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What are Emotions? Structure and Function of Emotions

Cezary Mordka

Maria Curie-Skłodowska University
in Lublin, Poland

e-mail: cemordka@poczta.onet.pl

Abstract:
This paper attempts to coin a stipulative definition of "emotions" to determine their functions. In this sense, "emotion" is a complex phenomenon consisting of an accurate (reliable) determination of the state of affairs in relation to the state of the subject and specific "points of adaptation". Apart from the cognitive aspect, this phenomenon also includes behavior, physiological changes and expressions (facial expression, voice, posture), feelings, and "execution" of emotions in the nervous system. Emotions fulfill informative, calibrating, identifying, existential, and motivating functions. Emotions capture the world as either positive or negative, important or unimportant, and are used to determine and assign weightings (to set up a kind of hierarchy). They emerge automatically (involuntarily), are difficult (or hardly possible) to control and are (to some extent) influenced by culture.
Keywords: emotion, feeling, action, brain, nervous system, expression, cognition, function, significance, positive, negative.

And the Lord *was sorry* that he had made
humankind on the earth, and it *grieved* him to his heart
Old Test. 6, 5-7.

1. Introduction

The word "emotion" may carry a meaning that consists of two elements: "e" and "movere", where "e" denotes "from", and "movere" means "to move". In the context of this analysis, the etymology of this word is worth mentioning if we assume "e" denotes something which is "outside" or "external" [36, p.750] which is connected with "moving out from one place to another [10. P.19] or, in other words, if we assume it refers to an action.

According to the Webster dictionary, emotion is defined as follows:

> […] conscious mental reaction (as anger or fear) subjectively experienced as strong feeling usually directed toward a specific object and typically accompanied by physiological and behavioral changes in the body [38].

The synonyms for "emotion" include the following words: "affect", "exultation", "excitement", "enthusiasm", "fascination", "ferment", "racing thoughts", "fever", "fire", "revival", "agitation", "passion", "concern", "agitation", "rapture", or "fascination". These expressions do not really contribute anything new, just like it would be pointless to analyze emotions by simply listing their attributes. A more detailed consideration is essentially necessary.

2. Are Emotions Non-Apprehensive (Non-Cognitive)?

Before any scientific research on emotions was initiated, emotions were investigated from a philosophical perspective (i.e. they were 'researched' in the historical sense of the word). However, philosophers did not simply delve into the subject of emotions – the meaning and significance of emotions were relevant only against the backdrop of universal (systemic) concepts. Philosophers almost always delivered profound analyses that were rooted into an individually preferred theoretical framework. With the absence of an experimental base, or the opportunity to broadly discuss the subject and to expose their concepts to criticism, the philosophers of the past arrived at very many different conclusions in the subject of emotions. As a starting point of my analysis, let me first refer to one of many philosophical concepts in order to provide a wider background illustrating the specifics of contemporary conclusions. Due to the time distance, I will now present a simplified outline of a concept by Saint Thomas Aquinas.

The models of emotions proposed by this philosopher is firmly entrenched in his metaphysics, but there is no need to discuss it in too much detail; it suffices to outline the cognitive system of a human the way St. Thomas saw it. Within the powers vested in humans (the powers of the soul), St. Thomas accounted for the following five genera of powers in the soul: (1) vegetative powers, or the ability to survive and reproduce, (2) the locomotive power, (3) sensitive, or the ability of sensual cognition (external senses and four internal senses: the common sense, the imagination, and the estimative and memorative powers), (4) the intellectual, or the ability of thinking and reasoning, (5) and the appetitive (*appetitus*), to which "feelings, emotions, and artifacts" belong. St. Thomas believed that desire (*appetitus*) may come from nature itself (*appetitus naturalis*), as well from sensual cognition (*appetitus sensitivus*), and finally from the intellect (*appetitius intellectualis seu voluntas*, or the act of will).

There are two types of appetites arising from sensual cognition. We distinguish *vis concupiscibilis* or sensitive concupiscible appetite related to the good as such that is perceived through senses, and *vis irascibilis*, or irascible faculty, an appetite to fight against obstacles, or the drive to conquer. This differentiation is all the more important since, as St. Thomas explains, the manifestations of these powers or appetites are referred to as passions (*passiones*).

Passions – in the context of the division introduced by Saint Thomas – are acts of the sensitive appetite. They are sensitive rather than apprehensive since they belong to the sphere of desires (cognition is vested in senses and the intellect, whereas will is in the realm of mental passions).

According to St. Thomas, each passion consists of three components:

1. Perceiving good or evil through senses: "For we have stated that the object of the concupiscible power is sensible good or evil, simply apprehended as such, which causes pleasure or pain " [32, p. 14]. "Good, inasmuch as it is delightful, moves the concupiscible power" [32, p. 14].
2. The emergence of the sensitive appetite movement (*omnis motus appetitus sensitivi)* with the propensity to act.
3. Bodily transmutation manifested by flushed cheeks, trembling, expression of the eyes, etc.

Appetitive “movements” (element two) is the essence of passions, although the element of “bodily transmutation” or “the perception of good or evil” through senses is also important; in other words, all that is sensual is perceived either as pleasure or pain. Passions are separate from reason; reason takes actions being indifferent to the consequences for the life of the subject – it only accounts for the value of truth. It is to conclude that passions are essentially motivational (appetitive) [30. p 11] rather than apprehensive (cognitive). The appetitive sphere is closely linked to physiological organs, hence “anger makes blood boil around the heart” [32, pp. 10-11] (Antoni Stępień, a neo-Thomist, distinguished between three types of emotional experiences: (1) experiences of emotional contents, (2) emotional states, and (3) emotional acts or emotions *sensu stricte* [29, pp. 3-9]).

