Natural Language based Neural activity classification using Neural network

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Abstract

Neural activity recording is the process of scanning individual neurons in the brain, and recording their activity in response to specific stimuli. The team has put together a language based neural activity study, where bilingual and monolingual test subjects are assessed with a 14 point brain scanning device that allows the team to monitor, and record, neural activity of each subject while being presented with language specific stimulus. This data is used to analyze differences in neuron activity between bilingual and monolingual subjects. The team expects to observe greater neural activity in bilingual subjects while assessing a visual stimulus.

Purpose

The purpose of this project was to examine the differences in brain functionality between bilingual and monolingual people. This data gives us a better understanding on how humans process different languages. The overall main goal was to take the data collected and implement the results to further develop machine learning algorithms.

Materials and Methods

CITI Training and Research
In order to be certified to test human subjects we need to complete the CITI Program Online Training. Once complete, we started to research Modeling the Antipodal Connectivity Structure of Neural Communities in order to understand the material and form an idea of how we were going to form our test.

Emotive EPOC
The Emotive EPOC is a 14 channel EEG brain scanner. We used this equipment along with the accompanying software in order to perform the tests.

Study
The study consisted of four test subjects, two bilingual, and two monolingual. Each subject was tested by showing simple phrases in English, and asking the monolingual subjects to read each phrase. Bilingual subjects were asked to read English phrases, as well as phrases written in their primary language. In between each test, we had the subjects listen to relaxing music for sixty seconds to calm the brain.

Analyzing the Data
While analyzing the data, we focused on the F7, FC5, T7, and P7 channels. These channels relate to Geschwind-Wernicke areas of the brain that process written and spoken word. Playing back these four channels, we compared the brain activity of monolingual subjects reading English, and bilingual subjects reading their primary language.

Results

During our analysis we found that there is an increased amount of brain activity while our subjects were reading their primary language. The F7, FC5, T7, and P7 channels, which correlate with word processing, show increased activity during the primary section of each test. The F7 channel in particular showed the most noticeable difference between tests. Although our sample size was small, these results have led us to reject our initial expectations of bilingual subjects having an overall higher level of brain activity than monolingual subjects.

Conclusion

After analyzing the results, we have concluded that, with the current technology and resources we possess, there is no identifiable difference between the brain activity of monolingual and bilingual individuals. According to our data, the brain processes the primary language equally across multiple languages even if the subject is bilingual. The data shows that there is increased brain activity while a subject is processing their primary language. This conclusion, although proven above, can be extended upon through continued research.

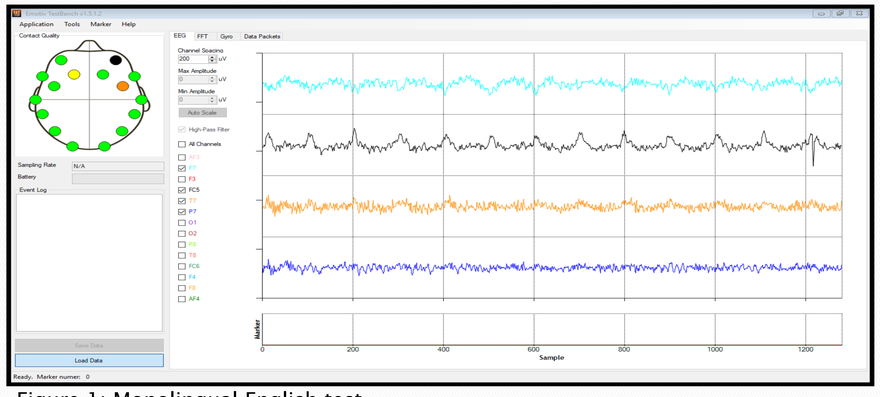

Figure 1: Monolingual English test

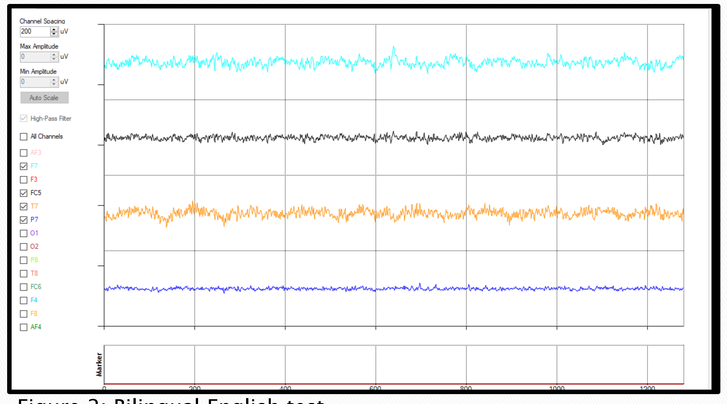

Figure 2: Bilingual English test

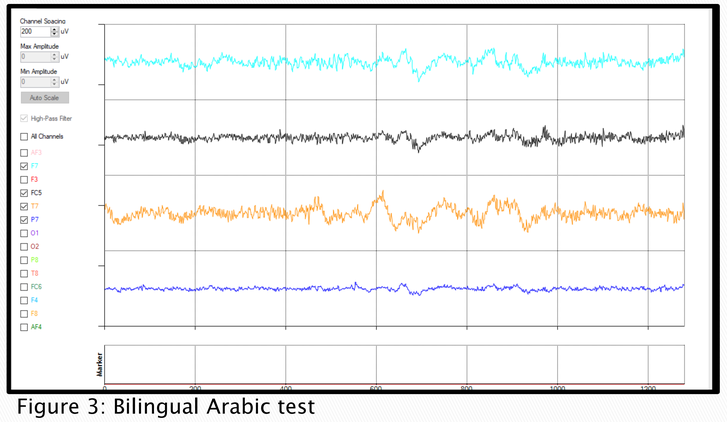

Figure 3: Bilingual Arabic test

References

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