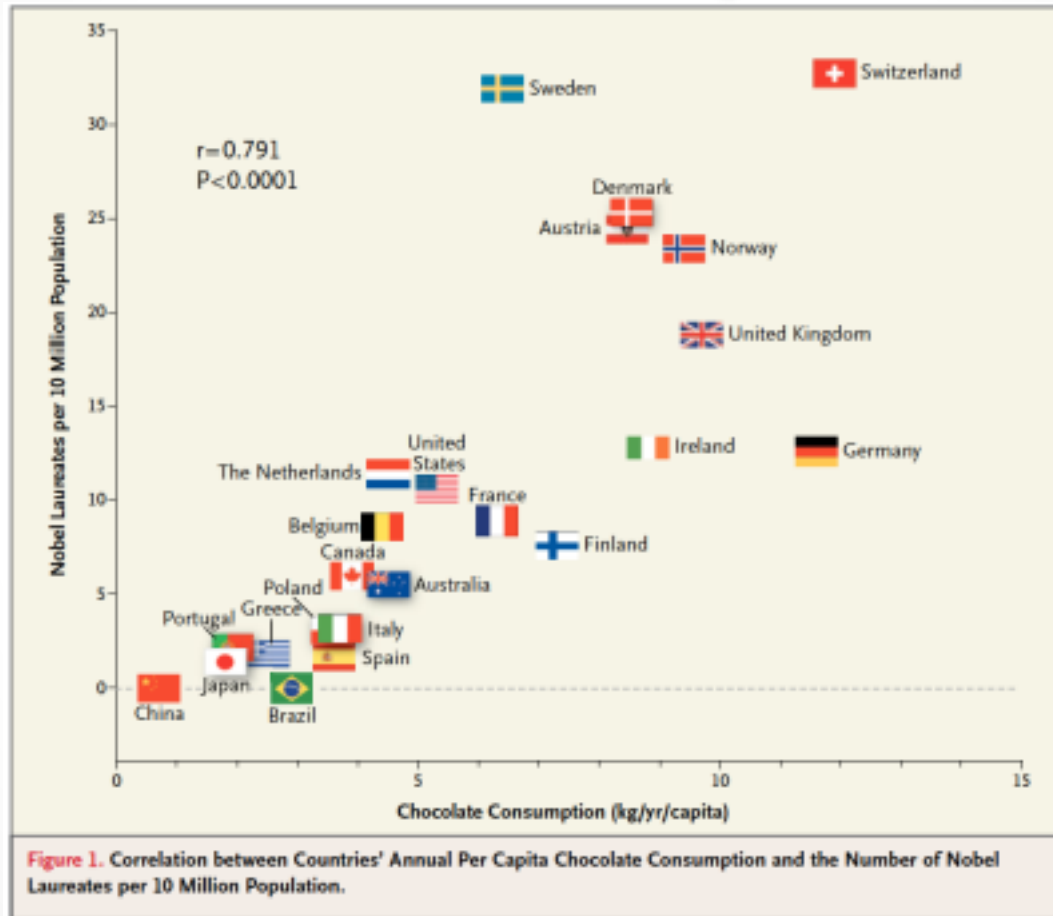


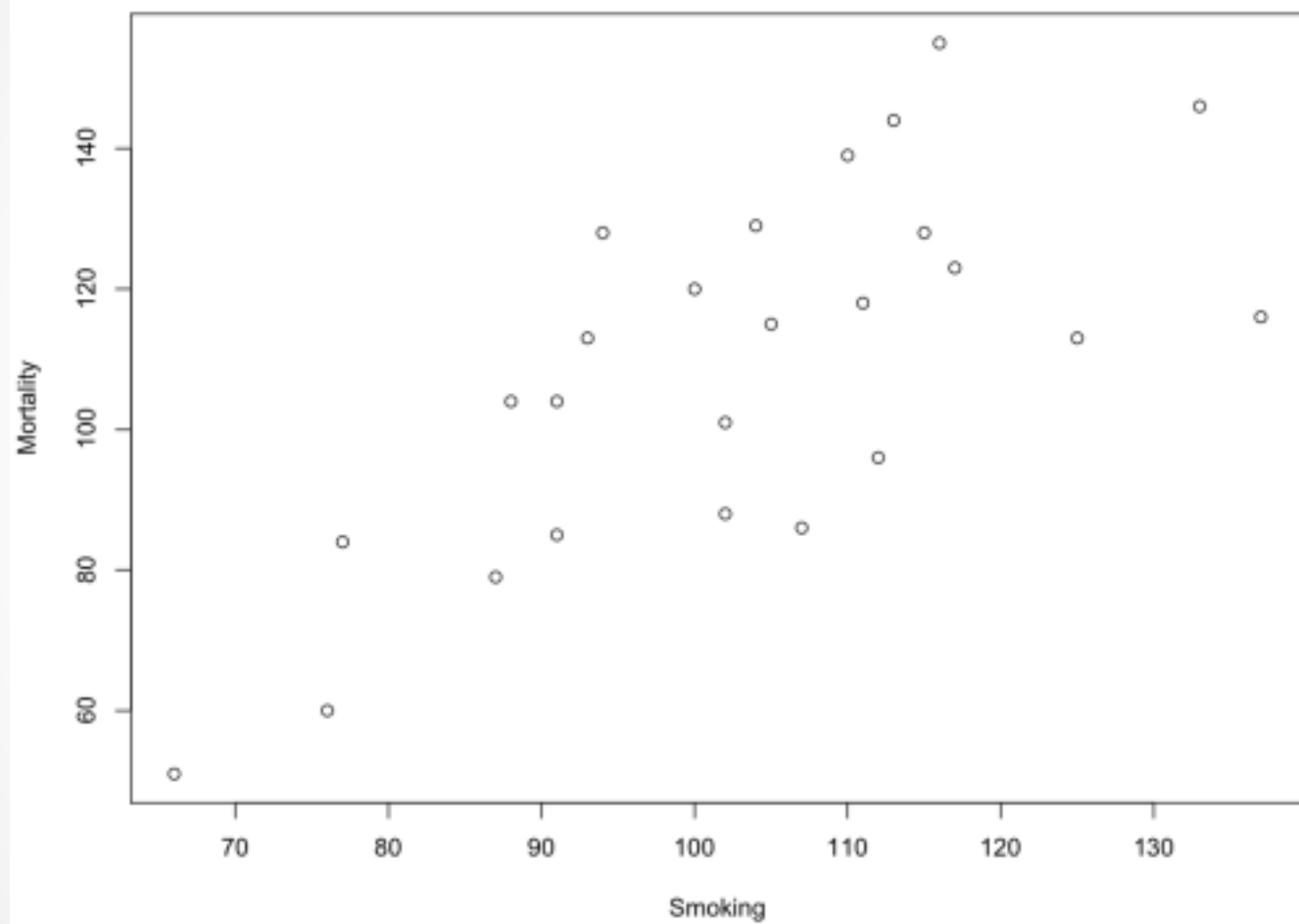
# Algorithms week 3-1: Causation

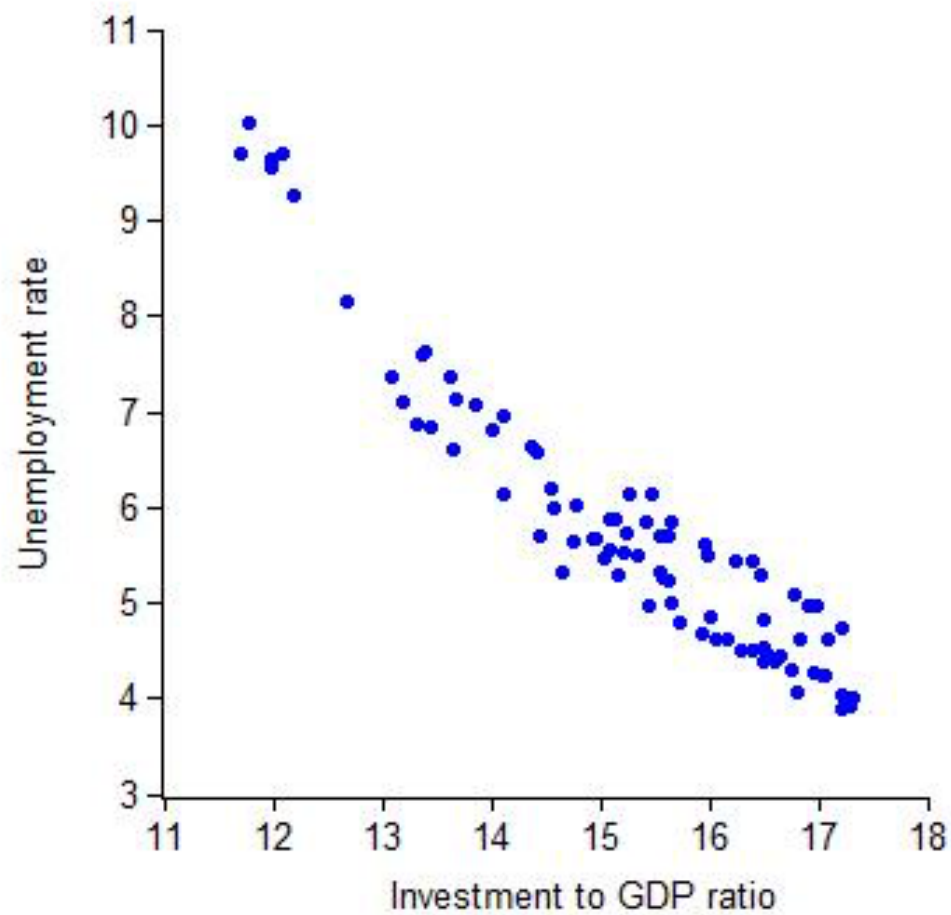
Jonathan Stray  
Columbia Lede Program  
July 30, 2018

# Does chocolate make you smarter?



Occupational Group	Smoking	Mortality
Farmers, foresters, and fisherman	77	84
Miners and quarrymen	137	116
Gas, coke and chemical makers	117	123
Glass and ceramics makers	94	128
Furnace, forge, foundry, and rolling mill	116	155
