Binaural Beats and Background Music For Increased Focus and Relaxation

Harshada Pawar[1], Shreya Rewadkar[2], Siddharth Sharma[3], Vaibhav Deokar[4], Vina Lomte[5]

[1] *Student, Dept.of Comp. Engg., RMDSSOE, Maharashta, India*
[2] *Student, Dept.of Comp. Engg., RMDSSOE, Maharashta, India*
[3] *Student, Dept.of Comp. Engg., RMDSSOE, Maharashta, India*
[4] *Student, Dept.of Comp. Engg., RMDSSOE, Maharashta, India*
[5] *Prof. and Head of Dept., Dept.of Comp. Engg., RMDSSOE, Maharashta, India*

ABSTRACT

Modern lifestyle requires an individual to do a plethora of tasks with utmost efficiency for longer periods of time. This becomes increasingly difficult to achieve due to a number of distractions available in today's environment. Our brains contain different brainwaves which influence our behaviour. These brainwaves can be manipulated to encourage certain kinds of behaviour. The objective of this paper is to provide a method of manipulating these brainwaves to achieve a greater degree of focus for a longer period of time. The method proposed in this paper makes use of a phenomenon called Binaural beats which occurs when two slightly different frequencies of sound are presented to each of the ear. The difference between the two frequencies would be the frequency of the binaural beats. Binaural beats of different frequency ranges were found to influence the brain waves producing cortical entertainment and was reported to affect the subject behaviour and cognitive functions. The method proposed in this paper combines short bursts and continuous stimulus of binaural beats for an increased effect in increasing the focus and concentration of the user.

Key words: *Short burst beats, Binaural Beats, EEG signal, Continuous Beats.*

1. Introduction

Focus and concentration form the center-piece of growth in today's competitive environment. Ironically, it is also becoming increasingly difficult to achieve them due to an increasing number of distractions available. This paper aims to solve the problem of achieving a higher degree of concentration and sustaining it for a longer period of time. A combination of short bursts and continuous stimulus of binaural beats is used to achieve this. This paper also aims to conquer the effect of habituation to binaural beats. A randomly generated probability based approach is employed in the proposed method of combining short bursts and continuous stream of binaural beats.

A lot of progress is made in the field of increasing the focus and productivity of people. Various methods have been employed to achieve the desired effect. Brainwave entertainment and manipulation seems to be a promising technique in influencing the behavior of people to achieve the desired effect. The effects of certain brainwaves can be increased or decreased by using special kind of music. This music has to be of certain frequency range depending upon the brainwave that you want to influence. Different brainwaves encourage different behaviors and cognitive functions.

2. Method

An effective strategy in countering the effect of habituation (subconsciously getting used to and tuning out the effects of binaural beats stimulation) to the binaural beats would be to use a combination of both short bursts and continuous stream of binaural beats rather than just using a single technique. This reduces the predictability of the binaural beats causing a decrease in the habituation effect. As a result, the individuals don't get used to the binaural beat stimulation (habituation) and don't tune it out subconsciously.

Moreover, the binaural beats are superimposed with lyric-less, instrumental music which does not evoke an emotional response from the listeners as it is neutral in nature. This kind of instrumental music on its own produces very desirable effects of increased focused and productivity among the workers. The stimulation of short burst and continuous stream of binaural beats coupled with instrumental music provides a greater degree of focus and relaxation, quickly, and sustains that effect for a longer period of time.

This system makes use of Alpha, Beta, Theta and Delta frequency ranges to stimulate certain kinds of behaviors and emotions from the human brains. Each frequency range promotes a certain kind of distinct behavior or emotion. By using binaural beats of these frequencies, these emotions and behaviors can be amplified to a greater extent.

Types of brainwaves	Condition
Beta (15Hz-30Hz)	Awake, normal alert consciousness
Alpha (9Hz-14Hz)	Relax, calm, meditation, creative visualization
Theta (4Hz-8HZ)	Deep relaxation and meditation, problem solving
Delta (1Hz-3Hz)	Deep, dreamless sleep

Table 1. Types of Brain waves[15]

