R^4H_2O: R for Water Professionals: Session 2

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Session 2 Program

- Recap
- Data Visualisation
- Creating Data Products

Figure 1: R for Water Professionals workshop (Melbourne, 2019).

R Basics

Which of these expressions calculates the flow in cubic meters per second for all heights (`h`) between 50mm and 500mm? Type them into the console to try each option and inspect the output.

```
Cd <- 0.6
g <- 9.81
b <- 0.6

(2/3) * Cd * sqrt(2 * 9.81) * b * (0.05:0.50)^(3/2)

(2/3) * Cd * sqrt(2 * 9.81) * b * ((50:500)/1000)^(3/2)
```

Or, repeat the formula for each value of `h`.

```
h <- seq(.05, .5, .01)
```

Loading and Exploring Data

```r
library(tidyverse)
gormsey <- read_csv("casestudy1/gormsey.csv")

gormsey_tt <- filter(gormsey, Measure == "Turbidity" | Meas

count(gormsey_tt, Measure)

gormsey_grouped <- group_by(gormsey_tt, Measure, Town)
summarise(gormsey_grouped, p95 = quantile(Result, 0.99))
```

Data Visualisation

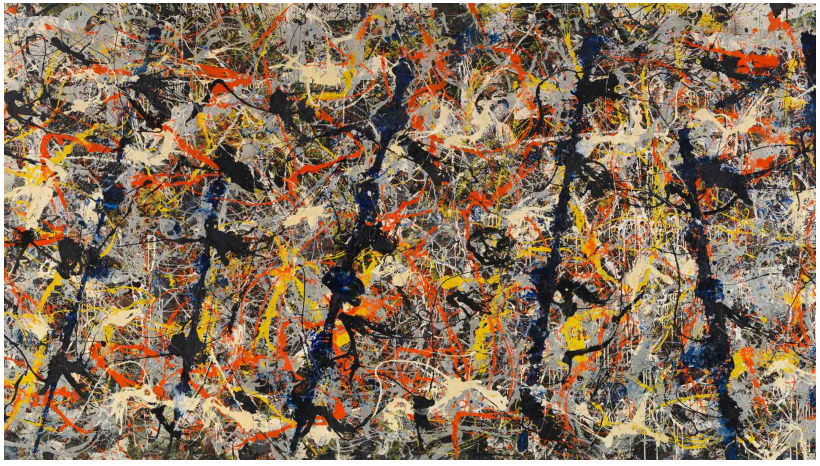


Figure 2: Jackson Pollock, *Blue Poles* (1973).

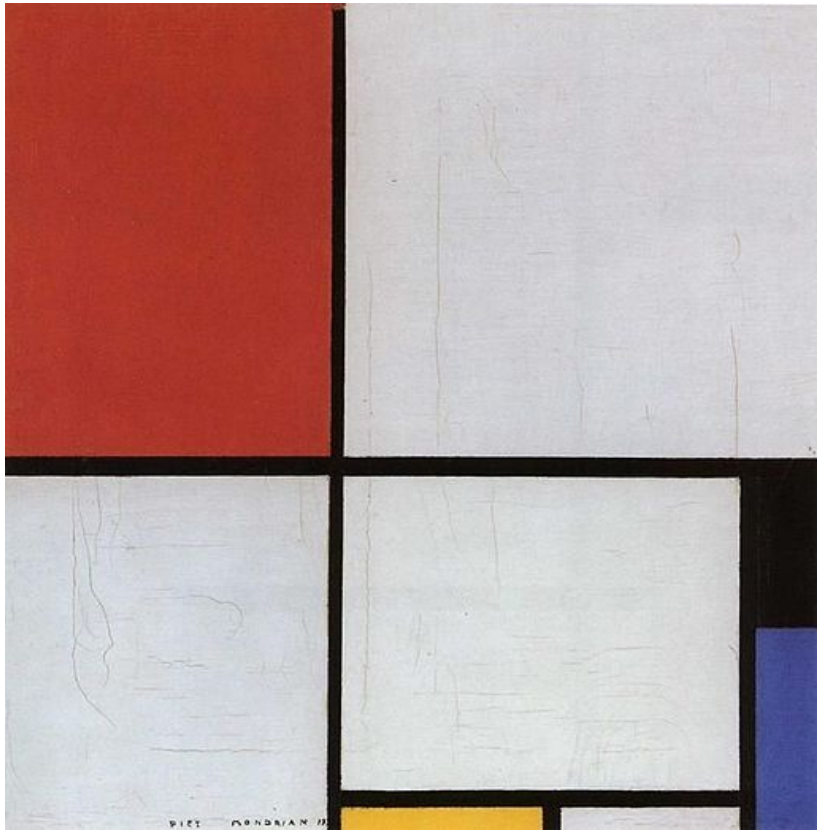


Figure 3: Piet Mondrian, *Composition in Red, Yellow and Blue* (1928)