Electrical and electronics workers	102	101
Engineering and allied trades	111	118
Woodworkers	93	113
Leather workers	88	104
Textile workers	102	88
Clothing workers	91	104
Food, drink, and tobacco workers	104	129
Paper and printing workers	107	86
Makers of other products	112	96





# Does marriage make women safer?

**Intimate partner violence against females, by household composition, 1993–2010**

Rate per 1,000 females

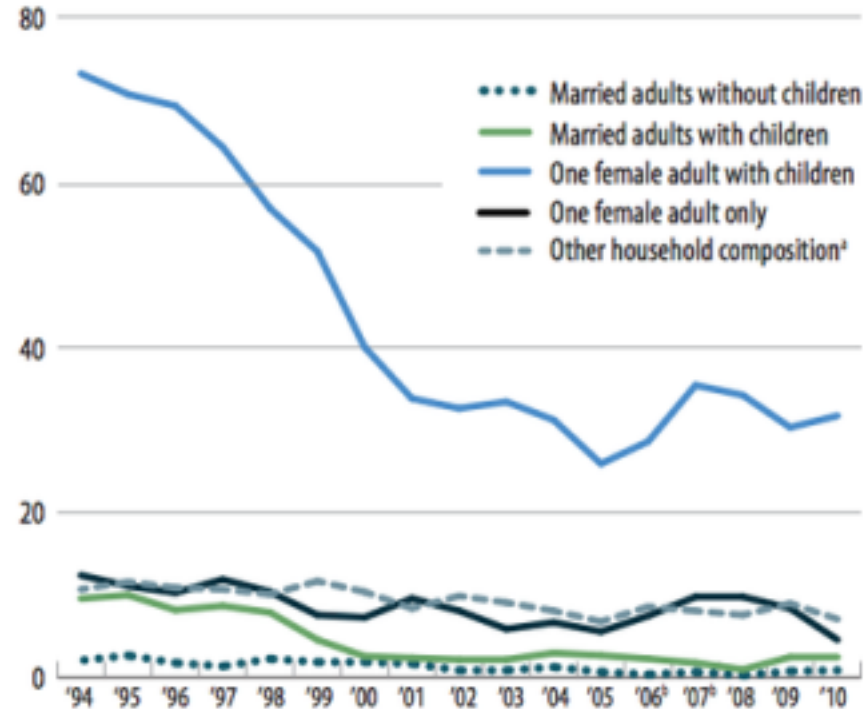


Fig. 1  
IS FACEBOOK DRIVING  
THE GREEK DEBT CRISIS?

