Introduction to Data Visualization

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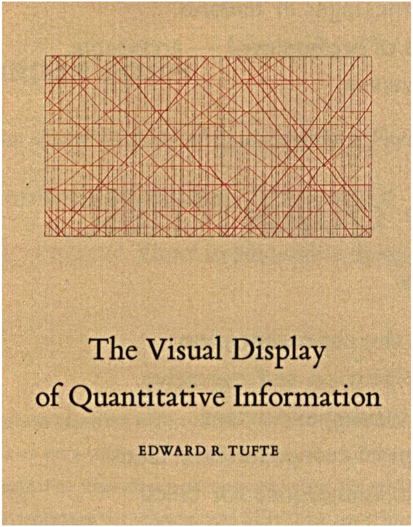
This material is part of the **statsTeachR** *project*

Visualization excellence

In Tufte's words:

- consists of complex ideas communicated with clarity, precision, and efficiency.
- is that which gives to the viewer the greatest number of ideas in the shortest time with the least ink in the smallest space.
- is nearly always multivariate.
- requires telling the truth about the data.



The Visual Display of Quantitative Information

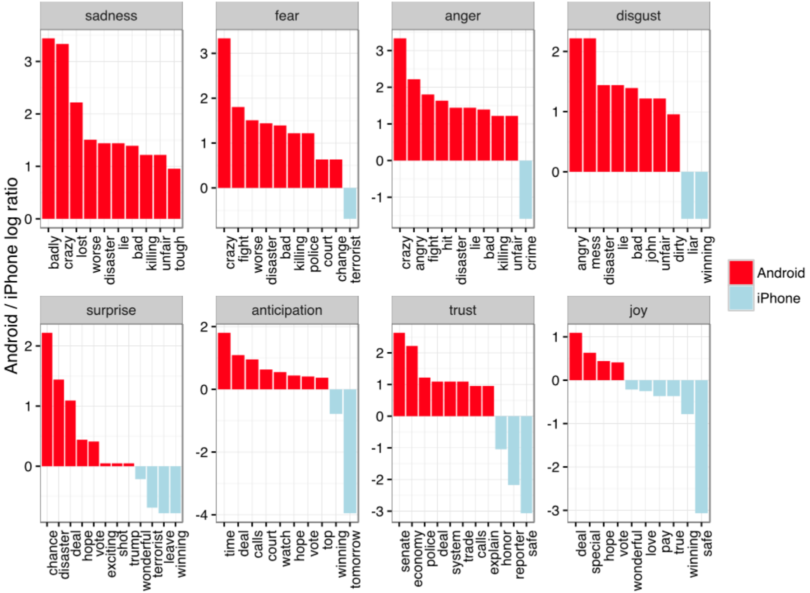
EDWARD R. TUFTE

Warm up

For each of the following graphics, work in pairs to

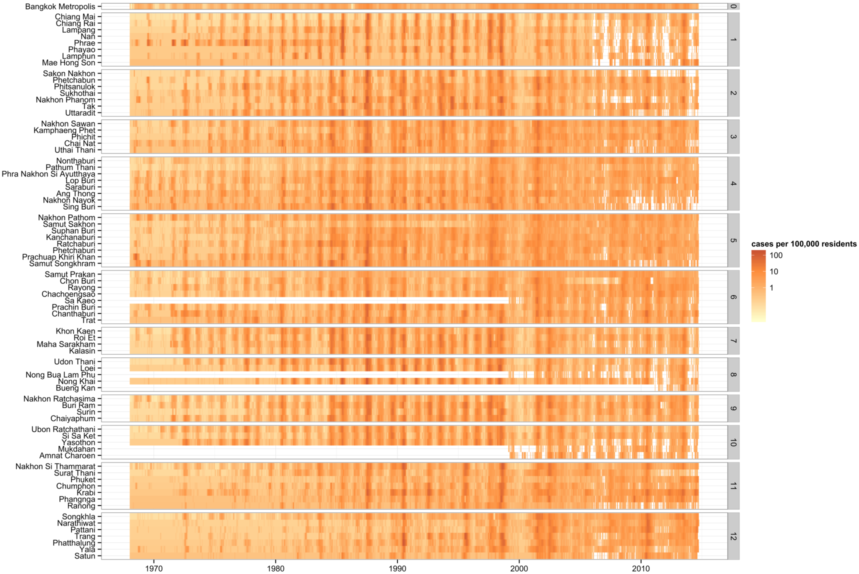
1. identify the variables displayed;
2. identify 2 features that you like and 2 that you don't;
3. sketch out the tidy data represented in the figure.

