

# The lazy and easily distracted report writer

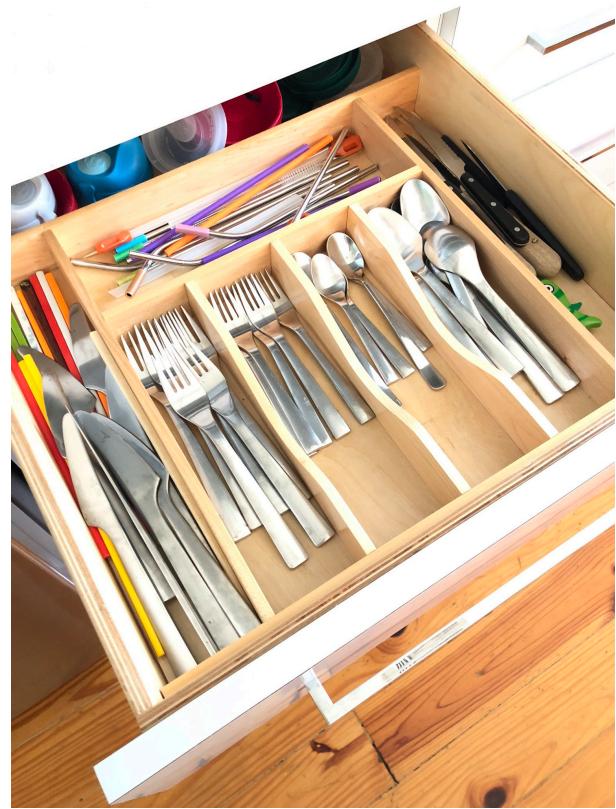
Mike K Smith (Pfizer R&D UK Ltd.)  
@MikeKSmith

RStudio::conf(2019)

# TL;DR & Disclaimer

- I used parameterised rmarkdown notebooks to write up an exploratory analysis which I shared with a drug development team consisting of quantitative and non-quantitative colleagues:
  - Statistician
  - Clinical Pharmacologists (including my manager)
  - Clinician
- The analysis presented here is **NOT** that analysis (for confidentiality) but it has similar attributes.

# Cutlery drawers & what they say about YOU



HT: @HadleyWickham, @jimhester\_, @dataandme

# Mine... (sorry / not sorry)



```
CutleryDrawer %>%
  group_by(Type) %>%
  gather( ) %>%
  arrange( )
```

#untidyverse



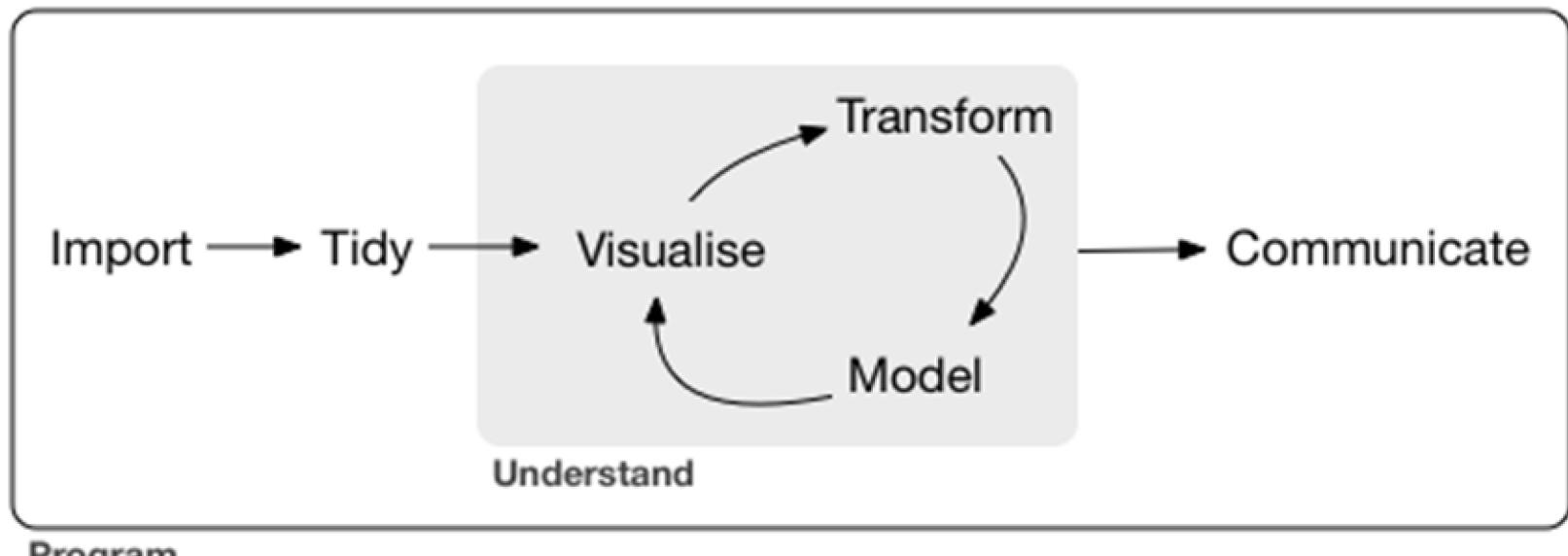
HOME ORGANIZATION TIP:  
JUST GIVE UP.

