Something old, something new, something borrowed, something blue

Ways to teach data science (and learn it too!)

Dr. Chester Ismay
Data Science Curriculum Lead at DataCamp
GitHub: ismayc
Twitter: @old_man_chester

Slides available at http://bit.ly/rstudioconf18

Question

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How can we introduce ***data and computation*** novices to:

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1. **Data science**: Data visualization, data wrangling, exploratory data analysis, data tidying

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How can we introduce ***data and computation*** novices to:

1. **Data science**: Data visualization, data wrangling, exploratory data analysis, data tidying

2. **Data modeling**: Explanation (causal inference) & prediction (machine learning), correlation

3. **Statistical inference**: sampling distributions, standard errors, confidence intervals, hypothesis/ A/B testing & p-values

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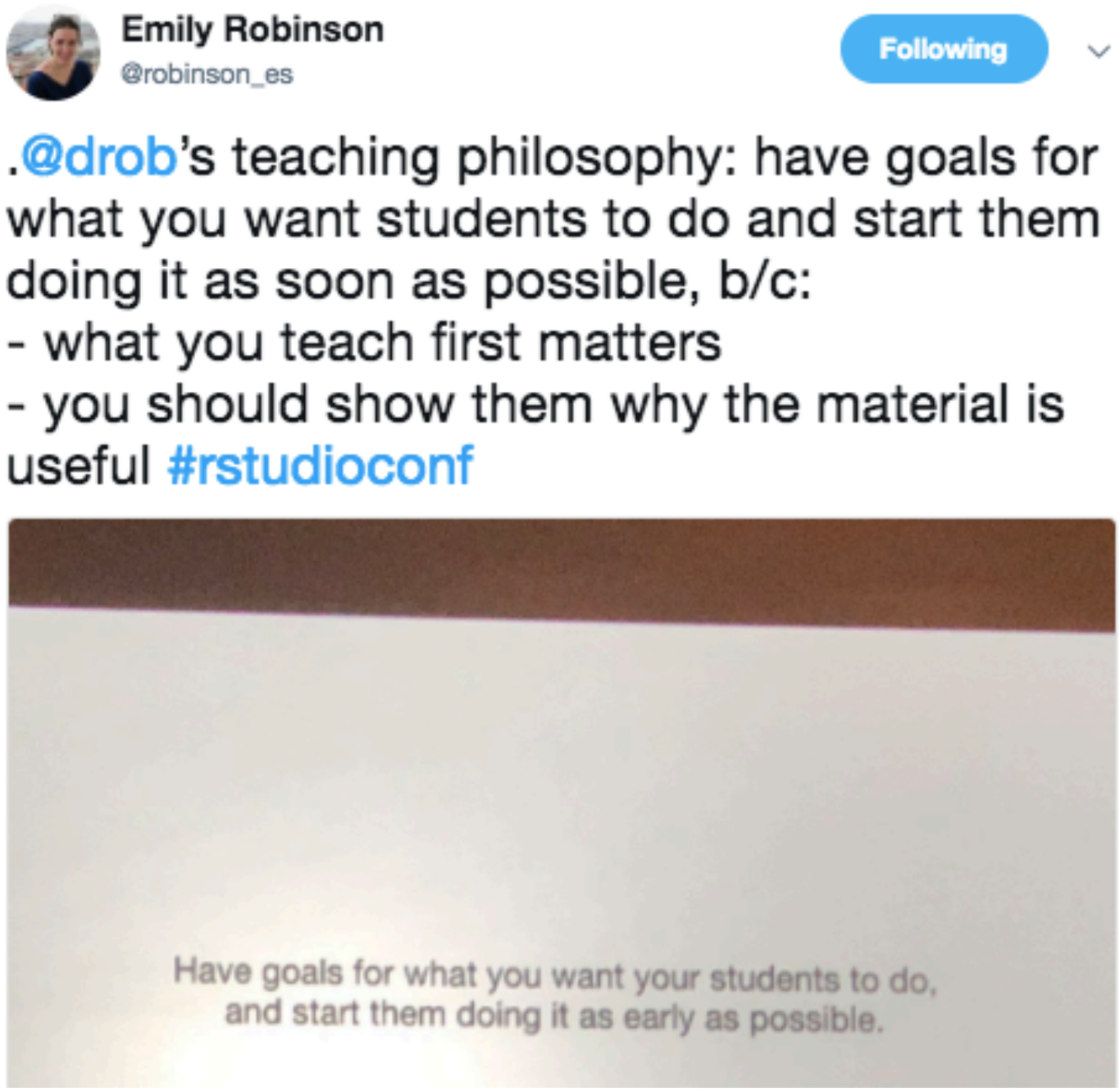
General Framework



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"A Modern Dive into Data with R"

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ModernDive

An Introduction to Statistical and Data Sciences via R

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- Co-authored with Albert Y. Kim

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- Why is this needed?

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ModernDive

An Introduction to Statistical and Data Sciences via R

- Why is this needed?
- How can this help you and your colleagues?
- How can you keep up-to-date on development?

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Analogy: Learning Long Division

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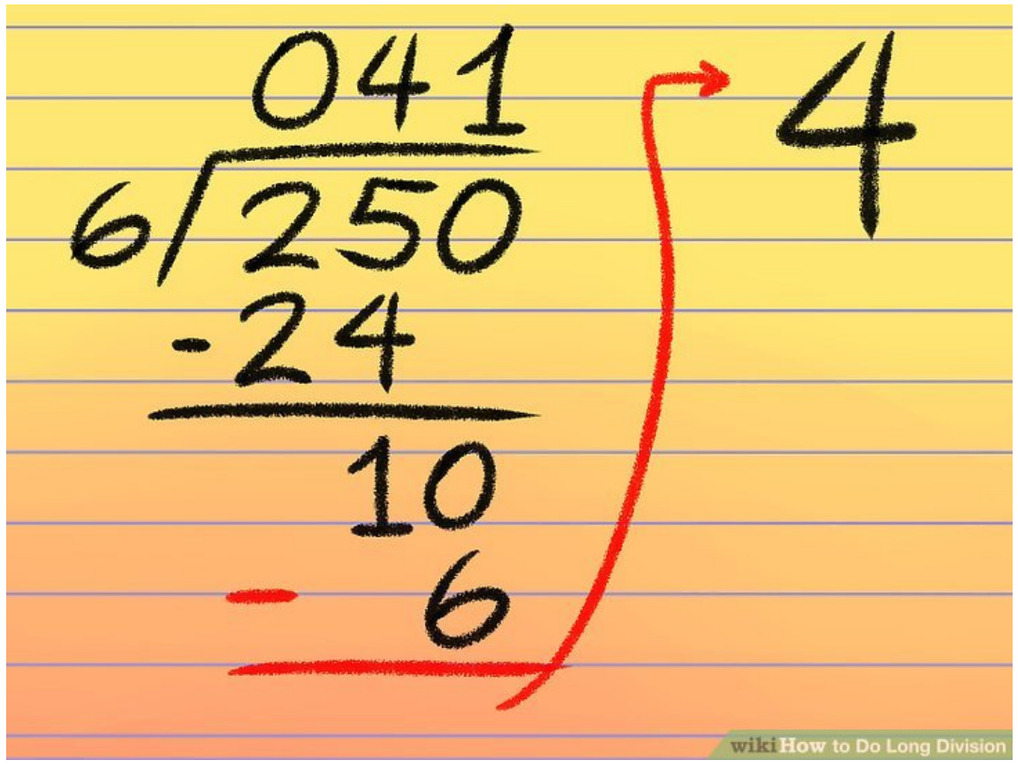
Analogy: Learning Long Division

Do this a few times:



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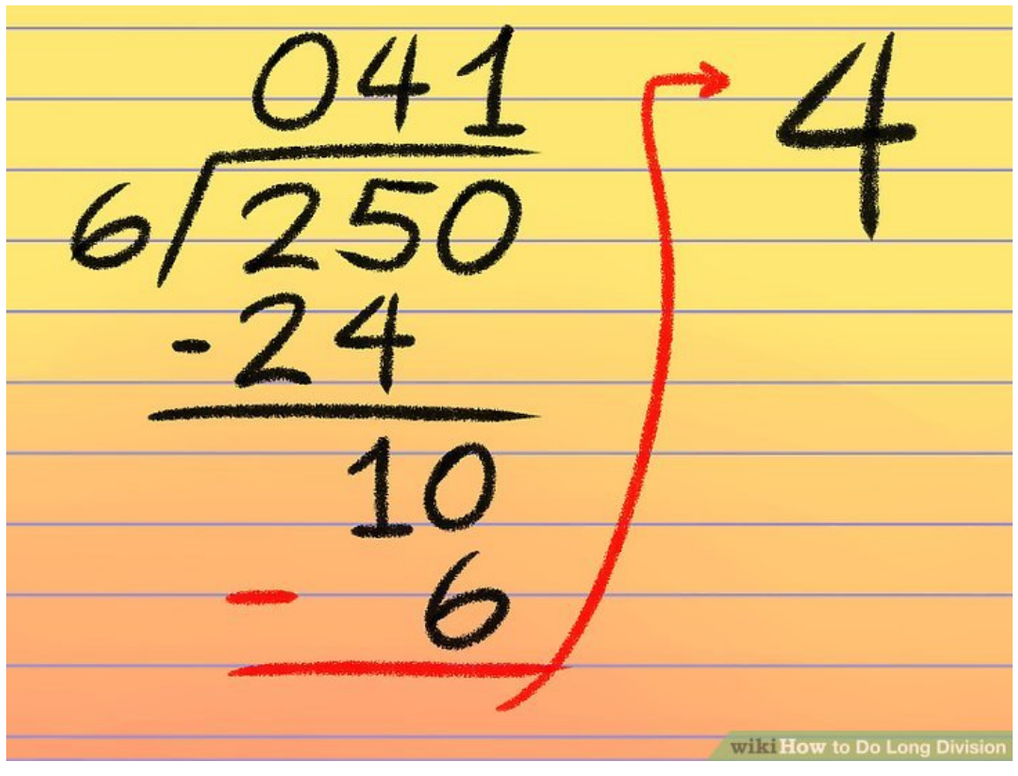

Then rely on this:

