



Correlation is
not Causation

Experimental
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Pros and Cons
of Experiments

Types of
Experiments

Exercise

Recap

Researching Crime and Criminal Justice

Week 10: Experiments

Jose Pina-Sánchez



Lecture Aims

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- To refute the common misconception of correlation = causation
- To introduce experimental designs

- Question: Is this evidence of vaccines causing autism?



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- Question: Is this evidence of vaccines causing autism?



- Question: What about this?
 - Is this evidence of science progress increasing suicide rates?
 - Is cheese consumption associated to deaths by bedsheets entanglement?
 - Is Nicolas Cage to be blamed for latest deaths by drownings in the US?

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- Correlation is a necessary but not sufficient condition for causation
 - For X to cause Y both events need to be correlated, X needs to precede Y in time, and they need to share a connection

Correlation \neq Causation

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- Correlation is a necessary but not sufficient condition for causation
 - For X to cause Y both events need to be correlated, X needs to precede Y in time, and they need to share a connection
- Spotting the lack of connection between people drawn and the number of films featuring Nicolas Cage is easy
 - In many other cases it is much harder to spot that



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- Correlation is a necessary but not sufficient condition for causation
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- Spotting the lack of connection between people drawn and the number of films featuring Nicolas Cage is easy
 - In many other cases it is much harder to spot that
- While exploring the CSEW some of you have come across interesting associations/correlations
 - Crime victimisation is higher in urban areas
 - Crime victimisation is lower for married than for single people
 - Previous burglary victimisation is related to current fear of crime



Problems with Cross-Sectional Designs

- Lots of correlations/associations between events that seem causally connected put forward in the literature
 - Male offenders (X) receive harsher sentences (discriminated?) than female offenders (Y)
 - Decentralised countries (X) tend to control corruption more effectively (Y)
 - Procedural justice (police-citizen encounters managed with fairness) (X) enhances perceptions of police legitimacy (Y)

Unidirectional Causality

$$X \longrightarrow Y$$

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Unidirectional Causality

$$X \longrightarrow Y$$

- However, if that evidence is non-experimental (e.g. if it is derived from a cross-sectional survey) we should be very suspicious



Problems with Cross-Sectional Designs

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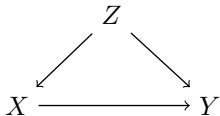
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Confounding Effects



Problems with Cross-Sectional Designs

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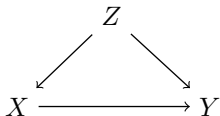
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Confounding Effects



- Question: Can you spot the confounding effect (Z) in the following relationships?
 - Sleeping with shoes on is strongly correlated with waking up with a headache
 - People wearing big shoes tend to have more car accidents
 - One glass of wine a day is good for your health

Problems with Cross-Sectional Designs

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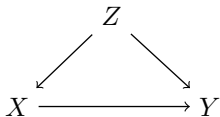
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 - Decentralised countries tend to control corruption more effectively



Problems with Cross-Sectional Designs

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Reverse Causality



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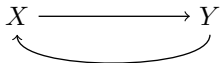
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Reverse Causality



- Question: Can you think of potential reverse causal mechanisms present in the following relationships?
 - High personal income (X) can buy better quality healthcare, which leads to better individual health (Y)
 - Police-citizen encounters managed with fairness (procedural justice, X) enhance public perceptions of police legitimacy (Y)
 - Probability of a demonstration becoming violent (X) affects the number of police officers allocated to control it (Y)



Alternatives to Cross-Sectional Designs

- It is often impossible to disentangle these issues using cross-sectional data
 - Remember not to over-claim when presenting your findings
 - And when presented with causal findings obtained using cross-sectional data, be very suspicious

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Alternatives to Cross-Sectional Designs

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- It is often impossible to disentangle these issues using cross-sectional data
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- We can try to overcome these issues using more complex designs
 - Longitudinal designs: involve following subjects across time
 - They allow us to shed light on the temporal order of associations
 - They are still affected by confounding factors
 - Experimental designs: involve comparing similar samples before an after...
 - subjects in one group receive an ‘intervention’ (treatment group) but not in the other (control group)
 - Considered the gold standard method to explore causal effects
 - Still affected by other important limitations



The Logic Behind Experiments

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- ① Take a representative sample from the population of interest
- ② Divide your sample in two groups selected at random (aka control and treatment groups)
- ③ Carry out an intervention (aka treatment) in one of the groups; ideally double-blinded
- ④ Compare the difference between the treatment and the control group



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Question: Why do you think groups are selected at random?

Question: Why the need for interventions to be 'double-blinded'?



Pros and Cons of Experiments

- Advantages
 - The key strength is that randomisation removes confounding effects
 - In addition, since the intervention is controlled we can observe the causal direction and the specific effect of a particular factor
 - As a result, causal conclusions have high internal validity: we can infer causal effects from statistical correlations
 - That's why they are the cornerstone of the scientific method
- Question: What do you think their disadvantages are?

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- Advantages
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 - Question: What do you think their disadvantages are?
 - Findings from experiments can be 'unrepresentative' (low external validity) and/or 'artificial' (ecological validity)
 - Can only be used to test pre-established hypotheses, i.e. purely deductive
 - Cannot illustrate trajectories of change (missing non-linear effects, tipping points, etc.)
 - They are difficult to implement in the Social Sciences
- Question: Why do you think that is the case?

