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# Mammals Would Not Exist Without Secondary Emotions: Analysis of the Phenomenon Emotion from the Darwinian Prism

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**Abstract:** Psychology proposes that secondary emotions are exclusively human since they are the result of the combination of primary emotions during the superior social interaction characteristic of our species. They base this conclusion on the fact that secondary emotions do not innately modify our bodily appearance when we express them. In this review we analyze the secondary emotions, according to the particular role they play in the framework of the systems that allow us to maintain homeostasis, with the purpose of pointing out that, against the criteria of psychology, three types of emotions could exist in mammals inalienable to life and consequently innate: Vital-Indicative Emotions, will guide the subject on the vital need that needs to be satisfied; Sensations-Emotions Evaluative (punishment-reward), are ascribed as a somatic marker to all our knowledge and learned behaviors to indicate their greater or lesser degree of suitability to satisfy the requirements of life within the framework of certain conditions and Motivational Sensations-Emotions, they make us feel the interest, the need or the desire to undertake actions aimed at the survival of the species. From this new classification, we examine the evolutionary reasons why secondary emotions would appear, which has allowed us to conclude that it is very likely that many of the emotions that psychology considers secondary could be innate, although they do not innately modify our bodily appearance when expressed, because without them mammals would not exist.

**Keywords:** Indicative Emotions, Motivational Emotions, Innate Secondary Emotions, Evaluative Emotions, Evolution of Secondary Emotions

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## 1. Introduction

Psychology categorizes emotions in primary and secondary depending on whether or not they innately modify body appearance [1, 2] because social interaction is considered the main reason why they exist. But when we think of emotions as essential parts of the response systems that allow us to maintain homeostasis, doubts arise about whether this classification is adequate because from the Darwinian point of view it could be wrong not to consider a basic emotion for the existence of the species as a primary emotion.

The purpose of this work is to contrast the biological-evolutionary reasons that would cause the emergence of secondary emotions to the specific functions they perform within the framework of the systems that allow us to

maintain life, in order to show that some secondary emotions could be inalienable to survival in mammals and consequently innate.

With this article we intend to make visible the need to investigate the neurophysiological relationships and the genetic roots of secondary emotions, since these could be key to understanding animal and human behavior.

## 2. Main Text

### *2.1. Emotions Are Part of the Behaviors That Allow Us to Interact with the Environment to Comply with Vital Functions: We Share Emotions with Other Mammals*

Emotions arise from very old subcortical structures that evolved before various cognitive abilities, thus they are much more widespread than the intellect [3, 4]. They appeared to

regulate adaptive behaviors, they are rapid information processing systems that allow to act with a minimal participation of thought [5, 6] exactly the type of mechanism that would allow those who do not have great cognition satisfactory to interact with the environment.

How do they work? Internal states that intervene between perceived (biologically relevant) stimuli and subsequent responses are considered, causing changes (in the mind and body) that enhance the action, giving rise to different behaviors in charge of responding to internal, environmental and social situations [7-10].

Consequently, if we have inherited a brain that regulates its interaction with the environment through emotions, it is illogical to think that those who evolutionarily preceded us do not have homologous networks for this same purpose [11], especially when it is not even necessary the conscious perception of the situation so that the emotion does its job [12, 13].

## **2.2. Relationship Between Emotions and Behaviors: Vital Behaviors and Emotions**

Some authors think that behavior causes emotion, others believe that emotions are part of behavior and a third group considers that emotion causes changes in behavior [14]. This could be due, respectively, to the fact that the behaviors we use are evaluated with a punishment-reward emotion depending on whether or not a vital function has been fulfilled. That emotion would ascribe to the behavior as a somatic marker and then it would indicate if such behavior is the most appropriate to interact with the environment in the framework of a similar situation [15-18].

On the other hand, there are authors who think that emotionality occurs with positive or negative valence (joy or sadness) [19] to identify the suitability of our actions while others believe that contrary emotional states can occur at the same time protected by the existence of mixed feelings [20]. Predictably there is no contradiction because the latter could be due to the fact that the emotional system is used individually by each vital behavior to punish or reward the performance of the subject in relation to the function that each of them is in charge of [21]. Thus an action such as ending a relationship can produce unhappiness if we are in love (intervention of the Mating behavior) and relief if it was with a wasteful person (intervention of the Selfish Gene behavior).

