

Introduction to Telling Stories with Data

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

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Communicating ideas with evidence

What is a narrative? [From the OED]

An account of a series of events, facts, etc., given in order and with the establishing of connections between them; a narration, a story, an account.

What is data? [From Google: literally, “what is data”]

da·tum

/ˈdætəm, ˈdætəm/ ⓘ

noun

plural noun: data

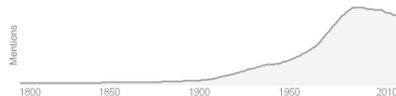
1. a piece of information.
 - an assumption or premise from which inferences may be drawn.
2. a fixed starting point of a scale or operation.

Origin



mid 18th century: from Latin, literally 'something given,' neuter past participle of *dare* 'give.'

Use over time for: data



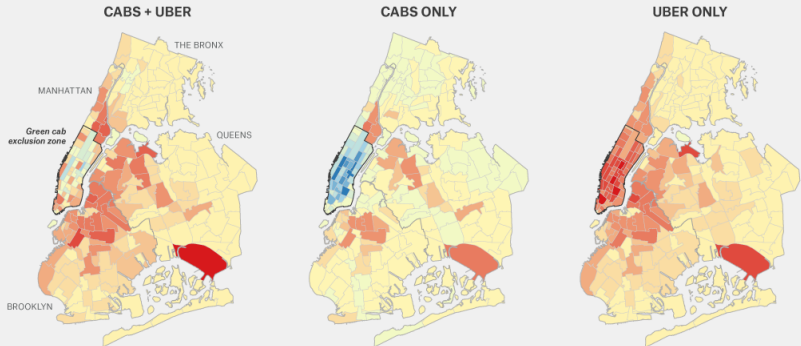
Uber Is Taking Millions Of Manhattan Rides Away From Taxis

The ride-share service probably isn't increasing congestion.

By REUBEN FISCHER-BAUM and CARL BIALIK

Are Ubers Supplementing Or Replacing Cabs?

Change in number of Uber and taxi pickups by taxi zone, April-June 2014 versus April-June 2015





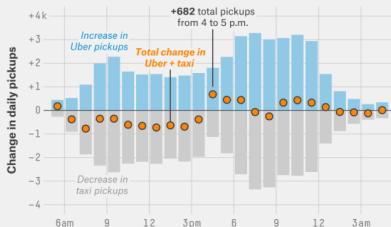
TRANSPORTATION | 11:19 AM | DEC 9, 2015

Is Uber Making NYC Rush-Hour Traffic Worse?

By CARL BIALIK, REUBEN FISCHER-BAUM and DHRUMIL MEHTA

Uber adds (a little) to Manhattan evening rush

Average change in Uber pickups, taxi pickups, and total Uber + taxi pickups by hour of day; April-June 2014 vs. April-June 2015



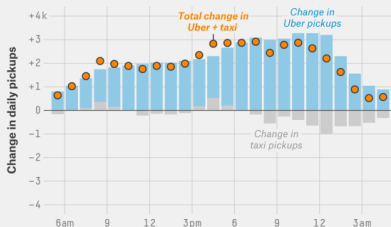
Non-holiday weekdays; Manhattan core taxi zones only

FIVETHIRTYEIGHT

SOURCE: NYC TAXI & LIMOUSINE COMMISSION

Thousands of new pickups outside Manhattan core

Average change in Uber pickups, taxi pickups, and total Uber + taxi pickups by hour of day; April-June 2014 vs. April-June 2015



Non-holiday weekdays; includes Manhattan taxi zones outside the core

FIVETHIRTYEIGHT

SOURCE: NYC TAXI & LIMOUSINE COMMISSION

How To Spot A Front-Runner On The 'Bachelor' Or 'Bachelorette'

What we learned from analyzing all 33 seasons.

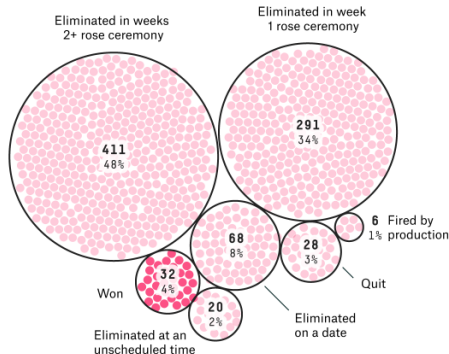
By [Ella Koeze](#) and [Walt Hickey](#)

Filed under [TV](#)

Get the data on [BitHub](#)

Published May 22, 2017

The fate of every 'Bachelor' and 'Bachelorette' contestant



A rose for every season

The path of every winner on every season of the "Bachelor" and "Bachelorette"

①
Each petal is a week



②
Each section of the petal is a contestant



③
Size indicates a contestant's weighted number of dates through that point in the season ...