Data-to-Pixel Ratio

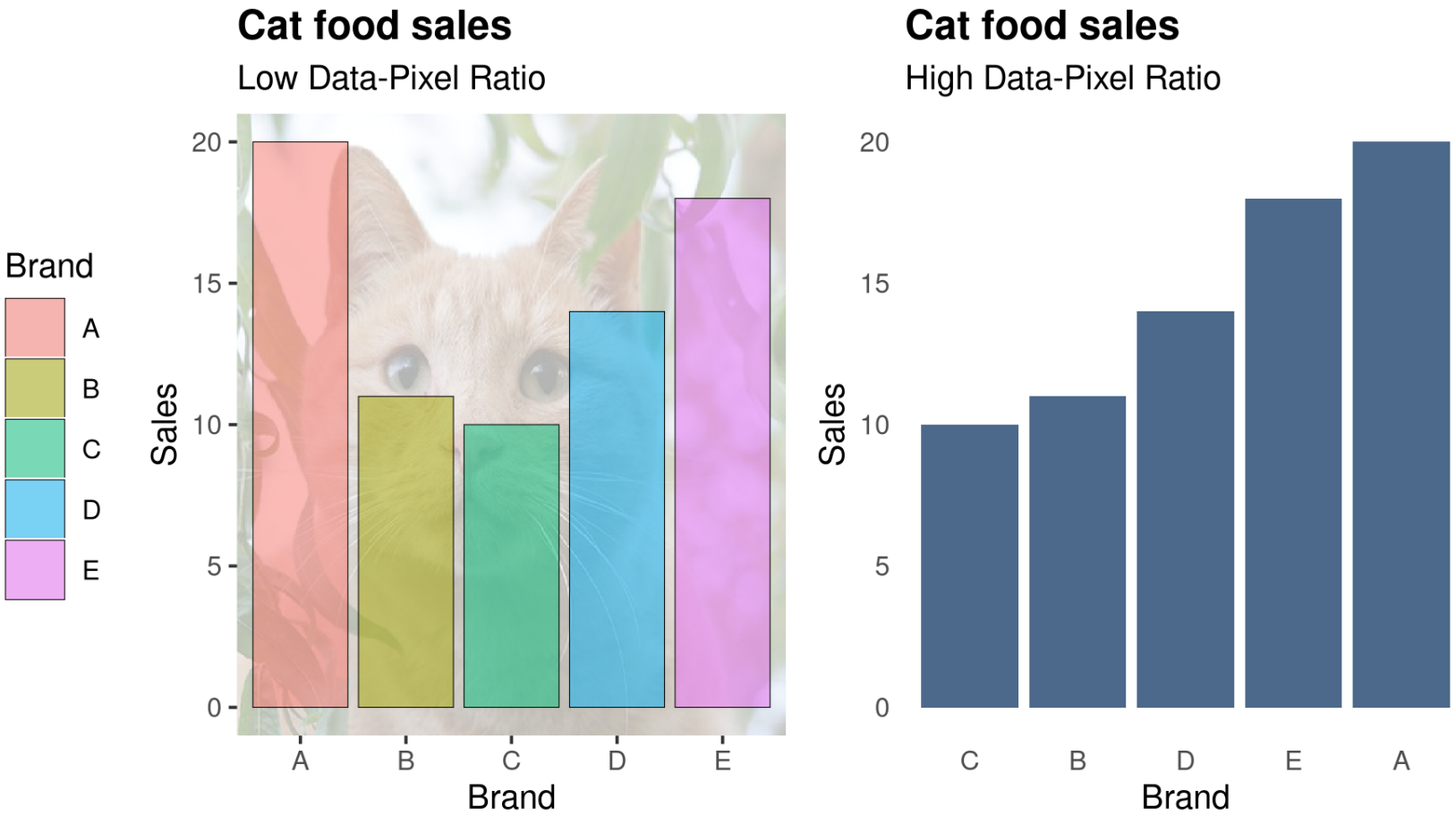


Figure 4: Maximise the data to pixel ratio for aesthetic visualisations.

