

The Effect of Music Therapy on Brain Wave Emissions

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Abstract:

Electroencephalography (EEG) can be used to examine the nature of brain wave emissions to inform researchers about a participant's state of alertness. Typically, when an adult is alert, their brain emits beta waves, which are associated with active thought and learning. When individuals are relaxed, alpha waves are dominant, and when meditating, in deep relaxation, or in early stages of sleep, theta waves become prevalent.¹ A sample of 4 participants from SUNY Potsdam's student body were evaluated by EEG while listening to music. The participants were also examined by EEG before the test to provide a baseline reading. The EEG data was then analyzed to quantify the prevalence of alpha and theta waves, and t-tests were performed to determine if there was an effect on state-of-mind, namely a significant increase in the power of alpha or theta waves during the experimental treatment.

Methods:

Our study participants will be asked not to consume any drugs the day of their tests, including caffeine, nicotine, and alcohol. The volunteers are composed of students who joined based on interest in the project and are from SUNY Potsdam's class of 2021.

- > The subjects will first be asked to wear an iWORX 24 lead EEG cap while sitting with their eyes open in silence, to derive a baseline reading and will be asked qualitative questions regarding their anxiety level
- > We will then ask them to listen to music of their choice for five minutes, followed by a rest period in a neutral environment to assess the length of physiological alteration, if any.



*iWORX Cap and Labscribe Software



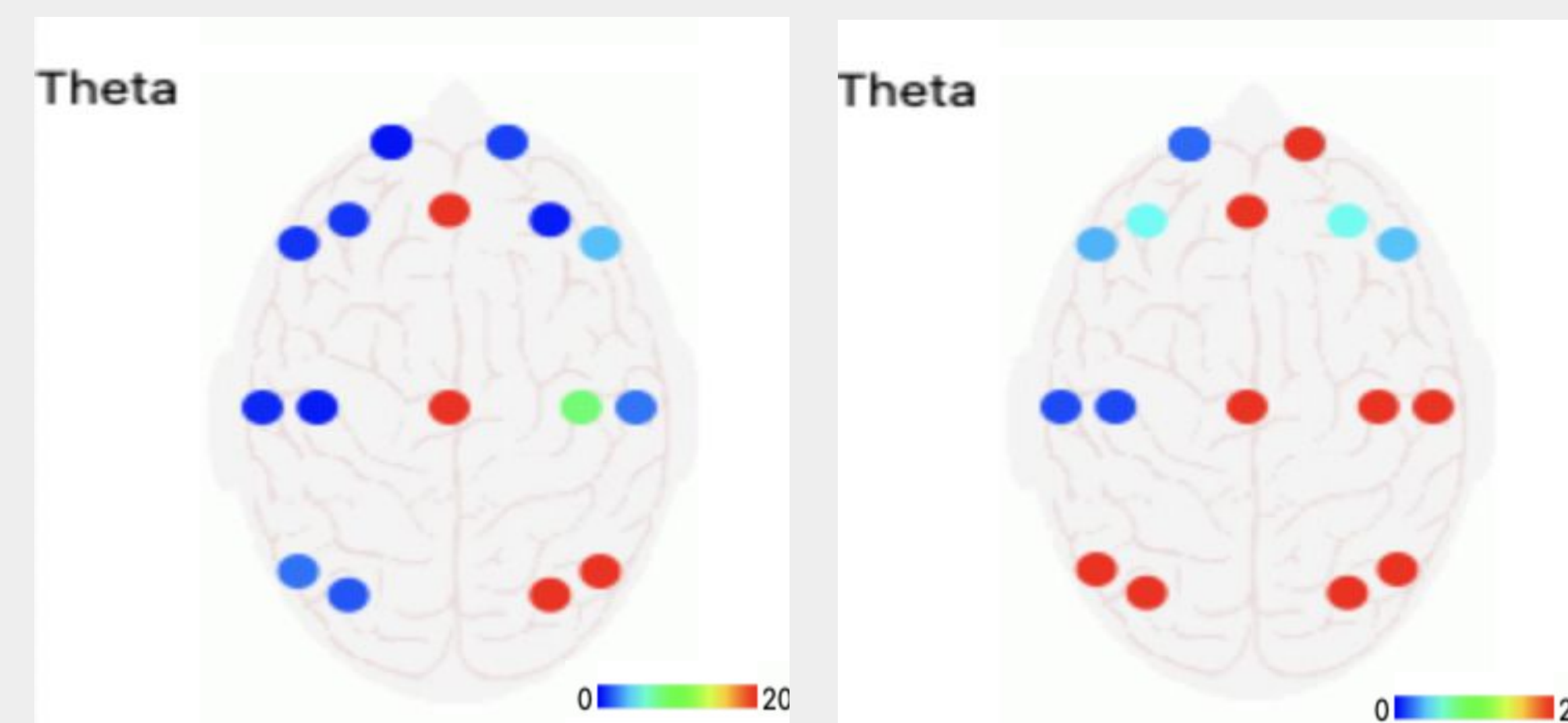
Findings:

