Aalto University
School of Science

Neural correlates for *words–brand association*

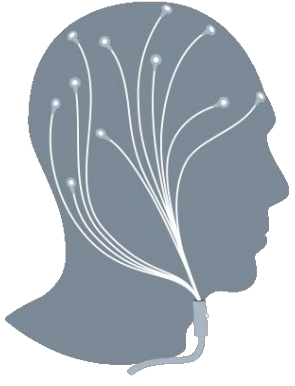
Neuromarketing

Aaltonen, Chen, Laitinen, Lassfolk, Salloum & Tommila

Recap

What is *neuromarketing*?

DECISION MAKING



EEG

Finnair *safe*	Finnair *dangerous*
nostalgic *Nokia*	great *Samsung*
Abloy *safe*	Abloy *luotettava*

6 study *subjects*

50% *male*

50% *female*

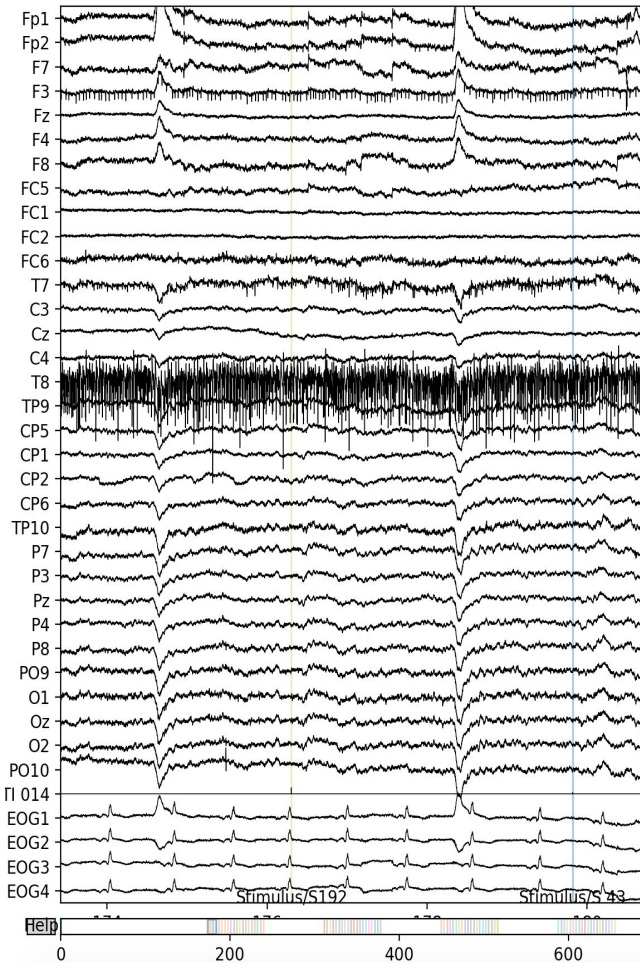
right *handed*

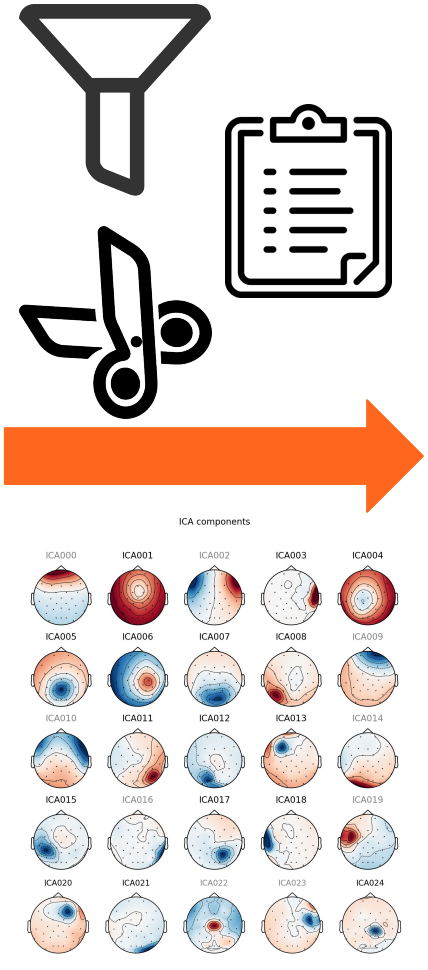
students

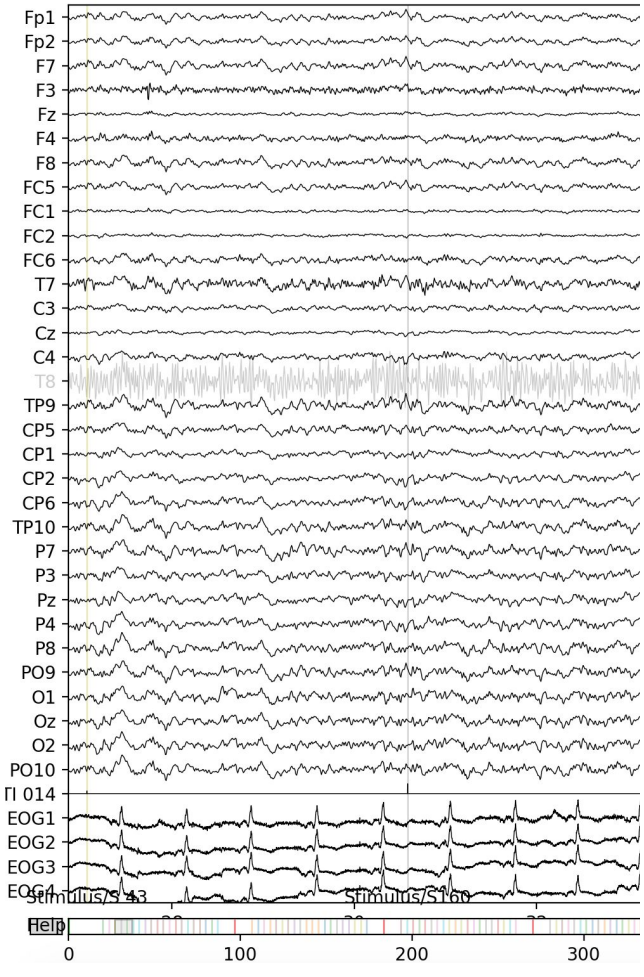
2/3 from *academic family*

different *fields*

median *age* 21