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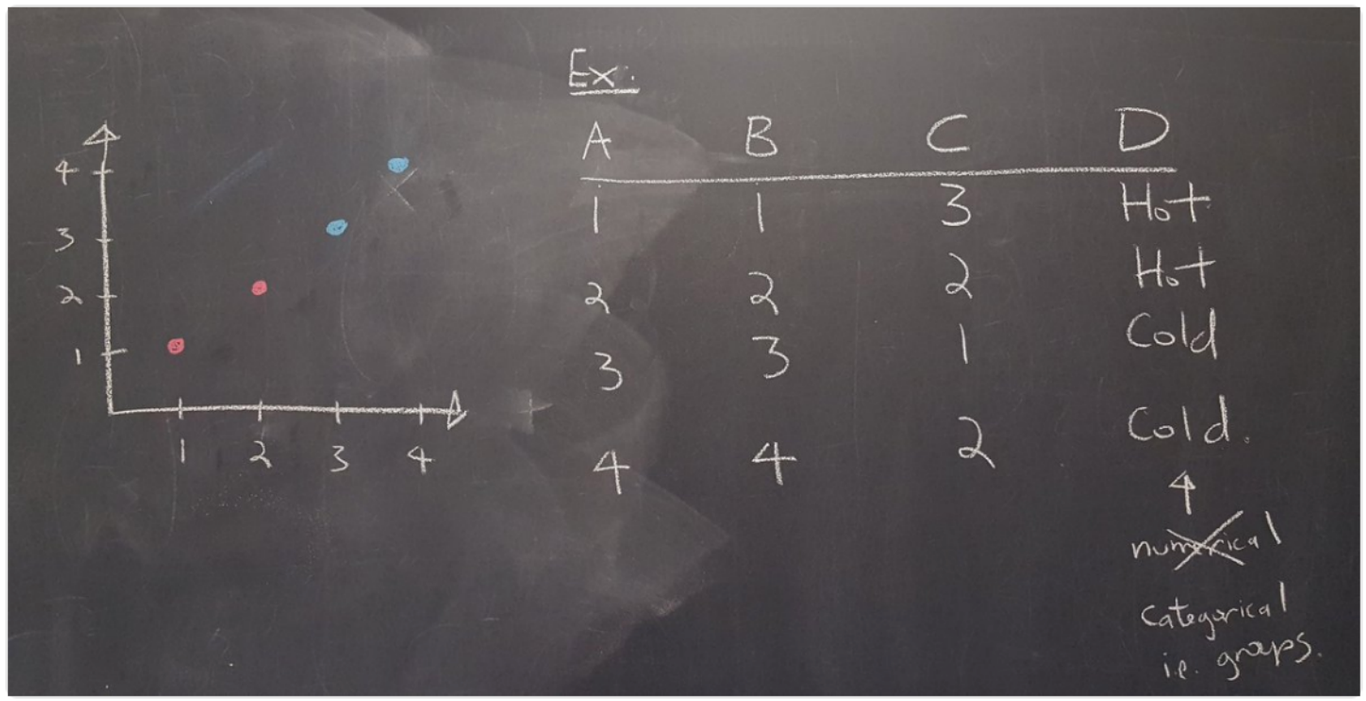
`ggplot2` via the Grammar of Graphics

Albert Y. Kim
@rudeboybert

Intro stats & data science #chalktalk of grammar of graphics + homage to @katyperry today, #ggplot2 tomorrow #rstats



11:58 AM - 11 Sep 2017 from Amherst College

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Tactile simulation of sampling to teach sampling distributions

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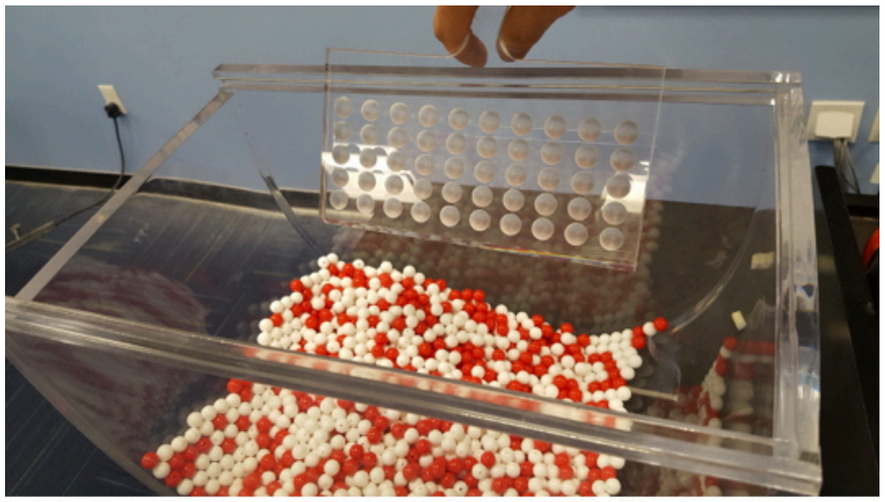

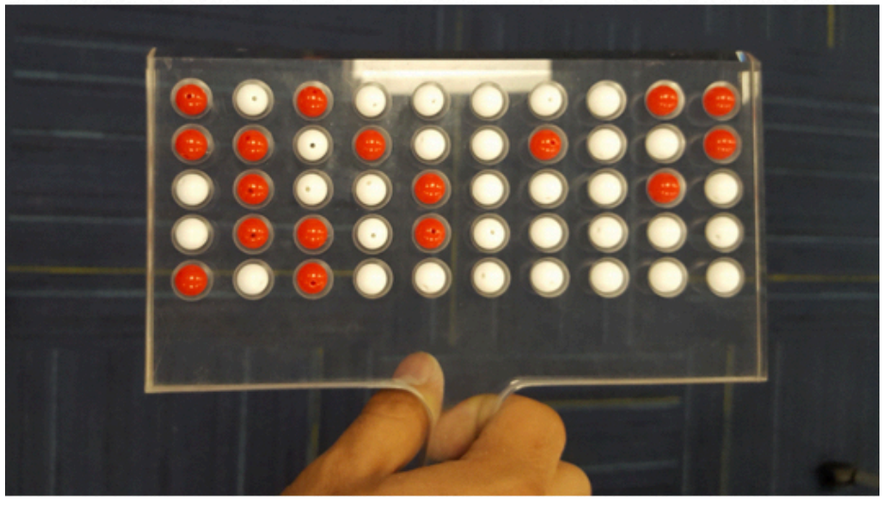

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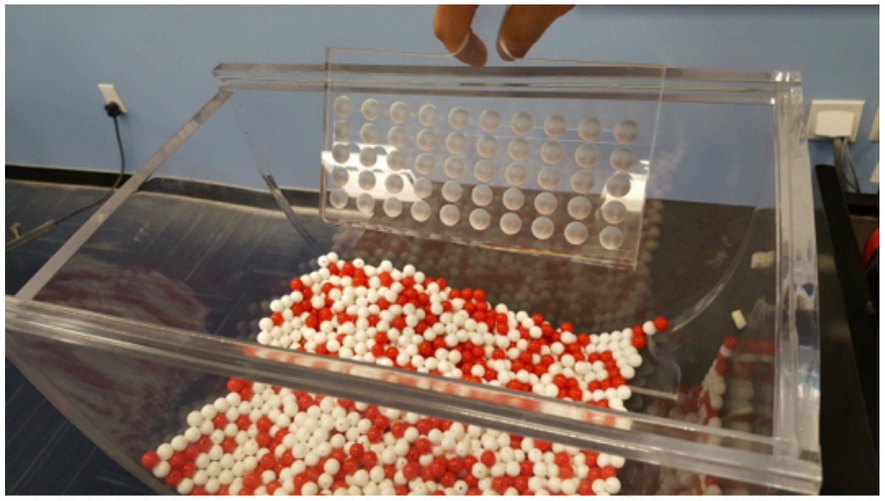

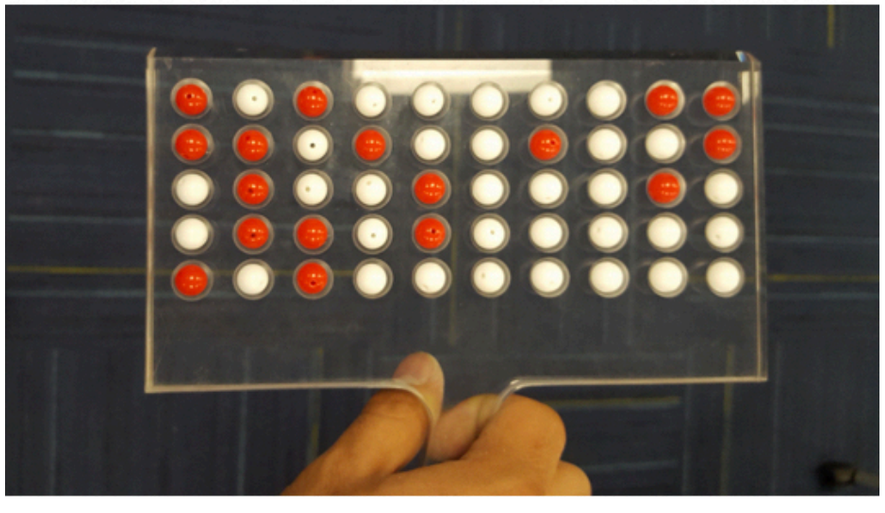

	group	red	n	prop_red
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2	Sean, Jack, and CJ	18	50	0.36
3	X and Judy	22	50	0.44
4	James and Jacob	21	50	0.42
5	Hannah and Siya	16	50	0.32
6	Niko, Sophie, and Caitlin	14	50	0.28
7	Niko, Sophie, and Caitlin	19	50	0.38
8	Aleja and Ray	20	50	0.40
9	Yaw and Drew	16	50	0.32
10	Yaw and Drew	21	50	0.42

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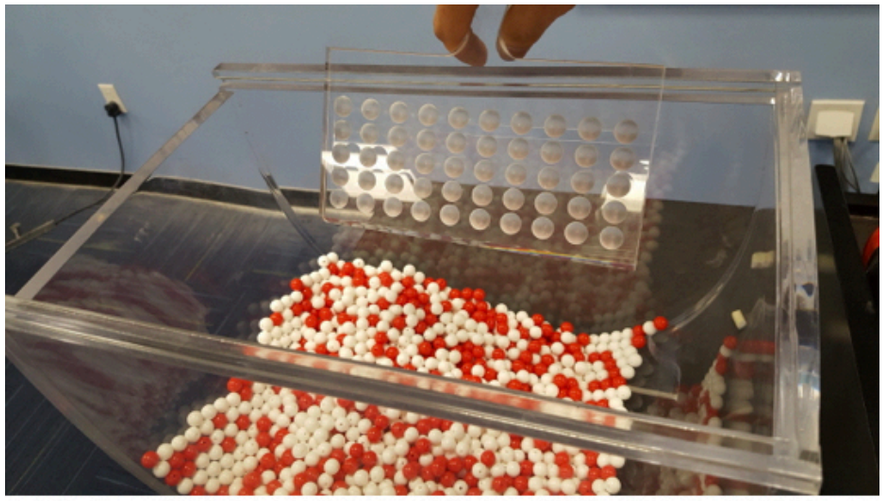

