EMOTIONAL INTELLIGENCE BASED ON EMPATHY NEUROLOGY FOR VISUAL STRESS STUDY USING INTELLIGENT AGENTS PARADIGM

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ABSTRACT

This article shows the progress of brain signals interpretation which identify primary emotions, using empathy neurological basis, on the visual stress environment, such behavior is learned by the Neurological Agent to measure visual stress degree, the idea of this research is that two or more entities, that could be robots (virtually or physically), may represent stress that is caused by primary emotions. Also this paper presents the following case study. Given that human beings feel and perceive all primary emotions we are doing an experiment with 4 people, 2 women and 2 men, forming 2 groups of 2 people, men and women, it is worth mentioning that ages are between 18-26 years and that these groups do not have mental problems. Emotions with which we carry out this study are only (happiness, sadness, surprise). These groups were shown a set of images that express emotions and that would take them to feel and express visual stress

KEYWORDS

Prefrontal cortex, Visual Stress, temporal cortex, Empathy, Neuroimaging, Intelligent Agents.

1 INTRODUCTION

Speaking of intelligence is to speak of a special faculty, typical of a certain class of organic beings that gives them, along with the thought, the will to act, existence awareness and individuality, as well as the means of establishing relationships with the outside world and to meet their needs. The art to develop is the ability to respond as best as possible to demands that the outside world puts before us.

Since man tried to relate with his peers it's assumed that he attempted to understand relationships, although he was unable to mention, express or use the term empathy, it is clear that from his knowledge and perspective he used a term or word to express it.
Now we have to put first a definition of what is understood or defined by empathy, the definition described by [21] is the ability to experience vicariously the emotional states of others, being crucial in many forms of adaptive social interaction. Empathy has two components: cognitive, closely related to the ability to abstract mental processes of others, and emotional, that would be the reaction to the emotional state of another person.

2 EMOTIONAL INTELLIGENCE

2.1. Terminology

Emotional intelligence concept became popular from the book published in 1995 [5], "Emotional Intelligence". This popularization raised interest in the study of emotional intelligence with their possible relationships. [19] Defines emotional intelligence as the ability to perceive, appreciate and express emotions accurately, the ability to access and / or generate feelings when they facilitate thought; ability to understand emotions and emotional knowledge and ability to regulate emotions promoting emotional and intellectual growth.

Emotional intelligence is related to different variables one is coping with stress. Studies in the U.S. show that those college students who scored higher in emotional intelligence, reported fewer physical symptoms, less social anxiety and depression, better self-esteem, greater use of active coping stress strategies for problem solving.

Also when students were exposed to stressful laboratory tasks, stressors were perceived as less threatening and the level off cortisol and blood pressure were lower and their negative moods induced experimentally were repaired even better [20]. It is mentioned in his research that people who perceive their emotions clearly, repair their negative moods, focus in the coping, minimizing the impact of stressful events. When we are in stressful situations we try to control or hold our emotions and behavior, this is called coping with stress, where behavioral and cognitive efforts are conducted in order to dominate, that is, to tolerate environment demands and / or situations created by external stressors. According to the presidential commission on mental health 25% of people is suffering from consequences of stress, this indicates that there is a high rate among people suffering stress or stress symptoms. [18]

There are several ways to control or reduce the effects of stress; one of these alternatives is to practice regular physical exercise. And it is mentioned that physically active people have better strategies for coping with stress, plus they have better self-concept, emotional stability, independence and self-control [13].

3 EMOTION

Since ancient times, emotions have caused interest because organic reactions are manifested in humans, a context that has influenced expectations of knowing which dependence exists between emotions and the behavior of individuals [5]. The study of emotions has examined the appearance of a theory which says that with the sound reasoning of emotions allows a better quality of life for humans; this would help achieve a harmonious socialization between subjects. To accomplish this, we need to understand how it has been the evolution of emotions through history; also, it is inevitable to know how the most important authors took them under different historical circumstances.

