



Measuring the Impact on Human Emotion When Listening and Reciting the Quran using AI/Machine Learning Techniques

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ABSTRACT

The aim of this study is to investigate how the brain responds to the activity of listening and reciting the Quran. The electroencephalogram (EEG) signals will be utilized as a means to evoke human emotions. The data will be acquired from several participants (subjects) by placing nineteen surface electrodes on the scalp according to the international 10-20 system. The efficacy of the Quran therapy is proposed to be investigated to determine the effect on the brain. There are similar studies conducted and accomplished about 75-89%. As a result, they found that surah Al-Hasyr may help in improving a person's stress level with beta band dominance to increase their alpha band by increasing balance between both brain hemispheres. However, the result did not suggest that surah Al-Mulk produced a lesser impact since almost all subjects who listened to the surah during the experiment were familiar with the surah and indirectly became less focused on their own recitation. Perhaps, if they paid full attention to the recitation activity, the result could be different. It is also observed that most of the previous work done used a limited number of testing subjects (people who recite/listen to the Quran). Therefore, our empirical study proposed a larger number of testing subjects so that the results would represent more concrete scientific evidence. Our results can be used to draw a conclusion on whether the Quran recitation can be one of the trusted emotional therapy. This can be beneficial to the community, religious institutions, the government, and other stakeholders.

1. INTRODUCTION

Over hundreds of years, researchers have learned much about the brain, including the numerous methods of estimating the effect of certain activities to the emotion. According to Islamic teachings, the Quran have positive effects on human emotion and curative power to heal negative emotional state. Quran is Allah's divine words which were revealed to the Prophet Muhammad (PBUH) in the 7th century. It was ultimately for us human to benefit from it in our daily life. According to the Islamic teaching, the Quran have positive effects on human emotion and curative power to heal negative emotional state. Nevertheless, there were very limited scientific evidence to prove the claim substantially. Research conducted in [1-3] were carried out to study whether the Quranic recitation helps to lessen stress and bring peace to mind and heart [1-3]. They found that when subjects listen to Quranic

recitation, the brainwaves reading were almost balanced – the left and right brain data reading were almost the same. Other than that, the rose of alpha waves while listening to the recitation is slightly higher than while listening to classical music. The increment in alpha waves showed that the subjects were more relaxed and had higher attentiveness. Other studies [4-5] observed that by calculating arousal-valence values while listening to the Quran, the emotional state of the samples were either in a good condition which was happy and relaxed or the emotions change from fear and sad to happy and calm.

The purpose of this study is to examine the following: There are many verses from the Quran that claim listening or reciting may heal and give calmness to the humankind. We would like to investigate whether there is any scientific evidence to prove such statements; specifically, in emotion study?

2. LITERATURE REVIEW

Often in the literatures, electroencephalogram (EEG) was used to perform emotion analysis. Generally, EEG is reliable, which means that all the data collected from the EEG is purely from how the brain's condition is at the present time. Using EEG method, one is required to attach small disc (electrodes) to the scalp. EEG measurement is based on the principle of the voltage changes in the brain which are considered as the centre of emotions. The signals will give specific patterns for specific task or event and this behaviour helps in determining the features to be extracted and fed into the classification block. It can be concluded that in emotion estimation, features extraction and classification are the two essential methods. Hence, researchers are left to search optimum techniques for both methods to achieve high accuracy. EEG is not only used in emotion detection but also in brain activities recognition [6-10].