<https://xkcd.com/1077/>

Your (my) brain is  
lazy, shallow, and  
easily distracted.

<https://www.slideshare.net/CJAtherton/chris-atherton-at-presentation-camp-london>

# Data analysis - THEORY



<https://r4ds.had.co.nz/>

# Data Analysis – In practice....

*(DISCLAIMER: I'm **sure** the experiences recounted here are **unique to me alone.**)*

**Go to email with link to data source...**

*read and respond to 3 other emails...*

**Download and read data into R...**

*stop and answer colleague's question(s)  
about the tidyverse...*

**Wrangle data and plot it...**

# *LUNCH*

*go to an (unrelated) meeting /  
teleconference call.*

# Make better plots.

*follow an interesting link that  
Mara Averick (@dataandme)  
just posted on Twitter*

## Fit preliminary model to data.

## *<Next day>*

Team find problem with data,  
share new version of data.

Change input data and redo analysis.

Check new version against  
previous version.

Discuss findings with my boss.

*file expenses.*

Circulate report.

**DONE!!!**

*< 6 months pass >*

Review comments come back...

Wait... Erm... ***WHAT*** was I thinking?

To the rescue...

rmarkdown & notebooks



# Who is your audience?

- Present (distracted) *me*
- Future (6 months later) *me*
- Quantitative colleagues / reviewers
- Decision makers (may not be quantitative)

# Notebooks / markdown **vs** scripts *(for analysis)*



**Mike K Smith** @MikeKSmith · Sep 12

My opinion: If you write more comments (explanation) than code, use rmarkdown. If you write more code than comments, then write more comments and use rmarkdown. [@StatGarrett](#) #earlconf



1



19



101



[Show this thread](#)

