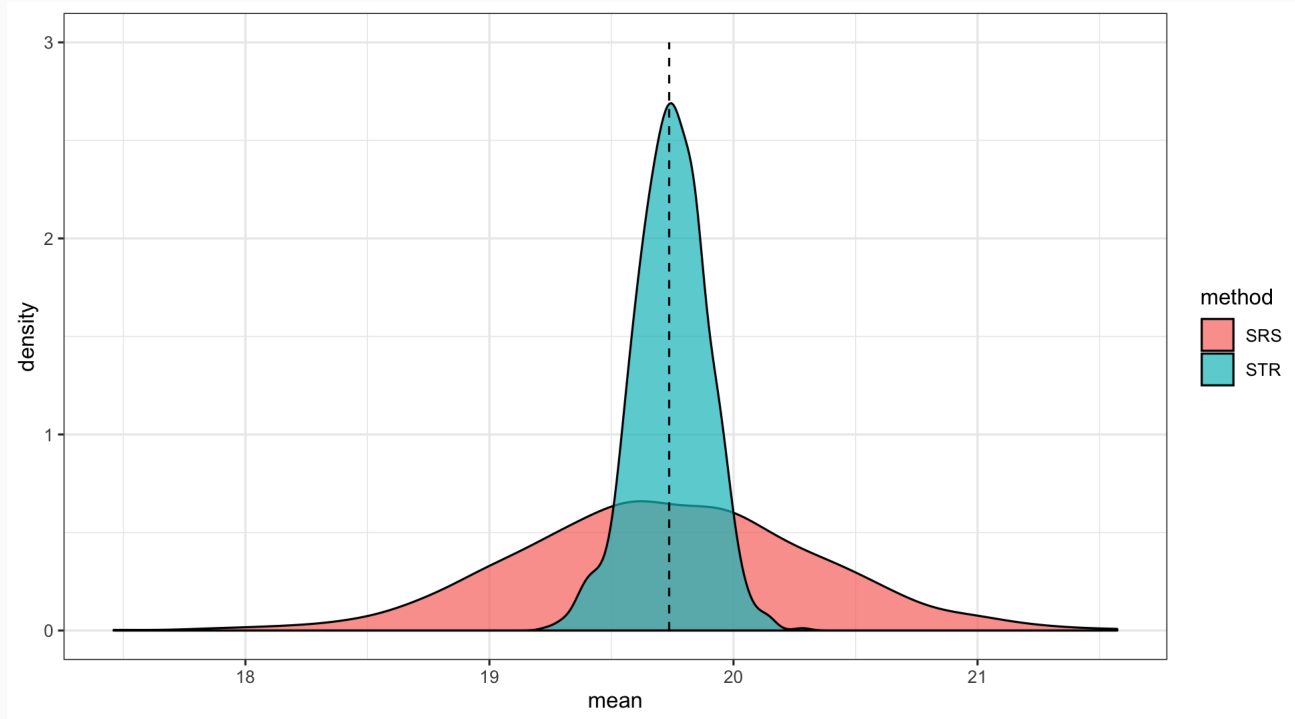


Experimental Design

```
teams <- c(rep("New York Yankees", 40),  
          rep("San Diego Padres", 40),  
          rep("Seattle Mariners", 40),  
          rep("Los Angeles Dodgers", 40))  
salary <- c(rnorm(40, mean = 25),  
            rnorm(40, 16),  
            rnorm(40, 23),  
            rnorm(40, 15))  
df <- data.frame(teams, salary)
```

