

# Course information for HTXN08

## Linguistics and Cognitive Science: ERP Research Methods – Theory and Practice Fall 2016

### Teachers:

Annika Andersson:

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Office hours: By appointment only.

### Course duration

2016-08-29 until 2016-10-28

7.5 Higher educational credits

Language of instruction: English

**Attendance is compulsory** at both the laboratory exercises and lectures. If you miss a session you will be requested to hand in a make up report to show that you were able to perform the exercises and acquire the information covered in the lecture on your own. We expect that the readings (see schedule below) are done prior to the lecture for more fruitful discussions and for better learning experiences. Therefore every lecture will be initiated with a short discussion on questions that arouse when reading the chapters. All students are expected to be active in these discussions.

### Course plan

[http://kursplaner.lu.se/english/HTXN08\\_english.pdf](http://kursplaner.lu.se/english/HTXN08_english.pdf)

### Course goals

In this course you will learn theoretical backgrounds to the recording of event-related potentials. We aim to give you hands on experience of one ERP system with teachers present to inform and answer questions. You will be trained in recognizing artifacts in continuous EEG and in ERP plots. After this course you will be able to identify individual averages for inclusion or exclusion for further analyses. You will get some

experience on how to reject artifacts such as eye movement from the data using for instance individual component analysis (ICA) within the program EEGLab.

In short student presentations you will get an idea of the vast types of studies in which the ERP technique has been utilized.

We will not cover how to statistically analyze ERP data, or power spectrum analyses.

We will not cover how to set up stimuli for an ERP experiment.

More in detail from the syllabus in the link above.

Students should after this course be able to:

- account for the basic principles of electrophysiological research methods and recording of EEG signals
- describe how a simple ERP experiment can be designed
- understand and report on published research papers and relate them to ERP and EEG measurements in their own field of study
- conduct an EEG recording in a predesigned experiment
- perform a simple analysis of EEG that leads to average ERP waves
- plan an ERP experiment in their own field of study
- read, understand and critically evaluate published research papers of relevance to the field of study
- critically assess the pros and cons of ERP methodology
- take a position on and predict difficulties and problems that may arise in research involving ERP methodology.

## Note

We will use the program Matlab and the freeware EEGLab. Students can download Matlab using this link:

<http://program.ddg.lth.se/>

and EEGLab using this link:

<http://sccn.ucsd.edu/eeglab/downloadtoolbox.html>

You will **not** be required to download these programs on your own computers. The course lab sessions and programming support will be geared **exclusively** towards the use of the computers with the programs in the PC lab (B054) and the data processing computers in the Humlab. That is, we are unfortunately not able to answer questions regarding how to run and script the programs on your personal computer. However, if you manage to set up your own computer (which should not be difficult), we are sure that you will be able to use the skills you learn in the course to run the EEG analyzes on your own computer, if you would wish to do so.

## Schedule

There are 10 lectures and 5 lab sessions in total.

**Lecture 1.** Monday August 29<sup>th</sup> 9.15-11.00.

Introduction to EEG. Students and teachers introduce themselves. Go through the course information and make sure all students know what is required to pass the course.

Room: L303b.

Readings: Chp 1 and 2.

Annika Andersson

**Lecture 2.** Wednesday August 31<sup>st</sup> 9.15-11.00.

Introduction to EEG/ERP research.

Room: L303b.

Readings: Chp 2 and 3

Annika Andersson

**Lecture 3.** Monday September 5<sup>th</sup> 9.15-11.00.

On EEG components and effects and how to design ERP experiments

Room: L303b.

Readings: Chp 3 and 4

Annika Andersson

**Lab session 1.** Wednesday September 7<sup>th</sup> 9.15-12.00. (Note time!)

Introduction to ERP research: setup, capping, a look at EEG and clean-up.

Room: Humanities Lab/EEG2.

No readings required but a skim through Chp 5 might make the lab more worthwhile.

Annika Andersson

**Lecture 4.** Monday September 12<sup>th</sup> 9.15-11.00.

On artifacts, detection, rejection and correction. Discussion of artifact detection homework.

Room: L303b.

Readings: Chp 5 and 6

Annika Andersson

**Lab session 2.** Wednesday September 14<sup>st</sup> 9.15-12.00. (Note time!)

Continue Curry7: setup, capping, a look at EEG and clean-up.

Room: Humanities Lab/EEG2.

Readings: Chp 5 and 6

Annika Andersson

**Lecture 5.** Monday September 19<sup>th</sup>. 9.15-11.00.

Introduction to filtering.

Room: L412a (Note the room number!).

Readings: Chp 7

Annika Andersson

**Lecture 6.** Wednesday September 21<sup>st</sup> 9.15-11.00.

ERP analyses and introduction to EEGLab.

