Natural Experiments

Overview and Applications

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Today's Agenda

Natural Experiments

- **Overview**: What natural experiments are and why we should care.
- **Application #1**: Physical appearance and elections.
- **Application #2**: Income redistribution.
- **Application #3**: Origin of banking systems.

Overview

Overview

The *nature* of *natural* experiments

- What's so "***natural***" about **natural experiments**?
  - It's all about the **"*nature*" of the treatment**:
    - These experiments are ***not*** "**designed/implemented**" by the researcher (**?**)
      Examples.
    - Treatment assignment is "**unknown**" ***and*** "**unknowable**" to the researcher (**?**)
      Examples.
- If you can't design one, and are unsure about the treatment, and the treatment doesn't depend on you, **how do *you* study causal effects using one?**

Overview

Randomization devices and unconfoundedness

- The ***only*** **way to ensure unconfoundedness** is via a "**randomization device/procedure**" (**?**)
  - A **set of rules** that allows the researcher to **assign the treatment** according to a ***known*** "**probability function**" (**?**)
  - What does a **"known probability function" ensure?**
  - Notice that the **researcher** must be able to **identify** the **probability distribution**, why**?**

Overview

Defining a natural experiment

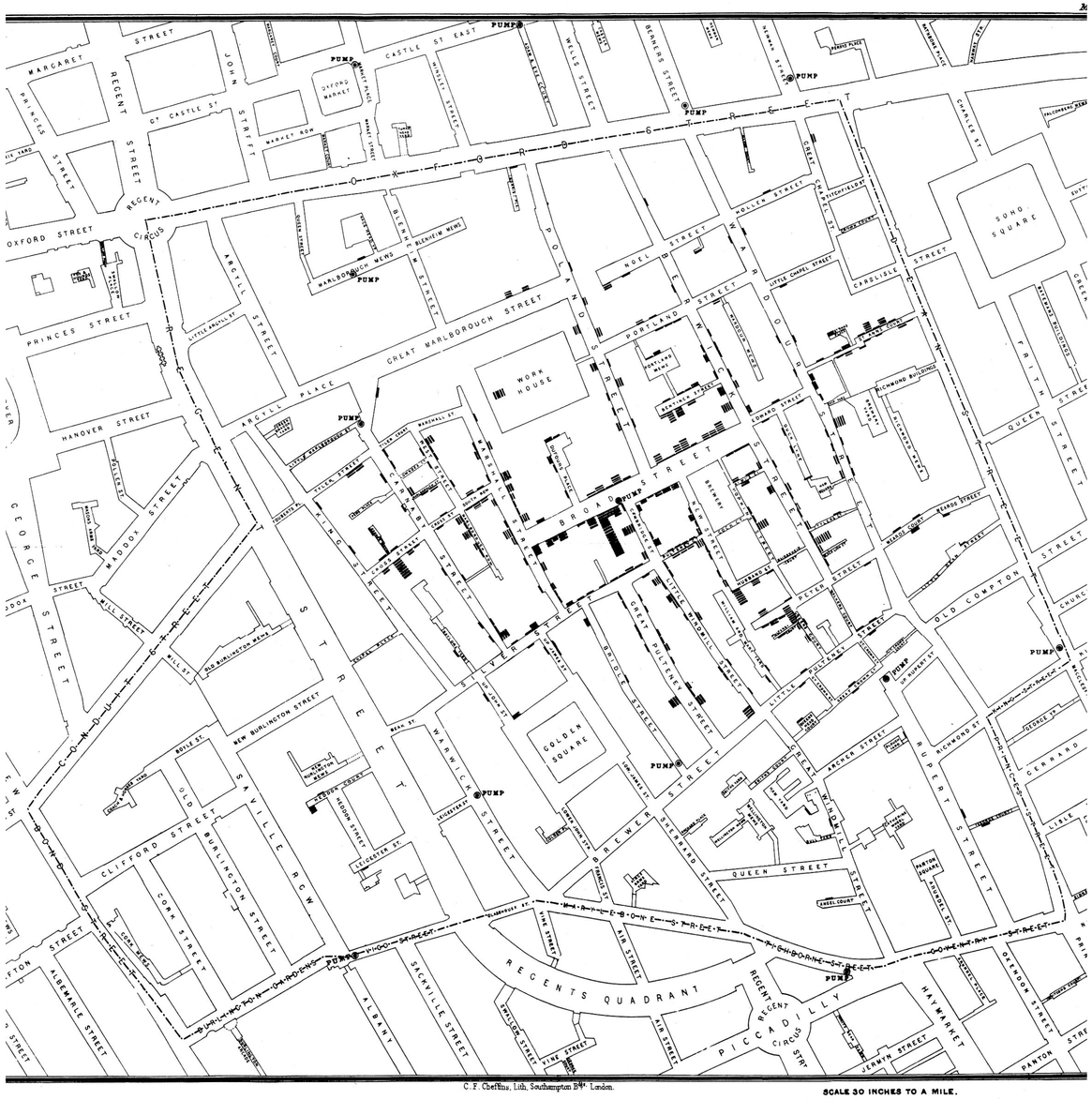
Randomization mechanism:

✓Is not designed/implemented by the researcher.