Fp1
Fp2
F7
F3
Fz
F4
F8
FC5
FC1
FC2
FC6
T7
C3
Cz
C4
T8
TP9
CP5
CP1
CP2
CP6
TP10
P7
P3
Pz
P4
P8
PO9
O1
Oz
O2
PO10
ΠI 014
EOG1
EOG2
EOG3
EOG4
Stimulus/S192
Stimulus/S 43
Help
0
200
400
600


ICA components
ICA000
ICA001
ICA002
ICA003
ICA004
ICA005
ICA006
ICA007
ICA008
ICA009
ICA010
ICA011
ICA012
ICA013
ICA014
ICA015
ICA016
ICA017
ICA018
ICA019
ICA020
ICA021
ICA022
ICA023
ICA024

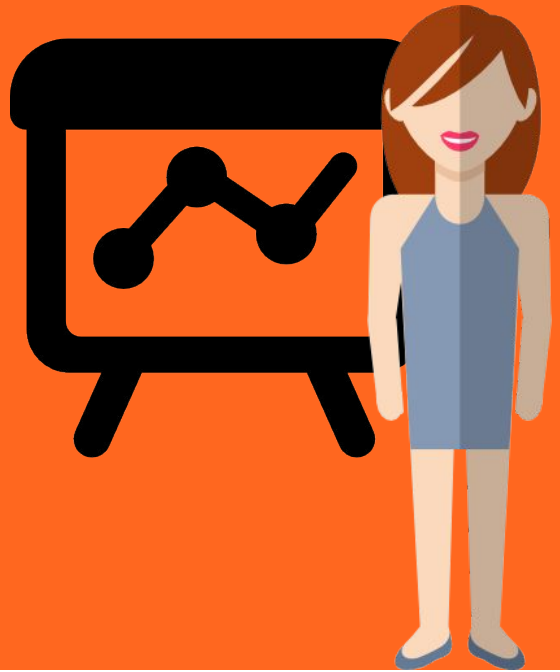

Fp1
Fp2
F7
F3
Fz
F4
F8
FC5
FC1
FC2
FC6
T7
C3
Cz
C4
T8
TP9
CP5
CP1
CP2
CP6
TP10
P7
P3
Pz
P4
P8
PO9
O1
Oz
O2
PO10
ΠI 014
EOG1
EOG2
EOG3
EOG4
Stimulus/S 43
Stimulus/S160
Help
0
100
200
300