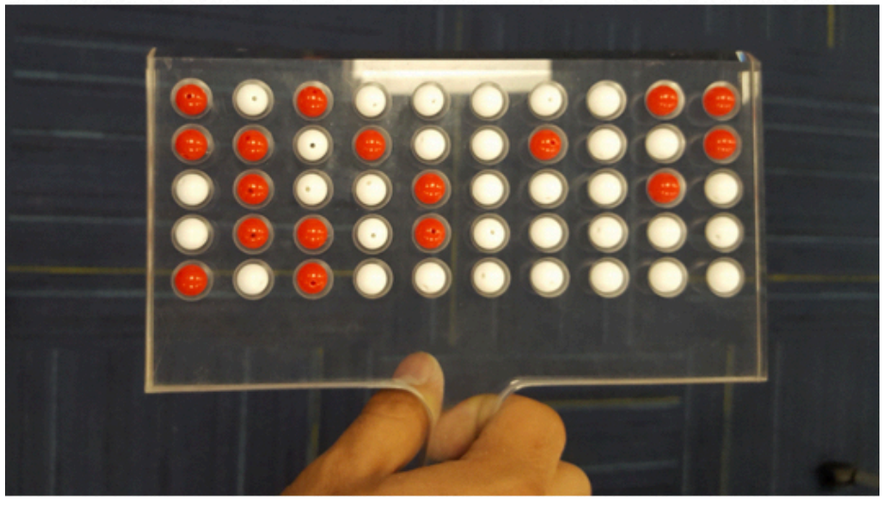

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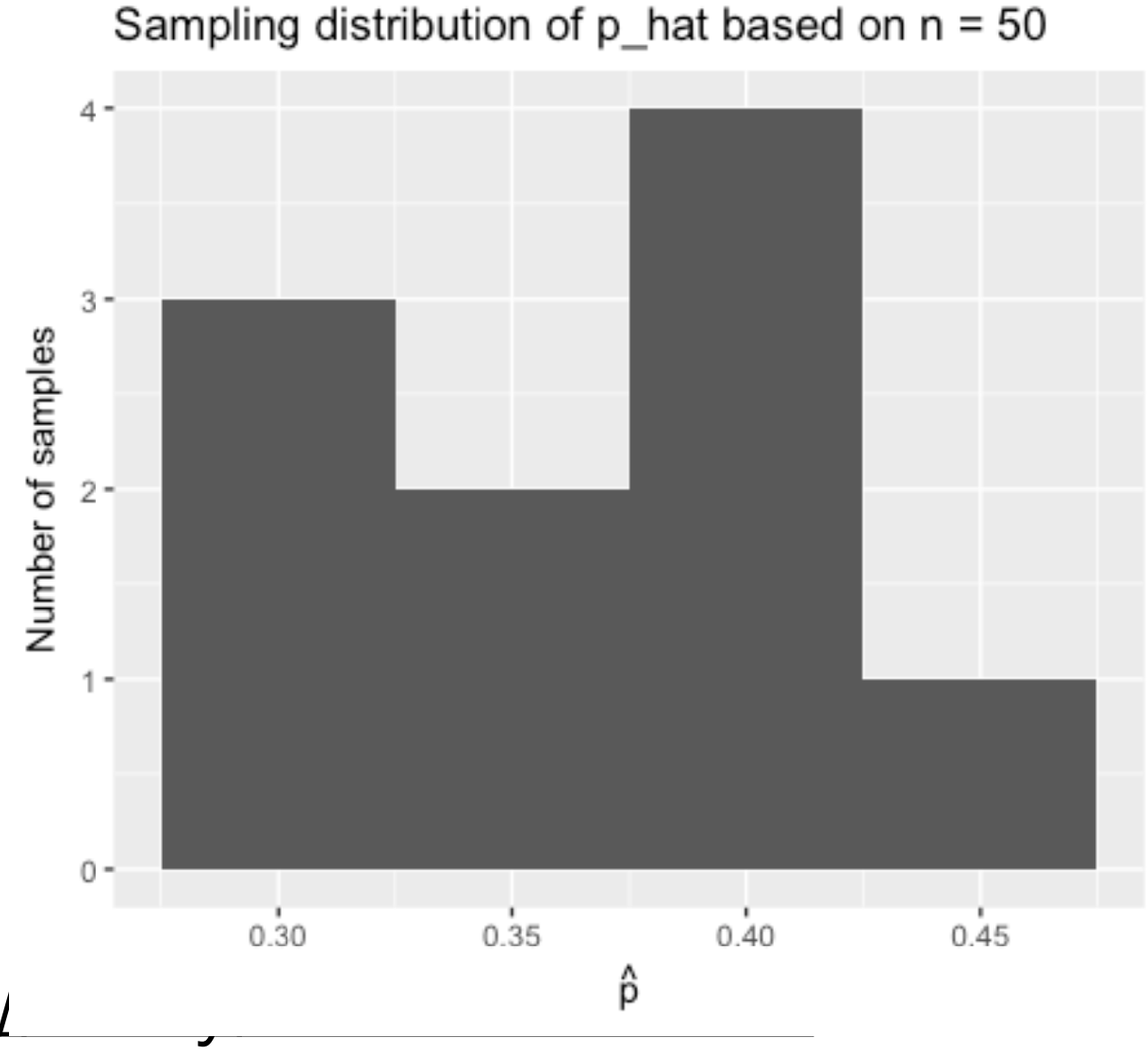

Slides available at http:/

Computer simulation of sampling to teach sampling distributions

Slides available at http://bit.ly/rstudioconf18

Computer simulation of sampling to teach sampling distributions

```
> library(moderndive)
> bowl
# A tibble: 2,400 x 2
   ball_ID color
     <int> <chr>
 1       1 white
 2       2 white
 3       3 white
 4       4   red
 5       5 white
 6       6 white
 7       7   red
 8       8 white
 9       9   red
10      10 white
# ... with 2,390 more rows
> bowl %>%
    rep_sample_n(size = 50, reps = 10000)
```

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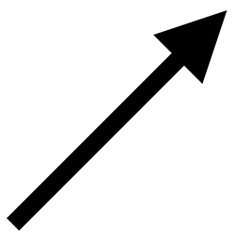

	replicate	red	n	prop_red
1	1	18	50	0.36
2	2	16	50	0.32
3	3	18	50	0.36
4	4	16	50	0.32
5	5	18	50	0.36
6	6	24	50	0.48
7	7	17	50	0.34
8	8	15	50	0.30
9	9	16	50	0.32
10	10	18	50	0.36

Showing 1 to 10 of 10,000 entries

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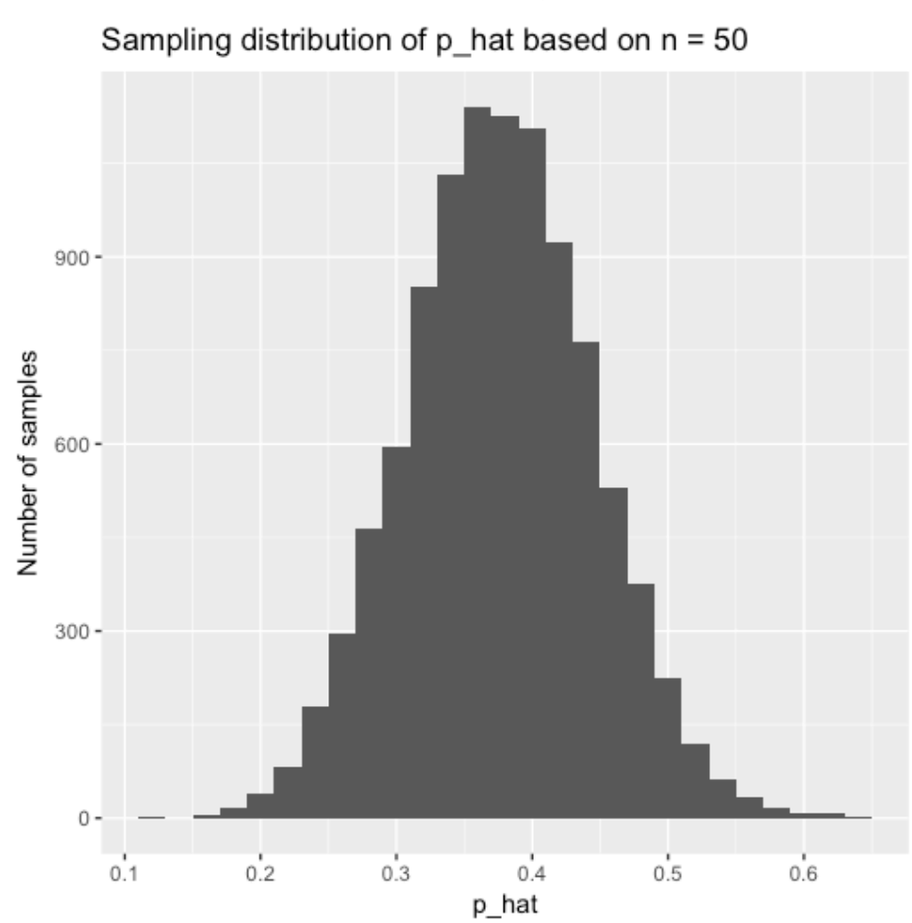
Showing 1 to 10 of 10,000 entries



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New Tools Specific for Data Science

David Robinson

Data Scientist at Stack Overflow, works in R and Python.

Teach the tidyverse to beginners

A few years ago, I wrote a post Don't teach built-in plotting to beginners (teach ggplot2). I argued that ggplot2 was not an advanced approach meant for experts, but rather a suitable introduction to data visualization.

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- Examples of the "Curse of knowledge"

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Leverage open source

Open data, such as data in R packages like **`nycflights13`**, **`gapminder`**, **`fivethirtyeight`**

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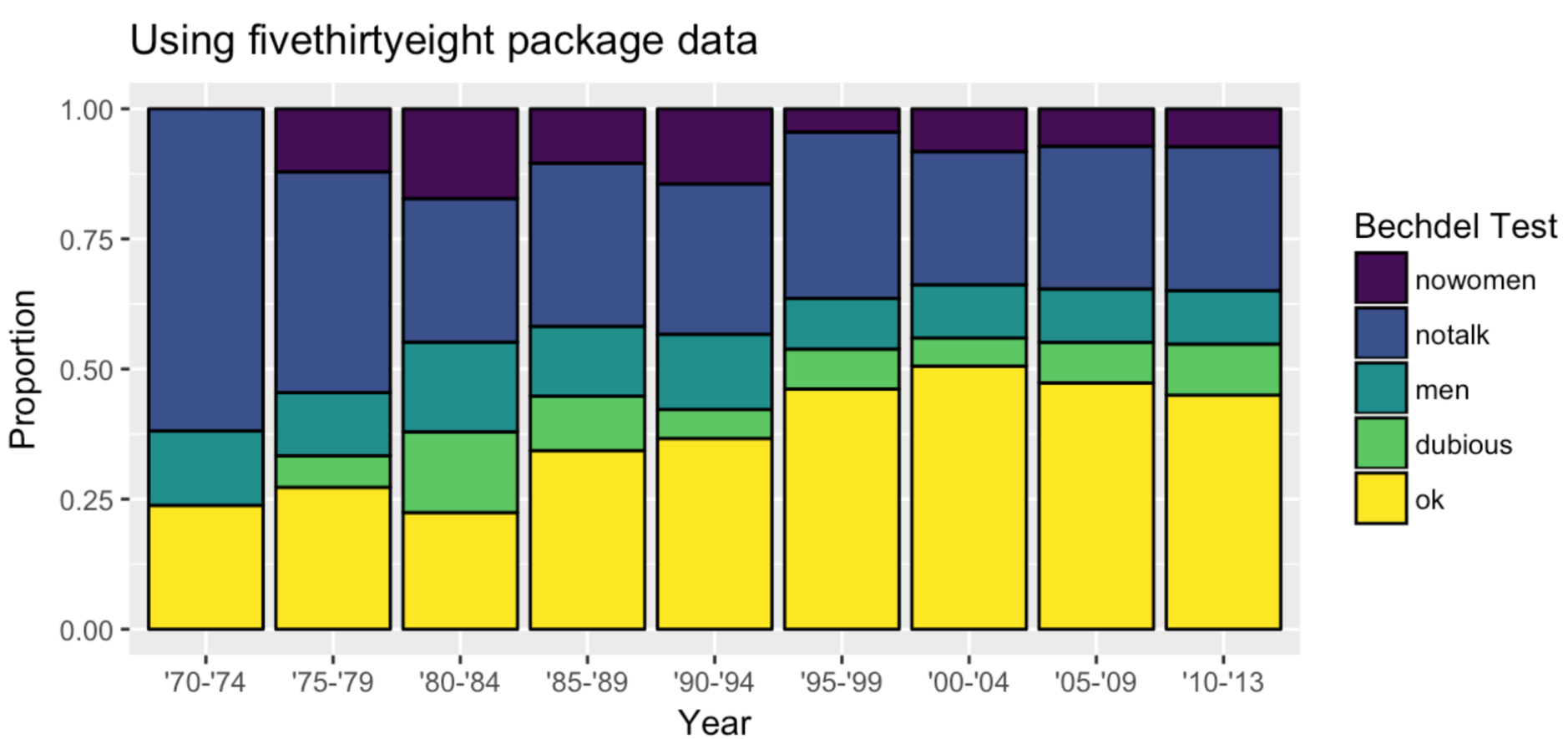

