

# Intro to R Markdown

Presentation for R-Ladies Coventry

2021/03/09

# Rmarkdown

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



p.s. *Allison Horst's R illustrations are amaaaazing and I will be using them throughout.*

# Overview

Learn how to use R Markdown to combine writing and code



Create new R project



Create, edit, and compile .Rmd file



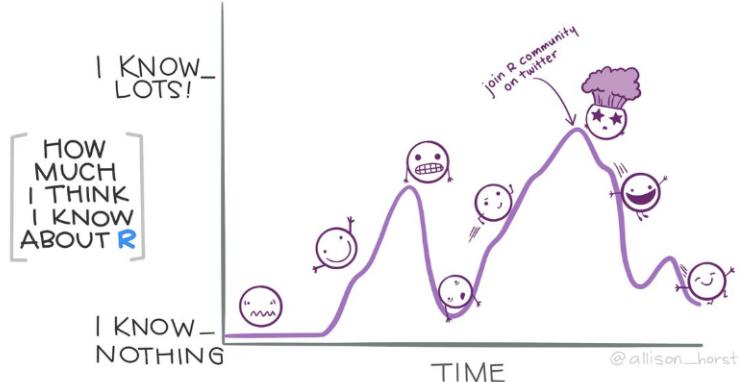
Create & edit helper.R file to feed to your .Rmd



**Allison Horst** @allison\_horst · Dec 4, 2019



Knowing so little never felt so fun. [#rstats](#)



**C.B. Standelmore**

@bankingonbardo

The funniest thing about this is that the time scale could be one day or the past 5 years.

18 12:44 PM - Dec 4, 2019



[See C.B. Standelmore's other Tweets](#)





Tool/interface to make it easy to work with R.



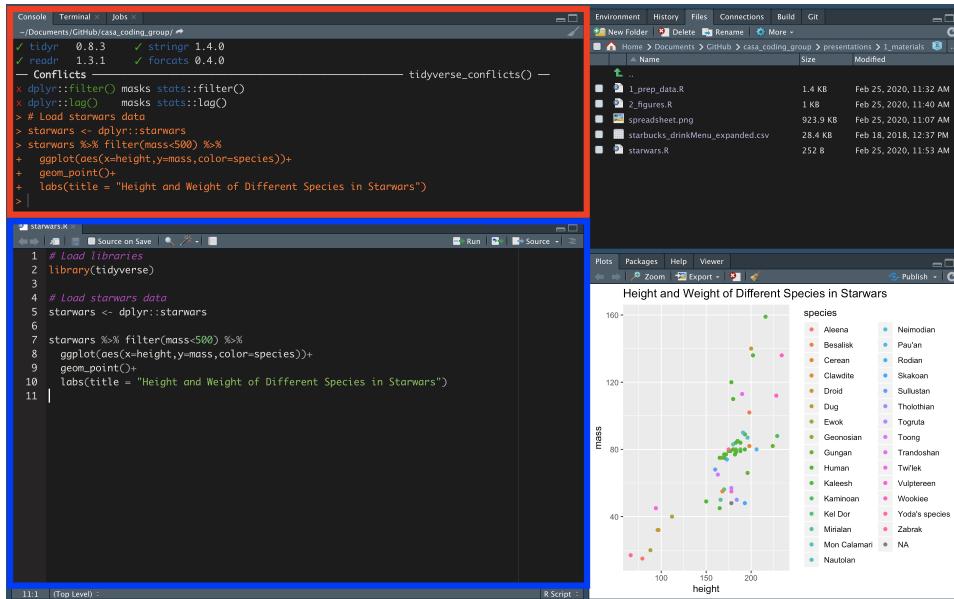
Programming language



Package designed to integrate text & R code

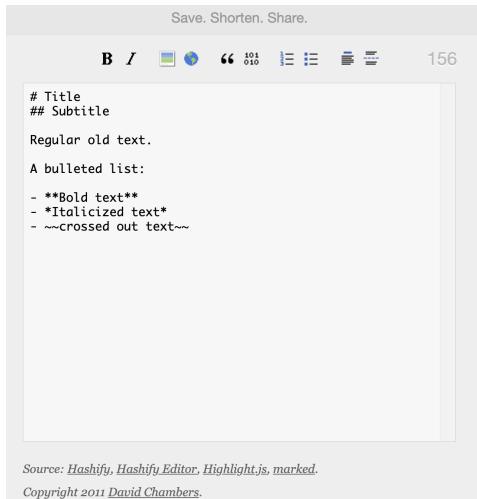


## Recap: Console and script panes in RStudio



- **Console:** Run code, see print outs, see warnings, messages, and errors
- **Source:** Run code from a script. Multiple scripts can be open at once.

# What is “Markdown?”



[Hashify.me](http://Hashify.me)

- Simple syntax that allows you to add tags to plain text to format it
- Originally designed to be HTML replacement
  - Easier to learn and easier to read
- “Minimalist writing system”

[Lifehacker: What is markdown and why is it better for my to do lists and notes?](#)

# What is R Markdown?



- Integrate R code directly into your writing using basic Markdown syntax
- Reference management integration
- Reproducibility
- Accessible learning curve

