Nutritional policy design: insights from the lab

Session 1A: Why experiments? Theory, relevance, principles

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UniMi, Nov 20th, 2025

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Can you really say that intervention X caused effect Y?

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Correlation does not imply causation.

$A \sim B$ could imply:

- causality! $A \Rightarrow B$

Correlation $\neq$ causation

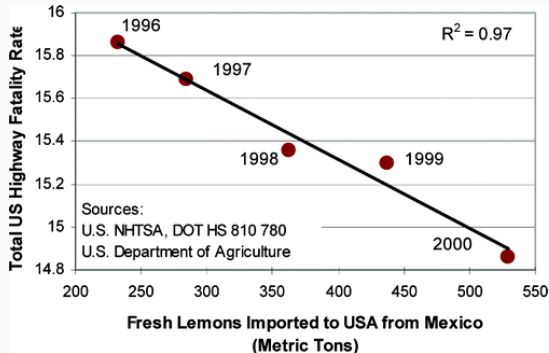*Correlation does not imply causation.*

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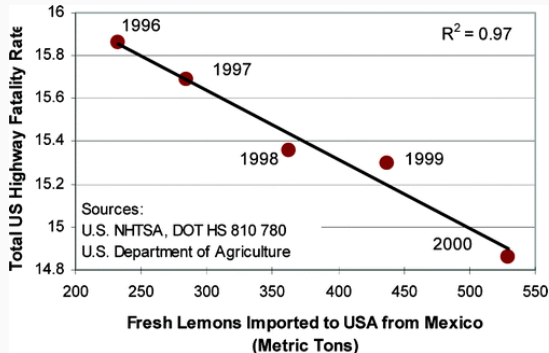- no causality: a spurious correlation

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- a common **unobserved** cause: $C \Rightarrow A$ and $C \Rightarrow B$ but $A \not\Rightarrow B$

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Is it **deaths** ⇒ *lockdowns* or **lockdown** ⇒ *deaths*?

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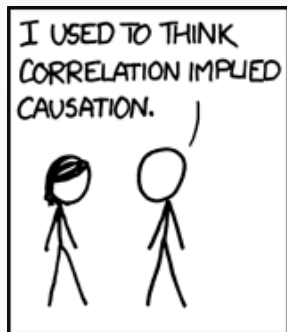
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United States Web Search activity for **italian wedding soup** and **furnace repair** (r=0.9220)

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If the world does not accord with you, you are wrong, not the world. [and that's fine. we learn.]

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Control is also called internal validity: being sure that you are actually testing what you think you are.

Relevance is also called external validity: being sure that what you do matters for the problem at hand

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- Measure must follow some standards (loi Carrez)
- Both observation and measure must be **replicable**

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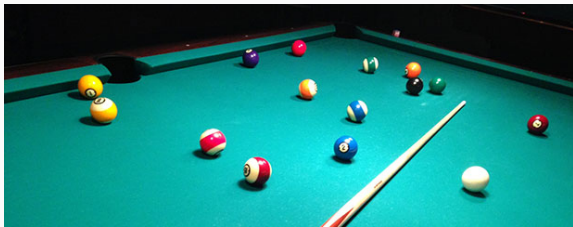
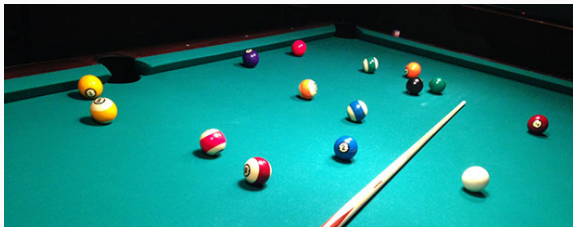## Experiments: Testable hypotheses

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- because you will **always** find something...

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Figure 1: A pool game with infinite balls: you always score, the point is *which one*?
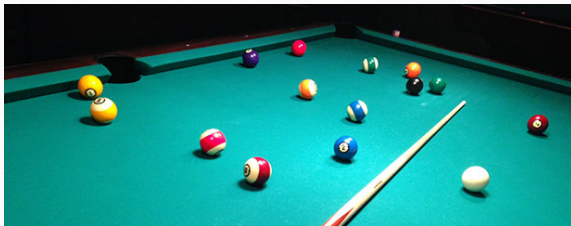
Figure 1: A pool game with infinite balls: you always score, the point is *which one*?

