PART OF THE DRAWING IS NOT SYMMETRICAL WHICH BOTHERS ME!

TYPE OF COMPLAINT:

- WEATHER
- HUSBAND
- ANIMALS
- FAMILY
- SOCIETY!
- THE WORLD TODAY
- ACQUAINTANCES!
- STRANGERS
- MY APPEARANCE
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- HEALTH
- HUNGER
- MYSELF
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- TRANSPORT

MY STUPID LEFT HAND!

MAIN STATS	
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* SECOND MOST COMPLAINTS ABOUT MY HUSBAND (SMART STEVE I LOVE YOU!)	

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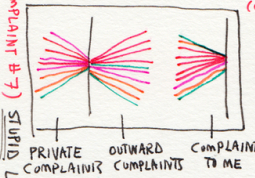
DELIVERED BY
HAND (SPECIAL NYC DELIVERY!)

DEAR DATA - WEEK 07

A WEEK OF COMPLAINTS*

AND GENERAL GRUMPINESS

HOW TO READ IT: (I ~~THREW~~ TREW DOWN MY PENS WHEN FINISHED)



(complaint #7) STUPID LEFT HAND

(complaint #7) STUPID LEFT HAND

(complaint #7) STUPID LEFT HAND

(complaint #7) STUPID LEFT HAND

(complaint #7) STUPID LEFT HAND

ALL COMPLAINTS IN CHRONOLOGICAL ORDER EXCEPT 'COMPLAINTS TO ME' BECAUSE (COMPLAINT #1) I MESSED UP THE ORDER + BY THAT TIME I HAD ALREADY SPENT 1.5 HOURS ON THIS... ARGH! AND (COMPLAINT #2) THIS PART OF THE DRAWING IS NOT SYMMETRICAL WHICH BOTHERS ME!

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 - HUSBAND
 - ANIMALS
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# OF PEOPLE WHO COMPLAINED TO ME:	MY DAD
COMPLAINED TO:	0
TOP COMPLAINER:	NOT THIS HAND
I COMPLAINED MOST ABOUT MY:	FAMILY (SORRY MOM + DAD I LOVE YOU!!)
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TYPE OF COMPLAINT:

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- HUSBAND
- ANIMALS
- FAMILY
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metadata

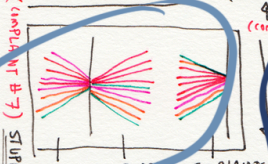
plots

text

DEAR DATA - WEEK 07

A WEEK OF COMPLAINTS* AND GENERAL GRUMPINESS

HOW TO READ IT: (I TREW DOWN MY PENS WHEN I FINISHED (COMPLAINT #7) WHAT IS WRONG W/ ME? ALL COMPLAINTS IN CHRONOLOGICAL ORDER EXCEPT 'COMPLAINTS TO ME' BECAUSE (COMPLAINT #1) I MESSED UP THE ORDER + BY THAT TIME I HAD ALREADY SPENT 1.5 HOURS ON THIS... AARGH! AND (COMPLAINT #3) THIS PART OF THE DRAWING IS NOT SYMMETRICAL WHICH SUCKS



TYPE OF COMPLAINT:

WEATHER	HEALTH
HUSBAND	HUNGER
ANIMALS	MYSELF
FAMILY	TECHNOLOGY/MEDIA
SOCIETY!	MONEY
THE WORLD TODAY	INANIMATE OBJECTS
ACQUAINTANCES/ STRANGERS	TRANSPORT
MY APPEARANCE	
FRIENDS	
WORK	

MAIN STATS

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# OF PEOPLE WHO COMPLAINED TO ME:	5
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TOP COMPLAINER:	MY DAD
TOP COMPLAINEE:	MY HUSBAND

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R Code

Inline code

```
`r insert code here`
```

Code chunks

```
```${r}  
insert code here
insert more code here
```
```

Inline R code

Embed R code directly in a markdown

```
`r <insert code here>`
```

For example:

```
The sum of 3 and 4 is `r 3 + 4`
```

Produces this:

The sum of 3 and 4 is 7

R Code chunks

```
```{r}  
bears %>%
 count(month)
```
```

What is the fate of this chunk?

```
bears %>%  
  count(month)
```

```
#> # A tibble: 12 × 2  
#>   month     n  
#>   <dbl> <int>  
#> 1     1     3  
#> 2     2     1  
#> 3     3     1  
#> 4     4     4  
#> 5     5    18  
#> 6     6    20  
#> 7     7    27  
#> 8     8    28  
#> 9     9    25  
#> 10    10    25  
#> 11    11    12  
#> 12    12     2
```


Code chunks

```
```{r}
monthlyCount <- bears %>%
 count(month)
```
```

```
monthlyCount <- bears %>%
  count(month)
```

What fate do you predict here?

