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Measurement Of Attentıon Levels Wıth Eeg Sıgnals

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ÖZET

In this study, in order to measure attention levels on ten people, their attention levels were measured using EEG Biosensor and brain signals while reading aloud and silently for 66 seconds, lying, telling the truth and listening to different music for 89 seconds. The data obtained from the measurement were recorded to the Arduino Nano with the HC-05 Bluetooth Module. The signals are processed to light up 10 LEDs from minimum to maximum, varying according to their attention level. Each LED on the Circuit Board is arranged to correspond to an attention level of 10%.

KEYWORDS: *EEG Biosensor, HC-Bluetooth, Arduino Nano, Led, Mindwave NeuroSky Mobile 2*

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I. INTRODUCTION

Emotion plays a nuclear role in human behavior, such as perception, attention, decision-making, and communication [1]. Positive emotions contribute to healthy life and e_cient work, while negative emotions may result in health problems [2].EEG signals e_ectively reflect the brain electrical activity, and have been widely applied in many fields, including cognitive performance prediction [3], mental load analysis [4,5], mental fatigue assessment [6], recommendation system [7] and decoding visual stimuli [8,9].Many tasks such as driving a car require human operators to be vigilant. Vigilance is a term with varied definitions, but the most common usage is sustained attention or tonic alertness, an ability to sustain attention to a task for a period of time [10]. Long-term and monotonous driving often lead to the decrease of vigilance levels [11], [12], which is oneof the major factors causing traffic accidents. Statistics Show that approximately 10–20% of road traffic accidents are due to drivers' decreased vigilance levels [13], [14].
Bu çalışma ile insanların dikkatlerini nelerin etkilediği araştırılarak somut sonuçlar elde edilmiştir.

II. MEASURİNG ATTENTİON AND MEDİTATİON LEVELS

2.1. Attention level measurement

The attention meter algorithm shows the intensity of mental "focus" or "attention". Values range from 0 to 100. Thanks to a user's single thought or external object, the level of concentration can be observed. The harder it is for the user's brain to work on a task, the higher the value. This can happen with both physical (eg drawing) and mental (eg reading) tasks.

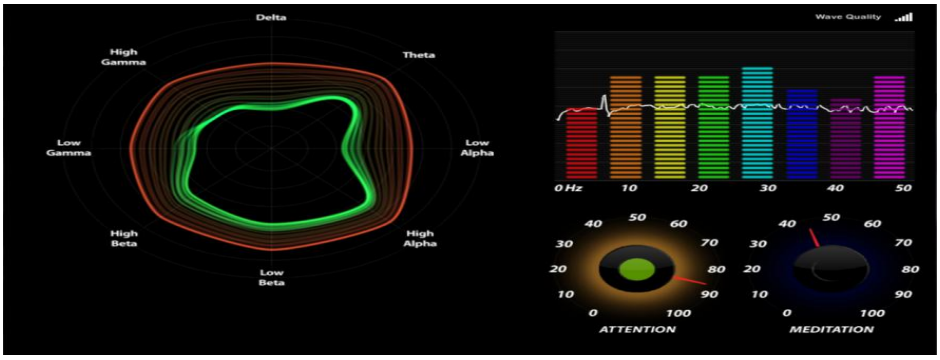

Figure 1. Measurement of attention level [15].

