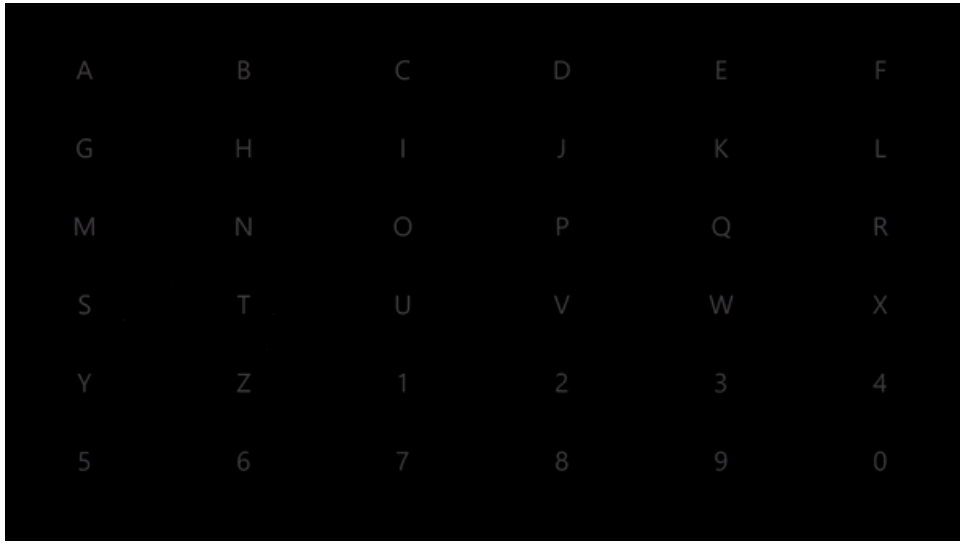
Sissejuhatus
psühhofüsioloogia
rakendustesse

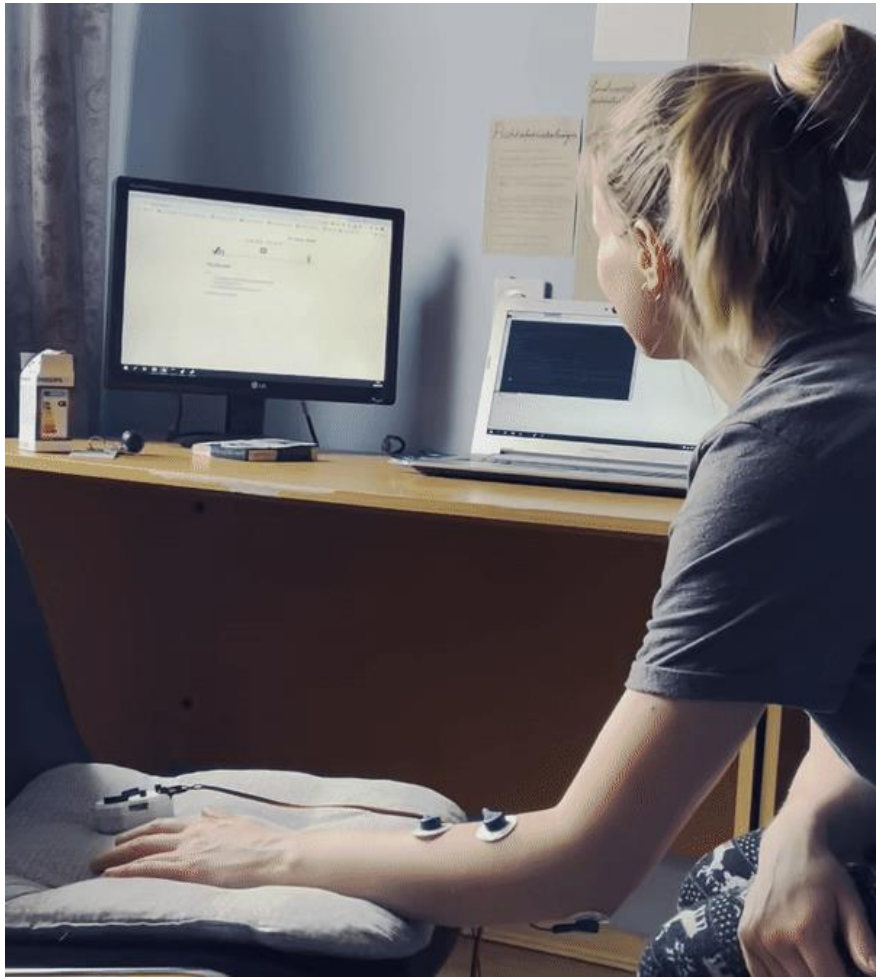
Elektroentsefalograafia



Richard Naar

Kursuse arendamist toetas Haridus- ja noorteameti IT-akadeemia

OpenBCI näidisprojektid



OpenBCI Documentation

Main Site Shop Forum Documentation Github

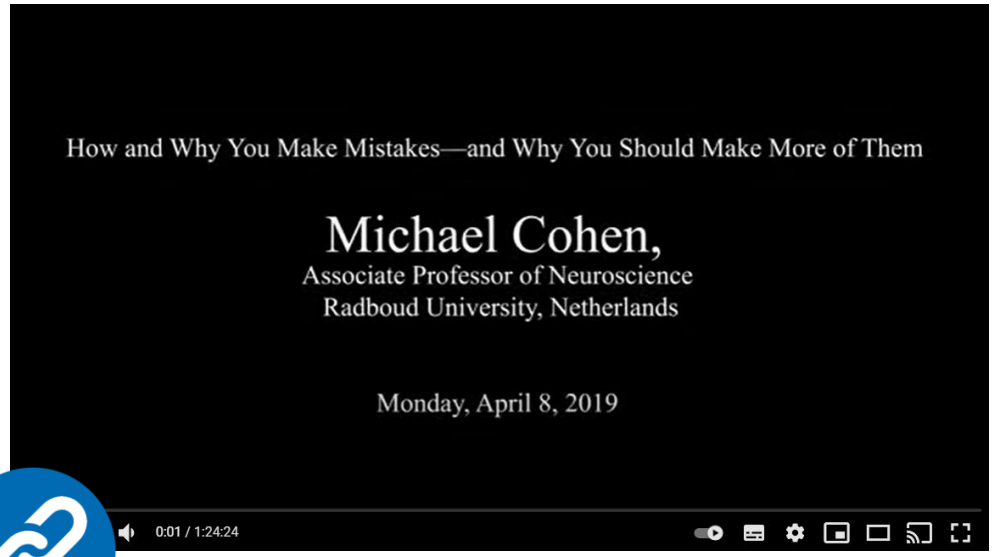
- Welcome to OpenBCI
- Getting Started
- Cyton Board
- Ganglion Board
- Headwear & Electrodes
- Third-Party Hardware
- Software
- For Developers
- Deprecated Documents
- Troubleshooting
- Example Projects
  - Example Projects
  - Experiments
    - Puppies and Kittens Experiment
  - Community Page Projects
    - Community Page Projects
  - EMG Projects and Tutorials
    - EMG Scrolling
    - EMG-controlled Stop/Start Music

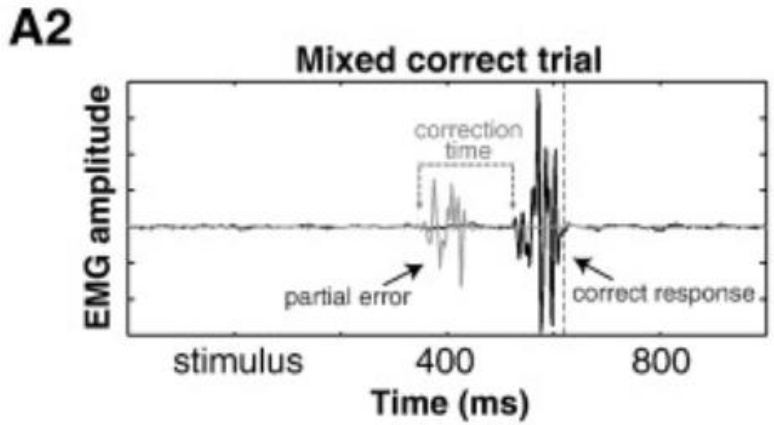
EMG Chrome Dino Game

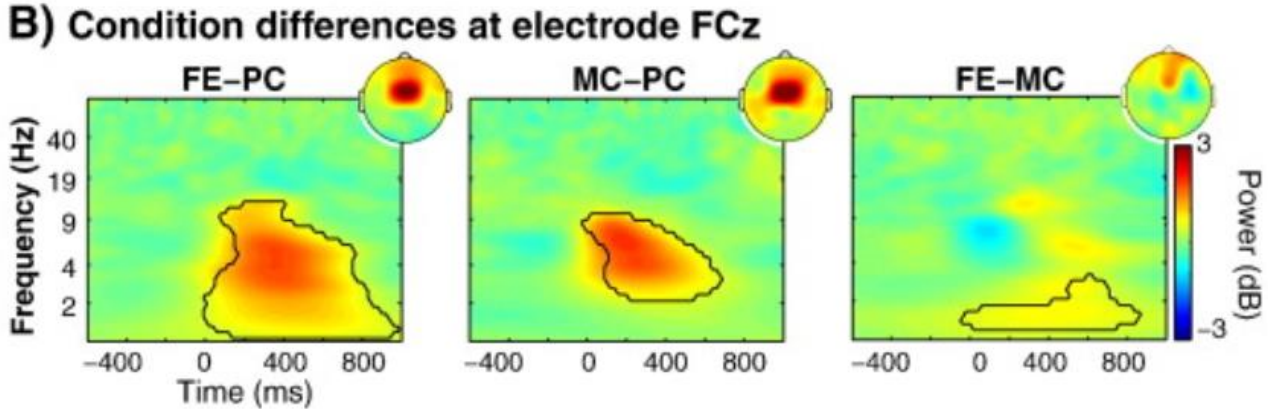
EDIT

In this tutorial we will show you how to play the Google Chrome Dinosaur Game without touching your laptop. To do that, we will read EMG data from your arm muscles and find the peaks which correspond to flexing, using them to trigger a jump of the dinosaur.

Check out an example video of this tutorial being put into action!

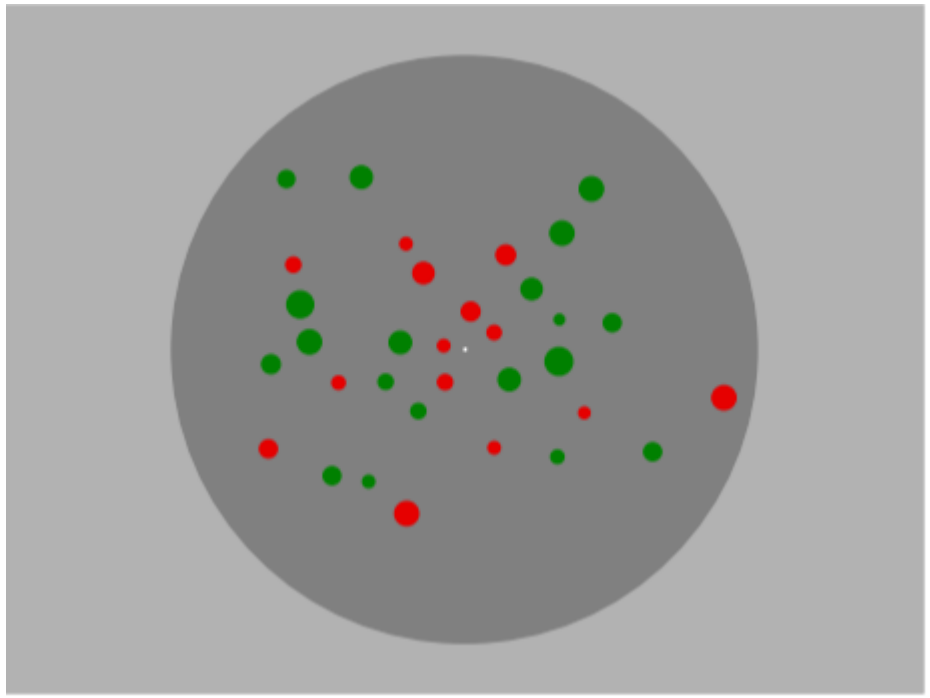






(Cohen, & van Gaal, 2014)

EEG sündmuspotentsiaalid (ERP)



Kui sekkuvat muutujat pole võimalik kontrollida, siis on mõistlik see vabaks lasta ehk muuta katsemanipulatsioonist sõltumatuks (st sekkuv muutuja ei tohiks olla süstemaatiliselt seotud katsetingimustega)

(Raidvee, Lember, & Allik, 2017)

EEG sündmuspotentsiaalid (ERP)