BUT, see also: <https://yihui.name/en/2018/09/notebook-war/>

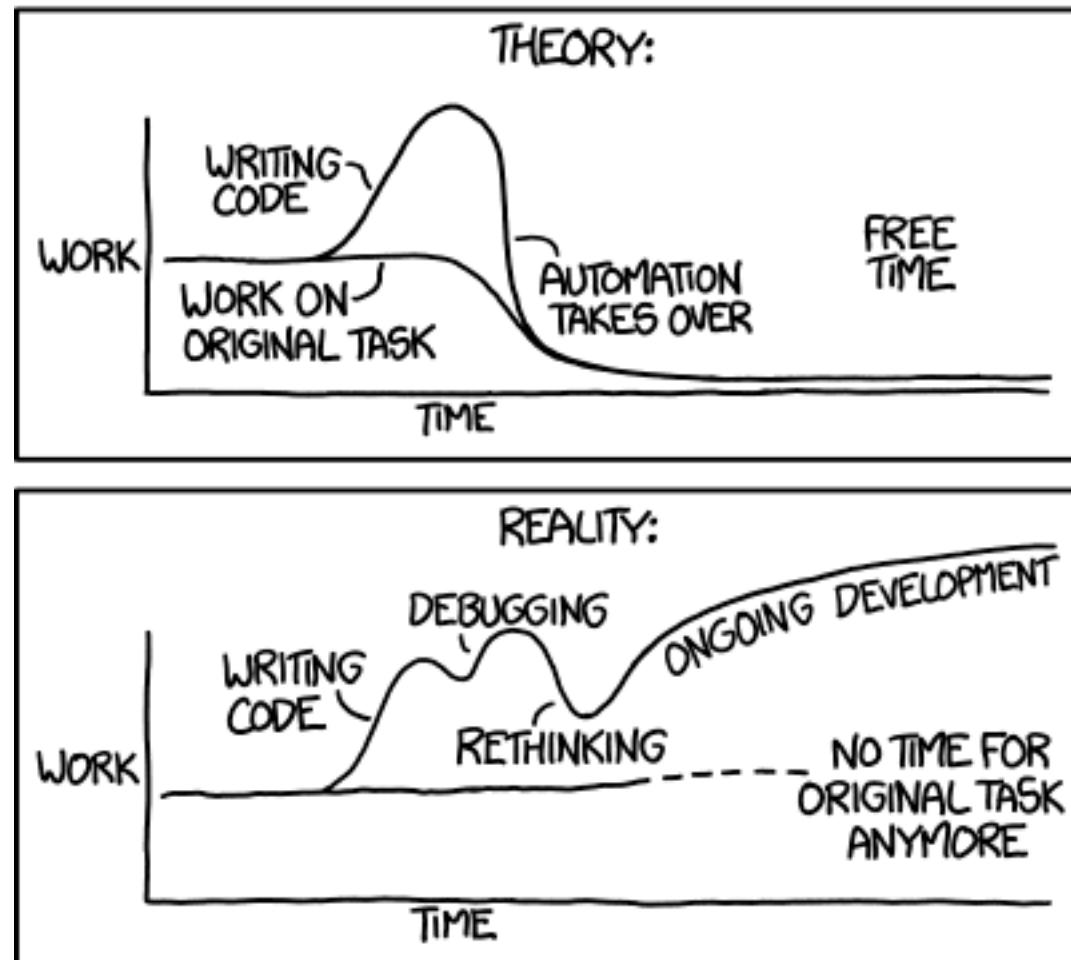
# Also...

I *knew* my manager / other reviewers  
would ask for reports  
on the *THREE* different endpoints.

# Rule of three

- Copy & paste code  $\geq 3$  times?
  - Write and use a function
- Perform analysis across  $\geq 3$  endpoints?
  - Multiple markdown reports?
  - ***NOPE. Parameterised*** reports.

"I SPEND A LOT OF TIME ON THIS TASK.  
I SHOULD WRITE A PROGRAM AUTOMATING IT!"



<https://xkcd.com/1319/>

# YAML header parameters

```
1 ---  
2 title: "Parameterised Report with child documents"  
3 author: "Mike K Smith"  
4 date: "`r format(sys.time(), '%d %B, %Y')`"  
5 params:  
6   endpoint:  
7     value: HAMDTL17  
8     choices:  
9       - HAMDTL17  
10      - HAMATOL  
11      - PGIIMP  
12   quantAudience: FALSE  
13 output:  
14   html_document:  
15     df_print: paged  
16     toc: TRUE  
17     toc_float: TRUE  
18     toc_depth: 4  
19     code_download: TRUE|  
20   pdf_document: default  
21   word_document: default  
22 ---
```

Parameters that can be used in the code / knitr options.

Note that endpoint has only three choices, and a default value (HAMDTL17)

NB. A bit like Shiny inputs

# Render with parameters

The screenshot shows the RStudio interface with a file named "Untitled1.Rmd" open. The code editor displays RMarkdown code. A context menu is open over the code, specifically over the line "Knit with Parameters...". The menu options include:

- Knit to HTML
- Knit to PDF
- Knit to Word
- Knit with Parameters... (selected)
- Knit Directory
- Clear Knitr Cache...

```
1 ---  
2 title: "Parameterised report with child documents"  
3 author: "John Doe"  
4 date: "2023-01-01"  
5 params:  
6   quantAudience: FALSE  
7  
8 output:  
9   html_document:  
10    df_print: paged  
11    toc: TRUE  
12    toc_float: TRUE  
13    toc_depth: 4  
14    code_download: TRUE  
15  pdf_document: default  
16  word_document: default  
17 ---  
18 ``{r, echo = FALSE, results = "hide"}  
19 ## Hide code if we're not rendering the report for a quantitative audience.  
20 if(!params$quantAudience)knitr::opts_chunk$set(echo = FALSE)  
21 ``  
22 ---  
23  
24 ---  
25 ---  
26 ---  
27 ---  
28 ---
```