Analysis

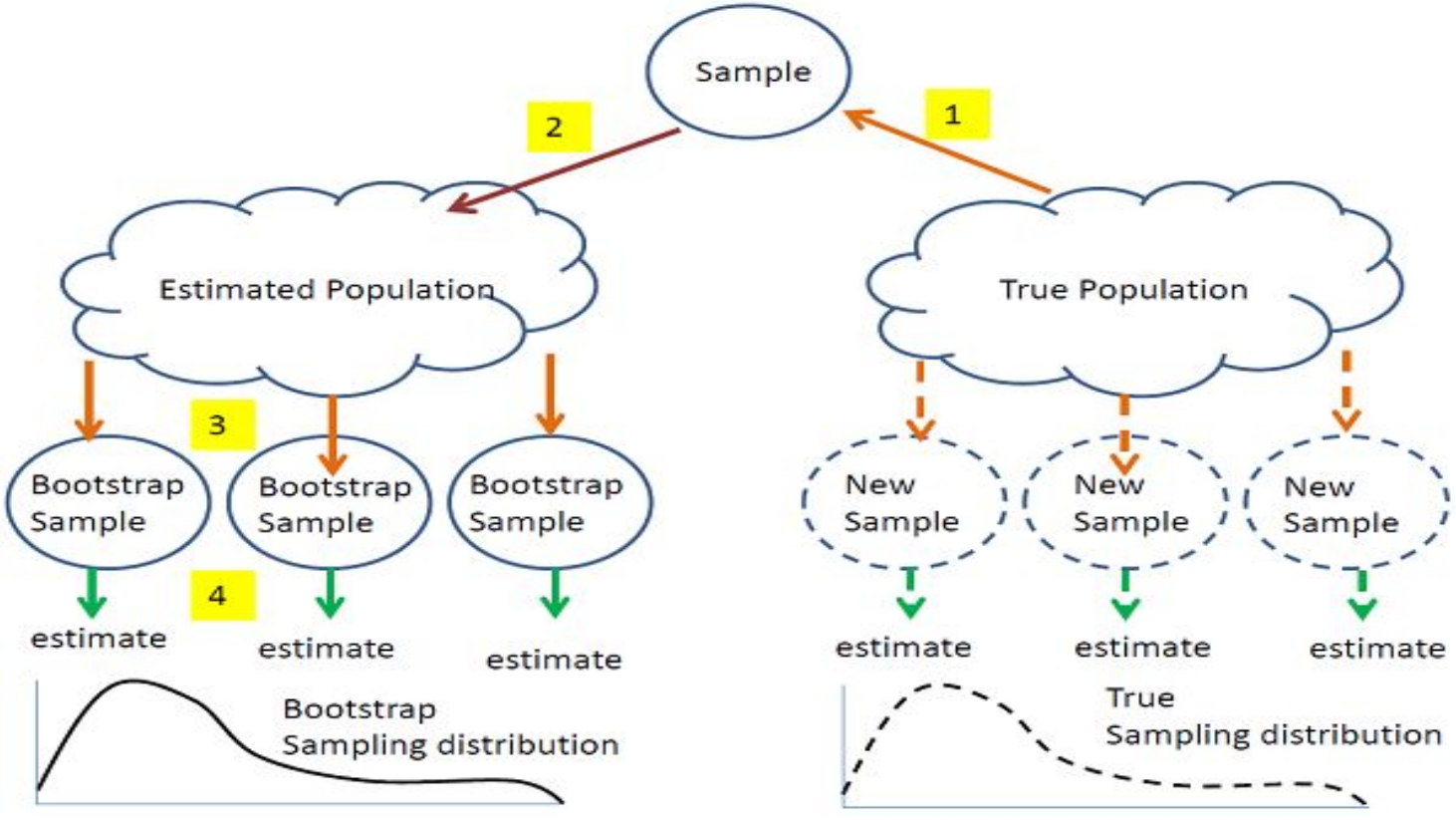
Statistical *testing*

1. Bootstrapping
2. Cluster analysis
3. Spatial analysis

MNE
MEG + EEG ANALYSIS & VISUALIZATION



1. *Boot*strapping



2. Cluster *analysis*

Permutation *F-test* on sensor data with 1D cluster level

➔ **To test if the evoked response is significantly different between conditions**

Clustering can be used for understanding data

To perform clustering you need to understand data

H0

The data in the experimental conditions come from the same probability distribution, i.e. the data in the conditions cannot be distinguished