The life of mammals and birds requires the fulfillment of a set of vital tasks such as feeding, self-protection, mating, raising offspring, escaping from dangers, etc. These functions are the responsibility of innate neural systems, extensive networks that associate environmental stimuli with the needs of the subject, with the corresponding emotions, and with the actions that will satisfy those needs. These complex innate neural systems are the vital behaviors. When a stimulus is perceived, it activates the vital behavior that would generate changes in the endocrine, autonomic and muscular systems that are the origin of our emotions [22, 16, 23]. This is the beginning of the behavioral response.

## **2.3. Predictable Networks Yield to Vital Behaviors and Related Emotions**

### **2.3.1. Non-social Vital Behaviors**

The hypothalamus is responsible for the motivation towards ingestion, copulation, attention, attack, flight, sexual behavior, feeding, thermoregulation, reproduction, sleep and wakefulness, among others [24-28, 18]. In addition to fight-flight, the amygdala is responsible for regulating sexual behavior, aggressiveness, and the satiety response [29].

### **2.3.2. Vital Social Behaviors**

Maternal behaviors are activated from nuclei such as hypothalamic ones [30 activating attachment-affection emotions [31]. The behaviors that make coexistence possible use emotions related to the anterior cingulate cortex such as: pride, arrogance, submission, modesty [32] shame, guilt [33] and gratitude [34].

## **2.4. Parts of Vital Behaviors**

### **2.4.1. The (IR) Reference Information**

In the case of primates, the neural system that detects and responds to the stimulus innately has very general information about the things, subjects or phenomena that should activate it. The Fear-Flight behavior is activated by great heights, pain, spiders, narrow spaces, snakes, etc. [35]. This is the reference information because it is the information that refers to the signal stimulus that must activate the vital behavior.

How would it work? In mammals, the IR (reference information) would be the neural network that builds the representation of the signal stimulus, both when we perceive it and when we remember it, but which, unlike other networks with the same function, would be innately connected to vital behavior. This connection is what would make it possible that when the signal stimulus (the spider) is perceived, the IR network is immediately activated and shortly afterwards the vital behavior is activated, which would generate the emotion of fear and activate the action of fleeing.

Innate IR is very basic, for example, baby tota monkeys (*Chlorocebus aethiops*) activate the alarm for aerial predators indiscriminately, even when they see a leaf fall [36].

### **2.4.2. The Actions**

In addition to reflexes, neonatal birds and mammals have some very elementary action patterns (motor programs), so much so that during their implementation the cerebellum has to rectify and organize the motor sequences that compose them in order to adapt them to the environment [37]. For example, the flight of birds is due to the development of ontogenetic processes and motor learning [38].

### **2.4.3. Complementary Behaviors in Mammals**

Because at birth the information (IR-actions) that our vital behaviors have is so reduced and basic, subjects are unable to fend for themselves, this creates the need for these behaviors to be complemented by learning. Thus complementary

behaviors would arise, which will ensure that the vital behavior is activated with all the direct or indirect variants that can be perceived or intuited from the signal stimulus. And that they will execute an action capable of responding to any of these variants, adapting to the specific context in which each stimulus has to be interacted with.

If the vital behavior is in charge of the function inalienable to life, the complementary behavior is the one which would do the work thanks to the diversification of IRs and actions.

#### **2.4.4. The (IR) Reference Information We Learn**

With experience, knowledge associations are built from our memories, associations of networks that elaborate representations [39] which allow us to see in images the relationships of spatial and temporal continuity, the basis of the causal relationships, that are established among our vital functions and each of the objects, phenomena and individuals in the environment and the spatio-temporal continuity relationships that they establish among themselves [40, 41, 42]. In this way, tota monkeys refine their "concept" of aerial predators until they manage to limit it to eagles [36]. This is enriching and diversifying the different types of IR.

#### **2.4.5. Types of IR**

(a) Internal IR: reflects vital needs through sensations and emotions (hunger, sleep, pain, thirst, cold, fear, selfishness, sadness, lust, anger, curiosity, concern, affection, etc.). (b) External IR: physical, causal and spatiotemporal information of the characteristics about the signal stimuli that can contribute or hinder the fulfillment of a vital function. (c) Context IR: offers physical, spatio-temporal and causal information about everything that can surround the signal stimulus at the time that it is necessary to interact with it.