Code chunks

```
```{r}
monthlyCount <- bears %>%
 count(month)

monthlyCount
```
```

```
monthlyCount <- bears %>%
  count(month)

monthlyCount
```

```
#> # A tibble: 12 × 2
#>   month     n
#>   <dbl> <int>
#> 1     1     3
#> 2     2     1
#> 3     3     1
#> 4     4     4
#> 5     5    18
#> 6     6    20
#> 7     7    27
#> 8     8    28
#> 9     9    25
#> 10    10    25
#> 11    11    12
```

Chunk options

Control what chunks output using options inside `{r}`:

Example: `{r, echo=FALSE, message=FALSE}`

| option | default | effect |
|-------------------------|----------|---|
| <code>eval</code> | TRUE | Whether to evaluate the code and include its results |
| <code>echo</code> | TRUE | Whether to display code along with its results |
| <code>warning</code> | TRUE | Whether to display warnings |
| <code>error</code> | FALSE | Whether to display errors |
| <code>message</code> | TRUE | Whether to display messages |
| <code>tidy</code> | FALSE | Whether to reformat code in a tidy way when displaying it |
| <code>results</code> | "markup" | "markup", "asis", "hold", or "hide" |
| <code>cache</code> | FALSE | Whether to cache results for future renders |
| <code>comment</code> | "##" | Comment character to preface results with |
| <code>fig.width</code> | 7 | Width in inches for plots created in chunk |
| <code>fig.height</code> | 7 | Height in inches for plots created in chunk |

Chunk options

By default, code chunks print **code** + **output**:

This...

```
```${r}  
cat('hello world!')
```
```

...produces this

```
cat('hello world!')
```

```
#> hello world!
```

Chunk output options

```
```{r, echo=FALSE}  
cat('hello world!')
```
```

Prints only **output**
(doesn't show code)

Output:

```
#> hello world!
```

```
```{r, eval=FALSE}  
cat('hello world!')
```
```

Prints only **code**
(doesn't run the code)

Output:

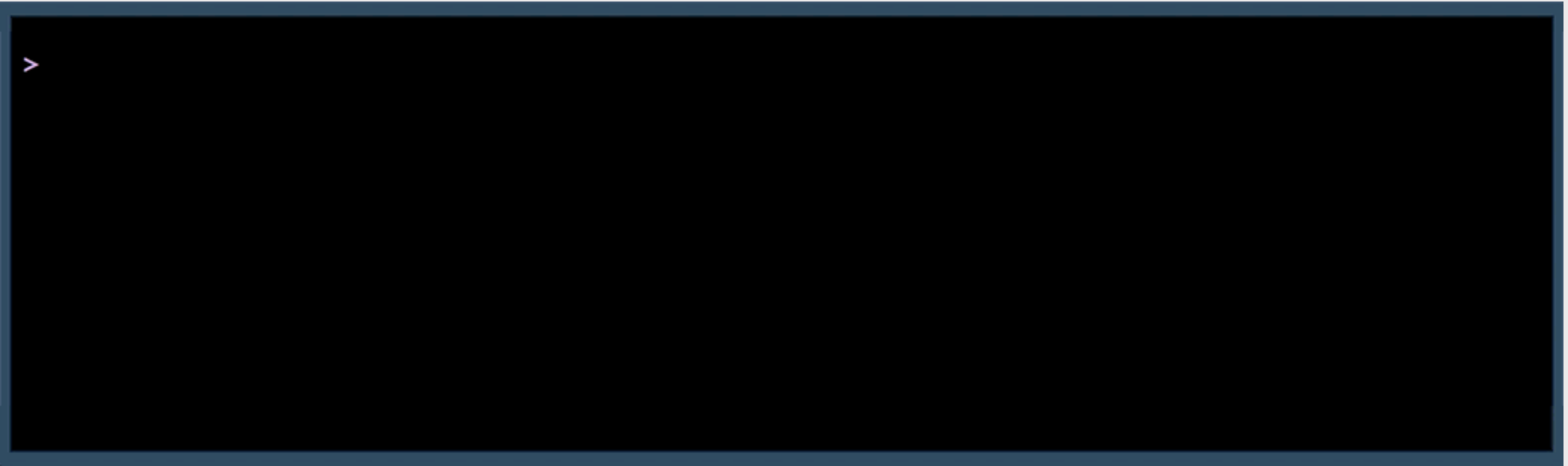
```
cat('hello world!')
```

```
```{r, include=FALSE}  
cat('hello world!')
```
```