✓Is probabilistic by virtue of an external “device.”

✓Is unknown and unknowable.

◉ **What’s this map?**



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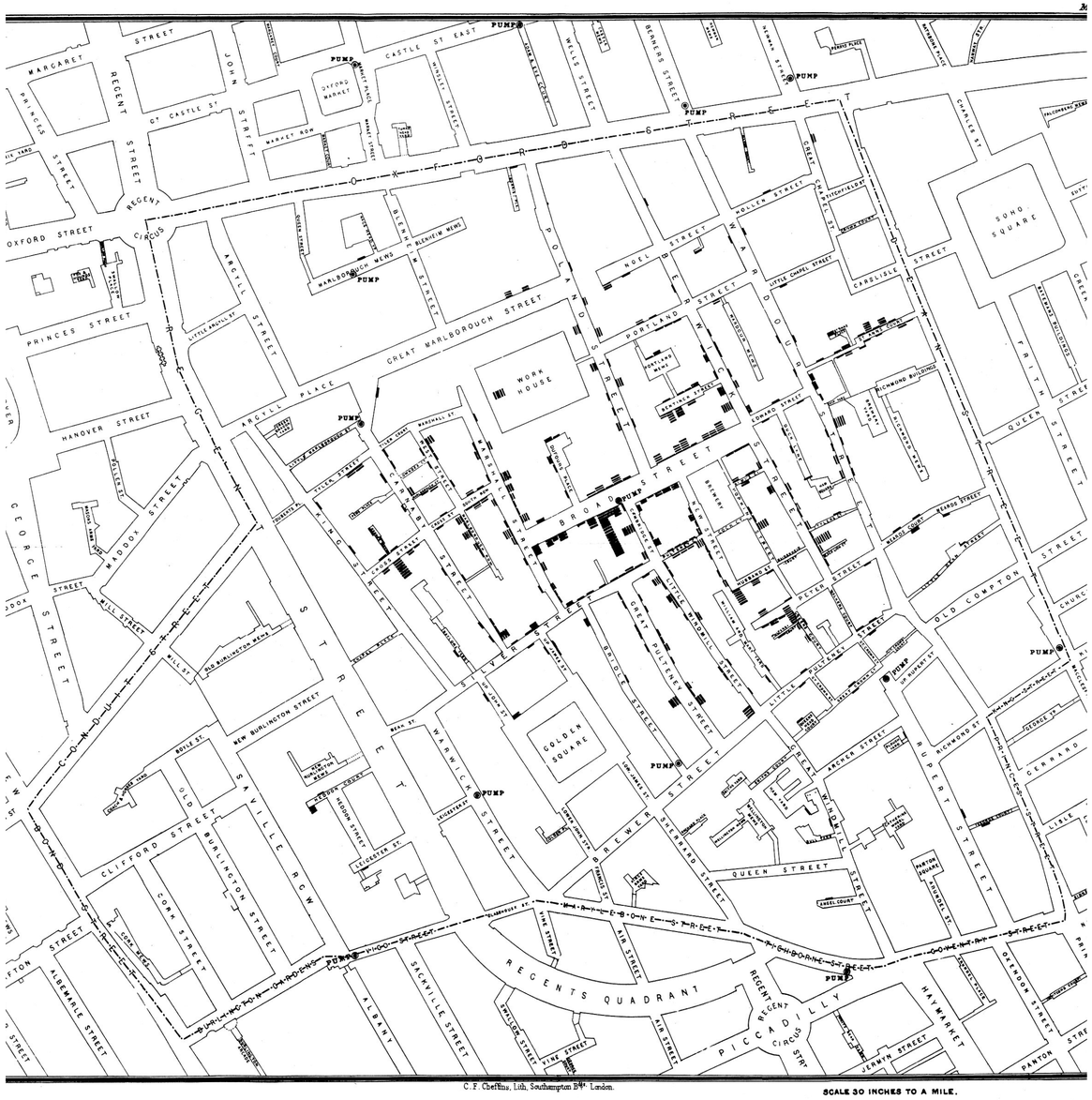
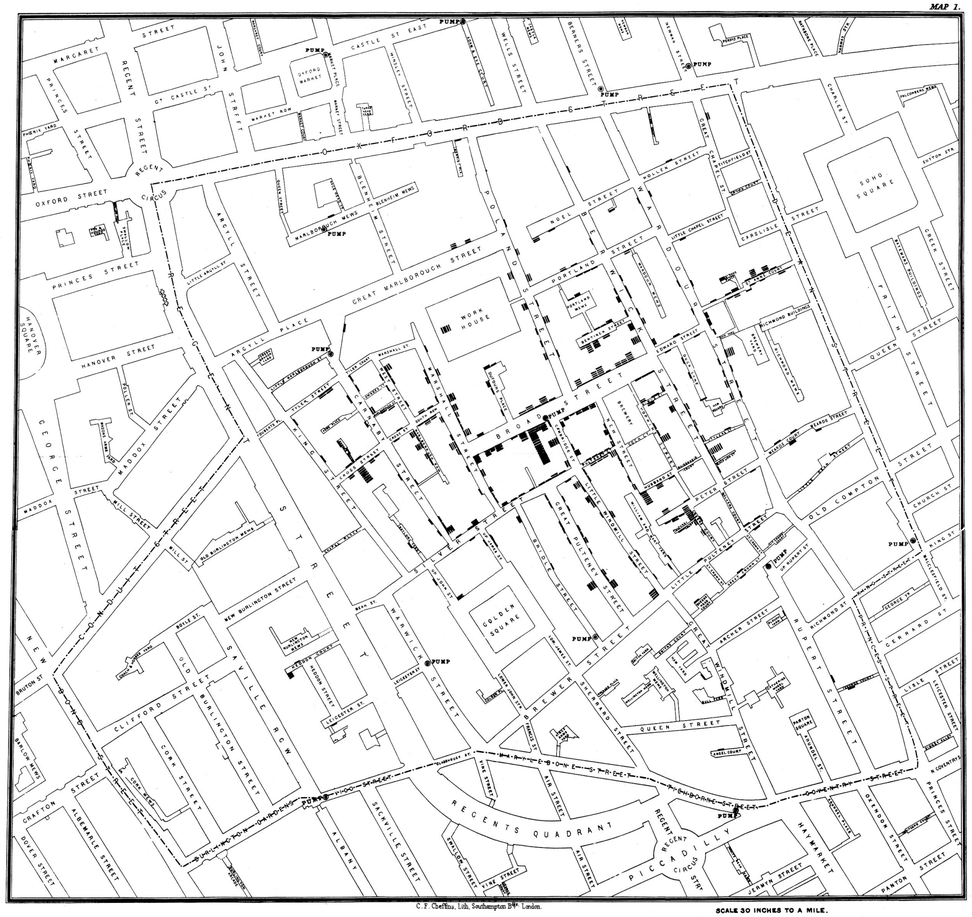