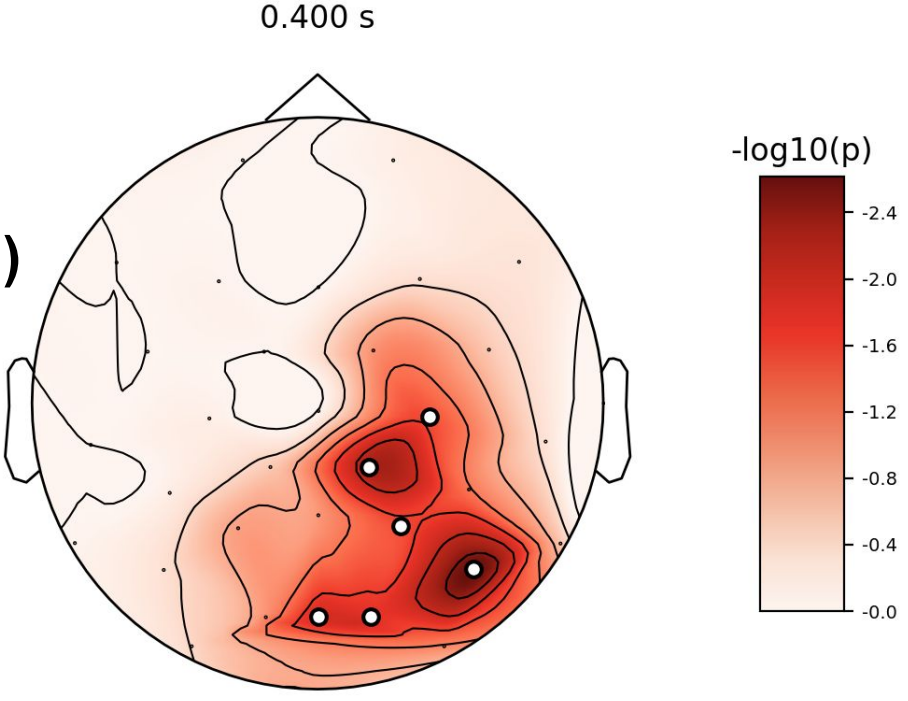
H1

The data in the experimental conditions do not come from the same probability distribution, i.e. the data are different

3. *Spatial* analysis

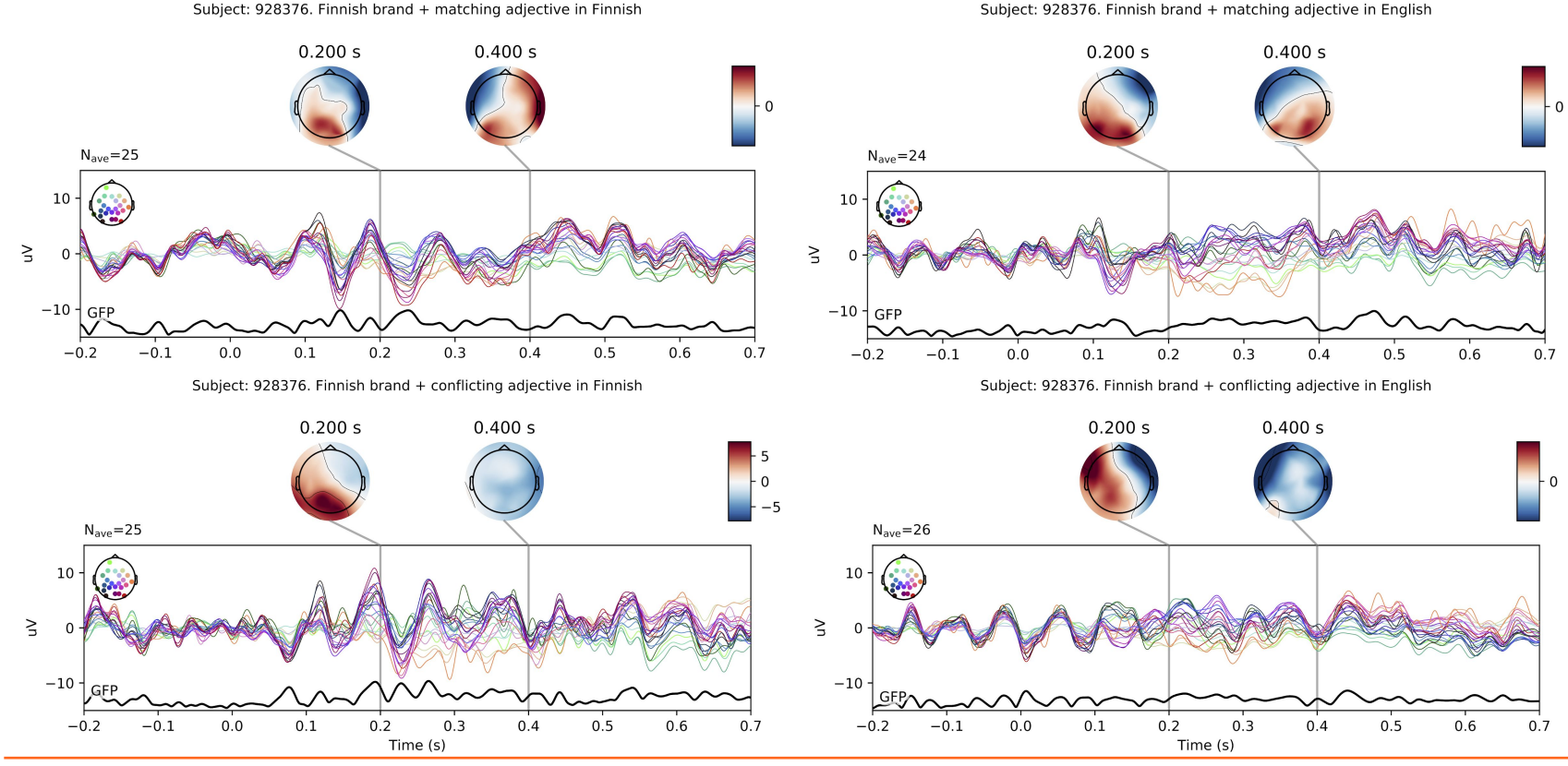
1. **Permutation t-test**
2. **Spatio-temporal cluster test - no results (so far…)**

