Syllabus

Introduction to EEG methods in Cognitive Science

PhD Elective Course
Department of Cognitive Science
Central European University
Fall 2019/20, 2 credits

Time: Fridays 11:00 to 12:40
Venue: Room 103, Október 6. utca 7, Somby Lab, Computer Lab N9 909

Introductory Session: 11:00 to 11:30, Friday September 13, Room 103

Instructors:
Gergely Csibra
Barbara Pomiechowska
Anna Zamm

Description:
This course introduces students to the use of electroencephalography (EEG) for measuring brain function to access cognitive mechanisms in humans. This is a practical course, where students receive hands-on experience in recording and analyzing EEG data, as well as in designing experiments and interpreting findings using this method.

Learning Outcomes
By the end of the course, students should

- be familiar with the nature of the EEG signal and its derivatives,
- be able to design experiments using EEG measures,
- know the basic steps of analyzing EEG data, and
- be able to critically interpret the results of studies published with this technique.

Evaluation:
Grade is awarded on the basis of

- attendance of classes and lab practice,
- completing assignments in data analysis,
- and submitting a research report and an experimental design by the end of the term (submission deadline: December 16, 2019).

Core reading:
Luck, S. J. (2005/2014). *An Introduction to the Event-Related Potential Technique*. MIT Press.

September 20 (Room 103)
Assessing cognitive mechanisms via EEG-derived methods

September 27 (Room 103)
The neural basis of the EEG signal and its dependent measures

Supplementary material:
- The first 25 minutes of Introduction to EEG/MEG:
  - Tutorial by Robert Oostenveld

October 4 (Room 103 and the Somby Lab)
Recording EEG
The experimental paradigm

Supplemental readings:
- Steve Luck's "Setting up and running an ERP lab"
- Rossion, B. & Jacques, C. (2011). The N170: Understanding the time course of face perception in the human brain. In: E. S. Kappenman & S. J. Luck (Eds.), *The Oxford Handbook of Event-Related Potential Components* (pp. 115-141). New York, NY, US: Oxford University Press.

October 11 (Somby Lab - session may extend into the afternoon)
Recording session

October 18 (Computer Lab, N9 909)
Intro to EEGLAB software + basic MATLAB syntax
EEG signal review

Suggested readings /supplementary materials:
- Mike Cohen's EEG video tutorials:
  - Introduction to Matlab programming
  - EEG data and indexing in Matlab
- EEGLAB Tutorial

October 25 (Computer Lab, N9 909)
EEG signal preprocessing

Chapters
"Artifact rejection and correction"
" Why are Filters necessary,"
"What everyone should know about filtering"

Supplementary material:
- Mike Cohen's EEG video tutorials:
  - Broad overview of EEG data analyses

November 8 (Computer Lab, N9 909)

ERP analysis

ERP quantification, grand average, statistics

Chapters

"Baseline correction"

"Averaging"

" Quantifying ERP amplitudes"

Supplementary material:

- Mike Cohen's EEG video tutorial:
  - Overview of time-domain analyses

November 15 (Computer Lab, N9 909)

Spectral analysis

Supplementary materials:

- Mike Cohen's EEG video tutorials:
  - Sine waves in time and in frequency
  - The discrete-time Fourier transform

November 22 (Computer Lab, N9 909)

Time-frequency analyses

Chapter

"Basics of time-frequency analysis"

Tallin-Baudry, C. & Bertrand, O. (1999). Oscillatory gamma activity in humans and its role in object representation. *Trends in Cognitive Sciences, 3*, 151-162.

November 29 (Room 103)

Experimental design for EEG studies

Chapter

"Overview of common ERP components"

December 6 (Room 103)

Critical evaluation of EEG studies