#### **2.4.6. Association of the Three IRs**

Neurons in the posterior insula make up the interoceptive representation of internal IR [43-45]. The anterior dorsal insula, through the anterior cingulate, is part of a cognitive network and the anterior ventral insula, also through the anterior cingulate, is part of a social cognitive network. Both networks are connected to the interoceptive posterior insula [46, 47]. This connection would make possible the association between the internal IR (vital needs) and all our knowledge about signal stimuli, social or not (external IR) and all the knowledge about the environments in which we will have to interact with them (IR of context).

For example, sacred baboons (*Papio hamadryas*), when deciding where to drink (thirst-internal IR), take into account where there may be water (external IR), the probable presence of predators and the distance (context IR). If they believe that there will be predators in the nearby watering hole, the activated behavior is the one that leads them to the waterhole that is less close [48, 49].

#### **2.4.7. The Actions We Learn**

Cognition, by trial and error, copying or intuition develops knowledge (association of representations) about what to do to find food and how to access it or how to turn competitors

into friends. Motor programs are integrated into these, thus configuring the actions.

For example, Thorndike's cat developed, by trial and error, the knowledge (action) that allowed him to get out of the cage. Imo, a macaque from the island of Koshima (*Macaca fuscata*), found that by submerging sweet potatoes in thermal water they were ready to eat within seconds [50]. Male chimpanzees (*Pan troglodytes*) learn that by regularly grooming the alpha subject they allow them to have sex with females in heat [51].

#### **2.4.8. Complementary Behaviors Are Integrated into Vital Behaviors**

Because when mammals, especially primates, are born, we are so devoid of useful information for life, IR and innate actions would be specially qualified to associate with learned information of their kind. Therefore, the two parts of the complementary behaviors (IR and learned actions) would be integrated separately to the corresponding part of the vital behavior related to them.

#### **2.4.9. Integration of the IR Learned to the Innate IR: Integration of Learned to Innate Actions**

When an electric shock is applied to a rat it experiences pain (innate external IR of the vital behavior Fear-Flight) and consequently feels fear (internal IR). By associating the sound of a bell (cause) with the electric shock (effect), the activation of the Fear-Flight behavior of the rat can be achieved without the need to apply the electric shock [52, 45]. This would indicate that the learned IR (sound of the bell) was associated with the innate external IR (pain) and thus became capable of activating the vital Fear-Stillness behavior of the rat by itself [45]. The learned IR only integrates with the innate IR to which it is related. For example, sound and light stimuli cannot be associated with smells and tastes that cause nausea [53].

The training of circus animals associated with rewards link the action that the subject must execute to the innate actions of vital behavior Nutrition. Proof of this is that animals cannot learn behaviors aimed at getting food if they include actions that push it away before bringing it closer [54, 55].

#### **2.4.10. Integration of Learned Complementary Behavior in Innate Vital Behavior**

In adult tota monkeys, the representation of the eagle (learned external IR) is associated with the innate external IR, a flying thing that falls and the learned action, launching instantly from the top of the tree to the branches at the base, is associated with the innate action of flight [36]. Thus, the image of the eagle manages to activate the Fear-Flight behavior that activates the action of jumping to the lower branches.

This system of complementary behaviors integrated into vital behaviors is the one that predictably allows us to interact with the environment. Now we have to expose the role that emotions would play in it.

### **2.5. The 3 Functions That the Emotions Could Perform in the Framework of the System That Allows Us to Meet the Vital Needs**

#### **2.5.1. The Evaluative Emotions (of Punishment-Reward)**

How does the individual know that a certain reference information and a specific action (complementary behavior) are adequate to interact with a signal stimulus in a specific context to fulfill a vital function? Imagine that Thorndike's cat had no information to indicate that a certain sequence of movements was what allowed him to get out of the cage. He would have had to start from scratch every time he faced the problem, to solve this evaluative emotions would arise.

