Emotions and their cognitive and adaptive functions

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ABSTRACT

Emotions appeared very early in phylogenetic and ontogenetic development. The word emotion originates from the Latin verb movere. However, attempts to distinguish and name the concept represented by the phrase emotion reach back to the beginnings of human language. The compound and subjective nature of emotions stress an essential aspect of this phenomenon, which leads to changes in physiological, psychological, and behavioral issues. World literature dedicates significant attention to the mutual associations between the cognitive and adaptive processes and emotions. Emotions help to estimate the adaptational meaning of stimuli. Its cognitive aspect is, however, just as significant. The review of the literature presented herein is an attempt to classify and evaluate particular emotions, both positive and negative, and the influence they have on physical and mental health. Paul Ekman, the author of one of the more esteemed classification attempts, has distinguished six basic emotions: anger, disgust, fear, happiness, sadness, and surprise. These universal emotions are recognized based on emotional facial expressions, the automatic reactions that unfold within microseconds. Robert Plutchik, on the other hand, devised his „emotion wheel" upon which he organized eight basic emotions by grouping them in pairs comprising a combination of positive and negative emotions. He is also the author of one of the best framed emotional combination theories. In this respect, emotions play a crucial role as compound model reactions to everyday situations such as a long-lasting effort ensuring survival and individual development.

Keywords: Classification of emotions, adaptation, cognition.

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INTRODUCTION

Emotions appeared in phylogenetic and ontogenetic human development very early, indicating the particular role emotions play in human life. They accompany rational thought, behavior, and expression, and they also very significantly change the way of perceiving the world. Emotions identify the relationship between man and the environment [1,2]. Evolution has, therefore, given feelings a central role to play in the human psyche – emotions augment reason when we face tasks and challenges so significant that reason alone is unable to handle them [3].

Due to the incredibly complex nature of emotions, the study of emotions has reached an interdisciplinary level populated by authorities from diverse disciplines such as physiology, psychology, philosophy, and anthropology. Despite the considerable progress of past years, no universal, generally accepted definition of emotion has been formed, and each point of view stresses a different but critical aspect of this phenomenon. Papers in this field are usually either very general or very detailed, concerning a very narrow scope of knowledge. The below-presented literature review is an attempt to draw attention to the most significant issues elaborated in both types of papers and simultaneously an effort to organize the extensive knowledge on emotions.

The word emotion originates from the Latin movere, which means to affect or to move, and suggests a particular tendency toward action contained in every emotion [4].

Usually, emotions are considered essential elements of motivation that constitute a more or less fixed „readiness to action" [5].

In other words, emotions trigger a performance program for particular situations and cause the subject either to come closer to the object of the emotions or to become more distant [2].

A pioneer of scientific psychology, Wilhelm Wundt [5] understood the emotional process as „a separate type of psychological phenomena, so multiple that no unit definitions can be made."

The American psychologist Titchener [5] has demonstrated the complexity of emotional phenomena by:

- distinguishing effects (e.g., happiness, hatred),
- moods (e.g., satisfaction, concern),
- complex emotions (e.g., intellectual, moral, religious, and esthetic emotions).

According to Izard [6], emotions have neurophysiological, neuromuscular, and phenomenological aspects.

Cannon [5] has promoted the then-innovative emotion model as processes that occur in the thalamic nuclei. He was the first to consider emotions as an expression of complex brain activity and indicated a behaviorally strict connection of emotional states with the functioning of the human organs.

Papez [7] assumed that emotional states are the result of the circuit factor impact (impulses from extra- and interceptors) and the effect of the psychological factor localized in the cerebral cortex. The connection between the cortex and the hypothalamus is the cingulate cortex, perceived by Papez as the center of experiencing emotions. Arnold was also a supporter of the cortex base of emotions [7].

She has described the neuronal systems engaged in regulating the emotional mechanisms. For years, the problem of referring feelings to anatomic brain structures seemed solved. However, the discoveries in the second half of the twentieth century have led many scientists to conclude that the most important structure of the limbic system, which plays a significant role in assigning affective meaning to sensory events, is the amygdala.

Paul MacLean has introduced the amygdala into the Papez's circuit. He developed a theory in which the brain contains the limbic system and emotions are its creations [8].

