

From Detection to Exposure: Critical Perspective of Emotion Awareness Technology

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Abstract

One of the most distinguishing traits in humans is the ability to experience emotions. It took a lot of time for scientists to accept and acknowledge the importance of emotions in human life. After this importance has been acknowledged, researchers are trying to identify, measure and expose these emotions. This is being done through a range of newly found emotion detection devices. These devices measure and record various physiological parameters. The quantified data is used to identify the current emotion. Depending on these emotions, specific applications are invoked. Sometimes these applications involve exposing users' emotion to third parties. Emotional exposure can have varied consequences. This paper analyzes the implications of this exposure.

Keywords: *Emotions, Emotion Contagion, Affective Computing, Wearable devices.*

1. Introduction to Emotions

An emotion can be defined as a “set of reactions that a human being has, when facing several situations” [13]. These reactions are influenced by an individual's personality i.e., the way they observe the world and their emotional state when those situations take place [5]. Until now, emotions have been considered non-scientific. They are assumed to be opposite of reasoning and there is no room for them in science. However, there is a small group of emotions that are exempted from this thinking. They are referred to as “non-interfering emotions”. It is assumed that all emotions except these ones interfere in scientific processes. Non-interfering emotions are the only ones that are considered to be useful in science. That been helpful to scientific processes, for example curiosity that drives scientific inquiry, frustration from failure and pleasure from discovery [14]. This was the scientific outlook on emotions. However, more recent experiments show that

emotions play an important role in rational decision-making, in human perception process, and particularly in interaction and intelligence [4]. They are considered to be pulling the levers of our lives. Experiments conducted by neurologists prove that emotions imbue scientifically sound and rational decisions. In his study, Richard Cytowic (1995) states “Authorities in neuroanatomy have confirmed that the hippocampus is a point where everything converges. All sensory inputs, external and visceral, must pass through the emotional limbic brain before being redistributed to the cortex for analysis, after which they return to the limbic system for a determination of whether the highly-transformed, multi-sensory input is salient or not.” [4].

Generally, the limbic region is considered responsible for managing emotions, and the cortex is responsible for logical decisions. However, experiments show that the limbic system influences human perception more than the cortex [3]. In these experiments, synthetic experiences were studied by monitoring the neurons in the brain. Results showed high activation of the limbic region. This indicates that limbic system plays an important role in sensory perception. Johndon-Laird and Shafir showed that if a person has to choose one out of a million paths and there is no time to actually evaluate all of the paths, then emotions come to the rescue. As a result, emotions help in learning the biases that lead to rational responses [2]. For instance, studies on frontal lobe disorders revealed that people suffering from this disorder have a hard time making small decisions. Due to the affected connections between the cortex and the limbic region it becomes really difficult for them to combine emotional responses with their rational decision-making [3].

For a long time researchers believed that categorization of emotions is an impossible task because people express themselves differently. However in the second half of the twentieth century, many studies including the famous

study by Paul Ekman were conducted to determine the categorization of emotions. In his study, Ekman proposed that emotions are biological in origin and can be universally identified. After 12 years from his first study, Ekman officially listed the six basic emotions. They were dependent on facial expressions. These emotions were: anger, disgust, fear, happiness, sadness and surprise. In 1990, Ekman and his colleagues extended their list with a range of emotions. They included more positive and negative emotions. The identification of these emotions took into consideration both facial expression and inner feelings. This list included amusement, contempt, contentment, embarrassment, excitement, guilt, pride of excitement, relief, satisfaction, sensory pleasure and shame [5]. Through this classification, Ekman gave an opportunity for researchers to measure human moods and feelings. Therefore, researchers started coming up with devices that could measure a user's moods and feelings. These devices would then use this information to suggest appropriate actions. Overall, it can be argued that emotions affect a person's psychological and biological functionings as well as social behavior. Thus, developing an emotion-based system that alters the functionality according to the user's current emotional state could go a long way in developing personalized systems that provide a more suitable service to users.