Evaluative emotions give meaning to our complementary memories, knowledge, beliefs, values (IR) and behaviors [56]. How do they do that? The vital behaviors would activate the mesocorticolimbic dopaminergic network to gratify or repress us, through sensations-emotions, depending on whether the memories, knowledge, values (IR) and complementary behaviors used in the action have satisfied or not the vital need of which they take care of. This emotional information is ascribed to these knowledge and behaviors in the form of a somatic marker in order to guide the motivational system in the future about whether or not they should be used again in the framework of a specific situation. [15, 57, 58, 17]. For example, the difficulties in impulse control, characteristic of psychopathy, are a consequence of the fact that continuous dopaminergic stimulation makes it impossible for the punishment-reward system to impose a negative somatic marker on certain inappropriate behaviors [59]. Somatic markers make culture possible, understood as the transmission of behavioral norms, and consequently social life [60].

#### **2.5.2. Relationship of Vital Needs That Would Cause the Emergence of Evaluative Emotions-Sensations (Punishment-Reward)**

1. Vital necessity: That mammals feel bad and uncomfortable when something, individual or phenomenon directly or indirectly hinders the fulfillment of a vital function, or when their way of proceeding does not contribute to it. With this, it is achieved that the evaluative emotions become a somatic marker that indicates to the individual what things, subjects and phenomena should avoid and that also indicates that learned behaviors are not adequate to fulfill a vital function within the framework of specific conditions [15, 57, 58, 17]. Emotion-sensation: Suffering, dissatisfaction, pain, annoyance, discomfort, grief.
2. Vital necessity: That mammals feel good and at ease when something, individual or phenomenon directly or indirectly facilitates the fulfillment of a vital function, or when their own way of proceeding contributes to it. When this information becomes a somatic marker, it will indicate what things, subjects and phenomena should be sought and what learned behaviors are adequate to fulfill a vital function within the framework of specific conditions. Emotion-sensation: Ecstasy,

delight, pleasure, satisfaction, well-being. [61, 15, 57, 58, 17].

#### **2.5.3. Motivational Emotions**

To save energy most of the time, while we cook, shower, eat, work, drive or talk, the interaction with the environment occurs in Automatic Pilot mode [62]. How does the brain tell us when and where to perform a certain complementary behavior? This is the task of motivational sensations-emotions.

Vital and evaluative emotions prepare the body for action but do not produce it [63, 64], this is what motivational emotions take care of. How do motivational emotions work? The somatic marker that the punishment-reward emotions impose on all knowledge (IR) and complementary behaviors guides the motivational system when activating the sensations-emotions that make the subject need and want to put them into practice [15, 16, 17, 18]. For example, when the scent of the fox triggers fear in the interoceptive posterior insula of a mouse, the information is sent via different routes to the amygdala and ventral striatum. When the perception of fear activates the pathway that leads from the insula to the amygdala, the Fear-Still behavior is activated and the mice stop eating, exploring the territory and having social contacts. But if at the same time the pathway that leads from the insula to the ventral striatum is deactivated, the mice continue to eat [65, 45]. This would indicate that, although the behavior is activated, if the motivational system does not generate the sensation-emotion (need-desire), this behaviour is not executed.

#### **2.5.4. Relationship of Vital Needs That Would Cause the Emergence of Motivational Sensations-Emotions**

1. Vital necessity: That mammals feel the need, interest and desire to perform different behaviors in order to make life possible, both when doing so produces pleasure and when it does not. Emotion-sensation: Need, desire, interest [65, 45].
2. Vital necessity: That mammals lose interest in things, individuals, matters, phenomena and activities that steal their time without contributing anything. Emotion-sensation: Apathy, indifference [66, 67].
3. Vital necessity: That mammals feel that it is possible to achieve difficult things that are far from their possibilities because in many cases the conditions of the environment can be very adverse for subsistence. Emotion-sensation: Optimism [68].
4. Vital necessity: The vast majority of the time the threats or the why of something are not discovered, nor are the good results obtained the first time, nor the second, nor the third, so it is necessary that mammals do not stop trying until they get to fulfill the vital task. Emotion-sensation: Obsession [69].
5. Vital necessity: That mammals need and want to stop doing something (even if it is important) when after a reasonable time it is found that there is no way to achieve it. Emotion-sensation: Fed up, frustration, disappointment [70-72].

6. Vital necessity: The importance of rest makes it rewarding and, consequently, appealing. So a motivational feeling is required that makes the mammal want and need to get out of inactivity. Emotion-sensation: Boredom [73].
7. Vital necessity: That the mammal makes a supreme effort when he/she is in an extreme situation. Emotion-sensation: Despair, stress [74, 75].