Among the features extraction techniques used were Higuchi Fractal Dimension (HFD), Power Spectral Density (PSD), Principal Component Analysis (PCA) and Linear Discriminant Analysis (LDA), Mel-Frequency Cepstral Coefficients (MFCC) and Kernel Density Estimate (KDE). When using HFD, fractal dimension of various EEG signals which are different were taken to be tested and analysed. Fractal dimension was defined as statistical complex element which consists of comparing pattern changes. Higuchi method helped a lot in calculating FD directly from time series and the algorithm approximated the mean length of the curve using samples. As for PSD, the features were taken from the frequency of EEG signals. Different bands of EEG signals with PSD were correlated with the affective state of a human. Higher frequency component in EEG signals carries more important information which is the positive emotions, rather than in low frequency and it was proved by referring to the valence state. Combination of PCA and LDA were also used to analyse the dimension of EEG data. PCA was used as feature for discriminative task where it projects from original s -dimensional space to w -dimensional space. Next, LDA was used to find the best projection course which made the set of training samples to have minimum and maximum between-class and within-class scatter. By doing that, it will reduce the dimension of the signals. However, it took both features to work together to get the best result. Besides that, KDE was also used to study human emotions while listening to Quran. To evoke emotions, some stimuli should be used and for that, they implemented International Affective Picture System (IAPS) database. Two-dimensional Arousal-Valence emotion model was used, and the result showed that listening to Quran recitation was able to change the

valence from negative to positive emotions. Finally, MFCC algorithm. The reason of using the method is because people of different beliefs have begun to learn various types of meditation in academic institution. Quranic recitation gives a positive change of the subjects' emotions from negative precursor emotions to calmness and happiness. All changes and observations are demonstrated by the positive valence of EEG and ECG signals [5].

For the classifier, Random Forest Algorithm (Decision Tree), Support Vector Machine (SVM), Multilayer Extreme Learning Machine (ML-ELM) and Multilayer Perceptron (MLP) were the focus in this review. These techniques are common AI/Machine Learning classification tools and have been used in multiple experiments in the field [12]. Arousal-valence values obtained were used as features of emotions to train the classifier. To get high accuracy, the classifier needed to be trained and the training process was repeated 10 times such that each time a different subgroup was left for assessment. The combination of HFD features extraction and decision tree as classifier gave better result. SVM was used to discriminate classes of emotions which were unhappy and happy. To train the classifier, cross-validation and grid search were used. The train procedure was also repeated for 10 times in which each subset was tested one time. By combining PSD as features and SVM as classifier, it will give the higher accuracy. ML-ELM also gave the best result when combining with PCA and LDA as the features. ML-ELM will initialize the hidden layer weight which performed the unsupervised training also it did not require fine tuning. The random weight between the input and hidden layer will give effect on the performance of the model. Thus, the increases in the layer use will decrease the efficiency. Other than that, Multi-Layer Perceptron also used as the classifier, and it produced the most accurate result when combining with the KDE and also MFCC as the feature extraction. All the emotion data for the subjects has been classified efficiently by using MLP and it will come out with the mean and standard deviation that have higher number of accuracy. But there will be a bit different when combining with MFCC where the MLP classifier was added with fivefold cross validation to obtain the best result.

Each of the features work effectively with their own combination of classifier which are Decision Tree, SVM, ML-ELM and MLP. The best combination for each of them were found by testing all the features extraction to each of the classifier and observation was done to which of the pairing gives the higher accuracy. The experiment was done by using various methods with many categories of examples to come out with the best analysis. There are some specific times where brain activity is found to be

more effective, and it proves by the result from the study of brain activity based on four types of brainwaves [11]. The first one is alpha wave which the frequency is between 8 to 13 hertz, and it is a moment where our brain is in calm and alert state of consciousness. Then, the other three types of brainwaves are beta, and it is the time for the brain to busy thinking while delta and theta are where the brain's performance is different for each of the brainwave. However, even the result of this study gives a positive response, no specific characteristic of verses that have been used being exposed. Brain activity works in a different way with different time and situation then produce different results of thinking. The importance of knowing how our brain works in certain times is for us to plan perfectly on how to generate good ideas or solving problems so that our daily life will become more systematic and enjoyable with no critical stressing over something that stuck in our mind.

3. METHODOLOGY

The research is performed at the Computer Laboratory, Faculty of Engineering and Technology, Multimedia University. This research is to examine the state of human emotions while listening and reciting the Quran.