Plutchik [9] perceives emotions in basic categories, a biological adaptation process typical to all living creatures.

Davidson [10] considered emotions a subjective mental state created as a result of a conscious or unconscious situation assessment that influences interests and targets.

Emotions are considered pleasant when a situation complies with expectations in the importance and target aspect and unpleasant when there is no such compliance. On the other hand, from a physiological point of view, the phenomena called emotions mainly serve to satisfy the instincts [11].

These examples of the definitions of emotions indicate a significant inconsistency in the taxonomy [5]. Some authors describe it by referring to physiological changes; others, as subjective feelings in the situations that trigger I [5].

The difficulty in defining emotional processes results from the fact that emotions are usually integrally connected with other experiences and rarely occur individually [5].

Aim of the study

The below-presented paper is an attempt to classification of basic emotions on the basis of those features that to a large extent render their description easier, like expression, intensity, depth and so on.

However, it is important to note that basic emotions evolved for their adaptive and cognitive value in dealing with fundamental life tasks.

Classification of emotions

Many attempts at classifying emotions have been undertaken, but none have been universally accepted by all authorities. The difficulty in finding the proper definition results from the presence of a much more significant number of subtle shades of emotions in comparison to the number of words required to define it. A certain consistency, however, is present in those classification features that in no small extent render their description easier. Emotions differ in return. Therefore, they are either positive or negative to the entity who experiences them. In the case of positive emotions, the person suffering them seeks to maintain this positive state while in the fact of negative emotions, there's a desire to stop it [7,12].

Paul Ekman [3] lists six basic emotions expressed by universal changes of mimics but different regarding content. These basic emotions are:

- happiness,
- anger,
- sadness,
- surprise,
- disgust,
- fear.

Ekman [13] has separated the culture-specific emotions expressed by body language from the universal emotional expressions such as face mimics. This body language includes emblems and illustrators. Symbols are movements that substitute for words such as „yes" signified by nodding the head and „no" by shaking the head. On the other hand, illustrators such as gesticulation, which emphasizes what we say and helps to explain it, are strictly connected to the contents and course of the speech.

Emotions may have the different intensity. Intense emotions selectively decrease perception and impair other cognitive processes such as logical thinking. Emotional intensity varies by the individual experiencing it. Different individuals may react differently to the same situation. Even the same person may experience different concentrations of the same emotion depending on many factors.

Bilikiewicz [14] has characterized emotions as sthenic and non-sthenic. Sthenic emotions (e.g., anger) increase the readiness to act, and non-sthenic emotions such as terror decrease the capability of effective action.

The differences in motivational forces are expressed in the depth of emotions. Deep emotions tend to exhibit a long-lasting action in a particular direction. The duration of maintaining the emotional level is also different and is referred to as the endurance [7].

Further, emotional features are the subject of emotions and their expression. Considering that an emotion is an expression of the opinion of someone or something, detecting the issue of the emotion is not difficult. Emotional expression is the external expression of the internal emotional state represented by the mimics, gestures, and physiological manifestations [7].

The final feature of emotions is a settlement, a situation present after emotions subside. In the case of significantly intense feelings, one may feel fatigue, sleepiness, and even oblivion [12].

According to evolutionary division, we can distinguish basic emotions associated with instincts that occur in both higher animals and humans and higher emotions typical in humans, which appeared as a result of the development of mental and social needs. The latter include moral, patriotic, esthetic, love, and feelings of friendship.

According to Mazurkiewicz [5], there are higher feelings – frontal and logical which are defined as „instinct stoppers" – that are associated with images representing reflections of the world or with abstract notions.

Currently, one of the most esteemed divisions of basic emotions is that by Robert Plutchik, which is based not only on facial expressions but also on the expressions of various body parts. It is similar to Ekman's model, but additionally, it contains acceptance and anticipation [15].

By using the notion of basic emotions, Pluchik [9] has defined the emotions that are the lowest in the hierarchy and cannot be further divided into more elementary feelings. He defined basic emotions as temporary experiences resulting from external stimulation and which are accompanied by individual behavior models.