Testing for possible significant points and sensors

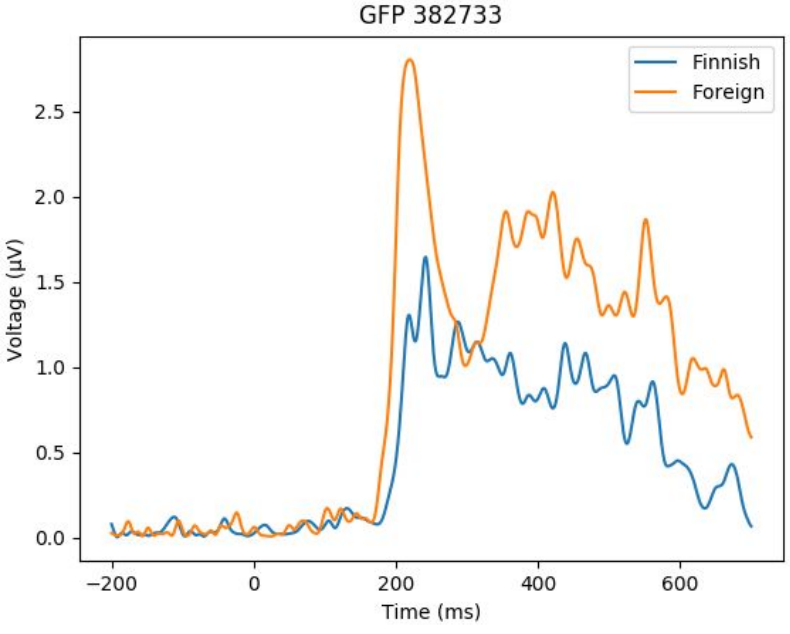


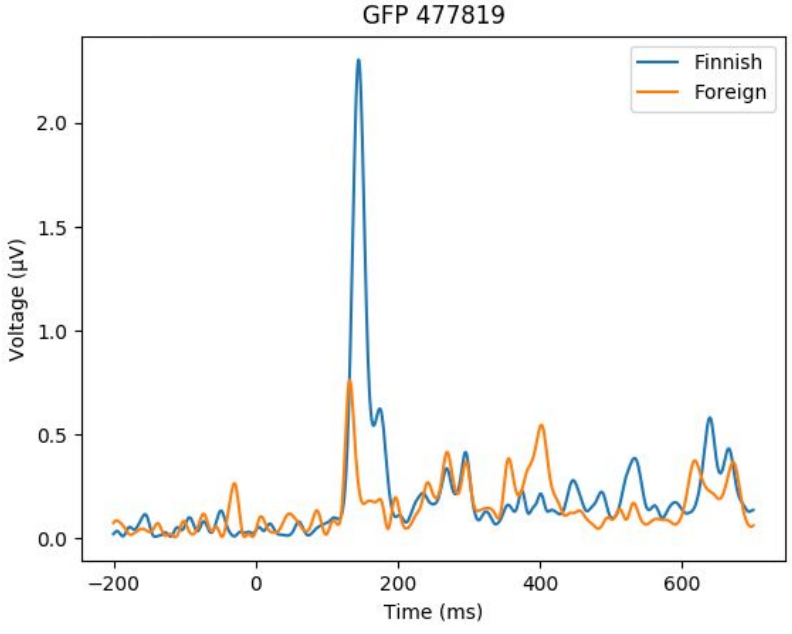
Results

Evoked *potentials* and N400