# Render with parameters

RStudio

File Edit Code View Plots Session Build Debug Profile Tools Help

Untitled1\* Parameterised report with child docu... x

Knit Insert Run Addins

```
1 ---  
2 title: "Parameterised Report with child documents"  
3 author: "Mike K Smith"  
4 date: `r format(sys.time(), '%d %B, %Y')`  
5 params:  
6   endpoint:  
7     value: HAMDTL17  
8     choices:  
9       - HAMDTL17  
10      - HAMATOL  
11      - PGIIMP  
12   quantAudience: FALSE  
13 output:  
14   html_document:  
15     df_print: paged  
16     toc: TRUE  
17     toc_float: TRUE  
18     toc_depth: 4  
19     code_download: TRUE  
20   pdf_document: default  
21   word_document: default  
22 ---  
23  
24 ```{r, echo = FALSE, results = 'hide'}  
25 ## Hide code if we're not  
26 if(!params$quantAudience)  
27 ``;  
28  
29  
30 # Aims  
31 This report shows how you  
32 produce reports for multi  
33  
34 ```{r loadTidyverse, warning = FALSE}  
35 library(tidyverse)  
36 library(broom.mixed)  
37 library(nlme)  
38  
39  
40 # Data Source  
41 We're using a publically  
42  
43 * The data is from http://www.ncbi.nlm.nih.gov/geo/  
44 (website accessed 05 June 2018).  
45 * The associated manuscript is  
46  
47 ```{r DataManipulation_sh, eval = TRUE}  
48  
49  
50 ```{r DataManipulation_noshow, eval = !params$quantAudience, message = FALSE, echo = FALSE, results = 'hide'}  
51 knitr::purl("DataManipulation.Rmd")
```

Knit with Parameters

endpoint

HAMDTL17

HAMATOL

PGIIMP

quantAudience

Cancel Knit

params:

endpoint: **HAMDTL17**

quantAudience: FALSE

Parameterised report with child docs : HAMDTL17 - non-quantitative audience

Log In RStudio Connect

Aims  
Data Source  
Outcomes  
Exploratory data analysis  
**Summary Statistics**  
Visualisation  
Analysis  
Appendix 1 - Session information

## Summary Statistics

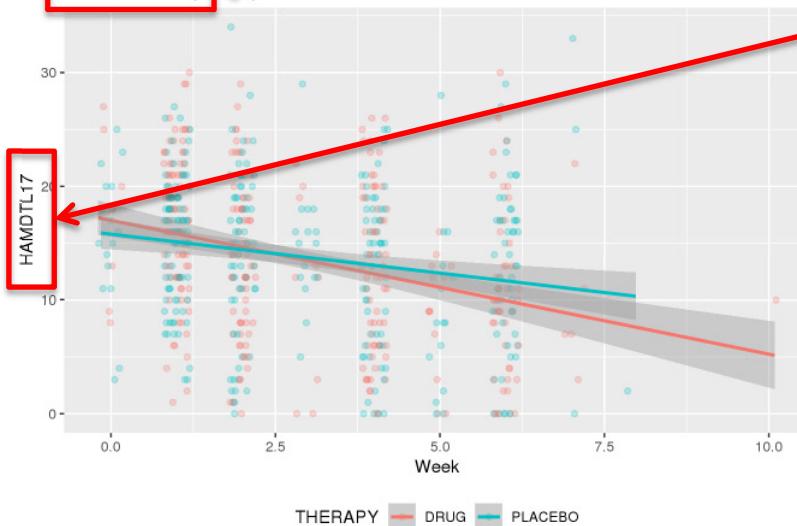
The table below shows mean HAMDTL17 by THERAPY and VISIT.