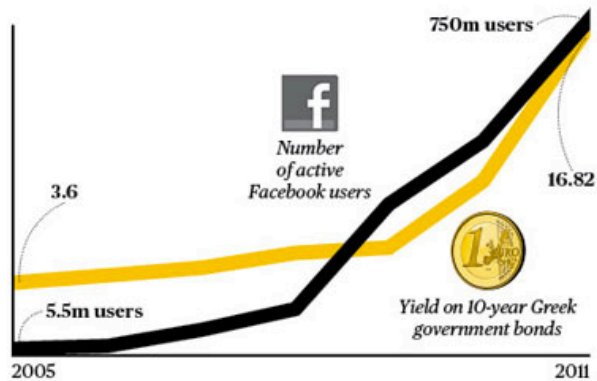


Fig. 2  
IS GLOBAL WARMING A HOAX  
PROPAGATED BY SCIENTISTS?

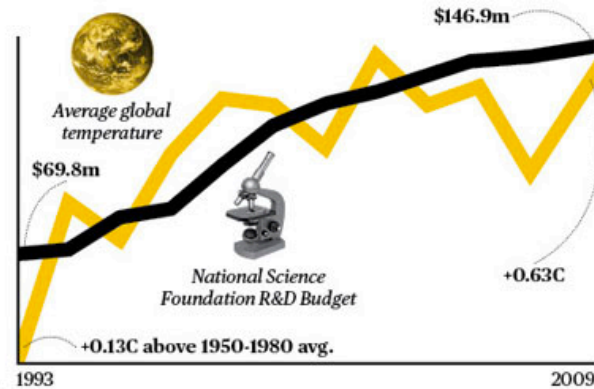


Fig. 3  
DID AVAS CAUSE  
THE U.S. HOUSING BUBBLE?

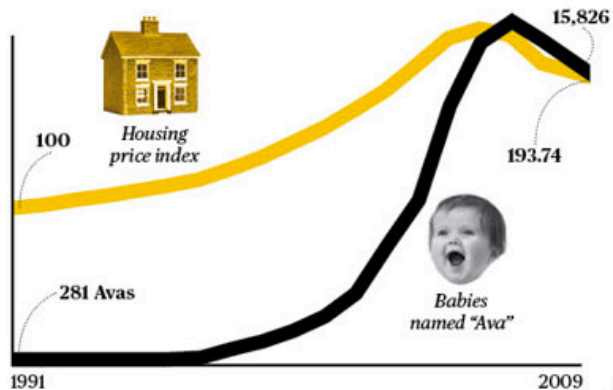
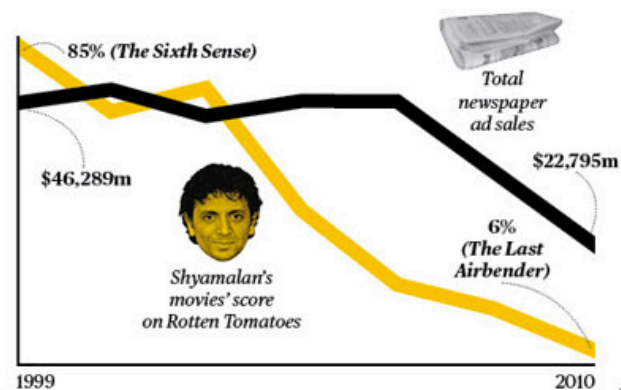
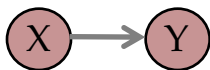


Fig. 4  
WOULD M. NIGHT SHYAMALAN START MAKING GOOD MOVIES  
AGAIN IF PEOPLE BOUGHT MORE NEWSPAPERS?



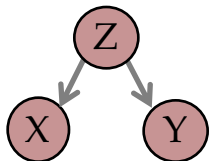
# How correlation happens



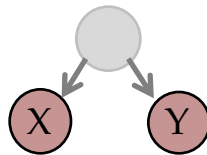
X causes Y



Y causes X



Z causes X and Y



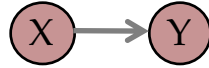
hidden variable causes X and Y



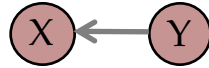
random chance!