The system architecture of proposed system can be given as,

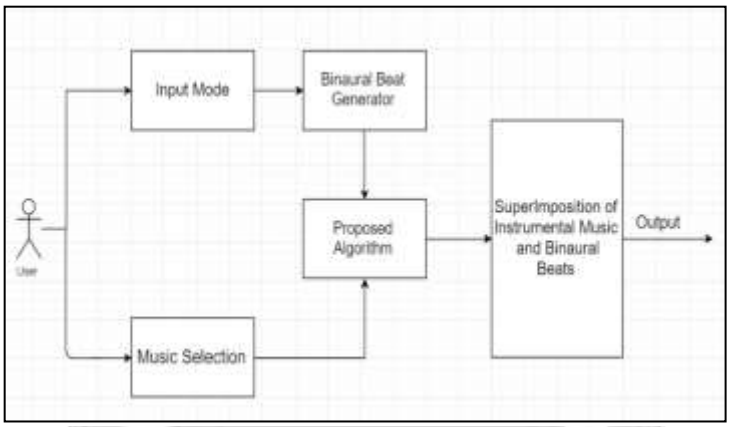

Figure 1: system architecture

3. RESULTS AND PERFORMANCE ANLYSIS

Existing systems use either short burst or continuous stream of binaural beats. The primary problem identified in the existing systems was of habituation to the binaural beat stimulation. Habituation is a condition where the user gets habitual of the binaural beat stimulation and their brainwaves stop generating the frequency-follow response (FFR)[8].

To prevent this phenomenon of habituation, we reduce the predictability of the generated binaural beats by combining both short burst and continuous stream of binaural beats. When the predictability of the music is reduced, the habituation decreases and the frequency-follow response persists for a longer period of time. The system also uses lyric-less, neutral, instrumental background music to further enhance the effect of system.

We compare the results obtained by the stimulation of short burst, continuous stream and proposed system on 10 subjects. 3 stimulations for short burst, continuous and proposed system were conducted on each subject. Each stimulation was conducted on a test subject for a period of 10 minutes.

3.1 Short Burst Stimulation

Subject Id	Time spent in beta range(sec)	Time spent in beta range(min)
1.	261	4.35
2.	236	3.93
3.	304	5.06
4.	350	5.83
5.	270	4.5
6.	308	5.12
7.	253	4.21
8.	248	4.13
9.	296	4.93
10.	194	3.23

Table 2: Short Burst Stimulation Data

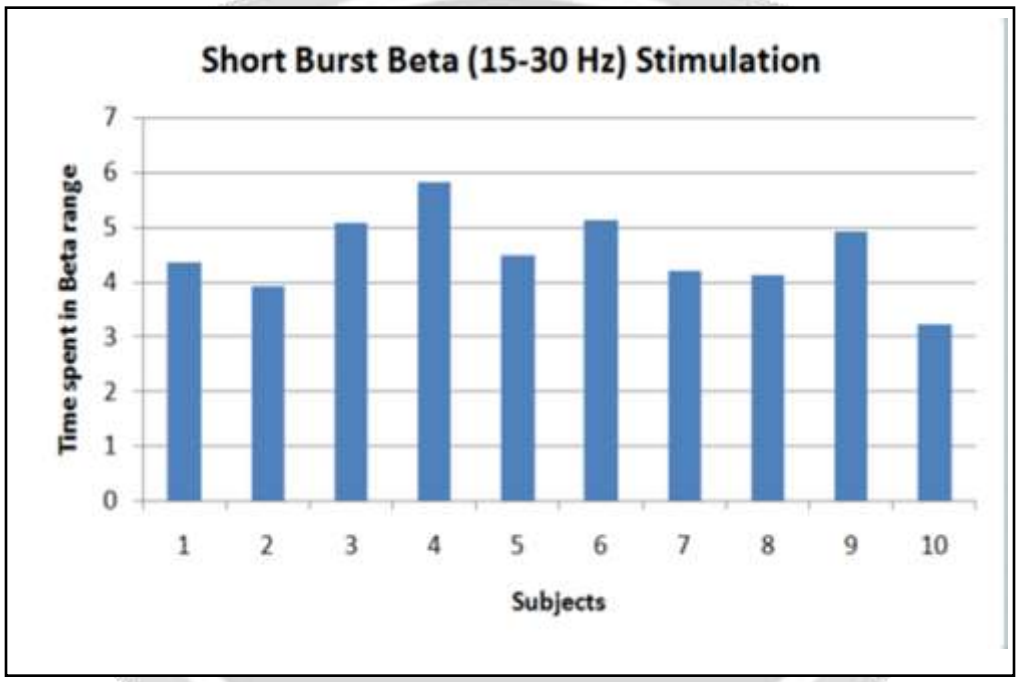

Figure 2: Short Burst Stimulation

3.2 Continuous Stimulation

Subject Id	Time spent in beta range(sec)	Time spent in beta range(min)
1.	259	4.31
2.	160	2.66
3.	183	3.05
4.	110	1.83
5.	214	3.56
6.	238	3.96
7.	242	4.03
8.	212	3.53
9.	172	2.86
10.	194	3.23