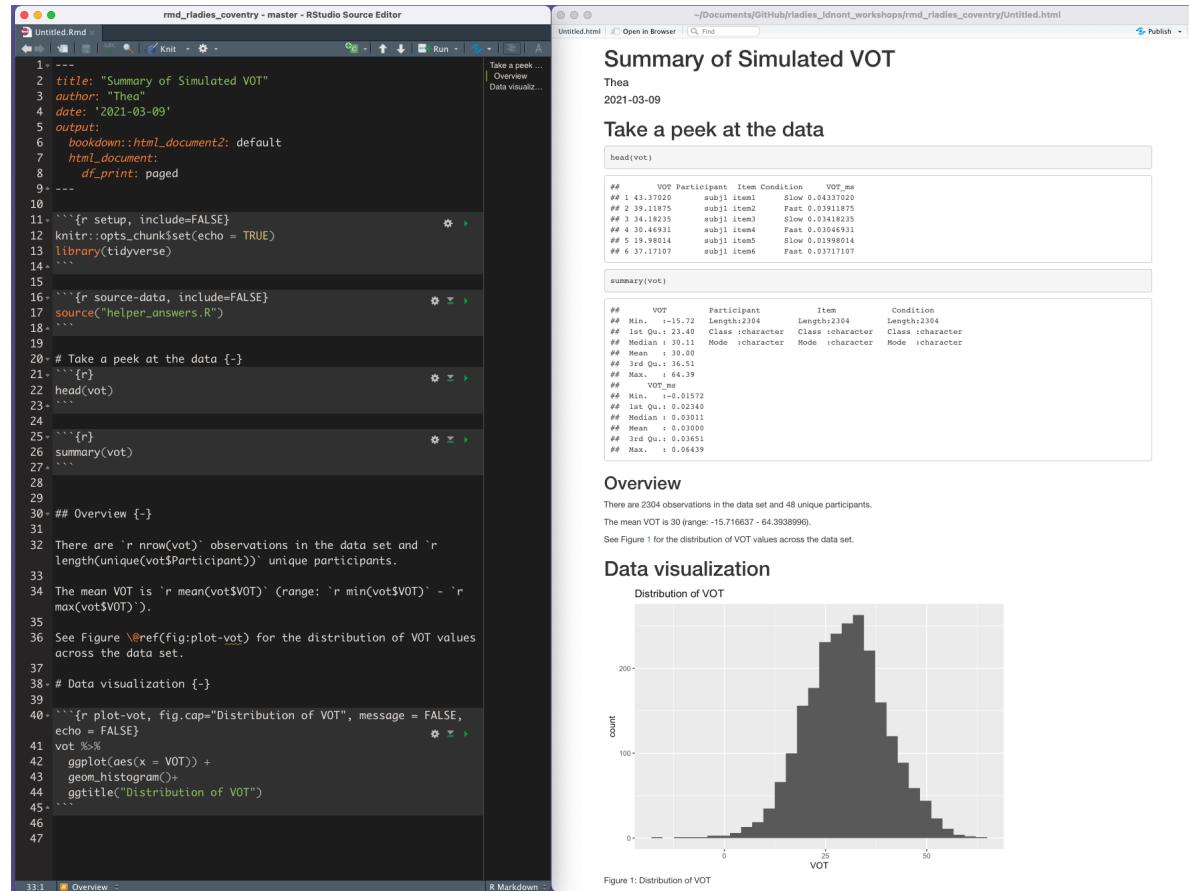
<https://rmarkdown.rstudio.com/>



Very useful for writing summary reports, articles, etc.

# R Markdown

We're going to make this today!



The screenshot shows the RStudio interface with two panes. The left pane is the RStudio Source Editor showing an R Markdown file named 'Untitled.Rmd'. The right pane is the RStudio Preview pane showing the generated HTML document 'Untitled.html'.

**Untitled.Rmd**

```
1 ->
2 title: "Summary of Simulated VOT"
3 author: "Thea"
4 date: '2021-03-09'
5 output:
6   bookdown::html_document2: default
7   html_document:
8     df.print: paged
9 ->
10
11 -> ``{r setup, include=FALSE}
12 knitr::opts_chunk$set(echo = TRUE)
13 library(tidyverse)
14 ->
15
16 -> ``{r source-data, include=FALSE}
17 source("helper_answers.R")
18 ->
19
20 -> # Take a peek at the data {-}
21 -> {r}
22 head(vot)
23 ->
24
25 -> ``{r}
26 summary(vot)
27 ->
28
29
30 -> ## Overview {-}
31
32 There are `r nrow(vot)` observations in the data set and `r length(unique(vot$Participant))` unique participants.
33
34 The mean VOT is `r mean(vot$VOT)` (range: `r min(vot$VOT)` - `r max(vot$VOT)`).
35
36 See Figure `@ref\(fig:plot-vot\)` for the distribution of VOT values
37 across the data set.
38 -> # Data visualization {-}
39
40 -> ``{r plot-vot, fig.cap="Distribution of VOT", message = FALSE,
41 echo = FALSE}
42 vot %>%
43   ggplot(aes(x = VOT)) +
44   geom_histogram()+
45   ggtitle("Distribution of VOT")
46 ->
47
```

**Untitled.html**

## Summary of Simulated VOT

Thea  
2021-03-09

### Take a peek at the data

```
head(vot)
```

VOT	Participant	Item	Condition	VOT_ms
## 1	43.37020	subj item1	Slow	0.04337020
## 2	39.11875	subj item2	Fast	0.03911875
## 3	39.11875	subj item3	Slow	0.03911875
## 4	30.46931	subj item4	Fast	0.03046931
## 5	19.98014	subj item5	Slow	0.01998014
## 6	37.17107	subj item6	Fast	0.03717107

```
summary(vot)
```

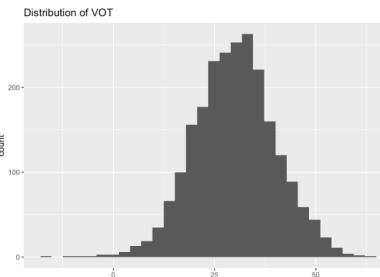
VOT	Participant	Item	Condition	VOT_ms
## Min.	-15.72	Length:2304	Length:2304	
## 1st Qu.	23.40	Class:character	Class:character	Class:character
## Median	30.11	Mode:character	Mode:character	Mode:character
## Mean	30.00			
## 3rd Qu.	36.51			
## Max.	64.39			
## VOT_ms				
## Min.	-0.01572			
## 1st Qu.	0.02340			
## Median	0.03211			
## Mean	0.03000			
## 3rd Qu.	0.03651			
## Max.	0.06439			

### Overview

There are 2304 observations in the data set and 48 unique participants. The mean VOT is 30 (range: -15.71637 - 64.393899). See Figure 1 for the distribution of VOT values across the data set.