Trump tweets[1]



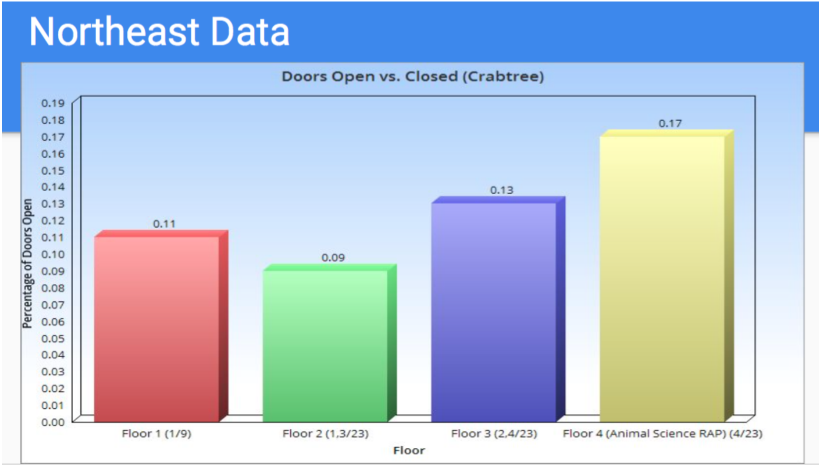
[1] http://varianceexplained.org/r/trump-tweets/

Dengue cases in Thailand[2]



[2] adapted from Reich et al, 2016.

RAP analysis



Northeast Data

"Cities, traffic and CO2"[3]

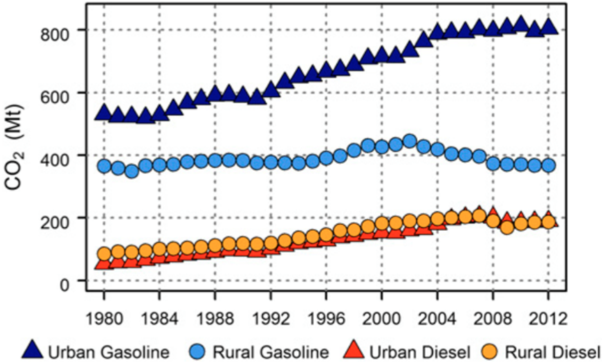


Fig. 2. Time series of US on-road CO_2 emissions. Urban roads accounted for 80% of total emissions growth since 1980. Rural road emissions have been declining since 2002.

[3] from "Cities, traffic, and CO2: A multidecadal assessment of trends, drivers, and scaling relationships", Gately et al, PNAS, 2015.

Why do we visualize data?

Exploratory graphics

- The most valuable graphics are often the simple ones you make for yourself.
- Exploratory graphics can introduce you to a dataset.
- Key goal: understand the variation.
- What do you want to know about these data?

```
data(airquality)
head(airquality)

##   Ozone Solar.R Wind Temp Month Day
## 1    41     190  7.4   67     5   1
## 2    36     118  8.0   72     5   2
## 3    12     149 12.6   74     5   3
## 4    18     313 11.5   62     5   4
## 5    NA      NA 14.3   56     5   5
## 6    28      NA 14.9   66     5   6
```

Exploratory summaries: airquality data

Some quick text-based/tabular summaries

```
nrow(airquality)

summary(airquality)

table(airquality$Month)

with(airquality, table(Month, Day))
```

Univariate graphics: airquality data

```r
library(ggplot2)

p <- ggplot(airquality)

## better or worse than the table?
p + geom_bar(aes(x=factor(Month)))

## which of these do you prefer and why?
p + geom_density(aes(Ozone))
p + geom_histogram(aes(x=Ozone))
```

Multivariate graphics: airquality data

```
p + geom_boxplot(aes(x=factor(Month), y=Ozone))

p2 <- ggplot(airquality, aes(x=Temp, y=Ozone))
p2 + geom_point()
p2 + geom_point() + geom_smooth()
p2 + geom_point() + geom_smooth(se=FALSE)

p3 <- ggplot(airquality,
             aes(x=Temp, y=Ozone, color=factor(Month)))
p3 + geom_point() + geom_smooth(se=FALSE)
```

Multivariate graphics: pairs plots!

Pairs plots are sweet, but can take some time to render (especially for big-datasets).

```
library(GGally)
ggpairs(airquality)
```

Your turn!

Try visualizing some of the NHANES data

```
library(NHANES)
data(NHANES)
?NHANES
```