Experiments in the Sciences

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Recap

- Experiments are the cornerstone of the scientific method
- Used predominantly in the Natural Sciences: Chemistry, Physics, Life Sciences, etc
- Within the Social Sciences they are also often used in Psychology and sometimes in Economics
- Rarely used in Politics, Sociology or Criminology
- Alternative designs approximating the conditions of experiments slowly becoming popular



Types of Experiments

- Controlled experiments & randomised controlled trials
 - Random groups
 - Precise and clearly defined interventions and outcome measures
 - Double-blinded
 - The former take place within a lab
 - The latter under real world conditions

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Recap

- Controlled experiments & randomised controlled trials
 - Random groups
 - Precise and clearly defined interventions and outcome measures
 - Double-blinded
 - The former take place within a lab
 - The latter under real world conditions
- Field experiments
 - Approximate the standards of controlled experiments
 - But often cannot meet all of them
 - An intervention is designed by the research team
 - Normally the control and treatment group are not identical
- Natural experiment (aka quasi-experiments)
 - For many questions, randomised experiments are not feasible
 - We then have to rely on observational studies
 - Researchers do not control the assignment of conditions to subjects
 - Involve comparisons in time or across areas



Exercise 1. Experiments

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Recap

- Identify the types of experiments used in each of the following three articles (abstracts in the next slides)
 - Olken (2007) ‘Monitoring corruption: Evidence from a ##### in Indonesia’. *Journal of Political Economy*, 115, 200-249
 - Pina-Sánchez and Linacre (2014) ‘Enhancing Consistency in Sentencing: Exploring the Effects of Guidelines in England and Wales’. *Journal of Quantitative Criminology*, 30, 731-748
 - Anderson et al. (2003) ‘Exposure to violent media: The effects of songs with violent lyrics on aggressive thoughts and feelings’. *Journal of Personality and Social Psychology*, 84, 960-971



Abstract 1 (Olken, 2007)

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This paper presents a randomized experiment on reducing corruption in over 600 Indonesian village road projects. I find that increasing government audits from 4 percent of projects to 100 percent reduced missing expenditures, as measured by discrepancies between official project costs and an independent engineers' estimate of costs, by eight percentage points. By contrast, increasing grassroots participation in monitoring had little average impact, reducing missing expenditures only in situations with limited free-rider problems and limited elite capture. Overall, the results suggest that traditional top-down monitoring can play an important role in reducing corruption, even in a highly corrupt environment.



Abstract 2 (Pina-Sánchez & Linacre, 2014)

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Abstract

Objectives The development and application of methods to assess consistency in sentencing before and after the 2011 England and Wales assault guideline came into force.

Methods We use the Crown Court Sentencing Survey to compare the goodness of fit of two regression analyses of sentence length on a set of legal factors before and after the assault guideline came into force. We then monitor the dispersion of residuals from these regressions models across time. Finally, we compare the variance in sentence length of equivalent types of offences using exact matching.

Results We find that legal factors can explain a greater portion of variability in sentencing after the guideline was implemented. Furthermore, we detect that the unexplained variability in sentencing decreases steadily during 2011, while results from exact matching point to a statistically significant average reduction in the variance of sentence length amongst same types of offences.

Conclusions We demonstrate the relevance of two new methods that can be used to produce more robust assessments regarding the evolution of consistency in sentencing, even in situations when only observational non-hierarchical data is available. The application of these methods showed an improvement in consistency during 2011 in England and Wales, although this positive effect cannot be conclusively ascribed to the implementation of the new assault guideline.



Abstract 3 (Anderson et al., 2003)

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Five experiments examined effects of songs with violent lyrics on aggressive thoughts and hostile feelings. Experiments 1, 3, 4 and 5 demonstrated that college students who heard a violent song felt more hostile than those who heard a similar but nonviolent song. Experiments 2–5 demonstrated a similar increase in aggressive thoughts. These effects replicated across songs and song types (e.g., rock, humorous, nonhumorous). Experiments 3–5 also demonstrated that trait hostility was positively related to state hostility but did not moderate the song lyric effects. Discussion centers on the potential role of lyric content on aggression in short-term settings, relation to catharsis and other media violence domains, development of aggressive personality, differences between long-term and short-term effects, and possible mitigating factors.



Exercise 2. Experiments

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- Question: Can you think of a potential experimental designs to explore the following research questions?
 - What is the impact of criminal record on employability?
 - What is the effect of Marijuana legalisation on drug crime rates?



Recap

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Recap

- Correlation \neq causation
- Be aware of confounding effects and bidirectional causal relationships
- Experiments are the best way to ascertain causal relationships
- We can use them to test theories, and to assess the impact of specific interventions
- They vary a lot in nature, from laboratory to natural experiments
- They are difficult but not impossible to implement in the Social Sciences
- They are considered the 'gold standard' but they are also affected by important limitations

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- To review what we have covered here read:
 - Bachman, R. & Schutt, R.K. (2015) Fundamentals of Research in Criminology and Criminal Justice. Chapter 6
 - And remember: correlation \neq causation
- To prepare for the next week's lecture on Ethics read:
 - May, T. (2011) Social Research: Issues, Methods and Process, Buckingham: Open University Press, Chapter 3 (available on Minerva)