A fourteen channel Emotiv neuroheadset as shown in Figure 2(a) was used in this research for data collection. The headset was acquired by placing the fourteen electrodes; AF3, F7, F3, FC5, T7, P7, O1, O2, P8, T8, FC6, F4, F8 and AF4 as in Figure 2(b) on the scalp distributional to international 10-20 system positions with addition to two reference electrodes.



Figure 2(a): EMOTIV EPOC+

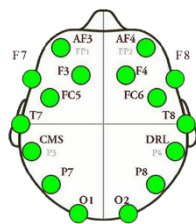
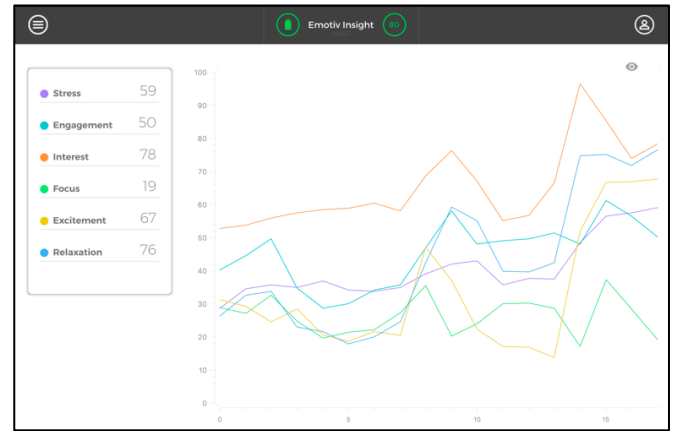


Figure 2(b) Electrode Arrangement

This research used Emotiv BCI software as in Figure 3 below to observe the emotion states. The value for each states; Stress, Engagement, Interest, Focus, Excitement and Relaxation were observed and tabulated.

Fifty healthy male subjects from various ages between 19-year-old to 24-year-old participated in the experiment.

Figure 3: Emotiv BCI Software



They were told about the experiment, the data collection procedure and the data confidential during approaching all the subjects.

We took some time in understanding the purpose of the research that will be carried out while finding a suitable surah that will be used for the experiment. Surah Al-Mulk and Surah Al-Fajr were selected to be tested based on the definition of each of these surahs in the Quran. Surah Al-Mulk was selected for the listening experiment while Surah Al-Fajr was used for the reciting experiment.

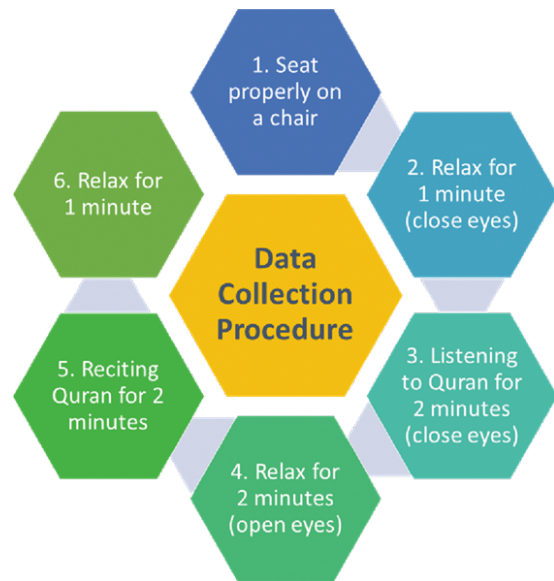


Figure 4: Experimental Procedure

Based on the experimental procedure in Figure 4, the subjects were asked to sit on the same chair and calm down before setting up the EEG and earphone in order to familiarise the subject with the room condition. After finish setting up the EEG on subject's head and earphone, the subject need to relax (close eyes) as to make sure that the result was not affected. After 1 minute, Surah Al-Mulk was played and the subject need to listen with the close

eyes condition and recorded the state of emotions value after 2 minutes. Then, removed the earphone and let the subject calm for about 2 minutes. Next, the subject was being tested for the recitation by reciting Surah Al-Fajr in the duration of 2 minutes and recorded the state of emotions value.