John Snow's map showing the clustering of cholera cases in Soho during the London epidemic of 1854

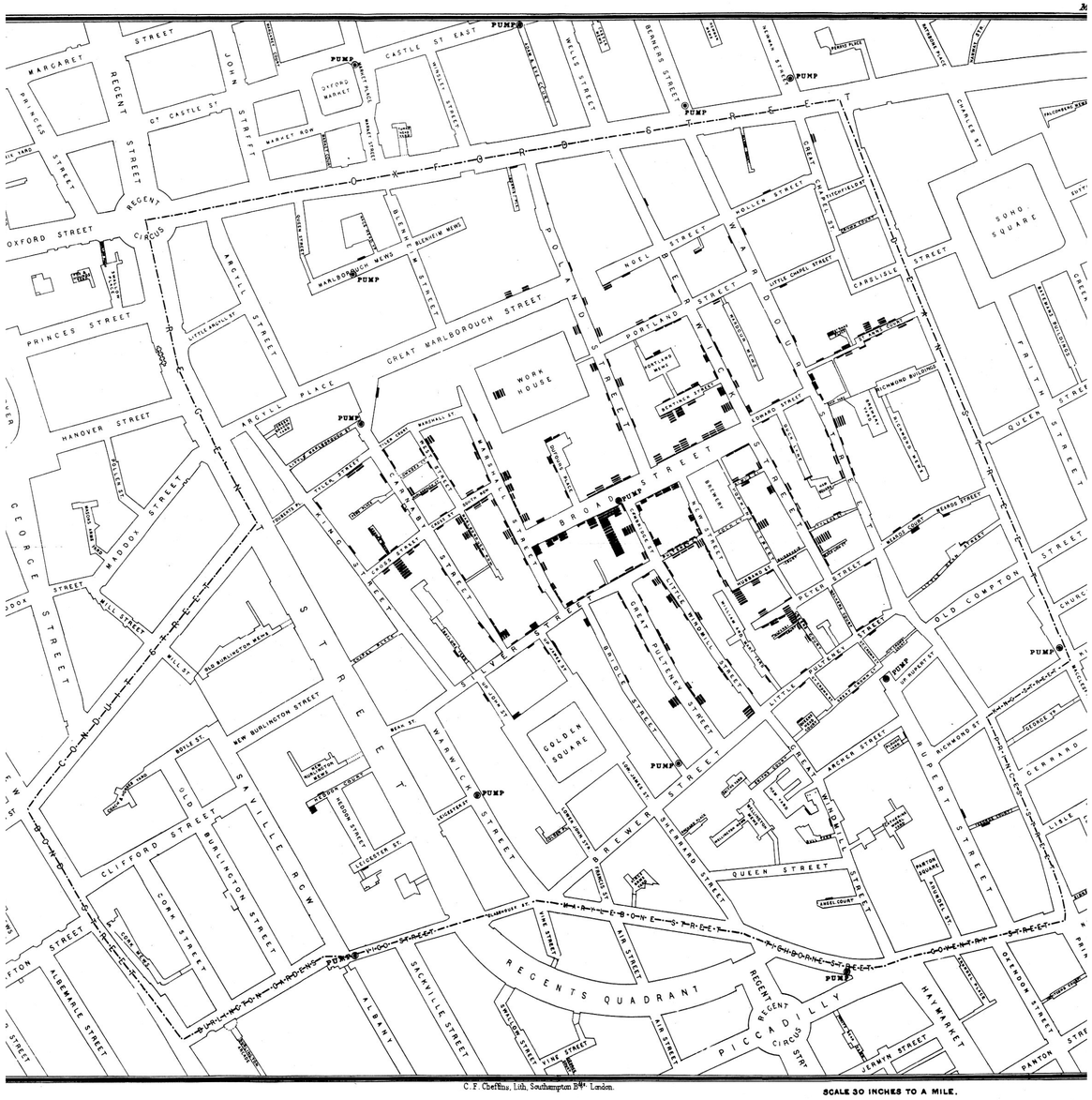
What *cause*s cholera?

