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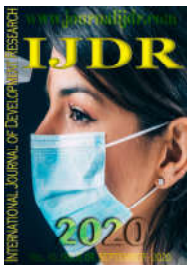

RESEARCH ARTICLE OPEN ACCESS

RECOGNITION OF FACIAL EXPRESSIONS: ACTIVE EMOTIONS DURING THE USE OF AUDIOVISUALS

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ABSTRACT

This article describes or recognizes facial and compared expressions as active emotions when using audiovisuals. This study investigated the parameters of facial expressions with the use of audiovisual information in the perception of emotions. Participants volunteer to enjoy two types of music videos. The videos were selected in two styles (pop / rock and classical music). The listening task and the answers are intended to investigate the emotional perception of those being tested. There is a difference between the styles of music used during the study. The emotions expressed on the faces of the investigated are evidenced during the expressions with movements of the lips and other expressions on the face. The results indicate that the judgment of the volunteers' emotions oscillated positively during the use of the classic audiovisual style of Mozart with the style of pop / rock music. Also, when reading brain activities inserted using an EEG sensor, this information is used as a constant increase in brain frequencies during the use of classic audiovisual.

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INTRODUCTION

Human beings use visual and auditory information to understand the intentions of others during face-to-face communication. It is normal that both emotions and facial expressions are perceived through multisensory stimuli. The face and the voice convey the emotions of the speakers and the integration of these clues allows us to recognize the emotions of others. Research has shown cultural differences in the integration of audiovisual information for the perception of emotions. For example, Tanaka, et al., (2010) demonstrated that Japanese perception of emotions tends to be influenced by vocal expressions, while Dutch people give more weight to facial expressions, suggesting that Japanese use auditory cues for the perception of emotions more than the Dutch. Different theories have been constructed, ranging from the view that many different emotional expressions are possible (for example Scherer et al., 2001). While Ekman, 1999 addresses a limited number of basic categories of distinguished facial expressions. Current literature indicates that student emotions are an integral part of the learning experience (Pekrun & Perry, 2014) and have great significance in learning processes (Cunningham, Dunfield & Stillman, 2013) and attentional responses (Kärner & Kögler, 2016). A common classification of emotional constructs is based on the differentiation of traits and the state of emotions. Emotional states are subjective, volatile experiences specific to the situation, integrating emotional, motivational and cognitive facets, and considered essential for the regulation of action (Kärner & Kögler, 2016).One of the challenging neuroscientific issues surrounding the phenomenon of musical preferences is how to listen to different types of music and how they can connect the same brain systems. When listening to the favorite music, people report that they often experience deeply personal and emotionally charged thoughts and memories (Janata, 2009). Empirical studies focusing on emotional states should be based on instruments capable of disseminating the volatility of individual experiences, rather than using inefficient questionnaires as responses to a study, (Bos et al., 2019b). Thus, it is necessary to have a measurement that is capable of bringing more effective results, is what we propose in this study. The present study focuses on the investigation of emotions, facial expressions and active brain frequencies during the appreciation of an audiovisual. Considering the

importance of study in the field of education, we compare the styles of audiovisual perception between classical music listeners and pop / rock style listeners. Finally, the study design and results will be reported and discussed.

RELATED STUDIES

The studies by Stöckli et al., 2018 present classification of images and videos of facial expressions for the emotions displayed and address the reliability of the affective confirmed by validation of static images. And in the work of Taggart et al., 2016 that address videos and demonstrate the recognition of reliable emotion by the software. For Ekman et al., 1976 the standard for measuring emotional facial expressions is the Facial Action Coding System (FACS).

The system is based on anatomy and allows the assessment of observable emotions to be established in humans (Ekman & Friesen, 1976).Investigations about facial expressions are based on the theory of discrete emotions and analyze universally recognized basic emotions (anger, disgust, fear, happiness, sadness and surprise), (Ekman et al. 1976). The basic model of musical emotions emerged from the work of Ekman (1992), and states that there is a basic series of emotions that music can express. Zentner, Grandjean& Scherer, 2008, focuses on the ability of music to express a finite set of emotions, including admiration, transcendence, tenderness, nostalgia, tranquility, power, cheerful activation, tension and sadness.

