

PSY 505: Advances in Statistical Methods and Research Practices in Psychology

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Course Objectives

Psychological methods keep evolving: psychology researchers constantly adopt new statistical methods, computational tools, and research practices. This course introduces the latest advances in research methods in psychological science through a series of lectures, tutorials, and seminars. Lectures are generally given by a guest speaker who introduces methodological and statistical issues relevant to psychology research. Students engage in a group discussion with the speaker before the lecture. Tutorials provide students with the necessary skills to build reproducible and transparent research programs. For instance, students learn how to use R, RMarkdown and Git/GitHub, or how to preregister their studies. Finally, students take part in seminars, in which they discuss timely topics in psychological methods (e.g., reproducibility, transparency, pre-registration).

Audience

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

Prerequisites

There are no prerequisites for this course.

Assignments

Students will read between one and two articles before seminars, which constitute about a third of the semester.

Tentative Course Outline

- *Introductions* (Week 1 - September 1, 2020)
- **Tutorial 1:** *Basics of R* (Week 2 - September 8, 2020)
- **Seminar 1:** *What is Ethical Research?* (Week 3 - September 15, 2020)
- **Tutorial 2:** *Transforming Data in R* (Week 4 - September 22, 2020)
- **Seminar 2:** *Reproducibility and Transparency in Psychology* (Week 5 - September 29, 2020)
- **Lecture 1:** David Funder, UC Riverside (Week 6 - October 6, 2020)
- **Tutorial 3:** *Visualizing Data in R* (Week 7 - October 13, 2020)
- **BREAK** (Week 8 - October 20, 2020)
- **Tutorial 4:** *Advanced Topics in R* (Week 9 - October 27, 2020)
- **Lecture 2:** Simine Vazire, University of Melbourne (Week 10 - November 3, 2020)
- **Seminar 3:** *Preregistration of Psychological Studies* (Week 11 - November 10, 2020)
- **Lecture 3:** Inbal (Billie) Nahum-Shani, University of Michigan (Week 12 - November 17, 2020)

Lectures

Lecture 1

Some Comments on the History of Statistics and the Evaluation of Effect Size

David Funder

University of California, Riverside

Statistics is typically taught to psychologists as unquestionable truth akin to mathematics, rather than as the philosophically complex and controversial topic that it is. Neglected issues include the meaning(s) of “probability,” the paradoxes that arise when rational judgment is defined in terms of statistics, the quest for numerical tools to make substantive decisions for us, and most of all, the fraught history and meanings of the term “significance.” I plan to briefly survey some of these topics, hoping to inspire listeners to read and learn more on their own, and then add some brief remarks on the evaluation of effect size. As a special case of the neglected issues in statistics, effect sizes have been simplistically and mindlessly evaluated, with special problems arising from common practices such as squaring correlations to yield “percentage of variance explained,” and the use of customary, arbitrary, and fundamentally meaningless standards. Instead, effect sizes should be evaluated in comparison to well-understood benchmarks or in terms of concrete consequences.

Lecture 2

Where are the self-correcting mechanisms in science?

Simine Vazire

University of Melbourne

We often hear the self-correcting mechanisms in science invoked as a reason to trust science, but it is not always clear what these mechanisms are. Some quality control mechanisms, such as peer review for journals, or vetting for textbooks or for public dissemination, have recently been found not to provide much of a safeguard against invalid claims. Instead, I argue that we should look for visible signs of a scientific community’s commitment to self-correction. These signs fall into two categories: transparency and critical appraisal. Transparency in the research and peer review process is vital, but not sufficient, for science to be self-correcting. Transparency makes it possible for errors to be detected and corrected, but actual correction depends on the transparency being used for critical appraisal, such as error detection and quality control. I argue that we should trust scientific claims more to the extent that they were produced by communities that have these hallmarks of credibility. Fields that are more transparent, and have more support for critical appraisal should earn more trust. Metascience can track these qualities of scientific fields and provide scientists and the public with valuable information in assessing the credibility of scientific fields.

Lecture 3

Experimental Designs for Developing Multi-Component Interventions: on Factorial Designs, SMARTs and MRTs.

Inbal (Billie) Nahum-Shani
University of Michigan

Behavioral interventions often include multiple components. A variety of experimental designs can be used to inform the construction of multi-component behavioral interventions. These include factorial designs, sequential multiple assignment randomized trials (SMART), and micro-randomized trials (MRT). This presentation is a non-technical introduction to multi-component interventions, including fixed interventions, adaptive interventions, and just-in-time adaptive interventions (JITAI). An organizing framework will be presented to help scientists select an experimental approach to inform intervention development. The connection between several experimental approaches will be discussed and a variety of case studies will be used for illustration.