2.2. Meditation level measurement

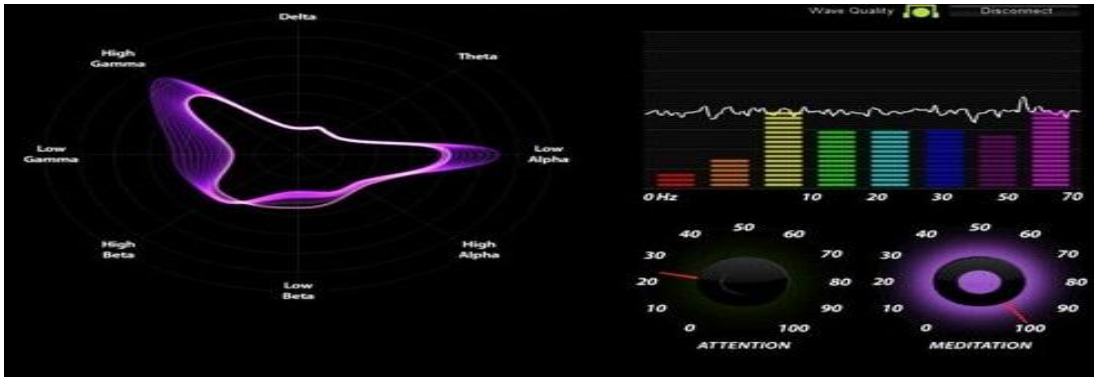

Figure 2. Measurement of meditation level[16]

The meditation measurement algorithm shows the user's personal calmness or relaxation values. These values are between 0-100. Meditation is about reduced activity of active mental processes in the brain. It has been supported by scientific studies that closing the eyes is an effective method to increase the level of meditation, as it closes the mental activity that processes images from the eyes. It is known that emotions such as attention-seeking thoughts, anxiety, stress, and anxiety reduce the level of meditation.

III. ELECTROENCEPHALOGRAM (EEG)

Electroencephalography or EEG brain imaging technology is a method that measures electrical activity in the brain. With electroencephalography (EEG), fluctuations in the spontaneous electrical activity of a large group of neurons in the cerebral cortex, which has a shirred shape and gray shell, are recorded from the surface. These electrical signals obtained from certain parts of the brain are converted into a mathematical value and passed through various formulations and provide information about activities such as attention, motivation, emotional interest, cognitive workload, and sleepiness [17].

IV. MİNDWAVE NEUROSKY MOBİLE 2

MindWave Mobile 2 reports the user's mood in the form of NeuroSky's proprietary algorithms, including Attention and Meditation eSense™ algorithms. NeuroSky MindWave Mobile 2 can be used with supported video games, educational software and many other applications.

Figure 3. Structure of EEG biosensor[20]

V. WORKİNG PRİNCİPLE OF THE CİRCUİT

The signals received from the EEG Sensor depending on the attention level are transferred to the Arduino. Here, when the attention threshold values determined in the code blocks are reached, digital outputs are received. As a result of these digital outputs, the ones above the threshold value out of 10 LEDs in the circuit give light. Each LED corresponds to an attention level of 10%. In other words, when the attention is 100%, all of the LEDs on the card will be coded to give light.

Figure 4. Structure of the application circuit

The circuit shown in Figure 4.2 was operated and it was seen that the attention level of the person was 60%, and accordingly, 6 LED lights on the electronic card gave.

VI. DOİNG THE EXPERİMENT

6.1. The effect of reading aloud and silently on attention

In this experiment, ten people were asked to read a book separately for 66 seconds. First of all, a silent reading was performed, the data obtained were recorded, and then these data were recorded by having the individuals read aloud. The average values of these obtained data are shown in the graphs below. It is seen in Graph 6 that silent readers are more careful than reading aloud.