To recap, the concupiscible power is the drive for pleasure, to the sensible good or evil generally recognized as either pleasure or pain.

> In the realm of the appetite, if a specific good is perceived through senses, then the entity feels movement towards, affinity to, focus of passion on this very good. The perceived good determined, transforms the passion and attacks it. This first preference, determination, focus of passion to a specific good is called love [15, p.6].

Where “evil” is perceived, we feel repulsion and are driven away from it. If the perceived object – a good that carries a pleasure – is not in our possession, we feel longing or desire. If the good is obtained, it brings us joy. If we constantly feel threatened through aversion, sensible hatred or detestation emerges, and if we are exposed to it in general – only sadness.

It is also sometimes, or rather generally the case that the object to which the inclination or aptitude leads us is difficult to obtain, and hence St. Thomas introduced the notion of concupiscible power. If evil evokes aversion and is difficult to conquer, the concupiscible power will give rise to daring or fear. If evil is directly present, daring is immediately followed by anger. Where this powerful feeling leads us to obtain what we long for, it will be transformed into joy. Otherwise it will turn into sadness [32, p. 22].

Emotions (from Latin *passions*) are sensible (or predominantly sensible) and appetitive processes (*desire)*, in other words they prompt us to act and to evaluate our actions, and are non-apprehensive (non-cognitive) since they do not have their own object and do not reveal the truth as such, they perceive an object from the pleasure/pain perspective and have a physiological (bodily) component. They are considered either as natural or concupiscible.

If this standard characteristics of emotions is considered correct [33, p. 46], which is defined by very quickly emerging, involuntary behavior or reaction to an perceptually identified and evaluated object correlated with the state of the body and the surrounding environment, and if we consider the function of emotions, such as anger, as ascribed to them in evolutionary psychology [5], it can be concluded that contemporary analyses do not go beyond the model devised by St. Thomas.

However, can it be established with certainty that emotions are non-apprehensive conditions? Do they have inherently motivational characteristics?

R. Zajonc was one of the first and most dedicated contemporary supporters of the thesis that emotions come before thinking, that they precede cognition [39]. Zajonc argued that preferences (or “liking something”) can emerge before cognition, without any conscious perception of events. When subjects were experimentally exposed to stimuli they did not consciously recognize, after which their preferences were openly tested, they were found to prefer patterns they had been exposed to (below the threshold of cognitive awareness) although – obviously – they could not explain why. The effect of “exposure” was broadly confirmed in many laboratories [2].

The thesis that emotions are not a part of cognition has a long historical tradition.

Many theorists claim that emotions are not cognitive, arguing that only sense-data and cognitive reflection belong to the sphere of reason. Others purport that emotional processes do not have any “object” (they are not about something) and they do not generate any lasting information about the world “as it is”, therefore they are not cognitive (for example, a rainy morning is not

"sad" in itself). Also, emotions are automatic (involuntary), whereas cognitive processes are controlled. Additionally, emotions and perceptive processes as well as thinking are controlled and processed by different areas of the brain. Also, it is important to note that, if an emotion emerged *after* acts of perception and thinking, there would be many situations where it would not be effective, i.e. an individual would otherwise fall prey to a predator (which is not the case).

In fact, emotional states may impair cognition (fear makes things look twice as bad as they are), while people who run amok cause detriment to themselves and reject all rational arguments.

In this context, it is worth noting that the mere finding that emotions are non-cognitive by nature since they are different and separate from senses or the activity of thinking prejudges the question of the actual nature of emotions. However, this prejudice should not be rejected as completely unfounded. The processes of thinking (that can be expressed by invoking the notion of "material", "operations", or "rules of thinking") – through which ideas, schemes, and judgments are developed – are focused on capturing general patterns of the world. Emotions play a different role, which does not necessarily mean they are non-cognitive.

3. Cognitive Approach to Emotions

It goes without saying that under certain circumstances, emotions may impair the process of reasoning, but cognitive processes are also susceptible to error (including so-called rationalizations), and there are plenty of books written about hallucinations and perceptual illusions.

In terms of cognition in the sense of a controlled and conscious process (being aware of and being conscious), quite obviously the problem emerges of informatively unconscious access to the world.

Many publications and reports argue that humans have a perceptive and categorizing access to the world in the sense that they are able to read words they are unaware of seeing (lexical decision task) [22, p. 550]. J. Marshall and P. Halligan described a series of experiments suggesting that reliable access to the external environment in conditions of unilateral neglect [11, pp. 13-21] (i.e. absence of conscious access to some data) is in fact possible.

Humans are able to learn complex information unconsciously and even more effectively than in conscious learning [26, p. 5].

T.D. Wilson coined the notion of adaptive unconsciousness and provided many examples to prove that it allows to assess the environment, to clarify and interpret it in order to be able to act quickly and unconsciously, which brings substantial benefits to the subject [35, p. 22].

Therefore, it is not the type of access (conscious or not) that determines whether something is cognitive or not. How is it determined?

The trouble is the following: there are many definitions of the words "to cognize" or "knowledge". In the absolutist approach (foundationalism), cognition was described as self-explanatory and controlled, and the outcomes of cognition were recognized as necessary and/or certain, generally important (for every cognitive subject), free of question-begging (*petitio principi* [30, p. 78], and obvious. In the traditional approach to the notion of "knowledge": „[...] *S* knows that *A* wtw (a) *A* is true; (b) *S* is convinced that *A;* (c) *S* has sufficient grounds to reasonably believe that *A* [...]" [37, p. 25].