Room: B054. (Note, B054 is booked 8-12 for your convenience)

Readings: Chp 8 and 9

Annika Andersson & Henrik Garde

**Lab session 3.** Monday September 26<sup>th</sup> 9.15-11.00.

EEGLab: Make IDVs, try different criteria and different filters.

Room: B054. (Note, B054 is booked 8-12 for your convenience)

Readings: Chp 7, 8, and 9

Annika Andersson & Henrik Garde

**Lecture 7.** Wednesday September 28<sup>th</sup> 9.15-11.00..

On filter and discussion of individual averages (IDVs). Annika will present an example of a short presentation with one slide.

Room: L412a. (Note the room number!)

Readings: Chp 7, 8, and 9 and TBA

Annika Andersson

**Lecture 8.** Monday October 3<sup>rd</sup> 9.15-11.00.

First part of the lecture: Short presentations of ERP proposals by students. Second part: Comparing IDVs from Lab session 3. Introduction to artifact reduction using ICA.

Room: L303b

Annika Andersson & Henrik Garde

**Lab session 4.** Wednesday October 5<sup>th</sup> 13.00-15.00. (Note time!)

Artifact reduction using ICA.

Room: B054. (Note, B054 is booked 12-16 for your convenience)

Annika Andersson & Henrik Garde

**Lecture 9.** Monday October 10<sup>th</sup> 9.15-11.00.

Discussions of individual averages from lab session 4, review and possibly first student presentations of research proposals.

Room: L303b.

Readings: Chp 3 and 4

Annika Andersson

**Lab session 5.** Wednesday October 12<sup>th</sup> 9.15-11.00.

Comparison of individual averages and grand averages.

Room: B054. (Note, B054 is booked 8-12 for your convenience)

Annika Andersson & Henrik Garde

**Lecture 10.** Monday October 17<sup>st</sup> 9.15-11.00.

Student presentations of research proposals. Information on how to upload students' final paper via urkund.com.

Room: L303b.

Readings: Chp 3 and 4

Annika Andersson

## Examination

- **Short homework assignments** (see below under Deadlines and Homework).
- **ERP research proposal presentations.** Choose a question that you would like to answer using EEG/ERP. Prepare a short presentation (~5 minutes, one slide) of your proposal for presentation on Monday October 3<sup>rd</sup> (Lecture 8). You will receive feedback from the teachers and the other students that will help you make changes to your final proposal. The final proposal presentations (10-15 minutes) and discussions will take place on Monday October 17<sup>th</sup> (Lecture 10).
  - Base your background on at 3-5 articles that use EEG/ERP. Be critical when you evaluate the ERP research and use the following outline for both the short and the long presentation:
    - Question at issue
    - Study design (This includes answers to questions like: Why will you use EEG to answer your question at issue? Will you combine EEG with anything else, like reaction times or behavioral measures? What kind of stimuli will you use? What conditions will you compare?)
    - Method (EEG system used, number of electrodes, baseline duration, filters etc.)
    - Analysis (Which components or ERP effects will you look at? How will you analyze your data?)
    - Results (What results are you expecting?)
- **Written ERP research proposal** that should be sent in to teachers digitally (see below). The paper format should be that of an article. That is, it should be written such that anyone new to the question at issue and to ERP could follow the arguments. Please consider the following:
  - Outline
    - Introduction
    - Method
      - Participants
      - Planned analyses
    - **Results**
    - Discussion
    - References
  - 5~7 pages double-spaced. Not including references.
  - Times or Times New Roman, 12 points.
  - Your name and title of the paper on a separate first page, not included in the page count.
  - A minimum of 5 references in APA style. Let us know if you do not know how to find information regarding how to do citations and references according to APA. Note: All references should be from peer-reviewed journals, and in the correct format!
  - You will have worked in feedback acquired during your presentation on Monday the 17<sup>th</sup> of October.

- Your paper should include topics covered in the lectures, including but not restricted to the following
  - Filter
  - Sampling rate
  - System
  - Components or ERP effects of interest
  - Analysis e.g., mean amplitude, peak latency
  - Other data acquired that you will relate to the ERPs
  - Stimuli presentation and conditions compared
- You will be graded especially on your understanding of how to set up an ERP study. That is, we are less interested in the specific phenomena you will study and the specific components/effects you will study in comparison to how EEG will be analyzed, coded, etc.
  - You will receive our grading guide that indicates how we will grade the papers in a timely fashion.
- We will check your papers for plagiarism by the use of urkund. Any suspicion of plagiarism will be reported and a grade will not be received until the disciplinary process is completed. If your paper contains plagiarism you risk receiving a grade of fail on the course.
  - See the following link for the process that will also be covered in the final lecture: <http://www.orkund.com/en/student>
  - You will upload your paper in the format doc, docx, or pdf to the following address: [annika.andersson.lu@analys.orkund.se](mailto:annika.andersson.lu@analys.orkund.se)
- Consider the following links for information regarding plagiarism.
  - From LU  
<http://libguides.lub.lu.se/content.php?pid=169847&sid=1966476>
  - From Högskolan Dalarna  
[http://www1.du.se/refero/Refero\\_eng/1intro.php](http://www1.du.se/refero/Refero_eng/1intro.php)  
[http://www1.du.se/refero/Refero\\_eng/tutorial/2plagiarism.php](http://www1.du.se/refero/Refero_eng/tutorial/2plagiarism.php)

