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# The Role of Low Frequency Waves on EEG Recordings during Stimuli of Sounds

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**Keywords:** stimuli of sound; delta band waves; spectral power.

## Introduction

I reported that the strongly impressed states with stimuli of feel are characterized by the delta band waves with large spectral power (Murakami, 2006). In this article, I verify, from the EEG recordings during stimuli of sounds, my hypothesis that the delta band waves with large spectral power were observed when participants were deeply moved or strongly impressed with stimulation.

## Experiment

**Participants** Twenty female students aged between 20 and 22 years participated in the experiment.

**Materials** The following six kinds of sound were used as stimuli. (The numbers in the parentheses indicate the duration of stimulation in seconds.)

**Gymnastics:** The broadcast of which Japanese men's artistic team won a gold medal at the artistic gymnastics in the 2004 Summer Olympics (68").

**Crowd:** The bustle of a crowd of people (30").

**Soccer:** The broadcast of which Shunsuke Nakamura kicked a goal at the soccer game of Japan vs. Brazil in the FIFA Confederation Cup Germany 2005 (87").

**Phantom:** The theme tune of the Phantom of the Opera (76").

**Swimming:** The broadcast of which Kousuke Kitajima won a gold medal at the Men's 200 meter breaststroke in the 2004 Summer Olympics (70").

**Aria:** The tune of Air on the G String (J. S. Bach) (91").

## Procedure

While the participants are exposed to the six different sounds, the EEG data were recorded into ESA-16 (NF Corporation) from 10 electrodes according to the international 10-20 system. The EEG data were measured for the participants at rest with the eyes closed. I calculated the difference of the spectral power between stimuli and no stimuli at peak frequency of waves. I also examined how strongly the participants were actually impressed with stimuli by conducting a written questionnaire survey immediately after each EEG measurement, and evaluated the answers using the semantic differential method (SD method).

## Results and Discussions

**Gymnastics, Soccer & Swimming:** Delta band waves with large spectral power were observed when participants were strongly stimulated by Gymnastics, Soccer and Swimming, as shown in Fig.1. This is supported by the evaluation in *feel*

*happy* (5.3~5.7), *be moved* (5.0~5.6), *brightened up* (5.5~5.9) and *get excited* (5.3~5.6), as shown in Fig.2.

**Aria:** Delta band waves with rather large spectral power were observed when participants were rather strongly stimulated by Aria, as shown in Fig.1. This is supported by the evaluation in *be moved* (5.2) and *calm down* (5.5), as shown in Fig.2.

**Phantom & Crowd:** Delta band waves with small spectral power were observed when participants were weakly stimulated by Phantom and Crowd, as shown in Fig.1. This is supported by the evaluation in *feel depressed* (4.9) for Phantom, in *feel depressed* (5.1) and *be not moved* (1.7) for Crowd, as shown in Fig.2.

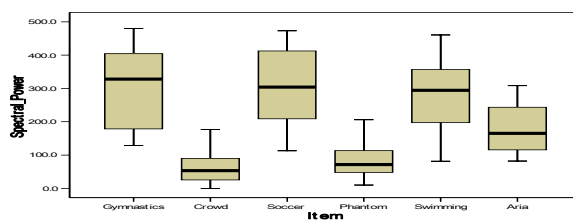
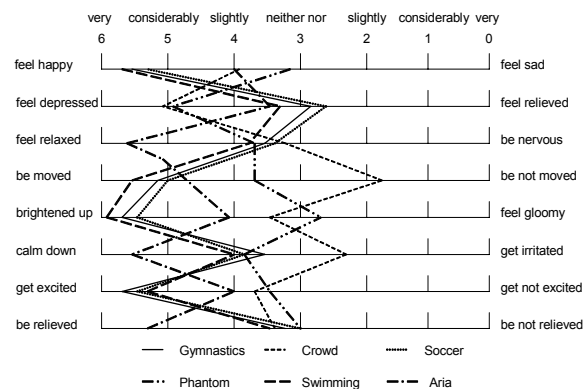


Figure 1: The spectral power of delta waves.

Figure 2: The evaluation according to the SD method.



## Reference

Murakami, H. (2006). Low Frequency Waves on EEG Recordings during Stimuli of Feel. *Proceedings of the 28th Annual Conference of the Cognitive Science Society* (pp. 2563). Ron Sun & Naomi Miyake, and Mahwah, NJ: Lawrence Erlbaum Associates.