### Data visualization

Distribution of VOT



A histogram titled 'Distribution of VOT' showing the frequency of VOT values. The x-axis is labeled 'VOT' and ranges from -15 to 60. The y-axis is labeled 'Count' and ranges from 0 to 200. The distribution is roughly bell-shaped, centered around 30, with the highest frequency (around 220) occurring between 25 and 30.

Figure 1: Distribution of VOT

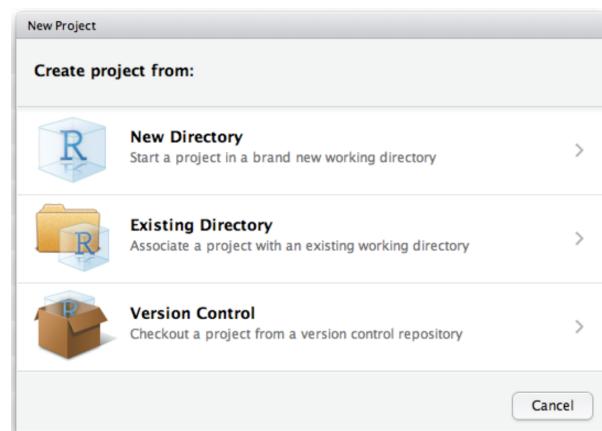
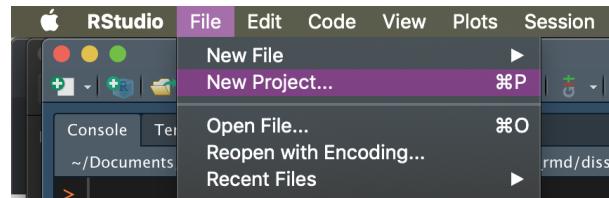
# Part 1

The basics



# Exercise 1

## Create a new R Project



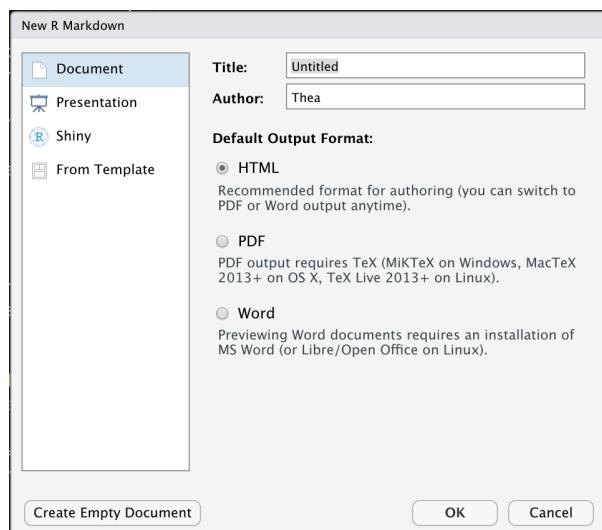
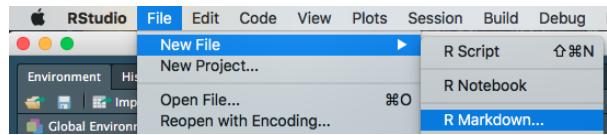
1. Make a new directory for this workshop
2. Put the workshop contents in the same directory

- You can restore where you left off by opening the *.RProj* file again later.
  - [More on RProjects](#)

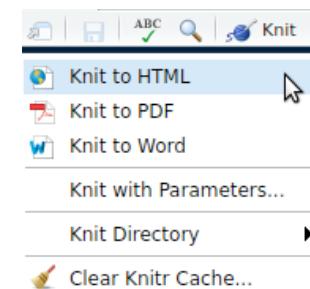


# Exercise 2

Create a new R Markdown document



1. Create a new R Markdown file
2. Title it something useful
3. Save it in the project folder you just made
4. Compile! ("Knit"): Cmd/Ctrl + K or with Knit button



# Essential parts of any R Markdown document

# Essential parts of any R Markdown document

```
title: "Untitled"  
author: "Thea Knowles"  
date: '2018-03-06'  
output: html_document  
---
```

**YAML Metadata**

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

**Chunk options**

```
## 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)  
```
```

**Text**

**R code chunks**

# YAML

YAML (rhymes with camel): The header that tells R Markdown how to generate your document. Indentation and spacing are very important.

- Permits the following to happen when you knit:
  - .Rmd -> knitr -> .md -> Pandoc -> output
  - Output can be .docx, .html, .pdf, and many others
- YAML: “YAML Ain’t Markup Language”

# YAML

## Basic:

```
title: "Untitled"  
author: "Thea Knowles"  
date: '2018-02-18'  
output: word_document
```

# YAML

## More options...

```
title: "Changes in voice acoustics along a speech rate continuum  
       in Parkinson's disease"  
author: "Thea Knowles, Scott G. Adams, Mandar Jog"  
date: Last updated `r Sys.Date()`  
output:  
  bookdown::word_document2:  
    reference_docx: "../rmd_templates/custom_reference.docx"  
  redoc::redoc:  
    highlight_outputs: FALSE  
    margins: 1  
    line_numbers: FALSE  
bibliography: references.bib  
csl: "csl_files/apa7.csl"
```

# YAML

## Even more options...

- templates for Word, PDF, etc.
- bibliography file
- `csl` (references style guide)
- `css` (supreme customization!)
- journal articles, slides, websites

## Different options for:

- [HTML output](#)
- [Word output](#)
- [PDF output](#)

*Note: We will just learn about HTML output today*

# Essential parts of any R Markdown document

```
title: "Untitled"  
author: "Thea Knowles"  
date: '2018-03-06'  
output: html_document  
---
```

**YAML Metadata**

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knitr::opts_chunk$set(echo = TRUE)  
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**Chunk options**

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

**Text**

**R code chunks**

# Code chunks

- Chunks are sections that will include R code. By setting defaults at the beginning of your document, you can specify what you want most of your chunks to do.
- In each chunk, you can specify options in the form `tag=value` in the chunk header.
  - For example, in the following, the tag `include` is set to `FALSE`, indicating that we don't want the contents of this chunk included in the output

# Code chunks

- Let's say we want to include a code chunk that assigns x the value of 10.
- Here are some ways we can do that.

# Code chunks

First, insert a new R chunk by

- Typing Alt + Cmd/Ctrl + i OR
- Clicking Code >> Insert Chunk from the R Studio menu

# Code chunks

Bare R code chunk (no labels or options)

