World Academy of Science, Engineering and Technology
International Journal of Cognitive and Language Sciences
Vol:9, No:12, 2015

Event-Related Potentials and Behavioral Reactions during Native and Foreign Languages Comprehension in Bilingual Inhabitants of Siberia

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Abstract : The study is dedicated to the research of brain activity in bilingual inhabitants of Siberia. We compared behavioral reactions and event-related potentials in Turkic-speaking inhabitants of Siberia (Tuvinians and Yakuts) and Russians. 63 healthy aboriginals of the Tyva Republic, 29 inhabitants of the Sakha (Yakutia) Republic, and 55 Russians from Novosibirsk participated in the study. All the healthy and right-handed participants, matched on age and sex, were students of different universities. EEG's were recorded during the solving of linguistic tasks. In these tasks, participants had to find a syntax error in the written sentences. There were four groups of sentences: Russian, English, Tuvinian, and Yakut. All participants completed the tasks in Russian and English. Additionally, Tuvinians and Yakuts completed the tasks in Tuvinian or Yakut respectively. For Russians, EEG's were recorded using 128-channels according to the extended International 10-10 system, and the signals were amplified using "Neuroscan (USA)" amplifiers. For Tuvinians and Yakuts, EEG's were recorded using 64-channels and amplifiers Brain Products, Germany. In all groups, 0.3-100 Hz analog filtering and sampling rate 1000 Hz were used. As parameters of behavioral reactions, response speed and the accuracy of recognition were used. Event-related potentials (ERP) responses P300 and P600 were used as indicators of brain activity. The behavioral reactions showed that in Russians, the response speed for Russian was faster than for English. Also, the accuracy of solving tasks was higher for Russian than for English. The peak P300 in Russians were higher for English, the peak P600 in the left temporal cortex were higher for the Russian language. Both Tuvinians and Yakuts have no difference in accuracy of solving tasks in Russian and in their respective national languages. However, the response speed was faster for tasks in Russian than for tasks in their national language. Tuvinians and Yakuts showed bad accuracy in English, but the response speed was higher for English than for Russian and the national languages. This can be explained by the fact that they did not think carefully and gave a random answer for English. In Tuvinians, The P300 and P600 amplitudes and cortical topology were the same for Russian and Tuvinian and different for English. In Yakuts, the P300 and P600 amplitudes and topology of ERP for Russian were the same as what Russians had for Russian. In Yakuts, brain reactions during Yakut and English comprehension had no difference, and were reflected to foreign language comprehension - while the Russian language comprehension was reflected to native language comprehension. We found out that the Tuvinians recognized both Russian and Tuvinian as native languages, and English as a foreign language. The Yakuts recognized both English and Yakut as a foreign language, and only Russian as a native language. According to the inquirer, both Tuvinians and Yakuts use the national language as a spoken language, whereas they don't use it for writing. It can well be a reason that Yakuts perceive the Yakut writing language as a foreign language while writing Russian as their native.

Keywords : EEG, ERP, native and foreign languages comprehension, Siberian inhabitants
Conference Title : ICLLTL 2015 : International Conference on Linguistics, Language Teaching and Learning
Conference Location : Paris, France
Conference Dates : December 30-31, 2015