Runs, but doesn't print
anything

Output:

message / warning



message / warning

```
```{r, message=FALSE, warning=FALSE}  
library(tidyverse)
```
```

```
library(tidyverse)
```

Using chunk options

```
```{r, message=FALSE, warning=FALSE}  
library(tidyverse)
```
```

- Place between curly braces
`{r option=value}`
- Multiple options separated by commas
`{r option1=value, option2=value}`
- Careful! The `r` part is the **code engine** (other engines possible)

Inserting a Python code chunk

Change `{r}` to `{python}` in the code chunk.

```
'In Python, you can concatenate strings' + ' like this!'
```

```
'In Python, you can concatenate strings like this!'
```

A global `setup` chunk

One chunk to rule them all!

```
```${r} setup, include = FALSE}
knitr::opts_chunk$set(
 warning = FALSE,
 message = FALSE,
 comment = "#>",
 fig.retina = 3,
 fig.path = "figs/"
)
```
```

- A special chunk label: `setup`
- Typically the first chunk
- All following chunks will use these options (i.e., sets global chunk options)
- **Tip:** set `include=FALSE`
- You can (and should) use individual chunk options too

Your turn: Birds & Bears

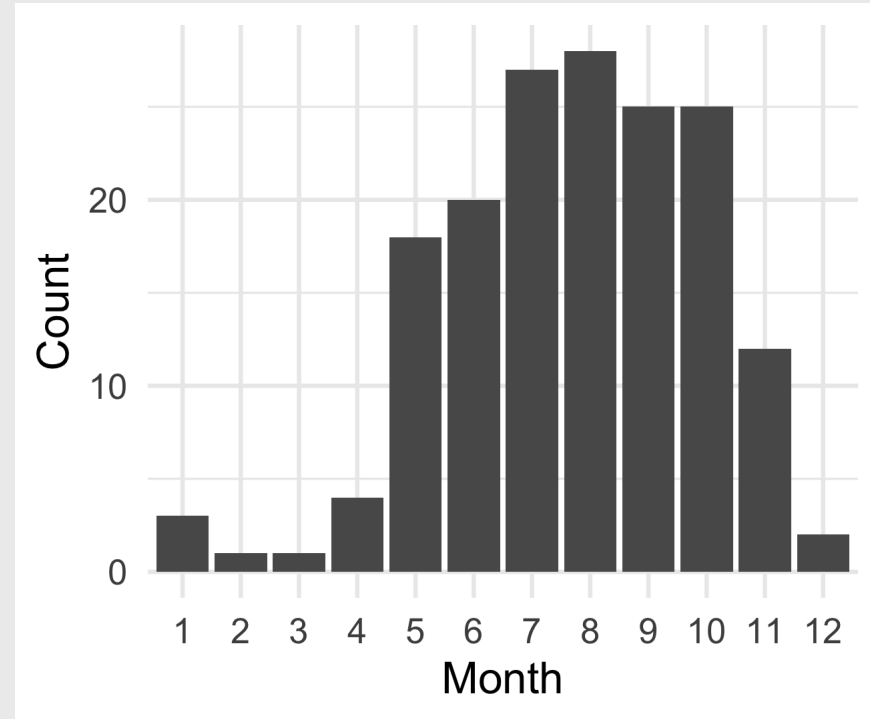
- 1) Create a new R Markdown file (`.Rmd`) in RStudio - title it *"Birds and Bears Analysis"*
- 2) Create a "setup" code chunk to load the `tidyverse` library and the `birds.csv` and `bears.csv` files.
- 3) Use text and code to find answers each of the following questions - show your code and results to justify each answer:
 - Which months have the highest and lowest number of bird impacts with aircraft?
 - Does the annual number of bird impacts appear to be changing over time?
 - Which months have the highest frequency of bear killings?
 - Who has been killed more often by bears: hunters or hikers?
 - How do the the number of bear attacks on men vs women compare?

Including plots

Including plots

```
bears %>%  
  count(month) %>%  
  ggplot() +  
  geom_col(  
    aes(x = as.factor(month), y=n)) +  
  theme_minimal(base_size = 22) +  
  labs(x = 'Month', y = 'Count')
```

Will this print?