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New textbook authoring paradigm

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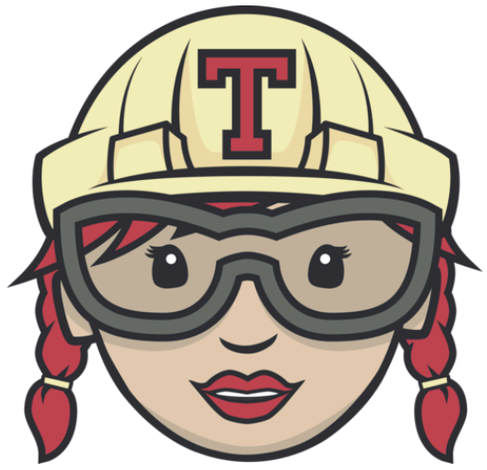

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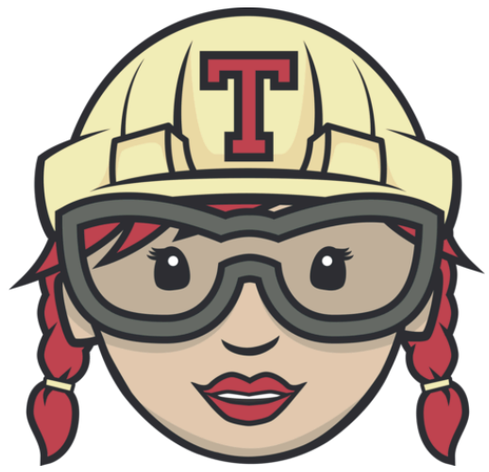

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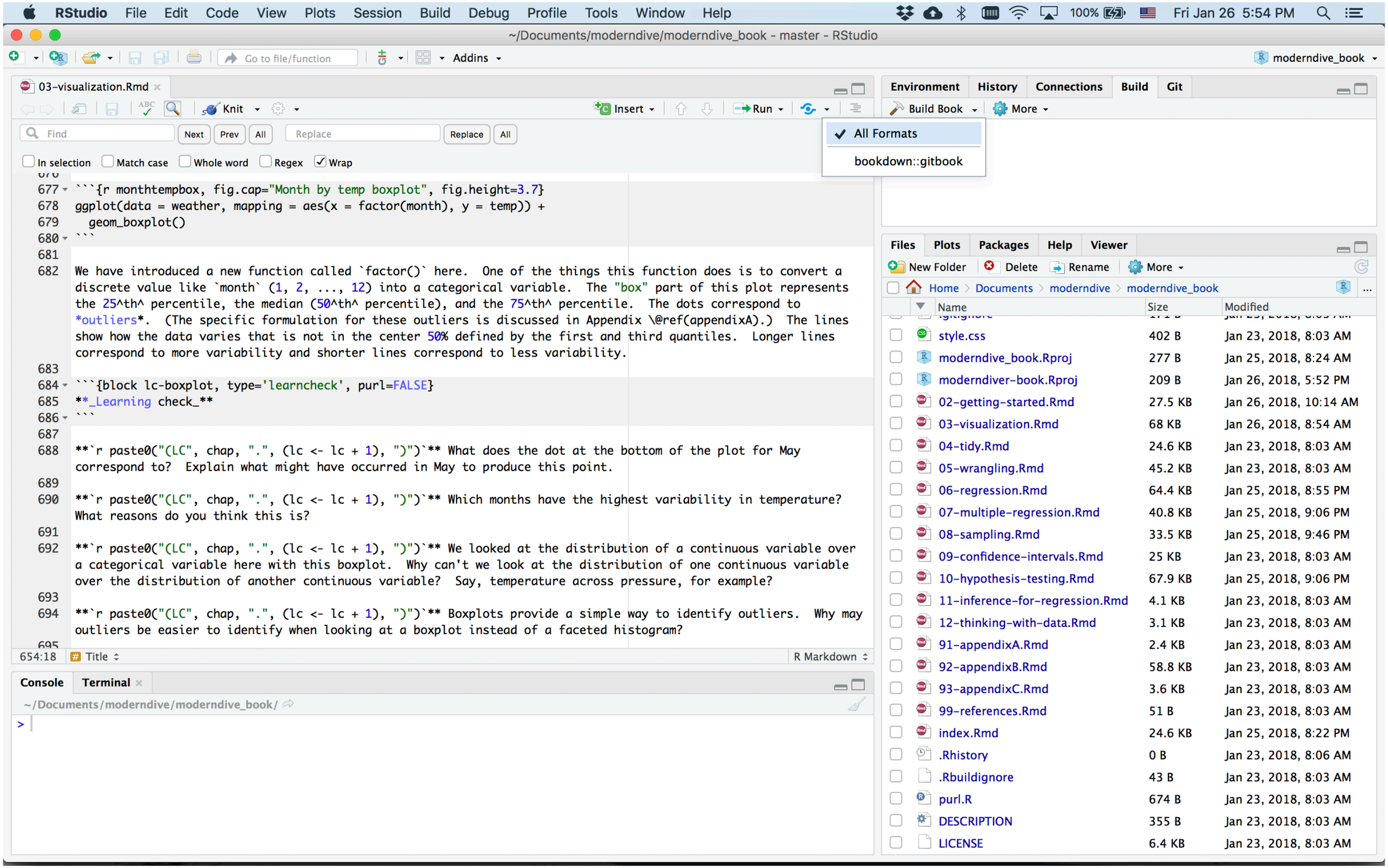

