2011 SUMMER RESEARCH PROPOSAL
Low Frequency EEG Waves Amongst Meditators and Dancers

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During moments of relaxation we have particular electric activities occurring in the brain, known as alpha waves. These alpha waves appear in moments prior to sleep, but also in times of meditation. Particularly in meditation, alpha wave activity is shown to occupy a larger area of the brain and soon concentrated in the frontal area, shifting to lower frequency waves such as theta and delta as more meditation training is received (Buzsaki, 2006). These alpha, theta, and delta waves (they are collectively referred to as low frequency waves) are measured by recording electroencephalogram (EEG), through electrodes placed over various locations on the scalp.

Alpha waves generally have the range of 8 to 12 Hz; theta 4 to 8 Hz; delta 1 to 4 Hz (Gazzaniga & Heatherton, 2003; Figure 1).

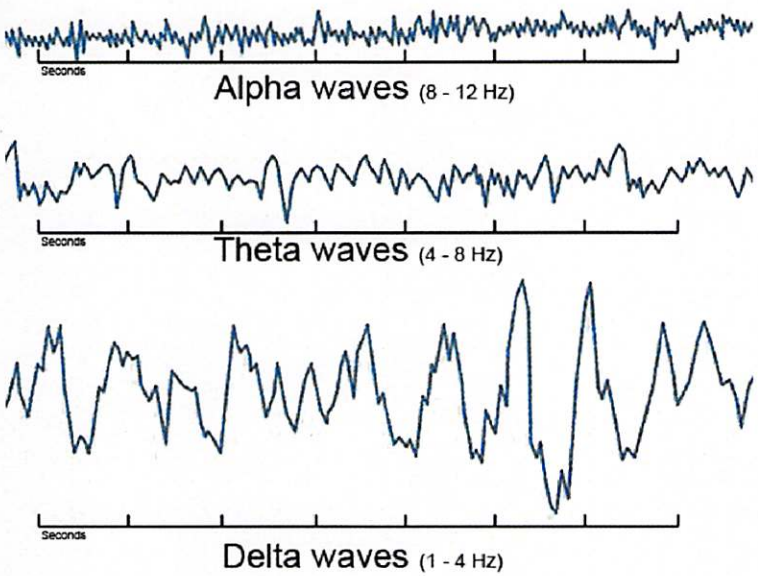

Figure 1 EEG recording of different wavelengths. Alpha waves generally have EEG frequency from 8 to 12 Hz, theta waves from 4 to 8 Hz, and delta waves less than 4 Hz. (Gazzaniga & Heatherton, 2003)

My research proposal is to investigate whether these low frequency wave activities are present in experienced dancers, primarily Argentine Tango dancers, and to contrast these findings against ballroom dancers and non-dancers. Buzsaki (2006) discusses potential association between the low frequency activities with the decrease of anxiety and stress, and the increase of attention mechanisms. This suggests that by meditating, we may be able to improve our physio-psychological state and cognitive ability.

Meditation is a conscious mental task, constantly imagining sensorimotor input and output in one's body, or concentrating thinking of same abstract concepts or concrete object within a certain time frame. This seems to be similar to athletes' "zone" state of mind. It has been reported that trained karate athletes and rhythmic gymnasts have powerful alpha waves even in their resting state (Babiloni et al, 2010). Del Percio et al (2009) describe their neural efficiency hypothesis as a way to organize the brain in order to send and receive cognitive and sensorimotor demands in a timely and precise manner in athletes. Thus, meditators and athletes may share the same underling neural organizational mechanisms.

I would investigate whether this neural efficiency hypothesis is applicable to other forms of physical training, such as dance. In this project, low frequency waves in experienced dancers will be compared to the experienced meditators' waves acquired by Dr. Nakano in one of her January Term course in 2010 (Meditation and the Brain). I hypothesize that experienced dancers would have low frequency waves similar to experienced meditators.

Dance, particularly Argentine Tango dancing, has been used in recent years as a therapy for depression (Hackney, Kantorovich & Earhart, 2007) and Parkinson's disease (Hackney & Earhart, 2009). So, it would be of interest to compare Argentine Tango dancers' waves with other type of dancers' waves (Ballroom). Although according to the neural efficiency hypothesis, both dancers should show similar patterns, if we observe some differences between the two types of dances, which would be the next scientific inquiry as to why Argentine Tango has various therapy effects.

Since the beginning of the fall 2010 semester, I have been working as a volunteer research assistant for Dr. Nakano (Department of Psychology). The current proposal is nested under the Tango and EEG project that Dr. Nakano and Dr. Rosario (Department of Physics) have been conducting. Since this spring semester, I have been assisting the Drs. Nakano and Rosario with another volunteer research assistant (Constanza de Dios), by recording EEG and analyzing the data. This has allowed me to learn whole research basics, such as literature research, designing an experiment, conducting an experiment, EEG data acquisition and analysis. This summer, I would like to further my research experience in neuroscience using EEG.

On average, one subject takes about three hours to complete the experiment. The three hours involves the preparation of the experiment (~30 minutes), EEG recording (~90 minutes), and post-experiment work such as some behavioral part of data entry, data saving and equipment cleaning (~30 minutes). These three hours are normally done with the other research assistant Constanza. Due to the level of complexity involved with running the EEG experiment, it would be ideal that both of us keep working together in the lab for this summer as we are a good team.

During summer research, I would tentatively test subjects within the first three weeks. During week four through nine, I would be conducting data analysis and, if necessary, test further subjects. In the final week, I would be preparing for presentations.

I plan on presenting this research at the Western Psychology Conference for Undergraduate Research, the Undergraduate Research Symposium, and potentially at the Cognitive Neuroscience Society Symposium.

I believe that the summer research opportunity will be a great help to my preparation for graduate school and a professional career. My prospective career goals are going to graduate school and studying sleep or neuropharmacology and afterwards to continue to research on one of these topics in either an academic or private institute. Research experience using the EEG technique will be a great help, particularly for a sleep study. Both sleep and neuropharmacology interest me, and in the future, I would like to investigate how drugs affect neurons and thus our sleep. I believe that the more hands-on research experience I get with EEG (the knowledge of EEG instrument, techniques to acquire EEG data, and EEG data analysis), the better prepared I will be for both my graduate school career and professional career.

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