Table 3: Continuous Stimulation Data

Figure 3: Continuous Stimulation

3.2 Proposed system stimulation

Subject Id	Time spent in beta range(sec)	Time spent in beta range(min)
1.	395	6.58
2.	371	6.18
3.	425	7.08
4.	359	5.98
5.	362	6.03
6.	301	5.01
7.	398	6.63
8.	439	7.31
9.	402	6.70
10.	374	6.23

Table 4: Proposed Stimulation Data

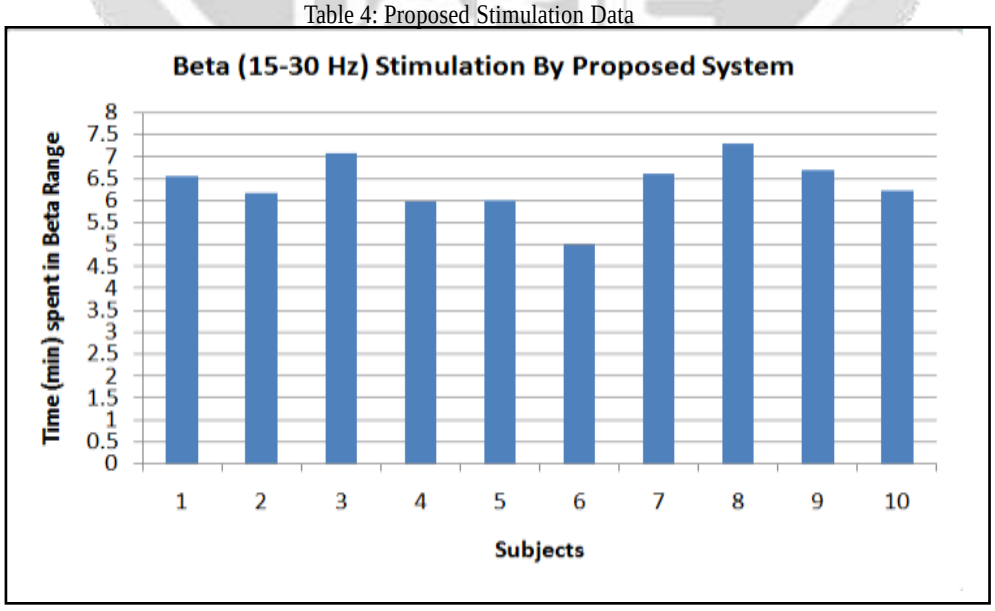

Figure 4: Proposed system Stimulation

4. CONCLUSION

We compare the results obtained by the stimulation of short burst, continuous stream and proposed system. We can observe that the average time spent in beta range is highest when the proposed system is used. This result is therefore consistent with the decrease in habituation effect that causes the frequency follow response (FFR) to diminish in other systems.

Sr. No	Stimulation Method	Avg Time spent in beta range(min)
1.	Short burst stimulation	4.53
2.	Continuous stimulation	3.30
3.	Proposed system	6.37