Chart Chooser

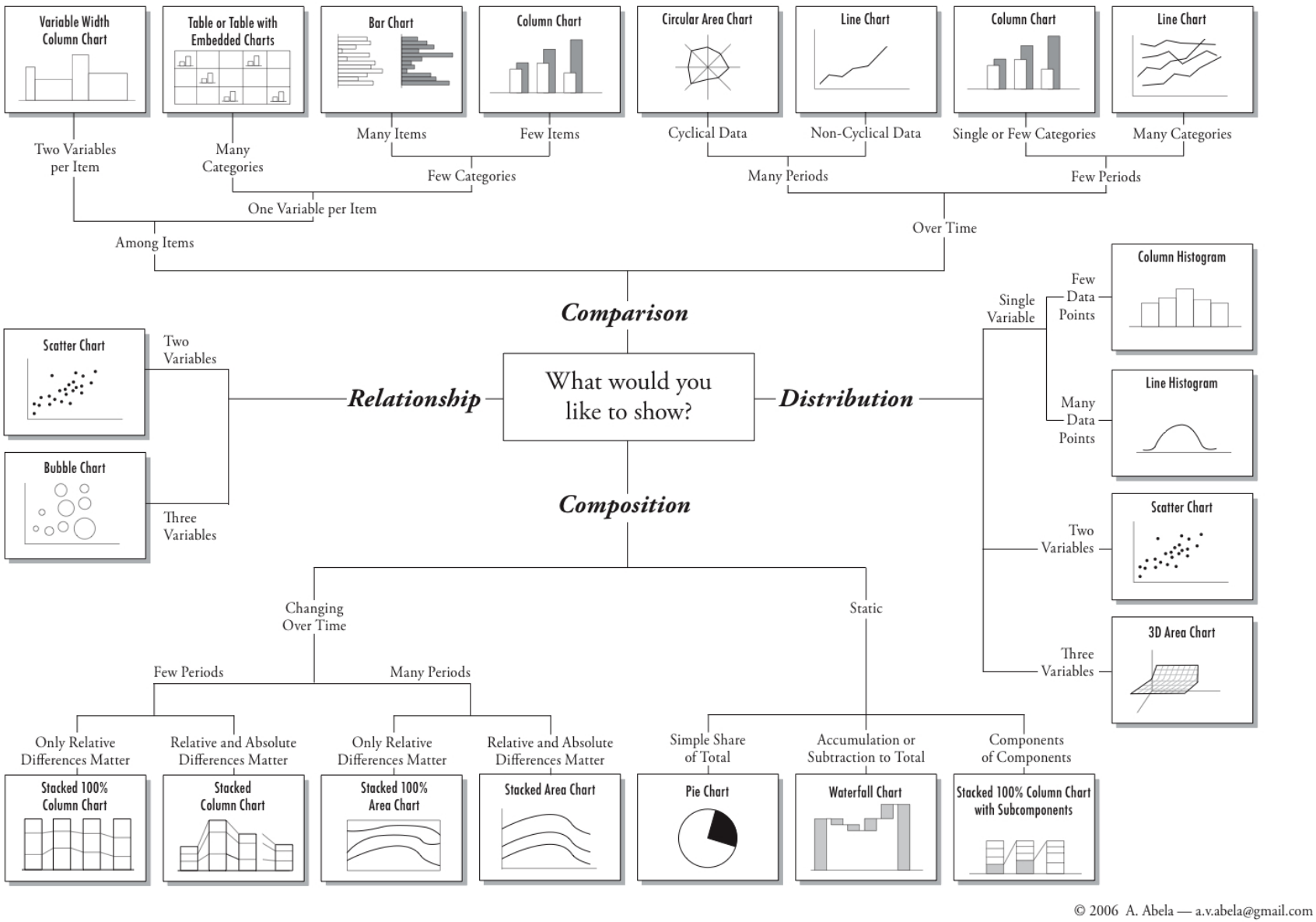
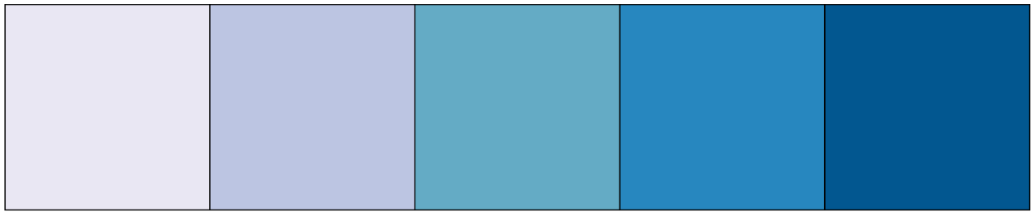