The earliest statements about emotions are perhaps from Aristotle (384 - 322 BC) to him, "love would be closely linked to friendship and those who feel it for us rejoices or grieves alongside us. Fear appears from the representation of evil or suffering that will ensue. Envy is almost always an upset in view of the good of others, even people that lack nothing are often just jealous" [3]. Aristotle thought that emotions should be in accordance with the time and situation. Juan Luis Vives (Spanish) [12] "established a doctrine on passions,

which is a fundamental criterion to opposition ordination. Vives admitted that passions (emotions) move the soul and influence sensory perceptions and behavior". Vives believes that emotions are important to people because they influence the way to observe the behavior of others from one's emotions [21].

Maine de Biran [16] divided emotions in active and passive, which were related to body functions such as circulation, respiration, secretion. He thought that the heart was an important part of people, because that is where the changes occur that result in emotions; he described specific emotions such as joy, sadness, fear and shyness. He also mentions that bodily changes that occur in emotions, in every dominant passion, somehow takes place a change in the circulation and with each emotion we feel a change in the heart ... "that could lead us to consider the heart as the seat of passions "[17].

Nietzsche [12], this author says that emotions are rooted in the brain (intellect). "He claimed that the will to generate affections (emotions), are intellectual constructs, and all general bodily feelings that we do not understand are interpreted by the intellect, that is: we look for a reason to feel in one way or another about people, experiences, etc. "[21].

4 STRESS

The term stress is commonly used and it is used to refer to a wide range of experiences, such as nervousness, tension, fatigue, exhaustion, anxiety and other feelings or similar experiences. It also applies to circumstances or situations describable responsible for these emotions, such as excessive work, excessive pressure that may occur in any difficult situation, for example, prepare a test, wait your turn at the dentist, losing your job discuss with the spouse, severe illness, endure a difficult boss, etc.. It is used the idea of "stress" so often and so indiscriminately that it has become a linguistic crutch that aims to characterize all types of threat that affects a person. Ultimately, the term, when operating in such diverse applications, has lost its specific meaning and the different theoretical frameworks from which reference by [7]. There the desirability of addressing the semantic content. One way is clarifying the historical treatment of the word, in its evolution process. [9].

5 VISUAL STRESS

The word stress (strain) refers to a medical term that includes all the changes taking place in the individual under a strain. These changes are normal adaptations that are triggered to carry out the task. The discomfort appears when the reaction is exaggerated, and then a multi-factorial phenomenon occurs and in some scientific circles the term "visual stress" is wedged. It is defined as "the person's inability to process certain visual information in a comfortable and efficient way." This term applies to the general stress produced by environments with high demands of visual activity and is manifested by mental and physical reactions. Among the first are changes in the electroencephalogram, increased heart rate, respiratory rate changes, changes in electrical skin response, etc.., Among the second: anguish, anxiety, irritability, depression, fatigue, etc.. Visual stress is accompanied by the whole discomfort procession referred to the visual system itself. Note that, as in

any situation of stress, personal reaction plays a decisive role [10,1,8].

6 SYSTEM(10-20)

They are responsible for transforming into electrical currents load changes that occur in the cortical nerve cells membranes as a product of brain activity. Their electrical characteristics are directly determined by the type of metal used.
You can also improve their performance by applying a conductive gel between the scalp and the metal, reducing in this way the impedance between contact and skin. The 10-20 System is a protocol which indicates the positions that electrodes can take on the patient's scalp; these are summarized in Fig 1.

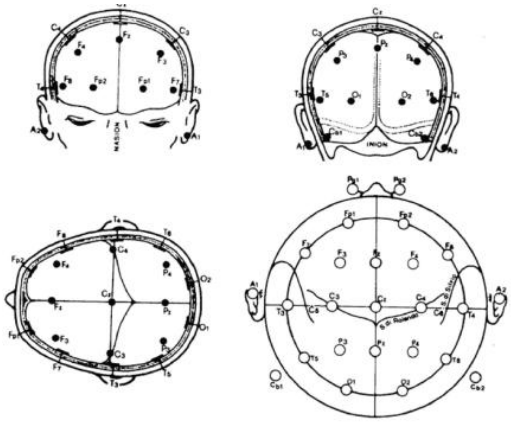

Figure 1. 10-20 System's scheme.

