Data Visualisation

Chapter 10: Dashboards

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Dashboard Definition

- Merriam Webster Dictionary definition: * 1. *“a screen on the front of a usually horse-drawn vehicle to intercept water, mud, or snow”* * 2. *“a panel extending across the interior of a vehicle (such as an automobile) below the windshield and usually containing instruments and controls”*
- Data Visualisation Definition:
  - “Visual display of the most information needed to achieve one or more objectives which fits entirely on a single computer screen so it can be monitored at a glance” (Few, 2006)

Good Dashboards

- So what makes a good dashboard? Few (2006) emphasises the following principles:
  - Exceptionally well organised
  - Dashboard must summarise and draw attention to important trends/unusual observations
  - Target a specific audience for a specific objective
  - Simple, concise and clear
  - Use best practice in data visualisation design and methods

COVID-19 Dashboards

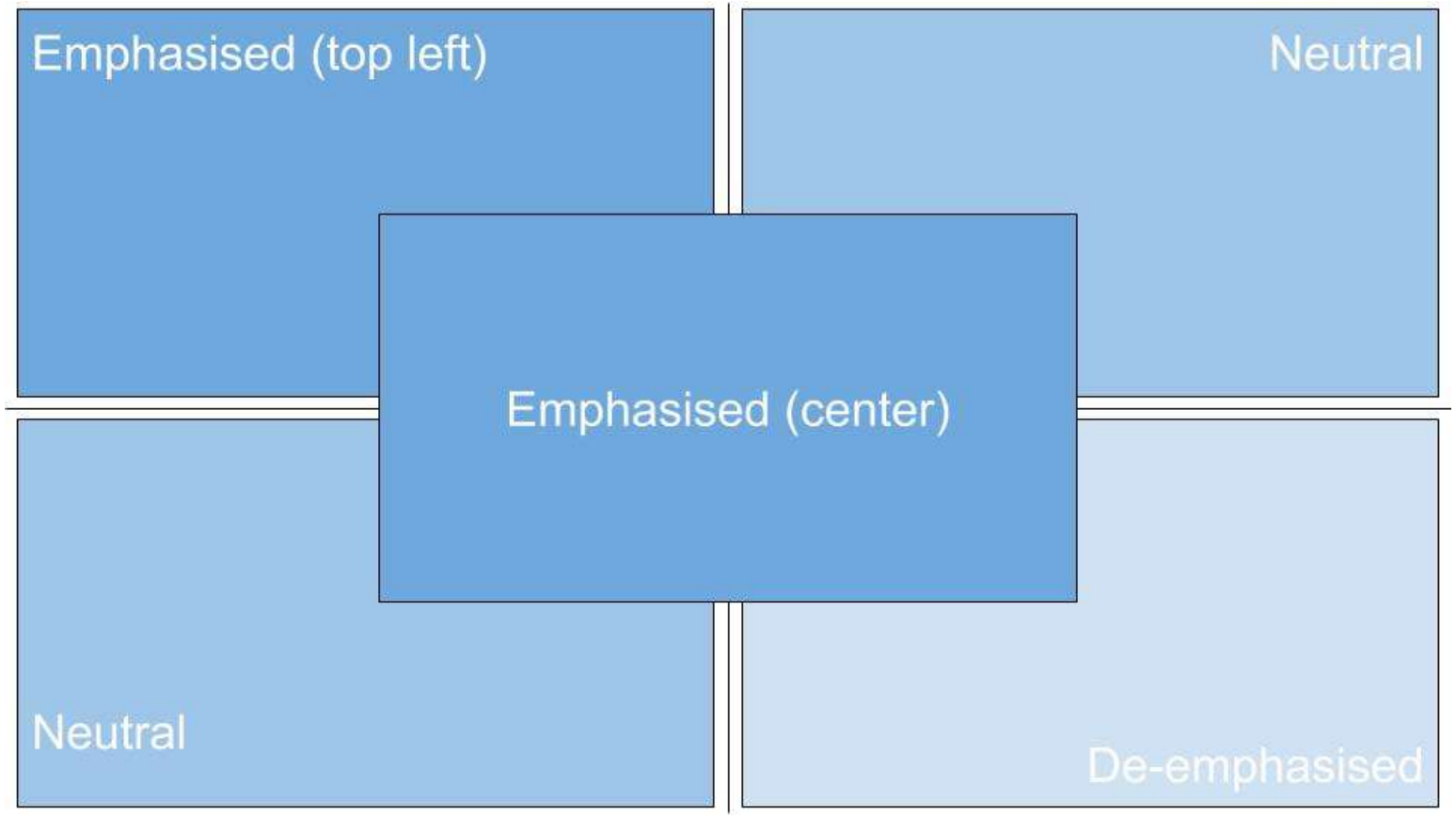
- WHO coronavirus disease (COVID-19) dashboard (World Health Organisation 2020)
- COVID-19 dashboard (Center for Systems Science and Engineering at John Hopkins University 2020)
- Global COVID-19 tracker (Tableau 2020)