In the broad meaning of the concept of relativism, however, knowledge is any content that is changeable relative to conditions and the historical moment, and allows to fulfill a particular objective; it is based on a specific ontology, it is not translatable into other languages and meets the specified common conditions for its assessment (intersubjectively). Neopragmatism, as expressed in R. Rorty's thinking, claims that to understand cognition, one has to understand the social institution of justification for belief, and thus there is no need to view it as accuracy of representation [27, p. 153]. There are plenty of examples to provide, but they do not bring us any closer to the notion of "cognition".

Without looking deeper into the question of superiority of one concept of "cognition" over another, let me recognize cognition as a set of acts or actions that produce a specific outcome, and

the outcome itself. The outcome will be referred to as a 'cognitive' result (by analogy, the acts that have led to the emergence of this outcome will also be called 'cognitive') as long as they accurately reveal the *state of affairs* (in the broadest sense of the word). The medium that carries this conviction is irrelevant, although it is most commonly language-based, nor does it matter whether the outcome has emerged from intended acts, conscious or unconscious.

What is more, the outcome may be accurate (i.e. cognitive) in many different ways. It can be either a confirmation that something exists, that it has specific properties at a given moment, or a more general characterization of the surrounding environment. The trouble is that we usually obtain the entire spectrum of "results" across all different levels. To recognize something as "colorful" brings within the entire spectrum of different "contents" (phenomenal variability). The same applies to categorical identification. Unless we have some compelling criteria, the problem of cognitive value has to be tackled in a different way. Unfortunately, there are no assumptions to rely on. So let us assume that I, the subject, exist somehow and that I do not exist unconditionally. And if so, I must have a generally reliable contact with the surrounding environment; in other words, my convictions and beliefs about the state of affairs must be accurate. The accuracy of these results are relativized against the discussed theoretical level. It is different in the case of a basic contact (for example, where a color of a particular apple is captured), and in the case of general sentences (e.g. dogs bark) or theory (e.g. the theory of evolution). At the simplest level of capturing the surrounding environment, for example when discussing colors, or in simple categorizations, the accuracy of our convictions is demonstrated indirectly, although actually we never have access to the world "as it is in itself" (as a consequence of phenomenal variability). This can be seen in two subjects, one of whom captures an object as "yellow honey", and the other one describes it as "grey honey". An object is unable to have two contradictory features (i.e. it cannot be yellow and grey at the same time), then, even if a subject mistakenly perceives it as "grey", the question arises: how can the subject perceive an *object* as grey? The answer is: he/she cannot. If both observations are the same in qualitative terms (i.e. they refer to a "color"), it can be concluded that the object *never* deals with light "itself", but has informative access to light. The value of this access can be measured "with what the subject allows to use". At the basic level discussed here, a systematic error is equivalent to the ultimate disappearance (death) of an object. Hence, contents are perceived from an epistemological perspective, indirectly, and are accurate to the extent which, for example, allows the perceiving subject to survive.

However, what is the role of emotions? In other words, how is the sentence "this honey is sweet and yellow" different from the sentence "this honey is *pleasantly* sweet and yellow"? Or what is the difference between sentences: "this dog barks" and "this dog barks *dangerously*"? Does the difference elicit an inclination to take action?

First of all, the quality of being "dangerous" or "pleasant" is not determined *in principle* by referring to the *type* of subject who perceives something to be either dangerous or pleasant. For example, a subject made of marble would not even consider itself to be in *danger* of being bitten. It is not only the reference to the type of subject that matters but also the time (moment) when this reference is made. Does the sweetness of a particular substance guarantee it will be pleasant permanently? It can be recognized without detailed research that the way the pleasant taste of food is perceived will change depending on whether the subject is hungry or not. Neither danger nor pleasure is a quality of the world itself.

Still, it can carry information about a specific property in relation to a particular *type* of subject and its state. What is this state about? In fact, this is any state that fulfils a presumable rationale (principle). Let us refer to this rationale as a "point of adaptation". The most general (abstract) points of adaptation are survival and reproduction; and for humans also the aspirations arising from the pursuit of a welfare model adopted by individual subjects. These most general "points of adaptation" are the (alleged) rationales or functions of what is happening in detail. Hence, a specific *non-pleasure* of hunger or *love* for somebody are cognitive contents (information) about the surrounding environment, addressed to a specific subject because of the "point of adaptation" assigned to it (in this case, it involves survival and the drive to reproduce). In this

approach, emotions can be seen against the wider backdrop. Emotions, just like "[...] our physical organs owe their complex structure to the information in the human genome, so, I believe, do our mental organs. We do not learn to have a pancreas, and we do not learn to have a visual system, language acquisition, common sense, or feelings of love, friendship, and justice" [24, p. 41].

I capture emotions as adaptations, and these emotions are the result of progressive advancements in the mechanism of DNA replication, in the process of natural selection. I assume genes are replicators that preserve high accuracy of the copied information; hence, any sections of the chromosomal material that can persist for generations become units of natural selection.

Replicators are one of the observed forms through which nature itself strives to maintain stability. Just like a soap bubble strives to become spherical in shape since this is how a stable configuration of thin layers filled with gas looks like. Salt crystals take a cube shape as it is the most stable form to accommodate atoms of sodium and chlorine [7, p. 29].

4. Structure of Emotions

This is the hypothetical context in which emotions emerge. Emotions understood as informative contents are beneficial for the subject; in a metaphorical sense, replicators are also the beneficiaries of emotions, and finally, the stability of natural structures can be maintained. This is not a thesis of biological reductionism as it should be borne in mind that humans pursue their own concept of welfare (in relation to specific emotions).

