

The Role of Linguistic Typology in Sentence Comprehension by Multilinguals: An fMRI Study

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Abstract

Recently, neuroimaging studies have investigated the pivotal role played by the proficiency and the age of acquisition of second (L2) and third language (L3) in cortical representation. Although such studies have shown that both factors are major determinant of the cortical representation of L2 and L3, there are few studies that have investigated the effects of linguistic factors (e.g., word order) on brain representation. Moreover, neuroimaging evidence in multilingual language processing has been investigated widely in Indo-European languages (e.g., English and French). Such empirical studies, however, are scarce in typologically dissimilar languages (e.g., Japanese and Korean). The purpose of this study was to examine the neural correlates of word order differences between the native (Korean) and two typologically distinct second (English) and third language (Japanese).

The participants were 30 healthy native adult speakers of Korean (L1) that have acquired English (L2) and Japanese (L3) as their second and their third languages, respectively. The functional Magnetic Resonance Imaging (fMRI) technique was employed to compare those brain areas activated during a sentence comprehension task with auditory stimuli, a design we considered appropriate for studies in the syntax of languages with different orthography. We draw attention to the word order, the major difference between the agglutinative languages (i.e. Korean and Japanese) with a basic Subject-Object-Verb (SOV) word order and the isolating language (i.e. English) that, in contrast, uses a Subject-Verb-Object (SVO) order. The task for the subjects was to listen to triplets of sentences in Korean, English and Japanese with semantic differences minimized, and to respond to whether or not they had understood the sentences.

In this experiment, we found that the bilateral superior temporal cortices were activated in all the three languages. In addition, the left inferior frontal cortex, which includes Broca's area, was significantly activated in the English task. In contrast, exposure to Japanese sentences induced no significant activation in this region. This contrast is striking considering the fact that the subjects had all spent significantly longer periods learning English (L2) than Japanese (L3), and that the proficiency test scores showed no significant difference between their English and Japanese proficiency. These results suggest that the typological contrast between English and Japanese is reflected in the activation of the left

inferior frontal cortex when native speakers of Korean listen to both L2 which is typologically remote, and to L3, which is typologically close to his/her native tongue Korean.