- Data was collected for the electrodes Fp1, Fp2, T3, T4, F3, F4, F7, F8, Fz, and normalised into percentages
 - Frontal and temporal electrodes are most susceptible to theta intrusion while awake²
- EEG Data was screened and artifacts were removed
 - Relative alpha and theta power was then calculated in $\mu V^2/Hz$ using iWorx Labscribe software
 - One-tailed t-tests assuming unequal variance showed a significant increase in the average theta (Θ) power between the baseline and music EEG readings for **three of four** study participants
- There was no observable trend in the prevalence of alpha waves

Participant	$\Delta \Theta$ Power ▲	P(T<=t) one-tail
1	119% increase	0.022
4	143% increase	0.085
2	291% increase	0.029
3	54% increase	0.031

*Values in table above reflect change in average theta power across frontal and temporal electrodes from the baseline to music readings

- All participants self-reported decreased anxiety during music treatments.
 - Heart rates and respiratory rates of the study participants also trended down during the experimental condition



*Graphic above shows average Θ power across EEG electrodes for participant two in 5 min baseline (left) and 5 min music therapy (right)

Future Goals:

- The methods for conducting research with EEG, including how to maintain, operate, and conduct clinical studies and data analysis with the machine have been well documented by the researchers
- This text/video instruction manual will be used by future students to further expand the medical and neuroscience research acumen at SUNY Potsdam from this lab
- The researchers are establishing a partnership with the Crane School of Music and SUNY Potsdam art department
 - Structured for cross-departmental work in coming semesters to further research the question of music and art therapy, as well as new, innovative ideas

Discussion/Conclusion:

Review of the EEG montages shows slowing of wave patterns and increased amplitudes while participants listened to music. An analysis of power values, which represent how much of an EEG wave for a given electrode over a period of time is composed of alpha, beta, theta, or gamma type subwaves informed the researchers that there was an increase in theta wave power. Following statistical analysis, the researchers confirmed the significance of the increase in theta band power for three of four study participants. This data suggests that the subjects were more relaxed while listening to music than while sitting in silence. Our sample size was limited due to availability of study participants during COVID-19. Future studies should be conducted which include additional subjects and experimental conditions such as art therapy, circumstances that were unable to be assessed at present due to volunteer time constraints.

References:

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- (2) Kučikienė, D., & Praninskienė, R. (2018). The impact of music on the bioelectrical oscillations of the brain. *Acta medica Lituanica*, 25(2), 101–106. <https://doi.org/10.6001/actamedica.v25i2.3763>
- (3) Myoungjin, K., Moonhee, G., Kyongok, O. (2013). Effect of the Group Music Therapy on Brain Wave, Behavior, and Cognitive Function among Patients with Chronic Schizophrenia. *Asian Nursing Research*, 7(4), 168-174. <https://doi.org/10.1016/j.anr.2013.09.005>