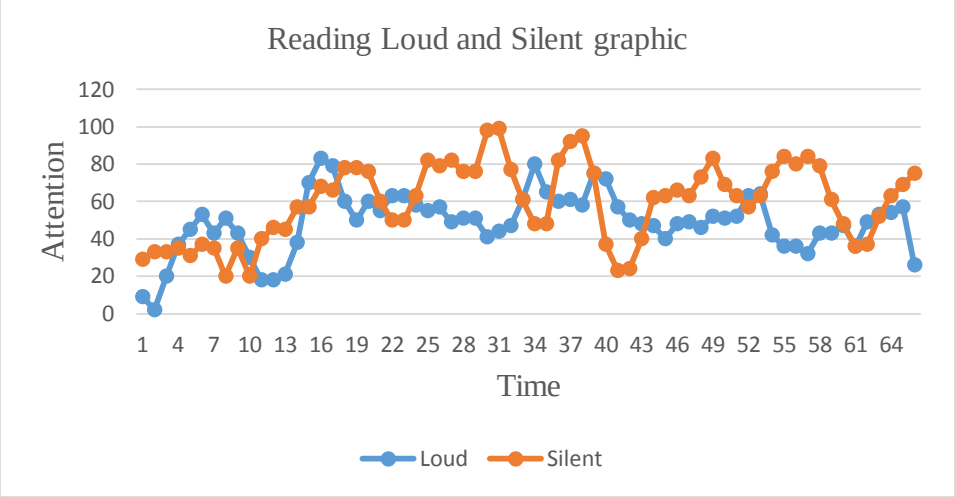

Figure 5. Comparison of attention levels during aloud and silent reading

As a result of the experiments, as can be seen in the graph, it has been revealed that people are 18.80% more attentive during silent reading than when reading aloud. It can be predicted that the wiggling of the lips during reading aloud causes inefficiency in reading.
Figure 6 and Figure 7 show the graphs of reading aloud and silently in pareto charts.

Figure6. Pareto chart of silent reading

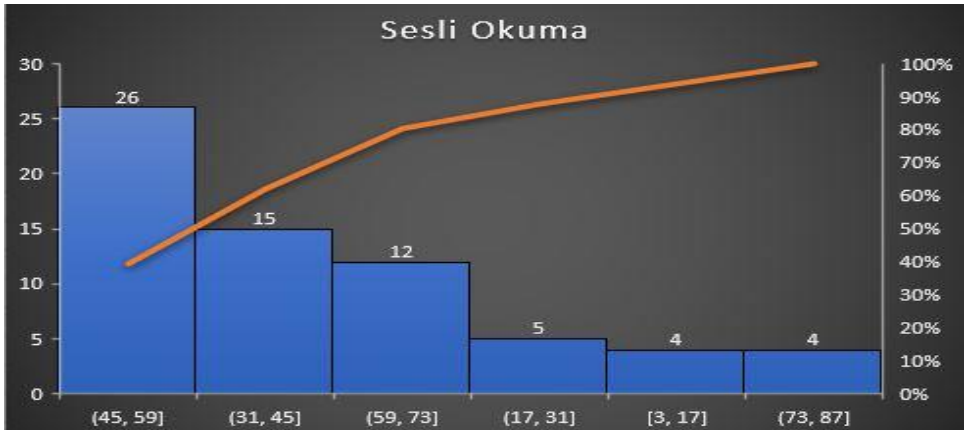

Figure 7. Pareto chart of reading aloud

6.2. Effects of Classical, Rap and Turkish Art music genres on attention

In this experiment, classical music, rap music and Turkish Classical Music were listened for approximately 89 seconds from ten people and the data obtained were recorded. These recorded data are shown in the chart below.

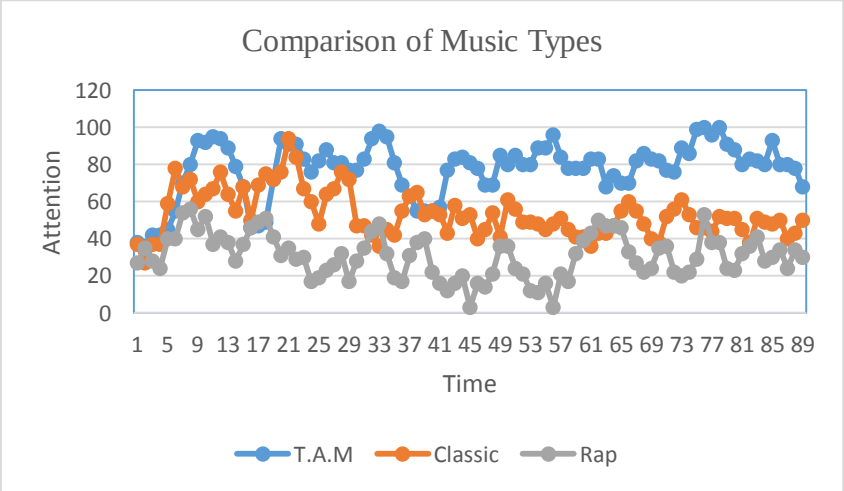

Figure 8. Comparison of Classical, Rap and Turkish Classical Music

As a result of the experiments, it was determined that people who listen to classical music are 42.96% more careful than those who listen to rap music, 31.54% more than those who listen to classical music while listening to Turkish Classical Music, and people who listen to Turkish Classical Music are 60.95% more careful than those who listen to Rap music. In Figure 9, Figure 10 and Figure 11, data on listening to Classical and Rap music are given in pareto charts.