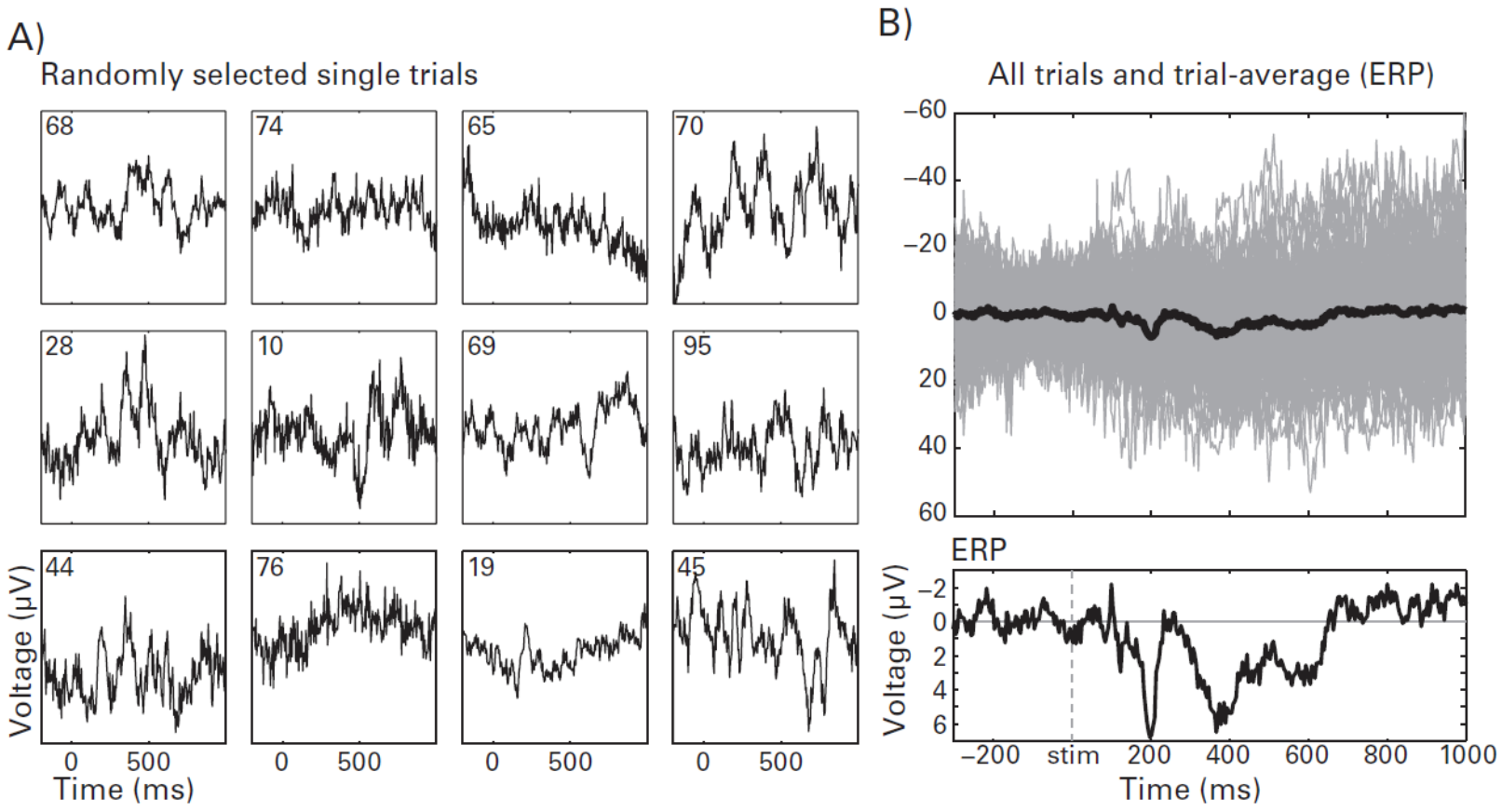
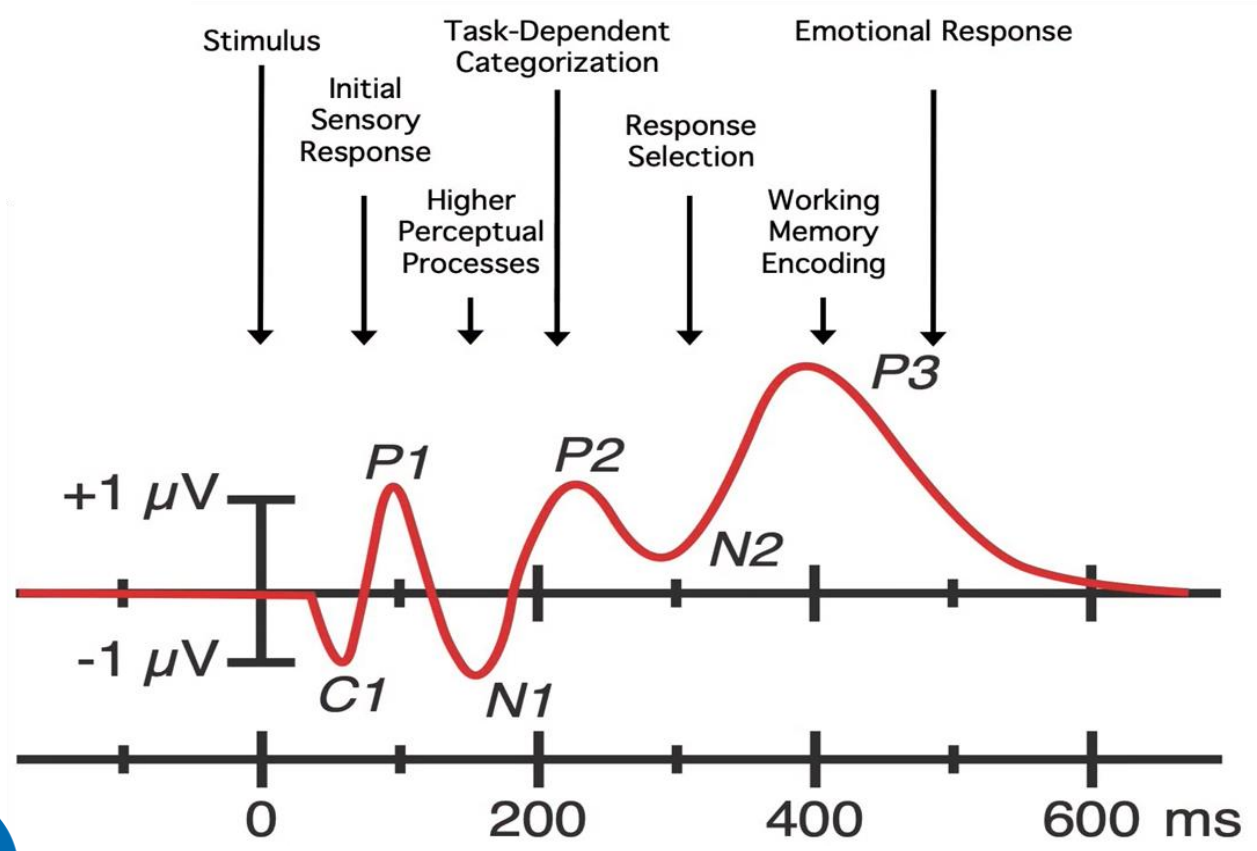


Figure 9.1

Üle paljude esituste keskmistatud EEG signaal on kordades **väiksema** amplituudiga kui mürarikkal üksikseerial

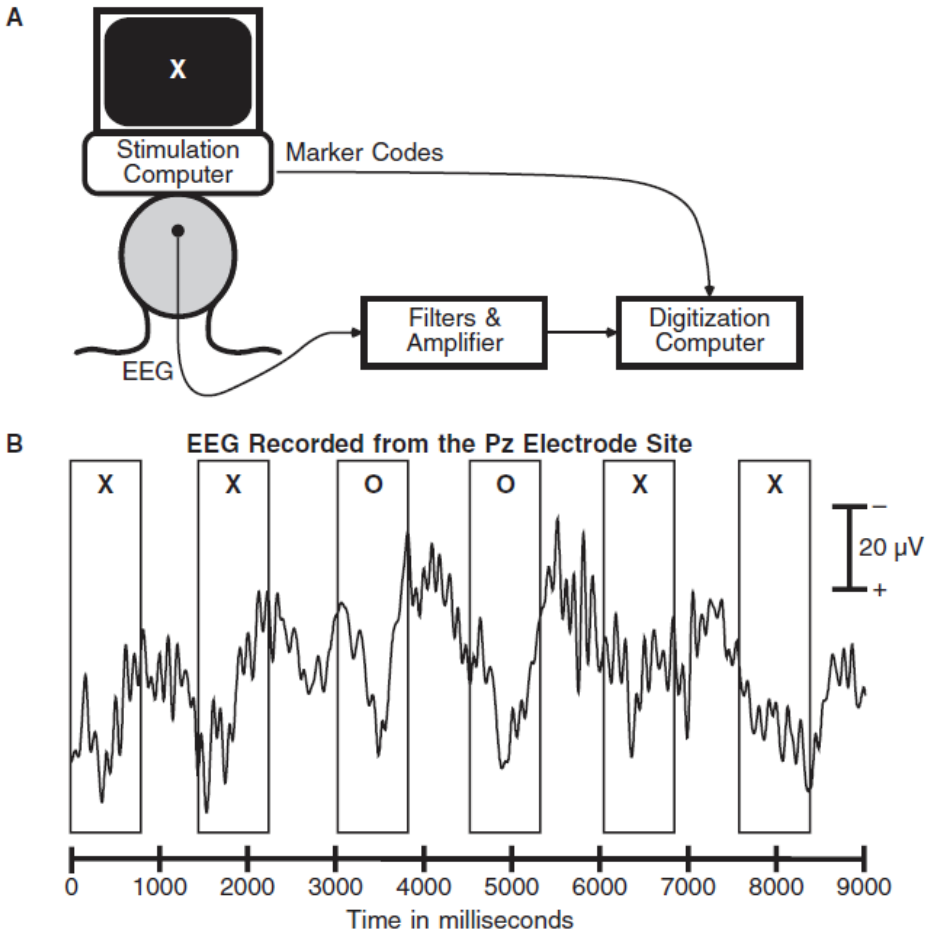
(Cohen, 2014, lk 98)

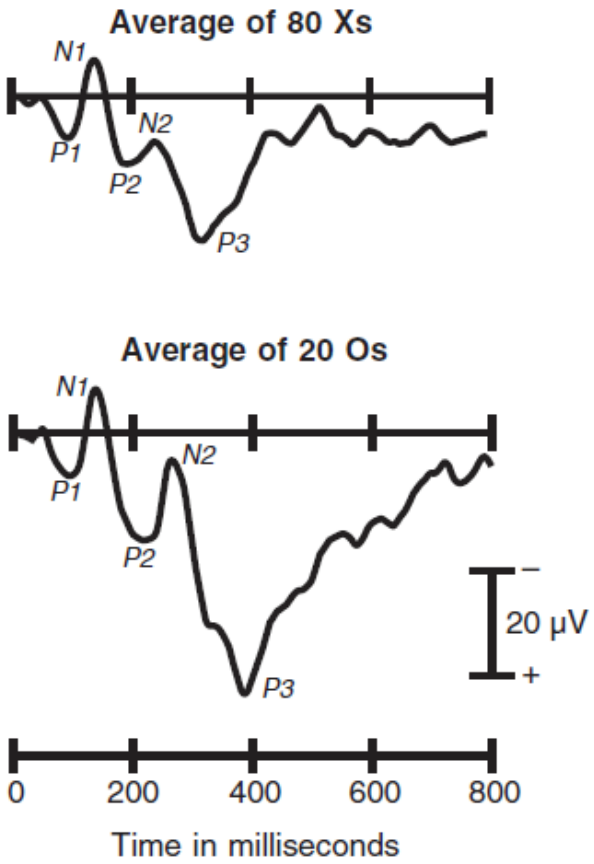
EEG sündmuspotentsiaalid (ERP)