# Guns and firearm homicides?



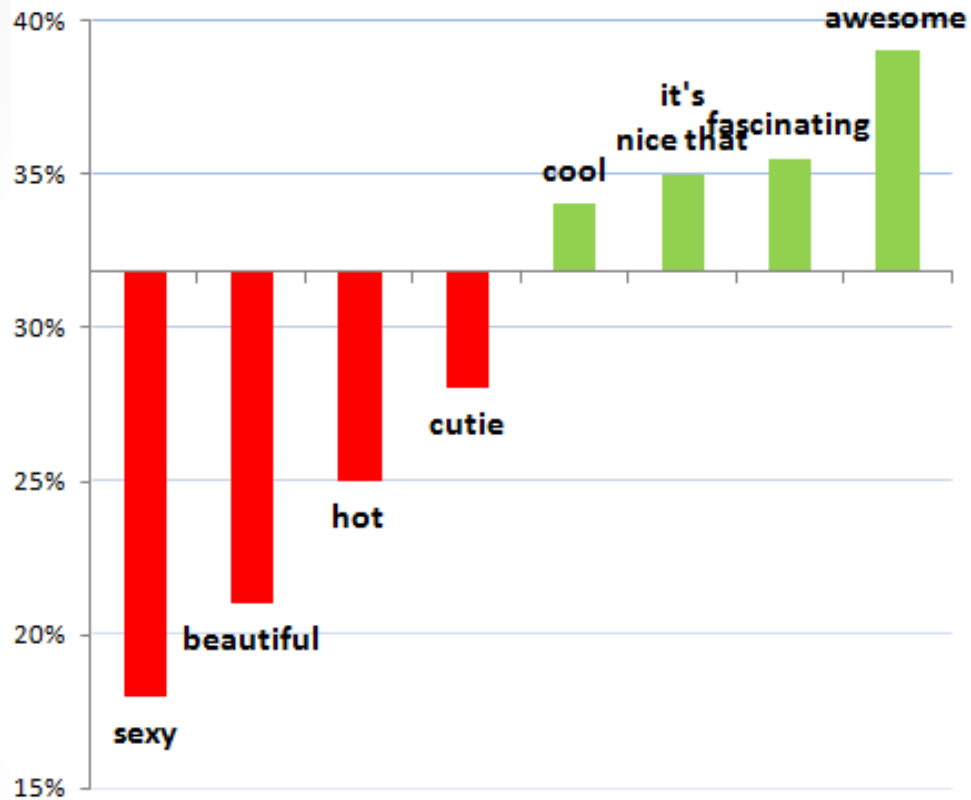
if you have a gun, you're going to use it