Pluchik is also the author of one of the best framed emotional combination theories. He created a wheel of emotions in 1980 which consisted of eight basic emotions and eight difficult emotions each composed of two basic ones, analogical to the wheel of colors, in which emotional mixing colors leads to the creation of new emotions (fig. 1). He has called the combination of two primary emotions diads. If we combine neighboring emotions within the wheel, we obtain first-order diads. The combination of feelings separated by another basic emotion results in a second-order diad, and so on. The more distant the two basic emotions are, the less probable is their combination [15,16]. Combining basic emotions into emotions of higher order is considered cognitive action and is probably human-specific. One emotion may easily change into another, except for those that are mutually contradictory. Contradictory emotions include fear and anger or sadness and happiness [15,16].

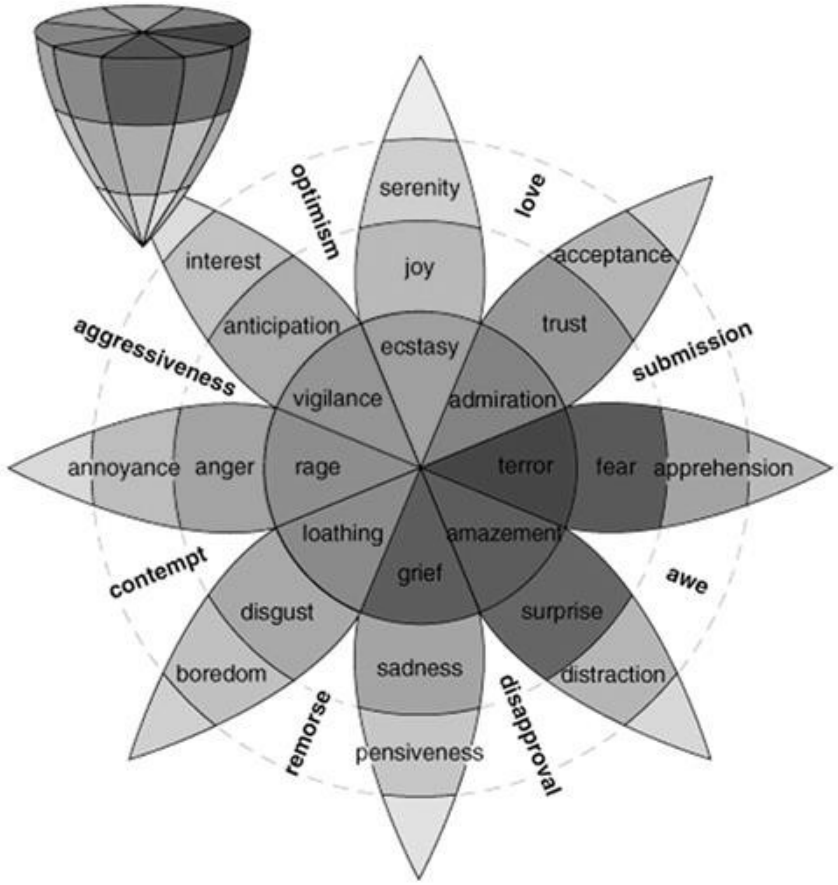

Figure 1. Pluchik's wheel of basic emotions and ways of emotional combinations [fig. acc. to 16]

The cognitive function of emotions

Cognitive process is the act of active processing information and requires the use of knowledge already possessed or the acquisition of new knowledge. The cognitive process covers issues of perception, memory, attention, pattern recognition, problem-solving, language, and cognitive development. Understanding and exploration of the world are dependent on the intensity of emotions, which significantly participate in decoding information after the preselection. On the other hand, the feelings strengthen the process of memory encoding, facilitate information to be recalled from memory and transformed into utility structures and skills [17]. The cognitive concept of emotion assumes that emotions manage human motives for action and switch attention from one matter to another by simultaneous adjustment of human responses to the circumstances [18,19].

There are two approaches to the issue of the relationships between emotions and cognitive processes. One assumes that emotions precede cognition, that the practical evaluation of a stimulus occurs before its full cognitive identification. The emerged emotions trigger useful marking of the new situation. It is a phenomenon of affective priming [19]. On the other hand, the theory of cognitive primariness assumes that the result of the evaluation of the situation is the condition for the appearance of emotion. Regardless of the approach, without a doubt, there is an active link between cognition and emotions.