A study of water supply and miasma in London, 1854



Overview

Was Snow’s design a natural experiment?



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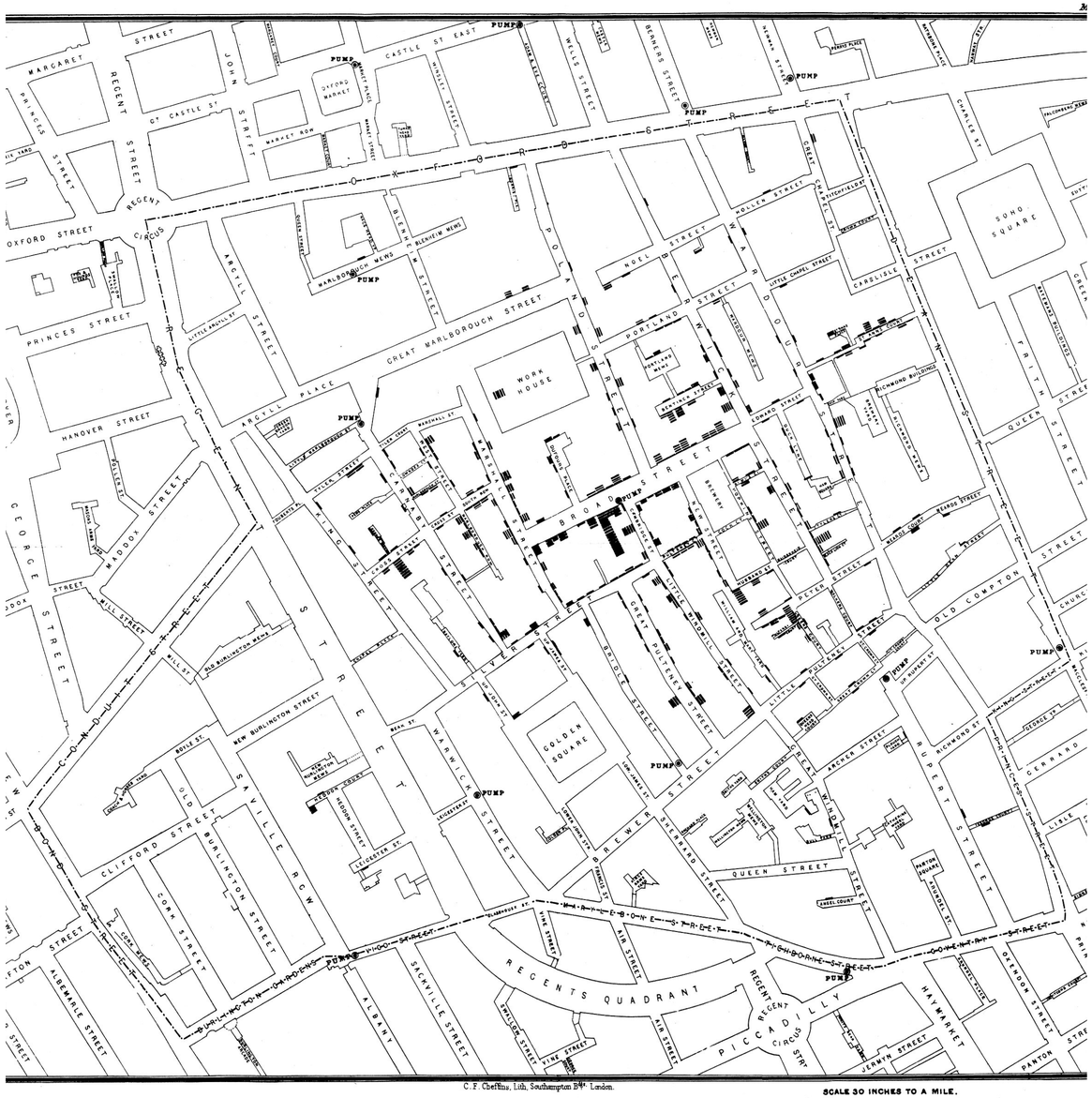
Overview

