

EITM Summer Institute Mannheim 2025
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Statistical Foundations of EITM

The basic motivation of EITM is it to closely connect formal theoretical models and empirical statistical tests. This course presents flexible Bayesian methods that lend themselves to testing predictions from formal models and to producing meaningful quantities of interest along with their uncertainties. Bayesian analysis involves two key aspects – inference based on probability theory and estimation using stochastic simulation. The course will spend some time on the basic principles of both aspects and then apply them to some of the workhorse models of the social sciences: choice models and IRT models for ideal point estimation. We will also discuss practical issues of applied Bayesian analysis, such as MCMC convergence diagnostics as well as Bayesian model checking and parameter summary.

Textbooks

Gill, Jeff & Le Bao. 2024. *Bayesian Social Science Statistics: From the Very Beginning*. Cambridge.

Jackman, Simon. 2009. *Bayesian Analysis for the Social Sciences*. Wiley. (BASS)

I will also provide slides and code in the Dropbox folder.

We will use R (<https://www.r-project.org>) and JAGS (<http://mcmc-jags.sourceforge.net>) for computation. Please make sure you have those programs installed on your computer.

Course Plan

Day 1: Basic Bayesian Analysis

Bayes Theorem, Conjugate Analysis of Proportions and Means

Readings: BASS Introduction, Ch. 1.1-1.7., Ch. 2.1

Learning about Means and Variances

Readings: BASS Ch. 2.4

Day 2: Computational Bayesian Statistics

Basic Monte Carlo Simulation

Readings: CH. 3.1-3.4

Markov Chains, Metropolis-Hastings Sampling, Gibbs Sampling

Readings: BASS Ch. 4.1-5.2

Practical MCMC: Convergence Diagnostics and Using JAGS

Readings: BASS Ch. 4.1-5.2

Day 3: Bayesian Models

Bayesian Linear and Non-Linear Regression Models

Readings: BASS Ch. 2.5, Ch. 8.1

Bayesian Models of Choice Making

Readings: BASS Ch. 8.2-8.4

Bayesian IRT Models for Ideal Point Estimation

Readings: BASS Ch. 9.1, 9.3