Therefore emotions (at the first glance) are embodiments of the surrounding environment that carry specific information, relative to the state of the subject by virtue of the existing rationale (points of adaptation).

They are based on other data (contents), astutely expressed by D. Weiner: "Emotions are processes that use selected information from the environment as harbingers of possible events that may occur in relation to them [33, p. 80]."

An emotion can be distinguished from other cognitive processes, each of which has its own specifics. The specificity of emotions means that they divide the world into a positive and a negative, something no other power or information processing can do. An emotion constitutes that something is "important" and, as a result, it makes this something "more or less important" to set up a hierarchy of actions. Subjects (entities who take actions instead of just being subjected to actions) may, in theory, take an infinite number of activities, but emotions introduce an element of radical simplification. In this approach, emotional disorders, and specifically reduced intensity or lack of emotions will have serious consequences for the subject.

A patient studied by A. Damasio (who had sections of his prefrontal cortex removed, more specifically the ventromedial frontal cortex) was physically competent and the majority of his mental abilities remained unscathed. However, his emotions have changed dramatically as compared to the period before injury. He has lost the decision-making ability, he was unable to effectively plan for the future, or to learn from his mistakes. Psychological and neuropsychological tests have demonstrated outstanding intellectual capabilities of the patient. He excelled in memory tests based on interference procedures, while his perception, memory, learning ability, language, and arithmetic skills remained intact. *However, his decisions and behaviors were only based on reasoning*, and the patient was therefore unable to assign any value to the options he was faced with (he felt equally strong rationale behind all choices). He would lose sight of the main goals by devoting his attention to detailed tasks [6, pp. 53, 69]. Similar dysfunctions of the decision-making processes and diminished emotional responsiveness were observed in other patients following prefrontal cortex damage. They tended to be stiff and stubborn, they were unable to organize the future or take care of their work. They were characterized by stereotypical manners, lack of sexual drive, elevated pain and pleasure threshold, and complete absence of curiosity.

Emotions not only introduce the idea of things being "positive or negative", they also prioritize things according to the value they assign, they also involve action (behavior) as their intrinsic characteristics.

As for some emotions (fear, love, rage), behavior is promoted automatically, or involuntarily. Other types of emotions can be controlled to a certain extent (except for the fact that they emerge), but this can result from the activation of a stronger emotion that controls the first one (i.e. containing anger for fear of revenge). This approach can be exemplified with the ancient concept of will as *liberum arbitrum.* A subject can control some emotional states (means) but does not choose the final goals of achieving a happy life. I do not preclude the possibility that a subject (a human) takes actions "because he/she wants to", but he/she also has to face the consequences. In the case of emotions, controlling emotions or the lack of such control is irrelevant; instead, functionality, or effective problem solving, is what matters. Hence, if a subject is not able to control justified anger and the accompanying retribution or revenge, no matter the costs, then the emotional state becomes an effective deterrent.

Emotion cannot be identified without proper behavior (the problem of 'beetles' discussed by Wittgenstein). Emotion is not an "expression" of something internal but a kind of "acquisition" of the means we are lacking.

Appropriate behavior is not merely a feature of the phenomenon of emotions but also of other mental activities, such as thinking or acts of will. We do not say that somebody thinks because there is a silent private process going on inside him that is never revealed to the outside world. Accordingly, we do not say that a person categorizes correctly when he reaches out for a cigarette case rather than a salad plate at the dinner table. Paraphrasing Wittgenstein, a person must do a lot to be considered a thinking person. Likewise, as for emotions, it is difficult to claim that a person loves somebody unless we see specific actions taking place.

However, with reference to Putnam's arguments about the superactor and superspartan, there are frequent cases where there is no action, but other aspects of emotions are activated instead. I will refer to conditions like this as quasi-emotions or q-emotions, as opposed to stricte-emotions or s-emotions, the outline of which is slowly beginning to emerge. Still, even q-emotions inherently involve the propensity to act.

Physiological changes are an important element of emotions – an element, not a symptom. Fear is accompanied by faster heart rate, lowered body temperature, pale skin, and panting. Blood flows into large skeletal muscles, such as muscles of the lower extremities, to make is easier to escape. Blood is drained from the face and the face turns pale. Interconnections between brain areas that control emotions initiate the process of hormone secretion to force the body to remain vigilant, to make it more sensitive to all external stimuli and reactive, while attention is focused on the imminent danger. Sensitivity to pain is reduced, which is very practical when the body can be injured. W. B. Cannon believed that feedback, especially between the brain and other organs, is a process which is too slow and too non-differentiated to determine the exact emotion we feel at a particular moment. Today, we known that internal organs secrete steroid hormones and peptide hormones during emotional arousal (instead of adrenalin, as Cannon argued) that get to the brain with blood. Therefore, the possibility cannot be ruled out that the activation of various emotional systems in the brain leads to a variety of different patterns with which hormones are released from internal organs, which could translate into a multitude of biochemical feedback patterns between hormones and the brain, and each of them would cause unique consequences, specific to particular emotions.

Physiological changes are correlated with expression (of the face, posture, tone of voice).

> […] when I clenched my jaws and lowered my eyebrows, I tried not to be angry, but I felt anger. I am not in the state of anger, but I have noticed that my thoughts keep coming back to the events that made me feel angry; I knew that this is an experiment, but I felt I was losing control over everything [10, p. 123].