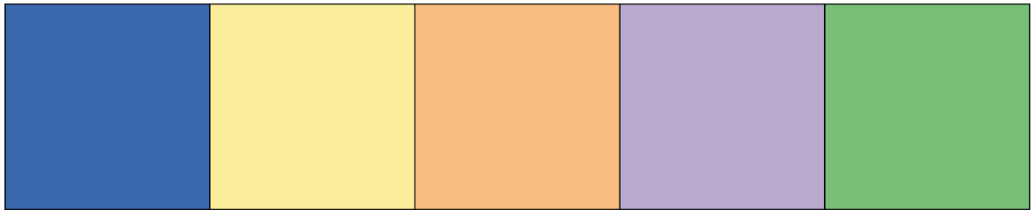
Figure 5: Chart suggestions by Andrew Abela.

Use Colours Sparingly



Sequential

Diverging



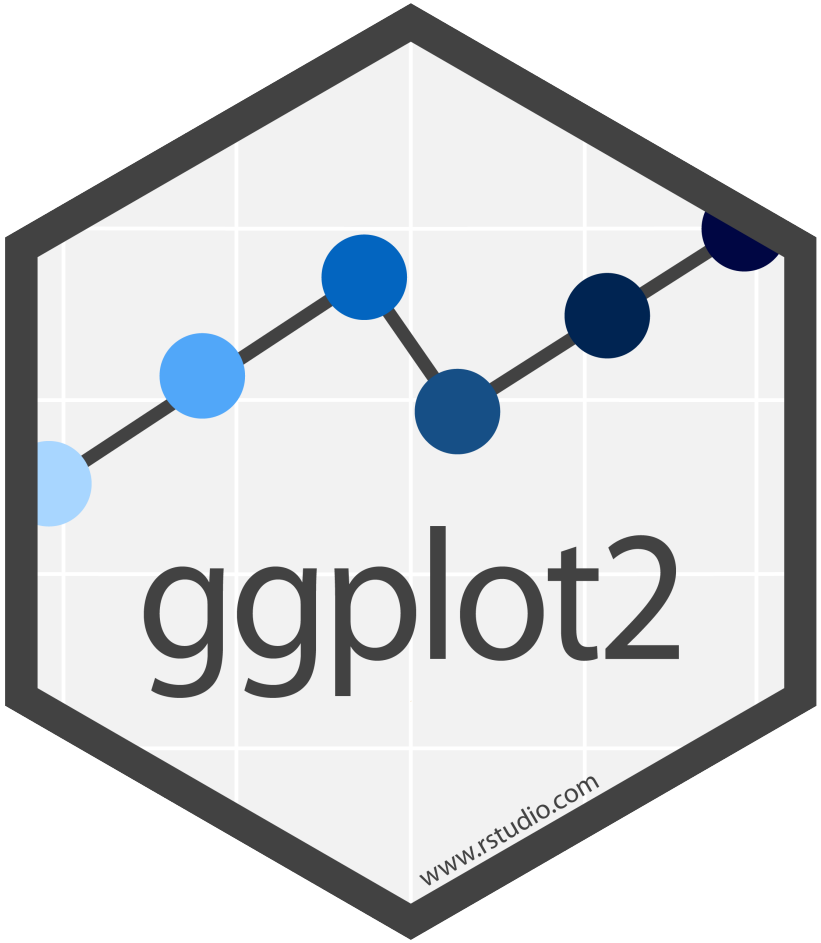
Qualitative

Figure 6: Types of colour pallets. Go to colorbrewer2.org for details.

ggplot2

- System for creating graphics, based on *The Grammar of Graphics*.
- Go to ggplot2.tidyverse.org for documentation.
- Included in the Tidyverse. You can call it separately with:

```
library(ggplot2)
```



Grammar of Graphics

Figure 7: Leland Wilkinson, *Grammar of Graphics* (2005).