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```
ggplot(data = weather, mapping = aes(x = factor(month), y = temp)) +
  geom_boxplot()
```

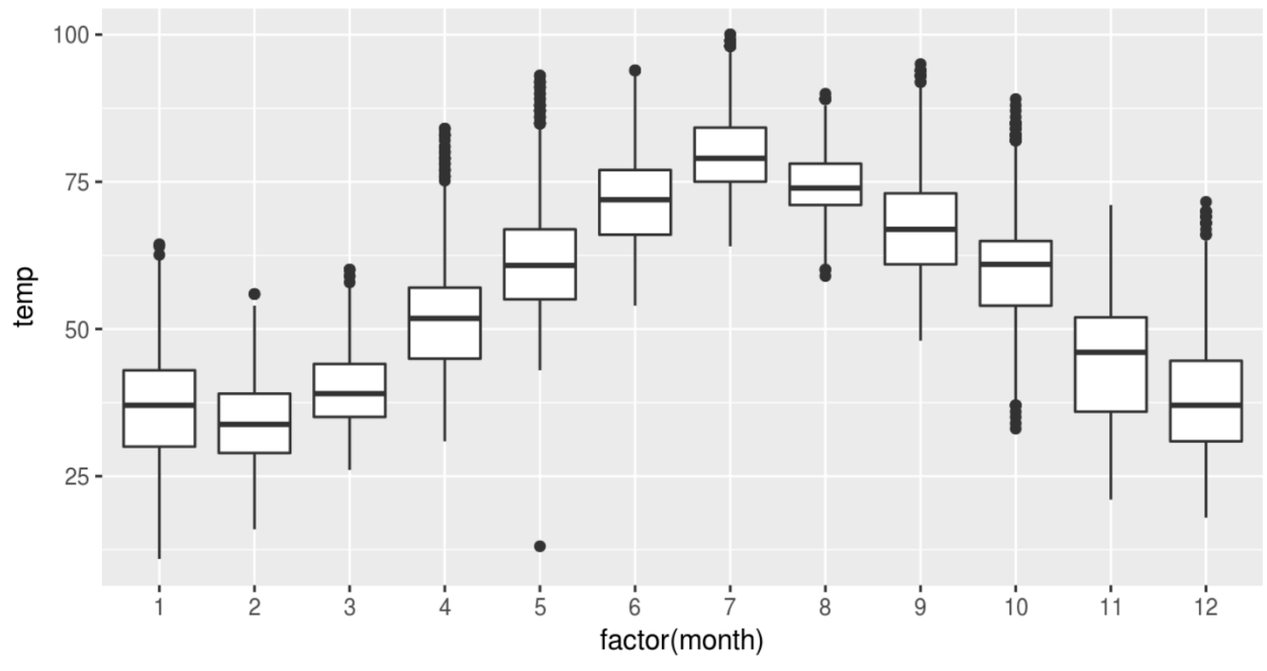

Figure 3.13: Month by temp boxplot

We have introduced a new function called `factor()` here. One of the things this function does is to convert a discrete value like `month` (1, 2, ..., 12) into a categorical variable. The "box" part of this plot represents the 25th percentile, the median (50th percentile), and the 75th percentile. The dots correspond to *outliers*. (The specific formulation for these outliers is discussed in Appendix A.) The lines show how the data varies that is not in the center 50% defined by the first and third quantiles. Longer lines correspond to more variability and shorter lines correspond to less variability.

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"If You're Not Embarrassed By The First Version Of Your Product, You've Launched Too Late"

Reid Hoffman, founder of LinkedIn

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2. Getting Started with Data in R

3. Data Visualization

4. Tidy Data

5. Data Wrangling

Data Science with `tidyverse`

6. Basic Regression

7. Multiple Regression

11. Inference for Regression

12. Thinking with Data

Data Modeling with `moderndive`

8. Sampling

9. Confidence Intervals

10. Hypothesis Testing

Statistical Inference with `infer`

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Diagram inspired by hadley/r4ds

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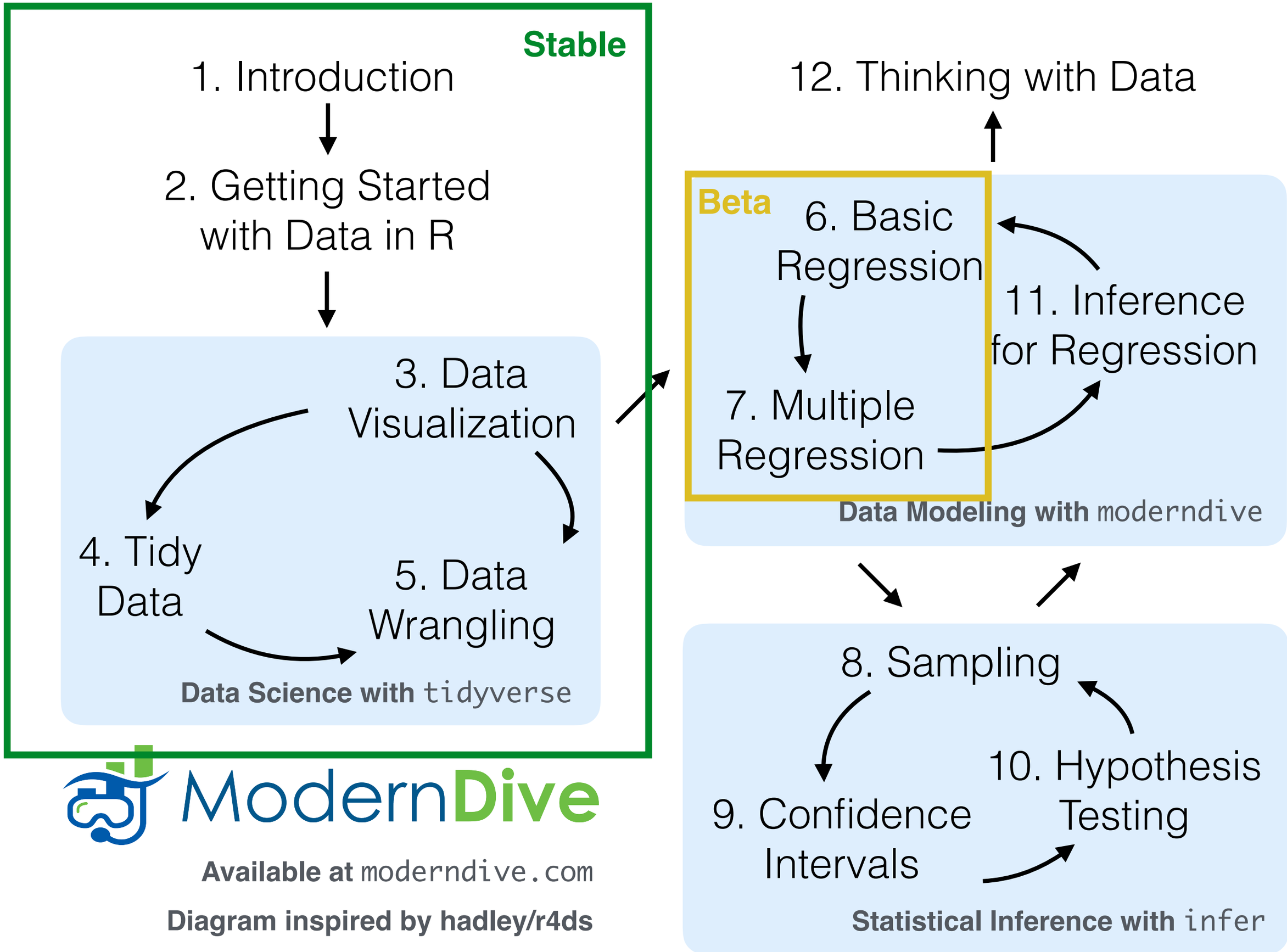

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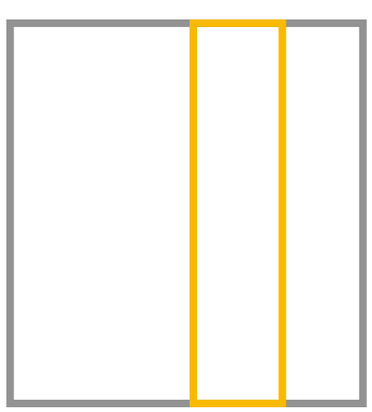

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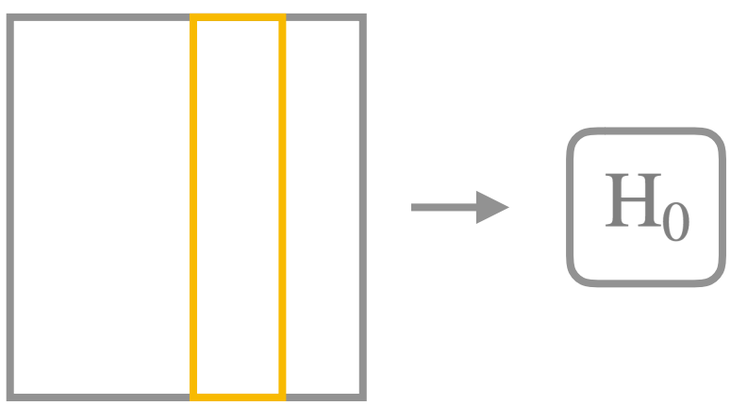


```
specify()