#### 2.5.5. *The Vital Emotions*

We have already described the systems that indicate through emotions which is the appropriate complementary behavior and when and where it should be carried out. But how does the subject know what he has to do? This, predictably, is the function of vital emotions.

They are directly linked to vital functions and the behaviors that are responsible for fulfilling them. The perception of a signal stimulus activates systems located in the brain stem, hypothalamus and amygdala that send orders to other emotion-inducing systems that in turn generate changes through the emission of monoamines and peptides that modify the musculoskeletal and visceral states and trigger certain behaviors such as mating, playing or crying [76]. These vital emotions-sensations: fear, cold, curiosity, thirst, selfishness, anger, compassion, hunger, worry, loneliness, and affection indicate to the individual such vital needs must be satisfied [43-45].

#### 2.5.6. *Relationship of Vital Needs That Would Cause the Emergence of Vital Sensations-Emotions (Indicative)*

1. Vital necessity: That mammals hoard for themselves everything that can be used to directly or indirectly fulfill a vital task: territory, food, couples, drinking troughs, friends, shelters, etc. Behavior: Selfish Gene. Emotion: Selfishness, territoriality [77], envy, jealousy [78].
2. Vital necessity: That mammals fight to acquire, maintain or recover everything that allows them to fulfill a vital task. Behavior: Anger-Attack. Emotion: Anger, annoyance, rage [79].
3. Vital necessity: That mammals avoid dangers and protect themselves from everything harmful. Behavior: Fear-Flight and Fear-Stillness. Emotion: Fear, panic [80, 81, 82].
4. Vital necessity: That mammals focus their attention insistently to where and when dangers or harmful circumstances may appear throughout the duration of the threat. Behavior: Concern. Emotion: Uncertainty, anxiety [83].
5. Vital necessity: That the mammal immediately focuses its attention on a stimulus (object, subject or phenomenon) that appears surreptitiously and suddenly. Behavior: Shock. Emotion: Surprise [84].
6. Vital necessity: For mammals to explore the environment (physical and social). Behavior: Snooping. Emotion: Curiosity [85].
7. Vital necessity: That mammals are pleasantly attracted to certain characteristics of the environment (because they could be synonymous with good conditions for life) and of the opposite sex (because they could mean good genes). Behavior: Admiration. Emotion: Enchantment [86].
8. Vital necessity: In a world full of dangers and competitors, it is necessary for the mammal to distrust, even of what is seeing. Behavior: Distrust [87]. Emotion: Disbelief.
9. Vital necessity: During early childhood, learned motor sequences need to be reorganized and polished by the cerebellum [37], in addition, muscles need to be strengthened. Behavior: Play. Emotion: Fun. [85].
10. Vital necessity: In mammals it is necessary for the young to learn by copying what their parents do. Behavior: Imitation [88, 89]. Emotion: Copy.
11. Vital necessity: That at the moment when the conditions for life become extremely adverse, the vertebrates capable of traveling great distances migrate. Behavior: Migration [90]. Emotion: Burden. [91, 92, 93].
12. Vital necessity: That constantly moving or migrating vertebrates and later social mammals protect themselves from dangers by taking advantage of the group as a refuge. Behavior: Gregarious.[94]. Emotion: Loneliness [95].
13. Vital necessity: Prepare vertebrates for hibernation-estivation by reducing their interaction with the environment, canceling the gratifications of the reward system, reducing their vital energy and self-confidence. Behavior: Depression-Catatonia [96]. Emotion: Sadness [97, 98].
14. Vital necessity: Reactivation of vertebrates after hibernation-estivation. Behavior: Mania. [96]. Emotion: Joy, euphoria [98].
15. Vital necessity: That endotherms reproduce without the emotions that bind them to make mating possible keep them together for life, since this would cause very little genetic diversity to be created. Behavior: Mating. Emotion-sensation: Lust [85, 6], love [86, 99].
16. Vital necessity: Saving on reproductive investment offers great advantages, but for them it is necessary that the parents take care of and protect the offspring, whether they are eggs or live births. Behavior: Maternal instinct [100]. Emotion: Compassion [101].
17. Vital necessity: For when it is necessary, to ensure that the endothermic parents remain united during parental care, also so that the parents remain united to the offspring and vice versa. Behavior: Attachment [102, 103]. Emotion: Affection.
18. Vital necessity: For parents to be able to keep their young children safe from themselves, it is necessary for them to feel superior so that they can impose themselves and for us to live in society, someone in command is needed. Behavior: Alpha. Emotion: Arrogance [104, 105].
19. Vital necessity: For parents to be able to keep their children safe from themselves, they must submit to

parental decisions, and for us to live in society, we must submit to power. Behavior: Beta. Emotion: Submission [106, 105].