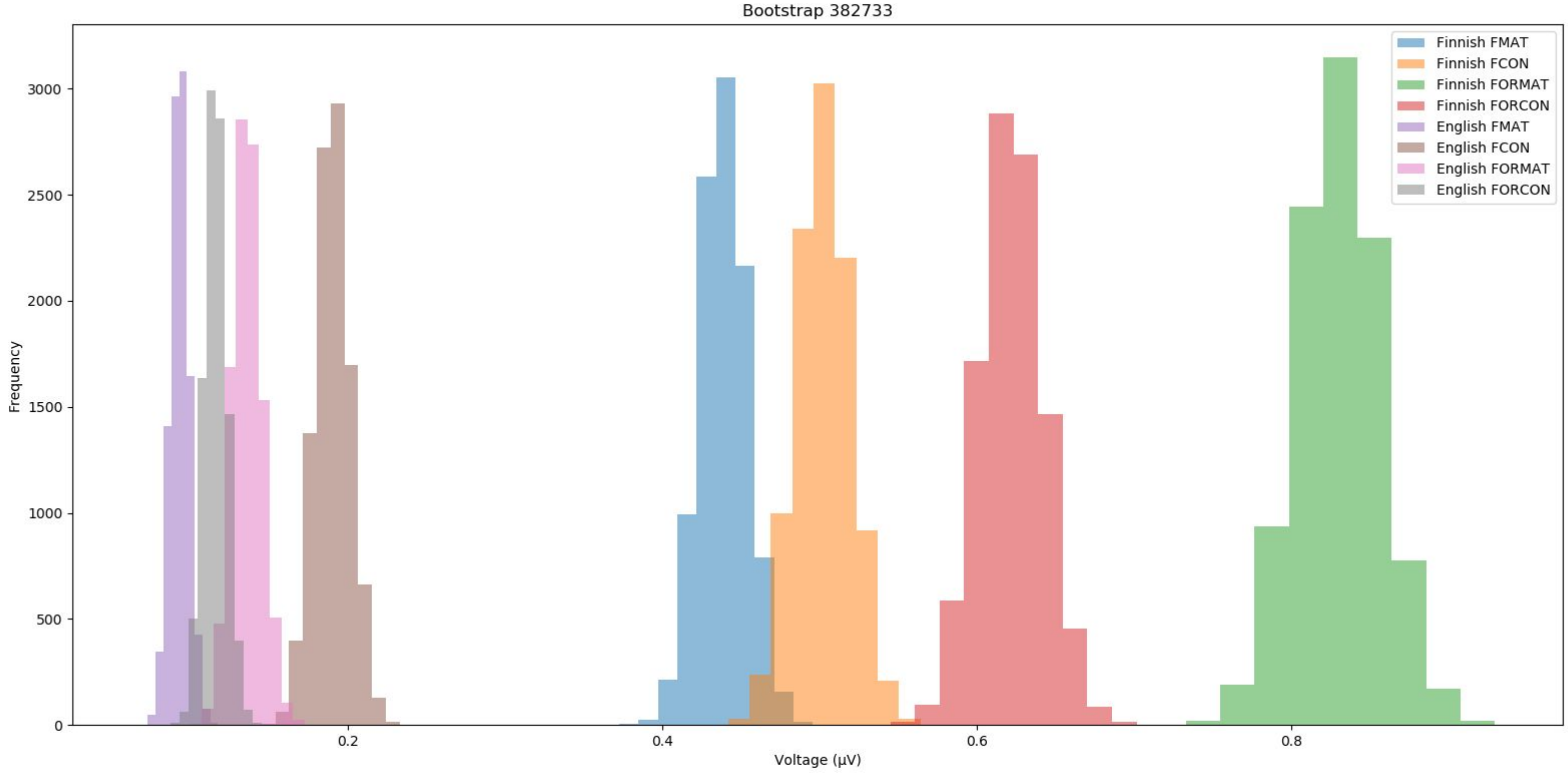


Global *field* power

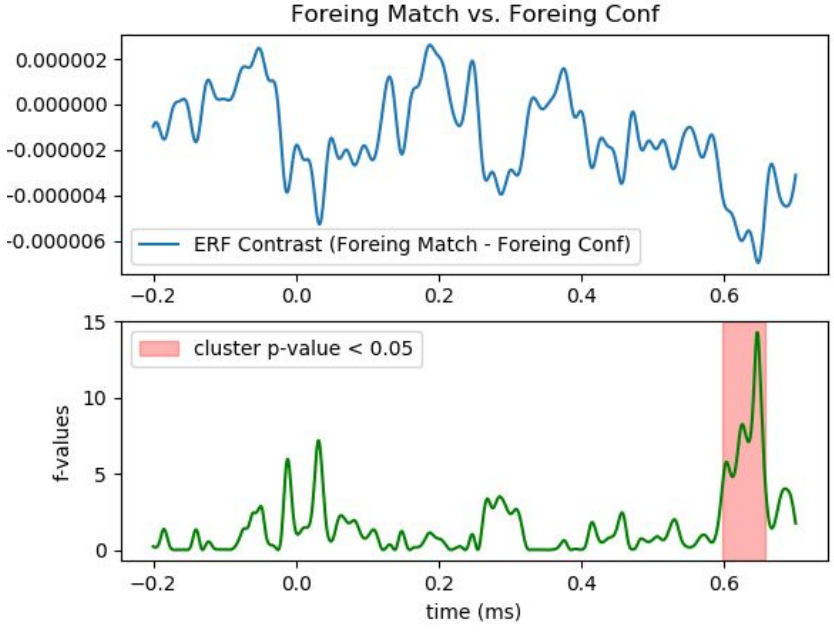


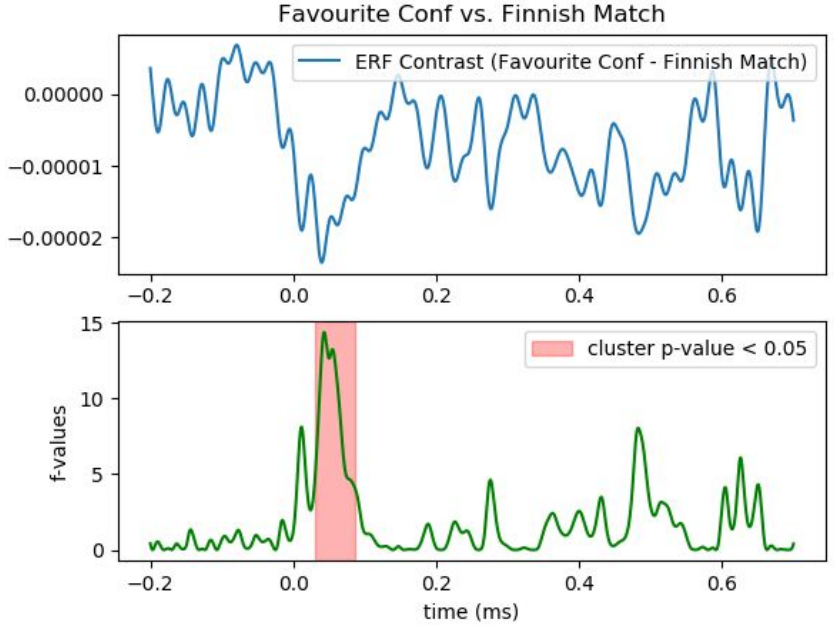


Bootstrap


Bootstrap 382733
Finnish FMAT
Finnish FCON
Finnish FORMAT
Finnish FORCON
English FMAT
English FCON
English FORMAT
English FORCON
Frequency
0
500
1000
1500
2000
2500
3000
0.2
0.4
0.6
0.8
Voltage (μV)

