# STAT 103 -Spurious Correlations

### **CAUSATION**

Causation indicates that one event is the result of the occurrence of the other event; i.e. there is a causal relationship between the two events. This is also referred to as cause and effect. Examples of causation:

- a. Working more hours at a job that pays a person hourly will cause that person to have a larger paycheck.
- b. As weather gets hot, people experience more sunburns.
- c. In cases of severe weather, there is more likely to be traffic accidents on the road.

## **Correlation and causation**

Most important takeaway from this chapter, and in life:

!!!! Correlation doesn't imply causation !!!!

# **Spurious Correlation**

In statistics, a spurious correlation (or spuriousness) refers to a connection between two variables that appears to be causal but is not. With spurious correlation, any observed dependencies between variables are merely due to chance or are both related to some unseen confounder.

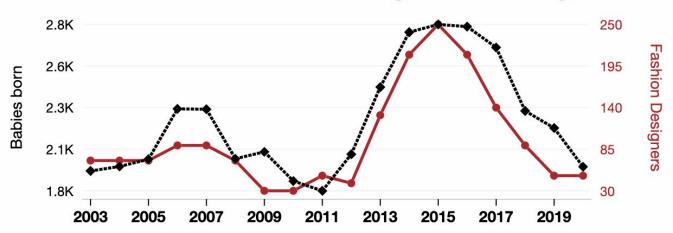
Spurious correlation are also important examples that correlation doesn't necessarily imply causation.

# Spurious correlations you never thought would exist. Correlation: r = 0.924

## Popularity of the first name Ariel

correlates with

## The number of fashion designers in Michigan



- ◆ Babies of all sexes born in the US named Ariel · Source: US Social Security Administration
- BLS estimate of fashion designers in Michigan · Source: Bureau of Larbor Statistics

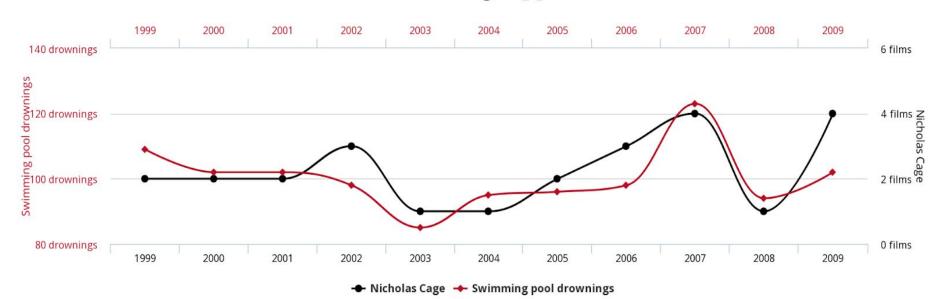
2003-2020, r=0.924, r<sup>2</sup>=0.854, p<0.01 · tylervigen.com/spurious/correlation/2985

# Time to launch a petition to ban Nicolas Cage to appear in a movie? Correlation: r = 0.666

## Number of people who drowned by falling into a pool

correlates with

## Films Nicolas Cage appeared in



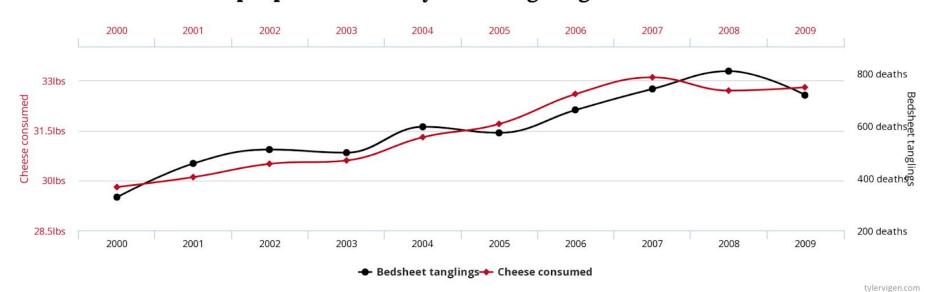
tylervigen.com

## Time to watch out on national cheese consumption? Correlation: r = 0.9471

#### Per capita cheese consumption

correlates with

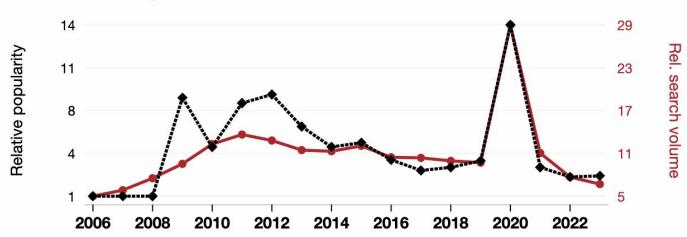
#### Number of people who died by becoming tangled in their bedsheets



## Popularity of the 'like a boss' meme

correlates with

## Google searches for 'how to cut own hair'



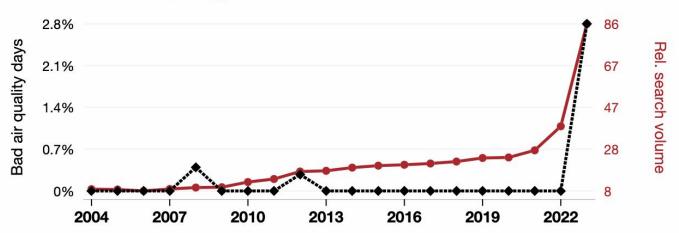
- ♣ Relative volume of Google searches for 'like a boss' (without quotes, in the United States) · Source: Google Trends
- Relative volume of Google searches for 'how to cut own hair' (Worldwide, without quotes) · Source: Google Trends

