Brain Signal Analysis of Meditation and its Impact on Concentration and Diluted Modes

Hussain Alhassan, Dr. Navarun Gupta

Abstract— Procrastination occurs when the brain switches from one mode to another to meet the situational requirements. Procrastination can lead to frustration if a subject lacks experience to commute between two modes of different thught. The primary cause stems from lack of assurance in one's ability to perform a task. To alleviate this problem, researchers have found a way to "fool" the brain from negative to positive affirmation. In this paper, we show brain signal changes occurring during people's interaction with non-familiar situations (diluted mode), and their performance during familiar activity (concentrated mode). We observe cerebral cortex signals from the participants using electroencephalography (EEG). Participants were induced to switch from a concentrated mode to a diluted mode by means of a narrow questionnaire. EEG signals revealed a shift from ± 200 μV (naturally occurring during concentrated mode) to twice the initial signal (indicating a shift to diluted mode). Investigators then supplied participants with techniques to overcome their shock upon questioning. Brain signals returned to normal levels.

Index Terms— Electroencephalography (EEG), Concentrated, Diluted, Relaxation, Procrastination, Frustration, Brain Behavior.

1 Introduction

THE human brain is assumed to have the highest levels of intelligence on the planet; and yet, it continues to absorb new information daily. With the ever increasing demands of civilization's expansion and development, the human brain is forced to evolve.

According to neuroscientists, the brain has two modes of thinking[1]. The first is referred to as the concentrated mode; this is when a person is focused. The second mode is the diluted mode; this is when a person diffuses information to discover new techniques to solve a problem. The brain cannot be in both modes at the same time[2].

Neuroscientists have determined the diluted mode produces the highest levels of EEG signals[3]. Psychologists have confirmed that the brain can analyze any sudden situation, but, performs better when the brain is familiar with the situation or a similar scheme[4]. When people are confronted with familiar situations their brain is in concentrated mode, attempting to recognize and study patterns. As soon as they are faced with a new situation which requires a new approach to solving a problem, the brain switches to diluted mode[5]. The brain attempts to generate a new solution by thinking in a different manner.

An example of this occurs when people are concerned with an appropriate answer to give to an unfamiliar question. They pause and mentally deliberate trying to bridge new ideas. This behavior displayed is similar to displaying procrastination in a real world situation[6]. This can lead to frustration due to a lack of confidence in one's ability to answer quickly to a task.

With the brain's continued interest to study and learn the evolving world within which it lives, it acquires the resources needed to troubleshoot daily problems. Frustration can be reduced, struggles resolved, and skills are made more efficacious. While mentally manipulating a new construct, people draw on these resources which are familiar to them[7]. It is imperative to notice, that despite all of the differences between people, and the self growth individuals experience over time, when tasked with a ubiquitous general question, people can answer comfortably[8]. This occurs even with the multitude of answers available to present to the question. People are making the unfamiliar, familiar on an independent level.

Training the mind to perform this technique more efficiently, improves one's access to the different modes of thinking, helping to better control frustration[9]. Training fools the subconscious into switching modes, and can be performed by employing certain guides. By learning to switch modes, the brain is rehearsing new methods to approach power and control over the mind. This increases confidence to look at the problem from a different perspective.

The purpose of our study is to show a physiological shift in brain signals with EEG when participants are challenged with unfamiliar information. We then attempt to show with rehearsed techniques, the modes will shift back to normal.

2 Methodology

2.1 EEG Data

Figure 1 shows the 10 – 20 System (Setup) named because it refers to the percent distance between each electrode from one another in relation to the size of head[10].

Letter (indicates the region) and number (indicates the hemisphere) correlates to location and side of the head (four lobes of the brain). C indicates the center, and A is for mastoid which is the pony portion behind the ear.

BioRadio 150 device required five cables to read EEG signal. The gold cup electrode attached to the Fp1, Fp2, A1, A2, and Fpz positions on the cerebral cortex.

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ISSN 2229-5518

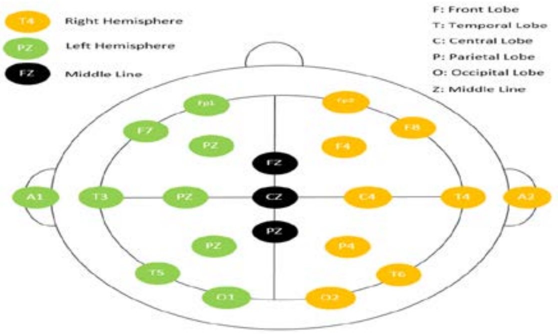


Fig. 1. 10 – 20 System

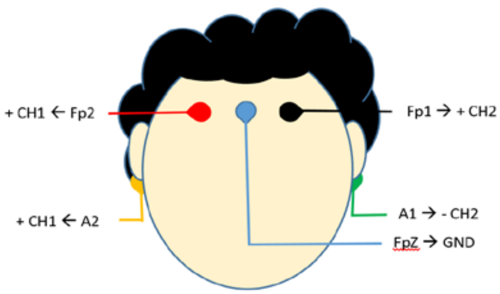


Fig. 2. Placement of EEG Wires

Shown in Figure 2 were the metal electrode wires attached to the participant's cerebral cortex on the scalp surface without any open wounds. The electrodes wired connected to a portable device of the USER UNIT BioRadio which sent signal wirelessly to a receiver.