```
```{r}
x <- 10
```
```

# Code chunks

Give it a label ("my-chunk")

```
```{r my-chunk}
x <- 10
```
```

 *Chunk labels CANNOT contain spaces, underscores, or special characters, but CAN contain hyphens.*

# Code chunks

Tell RMarkdown what to do with it (Set chunk options)

```
```{r my-chunk, echo = FALSE}
x <- 10
```
```

In this example, we set the echo option:

- echo = TRUE: show the code in the rendered Rmd document
- echo = FALSE: don't show the code in the output, but DO run it in the background

# Code chunks: More options

| Chunk options                    |               |   |
|----------------------------------|---------------|---|
| option                           | default value | description   |
| <strong>Code evaluation</strong> |               |   |
| <b>child</b>                     | NULL          | A character vector of filenames. Knitr will knit the files and place them into the main document.   |
| <b>code</b>                      | NULL          | Set to R code. Knitr will replace the code in the chunk with the code in the code option.   |
| <b>engine</b>                    | 'R'           | Knitr will evaluate the chunk in the named language, e.g. <code>engine = 'python'</code> . Run <code>names(knitr::knit_engines\$get())</code> to see supported languages.   |
| <b>eval</b>                      | TRUE          | If FALSE, knitr will not run the code in the code chunk.  |
| <b>include</b>                   | TRUE          | If FALSE, knitr will run the chunk but not include the chunk in the final document.   |
| <b>purl</b>                      | TRUE          | If FALSE, knitr will not include the chunk when running <code>purl()</code> to extract the source code.   |
| <strong>Results</strong>         |               |   |
| <b>collapse</b>                  | FALSE         | If TRUE, knitr will collapse all the source and output blocks created by the chunk into a single block.   |
| <b>echo</b>                      | TRUE          | If FALSE, knitr will not display the code in the code chunk above it's results in the final document.   |
| <b>results</b>                   | 'markup'      | If 'hide', knitr will not display the code's results in the final document. If 'hold', knitr will delay displaying all output pieces until the end of the chunk. If 'asis', knitr will pass through results without reformatting them (useful if results return raw HTML, etc.) |
| <b>error</b>                     | TRUE          | If FALSE, knitr will not display any error messages generated by the code.  |
| <b>message</b>                   | TRUE          | If FALSE, knitr will not display any messages generated by the code.  |
| <b>warning</b>                   | TRUE          | If FALSE, knitr will not display any warning messages generated by the code.  |
| <strong>Code Decoration</strong> |               |   |
| <b>comment</b>                   | '##'          | A character string. Knitr will append the string to the start of each line of results in the final document.  |
| <b>highlight</b>                 | TRUE          | If TRUE, knitr will highlight the source code in the final output.  |
| <b>prompt</b>                    | FALSE         | If TRUE, knitr will add > to the start of each line of code displayed in the final document.  |
| <b>strip.white</b>               | TRUE          | If TRUE, knitr will remove white spaces that appear at the beginning or end of a code chunk.  |
| <b>tidy</b>                      | FALSE         | If TRUE, knitr will tidy code chunks for display with the <code>tidy_source()</code> function in the <code>formatR</code> package.  |

# Code chunks: More options

 [RMarkdown cheat sheet](#)

 [RStudio lesson](#)

 [Knitr book chapter](#)

# Code chunks: Special setup code chunk

Let's say you want to set default behavior for all of your code chunks. You can do this using the `knitr` package in a special chunk at the beginning of your document.

When you create a new Rmarkdown document from the default template, this is included for you:

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

# Code chunks: Special setup code chunk

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

This chunk provides the following information for “knitting” the document:

- **setup**: the name of the chunk You shouldn’t have two chunks with the same name, unless they are unnamed (in which case they just get numbered automatically during the knit process)
- **include = false**: the chunk will not be included in the output after knitting.
- **knitr::opts\_chunk\$set(echo = TRUE)**: set `echo = TRUE` for all chunks (you can still set `echo = FALSE` in individual chunks later if you want)

# Essential parts of any R Markdown document

```
title: "Untitled"  
author: "Thea Knowles"  
date: '2018-03-06'  
output: html_document  
---
```

**YAML Metadata**

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

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

**Text**

**R code chunks**

# R Markdown

Text in Markdown syntax

# Markdown

**Markdown:** set of conventions for editing plain text.

Write as you normally would in a text editor or word processor, but you signal text formatting with certain characters (next slide).

Markdown (which is distinguished from *markUP* language) is designed to be

- **easy to read**
- **easy to write**
- **easy to learn**

# Markdown syntax

## syntax

```
Plain text
End a line with two spaces to start a new paragraph.
*italics* and _italics_
**bold** and __bold__
superscript^2^
~~strikethrough~~
[link](www.rstudio.com)

# Header 1

## Header 2

### Header 3

#### Header 4

##### Header 5

###### Header 6

endash: --
emdash: ---
ellipsis: ...
inline equation: $A = \pi * r^2$
image: 

horizontal rule (or slide break):