The 10-20 system is an internationally recognized method to describe and apply the location of scalp electrodes in the context of an EEG test or experiment. This method was developed to ensure the reproducibility standard by which a subject studies can be compared over time and subjects can be compared with each other. This system is based on the relationship between the location of an electrode and the area of the underlying cerebral cortex. The "10" and "20" refers to the fact that the actual distance between adjacent electrodes are 10% or 20% of the total distance from front to back or right to the left of the skull.
Each site has a letter to identify the lobe and a number to identify the location of the hemisphere. The letters F, T, C, P and O represent frontal, temporal, parietal, central, and occipital lobes, respectively. It should be noted that there is no central lobe, the letter "C" is used for identification purposes only. A "z" (zero) refers to an electrode placed in the midline. Even numbers (2,4,6,8) refer to positions of electrodes in the right hemisphere, while the odd numbers (1,3,5,7) refer to those in the left hemisphere [5].
Two anatomical landmarks are used for essential positioning of the electrode EEG: first, the nasion is the point between the forehead and nose, secondly, the inion which is the lowest point of the skull from the back of the head and is usually indicated by a big hole.

7 AGENTS

Although there is no universal agreement on the precise definition of the term "agent," definitions tend to agree on more points than they disagree. Some modelers consider any type of independent component (software, model, individual, etc..) to be an agent [3], the behavior of an independent component can range from primitive reactive decision rules to complex of adaptive artificial intelligence (AI). Others insist that the behavior of a component must be adaptable so that it can be considered an agent; agent label is reserved for components that can somehow learn from their environment and change their behavior in response.

[11], argues that agents must contain both basic rules of conduct, as well as higher level set of "rules to change the rules." The level of basic rules to respond to the environment, while the "rules for changing the rules" provide adaptation, [17] provides an agency's computer vision with emphasis on the essential feature of autonomous behavior. The fundamental characteristic of an agent component is the ability to make independent decisions. This requires agents to be active rather than passive. From a practical point of view model, we believe that agents have certain characteristics:

An agent is identifiable as a discrete person, with a set of features and rules that govern their behavior and decision-making capacity. Agents are autonomous. The requirement of discretion implies that an agent has a limit and you can easily determine whether something is part of an agent, is not part of an agent, or is a shared feature.

8. PSYCHOLOGICAL THEORY OF COLOR BY MAX LÜSCHER

Lüscher notes with practice that there are four psychological primary colors which can be subdivided into two pairs: heteronomous and autonomous colors.

Heteronomous colors are blue and yellow, representing night and day, respectively. That is the daily cycle of light and darkness. These are factors that govern man, which is imposed from the environment outside. Therefore, the blue represents peace, passivity, rest and metabolic activity general relaxation. By contrast, the yellow represents light of day, suggests the possibility of action, activity, and glandular stimulation. But these colors do not require these actions, if not suggest them.

Autonomous colors red and green represent the attack-defense activity of the body. Red as an external action aimed to conquer and acquire. Green as a self-preservation, defend against attacks and survive. Defense actions (Green) and attack (Red) are under the control of the individual; these colors are called autonomous or self-regulating.

Max also formulates in his theory that the ability to distinguish colors begins with the contrast, that is, light colors and dark colors (similar to Goethe). Differentiation, its name and any aesthetic reaction to the colors are functions of the cerebral cortex: is the result of development and education rather than a reactive response and instinct. On the other hand, instinctive reflex functions operate in the midbrain, in terms of contrast that affects physical and glandular systems by the pituitary gland [10].

8.1. Functional Psychology

Theories that relate color choice with the psychology of personality are called functional psychology. In the colors test (Max Lüscher) color structure is constant, that is, always has the same “objective meaning”. “Function” on the other hand, is a subjective activity to color, and this varies from one person to another, and in this are based the test interpretations.

The meanings of colors (shades of the Lüscher test of 8 colors) in summary are:

Blue (grayish): Represents the depth of feeling and is a concentric color, passive, associative, heteronomous, sensible, perceptive, unifier. Its affective aspects are tranquility, satisfaction, tenderness, love and affection.