Including plots

```
bearMonthPlot <- bears %>%  
  count(month) %>%  
  ggplot() +  
  geom_col(  
    aes(x = as.factor(month), y=n)) +  
  theme_minimal(base_size = 22) +  
  labs(x = 'Month', y = 'Count')
```

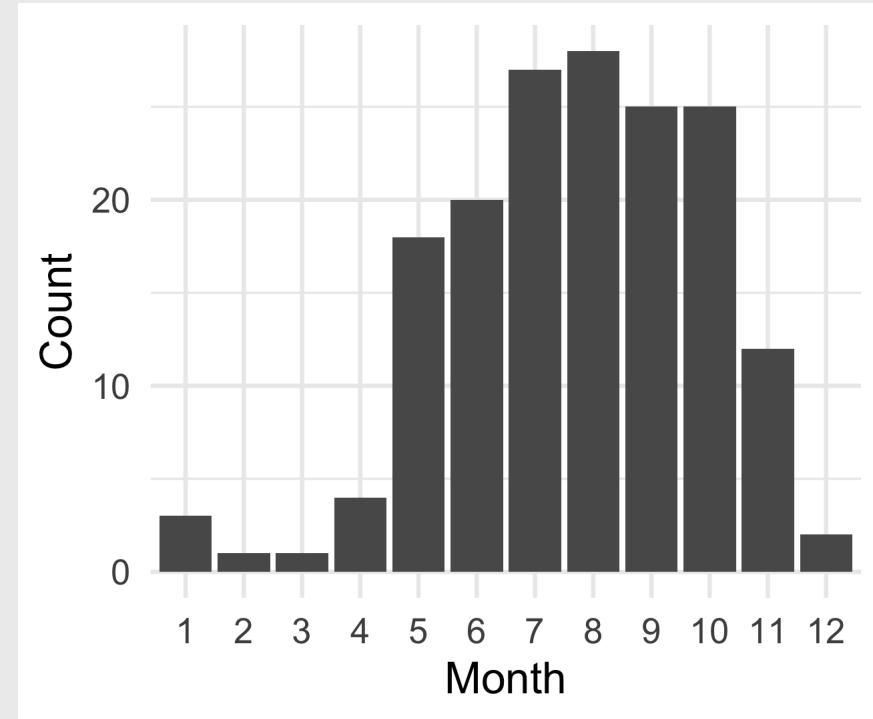
What about this?

Including plots

```
bearMonthPlot <- bears %>%  
  count(month) %>%  
  ggplot() +  
  geom_col(  
    aes(x = as.factor(month), y=n)) +  
  theme_minimal(base_size = 22) +  
  labs(x = 'Month', y = 'Count')
```

bearMonthPlot

What about this?

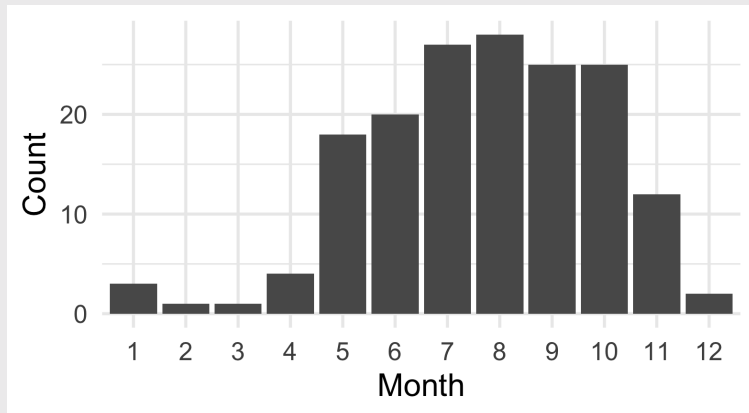


Chunk options for plots

- fig size
- fig resolution

out.width

```
```{r, out.width="70%"}  
bearMonthPlot
```
```



```
```{r, out.width="20%"}  
bearMonthPlot
```
```