After collecting 50 data experiments samples for each of listening and reciting the Quran, we analysed the results by understanding the pattern obtained by each subject.

4. RESULTS AND ANALYSIS

The study was to investigate the effect of reciting and listening to the Holy Quran and whether it will give positive emotions or not. There were two classes of the participants to participate in this research. The number of participants were divided into two groups "A" and "B". Experimentally to one group "A" was listened the recitation of the Holy Quran and to other group "B" reciting the Holy Quran for two minutes each. According to the result the nursing staff the following results obtained as shown in Fig 3. In this paper, we proposed to make a cut-off value for the emotions to be considered valid which is the Emotive reading will be greater than 50.

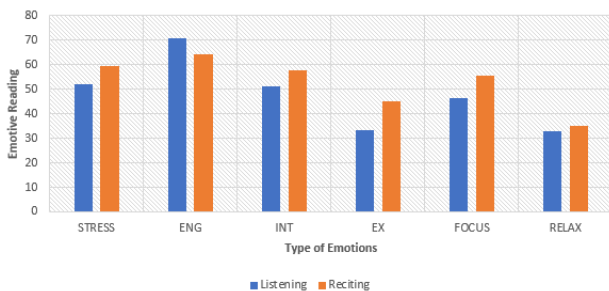


Figure 5: Effects of Listening and Reciting the Holy Quran

The following can be derived from the above figure 5:

- Engagement (positive emotion) dominates listening and reciting process
- Stress (negative emotion), engagement (positive emotion) and interest (positive emotion) are valid for group "A" listening.
- Stress (negative emotion), engagement (positive emotion), interest (positive emotion) and focus (positive emotion) are valid for group "B" reciting.
- Participants are in range of 20 years old.

This means the effects of listening and reciting the Holy Quran is positive where participants tend to engage more with the Holy Quran. Either the person is reciting or

listening to the Quran verses, engagement tends to be dominant. Hence, engagement skills can be improved by reciting or listening to the Holy Quran daily. Also, it shows the age of youth to be aggressive and high-spirited.

Group "A" is listening to the Surah Al-Mulk. From Figure 5, stress (negative emotion), engagement (positive emotion) and interest (positive emotion) are dominating for listening group. The meaning behind Surah Al-Mulk is about the power and sustenance of the Almighty so evident in this universe bears evidence that those who deny the Day of Reward and Punishment will have to face the torment of hell. Participants tend to be engaged and interested when the holy Quran is mentioning about the power and sustenance of Allah S.W.T and stress about the punishment of the hell due to fear. These results show correct correlation between the meaning of verse and the Emotive readings.

Group "B" is reciting Surah Al-Fajr. From Figure 5, stress (negative emotion), engagement (positive emotion) and interest (positive emotion) are dominating for reciting group. The meaning behind Surah Al-Fajr is about destruction of disbelieving peoples; the Ancient Egyptians, the people of Iram of the Pillars and Mada'in Saleh. Participants tend to be engaged and interested when the holy Quran is mentioning about the people who lived in the ancient time and stress about the destruction the disbelievers took as they disobeyed Allah.

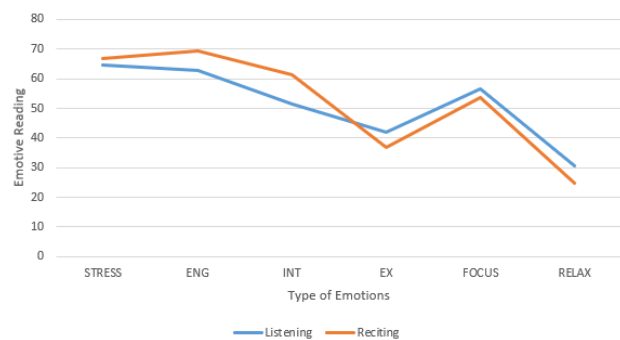


Figure 6: Effects of Listening and Reciting the Holy Quran

The following are from the above figure 6:

- Results shown are only for participants of age 22 years old.
- A total of 32 participants are taken into the mean value.
- All the participants were male.