***
```

## becomes

Plain text  
End a line with two spaces to start a new paragraph.  
*italics* and *italics*  
**bold** and **bold**  
superscript<sup>2</sup>  
strikethrough  
[link](#)

## Header 1

## Header 2

### Header 3

#### Header 4

##### Header 5

###### Header 6

endash: –  
emdash: —  
ellipsis: ...  
inline equation:  $A = \pi * r^2$   
image: 

horizontal rule (or slide break):

# Markdown syntax

Tables written like this:

| First Header | Second Header |
|--------------|---------------|
| Content Cell | Content Cell  |
| Content Cell | Content Cell  |

- See [Tables Generator website](#)
- *See remedy and beautifyR R packages/RStudio addins for dealing with markdown tables*
- Data frames can be turned into tables without manual modification
  - *See kable and flextable R packages*



# Exercise 3

## Customize

In the Rmarkdown document you created from the default template...

1. Delete everything after Line 12 (after the setup code chunk)
2. Add a new header
3. Add some plain text
4. Add some **bold** text
5. Add a code chunk that includes `x <- 5` and `x`
6. Include a line that says:

The value of x is `r x`

7. Compile! ("Knit"): Cmd/Ctrl + K or with Knit button.

# Part 2

Scaling up to real-world use

# My habits

- do my data cleaning/exploration in a separate .R script ("helper.R")
- *source* my helper.R file in my RMarkdown document and use code chunks to polish figures/tables
- include in-line R code that refers back to R objects made in helper.R



# Exercise 4

Create `helper.R`

First: make sure `simulated_vot_data.csv` is in your project folder (same level as the `.RProject`). Then:

1. Create a new `.R` script
2. Add the following code
3. Save it as `helper.R` in your project folder (same level as your `.RProject` for now)

Try to run the code in the R console.

We can pause to diagnose any errors people run into!



# Exercise 5

Source & use the code in `helper.R` in your RMarkdown document

Open your `.Rmd` file and insert a new code chunk below the setup chunk

```
```{r source-helper}
  source("helper.R")

  min(vot$VOT)
  max(vot$VOT)
```

```

Knit the `.Rmd` document. What do you see?

We can pause to diagnose any errors people run into!



# Exercise 6

Add in-line R code

Below your R chunk, add the following lines:

The mean VOT is `r vot\_m`.

The mean VOT is `r min(vot\$VOT)` and the max VOT is `r max(vot\$VOT)`.



# Exercise 7

Add a plot

Add another code chunk:

```
```{r vot-distribution}
  hist(vot$VOT)
```
```

# Exponentially useful

The ability to refer to your code in your document becomes EXTREMELY helpful once you start creating multiple figures, reporting summary variables and tables of statistics



*Tour of some of the ways I use RMarkdown*

- Manuscripts
- Dissertation
- Presentations like this one that needs to show/demonstrate code
- Summary documents to supervisor/colleagues/stats consults
  - “Trapper-keeper” for large projects
  - My websites

# Manuscript draft