2. Affective Computing

One of the fields that build on emotion analyses is affective computing. This is a Human Computer Interaction field with a special focus on detection, interpretation, manipulation and simulation of human affects. It is a shared field between computer science, psychology and cognitive science [15]. Initially, affective computing was based on philosophical inquiries into affect and identified by Rosalind Picard in her publication entitled "Affective Computing"[15]. In order to recognize and work with various emotions using affective computing, a system records some signals with non-invasive biosensors. They measure Blood volume (BVP), heart rate (EKG), galvanic skin conductance (SC) and respiratory rate. All these measurements produce patterns, which can be correlated to different self-reported emotional states. An effective way to distinguish between these emotions is described in the valence arousal dimension model [14]. This model include two dimensions: valence and arousal. Valence is the subject's description of an emotion as positive or negative. It ranges from being highly positive to highly negative. Arousal describes the intensity of the emotion felt. It can range between calming, soothing, exciting or agitating [14]. The basic functionality of an emotion-based system can be described as the

measurement of different biophysical signals (heart rate, skin conductance, etc.) and their transmission to the personalized system. This system detects the different patterns in information using machine learning algorithms. Once the pattern is deduced, it is matched to the database. The database contains information connecting different patterns to different emotional states. After the system finds out the user's current state, it invokes the corresponding emotion-based services [15]. These Affective Computing devices can exhibit a wide range of variations: they can initiate services depending on automatic emotion detection, or they can execute procedures depending on explicit user query.

3. Affective Computing Technology

There are many technologies in the market that can sense human emotions and suggest corresponding actions. This paper examines affective computing technology that provides context awareness. For instance, Neurortiq is a headdress in which the sensors are knitted into the fabric. It is 3D printed and contains EEG brain sensors. These sensors map the brain's thoughts and exhibit colors describing the state of the brain. The sensors are like neuron globules, which act like synapses. They are connected to colored lights that display the user's mood [12]. Another example is the mood sweater produced by Sansoree. It has a string of LED lights in the collar of the sweater. These LED lights glow in different colors depending on the mood of the user. There are bands attached to the wrist of the wearer. These bands have sensors in them that detect the pulse rate and body temperature of a user. These results change the color of the LED in the collar [11]. In addition, Microsoft research group has developed Smart Bra, which measures heart rate and perspiration to detect women's mood. It is designed to help emotional eaters. Various experiments show that people reach for high calorie food when they are feeling stressed, bored or discouraged. By detecting these moods, the smart bra also suggests distractions to the user. It helps users focus on other things until that emotional state passes away [10]. Affective computing technologies are also now being tested in some automobiles. For instance, Auto Emotive, an experiment being conducted by the MIT Media Lab, is a way of adding sensing technology to automobiles. It keeps track of a driver's stress level. Stress, out of all the emotions has the largest effect on driving skills. This car has sensors in the door handles and steering wheel. Detecting the force applied to grasp the door or the amount of sweat while holding the wheel helps determine the stress level of a driver as well as keeps track of a driver's heart rate and body temperature. Depending on his/her level of anxiety, the car suggests music for the

driver and displays colors on the reflective dashboard as well. The car can be painted with thermal paint that change their color to showcase the driver's emotions to help nearby drivers maintain an appropriate distance [1]. In order to help in reading the stress level of their passenger, airlines are working on projects to have context awareness wearables on board. British Airways experiments using happiness blanket with optic fiber woven into it. The blanket is connected to a headgear. This headgear detects brain signals and identified the mood of the user. This information is then transferred to the blanket. The optic fiber glows red to reflect stress and purple to showcase a calm state of mind. This helps the flight attendants serve their customers accordingly [16].

4. Emotional Contagion

Emotional Contagion is the inclination to imitate and synchronize actions, postures, vocalizations, movements and gestures with other person, which ultimately results into a collective converging emotionally [5]. People unconsciously mimic others' emotional expressions and subsequently feel the reflections of these emotions on their own. This phenomenon is observed frequently; people feel happy when they are surrounded by a group of happy friends or family. In contrast, people tend to feel sad when they are surrounded by a negative crowd. All these cases exemplify Emotional Contagion.

According to psychologists Hatfield et al, Emotional Contagion happens when people unconsciously imitate others and this leads to an emotional change, a reflection of the imitation. Emotional Contagion result from the nervous system sending instructions for copying other's non-verbal cues, used by humans to express their emotions. Mimicry leads to a feedback to the emotion centre of the brain. The brain starts interpreting this as user's emotion. This leads to mirroring of the emotions, not just externally but internally as well. The user mimics emotional expressions externally, and induces the same emotion internally. Psychologists Hatfield et al. conducted extensive research on Emotional Contagion. According to them, by measuring emotional and facial expressions (by electromyographic procedures), people show a change in emotions after observing others. They conclude that people's judgment of other's emotions is dependent upon what others say about their emotional state, while user's emotions are dependent on what others are actually feeling (which can be different from what they say about their emotions). People unconsciously mimic the nonverbal cues of others and hence reflect the emotions on themselves. This reflection makes them detect others feeling correctly [6].