    hypothesize()
```

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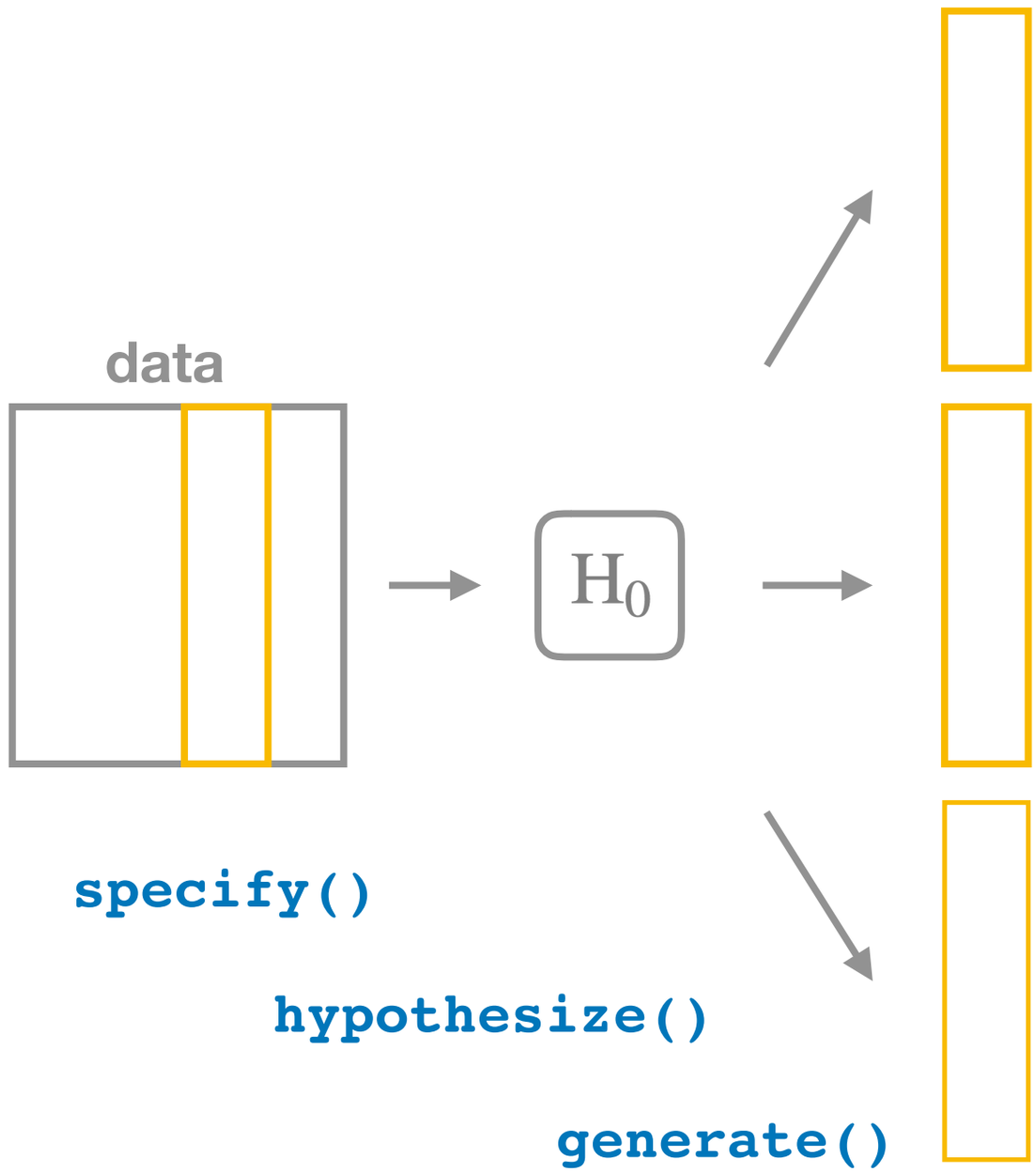

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`infer` package for tidy statistical inference

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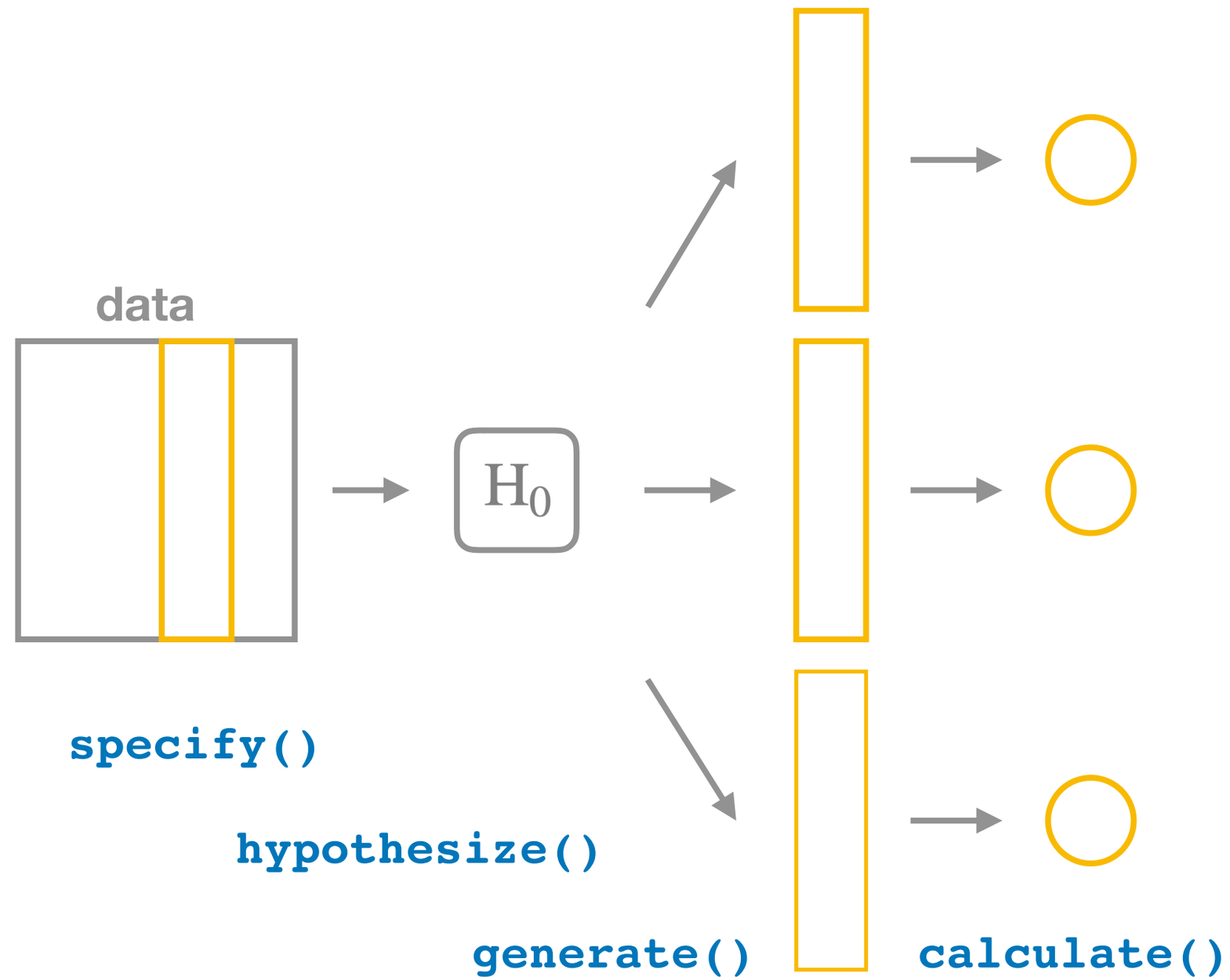

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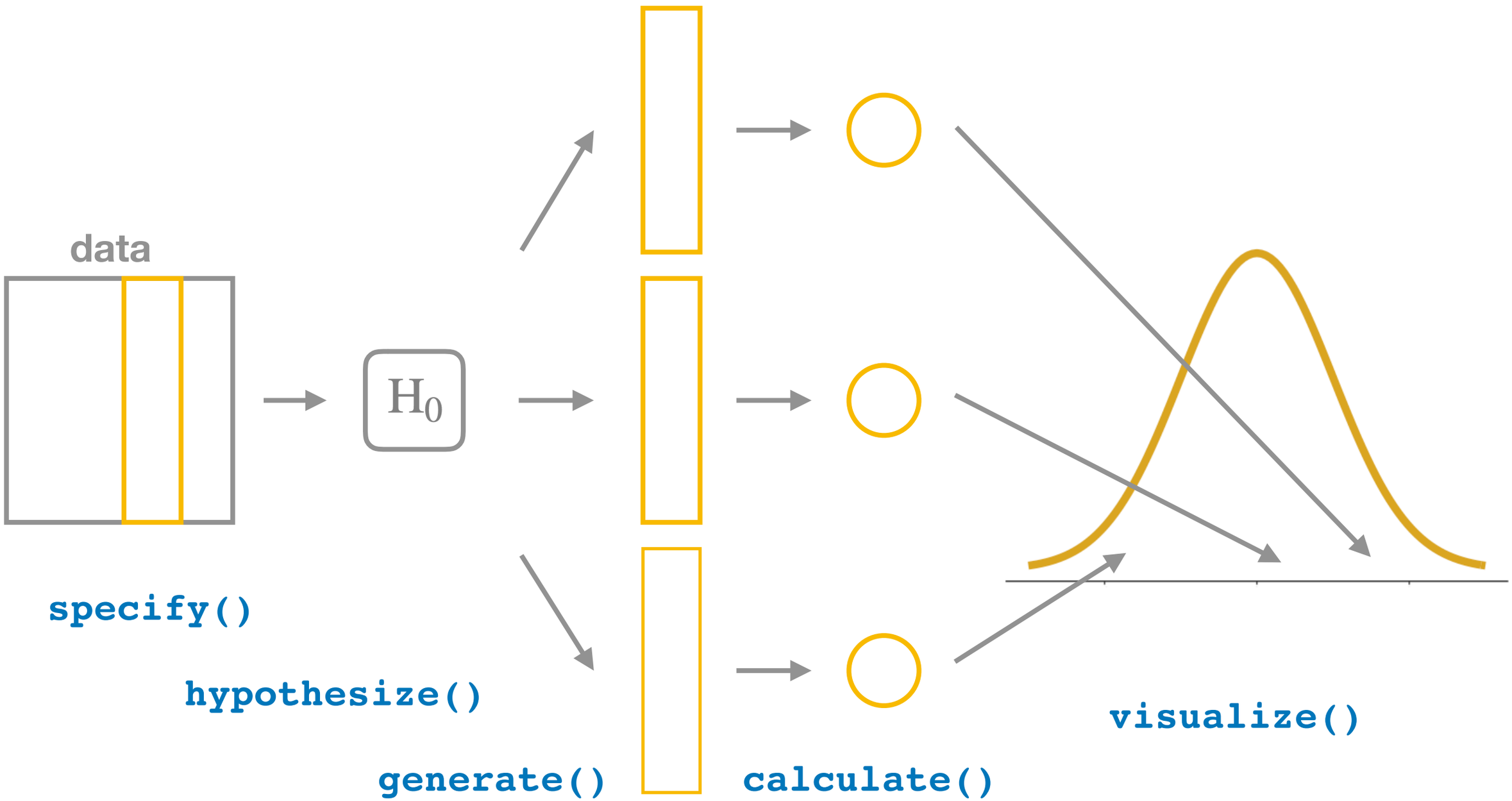

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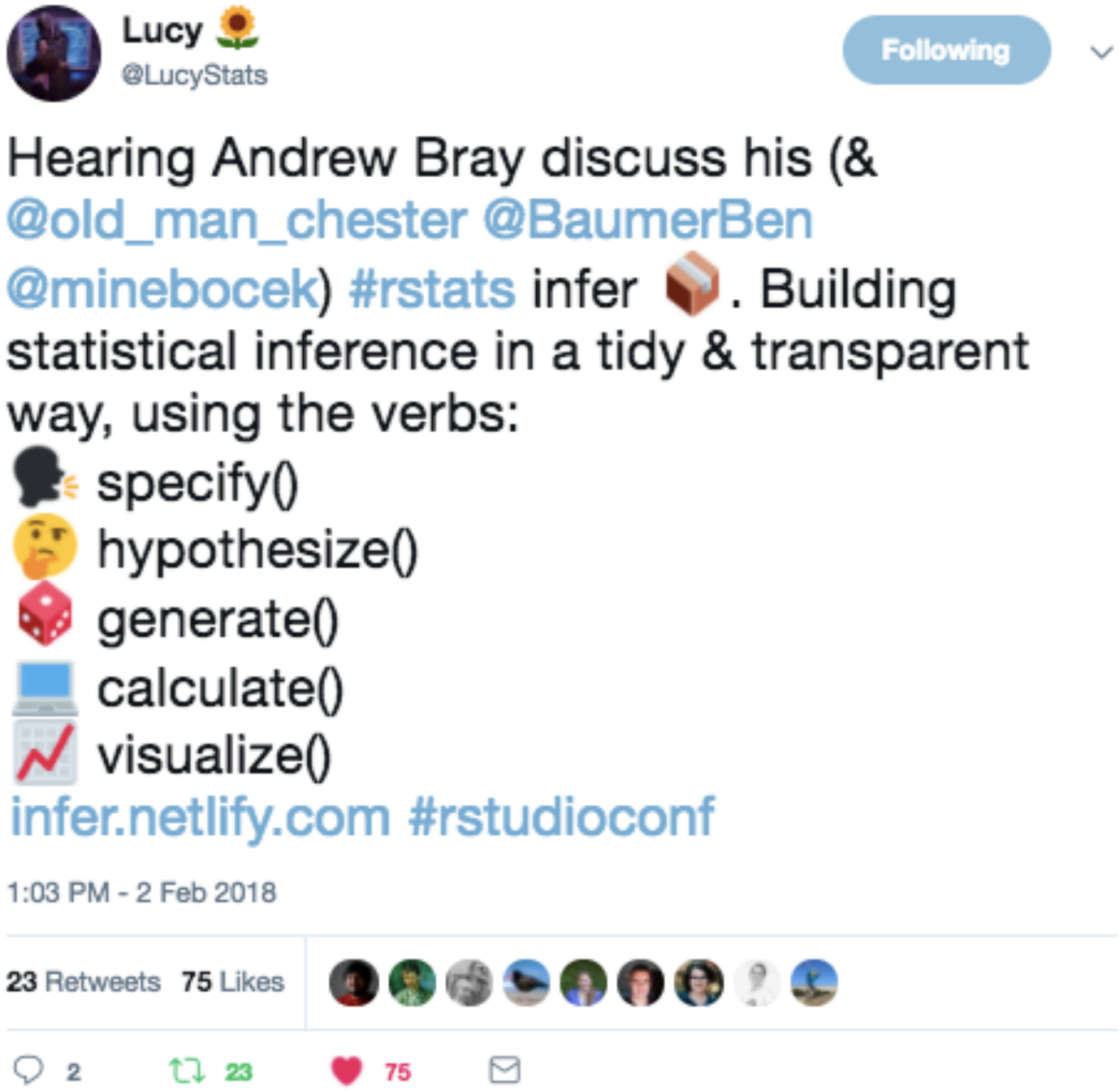

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Example student work

