

Experimental Design

Deep learning allows cheap prediction for political voting of neighbourhoods: Trucks (republicans) versus cars (democrats). Political surveys are expensive!

<http://www.pnas.org/content/114/50/13108.full>

Article on the bias in medical publishing (Ben Goldacre):

<https://trialsjournal.biomedcentral.com/articles/10.1186/s13063-019-3173-2>

Are statin a waste of time?

This is an excellent synopsis of an article that questioned conventional medical wisdom. It also links to a 'dictionary' of common experimental design terms in medicine.

<https://www.nhs.uk/news/heart-and-lungs/study-says-theres-no-link-between-cholesterol-and-heart-disease/>

Review:

Observational:

- Can identify associations between treatment and response
- Nature assigns treatments to subjects ie. QTL experiments
- Worry about **confounding variables** which mask or distort the causal relationship between variables ex.: ice cream and crime

• Experimental:

- **Researcher assigns treatment** (at least two treatments)
- Advantage of experimentation derives from **random assignment of treatment** to units
 - Randomization allows decreased influence of confounding variables
 - Can identify **causes** of association

Some violations in data can be corrected but some can't be (*bias due to non-random sampling*)*

Prevention is best!

- And even when you can correct it, it is hard (under very specific conditions, when you can gather more data that isn't biased and compare it to the suspected bias and, sometimes, 'machine learning'.....)

The design of the experiment spells success or failure

Elements of design:

- Experimental units
 - Patients in a medical trial
 - Plots in a field

- Treatments assigned to units
 - Drugs assigned to each patients
 - Application of different wheat varieties

Experimental artifact: a bias in measurement produced by unintended consequences of experimental procedures (white coat syndrome)

Types of Experimental Design:

- Clinical trial
 - an experimental study in which two or more treatments are applied to human subjects
 - “Gold Standard” - mistakes are **expensive**
- Laboratory/field experiments
 - Conducted on non-human subjects

Goals of experiments:

determine how explanatory variable (treatment) affects response variable

- **Eliminate Bias**
 - Controls
 - Random Assignment to Treatment
 - Blinding
- **Reduce Sampling Error**
 - Replication
 - Balance
 - Blocking
 - Extreme Treatments