The followers of the first approach claim that emotions not only influence the cognitive processes but in some cases are also an initial condition for its activation. Maruszewski [20] divides the functions of emotions into the following cognitive processes: orientation function – emotions deliver information significant in terms of the individual's point of view and therefore direct human attention to the most important matter;

- activation function – emotions deliver energy necessary to activate and perform various cognitive operations, emotions allow humans to engage in long-term cognitive activity;
- modulation function – emotions deliver sufficient amounts of energy to ensure the optimal functioning of cognitive processes, the human body most effectively functions at average levels of emotional tension;
- metacognitive function – it is connected with being oriented in one's own cognitive

processes and in the selection of such cognitive processes that may seem most effective in a particular situation.

It is worth noting that emotions modify not only behavior but also thoughts and memory although positive and negative emotions have a completely different impact. Positive emotions stretch the attention scope, allowing for the perception of a much more full range of stimuli. They make data processing easier, foster its positive evaluation, and broaden conventional thinking and action. Moreover, they result in a much better assessment of one's possibilities and increase access to personal resources. In the case of insufficient resources and skills, joyful emotions encourage the search for solutions on the way to the target perceived as real. The cognitive organization becomes more effective, and the brain is more flexibly organized [21,22], whereas, negative emotions significantly limit the attention scope by focusing concentration on threatening stimuli, considerably decreasing the evaluation of the situation. They strengthen memorization of the main details but weaken memorization of background details. When in a new situation, the brain perceives reality slightly differently than when in a familiar case. If negative emotions are intense, tunnel memory is created. People selectively memorize only the elements that have the primary meaning of survival in a situation of direct danger [13]. Emotions also influence the type of learned content: Positive emotions cause data to be remembered in a positive light. Similarly, negative emotions cause data to be recognized in a negative light. This is the principle of compliance of cognition with mood [13]. The cognitive process is itself also a significant stimulus for emotions.

Adaptive function of emotions

In evolutionary terms, emotions developed due to their adaptation value in dealing with basic life tasks. Each feeling has an individual performance readiness, and each pushes towards a particular behavior pattern that in the course of evolution, has best functioned in dealing with repetitive situations, significant concerning human targets [18]. Emotions concern repetitive "adaptive situations," each repeated countless times in the course of the species' history. This occurs because of the brain's "remembering" of emotions. The neurochemical emergency system that stimulates the body to react to sudden, life-threatening events through fight or escape makes these moments significantly more memorable [23]. The body "sees" the situation and is thus prepared to react to it in adaptation categories. It is not the adaptation to the current situation, however, but to those situations that took place in the species' past [24]. On the other hand, LeDoux [15], by indicating the role of the amygdala in human childhood, confirms that the interactions that occur between the child and its surroundings during the first years of its life form a set of emotional tutorials based on life adjustment. According to LeDoux, these emotional tutorials have an enormous influence on the child's subsequent behavior due to their life-long storage in the amygdala in the form of nonverbal patterns of emotional life.

Negative emotions can cause physiological changes that help the body adjust to a particular situation. Sometimes, in hostile conditions, after the initial evaluation of available power, the human body subsequently decides to fight, causing anger and the stimulation of the sympathetic nervous system. Heartbeat increases, blood pressure rises, and the increased secretion of hormones such as adrenaline and cortisol triggers an energy flow sufficient to cause dynamic action [25,26].

The adaptation functions of anger may be divided regarding the two different advantages it bears. The first one is self-defense. When our body is stimulated and reaches a state of functioning with maximum physical power, it helps defend against potential danger. The second adaptation function of anger is decompression. Decompression provides the body with the opportunity to relieve stress that has accumulated due to long-term frustration [25]. Such safety ventilation is an effective way of helping the autonomic nervous system function normally again and reaches the state of „calm after the storm." In this state, better preparations for dealing with future stress and frustration can take place. The ability to express anger is a healthy and assertive attitude, one of the hallmarks of mental health [25].

Under the influence of intense frustration stimuli, the accumulated negative emotions may trigger aggressive behavior, leading to the complete disorganization of the performed activity. On the other hand, aggression to plays an adaptive function – it leads to the discharge of frustration, which is often the cause of psychosomatic disorders, and in life-threatening situations, may save the life [25].In hostile situations, the human body does not always react with anger. Sometimes its initial evaluation of the situation indicates no chance of success in interaction with the enemy, causing a fear reaction. Blood flows out of the face and causes paleness, and at the same time, the body freezes for a moment to assess whether to retreat or hide. In this manner, anger generates intensified attempts to reach the target, and fear causes the body to stop and proceed with caution in the environment [23,26].