Expression delivers a reliable signal to the surrounding environment that the subject is in an emotional state and that this emotional state may have some consequences; for example, that the subject can be dangerous or friendly. Ludwig Wittgenstein asks:

> ‘*We see emotions’* – As opposed to what? – We do not see facial contortions and make inferences from them (like a doctor framing a diagnosis) about joy, grief, boredom. We describe a face immediately as sad, radiant, bored, even when we are unable to give any other prescription of the features. – Grief, one would like to say, is personified in the face [36, p. 225].

Visibly being angry can cause others to fear and allow the subject to achieve their own objectives. Thus, an emotion is not just a condition that carries information but also a means to communicate this condition.

In search of mechanisms explaining the development of facial expressions, researchers have come up with three main concepts. Facial expression can either originate from sensory reactions (T. Piderit, A. Pepier), from electromechanical laws governing the functioning of nerves and muscles (Spencer), or reactions which have led humans to accomplish their goals in the process of evolution [10, p. 97].

P. Ekman demonstrated that facial expression of people across different communities is highly similar, and accordingly, disgust is recognized by 92 percent of Americans, Brazilians, Argentineans, and Japanese (90 percent). Likewise, a large percentage share of people is able to correctly identify surprise, sadness, anger, or fear.

Apart from actions, physiological changes and expression, emotions also include *feelings*. This notion is only rarely evoked in contemporary concepts of emotions.

In a psychology textbook by J. Streal and D. Dolinski, “feelings” are not listed in the index. Feelings are not even mentioned in the book by P. Ekman and R. J. Davidson, and in the book by K. Oatley and J. M. Jenkins, *Understanding emotions*, feelings are referred to only three times. This limited use of the term “feelings” may be attributed to the fact that feelings are highly subjective (subject-oriented) and they sometimes cannot be captured and communicated in an intersubjective manner. In the meantime, despite the theoretical campaign lasting over a century, the word “feelings” is still present in the language we use.

> While speaking about emotions, we have feelings in mind *that psychologists describe as a subjective element of emotions.* Emotion is much more complicated [...] We mistakenly believe that emotions are only what we feel inside [20, p. 25].

I think the term “feeling” also characterizes emotions (although it may refer to a different time perspective) and has its own function and role, despite being private. Here, a feeling will mean a consciously accessible (qualitative) aspect of emotions. This is a type of synthesis (or simplification) of other aspects of an emotional phenomenon, especially in terms of subconsciously processed information. The true essence of feelings is the addressee or, in this case, the subject himself, meaning that the aspect of intersubjectivity or communicativeness is of secondary importance. A feeling appears in an unintentional manner, and therefore is a synthesized and simplified “product” of unconscious cognitive processes.

If the cognitive contents (information) are the fundamental aspect of emotional processes, these contents need to have an “executor”. Although cognitive results stem from the activity of the mind (and are figuratively located in the brain), the facts that make them cognitive are not located inside the brain. By invoking the arguments of F. Dretske, cognitive contents (representations) should be distinguished from the facts about the cognitive (representative) system. Therefore, cognitive contents are about something (that is not located in the brain), although they have their executor in the brain, just like information about temperature is not “located” in the scale or the mercury level in the thermometer, which are in fact the “executors” of this information. In systems of emotions, there is no single “executor” of emotions in the brain (or in the nervous system). When we analyze fear (which is one of the best investigated emotions), there is a relative clear network of

active interconnections through which fear is conditioned. B. Kapp argued that the central nucleus of the amygdala is actively linked with areas of the brain that are involved in changing the heart pace and other vegetative reactions [14]. It also controls reactions such as freezing, jerking, or changes in blood pressure. Therefore the amygdala is perhaps the "executor" of fear. It is provided with lower-tier inputs from the thalamus areas connected with the modalities of feelings, higher-tier inputs from the sensory cortex, and the highest-tier information (about the general situation) from the hippocampus [17, p. 197]. The amygdala is particularly sensitive to stimuli that have been evolutionally preprogrammed for a particular species. Amygdala axons reach out to various areas of the cortex. When the amygdala is agitated, these areas of the cortex are activated, which allows to focus attention on these factors (with the aid of short-term memory). The amygdala was also demonstrated to be connected to long-term memory networks, including the hippocampus and areas of the cortex that cooperate with the hippocampus. The amygdala is also linked with the anterior cingulate cortex, one of the co-partners that controls the working memory circuits, and the orbital cortex that is believed to be involved in creating memory of rewards and punishments. With this network of interconnections, the amygdala affects the informative contents of the working memory. Working memory consists of a general system and a few specialist systems (of interim information processing) that are combined to act as an "executor" of long-term memory. In general terms, the contents of working memory are our current thoughts, what we focus our attention on [see 17, p. 322] (i.e. the background of our feelings).

However, the discussed interconnections do not fully explain why informative data from senses, memory, or categorizations become emotionally relevant. Apart from interconnections between the amygdala and the cortex, there are different channels indirectly affecting the information processed. Of particular significance are interconnections that influence the arousal system. When it is activated, the cells of the cortex and the thalamus responsible for informative inputs become more sensitive, which results in higher alertness, better perception (or increased performance of sensory inputs), memorization and brain activity related to understanding or drawing conclusions. Very strong agitation reduces these abilities.

As for activation in response to stimuli that is considered dangerous, a particularly important role is played by the connectivity between the amygdala and the system containing acetylcholine, situated in close proximity to it, in the forebrain. Activation is caused not only by emotional stimuli, but any new situation we are exposed to. Activation of the amygdala automatically translates into the activation of neural networks responsible for controlling behavior and physiological changes. Reactions of the autonomic nervous system and the hormonal system combined can be perceived as visceral reactions, i.e. reactions of internal organs and glands (viscera). Whenever they arise, the body generates signals that are returned to the brain. Emotional reactions are accompanied by numerous feedback loops, many of which are fast enough to be specific for particular emotions. Finally, a feeling emerges as a conscious aspect of perceptions of information, a kind of synthesis of the processed information.

