
THEORY AND ANALYSIS OF EXPERIMENTS

POLI 263 — Fall 2019

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Office Location	SSB 346	Office Hours	TueThu 1.00 - 2.30 PM
Lecture Location	SSB 333	Lecture Time	Tue 9:00 - 11:50 AM

Useful Links

Latest version of syllabus:



Office hour signup:



Course Canvas page:



Download R and Rstudio:



Contents

1 Overview	2
1.1 Objectives	2
1.2 Textbook	2
1.3 Prerequisites	2
1.4 Assessment	2
1.5 Auditing	3
2 Logistics	4
2.1 Office Hours	4
2.2 Software	4
2.3 Problem Sets Policy	4
2.4 Problem Set Submission	4
2.5 Communication	4
2.6 Late submission	4
3 Weekly Outline	5
3.1 Week 1: Potential Outcomes and Estimands	5
3.2 Week 2: Randomization and Estimation	5
3.3 Week 3: Statistical Inference	5
3.4 Week 4: Blocks and Clusters	5
3.5 Week 5: Covariates and Weights	6
3.6 Week 6: Non-Compliance	6
3.7 Week 7: Attrition	6
3.8 Week 8: Spillovers	6
3.9 Week 9: Moderation and Mediation	7
3.10 Week 10: Ethics and Practicalities	7
4 Policies	8
4.1 Academic Integrity	8
4.2 OSD Accommodations	8
5 Resources	8

1 Overview

This course teaches the core principles that underlie experimental reasoning and research design. We start with a definition of causality and build from the ground up a set of simple but powerful intuitions about causal and statistical inference.

With these principles in hand, you will have everything you need to design high-quality survey, field, and lab experiments. They will also help you to reason through complex design choices in non-experimental research.

We spend the first half of the course setting up the basics. In the second half, we look at how experiments “break”—noncompliance, attrition, spillovers—and what to do about it. We look at causal moderation and mediation. We finish with a discussion of the ethics and practicalities of implementing experiments in the world.

1.1 Objectives

If I do my job, you should finish the course knowing at least ten things really well:

1. what a causal effect is
2. when experiments provide good answers about causal effects and when their answers are biased
3. what standard errors and p-values are, how they are useful, and when they can mislead
4. what blocks and clusters are, the problems they pose, and the problems they solve
5. how knowledge of assignment to treatment should guide estimation
6. when and why attrition matters, and what to do when it happens
7. when and why failure-to-treat matters, and what to do when it happens
8. when and why spillovers matter, and what to do when they happen
9. what post-treatment bias is
10. why mediation is hard

1.2 Textbook

The best way I know to learn experiments is to work through this book (FEDAI): Alan S. Gerber and Donald P. Green. *Field Experiments: Design, Analysis, and Interpretation*. W.W. Norton, New York, 2012. I recommend buying it, because it’s a resource you’ll constantly come back to. I’ve made sure the bookstore has copies. That said, there should be two copies on reserve at the library too. That’s the only book you’ll need for this course.

1.3 Prerequisites

Students of all methodological backgrounds are encouraged to take the course. An introduction to linear regression will help a lot, but advanced understanding of calculus, statistics, or coding is not required. Fundamental concepts are taught through simple algebraic proofs, numerical examples, and simulation. Another thing that will help a lot is proficiency with R, but if you don’t have any proficiency, that’s not a problem. You will by the end of the course!

1.4 Assessment

- **Five problem sets — 50%:**

Each problem set will be worth 10 points. These are all really straightforward. There are no trick questions: if you’ve read the FEDAI chapter and come to class, the problem set should not be too difficult. If it is, reach out to me via the [course canvas page](#).

- **In-class test — 25%.**

On: Tuesday, December 3.

No alarms and no surprises. This will focus mostly on material from the first part of the course: Weeks 1 (Potential outcomes and Estimands) through to 6 (Non-Compliance) inclusive. But it will include some questions on the latter part, too. I'll give plenty of detail in advance. If you've been diligent about doing the readings and the problem sets, you'll be fine. The first part will be definitions and short questions. The second part will be a practical exercise that only requires a calculator.

