

PSY 503: Foundations of Psychological Methods

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Class Hours: M W 10:00-11:20 a.m.

Room: zoom

Course Objectives

Psychological science is flourishing. Psychologists have spent the past decade improving the capabilities, robustness and transparency of the field, which has become increasingly sophisticated. Today, psychologists deploy large-scale field experiments, scrape data from the web, and run network or text analyses. They venture into the world of big data and machine learning, and “go bayesian”. Psychologists preregister their studies, use open source statistical software such as R and Python, and make their datasets and codes public.

This course is meant to empower you. The objective is to provide you with the statistical and computational foundations that will allow you to thrive in this new, evolving, and forward-thinking landscape. You will accumulate knowledge and skills that will give you the ability to adapt to new statistical advances, adopt new computational practices, collaborate with social and natural scientists within and outside of the discipline, and evaluate new research.

Topics

This course covers the statistical and computational foundations of psychological methods. You will learn about probability theory, design-based causal inference, regression analysis, and the basics of multilevel modeling.

We will use R, R Markdown, and Git/GitHub.

Audience

This course is designed for quantitative psychologists but it is relevant to any social and natural scientists studying human behavior.

Prerequisite

The main prerequisite for this course is a strong desire and willingness to learn. It is not essential that you have taken any statistics, probability, or programming courses in the past. We will start with the basics.

NOTE: Students are expected to enroll in *PSY 505: Advances in Statistical Methods and Research Practices in Psychology* (Fall 2020, T: 11am - 1pm), which constitutes an important complement to this course. You can think of PSY 505 as the required precept time of the week for PSY 503. Please reach out to me if you would like to enroll in PSY 503 but are not able to take PSY 505.

Teaching approach

This course approaches statistics through both formal mathematics and computer code. Mathematical rigor is essential to think clearly and rigorously about statistical concepts –it allows to digest information at a deeper level and build long-lasting knowledge. However, understanding statistical concepts and procedures through mathematics only is not always optimal, even for advanced mathematicians. It is sometimes difficult to grasp statistical concepts without a clear mental representation of what they are. This makes computer code crucial to learning statistics: we use it abundantly to illustrate, visualize, and understand the concepts.

Books

The primary textbook for this course is a draft of:

Gomila, R. (2020). *Foundations of Psychological Methods*. [\[link\]](#)

I will provide additional relevant resources (i.e., articles, book chapters) on a weekly basis.

Assignments

Assignments include weekly problem sets, a project pre-registration, and a final exam.

Tentative Course Outline

- **Foundations of Psychological Methods: Introduction and Relevance**
- **Causality and Potential Outcomes**
- **Fundamentals of Probability Theory**
- **Random Variables**

- **Statistical Inference**
- **Hypothesis Testing**
- **Simple and Multiple Linear Regression**
- **Encouragement and Quasi-Experimental Designs**
- **Multilevel Modeling**
- **Observational Studies**
- **Posttreatment Controls, Mediation, and Heterogeneity**