2.2 Participants

There were a total of 30 participants. Subjects were a mix of gender and they were 18 year and older. Each participant was voluntary and signed a consent form after it had been explained by the investigator. The participants were informed about the study and its procedure, as well as the aim behind the project before the study took place.

The invistegator cleaned the subject's skin of impurities which may otherwiseinterfere with EEG singal. Electrodes were placed at the selected spots.

Subjects were instructed to do mathematical problems in an isolated room for 10 minutes while researchers observed reactions on a monitor as suggested by past research. Afterwards there was a small break for an additional 10 minutes. Participants were instructed to relax and meditate about things that were occurring in their personal lives. Details to relax were mimicked from past research by calming themselves and supervising their brain. The final portion of testing required participants to repeat a new set of math problems for 10 minutes. The study took 40 minutes which included preparation

Each participant wore EEG monitoring equipment to collect participants' brain signals at all times. Data processing compared brain signals, as well as the time taken when solving problems before and after the meditation.

2.3 Hardware

Hardware 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 a BioRadio wireless device (USER UNIT) as displayed in Figure 3.

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

Fig. 3. BioRadio 150 USER UNIT & its Specifications

Signal were sent wirelessly via antenna from USER UNIT. A USB Receiver attached to the PC's to transfer the brain signals.

2.4 Software

The program's software used was the MATLAB 2014a version 64 bit used during implementation and simulation. BioRadio Application built via MATLAB Software was used to read signal data.

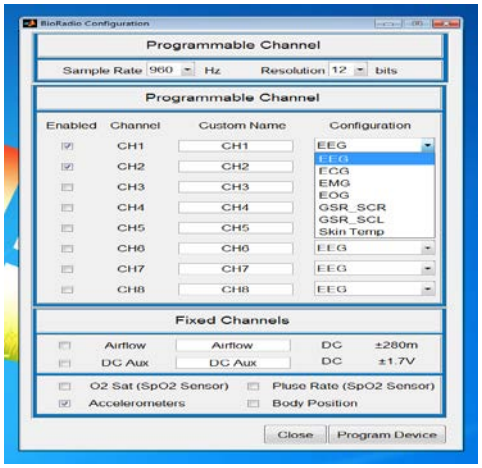


Fig. 4. BioRadio Configration for BioRadio USER UNIT

Figure 4: Through BioRadio Configration, we could change USER UNITs for specific input data to read EEG for brain signals. Including other purposes such as Electromyography (EMG) for muscle activity, Electrooculography (EOG) for eye movements and Arterial oxygen Saturation (SpO2). They will store selected configuration data in the USER UNIT and give the results of the signals received from participants.

ISSN 2229-5518

3 Evaluation and Analysis

As long the questions were general requiring an open answer, subjects reacted normally. Their brain signal was steady with slight changes while changeing thoughts (using their gathered information in experience, knowledge, and instinct).

Shown in Figure 5, when participants were asked a narrow set of questions, their brain reacted and produced different signals.

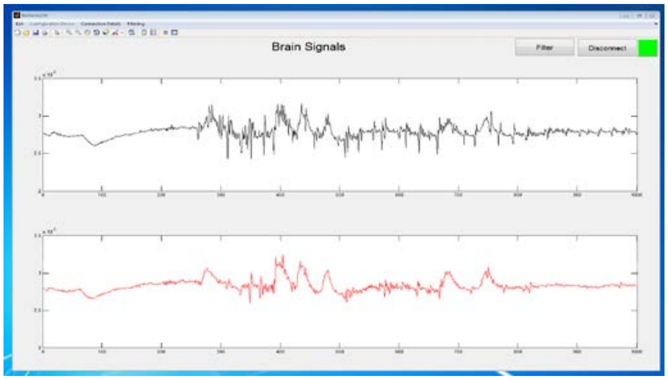


Fig. 5. Brain Signal Befor Training

This indicated the participants' brains switching from concentrated mode to diluted mode without paying attention to both modes because brain's instruction could be occured without pre-inform.

Investigators instructed participants with specific guides to overcome their initial surprise when questioning. Figure 6 showed brain signal was less scrambled when prepared with this information before line of questioning.

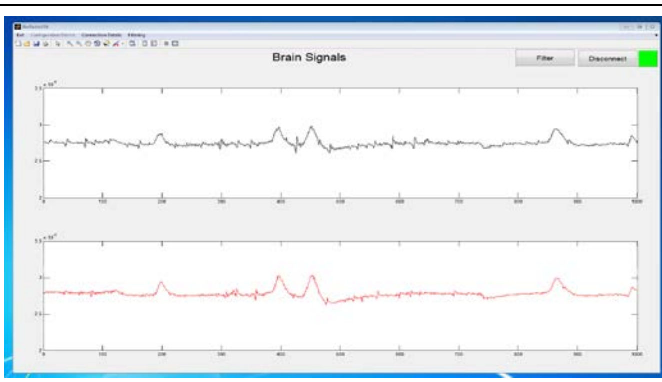


Fig. 6. Brain Signls after Training

4 Result

Accessing different modes of thinking as a readily available skill, is not an impossibility. It just requires training. By default, people's brains are in the concentrated mode, while they transform to diluted mode when their brain invents a new idea, or thinks of a different solution.