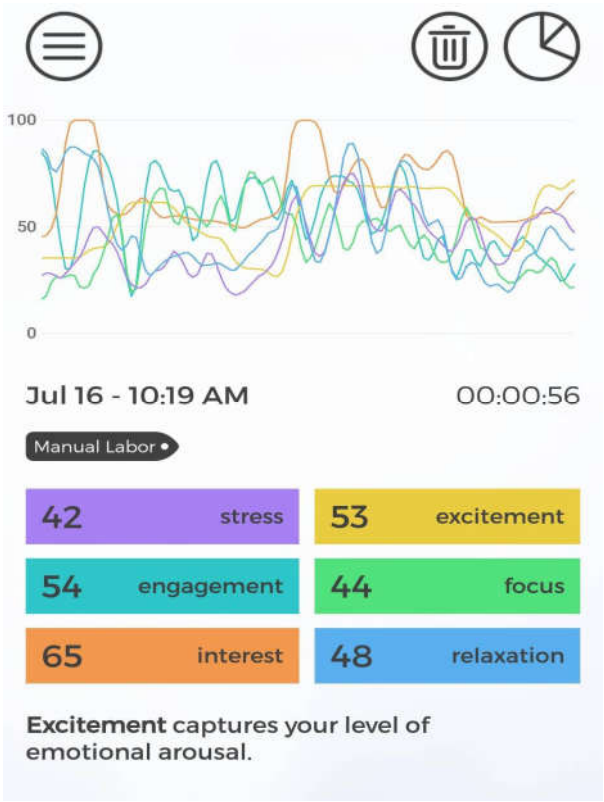
In recent years, advances in the area of facial expressions have been the detection of different basic emotions and facial muscle activities, (Lewinski et al., 2014).Still listening to music affects a confusing set of complexes processing systems in the brain (Zattore, 2003). Examples of commonly used systems are Emotiv and Neuro Sky's Mind Wave. The number of channels and positions between these systems are different, according to each device (Bos et al, 2019b).However, little is known about how music affects the brain (Gabrielsson A. & Bradbury R., 2011). Currently, there is a debate about the paradigm shift in the area of automatic classification of facial emotion (Vallverdu, J. (2014). In the next section, details of the technologies used during the study will be discussed.

TECHNOLOGIES USED ARE

Affdex Me Software: The application allows participants to be mapped into virtual experiences with their facial emotions in real time. The application analyzes and returns with *feedback* on facial expressions using the camera built into the mobile device. Metrics make up the expressions at the top and an emoji icon with the identification that corresponds to the facial expression. The app displays facial points while the face is tracked showing the gender avatar and glasses. It also detects changes in the main features of the face, facial reference points such as eyes, lips and eyebrows generating data that represent the basic emotions of the recorded face. There are different algorithms that detect facial marks and apply a set of classifications to finally classify emotions. Figure 1 shows an image of an example of the application of the experiment.

Emotiv EPOC +: The EMOTIV sensor is a non-invasive and complex device that exists for use in research. Emotiv displays performance metrics with the results of its algorithm for cognitive states. Performance metrics are displayed in the application on an axis scaled from 0 to 100 (Emotiv, 2020). Performance metrics are excitement, engagement, relaxation, interest, stress and focus. Figure 2 shows the performance oftheaforementionedmetrics.

Figure 1. Example of application in AffdexMe



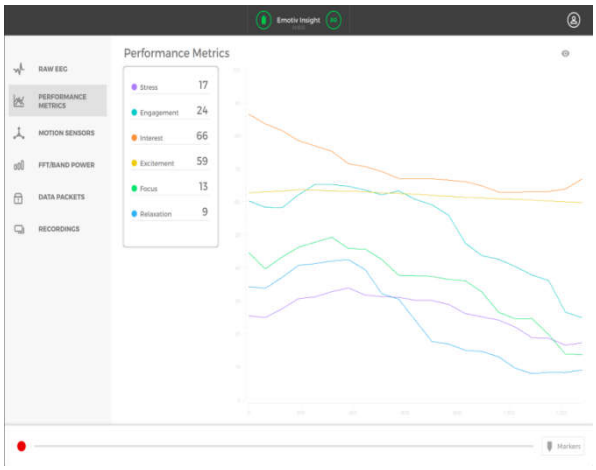


Figure 2. Emotiv performance metrics

MATERIALS AND METHODS

Participants: Participants were between nineteen and thirty-five years old, male and female. All participants were recruited from a Federal University in the metropolitan region of Porto Alegre-RS. Only participants without facial artifacts egg (glasses, beard) were included. Participants were seated in front of the notebook and a mobile device attached at a distance of one foot, instructed to remain in a stable and straight position without hands close to their faces. The visual stimuli displayed during the video playback were observed on a fifteen-inch monitor. The sound stimuli were placed in headphones at a medium volume. For the present study, the videos had an average time of 3 minutes each. Two studies were conducted to validate analyzes of facial expression and brain activity. The final sample was composed of five participants.