What is really worth pointing out is that these mechanisms combine the "executor" level with the actual action, physiological reactions, information, and feelings.

LeDoux pointed out that an exact identification of danger is not necessary in order to generate fear; instead, a perception (or information) of some key features of an object is sufficient, as identified by the primary somatosensory cortex and the amygdale [see 17, p. 156].

It is also worth mentioning that fear in humans has a genetic component that determines the type of the subject's nervous system, the specifics of mental processes and physiological functions.

However, what we actually do, think or feel in the given situation is determined by other factors instead of genes, including by social factors [see 17, p. 160].

To conclude this fragment, emotion is a complex phenomenon composed of key (non-accidental) elements: the moment of accurate (reliable), anticipatory perception of the state of affairs, proper behavior, physiological changes, expression and feelings, while the overall phenomenon is "executed" by the corresponding states of the brain.

I also entirely agree with W. James, who argues that an emotion, for example fear, is very difficult to comprehend without the accelerated heartbeat, shallow breathing, lip twitching, legs turning to jelly, or stomach cramps. Little is left of anger without violent actions, the fluttering feeling in the chest, increased flow of blood to the brain, flared nostrils, or grinding of the teeth. What is left of rage if the face remains peaceful, the breathing is regular, and the body position is relaxed? [see 12].

5. Emotions and Their Functions

Still, there is more to this than the mere structure of an emotional phenomenon. Emotions perform a wide range of functions. Let us discuss some of them. First and foremost, emotions have a *calibrating* function. Emotions calibrate the activity of other powers, authenticate them, which leads to the general conviction that emotions are real (reliability).

The problem of veridicality of the senses cannot be solved for a simple reason: “Our senses are numb – although Descartes and other philosophers discuss the testimony of the senses, our senses in fact tell us nothing, neither the truth, nor falsity” [1, p. 415].

The multitude of data we are faced with as a consequence of phenomenal variability of sensory perception or the manifold of categorization attempts could be solved (in terms of selecting either of the elements) using an assumption-free, non-contestable theory of cognition. Unfortunately, none such (universally accepted) theory exists. Yet there is another way. A subject (under the supervision of emotions) correlates specific facts (as for humans: sensory data, concepts, or perceptions) with a particular action and its consequences to create a personal model of the surrounding environment. This model is (more or less) functional since it allows the subject to accomplish goals or fulfill needs. Jerome Bruner notices:

> If a given perceptual hypothesis is rewarded by leading to food, water, love, fame, or what not, it will become fixated; […] the fixation of "sensory conditioning" is very resistant to extinction. As fixation takes place, the perceptual hypothesis grows stronger not only in the sense of growing more frequent in the presence of certain types of stimulation but also more perceptually accentuated. Perceptual objects which are habitually selected become more vivid, have greater clarity or greater brightness or greater apparent size [4, p.105].

This argument is correlated with the hypotheses about neuronal mechanisms relating to learning. We learn mainly “under the supervision” of emotions. We learn what offers some *positive consequences* instead of absorbing everything we are faced with.

B. Korzeniewski explains that the “neuronal drive structures” continuously signal the central “evaluative factor” in the brain – the reward system – whether they are stimulated or not. By giving higher priority to the appropriate synaptic connections (reducing their excitability threshold), this system boosts (or increases the throughput of) the associative structures whose development or activation was associated with satisfying a particular drive; it can also inhibit (block) these associative structures by reducing the priority of connections as soon as the drive is satisfied. In the present state of research, it is difficult to clearly identify the overall “evaluative system” in the brain.

It is commonly associated with the dopaminergic system, or a network of neurons extending all over the brain, whose axons are known to release a neurotransmitter called dopamine. Dopamine is released after a specific drive is satisfied (hunger, sexual intercourse), which is accompanied by pleasure. There is also the noradrenergic system (linked with a neurotransmitter called noradrenalin) that has an excitatory effect on most of the brain. In very many neurons, the noradrenergic system adds an additional excitatory signal to the combined signals at the base of the axon, thereby accelerating the brain function and the response to a specific situation. The serotonin system overlaps with the former two systems and is responsible for the regulation of the mood [16, pp. 82-87].

Emotions also perform a specifically existential function. By that I mean the way emotions unveil the surrounding environment and the consequences of this perception for ontological decisions. Some of them make us perceive the world as “hostile”, “abhorrent”, or “important”. The object perceived is directly seen as “extrinsic” for the subject, either threatening or obnoxious. Emotions connect us with the world (and with ourselves as a psycho-physical entity) in a way which is particularly drastic, primal and completely different than the testimony of cognitive perception or progression, which is particularly visible when something happens to the subject, when something is imposed on the subject, or if the subject is troubled by something.

> In this happening, imposing, or troubling, the adversity demonstrates the importance of reality that the subject is not capable to oppose. This real being is “given” in a way that any skeptical or idealistic questioning of reality is silenced [13, p. 236].

Moreover, an emotion has the power to make the subject distinctive (in a way that the sensual or conceptual data do not) and to identify the subject as an important one (in terms of time allocation and the actions taken).

It may be said that through emotions, the subject’s concern about himself, arising from the perception of the world as strange and unfriendly, provides the basis for future ontological distinctions, and in particular for the various forms of existence. One may conclude that, without emotions, the subject would not be able to conceive the idea of the world as something different (than the subject himself).