```

1104 <-- **(Xx group by rate)** -->
1105 Unlike in slower speech, at faster rates there were no group by rate interactions for VOT for either contrast
1106 (OC vs. PD; $hat{beta}$_0 = 'r vot_FB["groupOC vs rest:prop_wpm"]', $p$_5 r report_p{vot_FF["groupOC vs rest:prop_wpm"]};
1107 PD-Med vs. PD-DBS; $hat{beta}$_0 = 'r vot_FB["groupPD vs DBS:prop_wpm"]', $p$_5 r report_p{vot_FF["groupPD vs
1108 DBS:prop_wpm"]}');
1109
1110 <-- **(Xx THIS DIFFERED FROM LOG TRANSFORM, WHERE THERE WERE GROUP X RATE CONTRASTS BUT IS NOW UP TO DATE)** -->
1111
1112 <-- Significant two-way group by rate contrasts indicate that, collapsed -->
1113 <-- across all three voiceless speech groups, the OC and PD groups demonstrated -->
1114 <-- differences in the rates of VOT change associated with the OC group -->
1115 <-- 'r vot_FB["groupOC vs rest:prop_wpm"]', $p$_5 -->
1116 <-- differences between the two PD groups (PD-Med vs. PD-DBS; $hat{beta}$_0 = -->
1117 <-- 'r report_p{vot_FF["groupOC vs rest:prop_wpm"]}' ) but no significant -->
1118 <-- differences between the two PD groups (PD-Med vs. PD-DBS; $hat{beta}$_0 = -->
1119 <-- 'r report_p{vot_FF["groupPD vs DBS:prop_wpm"]}', $p$_5 -->
1120 <-- 'r report_p{vot_FF["groupPD vs DBS:prop_wpm"]}' ). **(Xx NOTE DIFFERENCES -->
1121
1122 <-- **(Xx group by voicing)** -->
1123 In faster speech, the PD-DBS group produced overall less distinction between voiced and voiceless VOT compared to the other groups, indicated by a significant positive effect for the PD-Med vs. PD-DBS group by voicing contrast
1124 ($hat{beta}$_0 = 'r vot_FB["groupPD vs DBS:voicingVcd vs Vcls"]', $p$_5 r report_p{vot_FF["groupPD vs DBS:voicingVcd vs
1125 Vcls"]}');
1126 This effect, which was not significant for the OC vs. PD group contrast
1126 ($hat{beta}$_0 = 'r vot_FB["groupOC vs rest:voicingVcd vs Vcls"]', $p$_5 r report_p{vot_FF["groupOC vs rest:voicingVcd vs
1127 Vcls"]}');
1128 reflects a similar trend to what was observed in slow speech (though in slow speech the negative estimate for the OC vs. PD
1129 group contrast reflected greater voicing distinctiveness for the OCs, but no observable differences between the PD groups).
1130
1131 <-- **(Xx group by voicing)** -->
1132 As with the other rate blocks (namely, habitual and slower), relatively faster rate was associated with decreased voicing distinctiveness within the fast speech blocks
1133 ($hat{beta}$_0 = 'r vot_FB["groupOC vs rest:voicingVcd vs Vcls"]', $p$_5 r report_p{vot_FF["groupOC vs rest:voicingVcd vs
1134 Vcls"]}');
1135 <-- **(Xx rate by group by voicing)** -->
1136 While the OC and PD-Med groups demonstrated similar degrees of increasing VOT voicing collapse as rate of speech increased,
1137 the PD-DBS group demonstrated a different pattern.
1138 Specifically, both voiced and voiceless VOT decreased as rate increased for the OC and PD-Med talkers, but voiceless VOT
1139 decreased by a greater extent, resulting in less voicing contrast at the fastest rates of speech.
1140 For the PD-DBS talkers, voiced VOT behaved in this same way, voiced VOT actually increased as speech rate increased.
1141 This is supported by a significant three-way group by rate by voicing interaction for the PD-Med vs. PD-DBS contrast
1142 ($hat{beta}$_0 = 'r vot_FB["groupPD vs DBS:prop_wpm:voicingVcd vs Vcls"]', $p$_5 r report_p{vot_FF["groupPD vs
1143 DBS:prop_wpm:voicingVcd vs Vcls"]}');
1144 The OC vs. PD contrast was not significant, reflecting the similarity between the OC and PD-Med groups:
1145 ($hat{beta}$_0 = 'r vot_FB["groupOC vs rest:prop_wpm:voicingVcd vs Vcls"]', $p$_5 r report_p{vot_FF["groupOC vs
1146 rest:prop_wpm:voicingVcd vs Vcls"]}');
1147 'r figs("plot-vot-sf",caption = "Voiced and voiceless VOT (in milliseconds) along proportionally slower and faster speech
1148 rates for each group.")'
1149 ``{r}
1150 stop_sf_df >>%
1151 ggplot(aes(x=prop_wpm,y=vot_dur,color=group,linetype=voicing))+
1152 # geom_point(alpha = 0.1,
1153 # aes(shape = split) +
1154 geom_smooth(method="lm")+
1155 # geom_abline(intercept = 0, slope = 1, color = "black")+
1156 # theme_bw()+
1157 # theme_legend.position="bottom"+
1158 # scale_color_manual(values = my_colors)
1159 ...
1160

```

Overall, at faster rates VOT was altered in predictable ways, i.e., longer for OC vs. PD  $\beta = 3.636, p = .499$ ; PD-Med vs. PD-DBS  $\beta = 8.581, p = .185$ . Significant two-way group by rate contrasts indicate that, collapsed across voiced and voiceless stops, the OC group demonstrated a steeper slope of change (OC vs. PD;  $\beta = -11.784, p = .022$ ) and the PD-DBS group demonstrating the shallowest (PD-Med vs. PD-DBS  $\beta = 21.535, p = .001$ ).

A two-way group by voicing interaction indicated that the OC group also produced a greater voiced/voiceless distinction, averaged across the slow rate spectrum ( $\beta = 5.942, p = .001$ ), but the OC vs. PD group contrast ( $\beta = 5.367, p = .036$ ) was not significant.

This relationship was further mediated by proportional speech rate adjustments, evidenced by a two-way rate by voicing interaction ( $\beta = 17.174, p = .018$ ). A significant two-way group by voicing by rate interaction for the OC vs. PD groups indicated that this increase was largest for the controls ( $\beta = 11.734, p = .018$ ). There was no three-way rate by voicing by rate interaction for the PD-Med vs. PD-DBS groups ( $\beta = 5.414, p = .001$ ).

In slower speech, the PD-DBS group produced overall less distinction between voiced and voiceless VOT compared to the other groups, indicated by a significant positive effect for the PD-Med vs. PD-DBS group by voicing contrast ( $\beta = 12.051, p = .028$ ). This effect, which was not significant for the OC vs. PD group contrast ( $\beta = 2.222, p = .117, p = .444$ ) but not for the OC vs. PD group contrast ( $\beta = 5.367, p = .036$ ). Unlike in slower speech, at faster rates there were no group by rate interactions for VOT for either contrast (OC vs. PD:  $\beta = 4.649, p = .065$ ; PD-Med vs. PD-DBS:  $\beta = 5.414, p = .001$ ).

As with the other rate blocks (namely, habitual and slower), relatively faster rate of speech was associated with decreased voicing distinctiveness within the fast speech blocks ( $\beta = 12.924, p = .001$ ).

While the OC and PD-Med groups demonstrated similar degrees of increasing VOT voicing collapse as rate increased, the PD-DBS talkers, but voiceless VOT decreased by a greater extent, resulting in less voicing contrast at the fastest rates of speech. For the PD-DBS talkers, voiced VOT increased as rate increased, but voiceless VOT decreased as rate increased. This is captured by a significant three-way group by rate by voicing interaction for the PD-Med vs. PD-DBS contrast ( $\beta = -7.992, p = .001$ ), but not for the OC vs. PD group contrast ( $\beta = 5.367, p = .036$ ), reflecting the similarity between the OC and PD-Med groups ( $\beta = 0.758, p = .799$ ).

As can be seen in Figure 7, this pattern can be observed for the PD-DBS group in its speech rate blocks. In slower speech, the PD-DBS group demonstrated continually greater VOT voicing contrast as rate continued to decrease. Conversely, at faster than normal rates of speech, the same overall pattern was observed, but was driven by the PD-DBS group producing less of a voicing contrast (and, specifically, by actually increasing voiced VOT as rate increased).

At habitual rates of speech, both voiced and voiceless VOT were overall more expanded (larger VOT) and shorter overall VOTs. Of the three groups, the PD-DBS group demonstrated the most vowel centralization and longest VOTs. Segmental strengthening (i.e., increased vowel centralization) has been observed in other studies of VOT, and this may have been captured by a main effect of rate for VOT, and a rate by voicing interaction for VOT. Conversely, at faster than normal rates of speech (i.e., not intentionally modified VOT), the PD-DBS group demonstrated a predictable inverse relationship with both vowel centralization and VOT lengthening for the OC and PD-Med groups.

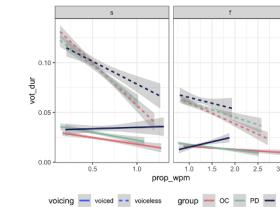
Q&A

Supporting vowel centralization patterns observed in the present study largely support the current literature. Specifically, talkers with PD demonstrated smaller working vowel spaces (greater centralization) compared to controls (Lam & Tiede, 2016; Lammer & Liu, 2014; McFarland et al., 2002; Raus et al., 2013; Shukla et al., 2011; Shukla, 2012; Shukla & Lammer, 2013; Shukla & Liu, 2013; Shukla & Wijesinghe, 2014), and more so for talkers with DBS (Sridha et al., 2016; de Tanaka et al., 2014; Shukla & Liu, 2013; Shukla & Wijesinghe, 2014). In addition, talkers with PD (Byrd, 1994; Fletcher et al., 2017; Jacewicz et al., 2009; Neel, 2008), while vowel centralization did not vary by rate when averaged across the groups, this was driven by talkers with PD demonstrating greater vowel centralization at faster habitual rates, and a similar degree of vowel centralization at faster habitual rates, the PD-DBS group demonstrated the opposite trend, with faster habitual rates associated with less vowel centralization (Figure 8).

VOT

While all groups produced global lengthening of VOT at slower habitual rates, a similar degree of lengthening for both voiced and voiceless VOT for the PD groups (i.e., absence of a voiceless by rate interaction) meant that this wasn't associated with

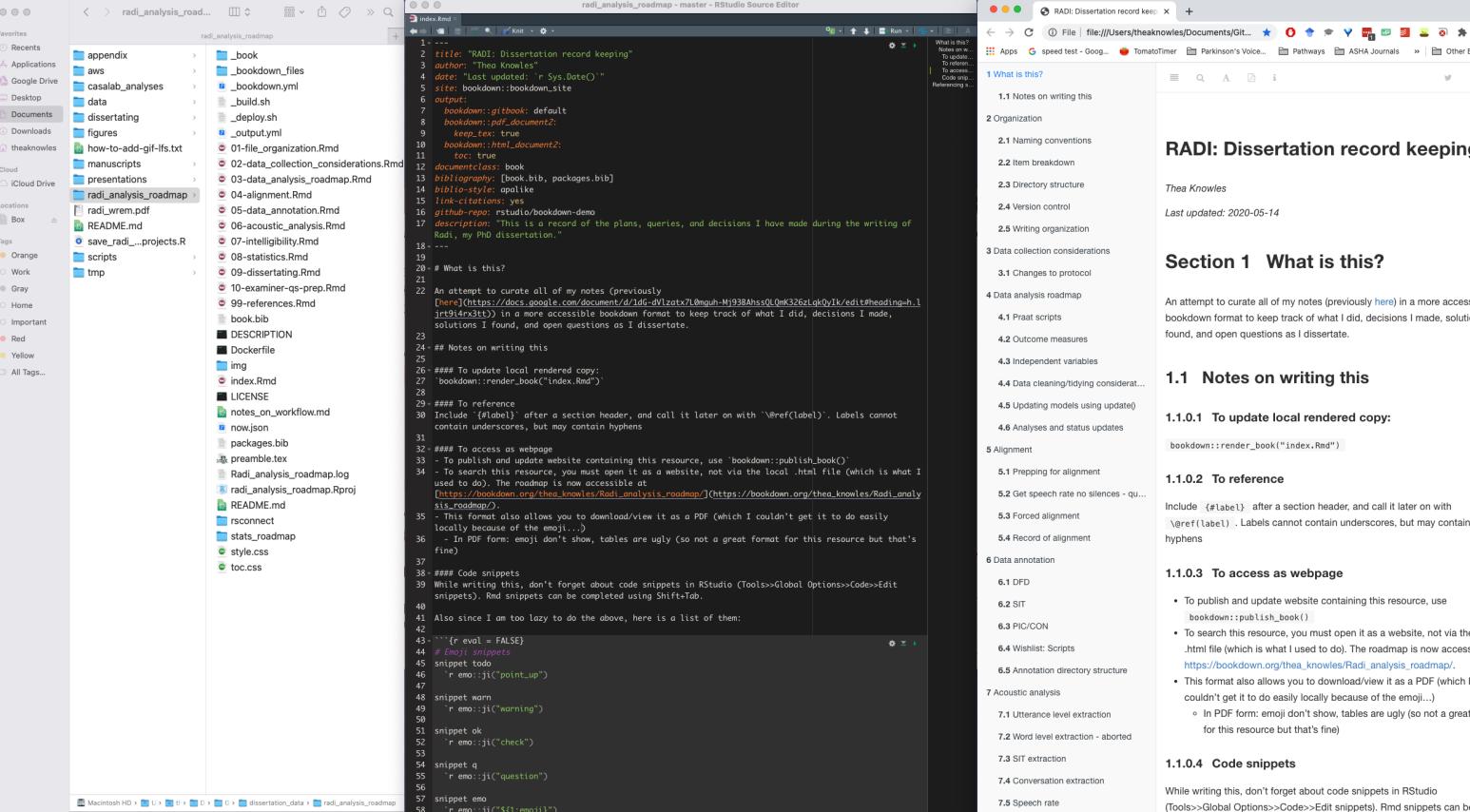
Figure 7: Voiced and voiceless VOT (in milliseconds) along proportionally slower and faster speech rates for each group.



Discussion

Page 20 of 47 15384 words English (United States)

# Dissertation record keeping



The image shows a dual-monitor setup. The left monitor displays the RADI analysis roadmap in RStudio, showing a file tree for 'radi\_analysis\_roadmap' and the content of 'index.Rmd'. The right monitor displays the RADI dissertation record keeping in RStudio, showing a file tree for 'radi\_dissertation\_record' and the content of 'index.Rmd'.

**Left Monitor: RADI analysis roadmap**

- File Tree:
  - radi\_analysis\_roadmap
  - appendix
  - aws
  - casablanca\_analyses
  - dissertating
  - figures
  - how-to-add-gif-lfs.txt
  - manuscripts
  - presentations
  - radi\_analysis\_roadmap
  - radi\_wrem.pdf
  - README.md
  - scripts
  - temp
- Content of index.Rmd (partial):