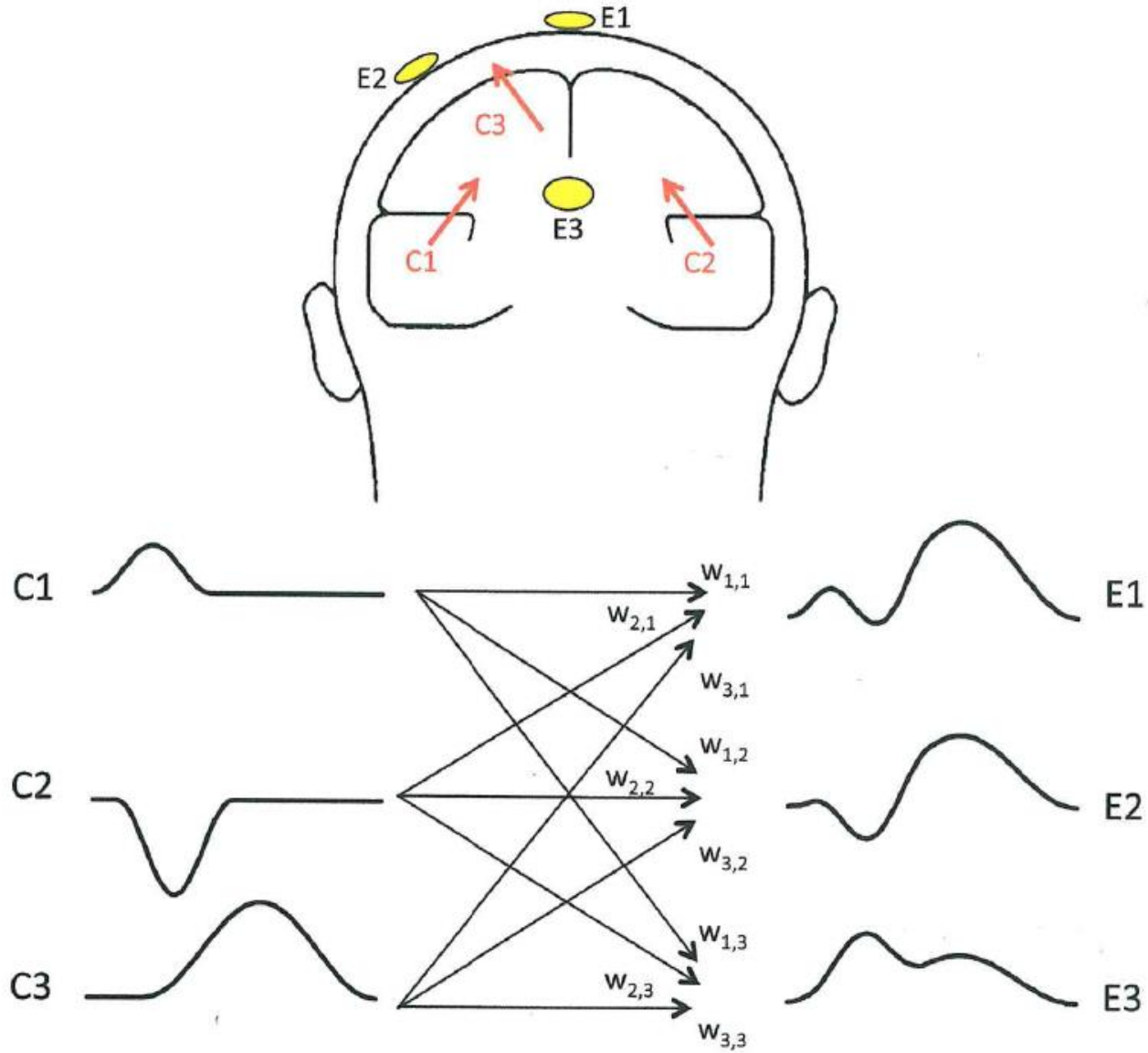
EEG sündmuspotentsiaal (*event related potential* - ERP) – sündmuse poolt esile kutsutud aju elektriliste potentsiaalide muutus

EEG sündmuspotentsiaalid (ERP)

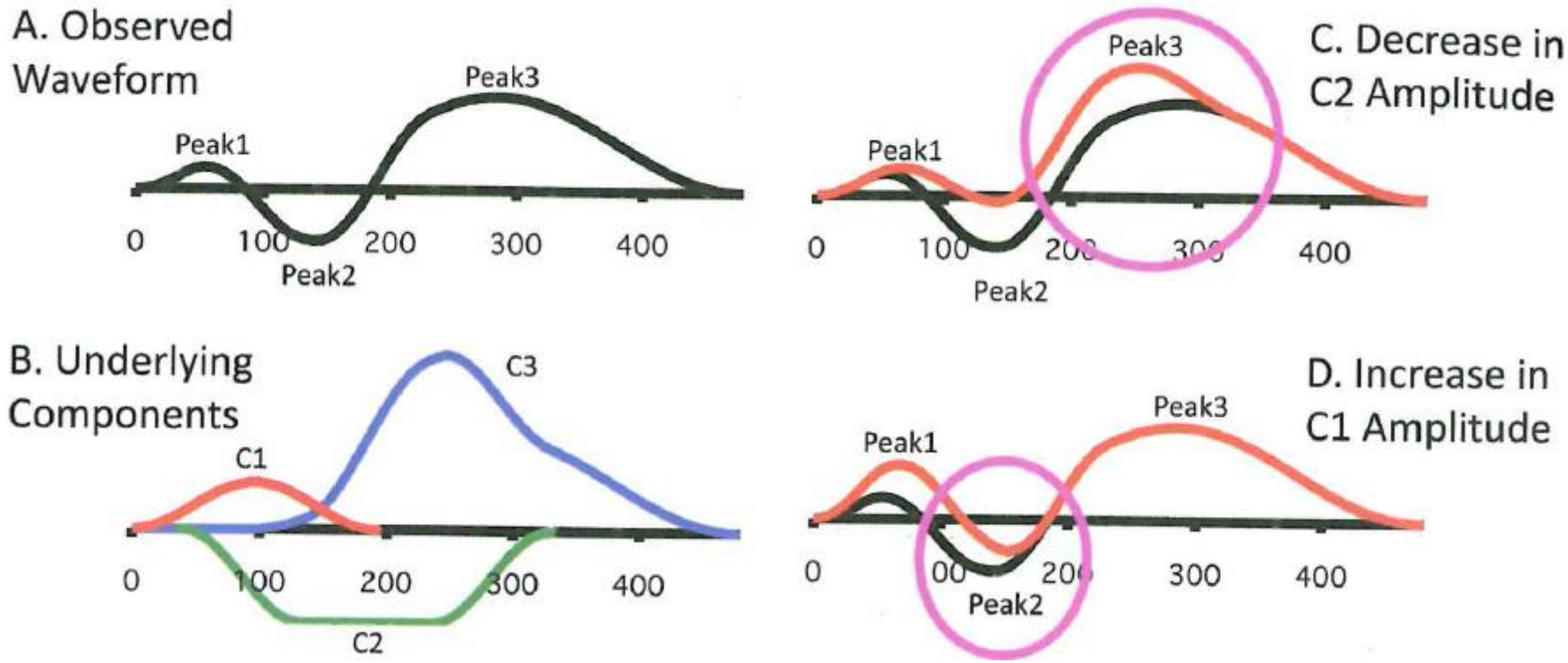




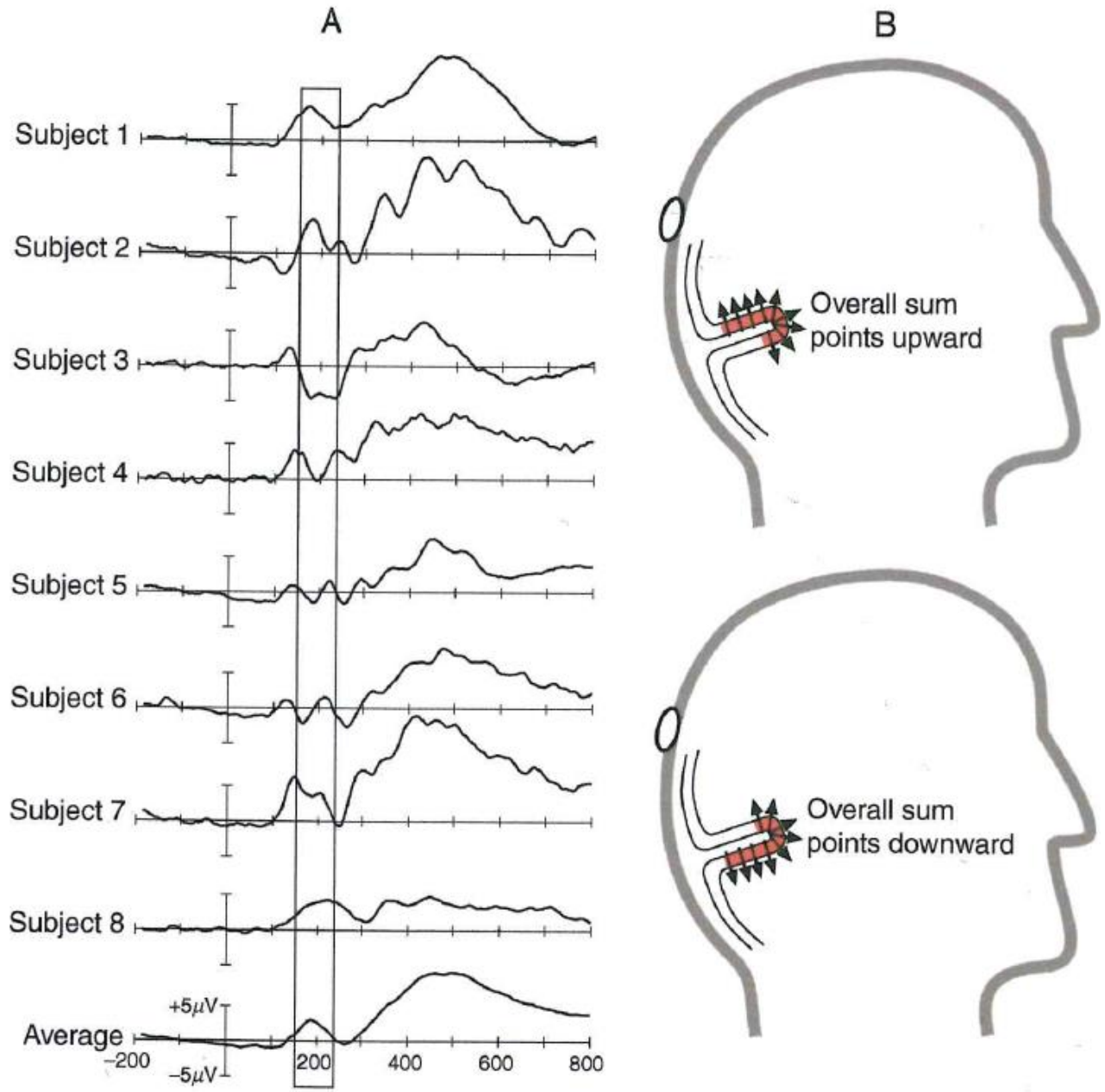
(Luck, 2005, lk 8)



(Luck, 2011, lk 7)