Emotional contagion can either be implicit or explicit. Implicit contagion occurs when someone unconsciously mimics others non-verbal cues and hence gets affected, while explicit contagion occurs when someone is being provoked into certain emotional state following others explicit verbal cues. However, someone can use this phenomenon to manipulate others' emotions [6]. In fact, the biological reason behind Emotion Contagion is the activation of mirror neurons. Mirror neurons are a set of brain cells that make people feel what they observe in other people. These neurons try to sync people's emotions. The signals generated by imitation are feed to the "emotion centre" of the brain. This causes the person to get affected externally as well as internally. Hatfield et al. write that "Mirror neurons are found in the premotor cortex, the supplementary motor area, the primary somatosensory cortex and the inferior parietal cortex of the brain" [6]. It has been observed that when a person performs some action or imitates someone, the mirror neurons in the premotor cortex get activated. This leads to the conclusion that the mirror neurons in this part of the brain are responsible for emotional imitation.

The effect of emotional contagion can be seen in babies as well. Babies unconsciously try mirror the emotions or the facial expressions of their caregivers. Even if they don't show the same emotion, their nervous system is making them feel the emotion felt by the caregiver. One crying baby in a nursery can trigger a wave of crying babies. Emotional Contagion can be used for a variety of purposes. It can be used to manipulate others' emotions in a number of ways. The way it is used depends on a person's intention whether used to motivate, inspire and make people feel happy or to develop a feeling of hatred, sadness or depression. It has been used in the past by leaders like Adolf Hitler to spread hatred amongst people through his speech, and it has played a big role in motivating and inspiring people as in the Martin Luther King Jr. speech "I Have a Dream".

One of the most recent examples of the occurrence of emotional contagion is the Facebook study published in 2014 by Kramer, Guillory and Hancock [8]. In this experiment, researchers manipulated some of the users' news feeds. They changed the number of negative and positive feeds received by a user. The observation of the experiment showed that upon reducing the number of positive feeds on a user's wall, the people started posting negative posts. When the users were exposed to high number of positive posts, they started posting happy things. This exemplified the theory that emotions are contagious. Another important fact that came up with this experiment was that emotions could be transmitting through text as well. This shows that the emotional contagion occurrence is independent of the transmitting medium [8]. It has been

established that emotions affect the decisions taken by individuals. This fact can be combined with emotional contagion to produce elaborate results. It can be used to influence others' decisions.

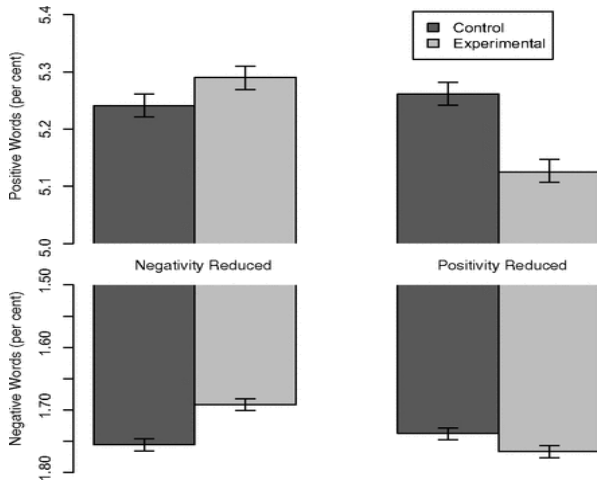


Fig. 1 Shows mean number of positive and negative words.

5. Dystopia

There are many cases where corporations, governments, or even individuals are likely to manipulate a user's emotions and decisions. Thus, before the emotion detecting devices are adopted at a large scale, we need to think about the repercussions they might have. If the medium doesn't matter, then the emotions displayed through these devices can affect many people surrounding the user. These displays can be used to induce happiness or misery in others who are close to the user. This paper examines critical scenarios where people are emotionally manipulated.

Back to affective computing devices, one of the potential uses is to increase the employee productivity. In order to do so, company CEOs can force their employees to wear these devices to work. They can be used to track, and hence, manipulate the employee's emotions. This can be a good thing if he/she uses it to boost up their morale, especially after a major professional failure. However, if this power is given to an unstable CEO, he/she can use it to manipulate their employees and keep them working for them by creating fear, instead of using promotions and bonuses.