Visual Emphasis

- Visual emphasis refers to the placement of data visualisations at key areas of the dashboard.
- The most important visualisations must be emphasised first.
- The following figure explains the idea of visual emphasis according to Few (2006)

Visual Emphasis 2

- Layout is important…



Visual Emphasis 3

- Size is also important…

Bad Dashboards

Here's how to make a bad dashboard (Few, 2006)

- Exceed the boundaries of a single screen
- Inadequate context for the data
- Excessive detail or precision
- Deficient measures
- Inappropriate data visualisation methods
- Meaningless variety
- …

Bad Dashboards Cont.

- Poorly designed data visualisations
- Misleading data visualisations
- Poor arrangement of plots and data
- Poor highlighting of important data
- Clutter and unnecessary decoration
- Poor colour use and aesthetics (ugliness)

Critique - WHO Dashboard

WHO coronavirus disease (COVID-19) dashboard (World Health Organisation 2020)

- Pros
  - Clear and easy to understand
  - Focuses on the visuals
  - Nice interactive feaures
- Cons
  - Audience might miss scrolling down!
  - Should be a single screen summary
  - Time series plots too small in first view

Critique - CSSE Dashboard

COVID-19 dashboard (Center for Systems Science and Engineering at John Hopkins University 2020)

- Pros
  - Map is well emphasised
  - Interative features work well to focus and reveal detail
  - The audience can choose the metric
- Cons
  - Text dominant
  - Issue with overplotting in map
  - Time-series de-emphasised

Critique - Tableau Dashboard

Global COVID-19 Tracker (Tableau 2020)

- Pros
  - Time and spatial trend in one screen
  - Clear and easy to understand
  - Allows the user to focus on a country of interest
- Cons
  - Interactivity can be slow

Dashboards and Pie Charts

- Why do pie charts and dashboards go hand-in-hand?
- Skeuomorphism - A throwback to speedometers and gauges from car dashboards
- A propensity to use meaningless variety - pie charts are an inferior substitute to bar charts
- Established norms - E.g. examples and advertising material from dashboard technology providers

Dashboards in R

- You have two main options for making dashboards in R:
  - flexdashboard - http://rmarkdown.rstudio.com/flexdashboard/
  - shinydashboards - https://rstudio.github.io/shinydashboard/

flexdashboard

- flexdashboard makes use of an R Markdown template.
- Works with Shiny and Plotly

```
install.packages("flexdashboard")
```

- Uses R Markdown output options and code to arrange your visualisations.
- Simple and easy to use.
- Let's look at an example…

flexdashboard

- Let's create a dashboard that provides an annual summary of airlines' performance for New York flights in 2013.
- Consumer focus - "Who is the most and least reliable airline?"
- The dashboard can be previewed here

flexdashboard code

````
---
title: "Airline Reliability Dashboard: New York Flights 2013"
output:
  flexdashboard::flex_dashboard:
    orientation: columns
---

```{r setup, include=FALSE}
library(flexdashboard)
library(ggplot2)
library(dplyr)
library(plotly)
library(nycflights13)
library(forcats)
library(tidyr)

flights_new <- flights
flights_new$dep_del_status <- ifelse(flights_new$dep_delay>=15, 1, 0)
flights_new$arr_del_status <- ifelse(flights_new$arr_delay>=15, 1, 0)
```

Column {data-width=650}
-----------------------------------------------------------------------

### Proportion of Flights Delayed (Departure and Arrival) by Carrier