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- How many f**ks does Tarantino give?
- Final projects: Code and data

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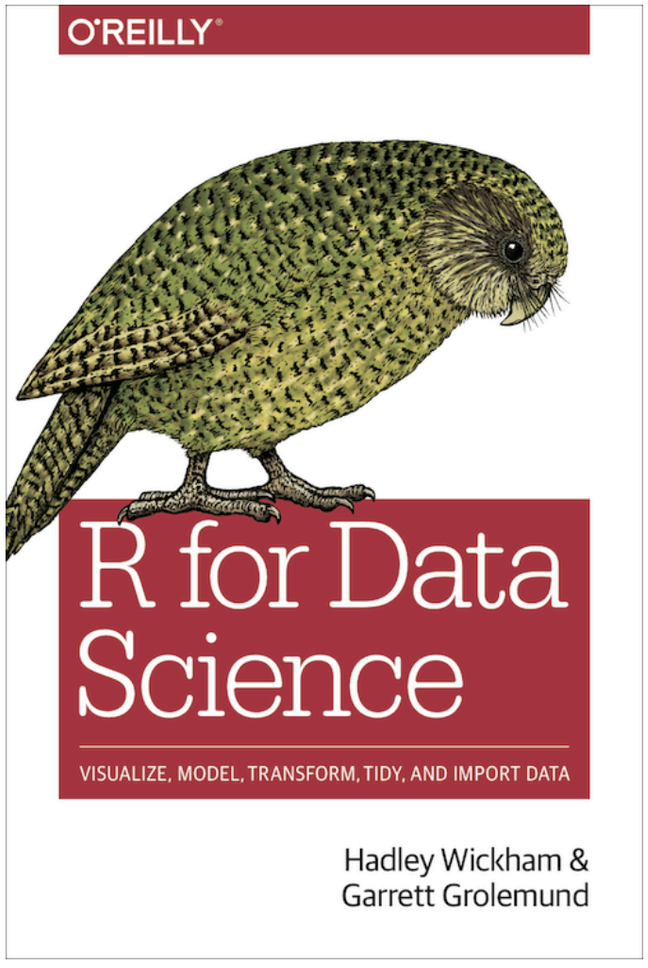

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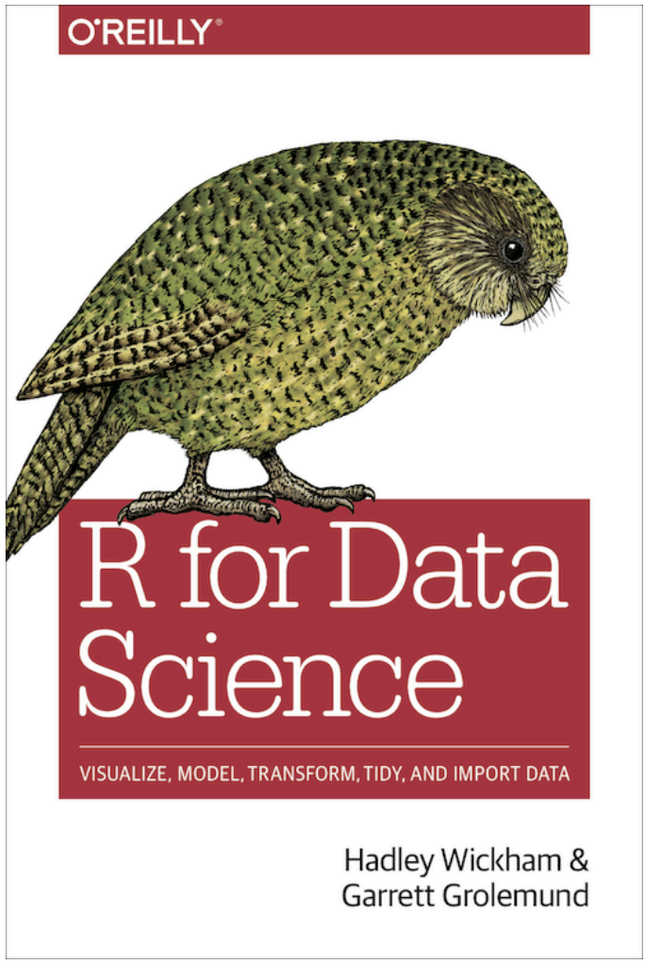

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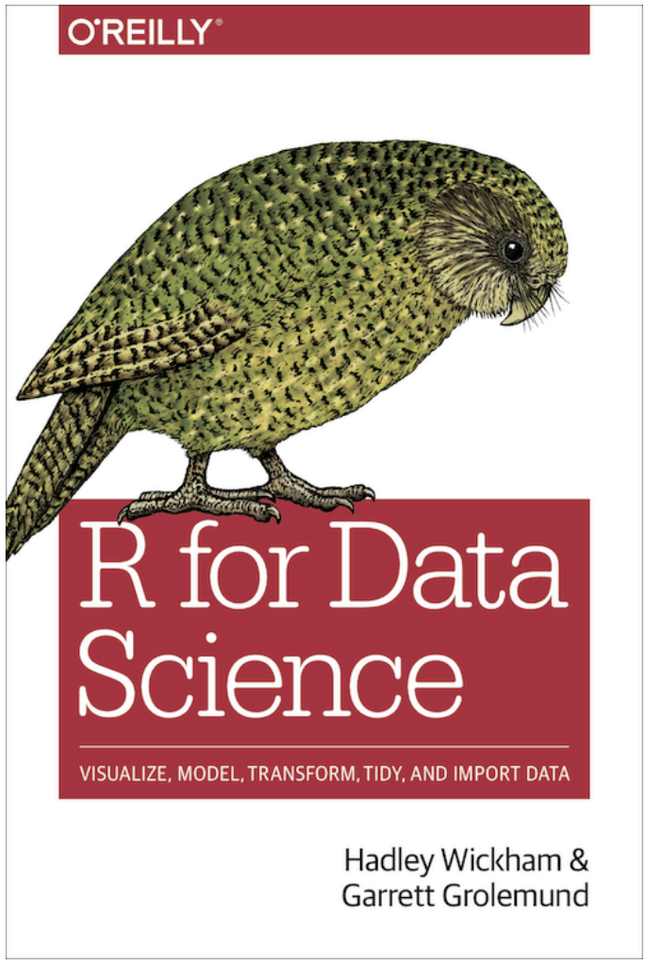

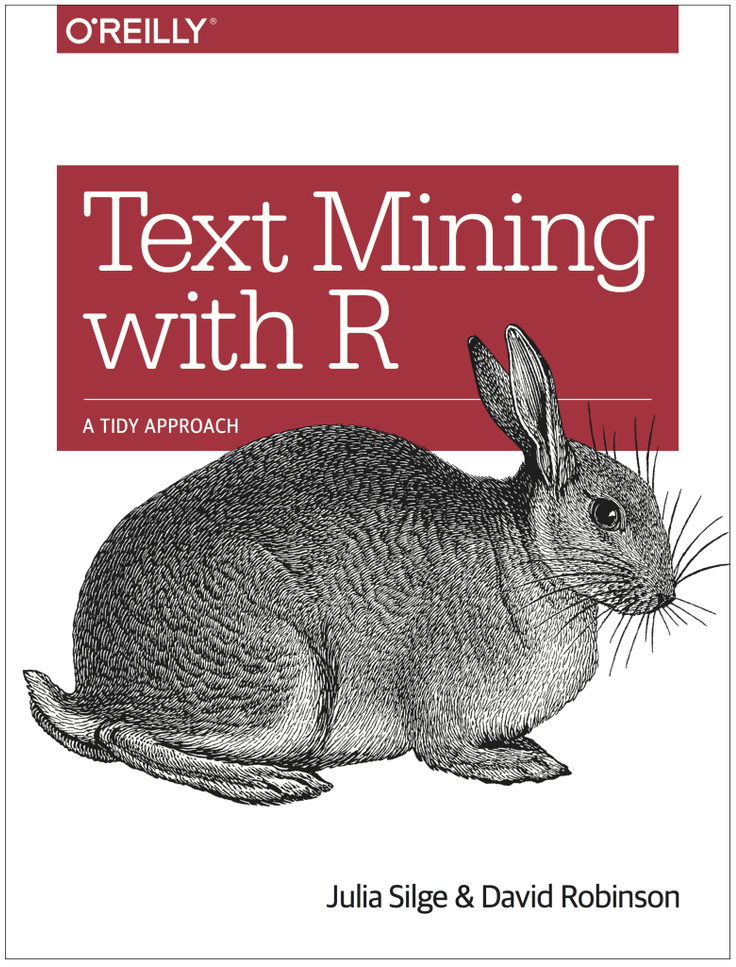

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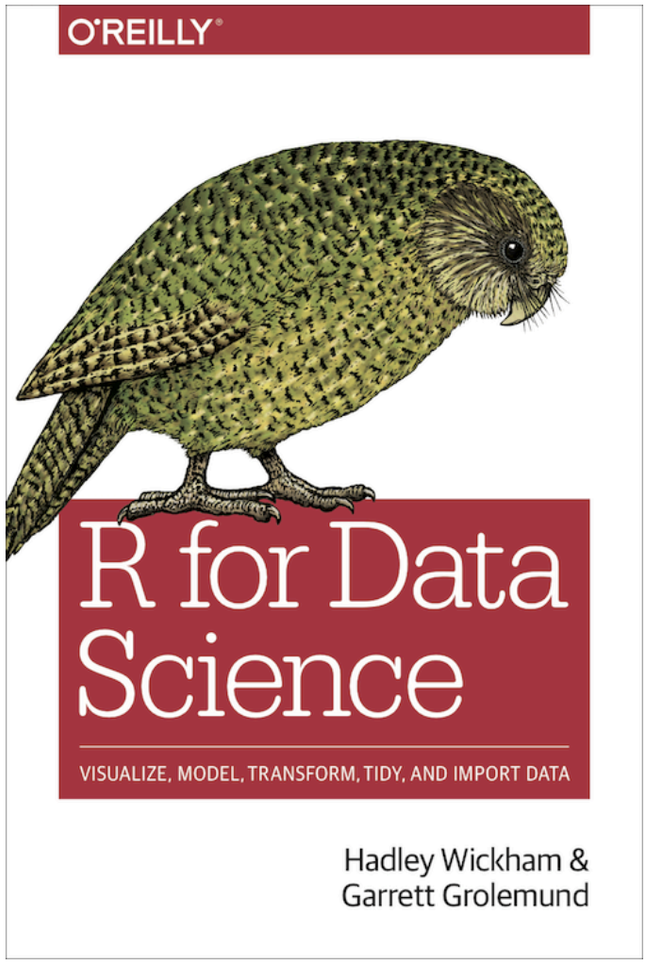

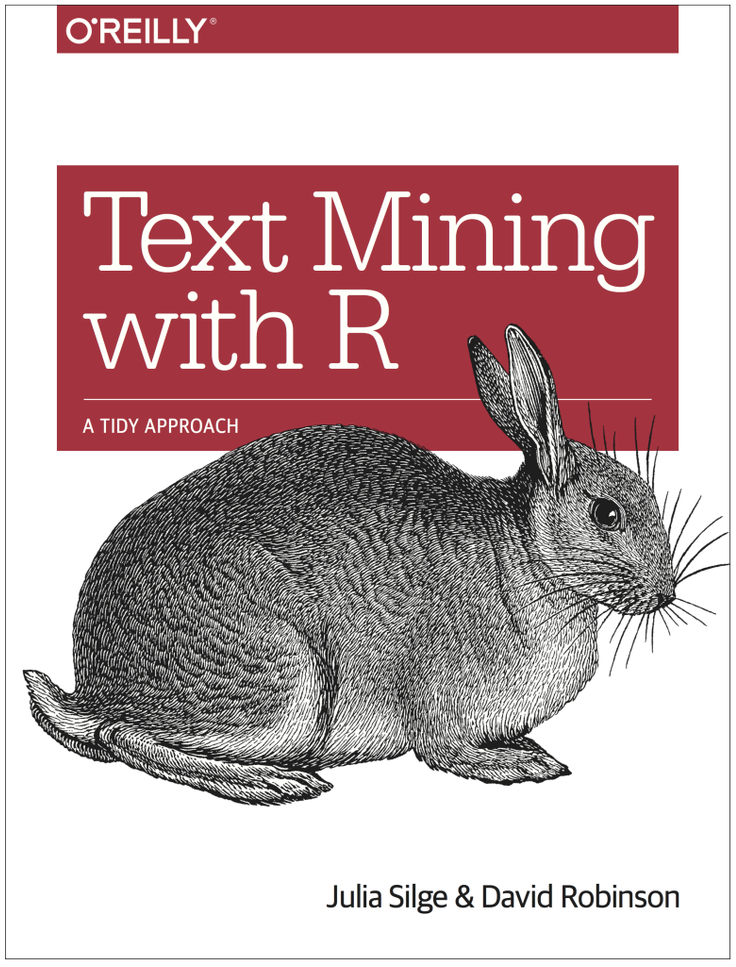