Was Snow's design a natural experiment?

Randomization mechanism:

- **Was it designed/implemented by the researcher?**
- **Was it probabilistic by virtue of an external "device"?**
- **Was it unknown and unknowable?**



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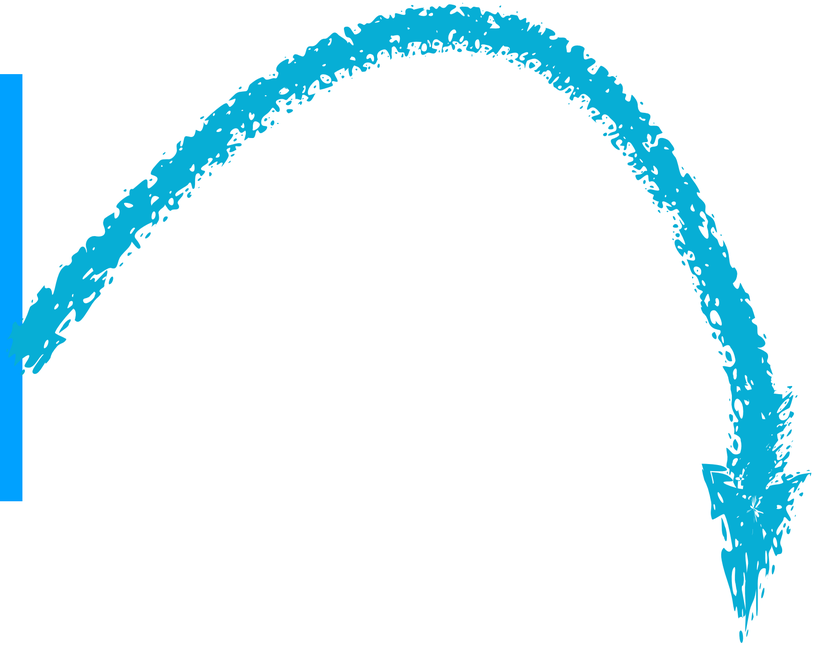
In a natural experiment […] the researcher finds some intervention that has been implemented and also finds some subjects. She then constructs a treatment and control groups to address a particular hypothesis. But the treatment and control groups are constructed *post hoc*.

