Brain Signals Analysis during Meditation and Problem Solving

Hussain AlHassan and Dr. Navarun Gupta
halhassa@my.bridgeport.edu, navarung@bridgeport.edu
Department of Computer Science & Engineering,
University of Bridgeport,
Bridgeport, Connecticut, United States

Abstract

Improving performance is one of the hot topics in every industry. Researchers are working on many perspectives to achieve ideal results to improve performance. Some of them study external factors while others focus on internal factors regarding performance. They consider it an essential base to affect subject productivity. However, relaxation, calming down, and confidence play major roles in refining the efficiency of people's productivity. This paper concentrates on the internal factors of individuals observing their performance during activity. It then analyzes brain signals during meditation and solving math problems by observing signals from the cerebral cortex of the participant using electroencephalography (EEG). Mastering the subconscious leads to improving subject productivity and performance. A person can change their habits and better themselves without using chemicals or drugs, and everything depends on a self-anchor. Meditation gives direct access to hidden power and forces the mind to act differently to gain strength reducing pain and stress and can be a self-anchor.

Keywords

Electroencephalography (EEG), Meditation, Stress, Relaxation, internal factors

Introduction

The brain is the center of commands and is the decision maker. Scientists found that controlling and understanding brain signals will help people change their life for the better without the necessity of chemicals or drugs. However, the brain's cerebral cortex structure is divided into four lobes (Frontal lobe, Parietal lobe, Occipital lobe, and Temporal lobe.) Each lobe is responsible for performing different functions. When the brain shifts from one stage to another it generates various waveforms (Beta, Alpha, Theta, Delta, and Gamma) with unique amplitudes, and frequencies. Each waveform indicates certain characteristics and details. Scientists have proven that confidence and relaxation are important elements that affect people's lives directly. Furthermore, they help people to improve faster when people know how to control those components. Learning how to master the subconscious resizes the anxiety, stress and anger issues. That is why development coaches and natural healers teach self-discipline. Psychiatrists believe twisting minds (mindfulness) is real when a person wants to do something and that mindfulness helps to increase the effort. Psychologists concentrate on the same elements when they help smokers to quit. The result after a couple months is that 66% of the group responded positively. In addition, scientists found that the brain communicates with the subconscious. It usually links to pictures and colors more than words to shift from one stage of brain signal to another or from a state of being such as discomfort to comfort and vice versa. For certain, working on internal and external factors is a great combination that makes unstoppable improvement. People that master their comfort experience life changes as a result.

Related Work

Researchers, neuroscientists, psychologists, and other scientists have devoted much research towards brain signals and the investigation of how the brain relates with psychological and physical aspects. Both consciousness and the body are associated because they affect each other. One study, about the relationship between brain signals and the body investigated heart rate patterns[1]. The results showed notably different effects in the nervous system. Neuroscientists recommend certain activities and sports to trigger the temporal lobe which generates gamma waves[2]. Research exhibits the brain, and classifies more than one source in the brain that generates gamma waves. However, stress and anxiety are reactions reflected on the physical body and through emotions. If they are reduced, and relieved, the body acts differently, even though some people do not know how to manage their emotions and heal their stress[3]. Investigation focused on binaural-beats environment on subjects' alpha waves affected the EEG signal[3]. Twisting mind and mindfulness terminology is used by medical professionals to practice training the brain to act differently compared to real situations. One of these techniques has been used monitoring brain signals and respiration signals during meditation to evaluate body response[4].

Methodology

Participants

There were 9 participating in this study, including both male and females. They are all 21 or over. They were all voluntarily participating in the study and they each signed a consent form. The participants were informed about the study and its procedure, as well as the aim behind the project before the study took place. They were going to do math problems. After that they were given a break. Next, they were instructed to relax and meditate about things that were occuring in their own lives. Finally, they were asked to do math problems again. Each participant wore a device to monitor the participants' brain signals at all times. Using the results, we will be comparing the brain signals, as well as the time taken with solving problems before and after the meditation.

Hardware

The hardware that's used in this study: Windows 7 pro as the PC's operating system installed on a powerful machine with Intel Core i7 CPU and 16 GB of memory, and Figure 1: BioRadio wireless device (USER UNIT). Figure 2: The metal electro wires attached to the participant's cerebral cortex on the surface without any open wounds. They connected to a BioRaido device. The device was sent the signal wirelessly via antenna. A USB Receiver attached to the PC's to get the brain signals.