```{r}
flights_delay <- flights_new %>% group_by(carrier) %>%
  summarise(dep_del = sum(dep_del_status,na.rm = TRUE),
            arr_del = sum(arr_del_status,na.rm = TRUE),
            n = n(),
            prop_dep_del = round(dep_del/n,2),
            prop_arr_del = round(arr_del/n,2)
  )

flights_delay$carrier <- fct_reorder(flights_delay$carrier, flights_delay$prop_dep_del)

flights_delay_long <- flights_delay %>% gather(key = "Delay", value = "prop", 5:6)

flights_delay_long$Delay <- factor(flights_delay_long$Delay,
                                   levels = c("prop_dep_del","prop_arr_del"))
````
````

shinydashboards

- `shinydashboard` integrates with the Shiny framework

```
install.packages("shinydashboard")
```

- Provides a high level of control of layout and appearance.
- Here is an example of a basic interactive dashboard (credit to Micah Agustin)…

shinydashboards Cont.

```
# Load packages and prepare data

library(plotly)
library(shiny)
library(shinydashboard)

body <- read.csv("../data/Body.csv")

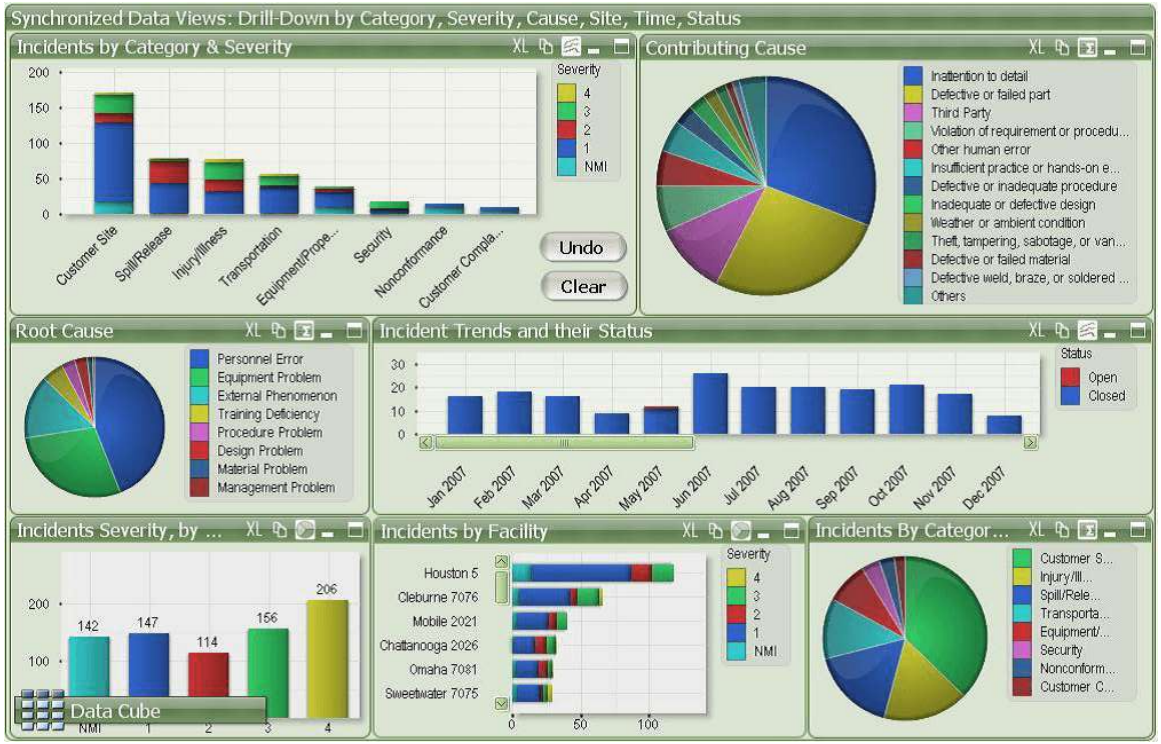
# Compute a correlation matrix for heat map

body <- body[,-1] # Remove ID variable
correlation <- round(cor(body), 3)
correlation[correlation == 1] <- NA
nms <- names(body)

# Assign ui function
```

Conclusion

- Dashboards incorporate everything we have learnt about data visualisation: design, visual perception, colour, methods, interactivity and applications.
- Try not to fail…



References

Center for Systems Science and Engineering at John Hopkins University. 2020. “COVID-19 dashboard.” https://coronavirus.jhu.edu/map.html.

Tableau. 2020. “Global COVID-19 tracker.” https://public.tableau.com/profile/covid.19.data.resource.hu19Cases{_}1584048837532O/COVID-19GlobalView.

World Health Organisation. 2020. “WHO coronavirus disease (COVID-19) dashboard.” https://covid19.who.int/.