Since unconfoundedness is unguaranteed



Natural Experiments are a subclass of "observational study" (?)

$$(Y(0), Y(1)) \perp\!\!\!\perp T \mid X$$

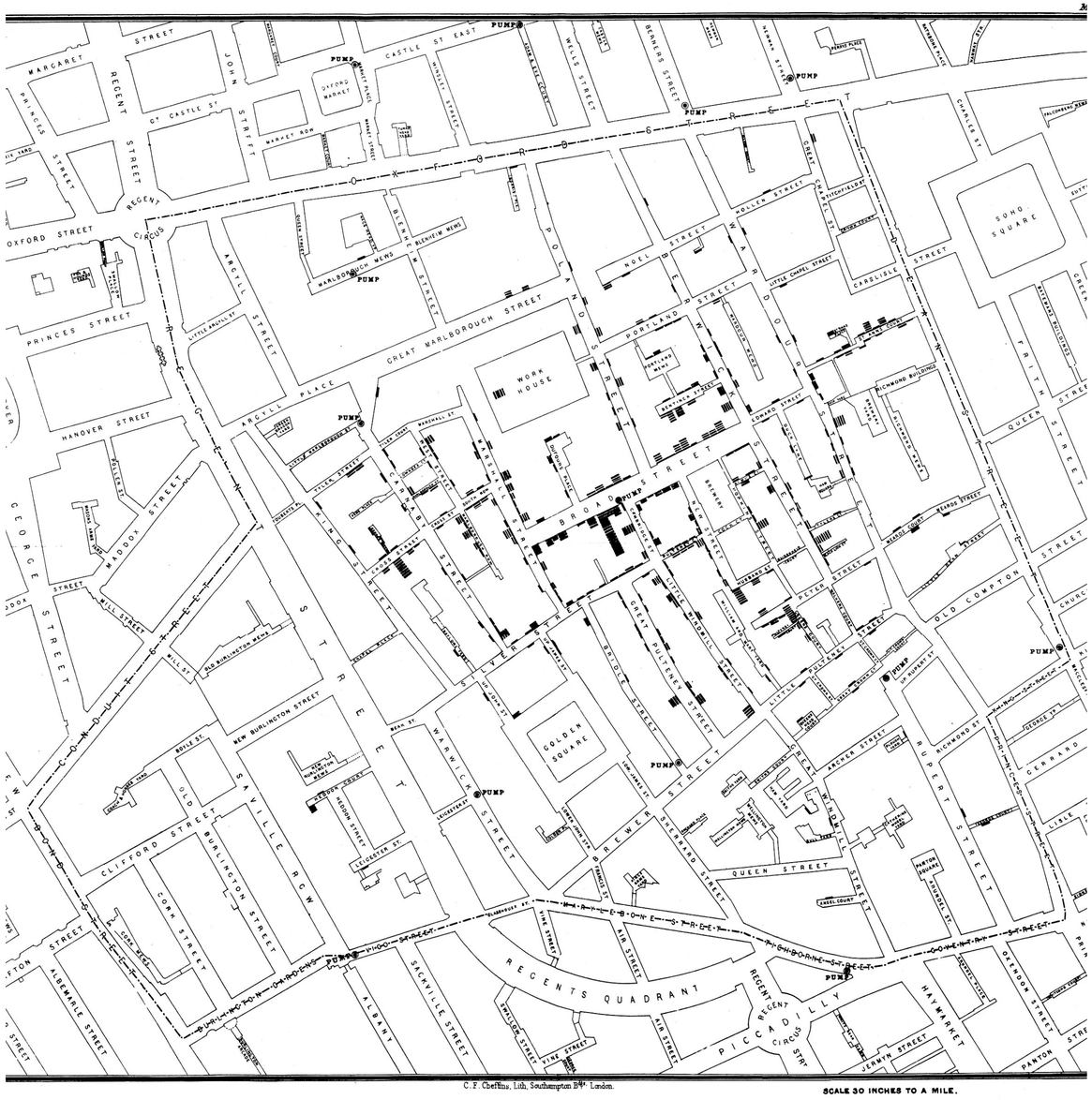
Overview

Natural experiments: A subclass of observational study

If certain assumptions hold, we can **claim** we have a natural experiment.

Randomization mechanism:

- Is not designed/implemented by the researcher.
- Is probabilistic by virtue of an external “device.”
  Researcher must <u>persuade</u> us.
- Is unknown and unknowable.
  Researcher must <u>persuade</u> us



John Snow's map showing the clustering of cholera cases in Soho during the London epidemic of 1854

"Various forms of quantitative and qualitative evidence, including detailed knowledge of the process that led to treatment assignment, must be used to evaluate the claim [of '*as-if random*']"

“Natural experiments” are then caused by social and political forces (not “natural” ones). They are not true experiments (they are a sub-class of observational studies). Then “natural experiments” are neither “natural” nor “experiments."