Review: Sampling Strategies



Sampling Strategies

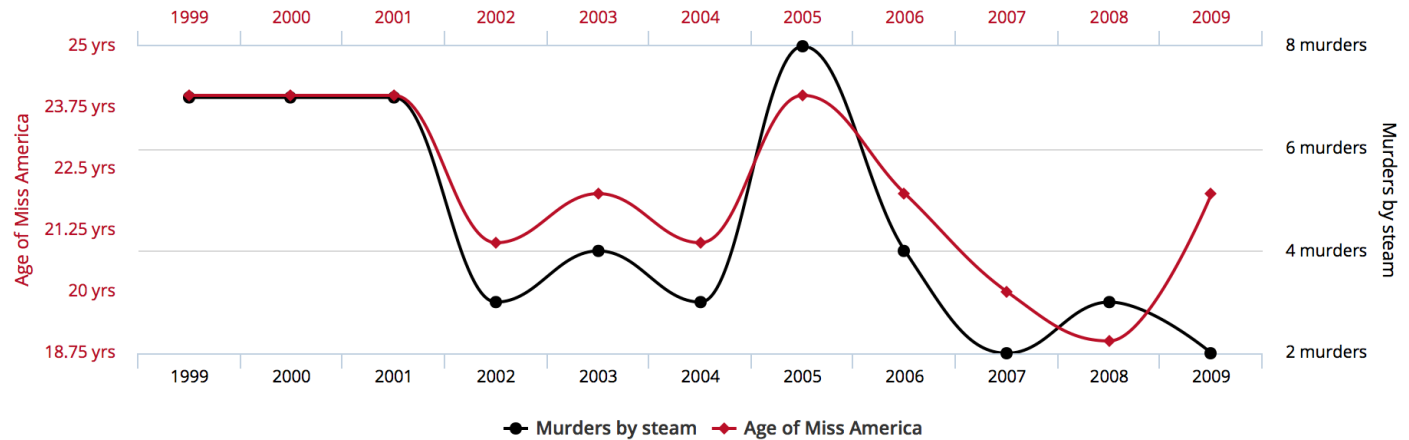
SRS: Unbiased, easy, but can be high variance.

Stratified Sampling: Divide population into strata that are *similar* within and *different* between. Draw SRS from within each strata.

Experimental Design

Age of Miss America correlates with Murders by steam, hot vapours and hot objects

Correlation: 87.01% ($r=0.870127$)



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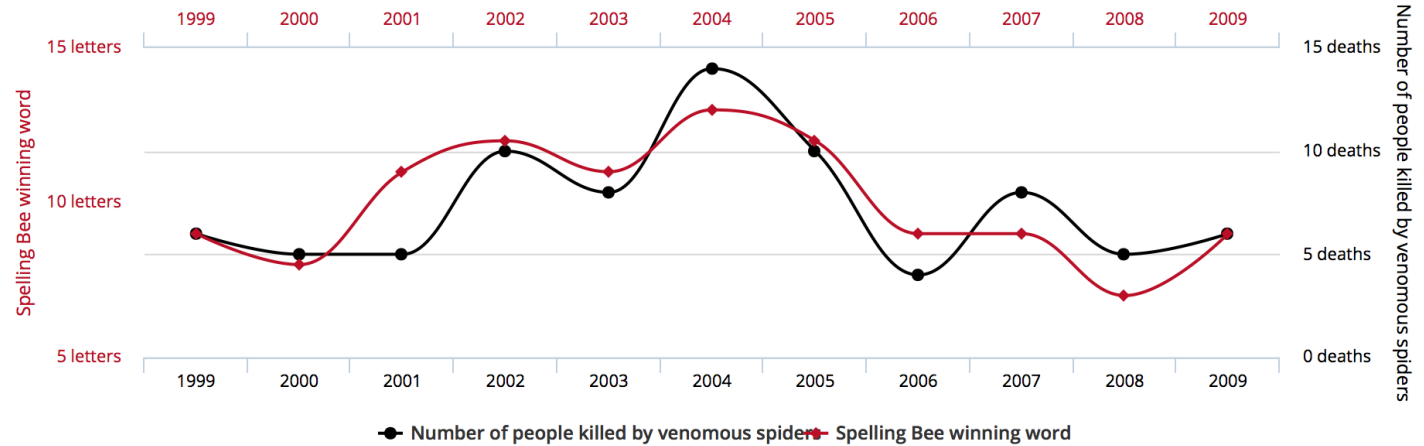
Data sources: Wikipedia and Centers for Disease Control & Prevention