Green (with some blue): Represents constancy of will and is a concentric color, passive, defensive, self-contained, cautious, possessive, immutable. Its affective aspects are persistence, assertiveness, stubbornness, and self esteem.
Red (with some yellow, which is orange): Represents the strength of will, and is eccentric, active, aggressive offender, autonomous, loco motor, competitive and efficient. Its affective aspects are the appetite, excitability, authority and sexuality.
Yellow (saturated some clear): Represents the spontaneity and is eccentric, active, scheduler, heteronomous, expansive, ambitious and inquisitive. Its affective aspects are the variability, expectation, originality and rejoicing.
Gray (neutral psychological, with lots of white): Represents neutrality and is divisive, impartial, insulation, absent of commitment.
Brown (something light): Represents the passive sensory responsiveness and is physical, physical sensory receptor, safe, sociable, dependent.
Black: Represents the absolute limit and denial, renunciation, abandonment, extreme, rejection, suppression, fear.
Violet (red) represents the fulfillment of desires and irresponsible, intuitive, sensitive, immature, emotional, and magical.
Objective perception of color is the same for everyone. However, there are those who reject it, feel indifference or otherwise sympathy or attraction. According to the mood of the moment, there are who accept or ignore a particular feeling, such as the perception of color. A color that is considered beautiful is accepted, that is, matches the mood. In the vast variety of colors can be reflected the emotional nuances that exist. Color is similar to music, a feelings language, highly differentiated. Colors are displayed feelings.

In general:
Blues correspond to the feelings (emotions), therefore also romantic relationships of friendship or marriage.
The green characterizes the self-control, willpower and the ability to enjoy.
The red represents the activity, initiatives and responses to the challenges.
The yellow ones indicate the attitude towards the future, new developments, the expectations [18].

9 METHOD

9.1. Neurological agent to measure the degree of visual stress

In the design of an Intelligent Agent the first tasks is to place it in its development and for this is used the PAGE function (Perceptions, Actions, Goals and Environment), which allows to know the actions to be taken as follows:

- Actions= f(P,G,A)
- Where data values are:
- P= Perceptions
- G= Goals
- A=Actions

PAGE's phase behavior:

1. Perceptions: The agent reacts when it detects disturbances in its world and responds to that in a programmed manner, this is identified by detecting a state of flux in the system so that it can be identified by one (warning, a rule set).
2. Action: As every intelligent being, the system must make decisions

according to the eventuality of the perception's primary state and it will execute the instructions defined.

3. Goals: This corresponds to the node's stability, so that if the agent was able to find the solution it will transmit a message, and if it is not the case, an error message.
4. Environment: It will contain the complete picture of the entire system as shown in Fig. 2.

Agent Type	Perception	Actions	Goals	Environment
NEAbSC	Detection	Localization	Identify area and emotion	Distributed System

Figure 1. Description of NEAbEsV as functions of PAGE

Consider a system that by its very nature, develops as a Distributed System (which is focused on multiple processes), and consists of a set of nodes, where each may be composed of one elements which we call [id]. On this [id] runs a set of tasks, all of them responsible for carrying out the functionality of the system.
To define and identify this distributed system we propose the following definitions:

Definition 1: Let id = id, to system's id.

Definition 2: Let T = {Tj}, the set of tasks running in the system, where "t" is the number of tasks that make up the system.

Definition 3: Distributed System is defined as the Tupla: DS = (id, T).

Once it is characterized, what might be called a Basic Distributed System (no feature of Neurological reading of emotion to determine the degree of stress); we proceed to the incorporation of Intelligent Agents paradigm to provide it with a layer for the study of neurological empathy to determine de grade o stress that is generated.
Now we will define the Agents, for reading basic emotions, to work in DS.

Definition 4: Let NEAbEsV-id an agent which is called Neurological Agent based on the Visual stress, whose mission is identification of basic emotions at id level.