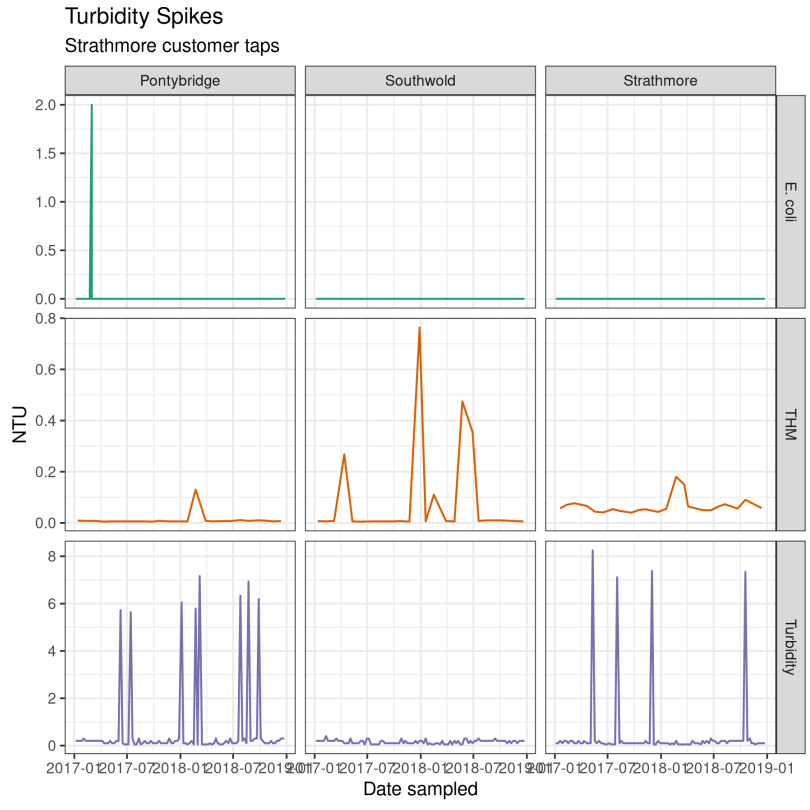
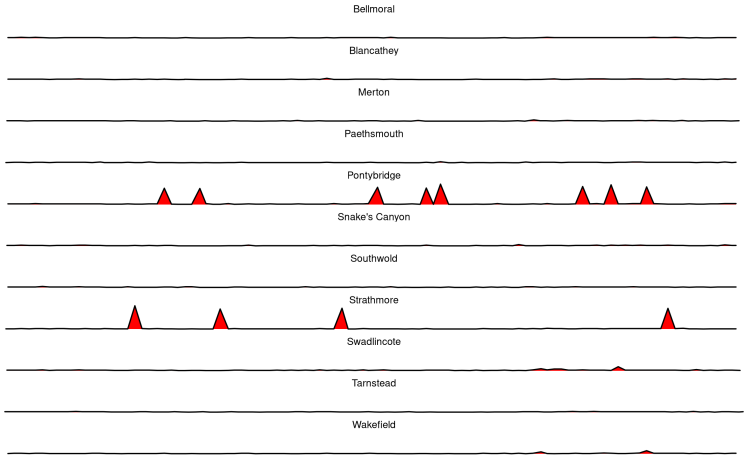


Figure 8: ggplot2 Example

Visualisation Exercise

Use your knowledge of the Gormsey data to create two visual data stories. Use the following four steps:

1. Explore the data and define the story you want to tell.
2. Decide on the best way to visualise the story.
3. Develop the basic visualisation.
4. Select a theme and annotate the graph.