20. Vital necessity: Infant mammals would not learn the rules of conduct that will keep them safe, nor those that allow them to live in society, if they did not feel guilty when they were reprimanded for doing something inappropriate. Behavior: Culpability. Emotion: Shame, regret [107].
21. Vital necessity: The coexistence of father (authority) and son (submitted) generates friction and conflicts that would make it impossible if there were no feelings in the children that compensate for the imbalance of power. Behavior: Gratefulness [108]. Emotion: Gratitude.
22. Vital necessity: That young people in their physical peak feel able to challenge adults in order to get hold of the goods (territory, food, sexual partner, social hierarchy, shelter, etc.) that the parents enjoy. Behavior: Irreverence. Emotion: Pride, self-sufficiency [104, 109].
23. Vital necessity: Acquisition of energy resources. Behavior: Nutrition. Emotion-sensation: Hunger, satiety [110].
24. Vital necessity: That mammals do not eat and reject what can cause them harm. Behavior: Aversion, disgust. Emotion: Asco [111, 112, 113].
25. Vital necessity: Ingestion of water. Behavior: Hydration. Emotion-sensation: Thirst [6].
26. Vital necessity: That terrestrial vertebrates maintain the optimum temperature at all times. Behavior: Thermal regulation. Emotion-sensation: Cold, heat.
27. Vital necessity: Recovery of physical condition. Behavior: Laziness. Emotion-sensation: Fatigue [114, 115].
28. Vital necessity: Remove residues. Behaviors: Excretors. Emotion-sensation: Urination, defecation.
29. Vital necessity: Endothermic vertebrates self-groom whenever it is necessary. Behavior: Grooming. Emotion: Coquetry.

In line with studies that describe secondary emotions in animals [116-119], the analysis of the phenomenon emotion from the evolutionary prism reveals that many of the emotions that neuropsychology considers secondary could be inalienable to life in mammals and consequently innate; although they do not innately modify body appearance.

## **2.6. Reasons That Suggest That Some Secondary Emotions Should Be Innate**

### **2.6.1. The Role of Emotions**

When a list of primary emotions is made based on their innate ability to modify body appearance, it is because it is believed that social interrelation, through empathy, is the reason why they exist and, consequently, the main function of emotions. From the evolutionary prism, could this be so?

### **2.6.2. Reasons Why the Primary Emotions Would Appear and the Circumstances That Would Make Them Acquire the Ability to Modify Body Appearance**

It is mostly considered that we share primary emotions with other species [120-124, 117].

Anger and fear: Showing that you are willing to fight or flee avoids countless unnecessary confrontations [125, 126], which is of great importance for the preservation of the species [127]. This would be the reason why, attached to the Fear-Flight and Anger-Attack behaviors, the ability to modify body appearance would appear. These vital behaviors in mammals are related to homonymous emotions.

Disgust: The contagion of the expression of disgust is an important warning sign to other individuals in the same population that there is something they should not try to eat [128-133, 11].

Surprise: The contagion of the expression of surprise allows the rest of the members of the population to react in time without the need to directly perceive what has caused the surprise [128-133, 11].

Happiness and sadness: These emotions appear to be linked to Depression and Mania behaviors [98]. Later, to make long-term parental care possible in mammals, they would acquire the ability to express themselves, since this indicates to the parent the state of the offspring, making social interaction possible [134].

Although anger, fear, disgust and surprise transmit information to others, the fact that they are present in non-social species [120, 123, 124, 117, 118], evolutionarily much older [135], would indicate that they would not appear to make social interrelation possible. Joy and sadness would not even arise for this purpose and would acquire the ability to express themselves later. Consequently, from an evolutionary perspective, it is incongruous to make a list of primary emotions based on their ability to express themselves.