THERAPY	VISIT	n	mean	sd	range
<chr>	<dbl>	<int>	<dbl>	<dbl>	<chr>
DRUG	4	83	16.72289	6.396099	1 - 30
DRUG	5	76	13.90759	6.911204	0 - 29
DRUG	6	72	11.93056	7.256520	0 - 26
DRUG	7	64	10.46875	7.219833	0 - 30
PLACEBO	4	88	15.68182	5.410473	3 - 27
PLACEBO	5	81	14.30864	7.098665	0 - 34
PLACEBO	6	76	12.73684	6.986403	0 - 29
PLACEBO	7	65	12.00000	7.830230	0 - 33

8 rows

## Visualisation

HAMDTL17 by study week



Using  
**params\$endpoint**  
in markdown text, plot code

My Parameterised report with child doc... × ModelDiagnostics\_text.Rmd × DataManipulation\_text.Rmd ×

ABC Knit Insert Run

```
1 ---  
2 title: "Parameterised Report with child documents"  
3 author: "Mike K Smith"  
4 date: `r format(sys.time(), "%d %B, %Y")`"  
5 params:  
6   endpoint:  
7     value: HAMDTL17  
8     choices:  
9       - HAMDTL17  
10      - HAMATOTL  
11      - PGIIMP  
12   quantAudience: FALSE  
13 output:  
14   html_document:  
15     df_print: paged  
16     toc: TRUE  
17     toc_float: TRUE  
18     toc_depth: 4  
19     code_download: TRUE|  
20   pdf_document: default  
21   word_document: default  
22 ---  
23  
24 ```{r, echo = FALSE, results = "hide"}  
25 ## Hide code if we're not rendering the report for a quantitative audience.  
26 if(!params$quantAudience)knitr::opts_chunk$set(echo = FALSE)  
27 ...
```

Knitr options:  
Show code in output **ONLY IF** quantitative audience,

Rename endpoint variable(s) to “outcome” (simplifies later code)

```
```{r DataManipulation, results="hide", message=FALSE, warnings=FALSE}
data <- haven::read_sas("chapter15_example.sas7bdat")

data <- data %>%
  rename_all(funs(
    str_replace(string = ., pattern=params$endpoint, replacement="outcome")
  )) %>%
  bind_cols(data,.) %>%
  drop_na()
````
```

Run this code **ONLY IF** params\$quantAudience = TRUE

```
```{r Show_data, eval = params$quantAudience}
data %>%
  head(10)
````
```

Run **ONLY IF** params\$quantAudience = TRUE, to pull in text *from child document*

```
```{r DataManipulationChildDoc, eval=params$quantAudience,
child="DataManipulation_text.Rmd"}````
```

Content / Parameterised report with child docs : HAMDTL17 - quantitative audience

Aims

Data Source

Data Manipulations

Conditional execution of Data Manipulation.

Renaming of the endpoint variable

Outcomes

Exploratory data analysis

Analysis

Appendix 1 - Session information

Appendix 2 - Code used in creation of this report

INPUT

## Data Source

We're using a publicly available dataset on depression.

- The data is from <https://missingdata.lshtm.ac.uk/category/dia-working-group/example-data-sets/> (Website accessed 05 June 2018).
- The associated manuscript is <https://www.ncbi.nlm.nih.gov/pubmed/15232330>.

```
data <- haven::read_sas("chapter15_example.sas7bdat")  
  
data <- data %>%  
  rename_all(funs(  
    str_replace(string = ., pattern= params$endpoint, replacement="outcome")) %>%  
  bind_cols(data,.) %>%  
  drop_na())  
  
data %>%  
  head(10)
```

Code shown

```
data %>%  
  head(10)
```

Chunk run

PATIENT	HAMATOL	PGIIMP	RELDAYS	VISIT	THERAPY	GEND...	POOLINV	basval
<dbl>	<dbl>	<dbl>	<dbl>	<dbl>	<chr>	<chr>	<chr>	<dbl>
1503	21	2	7	4	DRUG	F	006	32
1503	19	2	14	5	DRUG	F	006	32
1503	21	3	28	6	DRUG	F	006	32
1503	17	4	42	7	DRUG	F	006	2
1507	18	3	7	4	PLACEBO	F	006	14
1507	18	2	15	5	PLACEBO	F	006	14
1507	14	3	29	6	PLACEBO	F	006	14
1507	8	2	42	7	PLACEBO	F	006	14
1509	18	3	7	4	DRUG	F	006	21
1509	17	3	14	5	DRUG	F	006	21

1-10 of 10 rows | 1-9 of 22 columns

Data shown

## Data Manipulations

The data shows post-baseline measurements for subjects on duloxetine and placebo (+paroxetine). Although two doses of duloxetine were given in the study the data has been "anonymised" by randomly sampling from the two different doses.

Child doc text

## Conditional execution of Data Manipulation.

<https://rsconnectgpdbsx.pfizer.com/connect/#/apps/144/access/33>

RStudio Connect

Content / Parameterised report with child docs HAMDTL17 - quantitative audience

## Data Source

We're using a publicly available dataset on depression.

- The data is from <https://missingdata.lshtm.ac.uk/category/dia-working-group/example-data-sets/> (Website accessed 05 June 2018).
- The associated manuscript is <https://www.ncbi.nlm.nih.gov/pubmed/15232330>.