The results of study revealed, that while participants were relaxing, their brain signal produced ± 200 µV. This was considered an average voltage. When removed from their comfort zone, the brain signal increased almost twice the amplitude of normal status.

From Figure 6, we can see that once the subjects received proper instructions to work through unfamiliar situations, EEG signaling returned to normal state. These results came after training was administered, and during the repeat of the experiment.

5 Discussion

An explanation of Figure 5, showing diluted mode signals, could come from the participant's lack of assurance in answering comfortably. This may have been due to sensitive subjects, or embarrassing questions. While in Figure 6, we can see when participants were better equipped to handle a new scenario.

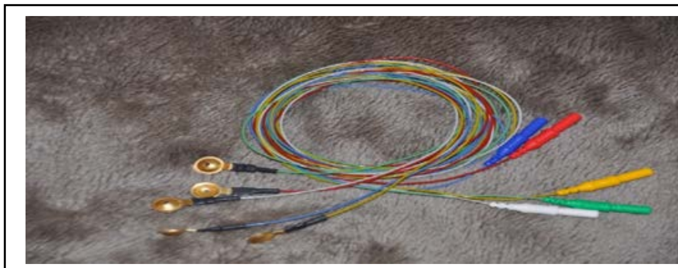
Changes from the ± 200 µV average lead us to believe subjects are wrestling with a moment of procrastination. This then spirals into a lack of confidence and intelligence, and stimulates frustration. However, subjects were able to reduce procrastination, which has influences over stress and anxiety exhibited life.

6 Conclusion and Future Direction

Studying brain signals in different modes helps us to understand the factors leading to procrastination and the delay of taking action when thinking. It also helps us to comprehend the brain, its functions, and to better understand different mode shifts.

This research has provided us with insight on improving our lives by accessing modes to reduce frustration and incrase confidence. Studying brain behavior and understanding it in-depth leads to better advice and training to prevent procrastination of a powerful mind.

Appendices



Gold cup electrode cables

USB Receiver

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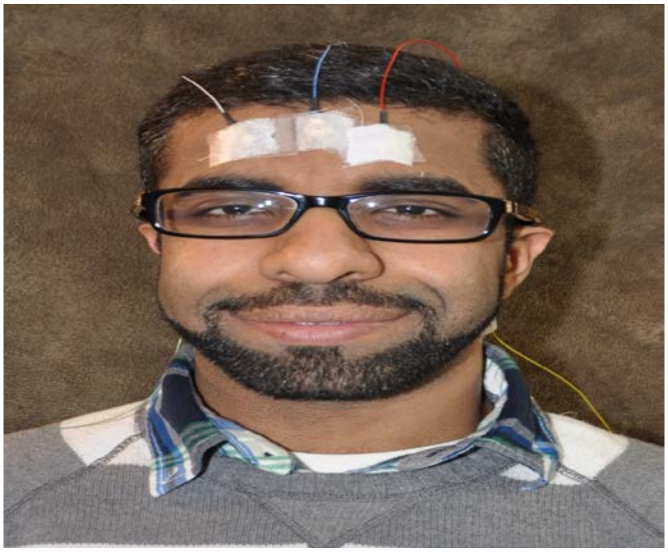
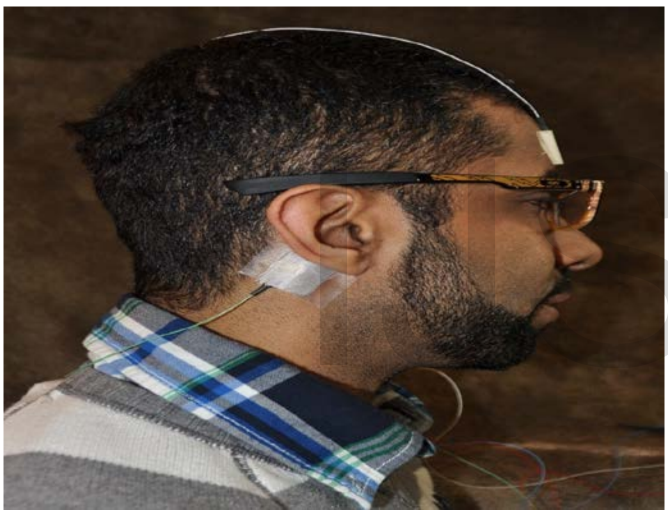


Electrodes (Fp1, FpZ, Fp2) on the Forhead



Electrodes (A1, A2) on back of the Ear

ACKNOWLEDGMENT

Special thanks of the author Peter W. Murphy using his book techniques and strategies “Always Know What To Say - Easy Ways To Approach And Talk To Anyone” with our participants during training.

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