Other emotions play an adaptation role. For example, raising the eyebrows when surprised helps to broaden the scope of sight and increase the access of the retina to light. Therefore, more sight information in unexpected situations is gathered,

and the person becomes aware of what is happening more quickly, which aids in developing a better action plan [23]. The signs of disgust expressed on the face—upper lip pulled together and a slightly crinkled nose—represent, as Darwin observed, the primary instincts to close the nostrils, which prevents smelling disgusting odors, or to spit out food that is poisonous, preventing the body from ingesting a potentially toxic substance [23]. Contempt is reflected in treating a person considered worthless without any respect [27]. Sadness causes the decrease of energy level and enthusiasm to undertake various life actions. As the feeling becomes stronger, depression appears, slowing down the body's metabolism. The apathy that accompanies depression helps to end a failed relationship, apathy during recovery. Regret is accompanied by the recurrence of painful memories, which decreases sadness. Withdrawal and introspection provide the opportunity to cry over the loss or the shattered hope and to understand the consequences of sorrow in our lives. As sadness disappears, an increase in motivation can be observed. A new meaning is assigned to the course of affairs, and the energy required to plan everything from the beginning is recovered [27].

Every negative emotion is a complex phenomenon, i.e., it deranges the sequence of activities that induced this emotion and activates protective mechanisms to alleviate its deleterious effect on the human body at the same time. As it mobilizes the body to react to danger quickly, the fast generation of negative emotions carries the vital meaning for its adaptation functions. The rapid change of emotional state is also adaptational. It usually does not last long if it is not repeatedly generated [13].

The adaptational role of positive emotions lies in its capability to change ways of thought and action. In a given moment of time, a temporary scope of human behavior becomes increased by thoughts and actions that appear spontaneously under the influence of the circumstances. Such behavior builds long-lasting personal resources that function as reserves that may be used at a future time [28]. As described by Barbara Fredrickson [22], the theory of positive emotions contradicts the traditional models, which assume that negative emotions have a more significant meaning in human life. The theory of positive emotions assumes that positive emotions—happiness, interest, satisfaction, pride, and love—build long-lasting personal resources, including physical, intellectual, social, and psychological resources [28]. According to Fredrickson [22], happiness supports creativity and the crossing of one's boundaries; interest supports gathering new information and experience; satisfaction allows one to be happy with current life conditions; pride provides happiness with one's achievements and the achievements of the people closest to the individual, generating the will to share information with others and to plan further successful actions; and love makes the intention to share one's life experience with the people closest to the individual.

Just as importantly, another adaptation role played by positive emotions is described by the "leveling hypothesis," according to which positive emotions that contrast negative emotions level their consequences [28]. Both positive and negative feelings intensify the activity of the sympathetic nervous system. After experiencing positive emotions, however, relatively quick restoration of the normal state is observed while in the case of negative emotions, returning to a healthy state is a slow process (longest in the case of sadness). Fredrickson [22] assumes that the occurrence of positive emotions immediately after negative experiences accelerates the return to the normal state, in both the mental and physical sense, by reducing sympathetic reactions [26]. By stimulating the restoration of the systems engaged in the emotional and defense response, positive emotions build a physical context for thoughts and behavior, simultaneously weakening the effects of the adverse life events [28].

CONCLUSIONS

Human emotions concern significant matters. According to Zimbardo [29], emotions regulate relationships among people and support pro-social behavior. They are part of our nonverbal communication system, and additionally, they play an essential role in regulating social interactions. The specific function of emotions as regulatory processes exists in a broadly understood evaluation that may involve the course of both cognitive and adaptation processes. Being aware of one's emotional processes allows management of behavior in particular situations, fundamental to understanding and knowing oneself and in shaping emotional maturity. It is achieved in the course of constructive dealing with random events under the influence of environmental impact or contacts with other people. To sum up, we may claim that emotions make us human in the humanistic sense of the word.

Conflicts of interest

The authors declare that they have no conflicts of interest.

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