```
data <- haven::read_sas("chapter15_example.sas7bdat")

data <- data %>%
  rename_all(funs(
    str_replace(string = ., pattern= params$endpoint, replacement="outcome"))
  )) %>%
  bind_cols(data,.) %>%
  drop_na()

data %>%
  head(10)
```

PATIENT	HAMATOL	PGIIMP	RELDAYS	VISIT	THERAPY	GEND...	POOLINV	basval
1503	21	2	7	4	DRUG	F	006	32
1503	19	2	14	5	DRUG	F	006	32
1503	21	3	28	6	DRUG	F	006	32
1503	17	4	42	7	DRUG	F	006	32
1507	18	3	7	4	PLACEBO	F	006	14
1507	18	2	15	5	PLACEBO	F	006	14
1507	14	3	29	6	PLACEBO	F	006	14
1507	8	2	42	7	PLACEBO	F	006	14
1509	18	3	7	4	DRUG	F	006	21
1509	17	3	14	5	DRUG	F	006	21

1-10 of 10 rows | 1-9 of 22 columns

## Data Manipulations

The data shows post-baseline measurements for subjects on duloxetine and placebo (+paroxetine). Although two doses of duloxetine were given in the study the data has been "anonymised" by randomly sampling from the two different doses.

## Conditional execution of Data Manipulation.

params :

endpoint: **HAMDTL17**

quantAudience: **TRUE**

**RStudio Connect** allows you (or visitor to your page) to specify parameters and render a parameterised report and then to save that report as a named item.

You can then have pre-rendered reports for various audiences ready to go...

# More parameterisation

- Question: Can I pass in parameters from the render command?
  - You betcha! `render(... , params=list( ... ) )`
- Question: how to show correct analysis for non-continuous endpoint?
  - Change analysis type in code depending on `params$endpoint`.
- Question: what to do if something goes wrong in the analysis?
  - Check for errors and handle appropriately using `tryCatch(...)`
  - Insert child document text: “**EMERGENCY!** Something has gone wrong... Contact your data scientist!”

HOW LONG CAN YOU WORK ON MAKING A ROUTINE TASK MORE  
EFFICIENT BEFORE YOU'RE SPENDING MORE TIME THAN YOU SAVE?  
(ACROSS FIVE YEARS)

		HOW OFTEN YOU DO THE TASK					
		50/DAY	5/DAY	DAILY	WEEKLY	MONTHLY	YEARLY
HOW MUCH TIME YOU SHAVE OFF	1 SECOND	1 DAY	2 HOURS	30 MINUTES	4 MINUTES	1 MINUTE	5 SECONDS
	5 SECONDS	5 DAYS	12 HOURS	2 HOURS	21 MINUTES	5 MINUTES	25 SECONDS
	30 SECONDS	4 WEEKS	3 DAYS	12 HOURS	2 HOURS	30 MINUTES	2 MINUTES
	1 MINUTE	8 WEEKS	6 DAYS	1 DAY	4 HOURS	1 HOUR	5 MINUTES
	5 MINUTES	9 MONTHS	4 WEEKS	6 DAYS	21 HOURS	5 HOURS	25 MINUTES
	30 MINUTES		6 MONTHS	5 WEEKS	5 DAYS	1 DAY	2 HOURS
	1 HOUR		10 MONTHS	2 MONTHS	10 DAYS	2 DAYS	5 HOURS
	6 HOURS				2 MONTHS	2 WEEKS	1 DAY
	1 DAY					8 WEEKS	5 DAYS

Feel free to ask  
me questions,  
but remember....

#untidyverse



@MikeKSmith



<https://github.com/MikeKSmith/RStudioConf2019>