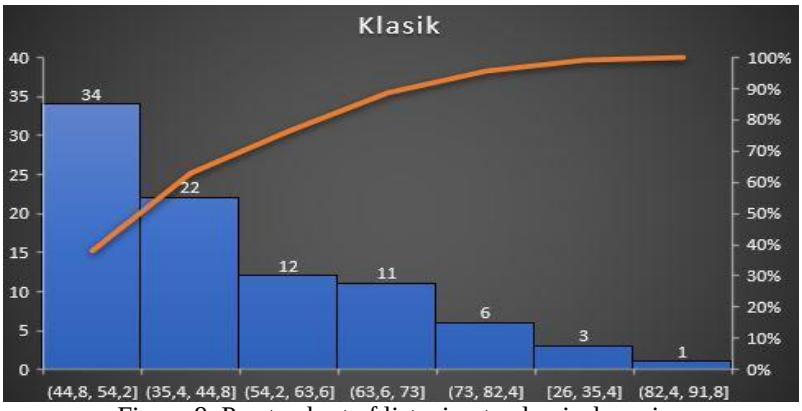

Figure 9. Pareto chart of listening to classical music

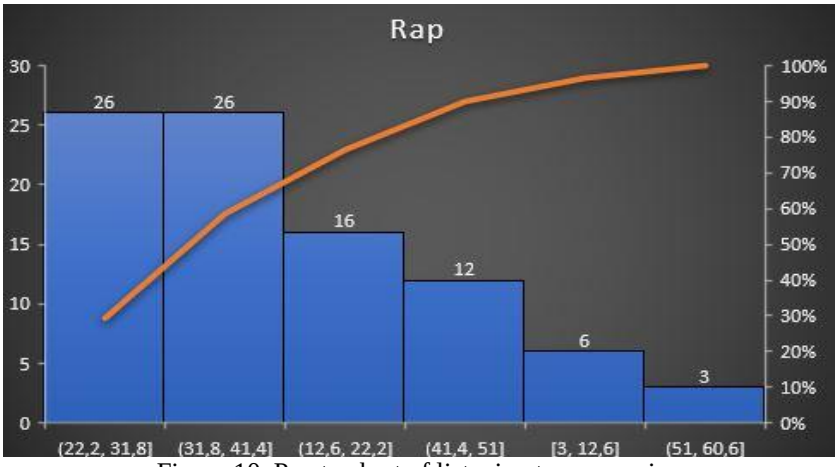

Figure 10. Pareto chart of listening to rap music

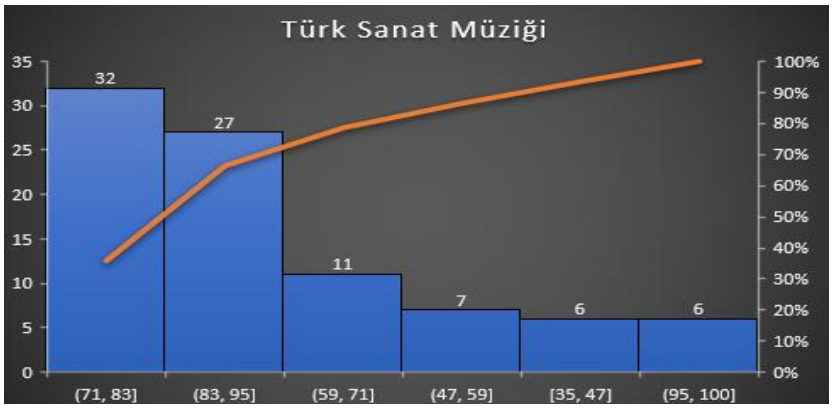

Figure 11 Pareto chart of listening to Turkish Classical Music

6.3. The effect of truth and lying on attention

In this experiment, the data obtained by asking ten people to lie for 64 seconds and then tell the truth were recorded. These recorded data are given in the graphic figure 12 below.