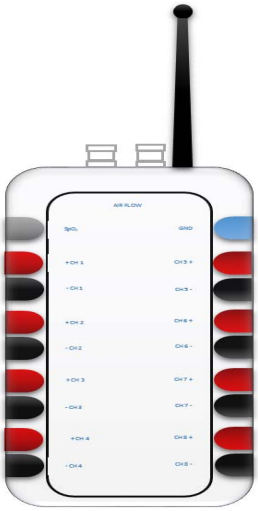

Figure 1: BioRadio 150 USER UNIT

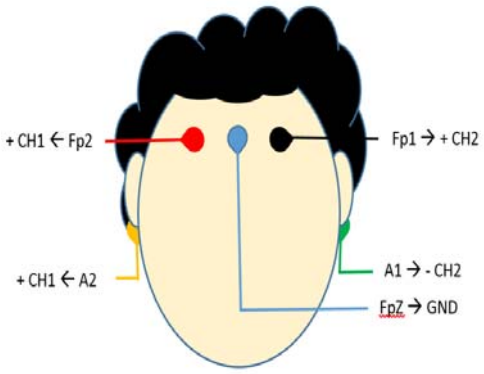

Figure 2: Place EEG wires

Software

The program's software being used include the MATLAB 2013a version 64bit that was used in implementation and simulation. BioCapture was used for reading the signals. Figure 3: Through the use of BioCapture, USER UNITs can be changed for specific input data to read the brain signals. They store data and give the results of the signals received from participants.

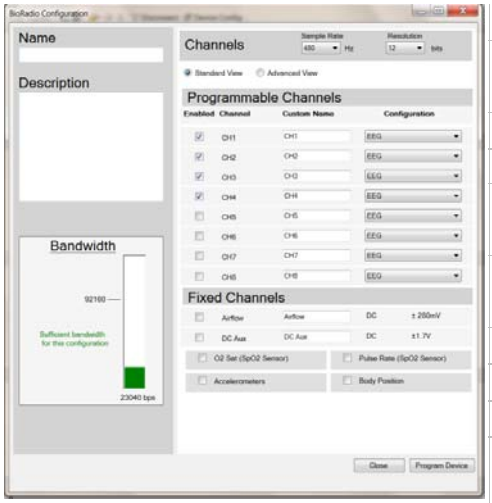

Figure 3: BioRadio Configuration

User Unit	
Number of Input	+ CH1, - CH1, + CH2, - CH2, GND.
Input Range:	± 750µV
Resolution:	12 bits
Noise:	< 2µV peak-to-peak (0.5 Hz – 100 Hz)
Sampling Rate:	480 samples per second per channel
CMRR:	>= 90 dB
Power Source:	2 AA
Input Impedance:	> 20 MΩ at 10 Hz
Filter Input Bandwidth:	0.5 Hz – 250 Hz (-3dB attenuation

Figure 4: USER UNIT Specification

Evaluation and Analysis

While the participants solved math problems in an isolated room the investigator observed the participants and monitored the screen with data[6]. Figure 5 shows that the brain signals suddenly changed after answering some math problems. The signals indicated the brain switched from comfortable status to a rough status of thinking, which might indicate deep thinking or a struggle and frustration.

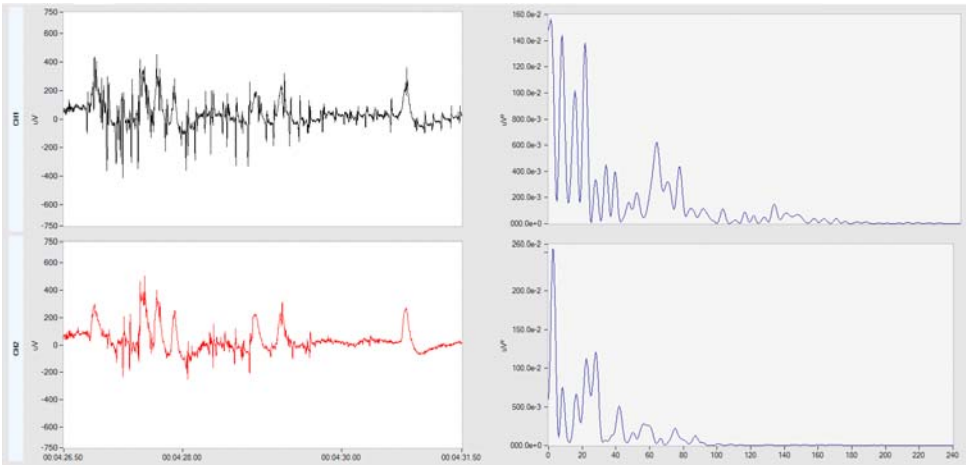

Figure 5: Brain Signals before Mediation

Brain signal are completely different during meditation. Figure 6: when participants free their mind releasing stress the brain generates different signals and that indicates the brain shifting from one wave to another with a different amplitude and frequency[7].