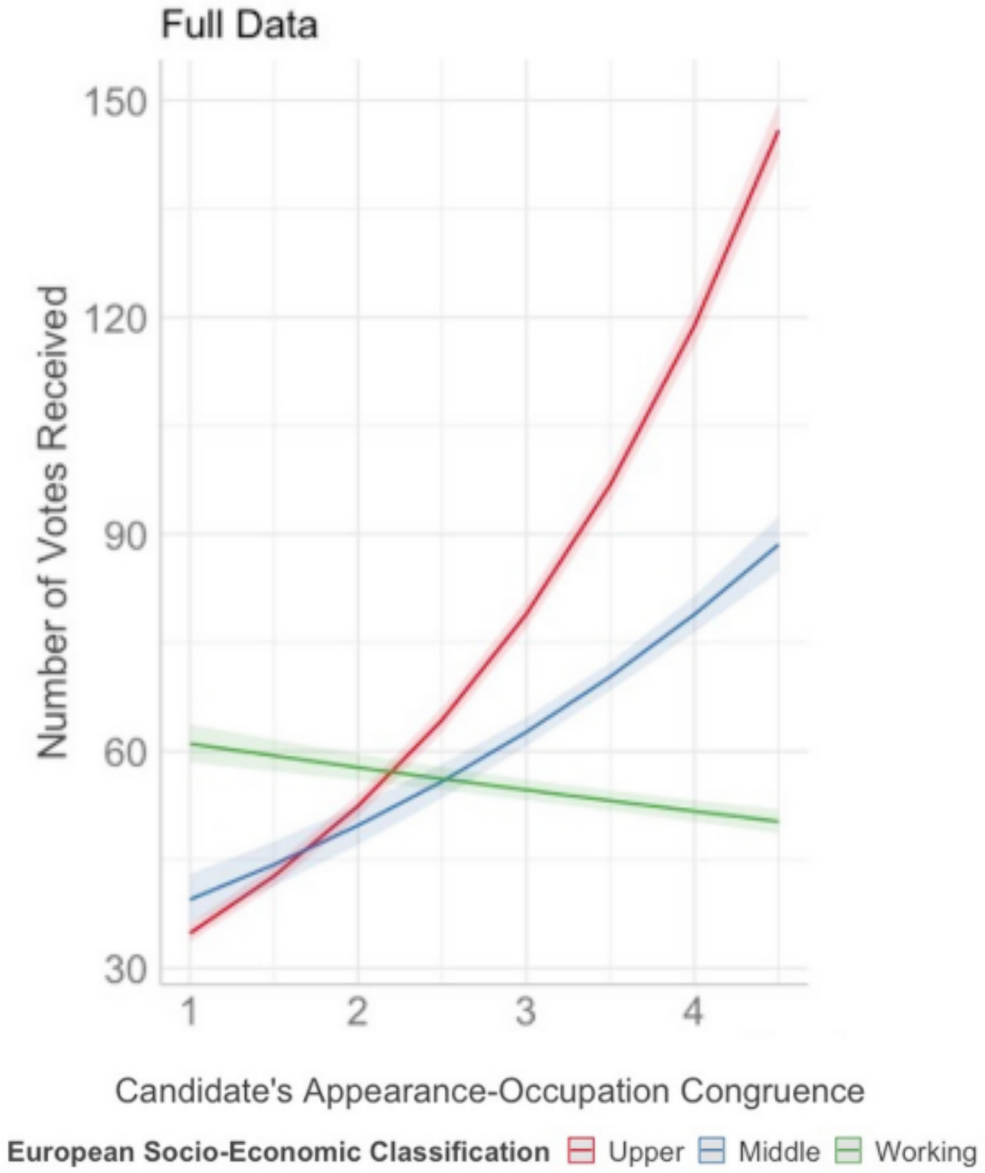
Physical Appearance and Elections

Application #1

Elections

Overview

- **Gist**: What do the authors find**?**
  - Working-class **appearance** negatively affects the number of **votes** received in Finnish municipal elections.
    This relationship affects *only* female candidates.
- Is this a natural experiment**?**
  Is there any randomization process, and if so, what's being randomized?
- Is this design "better" than a non-experimental (i.e. purely observational) design**?**
  Think of a survey.



Elections

Design: empirical advantages

What's to like about this piece? **Possible** *as-if* random assignment of "physical appearances" to political candidates.

- What do the following features achieve**?**
  - Extensive usage of **public posters** as the ***only*** means of campaigning.
  - The design exploits a **real situation**, with **real outcomes** and **actual behavior**.

Elections

Design: what could go wrong?

- You can see the authors **are really trying** to make the case that:

  1. There was ***no*** "**omitted variable bias**" (**?**)

     - **Assumption** that there is no "**private information**" (i.e. "gossip effects").
       Voters get "treated" *only* with posters (and no other alternatives sources of campaigning).

       - What could happen if there is **private information?**

       - Do the authors **solve** this potential **source of omitted variable bias?**

  2. There was ***no*** "**self-selection bias**" (**?**)

     - Only attractive individuals could **self-select** into political campaigning.
       What do the authors say?