If you try hard enough, you always find something

- especially with the huge amount of data available today
- especially if you test *n* hypotheses on the same data
- especially if you look for subgroups, special cases...
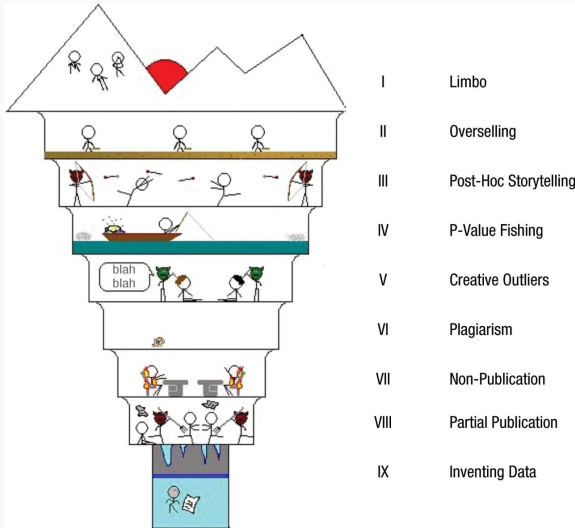
source: Nine circles of scientific hell (also on Github)

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  Internal validity is the basic minimum without which any experiment is uninterpretable: Did in fact the experimental treatments make a difference in the experimental instance?

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- (note that things get worse for questionnaires: it is *free* to lie / misreport / make mistakes)
- Possible solutions: give appropriate incentives; prove behavior is unchanged as incentives change.

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- and these cannot be generalized

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Selection bias is the selection of individuals, groups or data for analysis in such a way that proper randomization is not achieved, thereby ensuring that the sample obtained is not representative of the population intended to be analyzed [source: Wikipedia]

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You expose 50 consumers to a questionnaire on their use of electricty. Turns out the most used means of transport is the bike, and 30% have photo-voltaic cells on their roofs. You meant the sample to be random, but due to word of mouth 78% of subjects come from a group of activists of the green party.
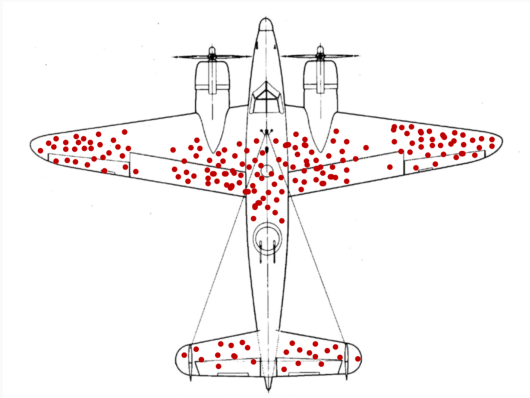
- selection effects can lead to biased and false claims
- selection is everywhere: **you** a random sample of the student population
- if you have selected subjects, you only observe *conditional* probabilities
- and these cannot be generalized
- solution: randomize, use large numbers, pay attention!

WW2 UK bomber planes

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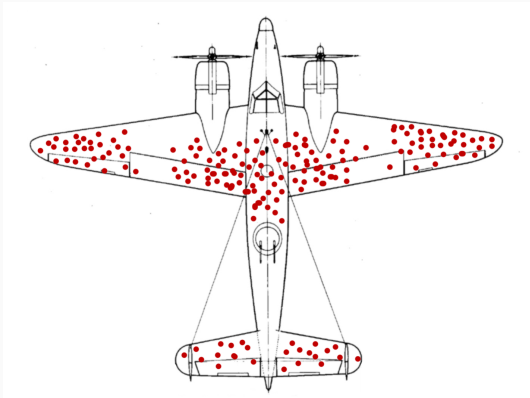
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Where would you add armor?

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- credibility is key: beliefs guide actions and all we can observe are actions (and not beliefs!)