④
... as does order.

The Bachelorette

💔 Broke up ❤️ Still together

❤️ Trista + Ryan
2003



💔 Meredith + Ian
2004



💔 Jen + Jerry
2005



💔 DeAnna + Jesse
2008



💔 Jillian + Ed
2009



💔 Ali + Roberto
2010



❤️ Ashley + J.P.
2011



💔 Emily + Jef
2012



❤️ Desiree + Chris
2013



💔 Andi + Josh
2014



❤️ Kaitlyn + Shawn
2015



❤️ JoJo + Jordan
2016



For nearly all seasons, dates did not begin until week two. Dates are weighted so that a one-on-one counts as one date, a two-on-one counts as 0.5 dates, etc.

Contestant Nick was rejected by both Andi and Kaitlyn in their final ceremonies. He went on to be the bachelor in 2017.

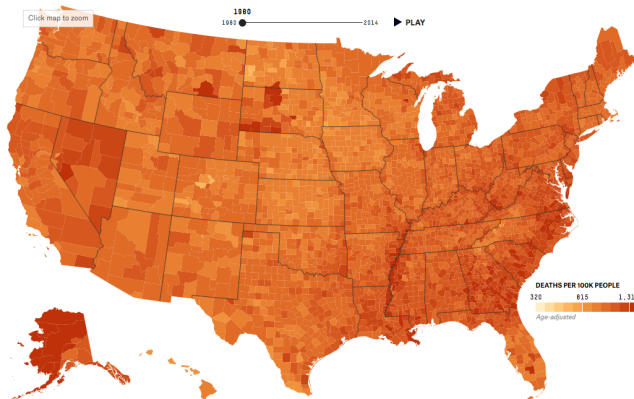


35 Years Of American Death

Mortality rates for leading causes of death in every U.S. county from 1980 to 2014.

By [Ella Koeze](#)

< All causes of death >



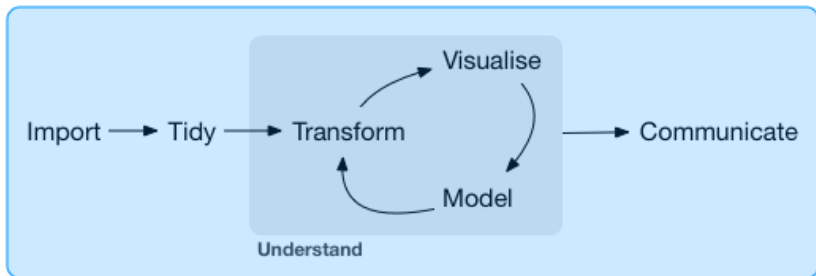
Mortality rates are age adjusted to account for higher mortality in older populations and geographic variations in the ages of county populations.

How to tell a story using data

Telling stories with data requires

- ▶ detective work
- ▶ creativity, both scientific and artistic
- ▶ experimentation with different storylines
- ▶ good data, (good data does not necessarily equal “big data”)

A process for data analysis



Program

A common modeling tool: regression

- The goal is to learn about the relationship between two variables: a “covariate” (or “predictor”) of interest and an “outcome” of interest.
 - Some models focus on prediction.
 - Other models focus on description.
- Regression is an exercise in inferential statistics: we are drawing evidence and conclusions from data about “complex aspects of reality”, i.e. “noisy” systems.

State-level SAT score data (1994-95)

```
## Error in library(mosaicData): there is no package  
called 'mosaicData'  
## Warning in data(SAT): data set 'SAT' not found  
## Error in cut(SAT$frac, breaks = c(0, 22, 49, 81),  
labels = c("low", "medium", : object 'SAT' not found  
## Error in ggplot(SAT): object 'SAT' not found
```

State-level SAT score data (1994-95)

```
## Error in ggplot(data, aesthetics, environment =  
env): object 'SAT' not found
```

State-level SAT score data (1994-95)

```
## Error in ggplot(aes(salary, sat), data = SAT):  
object 'SAT' not found
```

The SAT example

What is the outcome variable?