2006-2023, r=0.871, r<sup>2</sup>=0.758, p<0.01 · tylervigen.com/spurious/correlation/4994

### Air pollution in Appleton, Wisconsin

correlates with

## Google searches for 'ice bath'



- Percentage of days 'unhealthy' or worse air quality in Appleton, WI
  Source: Environmental Protection Agency
- Relative volume of Google searches for 'ice bath' (Worldwide, without quotes) · Source: Google Trends

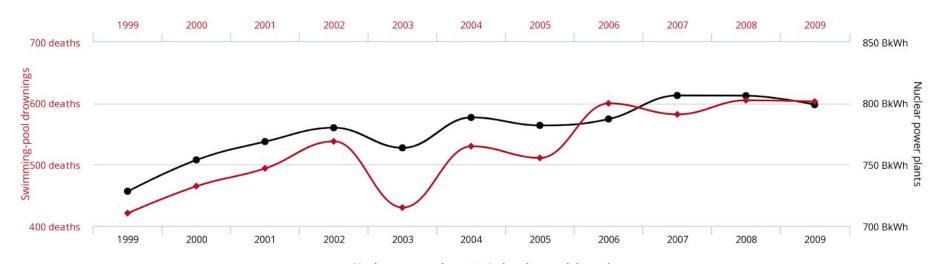
2004-2023, r=0.867, r<sup>2</sup>=0.752, p<0.01 · tylervigen.com/spurious/correlation/2867

# Don't worry you are not the only one thinking "How even?" Correlation: r = 0.9012

### Number people who drowned while in a swimming-pool

correlates with

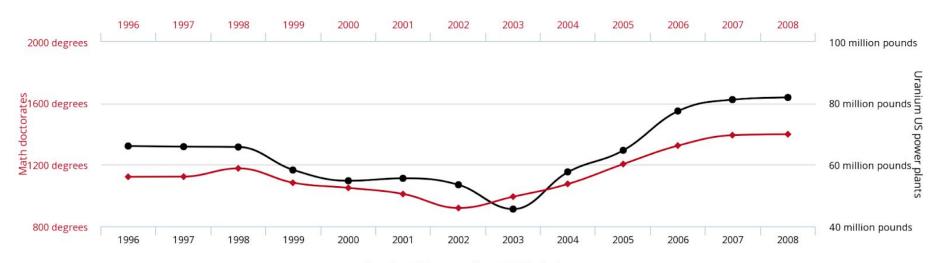
#### Power generated by US nuclear power plants



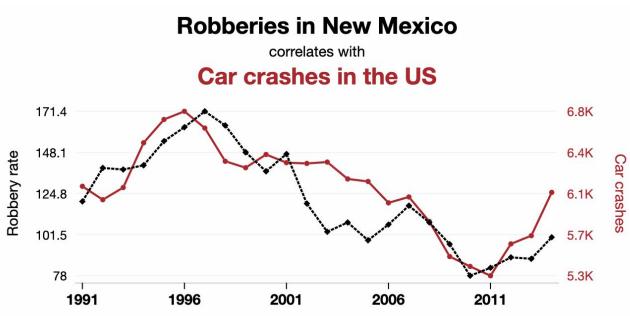
#### Math doctorates awarded

correlates with

## Uranium stored at US nuclear power plants



◆ Uranium US power plants ◆ Math doctorates

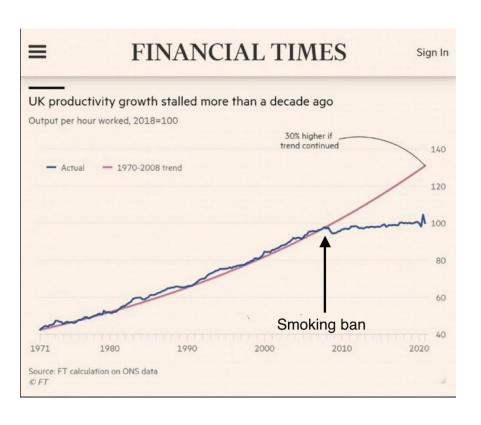


- •--- The robbery rate per 100,000 residents in New Mexico · Source: FBI Criminal Justice Information Services
- Total annual vehicle crash count in the US · Source: Statista 1991-2014, r=0.835, r²=0.697, p<0.01 · tylervigen.com/spurious/correlation/3981</p>

If you want to find more of these spurious correlations, you can visit:

https://www.tylervigen.com/spurious-correlations

# What do you think about this graph?



## **Answer:**

• Correlation doesn't imply causation.

• Smoking ban and stall in productivity are spurious correlations.

# **Closing thought:**

We successfully established that correlation doesn't imply causation, but what about the other way around?

Does causation imply correlation?

# **Causation implies correlation?**

Yes, it does. If one variables causes another, they surely must be correlated.