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- (example: die roll)

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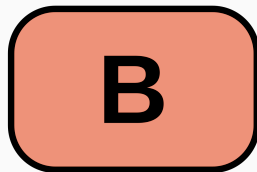- Within: same subject is exposed to all treatments (needs less data, order effects)
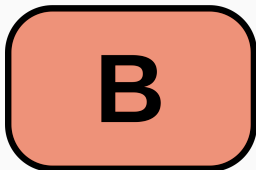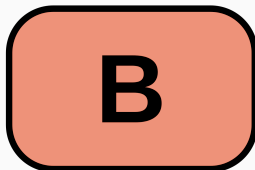
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Good scientists try as hard as they can to prove themselves wrong

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- more...
- if *one* of the ifs above is not fulfilled *then* you can arguably have *low* external validity

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Get as far away from reality as possible and near to theory

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- if the test is non-contextual then it is in principle stronger

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- from which we deduce the need for replication

That's the theory. But in practice?

Economics as a non-experimental science
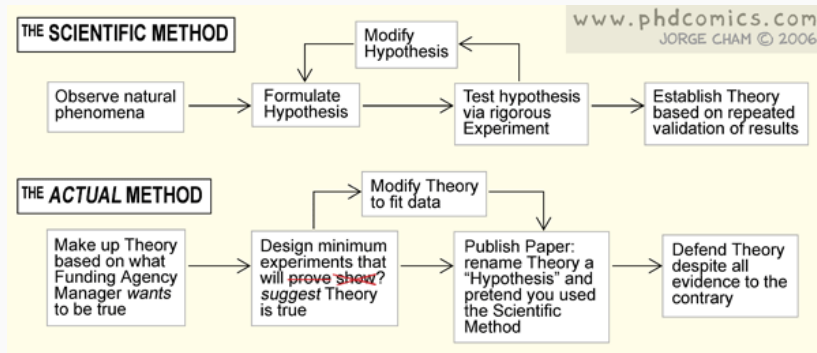
The economic world is extremely complicated. There are millions of people and firms, thousands of prices and industries. One possible way of figuring out economic laws in such a setting is by controlled experiments.

A controlled experiment takes place when everything else but the item under investigation is held constant. Thus a scientist trying to determine whether saccharine causes cancer in rats will hold "other things equal" and only vary the amount of saccharine. Same air, same light, same type of rat. Economists have no such luxury when testing economic laws. They cannot perform the controlled experiments of chemists or biologists because they cannot easily control other important factors. Like astronomers or meteorologists, they generally must be content largely to observe.

Samuelson, Paul A., and William D. Nordhaus, 1965

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Still, it is possible and there are things to be learned

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Different types of experiments

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Lab: the experimenter takes full control and *recreates the setting in a lab*; synthetically creates a control group and a manipulation, and sees details [this is the gold standard in the hard sciences]

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Example (Crime rate decline in the US and abortion laws)
According to Steve Levitt (book: Freakonomics) the legalization of abortion in the US reduced crime 20 years later. How can he prove it? via a natural experiment. Some US states legalized abortion before the others – and saw earlier declines. Moreover some states made it harder than others to perform an abortion – and in those states crime declined less. [more details on the video]

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But can it be generalized to other patients? other settings? slightly different drug? not really..

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Control vs. Randomization

- All is controlled, synthetic, recreated in perfect (from the point of view of the theory) conditions
- Only allocation to treatment or control is randomized

Experimental Economics: peculiarities

ExEc is the use of the experimental method in economics

- Usually relies on simple abstraction of real problems (k.i.s.s – *keep it simple, stupid!*)
- Usually does *not* trust subjects to tell the truth unless properly incentivized to do so
- Usually relies on giving full knowledge to participants
- Never lies and always tells subjects the truth, *never deceiving them*

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We go at great length to create incentive-compatible mechanisms

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Common knowledge levels the playing field

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Experimental Economics: credibility and the ban on deception

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Lying is usually the fastest route; no deception means hard work, but more trustworthy result

KEEP CALM

it's

QUESTION

TIME