

The Effect of Beat Sound on English Rhythm Acquisition: How are Brains of JLE Activated?

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Abstract

Japanese language has been widely accepted as mora-timed, while English as stress-timed. This phonological difference in rhythm is one of the difficulties for Japanese learners of English (JLE) when speaking in English. In the present experiment, using electro-encephalography (EEG), the author observed the brain activation of JLE when rhythm instruction material (RIM) modified from *Jazz Chants*^[1] which includes beat sound was conducted to a treatment group (Beat G.), while another type of RIM which does not include beat sound was conducted to a contrast group (No-beat G). It has previously been shown that rhythmic theta activity often appears over midfrontal region on EEG during various mental tasks in normal subjects^[2]. Such rhythmic activity was named frontal midline theta rhythm (Fm θ) and found to be related to some type of memory^[3]. In the present study, brain waves of the participants were recorded and analyzed.

Research questions (RQs) were as follows: 1. How do they improve their English?; 2. Can they store the stress-timed rhythm patterns in their long term memory?; 3. How are brains of JLE activated while they are learning the stress-timed rhythm through the instruction?

Results and Discussions

RQ1: During rhythm learning, proficiency in rhythm (*PR*) was examined counting how many rhythm patterns they repeated correctly after CD using following formula:

$$PR = \frac{\text{(the numbers of rhythm patterns repeated correctly)}}{\text{(total number of rhythm patterns in RIM)}}$$

The result showed that the difference in *PR* for Beat G. between day1 and day5 was larger than that for No-beat G. These results also suggest that beat sound enhance ability to learn English rhythm.

RQ 2: In the pre- and post-test, three sets of sentences were read aloud and the duration of inter-stressed intervals (*ISI*) in four types of rhythm patterns including one-four unstressed syllables, and that of each sentence (*T*) were measured. The result revealed that the difference in *ISI / T* between pre-test and post-test for Beat G was significant, while that for No-beat G. was not. This result suggested that beat sound enhance ability to store the stress-timed rhythm patterns in their long term memory more efficiently.

RQ3: During the experiment brain waves of the subjects were recorded and analyzed. The result revealed that θ wave power recorded at the frontal midline region for Beat G. was significantly correlated to their *PR*, but no correlation was found in other brain activities. In addition, no correlation between brain wave and *PR* was found for No-beat G. These results suggest that beat sound might enhance the English rhythm learning and acquisition, and Fm θ is correlated to rhythm acquisition. In the presentation, further discussions will be shown.

References

- [1] Graham, C. (1979) *Jazz Chants for Children*. Oxford University Press.
- [2] Mizuki, Y. et al (1980) Periodic appearance of theta rhythm in the frontal midline area during performance of a mental task. *Electroenceph. clin. Neurophysiol.* 49, 345-351.
- [3] ISHIHARA, T. et al (1972) Multivariate analytic study of EEG and mental activity in juvenile delinquents. *Electroencephalography and Clinic Neurophysiology*, 19, 305-308.