Data Science Workflow

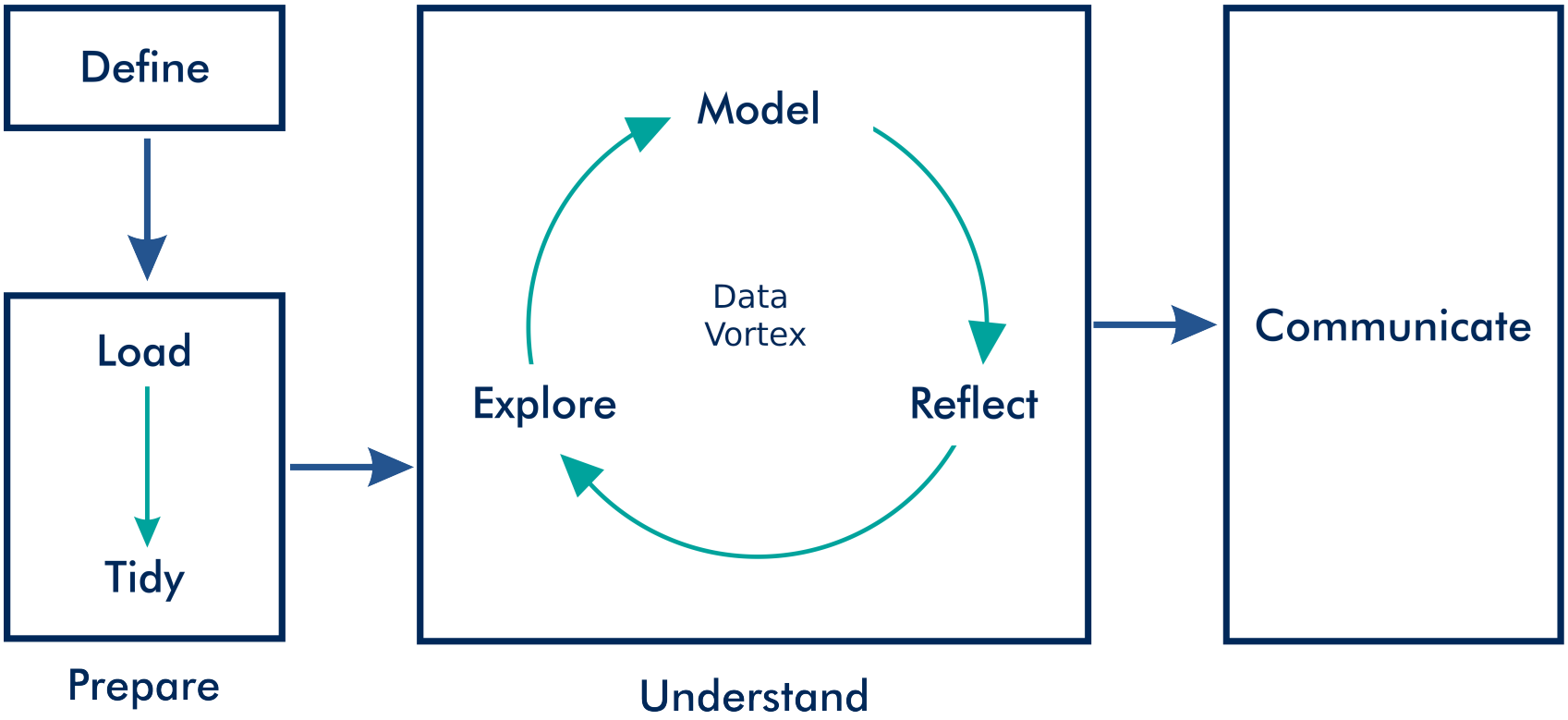


Figure 9: Data science wokflow

Data Products

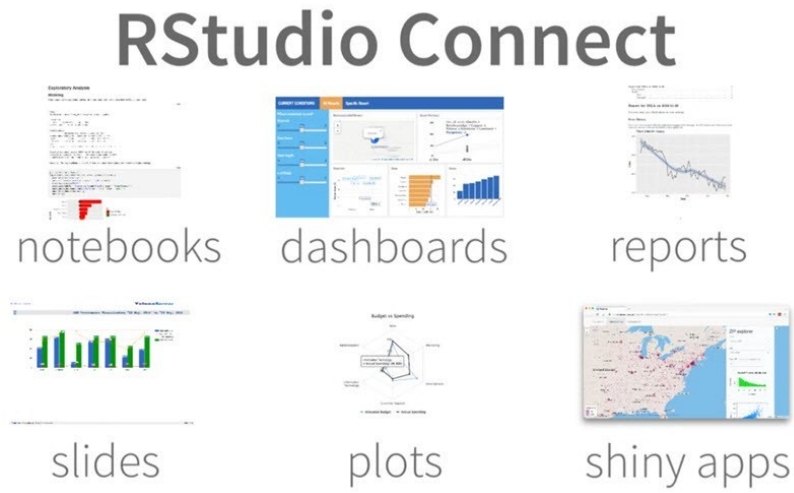
Static

- Word documents
- PowerPoint presentaions
- Web pages

Dynamic

- Shiny application
- Shiny presentation

Share - RStudio Connect - Your own server



RMarkdown

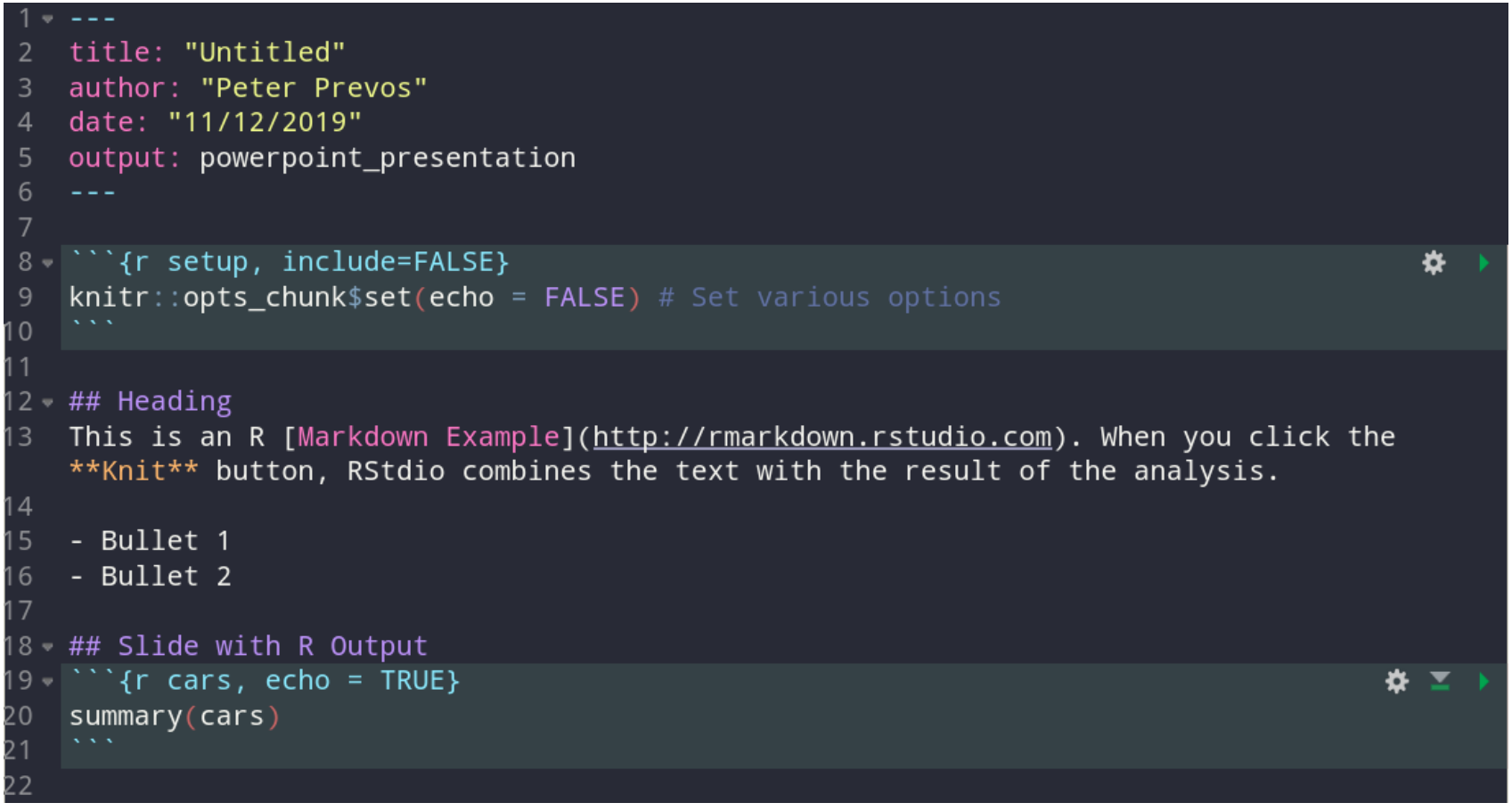
Literate programming:

- Combine prose with code
- Link the code to dynamic data
- Generate shareable output from code

Data products:

- Reports
- Web sites
- Presentations
- Applications (dashboards)

RMarkdown Syntax



```
---
title: "Untitled"
author: "Peter Prevos"
date: "11/12/2019"
output: powerpoint_presentation
---

