

UNIVERSITY OF VIENNA FIELD EXPERIMENTS

21 - 25 June 2021

Monday - Thursday: Lectures: 9.45-11.15, Labs: 13.15-15.45

Friday: Lecture 8.00-10.00, PAP: 13.15-15.15; 16.30-17.30

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Information:

“Correlation is not causation”. You must have heard this warning many times. But, what then is causation, and how can we test causal hypotheses, and identify the effects of interventions in the real world? Building on the potential outcomes framework, the module encourages students to think about challenges to causal inference at the design stage of a study. Published work will be evaluated based on how it addresses three key assumptions underlying causal inference: independence, excludability, and non-interference. Field experiments are attractive because they enable the researcher to ground statistical and causal inferences in features of the research design rather than assumptions about the world.

The goal of this 5-day course is to provide participants with the methodological knowledge and the practical skills to design, analyse, and eventually conduct their own field experiments. We will use the textbook by Gerber and Green (2012) as our main guide. Strong emphasis will be placed on developing practical skills for real research scenarios. Given resources, how should subjects be assigned to conditions? How many treatment arms should we include? How do we plan to analyze the resulting data? Each day will be broken up into a morning and an afternoon session. The morning session will provide a mix of statistical theory and practical tips for implementing field experiments, while the afternoon session will be dedicated to computer practice.

Prerequisites: The pre-requisite is any course covering linear regression and hypothesis testing. Other than that, we will build the statistical foundations for randomized field experiments from the ground up. For those with a deeper statistical background, there will be opportunities for exploration of more advanced topics.

Learning Outcomes: Students will understand the potential outcomes framework, and the key assumptions underlying causal inference. They will also understand how to design, analyse and interpret randomized field experiments, and they will be aware of the specific challenges that field experimentalists face. Moreover, they will gain the practical skills of applying these insights about experimental design and statistical knowledge to experimental data.

Problem Set: Students will complete a short problem set in the evenings of day 2. The submission deadline is 9am the next morning, and I will provide feedback the following day.

Experimental Design: For the research design session on day 5, students will be asked to come prepared with a 2-pager outlining an experimental design including 1) causal research question 2) hypotheses 3) experimental design (sample, experimental conditions, outcome variables, type of random assignment).

Course Page: All materials are available on Moodle.

Required Textbook:

Gerber, Alan and Donald P. Green. *Field Experiments: Design, Analysis, and Interpretation*, New York: W.W. Norton, 2012.

Recommended Texts on Field Experiments:

John, Peter. *Field Experiments in Political Science and Public Policy: Practical Lessons in Design and Delivery*, Routledge, 2017.

Glennerster, Rachel and Kudzai Takavarasha. *Running Randomized Evaluations: A Practical Guide*, Princeton University Press. 2013.

Karlan, Dean and Jacob Appel. *Failing in the Field*, Princeton University Press, 2016.

Software: Students will have a choice between using R or Stata. If you are unfamiliar with both languages, I would suggest using R, as it is free and open source. All analyses that we will conduct are easily done in either language, and code will be provided in both languages. However, demonstrations will focus on R.

R Intro:

Imai, Kosuke. *Quantitative Social Science. An Introduction*. Princeton: Princeton University Press, 2017.

Grolemund, Garrett and Hadley Wickham. Learn R Online with R for Data Science: <https://r4ds.had.co.nz>

Phillips, Nathaniel D. The Pirate's Guide to R: <https://bookdown.org/ndphillips/YaRrr/>

Lecture Outline

1. Introduction to the Potential Outcomes Framework
2. Sampling Variability and Randomization Inference
3. Analyze as you Randomize: Blocking, clustering and covariates
4. Dealing with complications (non-compliance and attrition)
5. Designing and Executing Field Experiments

21 June

Lecture: Introduction to the Potential Outcomes Framework

Gerber and Green: Chapters 1 and 2

Holland, Fundamental Problem of Causal Inference

Gelman, Forward Causal Inference

READ BEFORE DAY 1: Page, Stewart, 1998: Accepting the Gay Person, *Journal of Homosexuality* , 36: 2, 31-39.

- What is causal inference
- What is a field experiment

- Unobserved heterogeneity
- Potential outcomes
- Independence assumption
- Random assignment
- Potential and realised outcomes
- Difference-in-means estimator of the ATE
- Unbiasedness of ATE estimator
- Excludability and non-interference

Lab: Basics of experimental data analysis

- Conduct a random assignment
- Load in a simulated dataset that includes $Y(0)$ and $Y(1)$.
- Estimate the ATE using simulated and real data.

22 June

Lecture: Sampling variability and randomization inference

Gerber and Green: Chapter 3.

Coppock, Alexander: Randomization Inference Procedures with ri2 <https://egap.org/methods-guides/10-procedures-ri2>

Gomila, Robin: Logistic or Linear? Estimating Causal Effects of Treatments on Binary Outcomes Using Regression Analysis <https://psyarxiv.com/4gmbv>

- Sampling distribution of the ATE
- The true standard error
- Estimating the standard error
- Randomization inference
- Comparing linear regression and randomization inference

Lab: Randomisation inference

- Generate a sampling distribution of the ATE
- Estimate the standard error
- Learn to obtain p-values via randomization inference

23 June

Lecture: Analyze as you Randomize

Gerber and Green: Chapters 3 and 4

- Research design and experimental data analysis
 1. Blocks
 2. Clusters
 3. Covariate-adjustment

Lab: Analysing block and cluster randomised experiments

- Perform block and cluster random assignment
- Learn how clustering can widen a sampling distribution
- Learn how blocking can tighten a sampling distribution
- Learn how covariate adjustment can tighten a sampling distribution

24 June

Lecture: Non-compliance and attrition

Gerber and Green: Chapter 5, 6 and 7

- One-sided noncompliance
- Two-sided noncompliance
- The Intent-to-Treat Effect (ITT)
- The Complier Average Causal Effect (CACE)
- Two-stage least squares estimation of the CACE
- Design-based solutions (placebo-designs)
- Attrition as a potential outcome: MIPO, MIPO | X , MITA
- How to avoid attrition
- What to do and not to do about attrition (Manski- and Lee bounds)

Lab: CACE and attrition checks

- How to estimate the CACE using 2sls
- Conducting attrition checks
- Lee bound estimation

25 June

Lecture: Designing and Executing Field Experiments

Gerber and Green: Chapters 12 and 13.

John: Chapters 1, 2 and 3.

Coppock, Alexander: 10 Things to Know About Statistical Power: <https://egap.org/methods-guides/10-things-you-need-know-about-statistical-power>

Grady Chris and Nuole Chen: 10 Things to Know About Pre-Analysis Plans: <https://egap.org/methods-guides/10-things-pre-analysis-plans>

Humphreys, Macartan. “Reflections on the ethics of social experimentation.” *Journal of Globalization and Development* 6.1 (2015): 87-112.

- Ethics of field experimentation
- Working with partner organisations
- Power analysis
- Pre-Analysis Plans (PAPs)
- Pre-registration

Lab: Workshop your designs

- Work on your own experimental designs
- Write a PAP