- **Homemade experiment — 25%:**

Pre-analysis plan (10/25 points) due: Tuesday, November 26.

Final paper (15/25 points) due: Wednesday, December 11.

You conduct and write up an experiment using household objects! It should be short: 5-10 pages long, no citations or literature required. The idea is ideally to focus on one or two experimental design dilemmas. Both the pre-analysis plan and the final paper should be divided into seven sections: 1) Introduction; 2) Assumptions; 3) Estimand; 4) Randomization and Sampling; 5) Estimation Strategy; 6) Results; 7) Discussion. I'll provide more information on this as we go along.

1.5 Auditing

The aim of this course is to etch into your memory a set of really core intuitions that you will be able to apply long after the course is over. The only way I know of to learn these well is to do the problem sets. So, in general, I discourage auditing—I'd like everyone in the group to be engaging with the material as much as possible. However, if you want to audit, then you must register for an [S/U \(Satisfactory / Unsatisfactory\)](#) grade. If you do the problem sets and the in-class test, you will get an S. You don't have to get all of them right (they're not that hard anyway), but you do have to make a good-faith effort and turn in responses. If you are auditing, you will not receive a grade on the problem sets.

2 Logistics

2.1 Office Hours

I will hold office hours from 1:00 PM to 2:30 PM on Tuesday and Thursday afternoons in my office, room 346 of the Social Sciences Building. **Please make sure to sign up for office hours using the Calendly link:** calendly.com/jaspercooper/officehours.

2.2 Software

We will be using the open-source statistical software R. While other statistical software packages such as SPSS, Stata, or even Excel can of course be used for experimental analysis, R has many advantages.

First, it is the programming language of choice of many (most?) data scientists and statisticians. Second, it makes writing loops and functions very easy (tasks that are nearly impossible in Excel). Third, there is a large community of developers who have contributed a huge number of add-ons for R that you will find invaluable. Finally, it's free, and always will be, which is not true of other software. In addition to R, please also download and install RStudio, the top-of-the-line script editor. See the link at the top of the syllabus.

2.3 Problem Sets Policy

All students must write up their problem sets individually. However, you may work in groups of up to three (though you are not required to work in groups at all). Please indicate at the top of your homework the names of the other students you worked with that week. Don't "share" members across groups. Do not copy and paste the answers across group members. Ultimately, the problem sets are pretty easy compared to most graduate methods courses, and they'll really help you to retain the core lessons.

2.4 Problem Set Submission

Please submit all problem sets through the [course canvas page](#). I recommend using Rmarkdown to prepare your problem sets, though you can use whatever you like (Word, L^AT_EX, even .txt files!). Here's a great guide to getting started with Rmarkdown: https://rmarkdown.rstudio.com/articles_intro.html.

2.5 Communication

For questions about problem-sets, readings, and lecture content: Please post all technical questions on the [course Canvas page](#), so that everyone can benefit from the answers. And please also feel free to weigh in on others' questions!

Email: I try to respond to all emails as soon as I get them, and at least within 24 hours. Don't be afraid to send me a little reminder if I haven't responded within that window. Before writing to me with a question, check the syllabus to see if it's addressed there first. Please don't leave questions until the last minute. I don't respond to emails in the evening.

2.6 Late submission

I am willing to make reasonable accommodations and understand that difficult situations can arise. However, I will not make exceptions for one person that are not available to every other person in the course. Hand all assignments in on time and reach out to me if you are encountering troubles.