```{r setup, include=FALSE}
knitr::opts_chunk$set(echo = FALSE) # Set various options
```

Heading
This is an R [Markdown Example](http://rmarkdown.rstudio.com). When you click the
Knit button, RStdio combines the text with the result of the analysis.

- Bullet 1
- Bullet 2

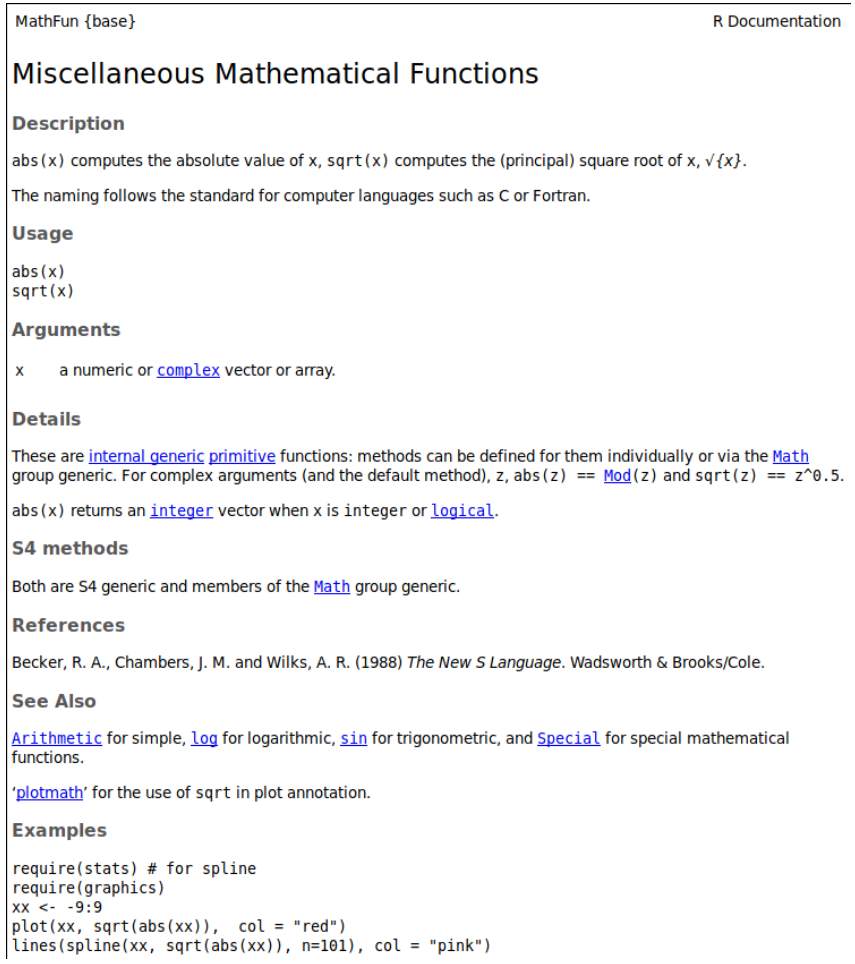
Slide with R Output
```{r cars, echo = TRUE}
summary(cars)
```

```

Figure 10: RMarkdown syntax example

# Finding Help

- Built-in `help()` function
- Cheat sheets (RStudio and Tidyverse websites)
- Use the R4H2O Slack channel
- Twitter #rstats
- Reddit rstats, rlanguage
- stackoverflow.com
- Google the problem



MathFun {base} R Documentation

## Miscellaneous Mathematical Functions

### Description

`abs(x)` computes the absolute value of `x`, `sqrt(x)` computes the (principal) square root of `x`, $\sqrt{x}$.

The naming follows the standard for computer languages such as C or Fortran.

### Usage

```
abs(x)
sqrt(x)
```

Arguments

x	a numeric or complex vector or array.

Details

These are internal generic primitive functions: methods can be defined for them individually or via the Math group generic. For complex arguments (and the default method), `z`, `abs(z) == Mod(z)` and `sqrt(z) == z^0.5`.

`abs(x)` returns an integer vector when `x` is `integer` or logical.

S4 methods

Both are S4 generic and members of the Math group generic.

References

Becker, R. A., Chambers, J. M. and Wilks, A. R. (1988) *The New S Language*. Wadsworth & Brooks/Cole.

See Also

Arithmetic for simple, log for logarithmic, sin for trigonometric, and Special for special mathematical functions.

'plotmath' for the use of `sqrt` in plot annotation.

Examples

```
require(stats) # for spline
require(graphics)
xx <- -9:9
plot(xx, sqrt(abs(xx)),  col = "red")
lines(spline(xx, sqrt(abs(xx)), n=101), col = "pink")
```

Figure 11: screenshot of help window.

Mini Hackathon

To close this day, we will do a mini hackathon.

1. Create a script that results in a PowerPoint presentation about the Gormsey data.
2. Pick a story you like to tell about this data.
3. Create a RMarkdown script that results in a Powerpoint presentation.
   - Add an introduction.
   - Explore the data.
   - Share the story.