Tilburg University

Cognitive Neuroscience

Word Count: 674

Group 8 Project Report (Resit)

Introduction

The study carried out by Roncaglia-Denissen, Schmidt-Kassow, Heine, and Kotz (2015) recorded and investigated the impact of speech rhythm on L2 (second language learners) using Event Related Potentials (ERP). ERPs provide us with information about ongoing language processing due to their ability to capture time sensitive information. The goals of the study were to find out if L2 learners could use rhythmic information in their second language to facilitate syntactic processing and if the use of rhythmic properties in L2 as a sentence segmentation cue is subject to the age of acquisition of L2.

The dataset we used was the RITA dataset which consisted of Turkish early learners and German late learners. German and Turkish were chosen as a pair because German is considered to be a stress timed language whereas Turkish is a syllable timed language. If Turkish L2 learners of German managed to utilize the rhythmic information in L2, then a rhythmic facilitation effect is expected to occur (Roncaglia-Denissen et al., 2015).

The dataset that resit group 8 used was the group 11 dataset provided to us. Thus, we analyzed the even trials in the dataset and split them into control and experimental groups. The group 11 dataset consisted of Early learners RB with OFRR triggers XX2 and XX6 (SF: Subject First, RR: Regular Rhythm). We had a Baseline set with 250 samples and an Evoked set with 501 samples.

Interpretation & Discussion

Initially we had to pre-process the data before the spectral analyses. This resulted in two graphs; one with the mean raw EEG traces and another with the mean normalized EEG traces (Figure 1). This data can primarily help us diagnose sleep disorders, coma, brain death etc. In the context of Language learning, we can show that L2 processing in non proficient speakers occurs in the right hemisphere of the brain as opposed to the left hemisphere processing that occurs in L1 and proficient speakers (Reiterer, Pereda, & Bhattacharya, 2009).

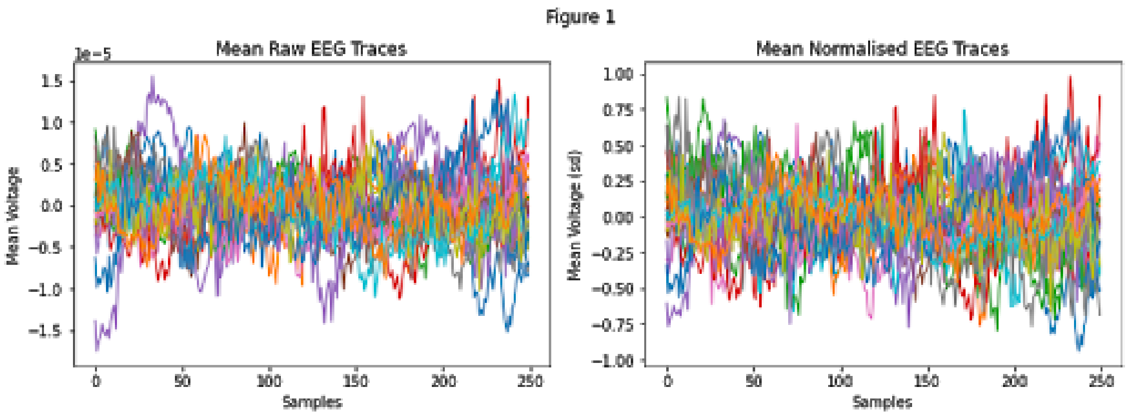

Figure 1. Mean raw EEG traces vs. mean normalized EEG traces

Normalizing the data makes it possible to compare it between participants. Then we subset the baseline data, chose a random participant and plotted the mean raw traces and the mean normalized traces. We then selected a specific channel (channel Pz) and checked the average powerspectrum per participant within it. Using this data we peak-normalized all the powerspectrum, and plotted the peak-normalized data, then the confidence interval of the peak-normalized powerspectrum (Figure 2).

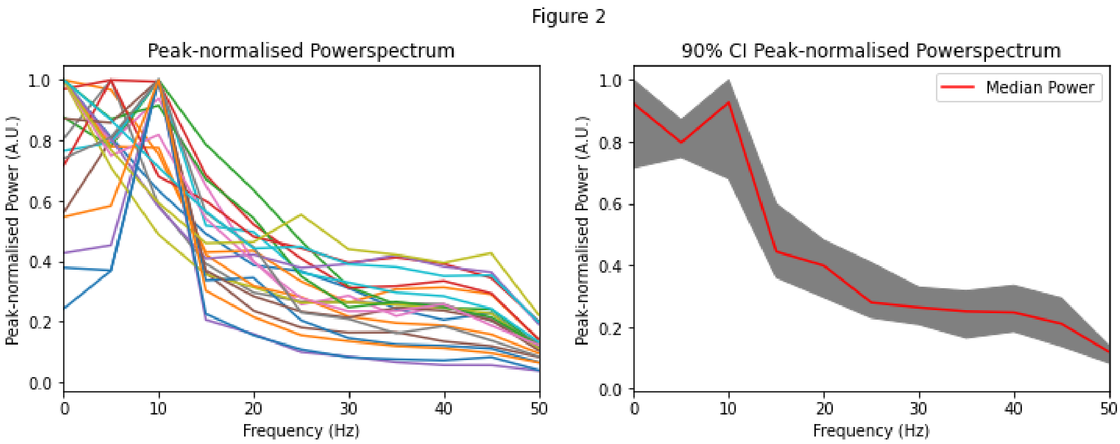

Figure 2. Peak-normalized powerspectrum vs. 90% CI normalized powerspectrum

We now have the peak power normalized powerspectrum. The powerspectrum can be used to study brain activation over a period of time in certain hemispheres. This can be used to see the trigger that caused brain activity to peak during language processing in their appropriate hemispheres. It can potentially highlight words/phrases that may have caught the subject's attention. The confidence interval graph helps us with recognizing any potential outliers by giving us an approximate location for the traces around the mean (Wang et al., 2015).