The Cotard delusion is an interesting case to exemplify the significance of the subject. This is a mental illness that generates a strong, non-modifiable delusion of non-existence, of being dead, or loss of some parts of the body.

> [...] in subsequent stages (of the Cotard delusion) patients start denying their own existence, some of them cannot even use the personal pronoun "I". One patient referred to herself as "Madame Zero", stressing her absence, while another patient of Doctor Anderson’s said about himself: "There is no use for this. Wrap it and throw it in the trash [9, p. 47].

Humans perceive and think, but they cannot access the emotional thetics I mentioned earlier.

However, the emotional system has many more functions to fulfill. Let us investigate the case of the Capgras delusion. It reveals an emotional unity with the world in the aspect of “being known”, it also has a fundamental meaning for recognizing the identity of specific individuals (including the subject himself). The Capgras delusion is where a person holds a delusion that they are not themselves, but their identical-looking impostor, or that relatives (or other acquaintances) look the same, but are strangers.

This delusion demonstrates that the perception itself, remembering a person or an object, is trapped in the emotional recognition of the “known”, which has consequences for the acceptance of the person’s identity (as my wife, my kids, or finally myself as me). The perceptive system functions properly, just like the conceptual system (individuals with the Capgras delusion agree that the “impostors” look exactly like their relatives or themselves).

Therefore, perception, the conceptual system (and memory) are not enough to identify somebody or something. Apparently the subject not only has to determine the general “what” but also that this something is *hecceitas* for the subject. Perhaps there is no point in remembering the individually of this tomato, but it worth to remember that I live here. I think the scope of this thesis can be extended to the entire surrounding that we perceive using the emotional categories: known or foreign. If this system fails, I will not recognize myself as myself and I will not recognize my child as mine. Wittgenstein was (partly) wrong. Yes, I do not learn that I am myself – I learn myself.

6. Kinds of Emotions

Finally, I would like to present three types of emotions and their cultural setting. There is no defined, universally accepted categorization of emotions (even in terms of basic or primary emotions). S. Tomkins identifies eight basic emotions (anger, interest, contempt, disgust, distress, fear, joy, shame, surprise), P. Ekman – six emotions (anger, disgust, fear, joy, sadness, surprise), R. Plutich created a wheel of emotions in which mixed and new emotions emerged, whereas D. Evans slightly modified the meaning of emotions to distinguish between joy, distress (not sadness), anger, fear, surprise, and disgust.

Moreover, there are multiple and vague names of emotional states: affections, feelings, agitation, moods [see 25] or passions.

In general, emotions presented in this approach will be addressed in the context of adaptive problems, and they will vary depending on the problem they solve – struggle for existence (e.g. fear), winning or keeping a partner (e.g. envy), children upbringing (concern), family relations (e.g. boredom), references to other members of the community (e.g. anger), position in the community (e.g. pride), and acquisition of knowledge (e.g. curiosity). These are the most general frameworks of emotions. In another sense, I distinguish (as above) a full emotional episode (s-emotion or stricte-emotion) provided that it consists of the following: informative estimation, feeling, behavior, physiological changes, expression, and the neuronal "executor". A quasi-emotion is where behavior, expression, or even feelings are missing.

Also, humans (and only humans) experience not only emotions, but also something that may be referred to as super-emotions. They cannot only be amazed (surprise) when their expectations are not fulfilled, they also experience super-emotions when they are amazed by the mere fact that the world exists. They are not only bored by the repeatability of daily activities, they can also be bored with life itself, experienced through adaptive emotions. They are not only curious to get to know the surrounding environment for practical reasons but also with "the way everything connects with everything else". There is another classification of emotions into adaptive emotions and superadaptive emotions.

Emotions are characterized by sign, content, and object, but most importantly they constitute the meaning (significance), which involves various levels of *intensity* measured by qualitative experience (feeling) and behavior. In terms of duration and intensity, emotions are classified into affective emotions, which are intensive and short (up to 0.5 s), proper emotions (intensive, lasting from 0.5 s to 4 s, according to P. Ekman), moods (background emotions) that are permanent, weak, and change from positive to negative and vice versa. Elevated mood translates into mania (up to 6 months) or depression (up to 6 months). Finally, there are passions and obsessions: intensive and ultra strong[1] emotions that may continue for many years.

The power (intensity) of emotions is to a greater or lesser extent essential to recognize the richness of "shades" of emotions[2]. A separate issue (which I will not discuss here) is the question of emotional disorders, which we may interpret analogously to disorders of other aspects of the mind (related to perception, memory, or intellect).

Nomenclatures for the classification of emotions and the resulting cultural background may be the source of difficulty.

Are St. Thomas' "passiones" equivalent to emotions? Their meaning is determined in conjunction with the category of "sensitive appetite" and the "irascible faculty". Are these appetites equivalent to contemporary motivations? I believe that this is not just a scholastic problem. A. Wierzbicka argues that the words denoting emotions are culture-bound, and there are no emotion-related notions among universal concepts [34, pp. 1-23]. She also explains that a large share of psychologists, such as P. Ekman or C. Izard, indiscriminately use the English language to name basic emotions. However, are the words anger, "gniew" (in Polish), "Wut", or "colère" equivalent? Moreover, in her book *Unnatural Emotions*, C. Lutz explains that the term "emotions" should also be deconstructed. Using this term in everyday language and in the language of science, C. Lutz posits, strictly depends on the social network. "Emotion" has no essence: it is universal, natural

rather than cultural, it carries an intensive meaning, it is unimaginable, unquantifiable, and irrational. This is not just a "label" of something taking place inside. C. Lutz does not claim that there are so-called "social emotions" (directed at other people) or that emotions are subjected to social influence. The very idea of emotions, she explains, is a type of social construct. "And while emotions are often seen as *evoked in* communal life, they are rarely presented as an *index* of social relationship rather than a sign of a personal state" [18, p. 4]

When emotions are de-essentialized, they can be captured as a cultural and interpersonal process of naming, justifying, and convincing in interpersonal relations. The emotional meaning is a social product rather than an individual one, "an emergent product of social life". *Unnatural Emotions* is an attempt to show how emotional meaning is fundamentally structured by individual cultural systems and the physical surrounding. The claim is made that emotional experience is not precultural but *permanently* cultural. The complex meaning of the emotional dictionary can be attributed to its importance of expressing human values, social relationships, and economic circumstances. Speaking of emotions is speaking about society, about power, politics, relatives, and marriage, about normality and deviations.