Letters in Winning Word of Scripps National Spelling Bee

correlates with

Number of people killed by venomous spiders

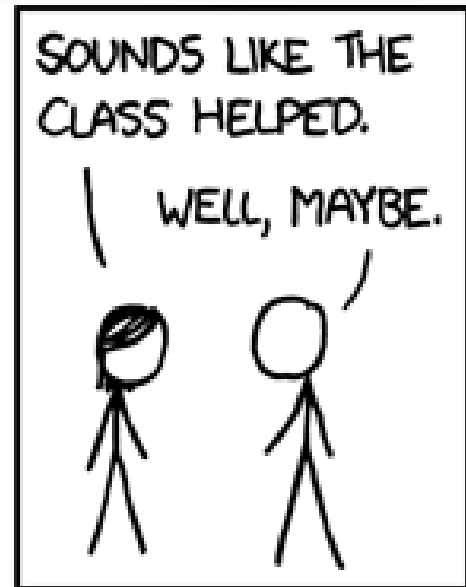
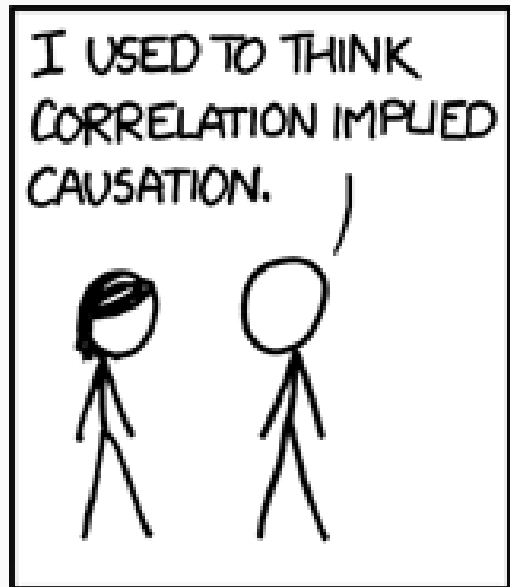
Correlation: 80.57% ($r=0.8057$)



Data sources: National Spelling Bee and Centers for Disease Control & Prevention

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If you learn one thing in this class...



Principles of Experimental Design

Control: Compare treatment of interest to a control group.

Randomization: Randomly assign subjects to treatments.

Replication: Within a study, replicate by collecting a sufficiently large sample. Or replicate the entire study.

Blocking: If there are variables that are known or suspected to affect the response variable, first group subjects into blocks based on these variables, and then randomize cases within each block to treatment groups.


Replication

SCIENCE


Many Psychology Findings Not as Strong as Claimed, Study Says


By BENEDICT CAREY AUG. 27, 2015

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The past several years have been bruising ones for the credibility of the social sciences. A star social psychologist [was caught](#) fabricating data, leading to more than 50 retracted papers. A top journal published [a study](#) supporting the existence of ESP that was widely criticized. The journal Science pulled a [political science paper](#) on the effect of gay canvassers on voters' behavior because of concerns about faked data.

Now, a painstaking yearslong effort to reproduce 100 studies published in three leading [psychology](#) journals has found that more than half of the findings did not hold up when retested. The analysis was done by research psychologists, many of whom volunteered their time to double-check what they considered important work. Their conclusions, reported Thursday in the [journal Science](#), have confirmed the worst fears of scientists who have long worried that the field needed a strong correction.

Blocking

A study is designed to test the effect of light level and noise level on exam performance of students. The researcher also believes that light and noise levels might have different effects on males and females, so wants to make sure both genders are represented equally under different conditions. Which of the below is correct?

1. There are 3 explanatory variables (light, noise, gender) and 1 response variable (exam performance)
2. There are 2 explanatory vars (light and noise), 1 blocking var (gender), and 1 response var (exam performance)
3. There is 1 explanatory var (gender) and 3 response vars (light, noise, exam performance)
4. There are 2 blocking vars (light and noise), 1 explanatory var (gender), and 1 response var (exam performance)

Other key ideas

Placebo: fake treatment, often used as the control group for medical studies

Placebo effect: experimental units showing improvement simply because they believe they are receiving a special treatment

Blinding: when experimental units do not know whether they are in the control or treatment group

Double-blind: when both the experimental units and the researchers do not know who is in the control and who is in the treatment group

Consider acupuncture



How do you test if acupuncture reduces pain?

"Sham acupuncture" is a good control.

Practice

1. Find a partner nearby and introduce yourself.
2. Discuss the problems on the handout and record your thoughts.