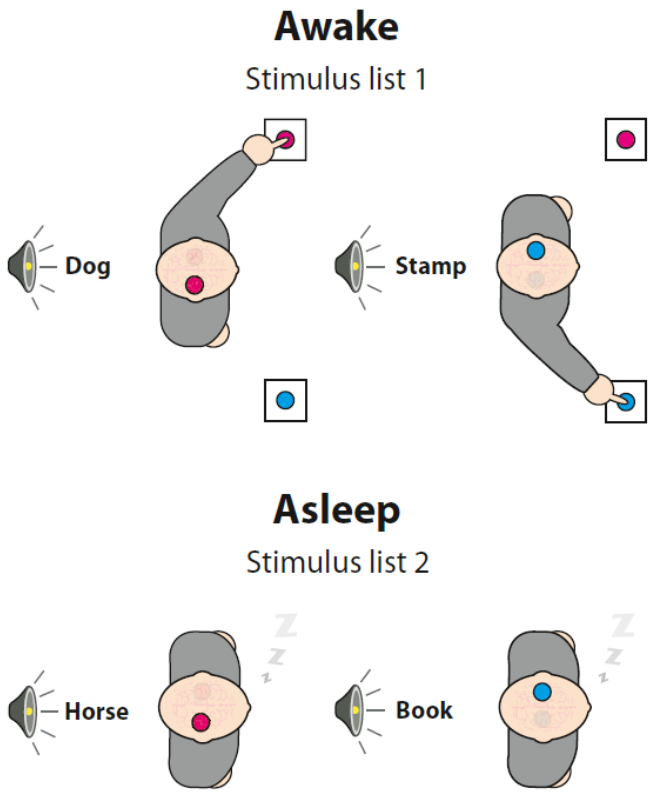


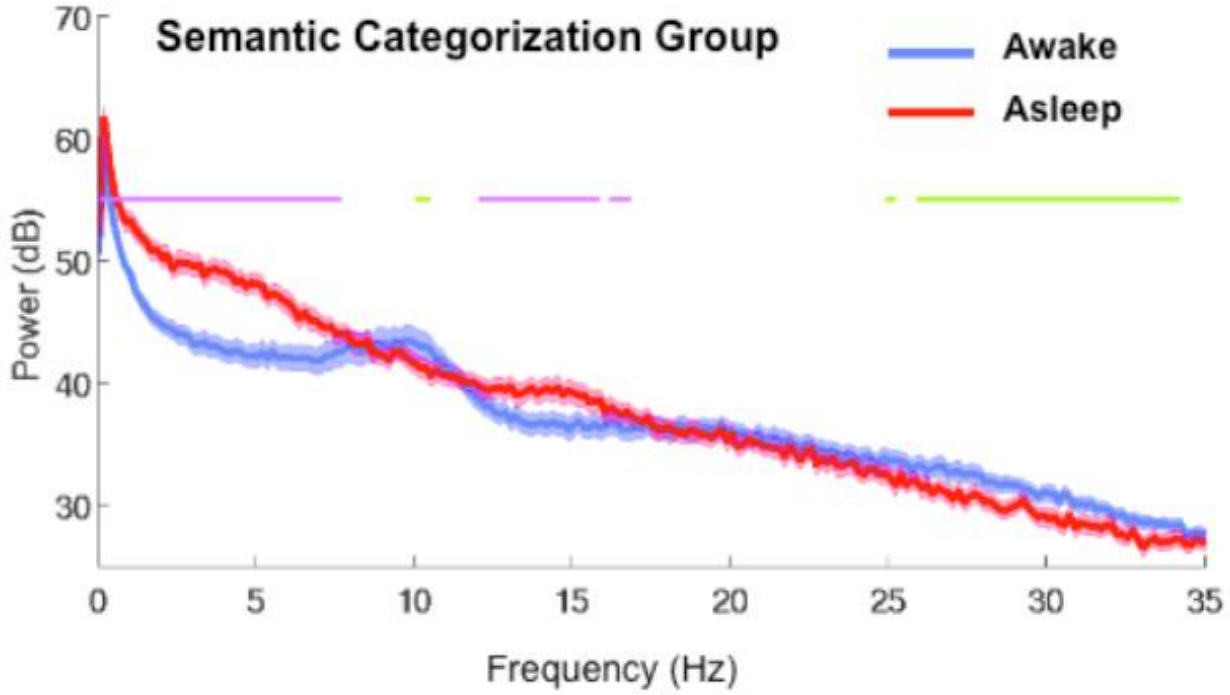
(Luck, 2011, lk 11)



(Luck, 2011, lk 7)

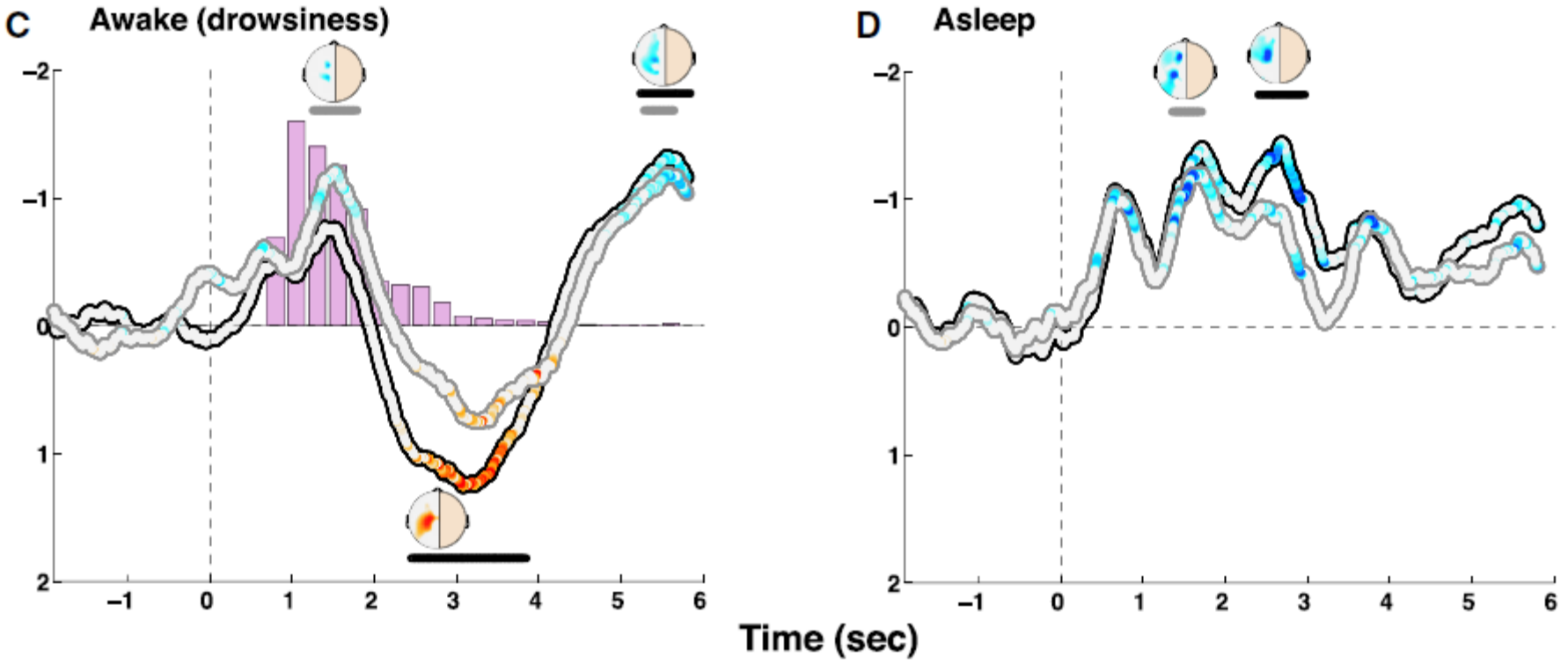
Milleks EEG?



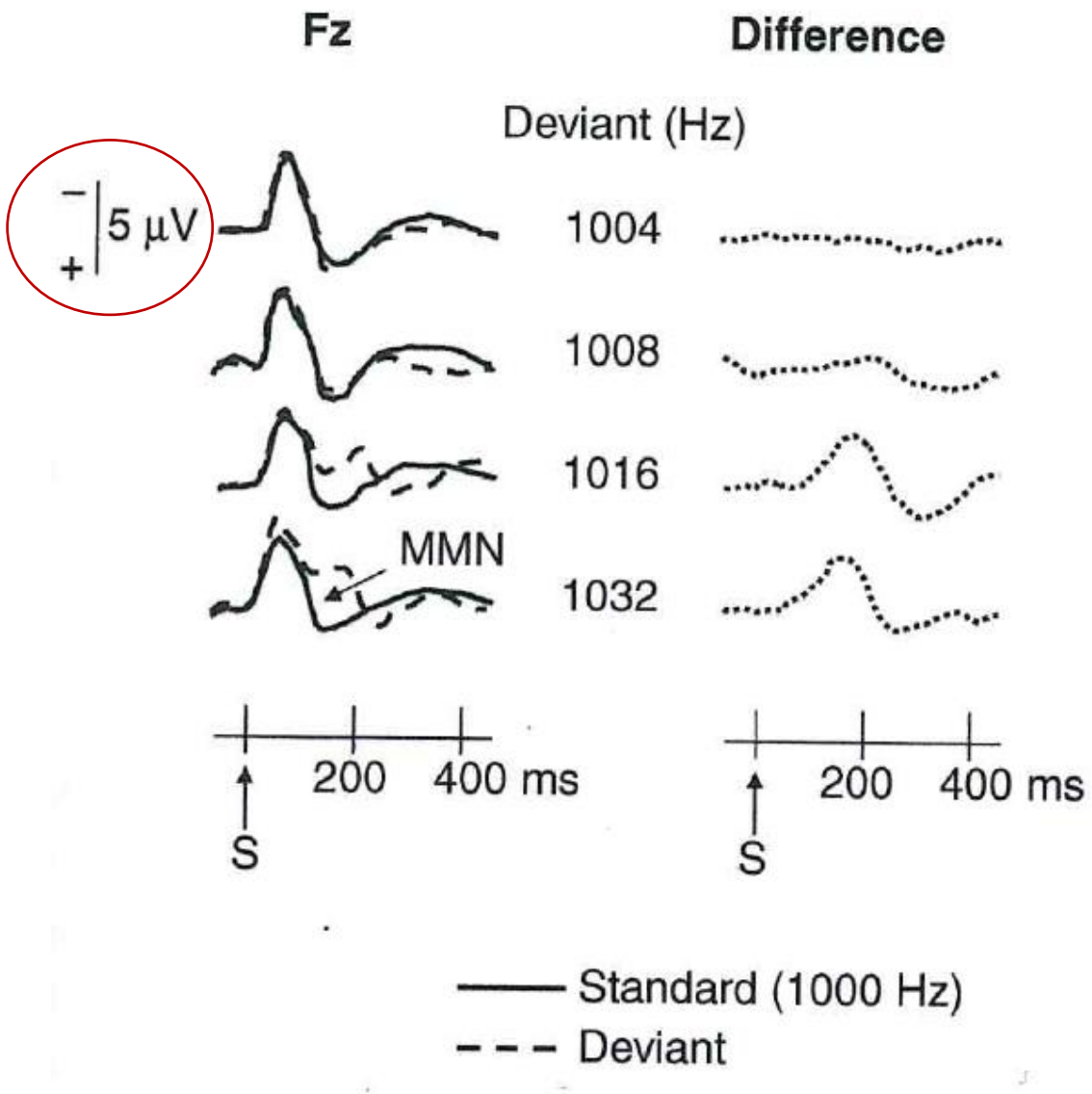


(Kouider, Andrillon, Barbosa, Goupil, & Bekinschtein, 2014)

Milleks EEG?



(Kouider, Andrillon, Barbosa, Goupil, & Bekinschtein, 2014)



(Luck, 2011, lk 23)

Mõned sündmuspotentsiaalide kasutusvaldkonnad

Uurida kognitiivsete ja tajuliste protsesside ajalist dünaamikat

Uurida katseisikuid, kes ei saa või ei suuda eksplitsiidseid vastuseid anda (nt imikuid, magavaid katseisikuid, kooma patsiente)

Uurida töötlust, mille puhul vastuse andmine võiks töötlust oluliselt muuta (nt stiimulite tähelepanuvälise töötluse puhul)

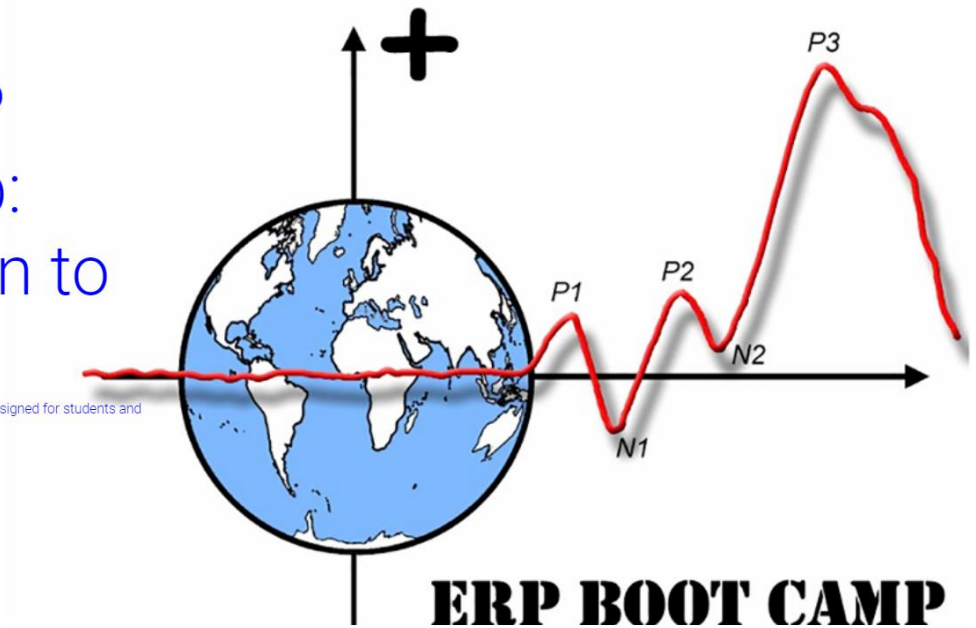
Uurida töötlust, mis ei pruugi käitumises väljenduda (nt maskeeritud stiimulite töötlemine).

EEG sündmuspotentsiaalid

Virtual ERP Boot Camp: Introduction to ERPs

Introduction to the event-related potential technique, designed for students and researchers with little or no prior ERP experience.