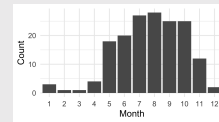
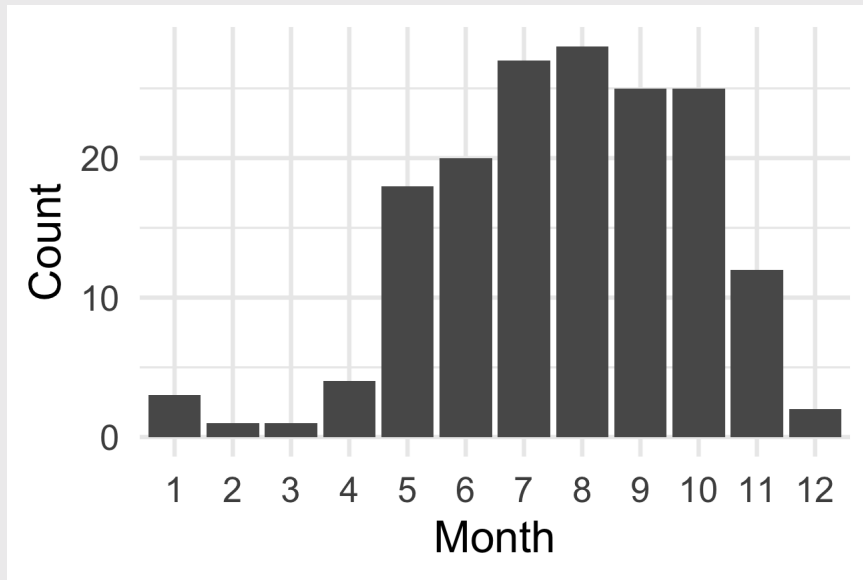


fig.width & fig.height

```
```{r, fig.width=6, fig.height=4}  
bearMonthPlot
```
```



```
```{r, fig.width=3, fig.height=4}  
bearMonthPlot
```
```

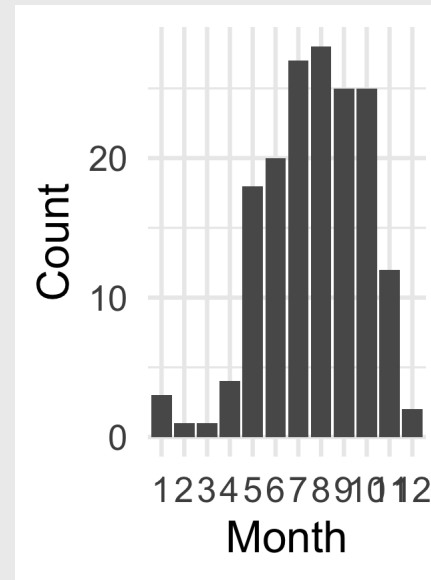


fig.path

```
```{r, fig.path="figs/", echo=FALSE}  
bearMonthPlot
```
```

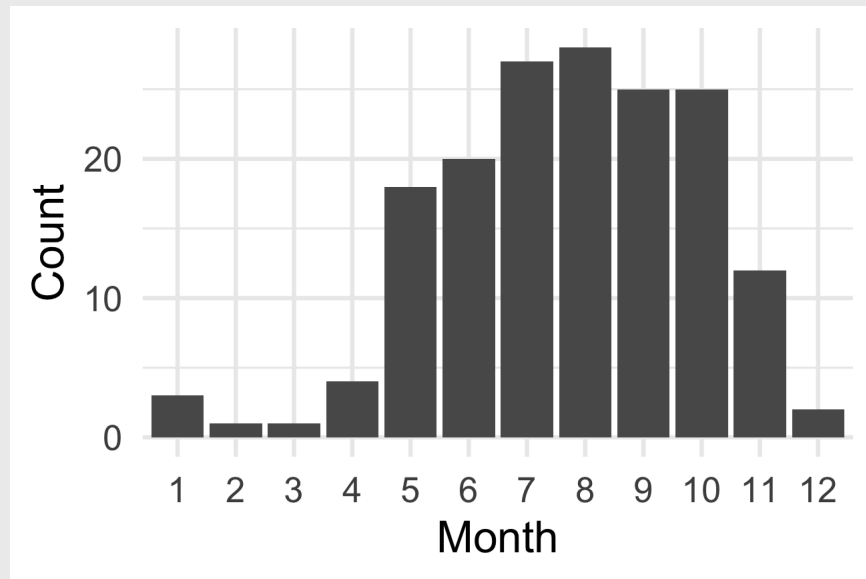
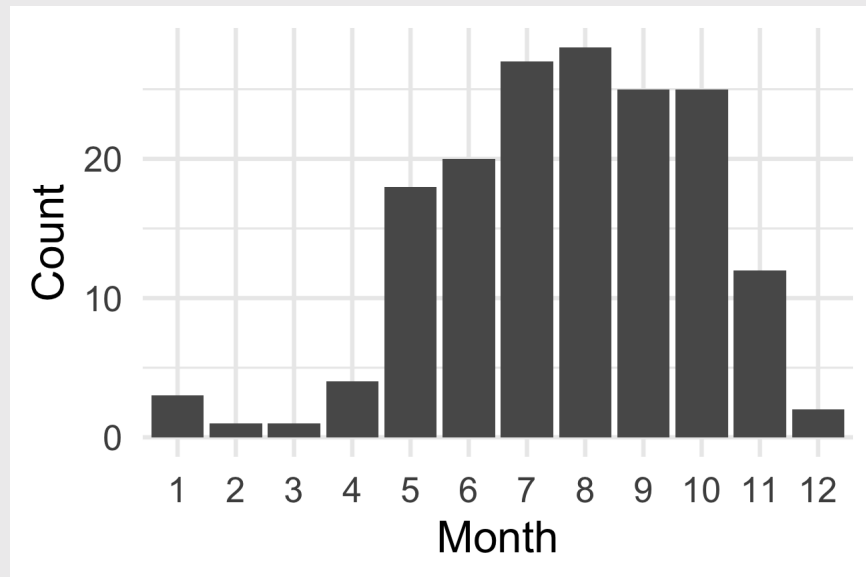


