

Lesson plan

In this course we will start again from the foundations of statistical thinking: What is like to build a model? How do our expectations and previous knowledge shape and constrain models? How do we assess whether our models are any good and where they fail? We adopt a Bayesian framework implemented in Stan (R-packages rethinking and brms), since this approach makes it easier to build your own models and make your assumptions explicit. During the course we will cover again the generalized linear mixed effects model (GLMM) framework, but the course prepares you to go beyond this, via additional online materials and/or in your bachelor thesis.

Mandatory handbook:

- McElreath (2015) Statistical Rethinking.
- The second edition of the book is announced for March 2020, but these things are rarely on time, so it won't make much sense to wait til it's out to buy the book.
- The book is awesome but uses base R, while we got used to the tidyverse. So, I strongly recommend this awesome resource recoding the code in the book to be tidyverse compliant (and using brms, a Bayesian equivalent to lme4)
 - https://bookdown.org/ajkurz/Statistical_Rethinking_recoded/
- There are video lectures connected to the book. They are also awesome and worth watching.

Complementary readings are indicated below.

- If you want to go more in-depth in the *mathematical grounding* of what we do in class, have a look at Lambert (2018) A student's guide to Bayesian statistics. NB: only useful if you already master the contents of the mandatory handbook.
- If you want to see cool examples of *more advanced models* than we'll cover, see this: <https://paul-buerkner.github.io/blog/brms-blogposts/> (e.g. Signal Detection Theory, Drift Diffusion, etc.)
- If you want to delve more in the *causal inference world* (again, after mastering the book):
 - Judea Pearl (2016) Causal Inference in Statistics: A Primer
 - Scott Cunningham (2019) Causal Inference: The mix tape
 - Hernán MA, Robins JM (2020). Causal Inference: What If. Boca Raton: Chapman & Hall/CRC.
- If you want a deeper perspective on how to build and compare models of *cognitive processes*:
 - Farrell, S., & Lewandowsky, S. (2018). *Computational modeling of cognition and behavior*. Cambridge University Press. (NB. The second edition! The first is not as good)
 - Lee, M. D., & Wagenmakers, E. J. (2014). *Bayesian cognitive modeling: A practical course*. Cambridge university press.

Exam: Portfolio exam on the lines of Experimental Methods 3 (see below for list of assignments). NB. The last assignment can (and is recommended to) be replaced by a Bayesian analysis of your Social and Cultural Dynamics study, *which can also be re-used in your final Social and Cultural Dynamics paper*.

Feedback: There will be no individual feedback (sorry not enough time). There will be a bullet points collective feedback the week after the full assignment is submitted. The collective feedback indicates general issues that people have in their assignments and that should be tackled in your revised final submission.

"Passed" criteria:

- All assignments are handed in before *exam* deadline
- All questions (except for the optional ones) need to have an answer
- All the points in the collective feedback marked as *crucial* have to be double-checked on your assignment and addressed if necessary

W1 - February 18 - Intro and Bayesian inference (ch 1 & 2)

- PE: February 20 [RF]: Wrapping up the eye-tracking analysis (assignment 1)

W2 - February 25 - Bayesian inference and linear models (ch 3 & 4)

- PE: February 27 - Assignment 2 Part 1 : Assessing your teachers' CogSci skills

W3 – March 3 - Linear models (ch 4)

- PE: March 5 - Assignment 2 Part 2

W4 - March 10 - Multiple regressions (ch 5)

- PE: March 12 - Exercises from chapter 5

W5 - March 17 - Causal inference in regression models (ch 5)

- PE: March 19 - Assignment 3 - Part 1 - Multiple regression

W6 - March 24 - Overfitting and information criteria (ch 6)

- PE: March 26 - Assignment 3 - Part 2 - Causal inference

W7 – March 31 - ICs and Interactions (ch 7)

- PE: April 2: April 2 [KE]: Exercises from chapter 7

W8 – April 14 – Markov Chain MonteCarlo (ch 8)

- PE: April 16 [KE]: Assignment 4 – Part 1: Informed vs. Skeptical priors

W9 - April 21 - GLM - diverse outcomes (ch 10-11)

- PE: April 23 [RF]: Assignment 4 – Part 2: Informed vs. Skeptical priors

W10 - April 28 – Multilevel models (ch 12)

W11 – May 5 – Portfolio and Assignment 5 livecoding