## Deadlines and homework

1. Hand in homework (artifact spotting, handed out and sent out in pdf format at Lec 3 Monday September 5<sup>th</sup>) by **Monday September 12<sup>th</sup>**. This homework requires you to circle and identify all artifacts such as HEOG, and EMG onto your received print outs or pdfs of continuous EEG. You can opt to save the trees and send the files electronically to Annika with the subject heading HW1 this also requires that you include your name and HW1 in the file name, i.e., **'your\_name'\_HW1**
2. Submit the title of your ERP research proposal with references to at least three articles that are found in peer reviewed journals by **Wednesday September 21<sup>st</sup>** to Annika by email use HW2 as subject heading. You can write this in the body of the email or attach a document, which then should be named **'your\_name'\_HW2**. You will be required to use the APA referencing system to receive a pass on this HW.
3. Submit PDFs/images of individual averages (IDV) from lab session 3 on the same day, **Wednesday September 26<sup>th</sup>**. These will be used on lecture 8 (Monday October 3<sup>rd</sup>) when we together will compare and evaluate different IDVs. At the end of the lab session you will be asked to put your PDFs in the folder on the x-drive under **EEG/ERP\_course/results/'your\_name'\_HW3**.
4. Hand in homework (summary of individual good and bad averages with explanations, handed out and sent as pdf at Lec 7, Wednesday September 28<sup>th</sup>) by Lec 8 **Monday October 3<sup>rd</sup>**. This homework requires you to circle and identify e.g., HEOG, and EMG onto your received print outs of IDVs. Annika will look to see if you could find and correctly identify any artifacts present and judge if the IDV should be accepted or not into a grand average (GAV). You can opt to save the trees and send the files electronically to Annika with the subject heading HW4 in the email. This requires that you include your name and HW4 in the file name i.e., **'your\_name'\_HW4**.
5. After Lab session 4 on **Wednesday October 5<sup>th</sup>**, submit PDFs/images of the best IDVs you produced along with a detailed description of the steps taken to reach those IDVs either onto the pdf image or in a separate word document. If you have any questions regarding what to include in the description please ask during the session. At the end of the lab session you will be asked to put your PDFs and the detailed description in the folder on the x-drive under **EEG/ERP\_course/results/'your\_name'\_HW5**. The detailed description can also be sent electronically to Annika with HW5 in the subject line of the email and the document name as **'your\_name'\_HW5**.
6. Submit final research proposal electronically through urkund to Annika (see above under *Written ERP proposal*) no later than **Friday October 28<sup>th</sup> 2016** (midnight). Please include your name in the file name. Grades will be given at the latest after 15 working days i.e., on Friday November 11<sup>th</sup>.

## Assessment

The assessment is based on student presentations, homework assignments, interactions and activities during the lectures and lab sessions in addition to the final written paper. Note that HWs and final paper that are sent in past midnight of the due date will receive a grade of fail if not specific arrangements have been made with one of the teachers.

Marking scale for PhD students: Fail, Pass

Marking scale for Master students: Fail, Pass, Pass with distinction.

Final papers will be graded as Fail, Pass, (or Pass with distinction, for Master students—see above). If you would like to have more detailed written feedback on your paper we require you to set up a meeting with Annika where you will discuss this written feedback for a better learning experience. The meeting date should be settled **by** Friday October 28<sup>th</sup>.

Students failing the final paper will be allowed to hand in a new proposal by November 25<sup>th</sup> 2016. This paper should follow the same outline as the first final paper, but need to be an entirely new proposal that is in no way based on the previously submitted proposal, this includes also entirely new references. Observe that this is not true for papers that receive a grade of fail due to plagiarism, which would result in a grade of Fail on the entire course.

## Readings (in APA 6<sup>th</sup> ed style)

Luck, S. J. (2014). *An Introduction to the Event-Related Potential Technique* (2nd ed.). Cambridge, MA: MIT Press books.

And potential research articles TBA