```
1 ---  
2 title: "RADI: Dissertation record keeping"  
3 author: "Thea Knowles"  
4 date: "Last updated: `r Sys.Date()`"  
5 site: bookdown::bookdown_site  
6   
7 bookdown::github:: default  
8 bookdown::pdf_document2:  
9 keep_tex: true  
10 bookdown::html_document2:  
11 toc: true  
12 documentclass: book  
13 bibliography: [book, bib, packages, bib]  
14 biblio-style: apalike  
15 link-citations: yes  
16 github-repo: rstudio/bookdown-demo  
17 description: "This is a record of the plans, queries, and decisions I have made during the writing of RADI, my PhD dissertation."  
18 ---  
19  
20 # What is this?  
21  
22 An attempt to curate all of my notes (previously [here](https://thea_knowles.github.io/radi_wrem/7L0mgh-M193BAhs0LOm2326Lc0QIk/edit#heading-h1)) in a more accessible bookdown format to keep track of what I did, decisions I made, solutions I found, and open questions as I dissertation.  
23  
24 ## Notes on writing this  
25  
26 ##### To update local rendered copy:  
27 bookdown::render_book("index.Rmd")  
28  
29 ##### To reference  
30 Include `#label` after a section header, and call it later on with `@ref(label)`. Labels cannot  
31 contain underscores, but may contain hyphens  
32  
33 ##### To access as webpage  
34 - To publish and update website containing this resource, use `bookdown::publish_book()`  
35 - To search this resource, you must open it as a website, not via the local .html file (which is what I  
36 used to do). The roadmap is now accessible at  
[https://bookdown.org/thea_knowles/RADI_analysis_roadmap/](https://bookdown.org/thea_knowles/RADI_analysis_roadmap/)  
37 - You can also allow to download/view it as a PDF (which I couldn't get it to do easily  
38 locally because of the emoji...)  
39 - In PDF form: emoji don't show, tables are ugly (so not a great format for this resource but that's  
39 fine)  
40  
41 Also since I am too lazy to do the above, here is a list of them:  
42  
43 ---{r eval = FALSE}  
44 # Emojis snippets  
45 snippet todo  
46 r emoji::i("point_up")  
47  
48 snippet warn  
49 r emoji::i("warning")  
50  
51 snippet ok  
52 r emoji::i("check")  
53  
54 snippet q  
55 r emoji::i("question")  
56  
57 snippet emoj  
58 r emoji::i("${1:emoji}")  
59  
60 ---
```

Bottom status bar: Macintosh HD, 45.64 GB available

**Right Monitor: RADI: Dissertation record keeping**

- File Tree:
  - radi\_dissertation\_record
  - App
  - File | file:///Users/theaknowles/Documents/Git...
  - speed test - Goog...
  - TomatoTimer
  - Parkinson's Voice...
  - Pathways
  - ASHA Journals
  - Other Book...
- Content of index.Rmd (partial):