fig.path

```
```{r bear-month-plot, fig.path="figs/", echo=FALSE}  
bearMonthPlot
```
```



A good chunk label

Think: kebabs, not snakes

Good

`my-plot`

`myplot`

`myplot1`

`myplot-1`

`MY-PLOT`

Bad

`my_plot`

`my plot`

everything else!

View default options

```
str(knitr::opts_chunk$get())
```

```
#> List of 53
#> $ eval      : logi TRUE
#> $ echo      : logi TRUE
#> $ results   : chr "markup"
#> $ tidy      : logi FALSE
#> $ tidy.opts : NULL
#> $ collapse : logi FALSE
#> $ prompt    : logi FALSE
#> $ comment   : chr "#>"
#> $ highlight : logi TRUE
#> $ size      : chr "normalsize"
#> $ background : chr "#F7F7F7"
#> $ strip.white : 'AsIs' logi TRUE
#> $ cache     : logi FALSE
#> $ cache.path : chr "index_cache/html/"
#> $ cache.vars : NULL
#> $ cache.lazy : logi TRUE
#> $ dependson  : NULL
#> $ autodep    : logi FALSE
#> $ cache.rebuild: logi FALSE
#> $ fig.keep   : chr "high"
#> $ fig.show   : chr "asis"
#> $ fig.align  : chr "default"
#> $ fig.path   : chr "figs/"
#> $ dev       : chr "png"
```

Two more important chunks:

- Images
- Tables

Image chunks

Insert images with markdown

```

```

Insert images with chunks (so you can resize it)

```
```{r, echo=FALSE, out.width="20%"}  
knitr::include_graphics("images/p4a_hex_sticker.png")
```
```


Image chunks

```
```{r, echo=FALSE, out.width="20%"}  
knitr::include_graphics("images/p4a_hex_stic"
````
```



```
```{r, echo=FALSE, out.width="50%"}  
knitr::include_graphics("images/p4a_hex_stic"
````
```



Convert a data frame to a table with `kable()`

```
bears %>%  
  count(bearType, wildOrCaptive)
```

```
#> # A tibble: 6 × 3  
#>   bearType wildOrCaptive     n  
#>   <chr>      <chr>         <int>  
#> 1 Black      Captive          16  
#> 2 Black      Wild             60  
#> 3 Brown     Captive           8  
#> 4 Brown     Wild             72  
#> 5 Polar     Captive           4  
#> 6 Polar     Wild              6
```

```
bears %>%  
  count(bearType, wildOrCaptive) %>%  
  kable()
```

| bearType | wildOrCaptive | n |
|-----------------|----------------------|----------|
| Black | Captive | 16 |
| Black | Wild | 60 |
| Brown | Captive | 8 |
| Brown | Wild | 72 |
| Polar | Captive | 4 |
| Polar | Wild | 6 |

Your turn: College Majors

- 1) Create a new R Markdown file (`.Rmd`) in RStudio - title it *"College Majors Analysis"*
- 2) Create a "setup" code chunk to load the `tidyverse` library and the `recent_grads.csv` file.
- 3) Use text, code, and plots to find answers each of the following questions - show your code and results to justify each answer:
 - What are the highest earning engineering majors?
 - Within the engineering majors, which ones have better employment rates?
 - Within the engineering majors, which ones have a better gender balance?

(Use good code chunk names for your figures!)