Enroll for free



Professor Steven Luck

(Kalifornia Ülikool, Davis)

Kaasprofessor Emily Kappenman

(San Diego Osariiklik Ülikool)

Clinical Neurophysiology
Volume 112, Issue 3, March 2001, Pages 536-544

Takistus

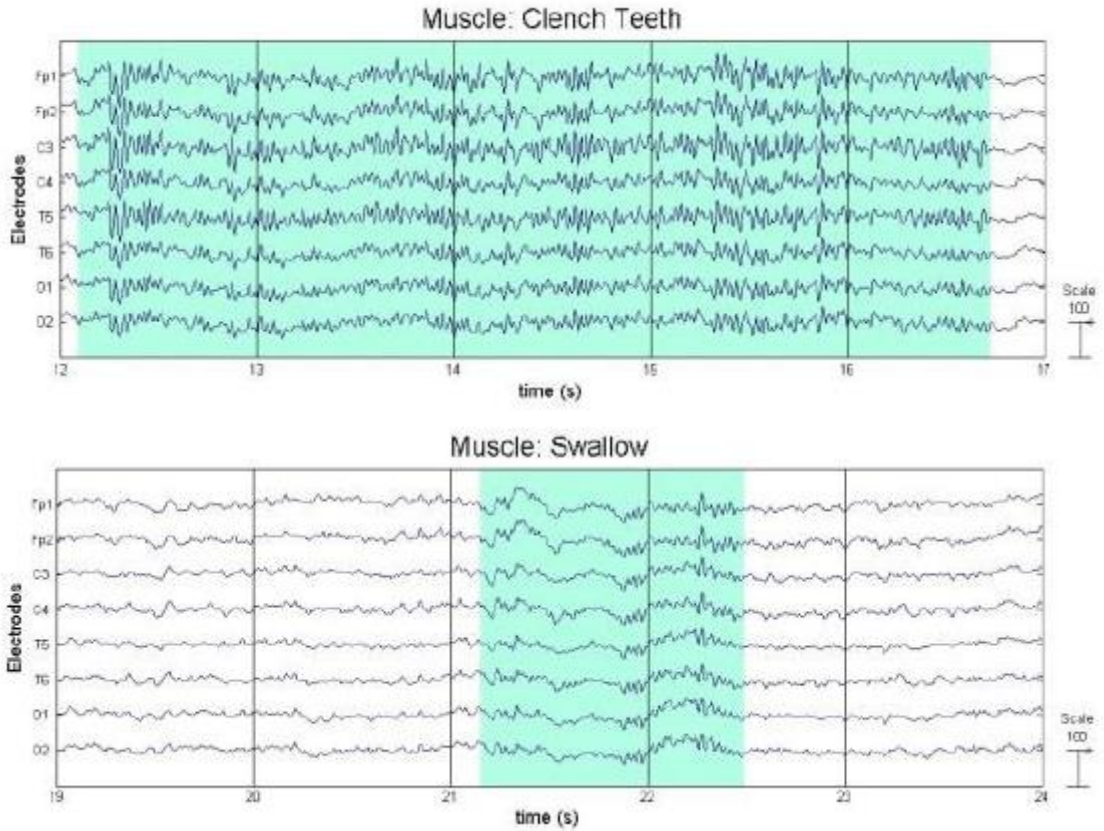
Scalp electrode impedance, infection risk, and EEG data quality

Thomas C Ferree [a, b], Phan Luu [a, c], Gerald S Russell [a, d], Don M Tucker [a, c]

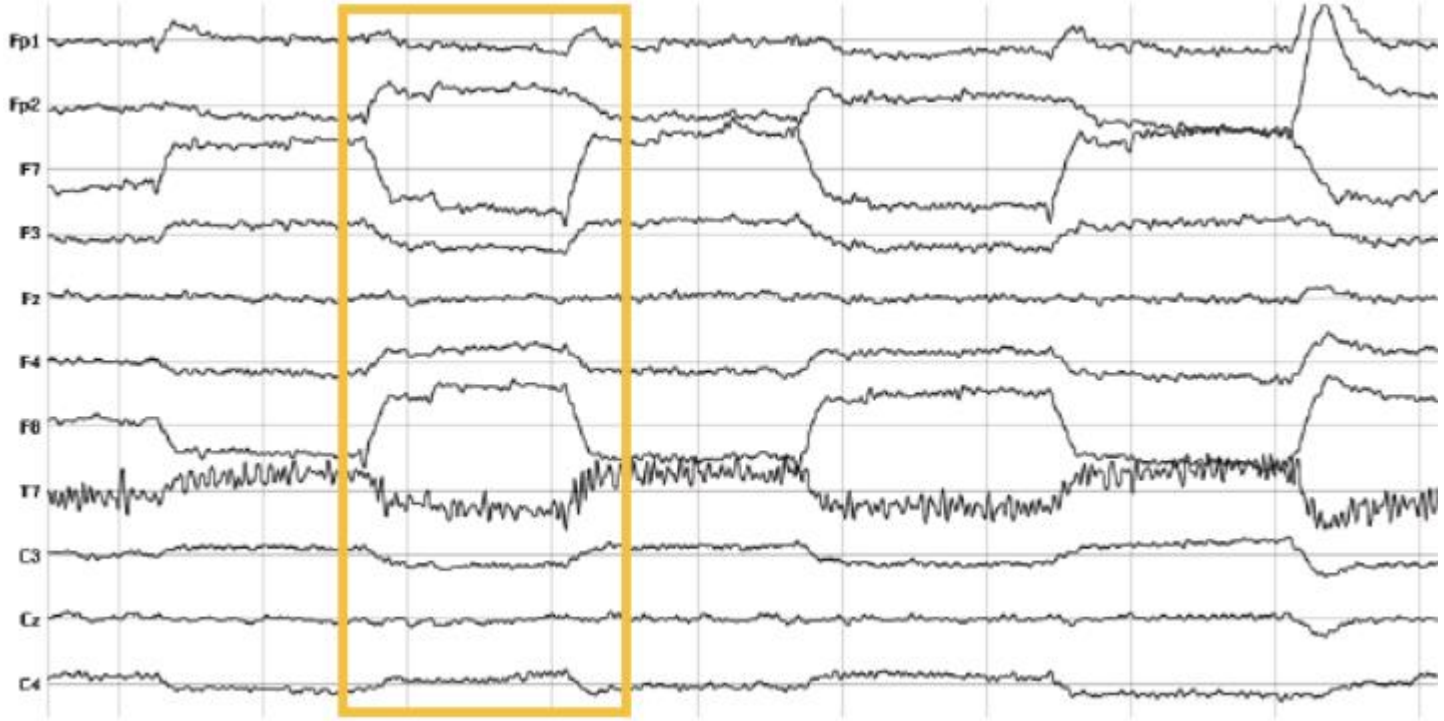
Results: There was no significant change in amplitude of any EEG frequency as scalp-electrode impedance increased from less than 5 kΩ (abraded skin) to 40 kΩ (intact skin). As expected, 60 Hz noise increased linearly as a function of the absolute impedance and impedance mismatch between the measurement and reference electrodes.

Conclusion: With modern high input-impedance amplifiers and accurate digital filters for power line noise, high-quality EEG can be recorded without skin lesions.

Lihasmüra (EMG, ECG)

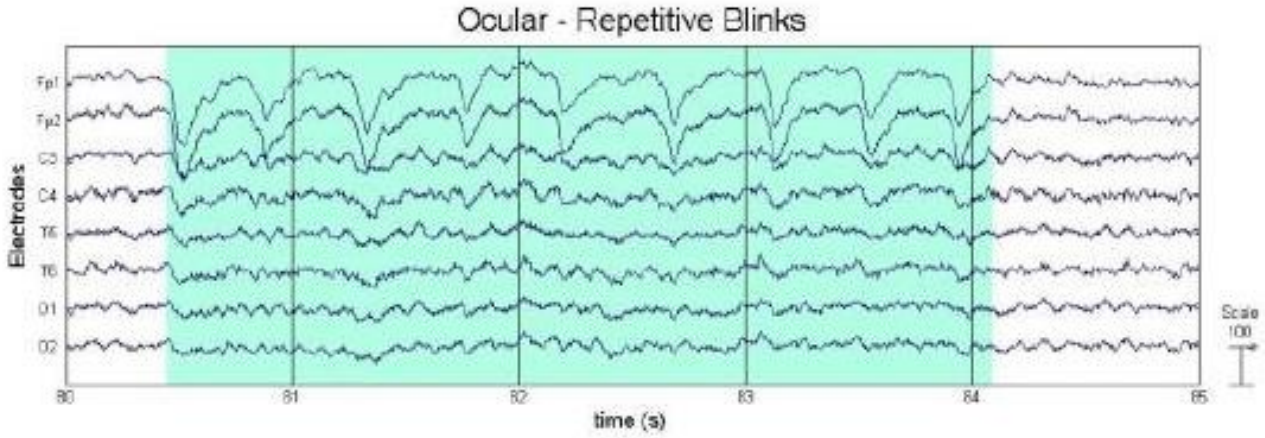


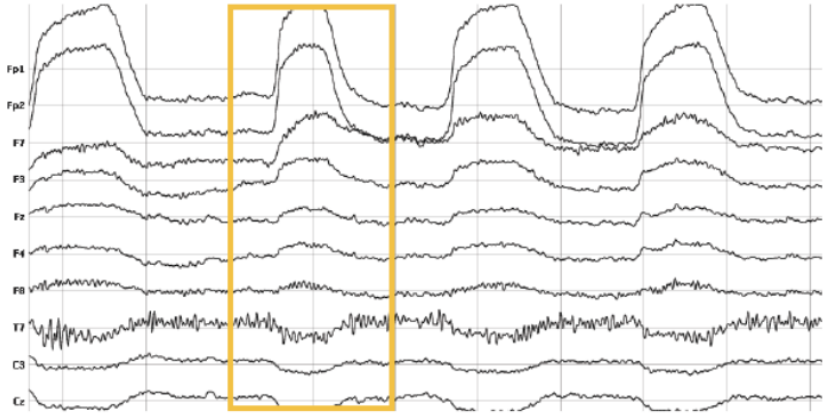
Silmaliigutused



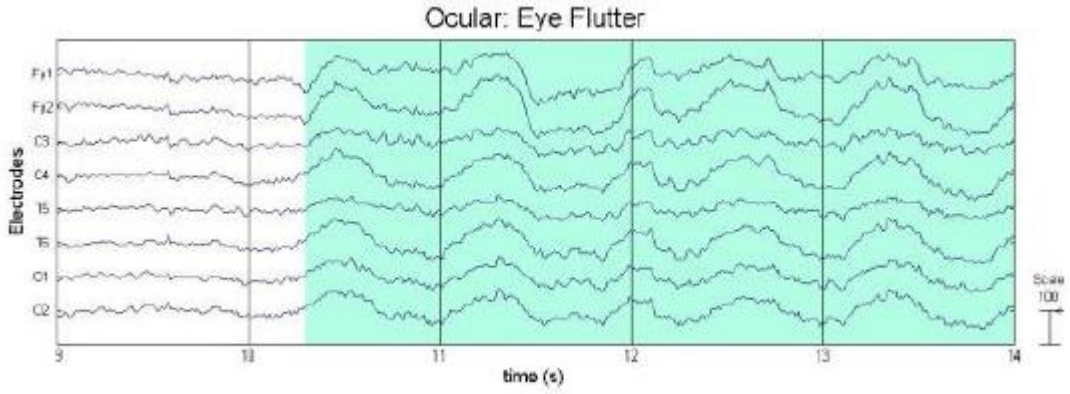
(Farnsworth, 2019)

Pilgutused



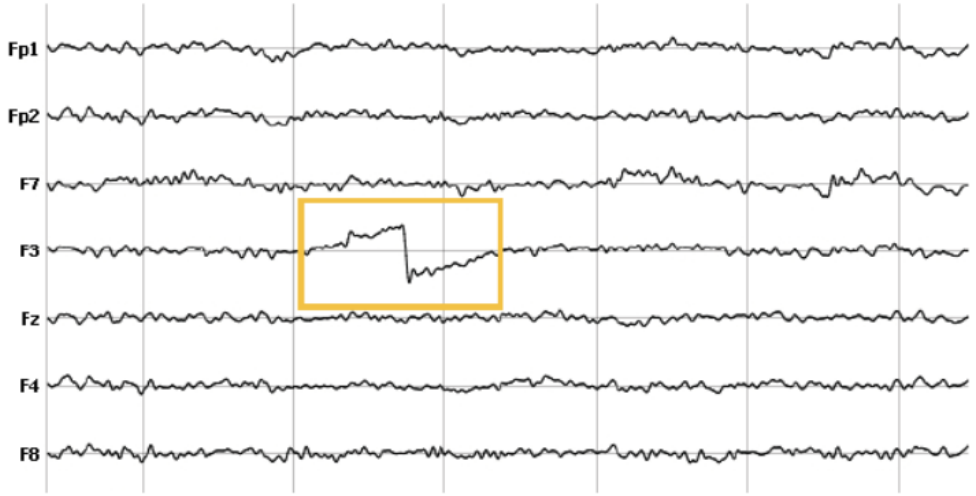


(Farnsworth, 2019)