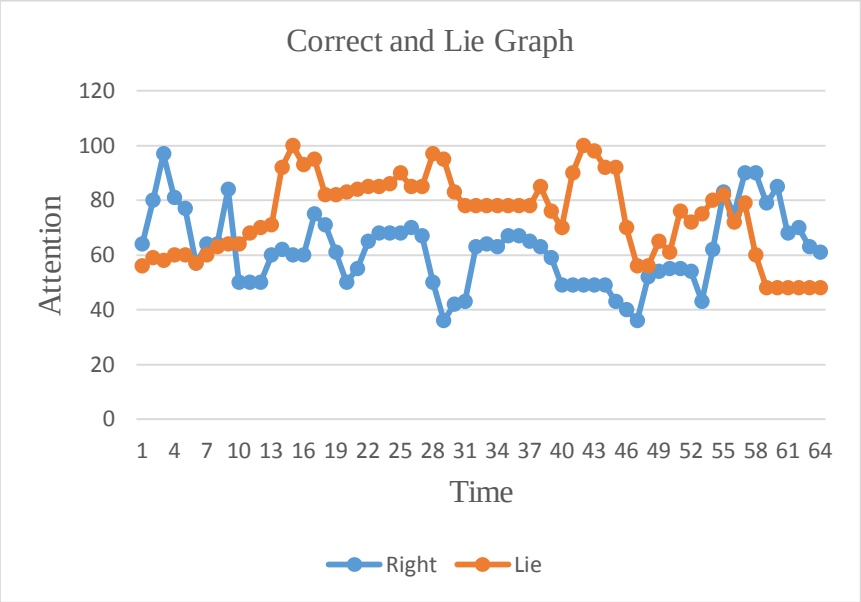

Figure 12. Graph showing the level of attention when lying and telling the truth.

As a result of the experiments, it was seen that people are 16,69% more careful when lying than telling the truth. It can be predicted that the reason for this is the need to give details in order to hide the lie arising from the worry and anxiety of the lie to be revealed. This situation is shown in the pareto charts in figure 13 and figure 14.

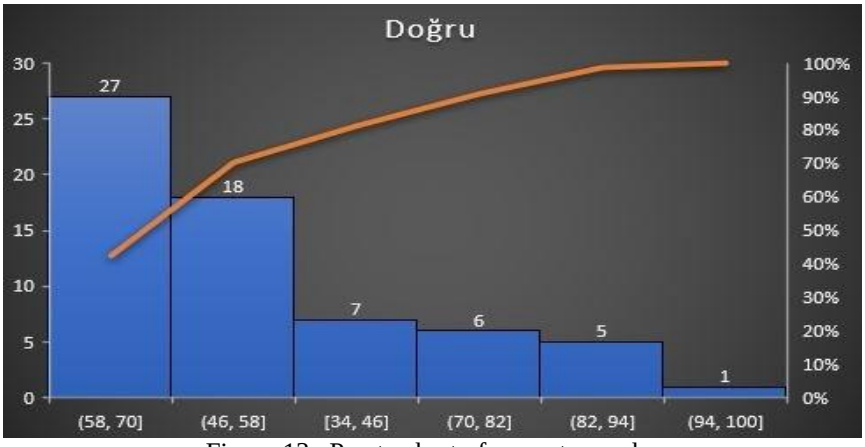

Figure 13. Pareto chart of correct speech

Figure 14. Pareto chart of lying

VII. CONCLUSION

In this study, it was determined that 18.80% of people compared to reading aloud during silent reading, 42.96% compared to listening to rap music while listening to classical music, 31.54% compared to listening to classical music while listening to Turkish Art Music, people who listen to Turkish Classical Music compared to those who listen to Rap music. The result of the experiment was revealed that they were 60.95% more careful than their counterparts. It is predicted that the effect of Turkish Classical Music on increasing attention is due to the fact that it appeals to people's emotional and thought worlds, both verbally and musically. It is predicted that Classical Music increases attention by putting people's body functions in a stress-free environment, while Rap Music causes people to be unable to concentrate when words are spoken too quickly. As a result of the experiments, it was seen that people concentrate 16,69% more when lying than telling the truth.

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