if it's a dangerous neighborhood, you'll buy a gun

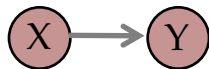


the correlation is due to chance

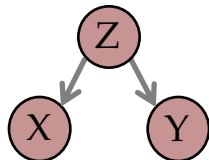


Exactly what to say in a first message, OK Cupid blog, 2009

# Messages and responses



Comments on her appearance  
make her respond less

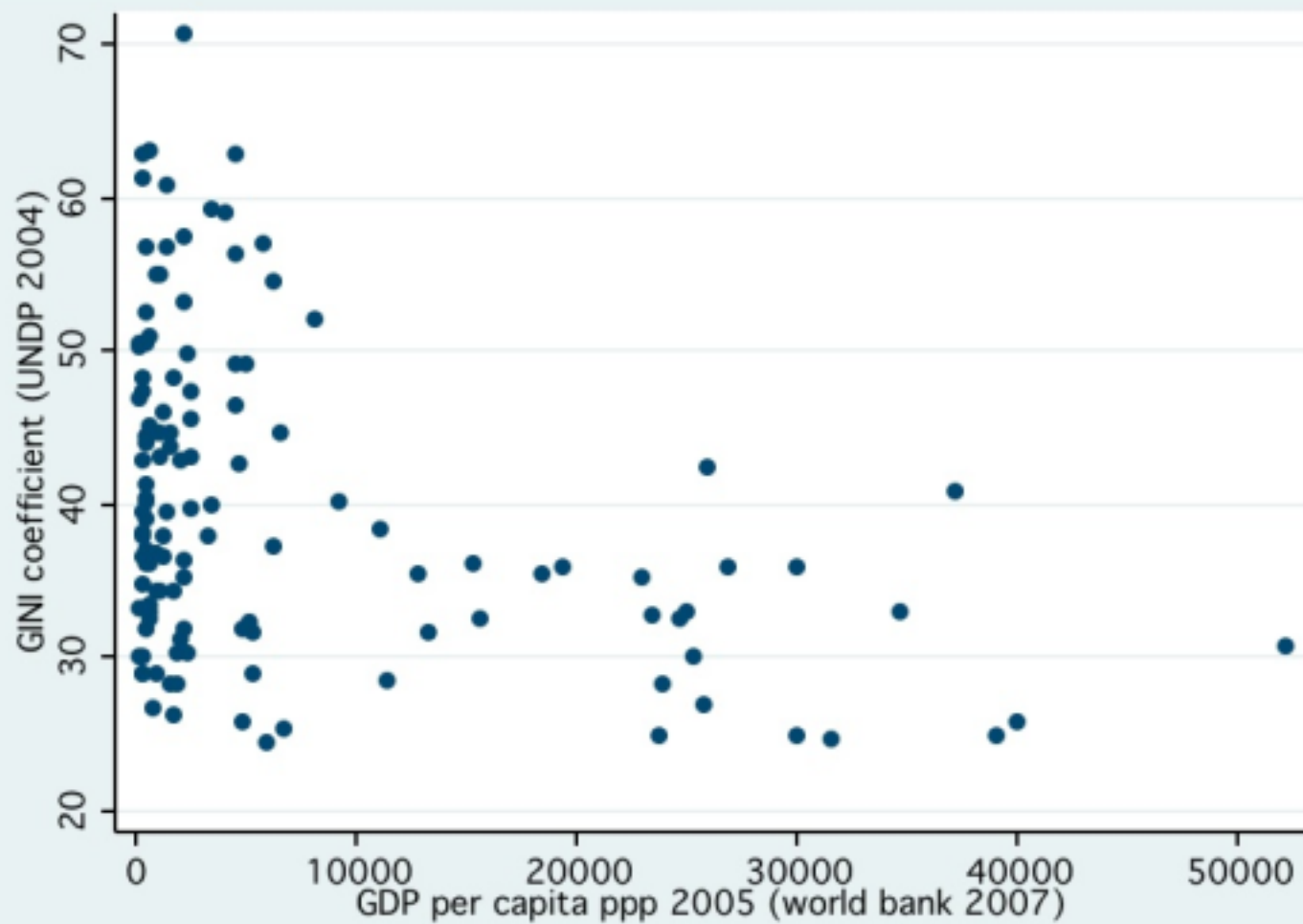


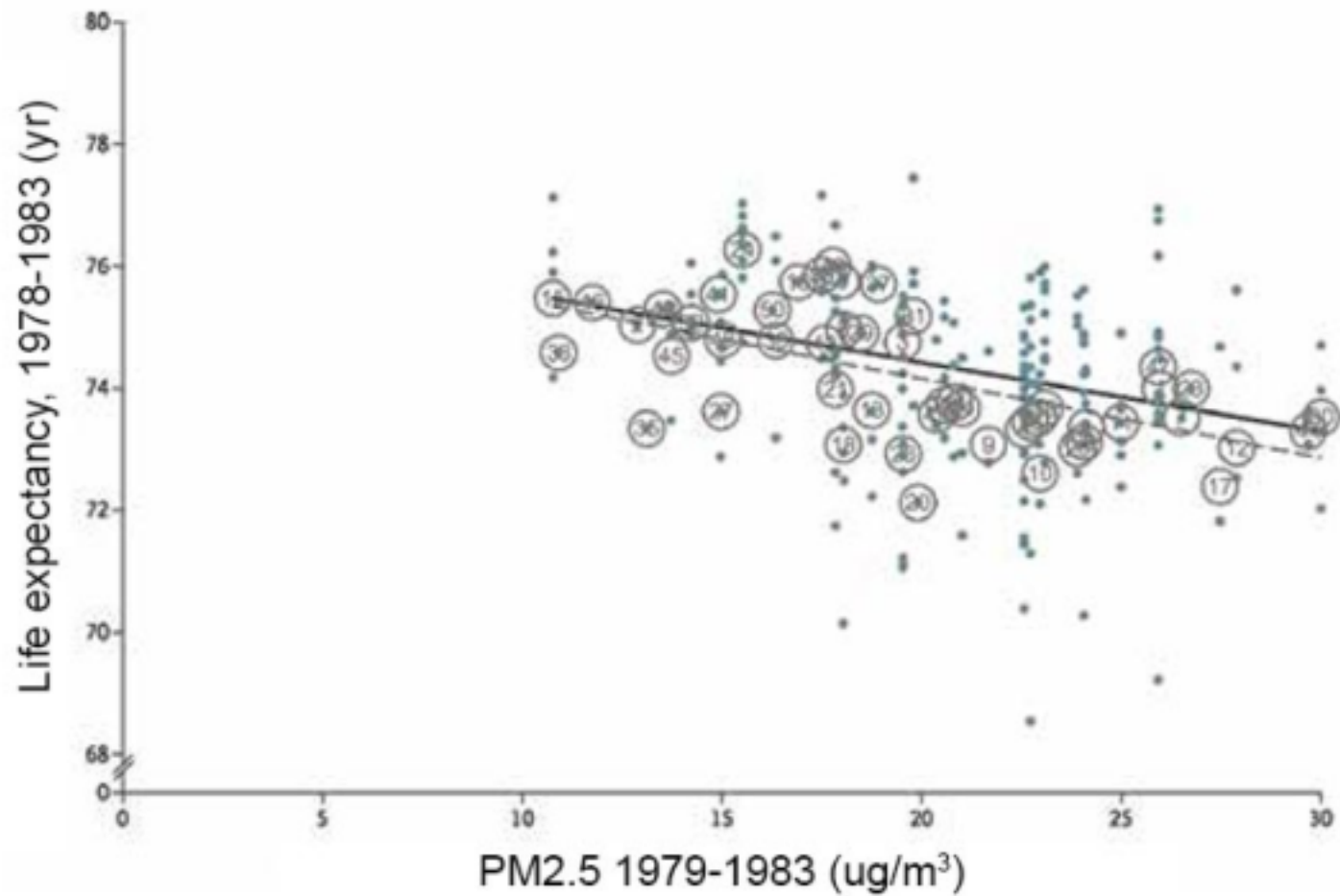
if a woman is attractive,  
1) she'll respond less  
2) people will tell her that

Attractiveness is a "confounding variable." The correlation between words and response rates is not necessarily causal.