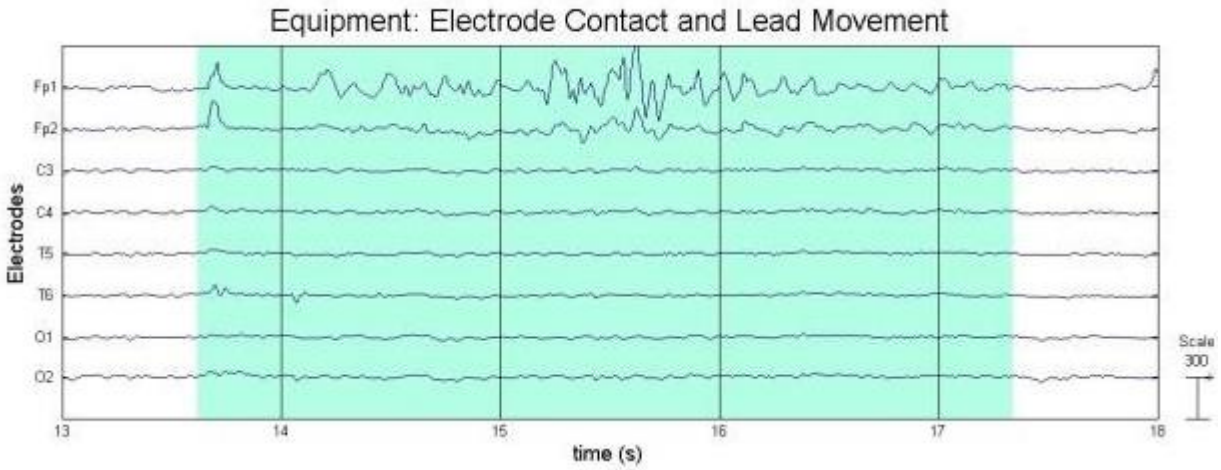


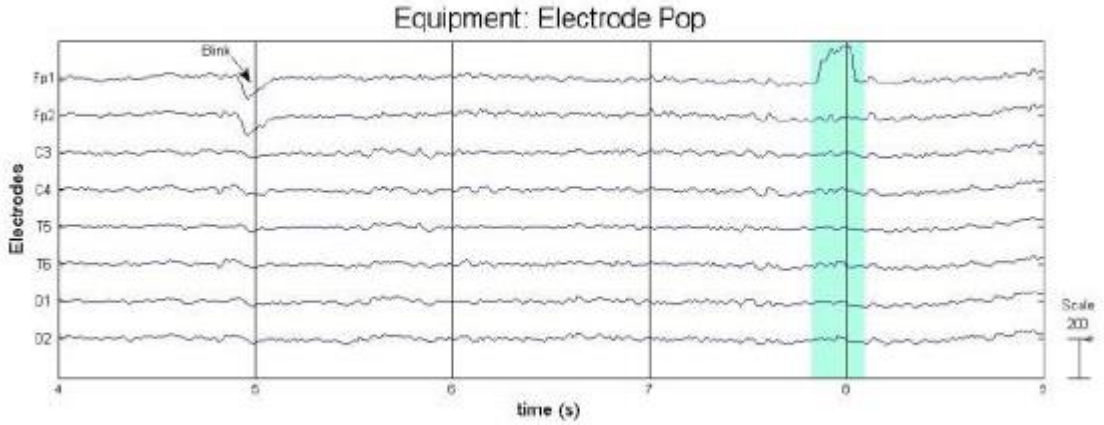
(Schembri, Anthony, & Pelc, 2017)

Elektroodide liikumine ja ühenduse probleemid



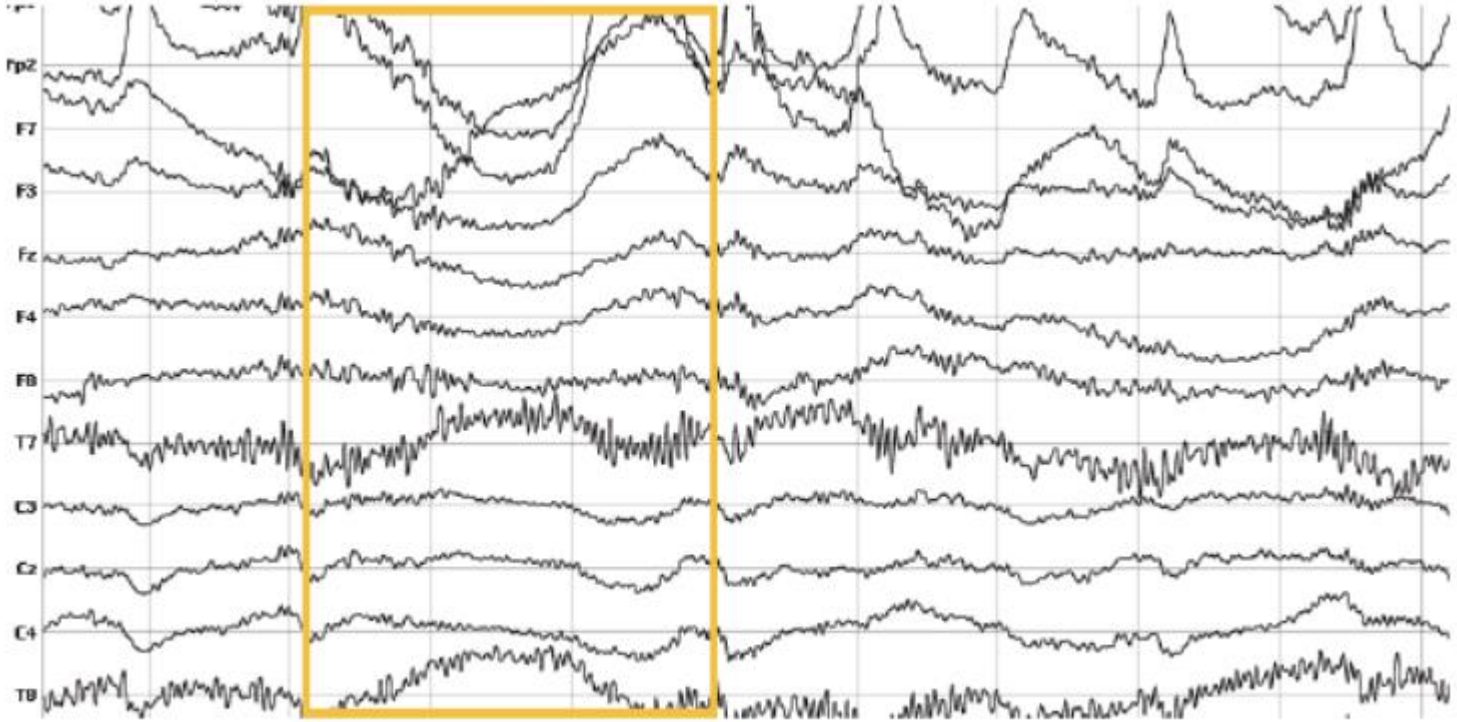
(Farnsworth, 2019)





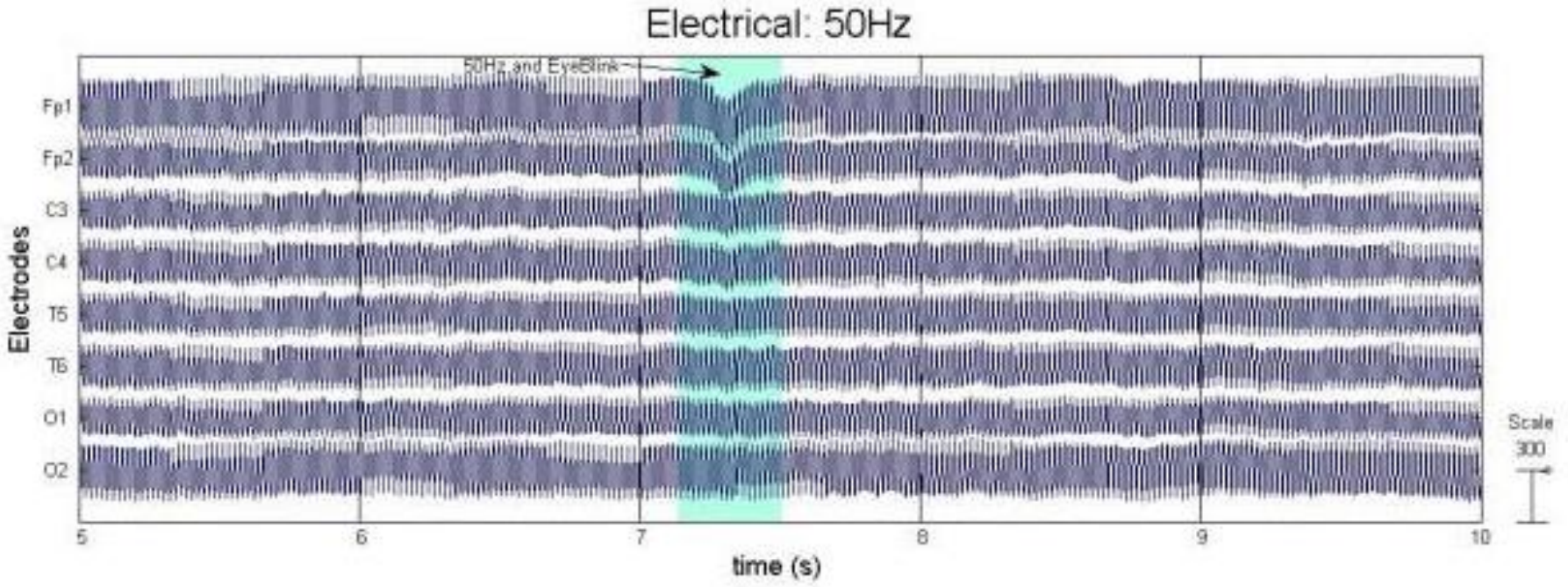
(Schembri, Anthony, & Pelc, 2017)

Katseisiku pea liikumine



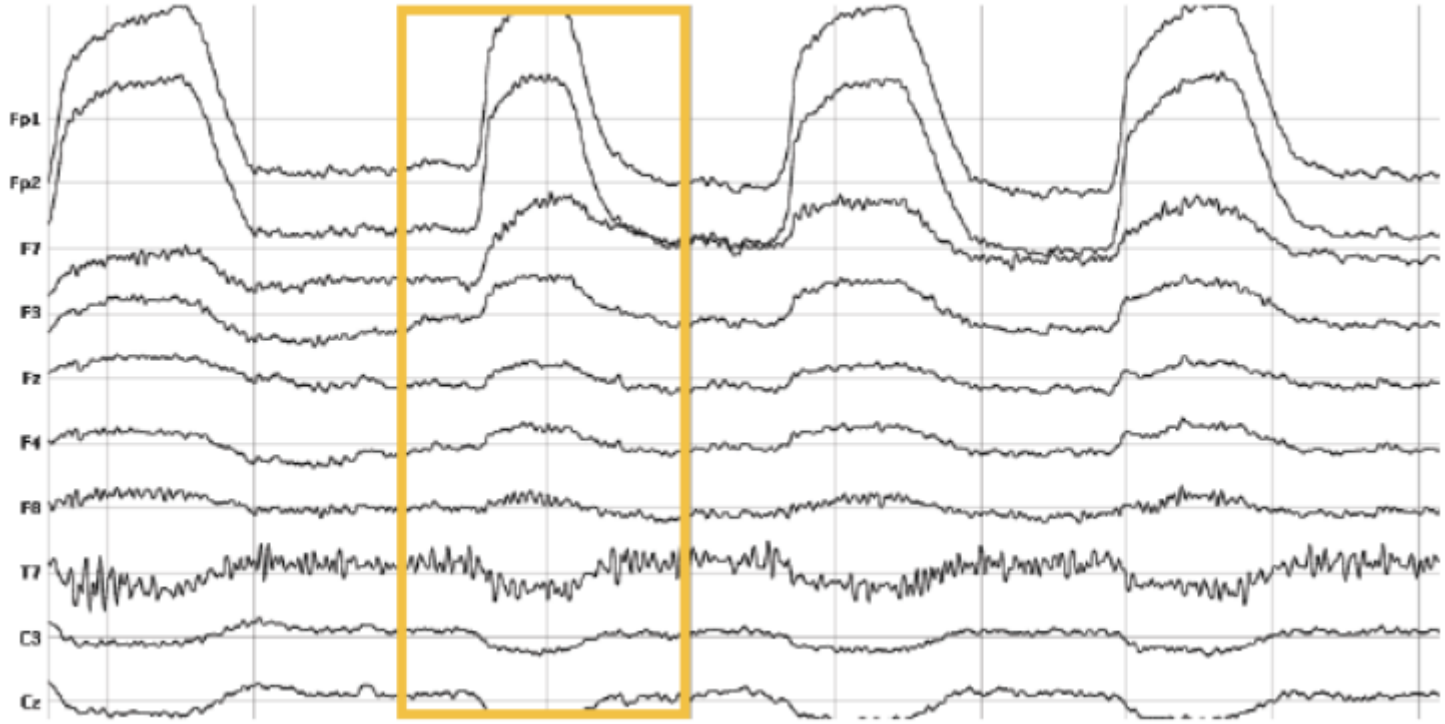
(Farnsworth, 2019)