3 Weekly Outline

3.1 Week 1: Potential Outcomes and Estimands

Tuesday, October 1

- Read before class:
 - FEDAI Chapter 2 pp. 22-30
- Assignment due:
 - Install R, Rstudio, and swirl, following instructions here: <https://swirlstats.com/students.html>
 - Complete as many swirl modules in basic R programming as possible

3.2 Week 2: Randomization and Estimation

Tuesday, October 8

- Read before class:
 - FEDAI Chapter 2 pp. 30-45
- Assignment distributed:
 - Problem set 1

3.3 Week 3: Statistical Inference

Tuesday, October 15

- Read before class:
 - FEDAI Chapter 3 pp. 51-71
- Assignment due:
 - Problem set 1
- Assignment distributed:
 - Problem set 2

3.4 Week 4: Blocks and Clusters

Tuesday, October 22

- Read before class:
 - FEDAI Chapter 3 pp. 71-86
 - FEDAI Chapter 4 pp. 109-116

3.5 Week 5: Covariates and Weights

Tuesday, October 29

- Read before class:
 - FEDAI Chapter 4 pp. 95-109
 - FEDAI Chapter 4 pp. 116-121
- Assignment due:
 - Problem set 2
- Assignment distributed:
 - Problem set 3

3.6 Week 6: Non-Compliance

Tuesday, November 5

- Read before class:
 - FEDAI Chapter 5
 - FEDAI Chapter 6

3.7 Week 7: Attrition

Tue, Nov 12, 2019

- Read before class:
 - FEDAI Chapter 7
- Assignment due:
 - Problem set 3
- Assignment distributed:
 - Problem set 4

3.8 Week 8: Spillovers

Tue, Nov 19, 2019

- Read before class:
 - FEDAI Chapter 8
- Assignment due:
 - Problem set 4
- Assignment distributed:
 - Problem set 5

3.9 Week 9: Moderation and Mediation

Tue, Nov 26, 2019

- Read before class:
 - FEDAI Chapter 9
 - FEDAI Chapter 10
- Assignments due:
 - Problem set 5
 - Pre-analysis plan

3.10 Week 10: Ethics and Practicalities

Tue, Dec 3, 2019

- In-class test (1 hr 45 min)
- After the test, we will discuss:
 - Scott Desposato. Subjects and scholars' views on the ethics of political science field experiments. *Perspectives on Politics*, 16(3):739–750, 2018
 - Macartan Humphreys. Reflections on the ethics of social experimentation. *Journal of Globalization and Development*, 6(1):87–112, 2015

4 Policies

4.1 Academic Integrity

Students agree that by taking this course all required papers will be subject to submission for textual similarity review to Turnitin.com for the detection of plagiarism. All submitted papers will be included as source documents in the Turnitin.com reference database solely for the purpose of detecting plagiarism of such papers. Use of the Turnitin.com service is subject to the terms of use agreement posted on the Turnitin.com site.

4.2 OSD Accommodations

Students requesting accommodations for this course due to a disability must provide a current Authorization for Accommodation (AFA) letter issued by the Office for Students with Disabilities (<https://osd.ucsd.edu/>). Students are required to discuss accommodation arrangements with instructors and OSD liaisons in the department well in advance of any exams or assignments. The OSD Liaison for the Department of Political Science is Joanna Peralta; please connect with her via in-person advising (SSB 301) or the Virtual Advising Center.

5 Resources

Library help and research tools:	https://library.ucsd.edu/ask-us/triton-ed.html
Writing Hub:	https://commons.ucsd.edu/students/writing/index.html
Supplemental Instruction:	https://commons.ucsd.edu/academic-support/supplemental-instruction/si-students.html
Tutoring:	https://commons.ucsd.edu/academic-support/content-tutoring/index.html
Mental Health Services:	https://caps.ucsd.edu
Community Centers:	Learn about the different ways UC San Diego explores, supports, and celebrates the many cultures that make up our diverse community. https://students.ucsd.edu/student-life/diversity/index.html
Accessibility:	https://disabilities.ucsd.edu/
Basic Needs:	Any student who has difficulty accessing sufficient food to eat every day, or who lacks a safe and stable place to live, and believes this may affect their performance in this course, is encouraged to contact: foodpantry@ucsd.edu and basicneeds@ucsd.edu