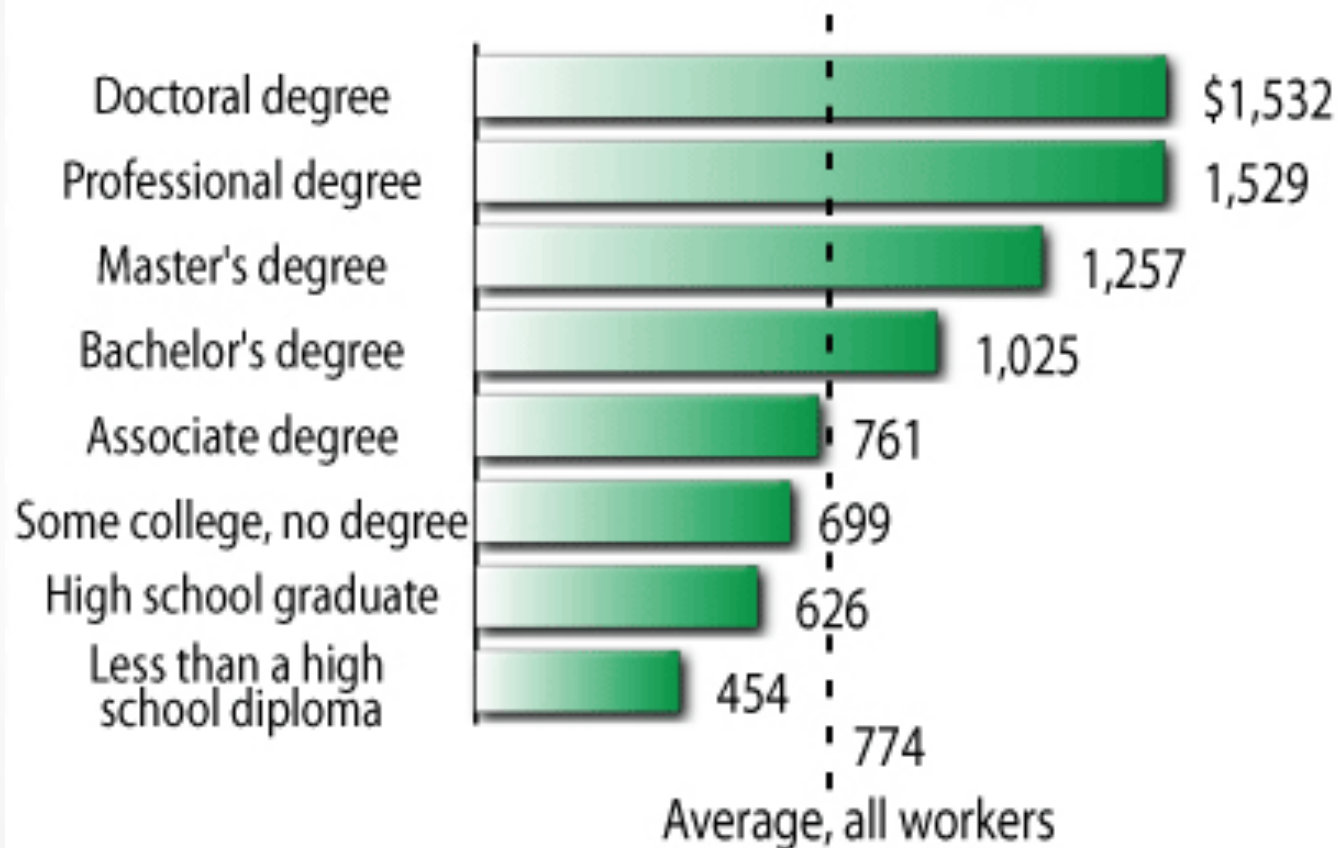
# Examples

...





# Median weekly earnings in 2009



## Less is more

Fertility vs GDP, 2007

2

Size of circle is proportional to country's population



Source: gapminder.org

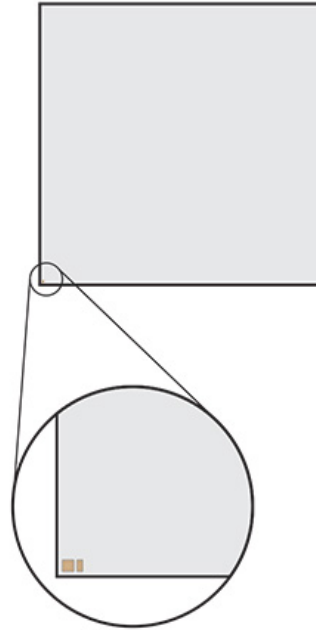


# Odds ratio

...

## Teenage White Men

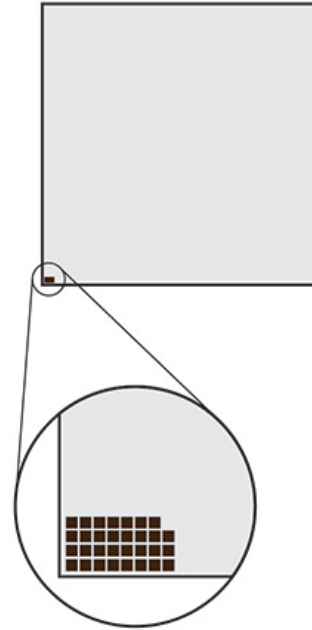
1 million



1.5 in 1 million reported

## Teenage Black Men

1 million



31 in 1 million reported

Reported killings by police during 2010-2012

**21 times as likely for black vs. white teenage men**

- *Deadly Force in Black and White*, ProPublica 10/10/2014

“Controlling” for a variable

...