Income Redistribution

Application #2

Income Redistribution

Overview

- **Gist**: What do the authors find**?**
  - **Lottery money**:
    1. **Increases hostility** towards **taxation**.
    2. **Increases hostility** towards **redistribution**.
    3. **Does not affect** attitudes concerning **socio-economic stratification**.
- Is this a natural experiment**?**
  What's being randomized?
- Is this design "**better**" than a non-experimental (i.e. observational) design**?**
  Think of a survey.

Income Redistribution

Design: empirical advantages

What's to like about this piece? **Income** is **widely used** in social sciences. However, **income is never random**. In fact, income is usually **correlated** with something else. In this design, however, we can ask a super interesting question:

Does randomly assigned income causally change attitudes towards redistribution?

What's neat about this piece is that:

- Lotteries *are* **random.**
- Authors exploit amount of the prize (i.e., ***continuous*** **non-binary treatment**).

Income Redistribution

Design: what could go wrong?

Is this piece perfect, though? What could go wrong?

- You can clearly see the authors struggled with the following:
  - "**Demand bias**": the authors had to **interview** prize winners and **ask them directly** about their **attitudes towards redistribution**.
    What could go wrong here?
  - "**Sample attrition**": ***some*** prize winners **did not want to be interviewed**.
    Is that a problem?
  - **Different *marginal utilities* of prize winners**: Does the same dollar awarded satisfies you the same, regardless if you are poor or rich?
  - **Importantly:** are lottery gamblers' attitudes comparable to non-gamblers?

Origin of Banking Systems

Application #3

Origin of Banking Systems

Motivation

- Some countries have a lot of banks, some others have just a few.
  Why care**?**
  - More banks means wider access to credit.
    More market competition, lower interest rates, wider access to credit, less inequality.

- This piece explains that countries "***treated***" with **democracy** incentivize the development of the banking system, as opposed to "***control***" countries that remain **undemocratic**.

Origin of Banking Systems

Setup

- As in any experimental setup, it is important to claim "**covariate balance**" (**?**).
- What does the author do to claim (*some*) covariate balance**?**
  - "[the United States, Brazil, and Mexico] ***All three*** countries began their existence as independent nations without preexisting banking systems because their colonial powers did not permit the chartering of banks. ***All three*** obtained independence within a few decades of one another, and ***all three*** new governments needed banks in order to finance their operations."
- If you notice, "**natural experiments of history**" do ***not*** necessarily require numbers or stats.
  It relies on a reasonable narrative.

Origin of Banking Systems

Causal Mechanism

- In natural experiments of history, the analyst finds and justifies what might be a **necessary condition to observe the effects of a treatment**.
- In this case, these are:
  - "**conditions** [that] are associated with political institutions that simultaneously **limit the authority** and discretion of public officials, allow the users of credit the **right to vote**, and provide the owners of financial assets with the ability to **veto the redistributionist urges of voters**."
    Examples of such institutions?
  - **A democratic constitution and a democratic Congress**. Why**?**
    - These are institutions **spread political power** among people (non-elites), **reducing the probability of expropriation**.
    - **Since these institutions spread power, they also limit initial monopolies, allowing market competition (good for borrowers)**.

Origin of Banking Systems

Causal Mechanism

- Direct implication:
  - Countries that failed to implement such institutions: **no incentives to open up banks (fear of expropriation)**.
    Less banks, less access to credit, only the wealthy can invest, more inequality (Brazil and Mexico).
  - Countries that succeed at implementing such institutions: **if property rights are in place**, there is no fear of expropriation.
    More banks, more access to credit, investment is widely spread out, less inequality (U.S.).

Thus, in natural experiments of history, the analyst finds a case, and justifies a “treatment”

What can go wrong?

Since the analyst does not control the treatment, this is no different than an observational study

Treatment, control, and treatment assignment are justified in a narrative way

Natural Experiments
Discussion

- Today we reviewed one natural experiment where nature randomly assigned physical appearances. One lottery study (with a known probability distribution). And one “natural experiment of history.”
- **Typical natural experiments** are excellent tools to observe whether the treatment has any effect on the sample of interest.
- Unfortunately, while questions tend to be **relevant**, they can be **too narrow and too local**:
  - **The effect of introducing co-payments for malaria mosquito netting**.
  - **Changes in electoral rules on ethnic voting**.

    These are interesting questions, but **not the type of big questions** social scientists traditionally used to ask.
  - Thus, a possible critique is that these questions and findings do ***not*** “**aggregate into broader knowledge**.”

Thank you