Vahelduvvooluga seotud müra



(Schembri, Anthony, & Pelc, 2017)

Pilgutused



(Farnsworth, 2019)

Eeltöötlus

0. Kontrollin, kas kõik on nii nagu peab (sh stiimulite ja vastamisklahvide ajastus, randomiseerimine, sündmussignaalid ja nende ajastus)

1. Andmete importimine, referentsi valimine ja rakendamine, filtreerimine (nt 0,1/0,5 Hz kõrgpääsu filter, ribatõkke filter 48-52 Hz / 30 Hz madalpääsu filter), ajaakende defineerimine (nt -1 s ja +3 s) ja leidmine, baastaseme lahutamine (nt -0,2 s), mürarikaste seeriate väljajätmine (manuaalne/automaatne), mürarikaste kanalite interpoleerimine, sõltumatute komponentide analüüs (*independent component analysis*; ICA)

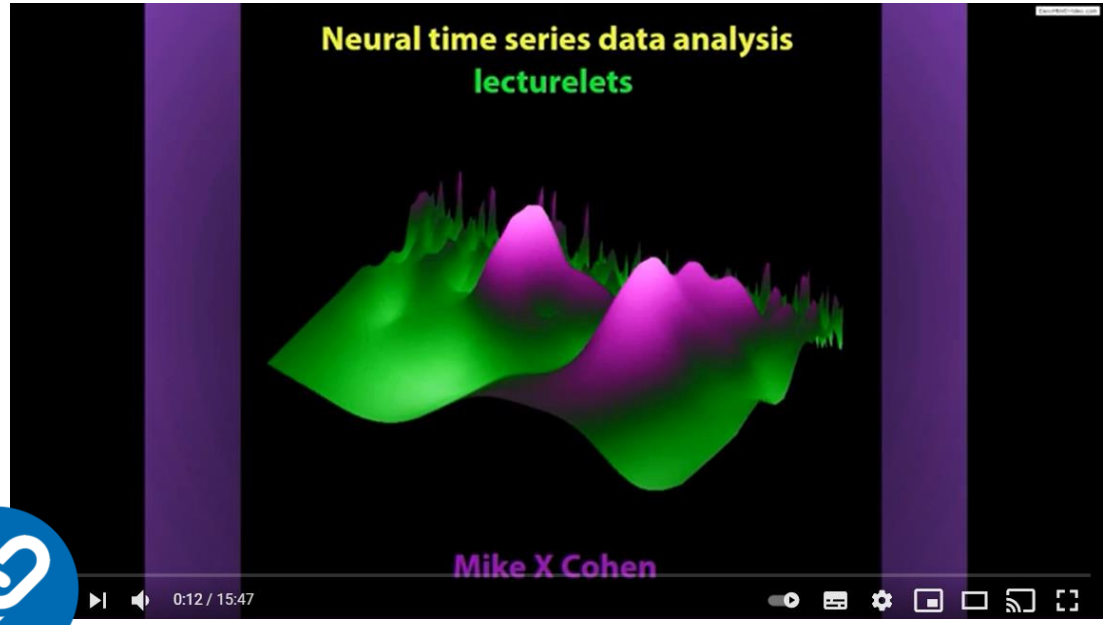
Eeltöötlus

2. Põhiliselt silmaliigutustega seotud ICA komponentide eemaldamine

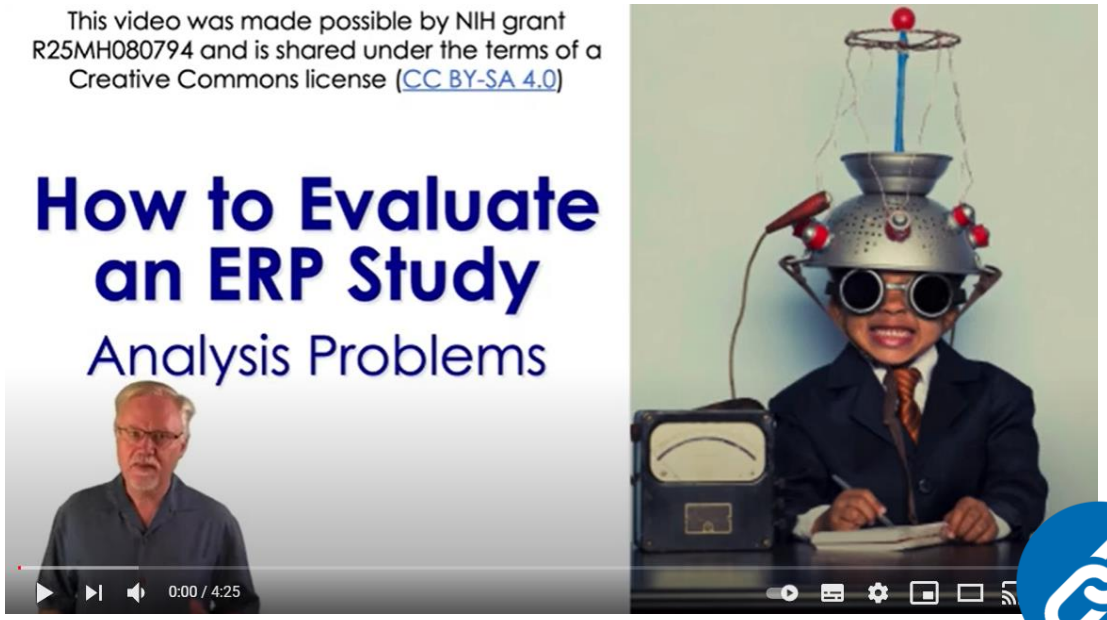
3. Ajaakende ja tingimuste keskmise leidmine, sagedusanalüüs jne

4. Andmete visualiseerimine ja tabelisse salvestamine, statistika jne

Ülevaade EEG signaali eeltöötlusest

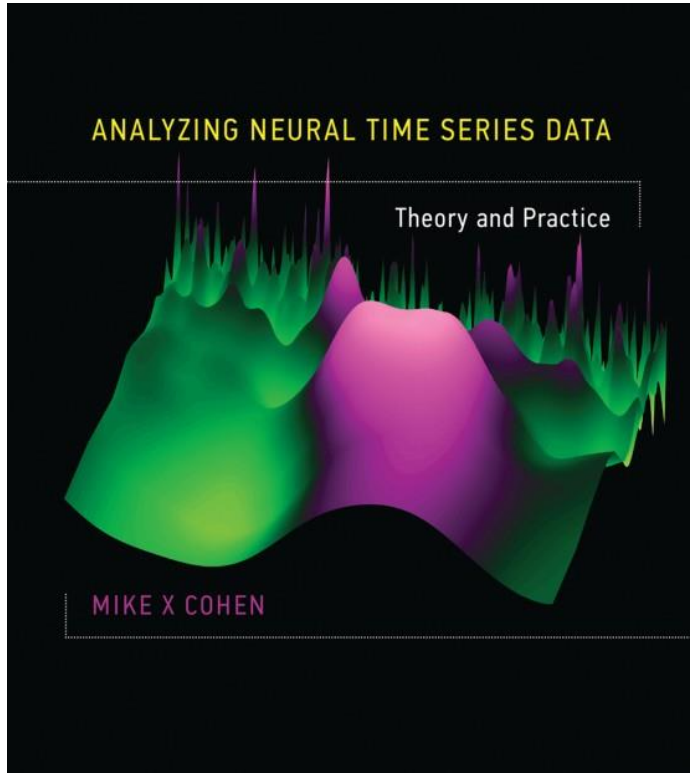


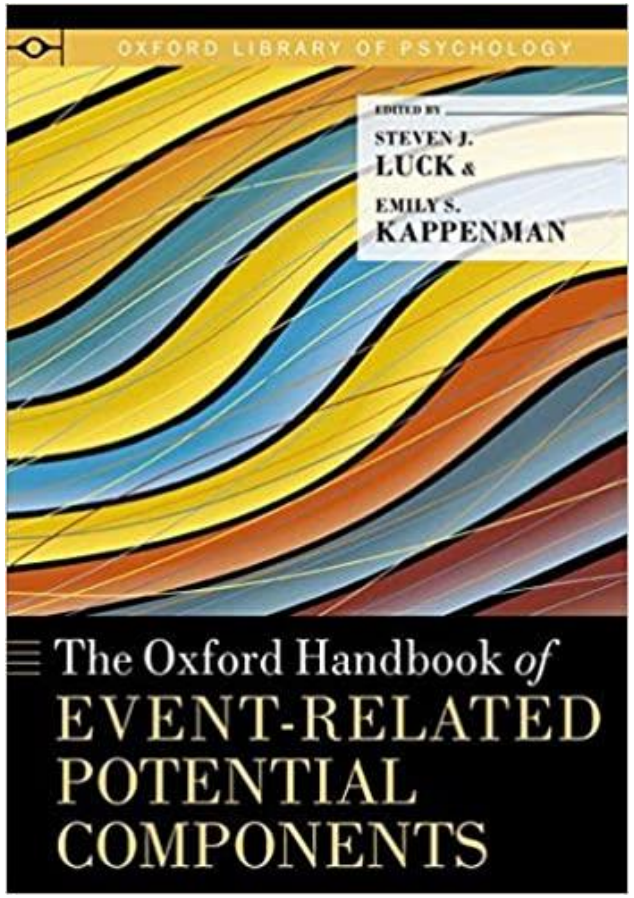
Professor Mike X Cohen (Radboudi Ülikool ja Dondersi instituut)



Professor Steven Luck (Kalifornia Ülikool, Davis)

Kaasprofessor Emily Kappenman (San Diego Osariiklik Ülikool)


ANALYZING NEURAL TIME SERIES DATA
Theory and Practice
MIKE X COHEN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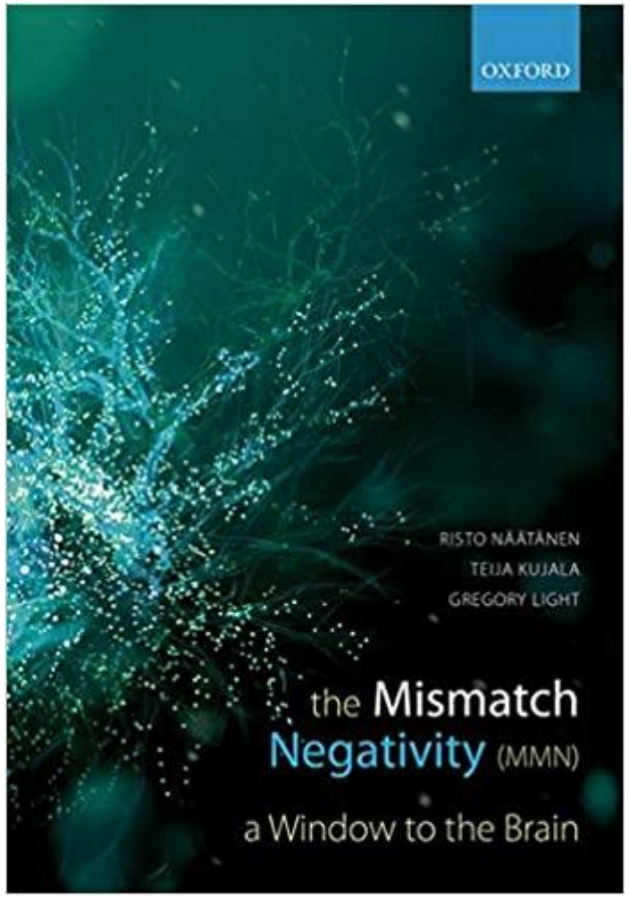
EDITED BY
STEVEN J. LUCK &
EMILY S. KAPPENMAN
The Oxford Handbook of
EVENT-RELATED POTENTIAL COMPONENTS