These devices can also be used by politicians to create hatred against a particular social group of people through their speeches. If the data collected through these devices are made available to government agencies, it could help

in the establishment of tyranny. However this would depend on many factors including whether the country under a dictatorship or a democratic government. Even if emotional data is collected by a democratic government, emotions are supposed to be private for human beings. Sometimes people want to hide their emotions to protect their loved ones from getting hurt. People should have the option of either keep their emotions private or exposing them.

The movie 'Equilibrium' (2002) describes a world where all types of feelings, emotions and artistic expression are prohibited. The citizens of this world are injected with drugs to eliminate their emotions. The movie showcased people becoming lifeless and robotic, once they become detached from their emotions. They stopped appreciating the little things of life.

Emotional manipulation can also be used for marketing purposes. The data collected using these emotion awareness devices can be used by corporations to increase the sales of their products. The data about user emotions can be used to market different products, or to market the product differently. This can be done either to provide better services to the user or to capitalize their weaknesses. There have been instances of big corporations illegally selling off data about their users to a third party. The data might contain valuable information, such as the users' search history about, their likes and dislikes, and the people they follow. Combining all this data can pretty much sum up a user's life. All of these data being exposed to third parties is a scary idea. Some may argue that this can provide a high level of service, but is it ethically appropriate to sell this data? Shouldn't the user be given the right to decide the amount of data they want to disclose to different corporation?

6. The Silver Lining

It is clear that emotion detecting devices can be beneficial in numerous areas. They can help users with special needs to communicate with the outside world. For instance, they can help autistic children communicate their emotions. Sometimes it is difficult for these children to convey their emotions and to understand others' emotions. They are not able to pick up the non-verbal cues of the people surrounding them. This creates a communication gap. Emotion detecting devices can help them understand these non-verbal cues. They can also, be used to detect the emotions of an infant. This can help parents understand their infant emotion. In addition to all this, affective computing devices can facilitate the marketing of some products. Acceptance of the product can be measured by user's emotional reaction to the product. This can be done

at an early stage of product development. It can serve as a form of acceptance testing. This can be used to test the marketing strategies as well. Likewise, emotion detecting device can assist game designers testing their games. If they detect that “test users” are getting frustrated at a particular level, they can reduce the difficulty level, if they detect confusion, tutorials can be added. This can help design a more engageable game.

7. Proposed Solutions

As discussed earlier, a major misapplication of emotion detecting devices could be emotional exploitation. To avoid this situation and improve the reception of these devices by users, it is critical to develop certain guidelines before introducing the product in the market. In the following sections, we propose a few suggestions that could be used to build such guidelines. Firstly and most importantly, there should be complete transparency in the way data is disseminated and used. It is also crucial to apply legal restrictions on the companies that hold the data to prevent them from misusing or selling them. In addition, increased awareness among people regarding the negative impact of using these devices would be an important step. Every individual should be aware of the ways through which their emotional data could be misused and accessed by deceitful organizations. Issues like emotional contagion and its negative consequences should also be communicated to the public. This should be followed by instructing on ways to overcome the problem, which include prompt recognition and acknowledgement of the emotions. Furthermore, companies producing and marketing such devices should be made responsible for educating consumers with such information as that of emotional contagion. A disclosure at the beginning, making people sign a consent form and giving them the rights regarding the use and transfer of data should be among the mandatory steps. Apart from giving users the right to control the sharing of their emotional data, government should also introduce a separate unit dedicated to collecting, storing and regulating the usage of these data.

8. Conclusion

In conclusion, we disapprove of widespread development and adoption of emotion detection devices because of their negative effects on human

lives. Emotions are individual feature of every human being also give a uniqueness to their character. This makes them sensitive characteristics for a person and should be protected from commercialization. The unfavorable effects have been discussed in the paper by reflecting on examples of such trial implementations in markets. In another section, critical scenarios regarding social and cultural implications of human contagion have been discussed. In addition, we have made some suggestions and guidelines on how to avoid such events. We would like to conclude by saying that implementation and usage of these emotion-detecting devices could open a whole box of malefaction, misdeeds and regulation of such activities is nothing but difficult and time consuming. Their impact could be as severe as the loss of normal expression of human emotions. Emotions are what make us humans and if people begin to control or being controlled by their emotions, this might result in the loss of most basic nature, humanity.

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