### **2.6.3. The Main Function of Evaluative and Motivational Sensations-Emotions**

Motivational and evaluative emotions-sensations (punishment-reward) do not innately modify the musculoskeletal system, neither do they prepare the body for action and, although evaluative sensations guide the subject about what to do, they do it in an indirect manner. Consequently, the main function of the evaluative sensations-emotions could be to impose a somatic marker on all our knowledge and learned behaviors and the main function of the motivational sensations-emotions could be to make the subject want and need to execute, or not, these behaviors [15, 57, 58, 17].

### **2.6.4. The Main Function of Vital Emotions**

If the main function of emotions were the transmission of information in order to make empathy and social interrelation possible, it would be expected that, at least, social emotions inalienable to life in mammals such as guilt, submission, affection, gratitude, and arrogance, innately have the ability to express themselves. This does not happen [136].

On the other hand, the ability to recruit energies and

resources is related only to fear [137], anger [138], and lust. And only stress, joy, and sadness are related to long-term empowerment [65]. However, the indicative function is common to all vital emotions.

What makes us think that the main function of vital emotions is to indicate to the subject what is the task to undertake? Adult humans with Klüver Bucy syndrome have damaged amygdala. As a consequence, although they know the things that are dangerous, they do not run away from them because they do not feel fear. Our great cognition makes us know that it is not advisable to enter a tiger's cage. But, how can a macaque without an amygdala know that it is a bad idea to catch a snake, if it does not have the fear emotion to indicate it? It has no way of knowing, which is why macaques whose temporal lobe have been experimentally sectioned, interact with snakes as if they were a plasticine sausage [139].

In the same way that fear indicates that you have to flee, or that cold indicates that you have to take shelter; worry would indicate that we must continue paying attention, guilt would indicate that there is something we should not do again, sadness-depression would indicate that we must stop fighting for life, burden would indicate that we must leave, selfishness would indicate that you have to hoard, curiosity would indicate that you have to explore the environment, affection would indicate that you have to be close to that subject, and so on with all vital emotions-sensations.

### 2.7. Are the Mentioned Secondary Emotions Innate

Some psychologists propose that secondary emotions arise during the socialization process because our great cognition associates primary emotions [140]. This premise presupposes that in other species there can be no secondary emotions. Is that so? Birds and mammals may experience boredom [141], loneliness [142], hunger, frustration, pleasure [143], optimism [144], suffering [145], despair [143], anxiety [146], jealousy [147], grief or sorrow [148], depression [149], happiness [150].

Starting from 6 primary (innate) emotions, how much cognition is necessary to associate in order to build these secondary sensations-emotions? Does a meerkat, a dolphin, a wildebeest or a chimpanzee have that degree of cognition? It seems that this is not the case, which leads us to think that we are probably in the presence of innate sensations-emotions.

Mammals are a lineage that requires prolonged parental care [151], which requires the coexistence of two subjects with their own needs and interests that are often in conflict [152]. Furthermore, social mammals have not stopped being territorial or competing for food [153], yet they share living space without killing each other. In both cases, what would make coexistence possible? That they experience secondary social emotions such as arrogance, guilt, gratitude, submission, pride, shame, compassion and attachment-affection. [154, 155, 156 129].

These arguments make it very difficult to consider, from the Darwinian perspective, that these secondary emotions are not innate.

## 3. Conclusions

1. In line with the work of Buck [155], Bekoff [117] and Bekoff [118], we believe that secondary emotions such as boredom, curiosity, frustration, loneliness, burden, amusement, despair, disbelief, anxiety, grief, selfishness, rapture or jealousy are inalienable to life in mammals, social and non-social, so that they would have to be innate.
2. According to the work of Buck [154], Spoor & Kelly [155], De Waal [129] and Špinka [156] we believe that there is a very important relationship between secondary social emotions and social interaction, but it could be the contrary to what psychology presupposes, since these emotions are the ones that would make possible, first, the emergence of mammals, and later, the emergence of social mammals.
3. For the study of behavior, it could be more convenient to classify emotions into motivational, evaluative (punishment-reward) and indicative (vital) since this classification follows the role they play within the framework of the systems that make life possible.
4. For all the above, a list of primary emotions based on their ability to express themselves might not be the ideal one to face the study of animal and human behavior.

Although this may seem logical, none of this is valid until the neurophysiological correlations and the genetic roots of secondary emotions are investigated. If you allow me, from this magnificent platform I encourage you to develop these types of studies.

## List of Abbreviations

Ir - reference information.

## Competing Interests

The author declares that there is no conflict of interest.

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