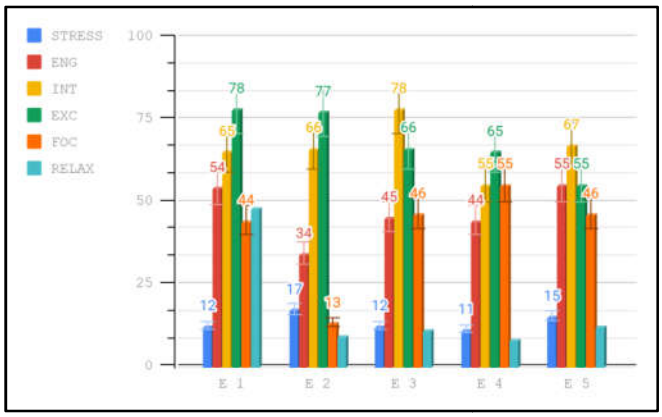


Figure 3. Analysis pattern with the classic Mozart style

In study 1, the validation procedures were performed, computing measures to recognize facial expressions together with brain frequency metrics during the appreciation of video 1 (one) that had the classical music style. In study 2 (two), participants were exposed to video material with the exposure of audiovisual material with music video in the style of pop / rock. During the tests, evidence of more and less evocative expressions was perceived according to each proposed audiovisual material and the participants' preferred musical styles.

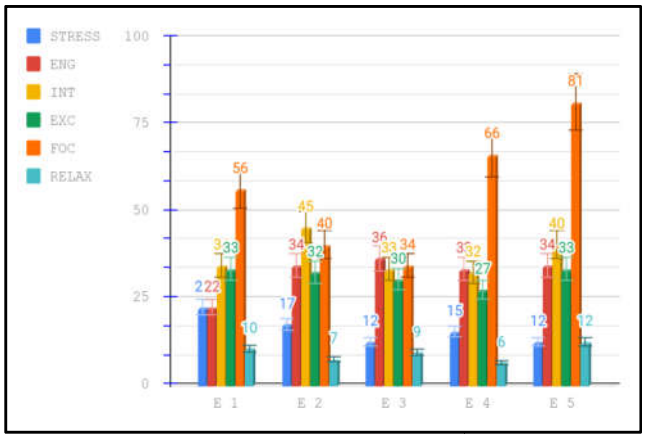


Figure 4. Analysis pattern with the pop / rock style

Means and procedures: The researchers used a fifteen-inch notebook to present and control audiovisual stimuli by executing the video materials. The Emotiv sensor was also used to measure brain frequencies during the study. The accuracy of the emotional classification was measured according to the AffdexMe algorithm, according to the software database, the same procedure with the metrics of the sensor so that the data could be analyzed.

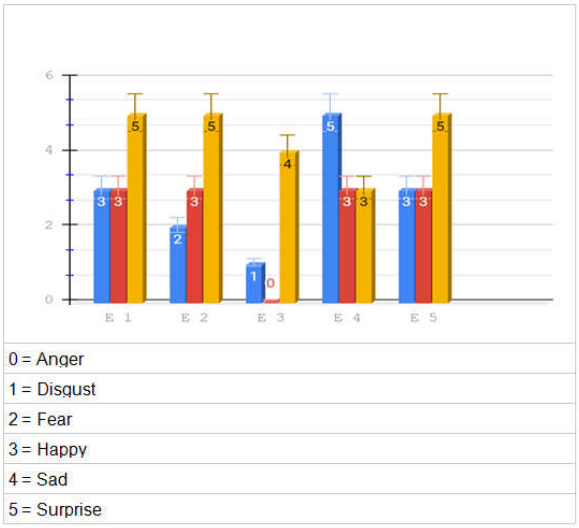


Figure 5. Facial expressions with the classic Mozart style technique

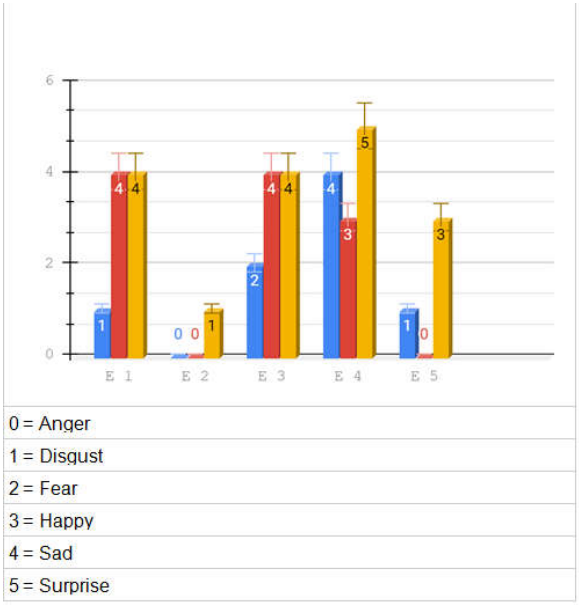


Figure 6. Facial expressions with the pop / rock style technique

To capture the accuracy of AffdexMe in detecting facial expressions, two different musical styles were thought out according to the participants' emotions and expressions. It should be noted that the audiovisual material is composed of moving images plus the insertion of the audio synchronized in real time, thereby generating standard stimuli with positive and negative emotional content used to provoke emotions, satisfaction and excitement, or on the other hand, calm, balance, peace of mind in experimental research.