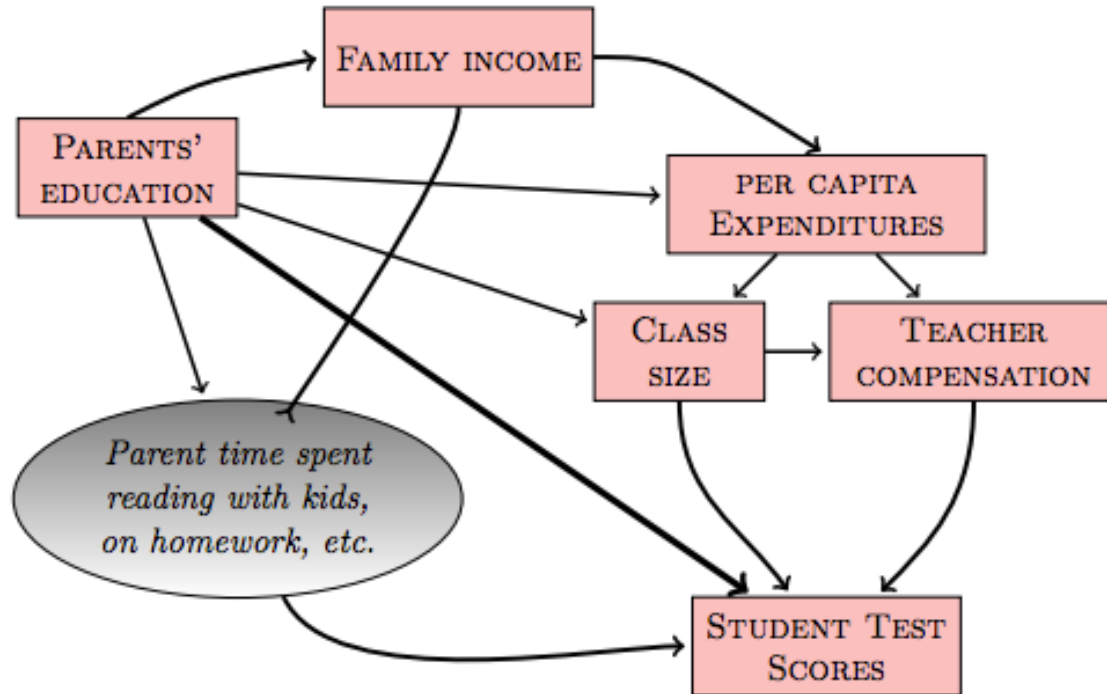
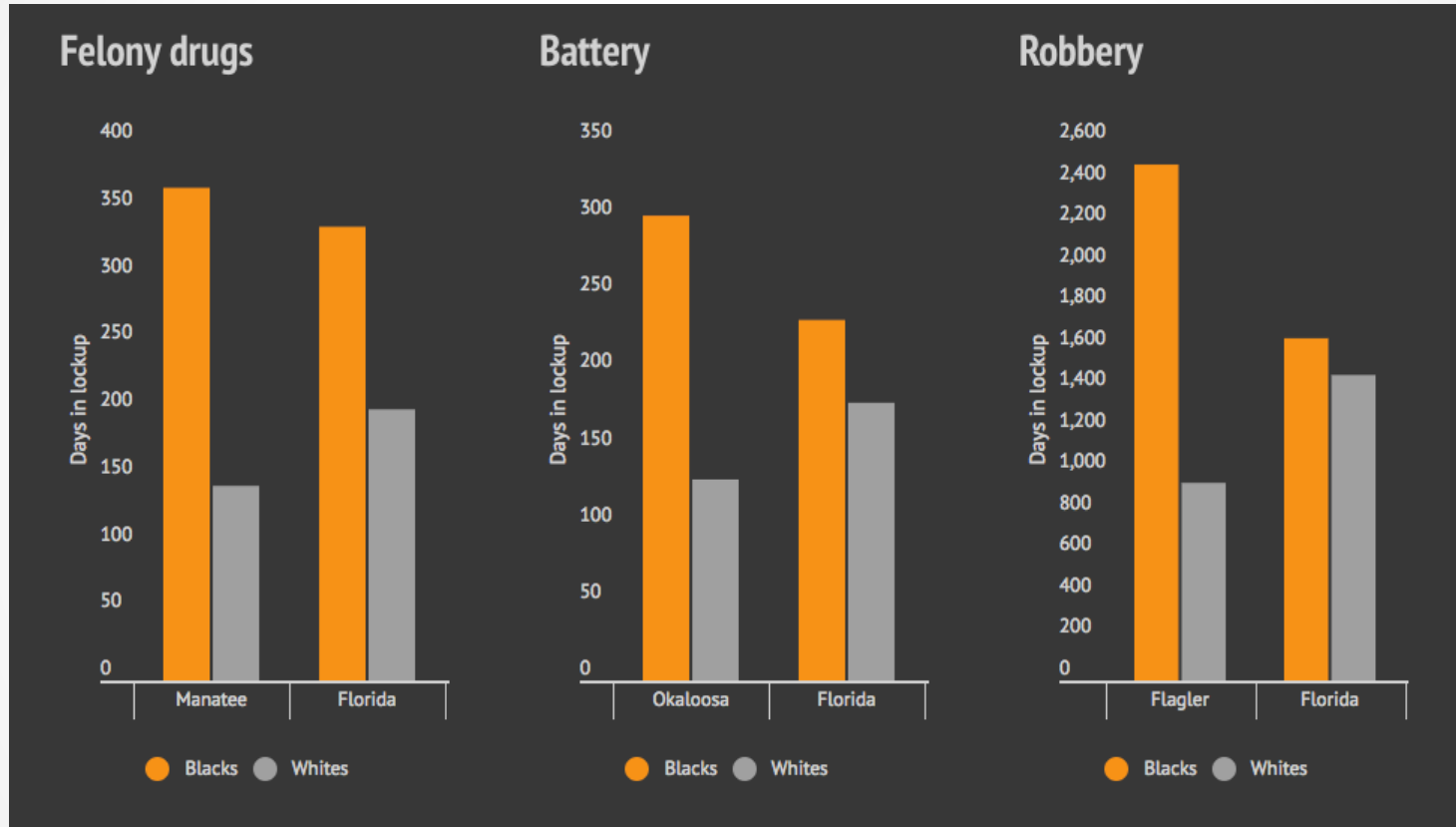


Figure 17.9: A hypothetical causal network relating student test scores to various educational policies and social conditions.

• A causal network. From *Statistical Modeling: A Fresh Approach* •

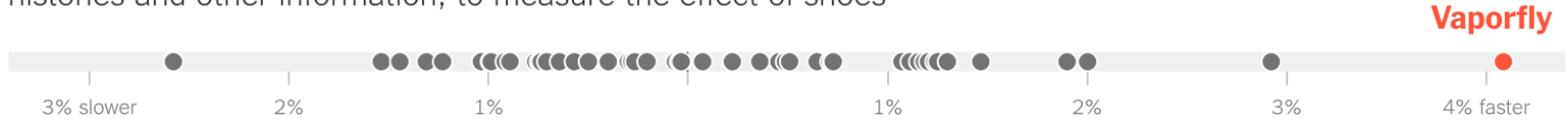
# Florida sentencing analysis adjusted for “points”



*Bias on the Bench*, Michael Braga, Herald Tribune

## How the Nike Vaporflys compare with other popular running shoes ...

When we use a statistical model, based on runners' ages, genders, race histories and other information, to measure the effect of shoes



When we compare changes in race times among groups of runners who ran the same pairs of races



When we measure finish times after runners switch to new shoes

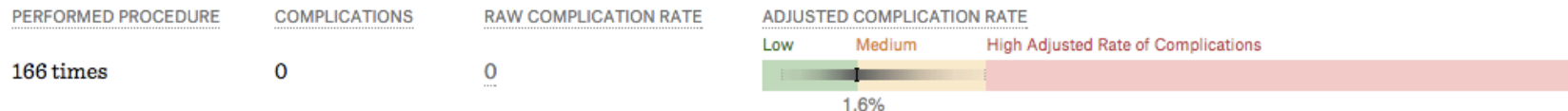


*Nike Says Its \$250 Running Shoes Will Make You Run Much Faster,*  
New York Times

# Knee Replacement

Replace diseased knee joint with an artificial knee. The most common reason for a knee replacement is osteoarthritis, which is a breakdown of the cartilage in the joint. [More information](#)