OXFORD
RISTO NÄÄTÄNEN
TEIJA KUJALA
GREGORY LIGHT
the Mismatch Negativity (MMN)
a Window to the Brain

The Mismatch Negativity (MMN)

Risto Näätänen and Kairi Kreegipuu

The Oxford Handbook of Event-Related Potential Components
Edited by Emily S. Kappenman and Steven J. Luck

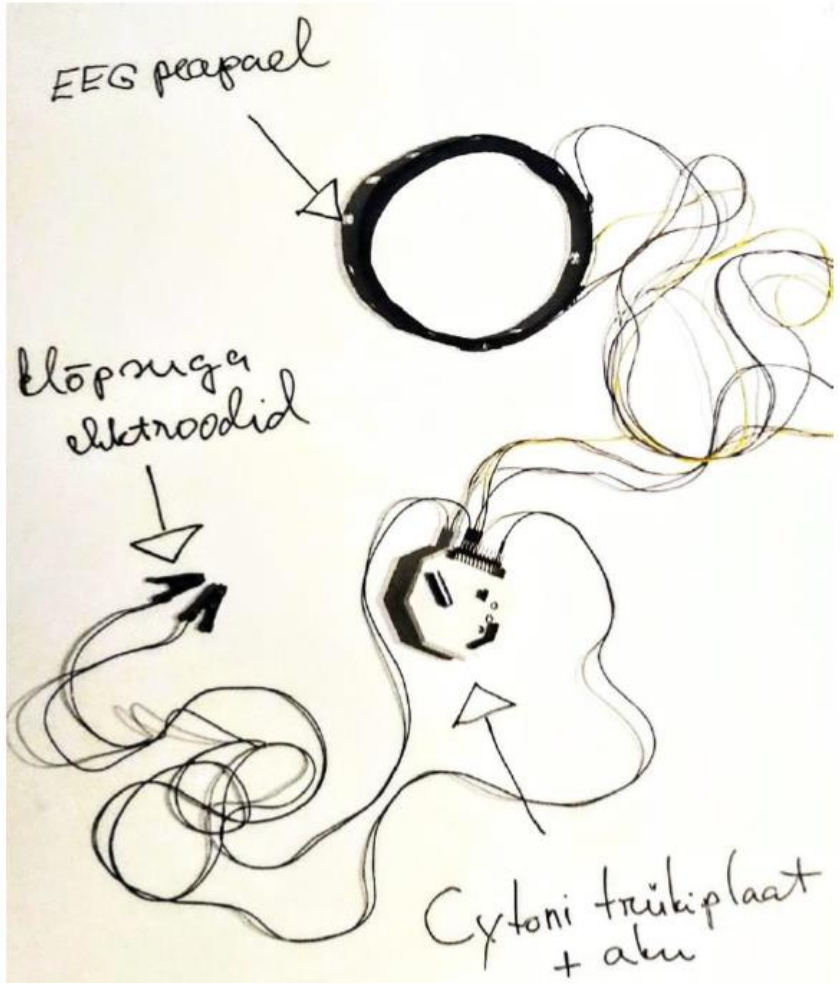
Print Publication Date: Dec 2011 Subject: Psychology, Cognitive Psychology, Cognitive Neuroscience
Online Publication Date: Sep 2012 DOI: 10.1093/oxfordhb/9780195374148.013.0081

[–] Abstract and Keywords

The auditory mismatch negativity (MMN) is a change-specific component of the auditory event-related brain potential (ERP) that is elicited even in the absence of attention and can be used as an objective index of sound-discrimination accuracy and auditory sensory memory. The MMN enables one to reach a new level of understanding of the brain processes forming the biological substrate of central auditory perception and the different forms of auditory memory. A review of MMN studies indicates that the central auditory system performs complex cognitive operations, such as generalization leading to simple concept formation (e.g., a rising pair irrespective of the specific frequency values), rule extraction, and the anticipation of the next stimulus at the preattentive level. These findings demonstrate the presence of a cognitive change-detection mechanism in the auditory cortex.

Keywords: mismatch negativity (MMN), auditory event-related potential, sound discrimination, auditory sensory memory

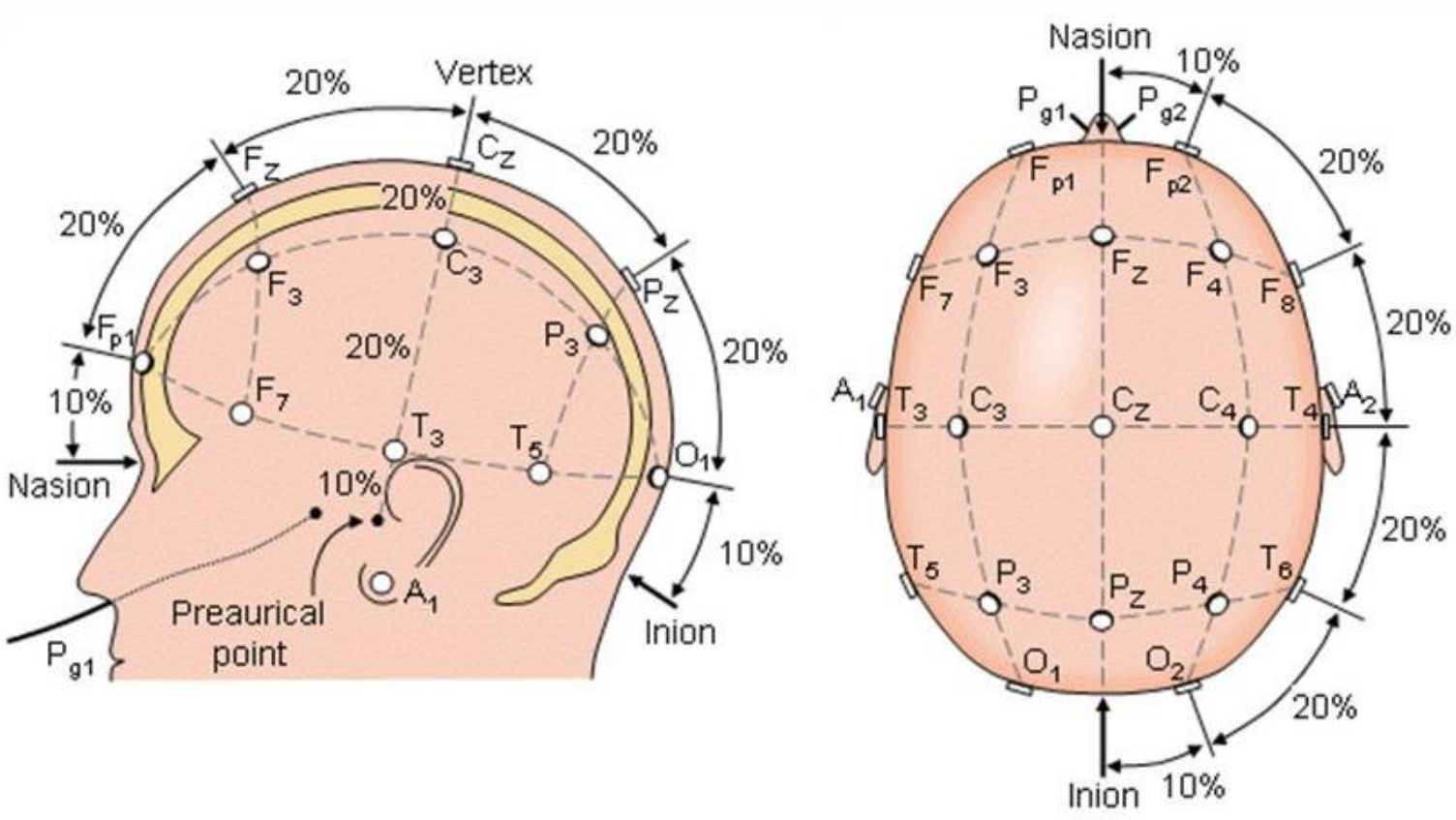
P300 demo OpenVibe’is



Selle demo jooksutamiseks läheb tarvis:

- OpenVibe’i tarkvara (versioon 2.2.0)
- Cytoni trükiplaati ja akut (aku on juba trükiplaadi külge ühendatud)
- Cytoni donglit
- Kõrva külge kinnitatavaid musti klõpsuga elektroode
- OpenBCI kolme elektroodiga peapaela
- Desinfitseerivaid vahendeid kõrvaelektroodide aluse naha puhastamiseks

Elektroodide paigutamine



Kasutatud kirjandus (esinemise järjekorras)

Cohen, M. X., & van Gaal, S. (2014). Subthreshold muscle twitches dissociate oscillatory neural signatures of conflicts from errors. *Neuroimage*, *86*, 503-513.

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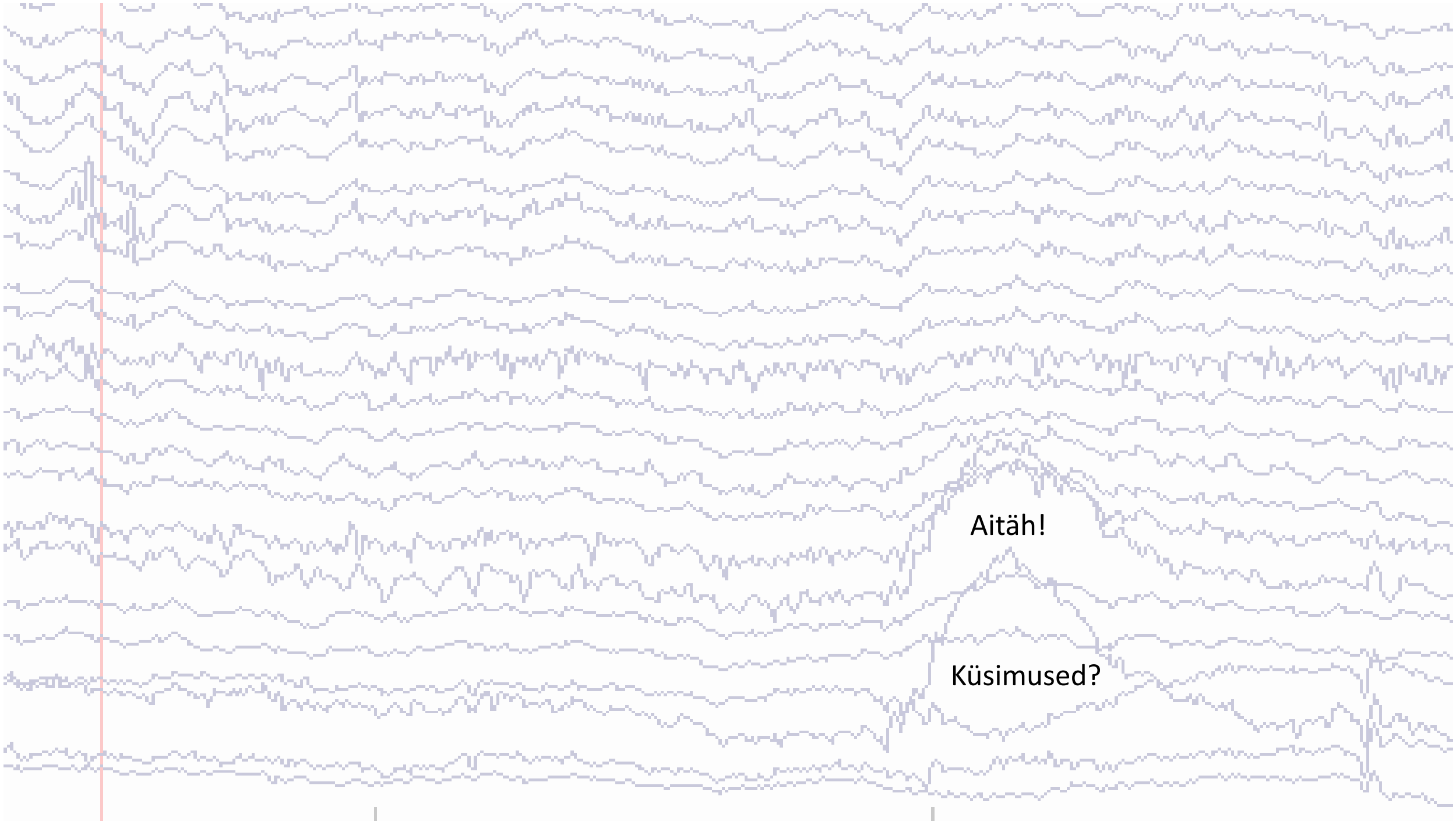
Aitäh!
Küsimused?