```
1 What is this?  
2 Notes on writing this  
3 Organization  
4 Data collection considerations  
5 Data analysis roadmap  
6 Alignment  
7 Acoustic analysis  
8 SIT extraction  
9 Conversation extraction  
10 Speech rate
```

## RADI: Dissertation record keeping

**Thea Knowles**  
Last updated: 2020-05-14

## Section 1 What is this?

An attempt to curate all of my notes (previously [here](#)) in a more accessible bookdown format to keep track of what I did, decisions I made, solutions I found, and open questions as I dissertation.

### 1.1 Notes on writing this

#### 1.1.0.1 To update local rendered copy:

```
bookdown::render_book("index.Rmd")
```

#### 1.1.0.2 To reference

Include `#label` after a section header, and call it later on with `@ref(label)`. Labels cannot contain underscores, but may contain hyphens

#### 1.1.0.3 To access as webpage

  - To publish and update website containing this resource, use `bookdown::publish\_book()`
  - To search this resource, you must open it as a website, not via the local .html file (which is what I used to do). The roadmap is now accessible at [https://bookdown.org/thea\\_knowles/RADI\\_analysis\\_roadmap/](https://bookdown.org/thea_knowles/RADI_analysis_roadmap/).
  - This format also allows you to download/view it as a PDF (which I couldn't get it to do easily locally because of the emoji...)
  - In PDF form: emoji don't show, tables are ugly (so not a great format for this resource but that's fine)

#### 1.1.0.4 Code snippets

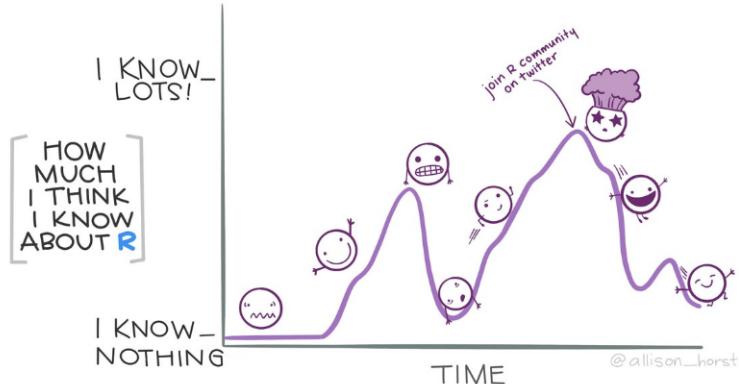
While writing this, don't forget about code snippets in RStudio (Tools->Global Options->Code->Edit snippets). Rmd snippets can be completed using Shift+Tab.



**Allison Horst** @allison\_horst · Dec 4, 2019



Knowing so little never felt so fun. [#rstats](#)



**C.B. Standelmore**

@bankingonbardo

The funniest thing about this is that the time scale could be one day or the past 5 years.

18 12:44 PM - Dec 4, 2019



[See C.B. Standelmore's other Tweets](#)



# Build your skills gradually

Build your skill set to tailor to your goals: Some guiding suggestions based on my own experience

- Start with using R Markdown to tell the story of your data to you, to your supervisor (summary reports)
- If dissertating - start early! Use RMarkdown as a way to keep track of your data. Compile frequently and read up on project management
- Write an article in RMarkdown & learn how to use templates, reference management integration, and .RData files
- Present your data using RMarkdown
  - This presentation uses the `ioslides_presentation` output, but [xaringan](#) is an extremely powerful & popular tool for RMarkdown presentations

# R Studio Visual R Markdown

- RStudio v1.4 released a mode to edit markdown more easily - the result is a word processor-style experience
- I still recommend getting the basics down first, but this is an exciting development

[Read more about Visual R Markdown Editing Mode here](#)

---

# More resources

# More resources

- [R Markdown: The Definitive Guide](#)
- [R Markdown Cookbook](#)
- [R-Ladies #LdnOnt guide to dissertationing with R Markdown and bookdown](#)
- [Page Piccinini's R for Publication Lessons](#)
- [A curated/quasirandom list of other very helpful resources](#)