Table 5: System Comparison

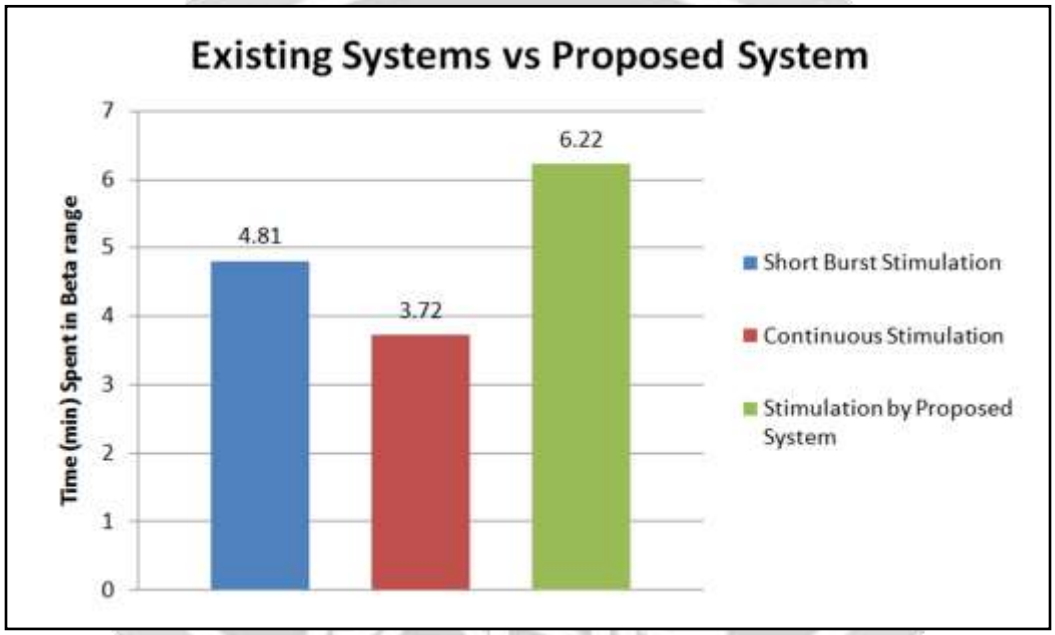

Figure 5: Comparison

5. ACKNOWLEDGEMENT

We would like to thank our HOD, Department of Computer Engineering and guide Prof. Vina M. Lomte and Prof. Parth Sagar for their support and guidance throughout our review work. We express our gratitude towards them for giving us this opportunity. We would also acknowledge the authors of the base paper as well as references for their work and inspiration.

6. REFERENCES

[1] G Guruprasath, S Gnanavel," Effect of continuous and short burst binaural beats on EEG signals", IEEE Sponsored 2nd International Conference on Innovations in Information,Embedded and Communication systems (ICIIECS)2015

[2] Norhazman H., Mohamad Zaini N., Taib M.N., Omar H.A.,Jailani R., Lias S., Mazalan L. and Maizura Mohd Sani. Behaviour of EEG Alpha Asymmetry When Stress Is Induced And Binaural Beat Is Applied; 2012: Published by ISCAIE.

[3] F. R. On, R. Jailani, H. Norhazman and N. Mohamad Zaini. Binaural Beat Effect on Brainwaves based on EEG; 2013: Published by IEEE Signal processing and applications.

[4] Juti Naraballobh, Dusit Thanapatay, Jatuporn Chinrungrueng and Akinori Nishihara. Effect of Auditory Stimulus in EEG Signal using a Brain-Computer Interface; 2015: Published by IEEE.

[5] Nantawachara Jirakittayakorn, and Yodchanan Wongsawat. The Brain Responses to Different Frequencies of Binaural Beat Sounds on QEEG at Cortical Level; 2015: Published by IEEE.

[6] Traisak Yamsa-ard, and Yodchanan Wongsawat. The Observation of Theta Wave Modulation on Brain Training by 5 Hz-Binaural Beat Stimulation in Seven Days; 2015: Published by IEEE.

[7] Yi-Nuo Shih, Rong-Hwa Huang and Hsin-Yu Chiang. Background music: Effects on attention performance;2012: Published by IOS Press and the authors.

[8] TERESA LESIUK. Article-The effect of music listening on work performance.

[9] RongHwa Huang and YiNuo Shih. Effects of background music on concentration of workers; 2009.

[10] Eran Eldar, Ori Ganor, Roee Admon, Avraham Bleich, and Talma Hendler. Feeling the Real World: Limbic Response to Music Depends on Related Content; 2007: Published by Advance Access Publication.

[11] SYMEON P. VLACHOPOULOS, COSTAS I. KARAGEORGHIS and PETER C. TERRY. Hierarchical confirmatory factor analysis of the Flow State Scale in an exercise setting; 2000: Published by Journal of Sports Sciences.

[12] Todor Mihajloski, Jorge Bohorquez and Özcan Özdamar. Effects of Single Cycle Binaural Beat Duration on Auditory Evoked Potentials; 2014: Published by IEEE.

[13] Susan J. Sara and Sebastien Bouret, Orienting and Reorienting: The Locus Coeruleus Mediates Cognition through Arousal; 2012 Published by Elsevier Inc.

[14] T. Yamsa-ard and Y. Wongsawat. The relationship between EEG and binaural beat stimulation in meditation; 2014: Published by IEEE.

[15] N.S.Mohd Puzi., R.Jailani, H.Norhazman and N.Mohamad Zaini. Alpha and Beta Brainwave Characteristics to BinauralBeat Treatment; 2013 : Published by IEEE.

[16] Christos N. Moridis, Manousos A. Klados, Ioannis A. Kokkinakis, Vasileios Terzis, Anastasios A. Economides, Anna Karlovasitou, Panagiotis D. Bamidis, Vasileios E. Karabatakis. The Impact of Audio-Visual Stimulation on Alpha Brain Oscillations: an EEG Study; 2010 Published by IEEE.