RESULTS

The objective was to observe the positive and negative effects in affective terms in relation to the evidenced musical styles. To that end, we have eliminated some conditions from music

genres. We chose this specific criterion because they are two totally different musical styles, that is, one with classical style and the other with pop / rock genre, the chosen songs were the classic of "Mozart - Eine Kleine Nachtmusik and Skank - Response". Thus, with these two musical categories, results can be obtained about the musical stimulus aroused and expressed during the study. Before the musical performance, participants had their headphones tested and the music volume adjusted. However, given the importance of emotion research in general, brain activities monitored during the process have still been proposed. It can be seen that among the participants there was a difference in the oscillations in the patterns of the observed analyzes. The logic of differentiating between a favorite and a non-preferred song determines the responses in the brain network and may differ between the two. The music preferred by the participant generates a broader experience and, in general, the preferred listening experience. On the other hand, in contradiction to this, there is also a lack of motivation in listening. In the standard with the classic Mozart style, it was observed that the excitement and interest scores were the ones that scored the most positively. In the color in "green" the excitation appears as scores of E1 = 78, E2 = 77, E3 = 66, E4 = 65 and E5 = 55 on a scale from 0 to 100. Already followed by interest in the "yellow" color shows that the students oscillated at 65, 66, 78.55, and 67 respectively. And as a negative point, the stress in the colors in "blue" is observed with student scores E1 = 12, E2 = 17, E3 = 12, E4 = 11, E5 = 15. In Figure 3, the evidence of the study with the technique of using the EMOTIV sensor with brainwave measurements using Mozart's classic music video.

In study 2, performance metrics are presented with the use of the sensor and their brain measurements with the use of music video in a pop / rock style with the music of Banda Skank. Each selection was presented as a continuous video clip of approximately three minutes without interruption. In the visual scale shown in Figure 4 of the pattern of analysis with the pop / rock style, the following emotions were analyzed. The music video included a pop / rock style. The classification of emotions observed here was that only three students reached the engagement (in orange colors) as a positive score, followed by E1 = 56, E2 = 40, E3 = 34, E4 = 66, E5 = 81 respectively. During this section of appreciation of the video, it can be seen that preferences for musical style added a negative score in the classification in relation to the study above. Figure 4 presents the analysis patterns with the pop / rock styles. To examine the validity of emotional classifications, comparisons were made. (a) classifications of facial expressions obtained while listening to music in the context of classical style. (b) classifications of the facial expressions of the sampling obtained while listening to the music in the context of the pop / rock style. The participants' favorite music as viewed on the visual scale shown provides evidence that the highest punctuated facial expressions were "surprise" and followed by "happy" respectively. Figure 5 shows the facial expressions using Mozart's classical musical style technique.In the facial expressions seen in Figure 6, the lowest score was used to determine the least preferred song. Participants show that according to their favorite music it also interferes with their emotions. Participants rate their preference on the scales noted below according to musical style. The facial expressions that predominated in this study were "4 = sad" on the visual scale. The lowest score report was used to determine the song that did not have the highest musical preference among students. In the lowest score, the facial expressions "0 = anger" appear, followed by "1 = disgust" and lastly and the lowest observed the "3 = happy" scale. The results presented are of the participants' facial expressions and their experiences with the lowest classification with the gender selected by the researcher. Figure 6 shows facial expressions using the pop / rock style technique.

DISCUSSION

The present study aimed to measure audiovisual materials with different participants with the identification of basic emotions along with readings of brain activities. We expected that measures of emotion scores would be comparable to brain frequencies. According to the hypotheses, there was a significant correlation between the measures of the affective and the Emotiv. The difference scores were significantly positive in terms of joy in their score. And negative in conditions of anger, still emphasizing that in the neutral condition, the scores indicated that there was the main activity more favorable to positivity. In addition, even in the application of affectiva in the positive scores, it can be verified that there were scores significantly in the neural oscillations in their peaks of the wave spectrum. High correlations show that both methods are generally comparable. Facial expressions can differ from spontaneous and naturally provoked emotions and may even be independent of the real emotions that a person is feeling (Fridlund, 2014). Emotions can be provoked naturally, featuring videos that induce emotions. This manipulation can lead to more natural, although less controlled, facial demonstrations. Therefore, more natural displays of emotions should be used in future investigations. Future research can explore other emotions with new methods applied.

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