However, with respect to the above, if emotions are a cultural product, the issue arises as to whether animals (non-cultural, but socialized) are emotion-less? Don't newborns or deaf-mute people feel emotions? J.Panksepp and J.Burgdorf observed that young rats emitted ultrasonic sounds while playing (50 kHz). This chirping could be heard only when rats were playing or received rewards. When the rats were tickled, the chirps were even more audible [23]. Were they showing emotions?

> Panksepp believes that it would not be anthropomorphic to say that the young rats were laughing, and their reactions reflect the positive effect, an evolutionary prototype of human joy, an equivalent of simple laughter of social character observed in babies when they play [19, p. 29].

The "meaning" of emotions in the cultural aspect and the function of culture itself (if any) are unclear.

And how are some emotions recognized across different cultures? When emotions are analyzed from the cultural approach, it is not entirely impossible to translate (be it only a rough translation) the emotional nomenclature used by various communities, or the intercultural recognition of emotions.

When analyzing the basic emotions of anger, disgust, fear, happiness, sadness, and surprise, and their equivalents in the Malay language: *marah, bosan, takut, gembira, sedeh*, and *hairan*, Boucher and Barndt demonstrated that both cultures were able to correctly identify situations of fear and joy (80 percent compliance) but were less skilled in recognizing anger (53 percent compliance) [3, p. 274].

It is worth noting that the emotion recognition rates were relatively high if we assume that emotions can be a cultural construct. In a study by K. R. Scherer conducted in thirty seven countries worldwide, seven basic names of emotions were identified, such as fear, disgust, joy, sadness, anger, guilt, and shame [28].

Here are apparent differences across cultures in the frequency with which emotions are expressed, discussed, and the extent to which emotions influence behavior. In the Western culture, emotions are to a large extent outside volitional control but are essentially allowed to be expressed, whereas in Japan, many emotions and states of the body are cultivated or controlled, depending on the circumstances.

Of course, there are many emotions specific for particular cultures, but in essence they are translatable. For example, Lutz translates the emotion of ker found in Ifaluk as "happiness/excitement". P. Ekman demonstrated that the major cultural differences lie in the public expression of feelings. Some emotions can be identified without any training, some can only be recognized in a cultural context. There is nothing strange about this.

7. Conclusion

Taking into account the general considerations outlined above, a stipulative definition of "emotion" can be coined. I understand the term "emotion" as a complex phenomenon accurately (reliably) describing the (anticipated) state of affairs, which is reliable in terms of the state of the subject and specific "points of adaptation" (standards). "Emotion" is functional, it emerges automatically (involuntarily), it is difficult (or hardly possible) to control and is (to some extent) influenced by culture.

Emotions go hand in hand with perceptive, intellectual, and memory processes; the beneficiaries of emotions are the subjects of emotions and, to put it metaphorically, the replicators when considering the final element of maintaining stability in nature. Emotions also perform existential, identifying, calibrating, and motivating functions.

Emotions capture the world as either positive or negative, important or unimportant, and are used to determine and assign weightings (prioritize). They are a kind of *gestalt* from the cognitive perspective (at the level of conscious feelings), actions (behavior), physiological changes, expression, and the executor (the nervous system).

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Notes

1. The notion of "passion" has been used in psychological literature in the context of love and love-related emotions, such as desire or envy. Generally this expression is used to describe the initial phase of love or infatuation, a specific form of psychosis (Bilikiewicz 1989). In the historical context, passion also meant the lust for power, hazard, greed.

What are the characteristic features of passions? To name just a few:
Intensity (highly intensive), irresistibility (impossible to ignore), insatiability, self-confirmation and wishful thinking, sharp decline in the case of love, certainty of accomplishing goals, limited controllability. W.Łukaszewski, [in:] Namiętności, Smak słowa, Sopot, 2011, pp. 14-21.
Anger: fury, outrage, resentment, wrath, irritation, indignation, spite, hostility, pathological hatred, madness.
Sadness: despair, anguish, melancholy, self-pity, despondency, gloom, deep depression.
Fear: alarm, apprehension, nervousness, concern, dismay, distress, uneasiness, intimidation, anxiety, dread, panic; in psychopathological form – phobias and panic attacks.
Content: happiness, pleasure, relief, blissfulness, bliss, joy, fun, entertainment, pride, sensual pleasure, pleasant thrill, ravishment, delight, satisfaction, euphoria, satisfaction of whim, ecstasy, and an extreme emotion – mania.
Love: acceptance, fondness, trustfulness, kindness, closeness, devotion, attractiveness, infatuation.
Surprise: amazement, astonishment, bewilderment, wonderment.
Disgust: contempt, scorn, unfriendliness, revulsion, loathing, distaste, aversion.
Shame: guilt, embarrassment, awkwardness, guilty conscience, humiliation, regrets, disgrace.

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