From the results indicated in Figure 6, participants tend to have higher emotion level of stress, engagement and interest in reciting but lower emotion level of excitement, focus and relaxation in listening. It means that male of 22 years old will have more stress, engagement and interest

in reciting the Holy Quran but lower in excitement, focus and relaxation. These show that reciting the Holy Quran give better positive emotions to the reader compared to listening to the surah but at the same time, negative emotion will occur depending on the meaning of the surah. This is because more of the human senses are engaged when a Muslim recites the Quran aloud, rather than when they just listen to it. This finding suits the Hadith of Prophet Muhammad (peace be upon him):

“If anyone recites a letter from Allah’s Book, he will be credited with a good deed, and a good deed gets a tenfold reward. I do not say that Alif-Laam-Meem is one letter, but Alif is a letter, Laam is a letter and Meem is a letter.” [Jami Al Tirmidhi]

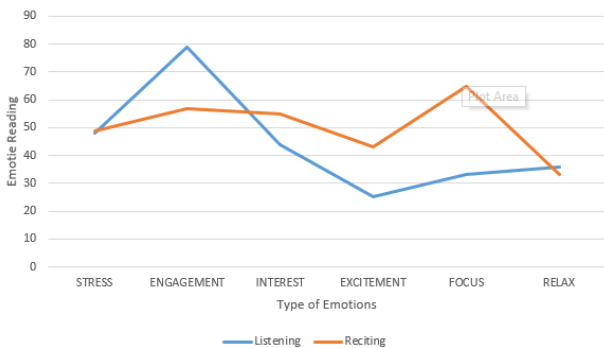


Figure 7: Reading from participant no. 030



Figure 8: Reading from participant no. 032



Figure 9: Reading from participant no. 036

These three figures above (Figures 7 through 9) are taken randomly from the participant database. From figure 7, figure 8, and figure 9, the same patterns are showed

regarding the Emotive Reading. The listening graph will start at high values and start decreasing when entering interest emotion. As for reciting, it will start lower than value of listening but increase when entering engagement emotion. This shows the similarity of results acquired from the Emotive device because the experiment’s procedure was the same for all the participants. Also, these three figures were from participants with the same age and gender.

5. CONCLUSION

The method used in this study presents decent and attractive technique and does not conflict with the other methods used to achieve relaxation, engagement etc. The study measured the “Recitation of the Holy Quran” and “Listening of the Holy Quran” by using current technology and the use of AI/machine learning techniques. The Holy Quran is one of the softest and lightest musical notes in nature, which originated from a pure revelation source, can be used to prevent a great number of physical and mental sufferings.

In this paper, the use of our proposed method gives a decent result both numerically and comparatively the balance condition of both negative and positive emotions. Our surrounding and nature have infinite amount of sounds. Natural sounds such as the flow of a river, bird chirping, air on the top of mountains, vibration of trees etc. provide natural soothing sounds and brings peace to the listener. Also, we have other sources of sound such as the sound emanating from a factory, construction, guitar plucking etc that somehow bring some sense of relaxation to the listener. The effectiveness of their deployment is highly dependable on the individual interest. There are several methods to achieve relaxation or any other positive emotions such as listening to music, jogging, enjoying the views of the nature, travelling etc.

One of the limitations of this study is the number of subjects used in the experiment and the number of surahs used. This experiment can be expanded in the future to include more participants and increase the number of surahs in the Quran to test their effectiveness in the said emotions.

The experiments conducted shows the effectiveness of listening or reciting the Holy Quran and that it indeed brings peace and positive emotions to the users. The results demonstrated in this empirical study support these findings. These findings can be used as evidences to elicit the usage of the Quran for emotional transformation by community elders, Islamic organizations and institutions,

or even the government entities when prescribing techniques for the youth and members of the community.

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