Neural basis of morphologically complex word processing: EEG studies

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論 文 名　：

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(脳波実験による形態的に複雑な語処理の神経基盤の研究)

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論　文　内　容　の　要　旨

Language is a unique cognitive faculty of humans. This faculty allows us to generate an infinite range of expressions (i.e., phrases and sentences) from a finite set of smaller units that bear meanings (i.e., words). Therefore, one of the core problems in linguistics is the mechanisms between phrases/sentences (syntax) and words (morphology). Unlike phrases/sentences, which are not limited in their productivity, words are limited in their productivity and irregularity (e.g., allomorphs). Due to these features, words have been dealt with differently in phrases/ sentences.

Previous theoretical and neurolinguistic studies have investigated processing phrases and sentences, revealing their processing profile in the brain, and theoretical studies of words suggested that words have a similar hierarchical structure of phrases/sentences, suggesting that a similar syntactic operation can explain both syntax and morphology. However, this fundamental implication of linguistics has not been well investigated in the neurophysiological aspect, and research on word processing in Japanese has inconsistent results.

In this dissertation, we fill the following two gaps in word processing with three EEG experiments: the inconsistent results of the processing of de-adjectival nouns in Japanese and the similarity in processing the words and phrases/sentences with their hierarchical structure. This dissertation is organized as follows.

Chapter 1 starts the dissertation by reviewing the research history of the processing of complex words. An overview of the dissertation is also provided. In Chapter 2, we introduce experimental methods and terms of brain activation to interpret the dissertation. In Chapters 3 and 4, we solve the contradiction of de-adjectival nouns in Japanese through two EEG experiments. Specifically, focusing on functionally different stages of word processing [i.e., morphological decomposition (Chapter 3) and lexical processing (Chapter 4)], we demonstrate that the de-adjectival nouns are treated as morphemes but not whole words. Then, we fill the gap between word processing and phrase/sentence processing by demonstrating that the hierarchical structure of words evokes a similar brain activation of phrases and sentences (Chapter 5). In Chapter 6, we discuss the results for their implications. First, we demonstrate the cross-linguistic universality of word processing from the results of Chapters 3 and 4. Then, we demonstrate a common neural mechanism between words and phrases/sentences from the results of Chapter 5. Finally, in Chapter 7, we summarize the results and refer to limitations and propose future directions in the processing of words.