The TFR contrast graph (Figure 3) can help with recognizing high brain activity at certain frequencies. High frequency brain activity does play a role in attention, participation and language processing. We can also define spatio temporal activity patterns and define topographies in order to better understand brain activations in high frequencies (Pulvermüller, Birbaumer, Lutzenberger, & Mohr, 1997).

Figure 3

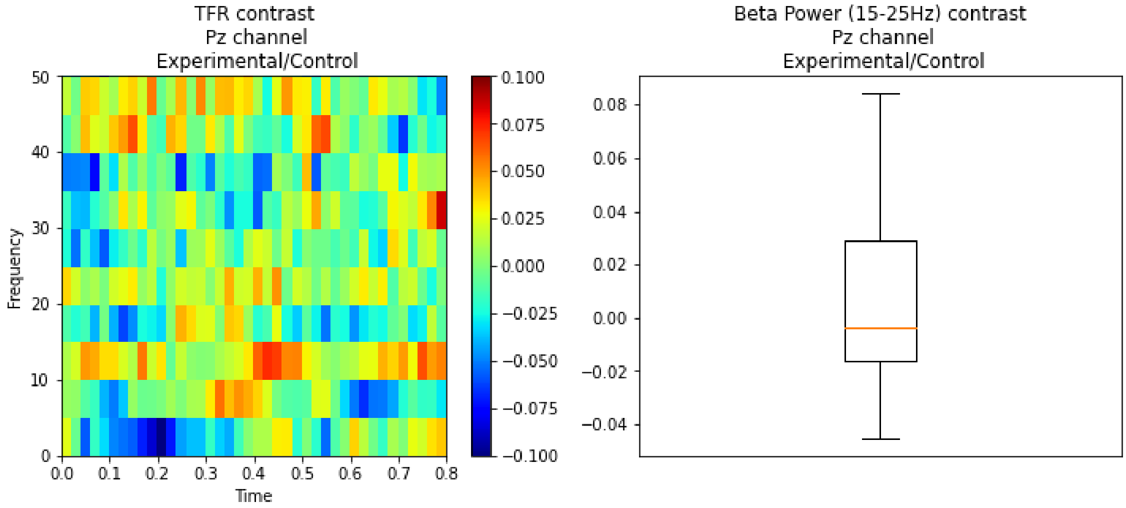

Figure 3. TFR contrast, Pz channel vs Beta Power contrast, Pz channel

For the last question we decided to change the channel to Fz to take a look at the TFR distribution and compare it to our previous TFR within the Pz channel (Figure 3). The frequency activation for the graphs seemed to differ. Visually, there are much lower activation values in the Fz channel (Figure 4) around the lower to mid range frequencies in comparison to Pz. There appears to be more activation towards the top right of the Pz channel TFR whereas the Fz channel TFR displays more activation towards the bottom left. The mean, maximum, and minimum value in Fz are slightly lower, as presented in the box plot. This may mean the Fz channel received less beta signals than Pz.

Figure 4

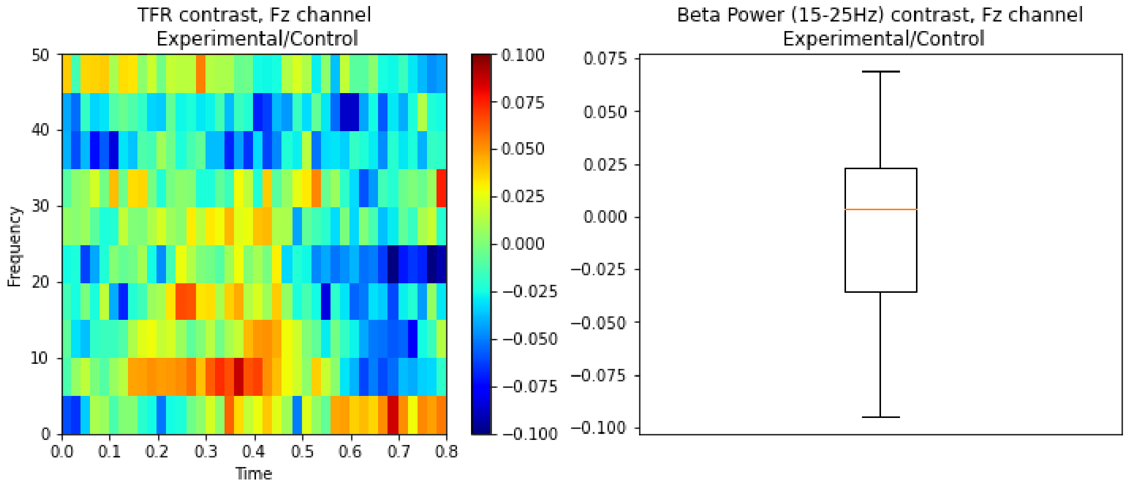

Figure 4. TFR contrast, Fz channel vs Beta Power contrast, Fz channel

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