What is the covariate or predictor variable?

What other data might be part of this story?

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State-level SAT score data (1994-95)

```
## Error in ggplot(aes(salary, sat, color = fracgrp),  
data = SAT): object 'SAT' not found
```

State-level SAT score data (1994-95)

```
## Error in ggplot(SAT, aes(x = salary, y = sat)):  
object 'SAT' not found
```

State-level SAT score data (1994-95)

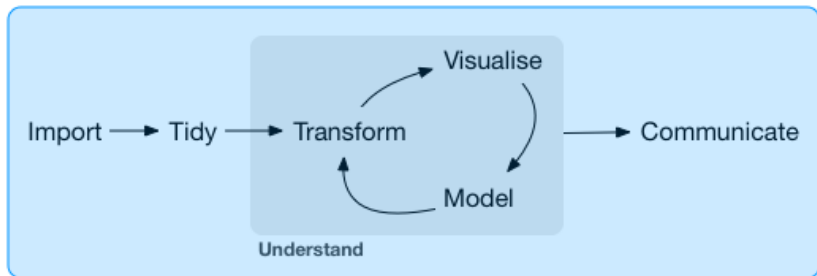
What can we conclude from all of this? (BTW, this is an example of "Simpson's Paradox".)

Regression modeling

The process of using data to describe the relationship between outcomes and predictors is called modeling.

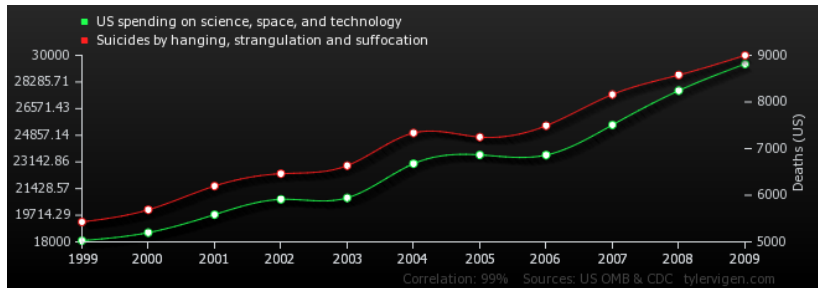
- Models are models, not reality.
- “All models are wrong, but some are useful.”
- Introduce structure to our model that balances realism with “goodness of fit” .

Things to come

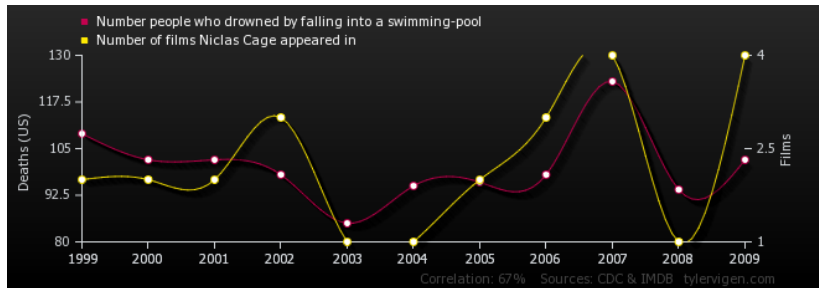


Program

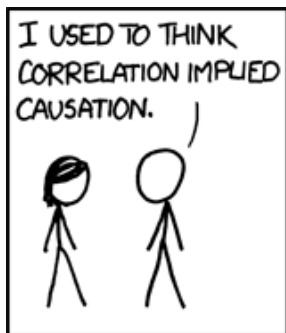
Beware of correlation!



Beware of correlation!



Hat tip to www.tylervigen.com



<https://xkcd.com/552/>

Appendix: Code for plotting

```
library(mosaicData)
library(ggplot2)
theme_set(theme_bw())
data(SAT)
SAT$fracgrp = cut(SAT$frac, breaks=c(0, 22, 49, 81),
                  labels=c("low", "medium", "high"))
ggplot(SAT) +
  geom_text(aes(x=salary, y=sat, label=state), size=4, show.legend=FALSE) +
  xlab("est. average public school teacher salary") +
  ylab("average total SAT score")
```

More plotting code available [here](#).