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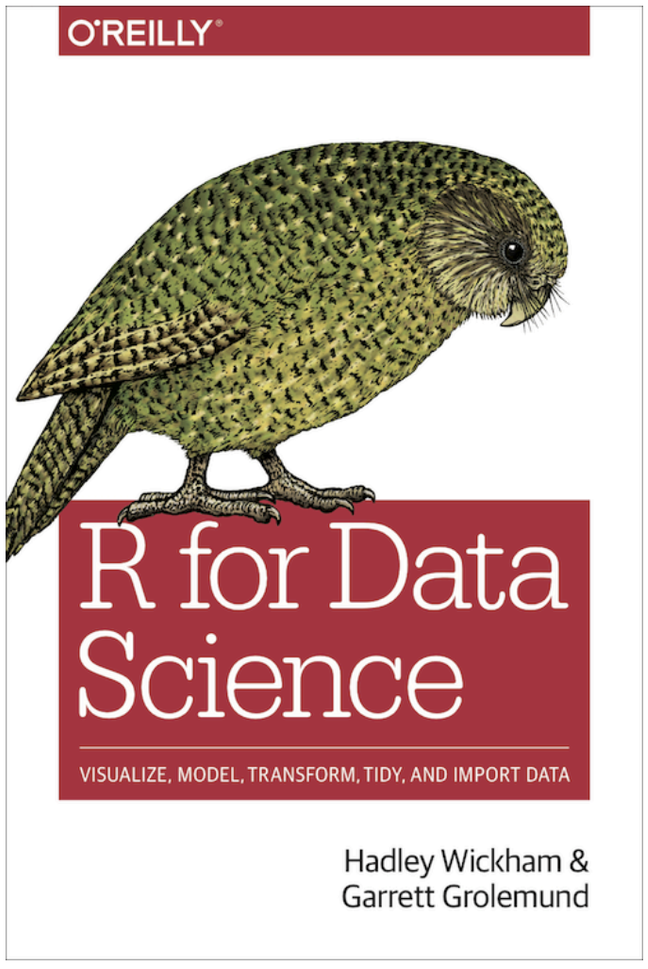

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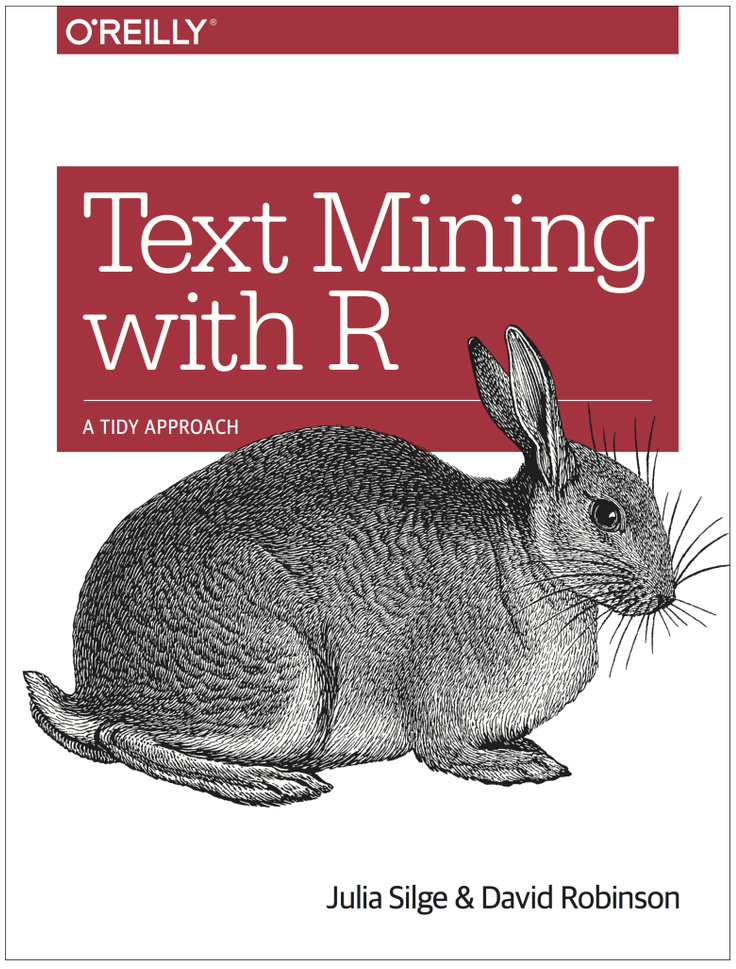

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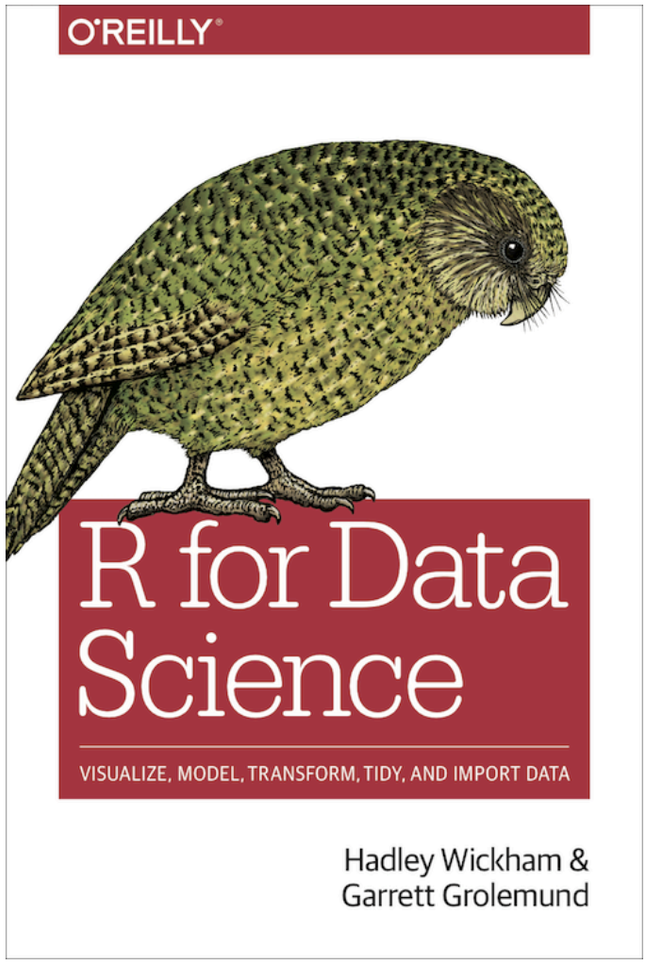

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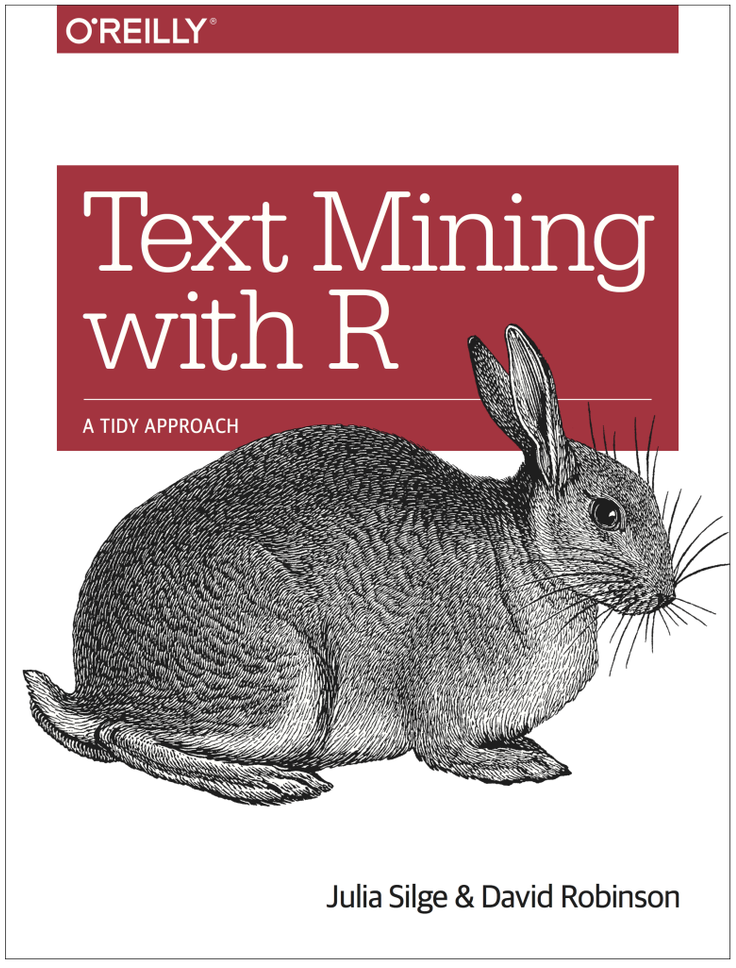

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New
Borrowed
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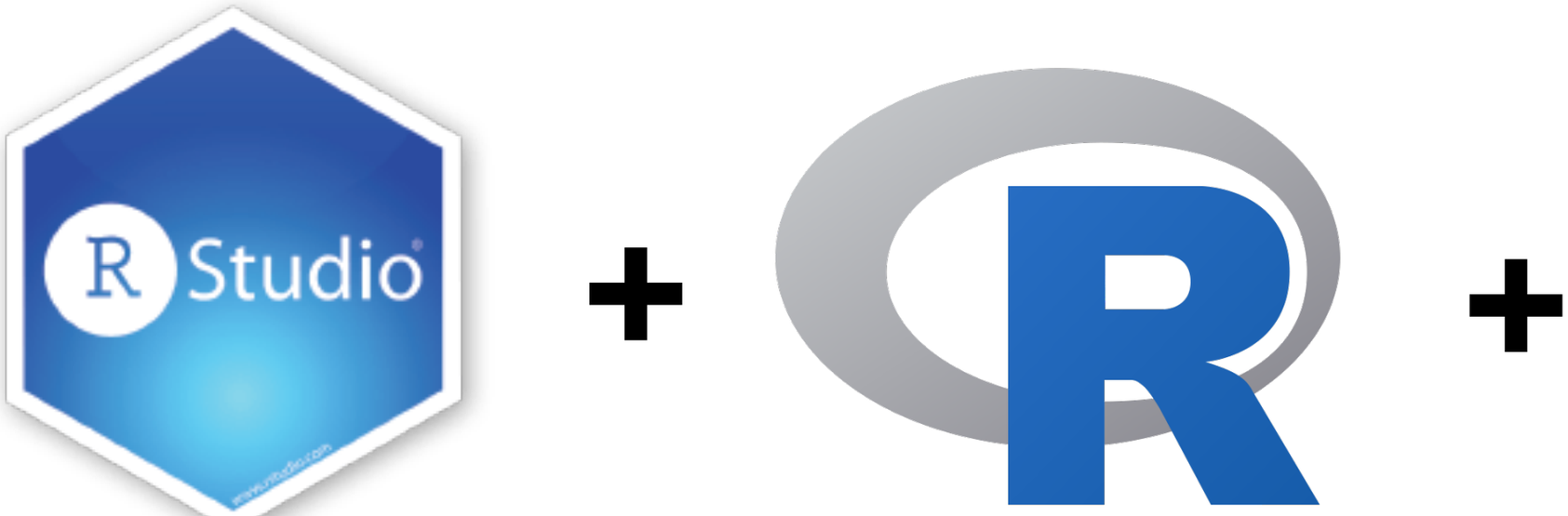

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