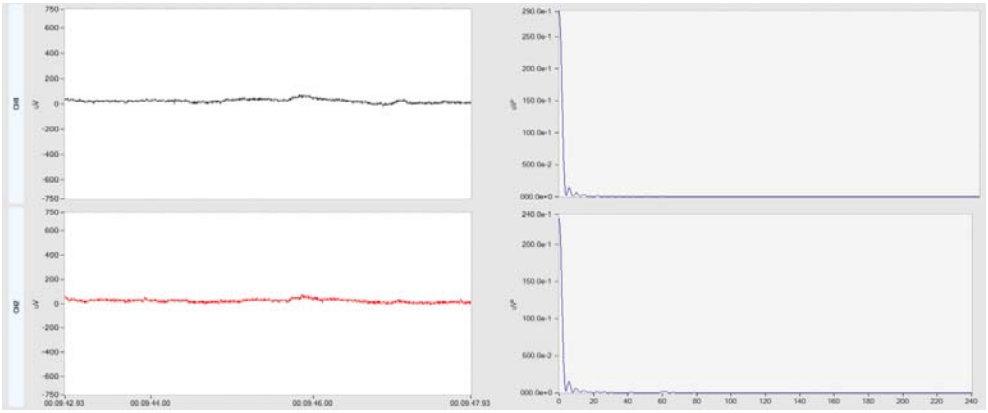

Figure 6: Brain Signal during Mediation

People's performances vary differently even though they are facing the same difficulty. Their brain views the situation in a different way. Participants took the same level of math problems and their results improved compared to their productivity before mediation[8]. They were asked to calm themselves down and supervise their brain[9]. Figure 7 shows that the participants' brain signals are smoother compared to the same participant's brain signal in Figure 5.

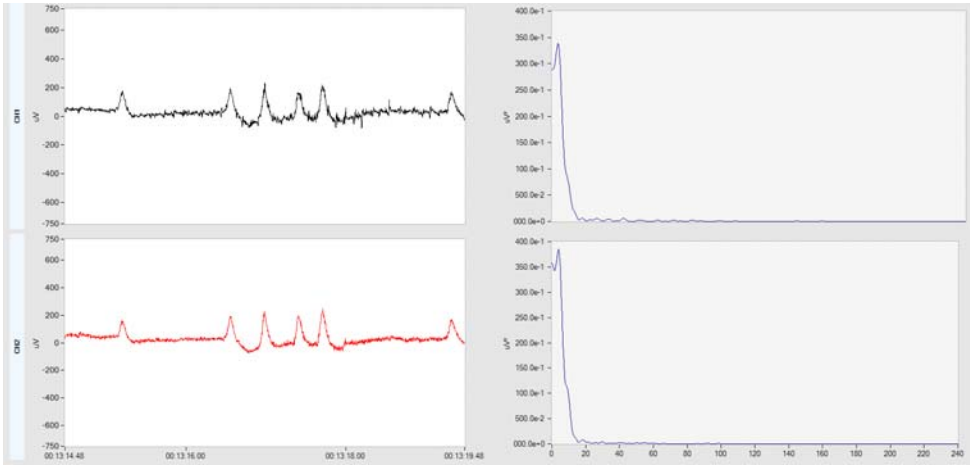

Figure 7: Brain Signal after Meditation

Result

The brain relies on knowledge to deal with life, and stay in a relaxing mode. Sometimes, people need to know how to fool their brain to overcome their obstacles, and gain knowledge in terms of thinking and power in terms of the physical body. However, controlling the subconscious is the ultimate way to achieve a target of life, and success in any challenge. Frustration and struggle are some of the emotions that limit humans' creativity. The hidden power of people's subconscious mind can be reached through meditation. In the experiment people had the same difficulty with math problems. They did better after mediation compared to their work before relaxing.

Conclusions and Future Directions

By studying brain signals in different phases we can research how they are related to the participants' productivity and see if it will increase the awareness of the brain. It will give us more clues regarding brain functions. The result will lead to better control of productivity. These results are necessary to figuring out how to stimulate relaxation without external influences such as place, material, and moment.

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Hussain AlHassan

AlHassan is a PhD candidate in Computer Science & Engineering. He received a diploma in Computer Technical Support from Al-Ahsa College of Technology, Alhassa, Saudi Arabia. His B.S. is in Computer Science from Western Oregon University (WOU), Monmouth, OR, US, and his M.S in Computer Science is from Saint Joseph's University (SJU), Philadelphia, PA, US.

Navarun Gupta

Dr. Gupta is the Department Chair of electrical engineering, and also holds the position of Chair Elect of American Society for Engineering Education (ASEE). He received a M.S. in Physics from Georgia State University (GSU),a M.S in electrical engineering from Mercer University, and a PhD in electrical engineering from Florida International University (FIU).