Clustering

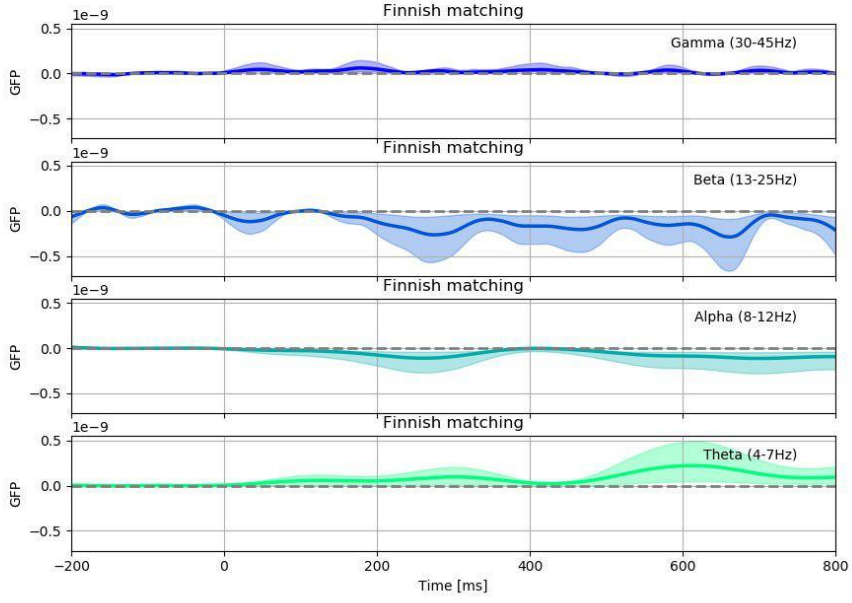

Foreing Match vs. Foreing Conf
ERF Contrast (Foreing Match - Foreing Conf)
cluster p-value < 0.05
f-values
time (ms)

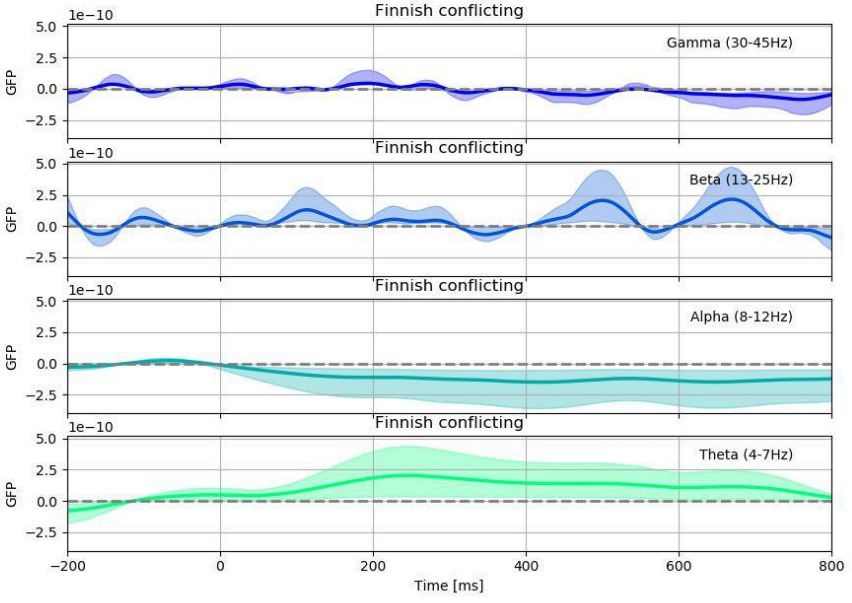

Favourite Conf vs. Finnish Match
ERF Contrast (Favourite Conf - Finnish Match)
cluster p-value < 0.05
f-values
time (ms)

p-values of *hypothesis* testing

Subject ID / Hypothesis	382733	477819	554432	884723	928376	990291
Matching adjective	0.0	1.0	0.009	0.73	0.0	1.0
Origin of the brand	1.0	0.0	1.0	0.0	1.0	0.0
Language	0.0	0.053	1.0	0.0	0.498	0.0

Brain *waves*


Finnish matching
Gamma (30-45Hz)
Beta (13-25Hz)
Alpha (8-12Hz)
Theta (4-7Hz)
GFP
1e−9
Time [ms]


Finnish conflicting
Gamma (30-45Hz)
Beta (13-25Hz)
Alpha (8-12Hz)
Theta (4-7Hz)
GFP
1e−10
Time [ms]

Conclusion

So *what*?

Hypothesis

Matching word - brand combination doesn't affect brain activity. Conflicting word - brand combination does

Response of Finnish brands equal to Non-Finnish brands

Responses have same strength when test is done in Finnish or in English

Result?

The famous N400 component was detected, but no support for the claim in question.

All the subjects with technical background had clearly stronger responses towards Non-Finnish brands.

The language has definitely an effect but it depends on the subject.

Neuromarketing: Takeaways

1. Be as detailed as possible

2. You can never have too much data

3. Every human being is unique

Thank *you*!