The development of this process would take place as follows in the EEG are detected and capture the emotions (joy, sadness, surprise)
These values are captured in the EAgEsV in which the emotion that is identifying, in turn the {T} will contain the actions to perform with the emotions that the NEAgEsV identify, and learn that both the degree of chronic stress that generates in turn the S coordinate the NEAgEsV and know all the emotions and tasks.
The measurement of stress degree calculation is taken from the test and is determined by the eye movement and this displays more brain activity.

10 RESULTS

Jade container was used to implement the Neurological Agent of visual stress learning.
Jade (Java Agent Development framework) is the development environment for creating, communicating and interacting Intelligent Agents, it can be considered a "middleware" that implements Agents:

- An agent platform (runtime)
- A development framework (class library)

Figure 3 shows the container where agents are being loaded during NEAbEsV runtime.

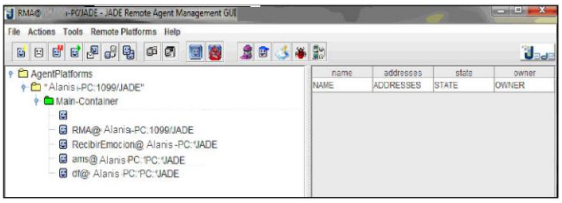

Figure. 3. Jade´s container.

A study was conducted with 4 people, who were shown a series of pictures representing emotions, these emotions are: happiness, sadness, surprise, and these were captured on EEG, and those values were interpreted and captured in NEAgEsV, these images were shown to the 4 persons 30 times per emotion.

The results obtained with the EEG are shown below.
To the first 4 people was performed a test showing them images with the emotion of joy.
For purposes of this article, we present only the result of the first person that we realize the test.
Areas that were activated to the first person are C3, C2 and these are shown in Figure 4

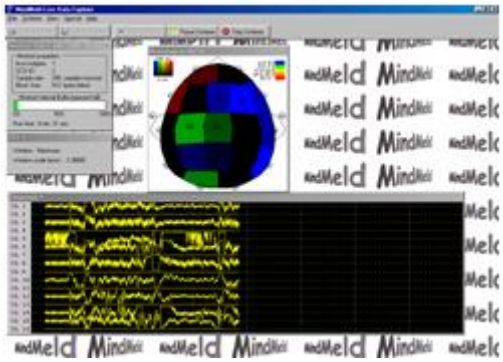

Figure 4. Areas activated in person 1 with emotion of joy

To the second group of 4 people was performed a test showing them images with the emotion of sadness.
Areas activated in the first person were Fp1, F7 as shown in Figure 5.

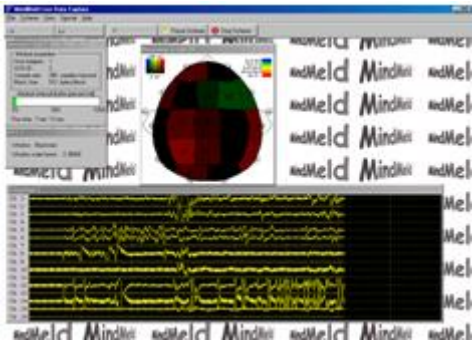

Figure 5. Areas activated in person 1 with emotion of sadness

To the third group of 4 people was performed a test showing them images with emotion of surprise.
Areas activated in the first person were F3, F8 as shown in Figure 6.

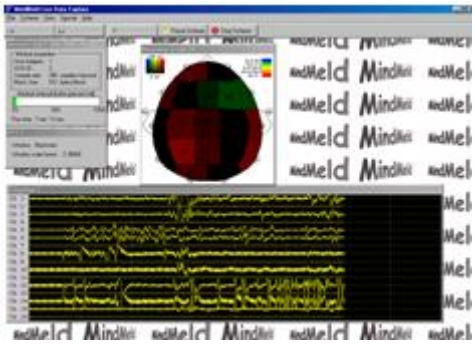

Figure 6. Areas activated in person 1 with emotion of surprise.

11 FUTURE WORK

So far we have the brain readings of emotions and we are working in eye movement's calculation to determine whether the brain areas that are taken as samples, generate more activity or the areas change after generating the visual stress.

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