## WILLIAM MCGANN »



## EUGENE WOLF »



## WILLIAM MONTGOMERY »



## MICHAEL RIES »



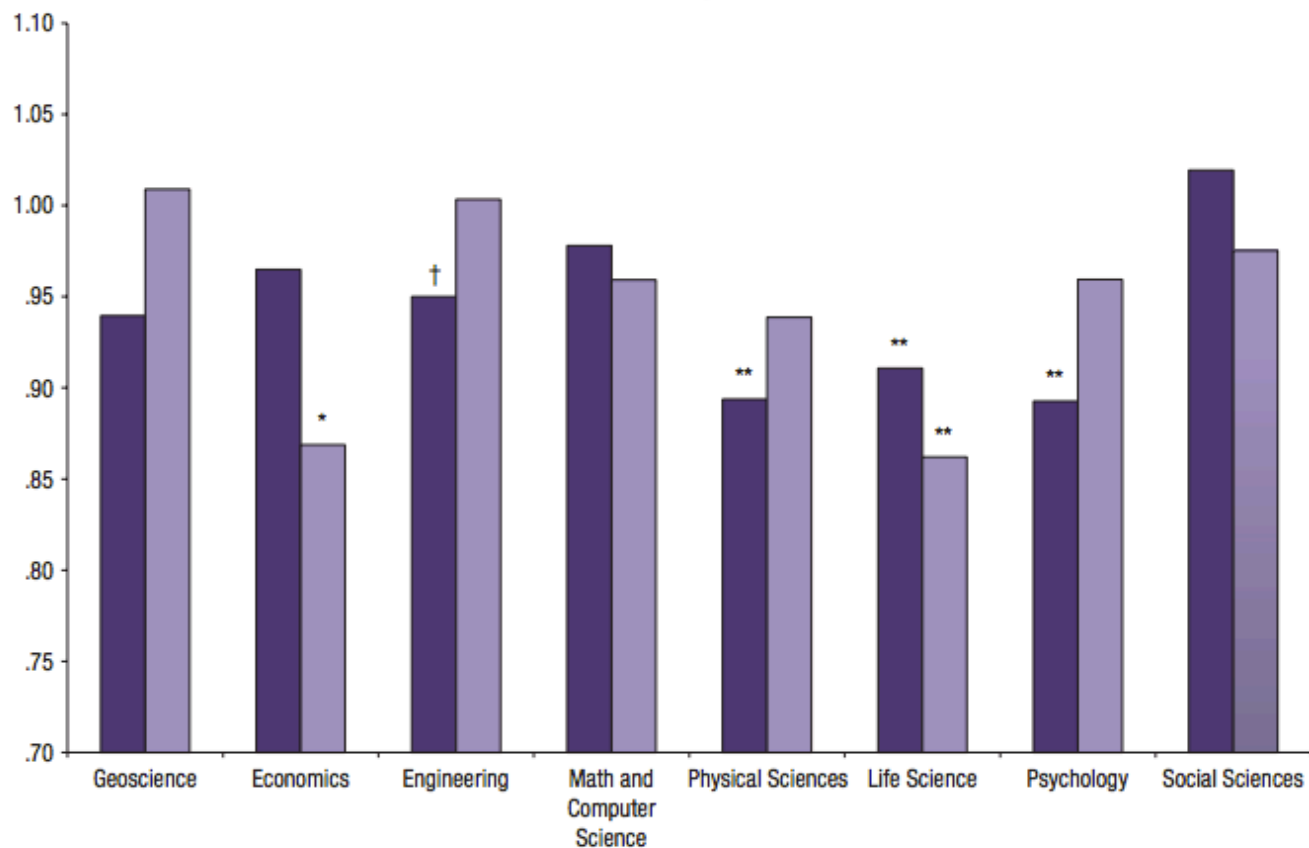
# Observation vs. Experiments

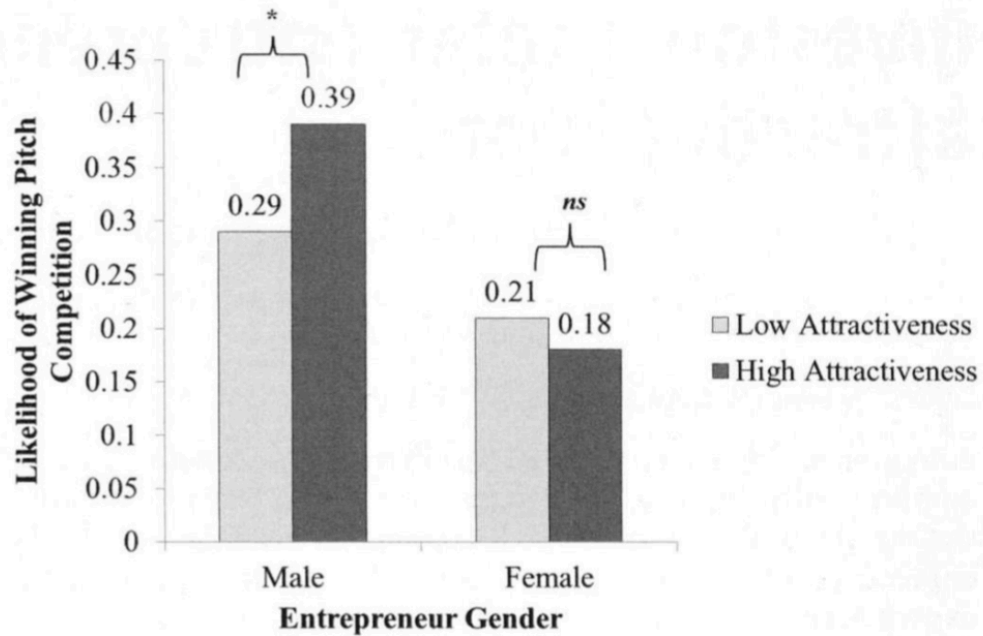
...



■ 1995 ■ 2010

### Female Assistant Professor Salaries as a Proportion of Male Salaries in 1995 and 2010





\*  $p = .042$

**Fig. 1.** The effect of entrepreneur gender and physical attractiveness on pitch success rate in a field setting ( $n = 90$ ). ns, not significant.

*Investors prefer entrepreneurial ventures pitched by attractive men,*

Brooks et. al. 2014

# Does Facebook news feed cause people to share links?

