

Does farm animals experience emotions and feelings?

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Abstract In recent years, there has been a great increase in the interest of "emotion" and how it can be studied and translated from animals. Emotions arise when the brain receives an external stimulus, while the feeling is a response to emotion and concerns how the individual feels before that emotion. Emotional states do not exist to be locked within an individual. Emotions are expressed in some way and have great importance for the welfare of animals, especially within the farm animal production chains. The affective side of emotions is more difficult to be studied, however, it takes an effort to evaluate what is observable, registrable and measurable: behavioral and physiological measures that may indicate positive and negative emotional states. It is possible to use behavioral and even physiological information to analyze the feeling and, especially, the immediate emotion that triggers it in animals. The aim of this article is to review the concepts and researches on emotions and feelings in farm animals that may be related to the expression of emotions.

Keywords: expression, negative stimulus, positive stimulus, welfare

Introduction

Initially, when we speak of emotional states in animals, it is important to define that the expression of emotion comes from a stimulus that will result in an emotion.

In this vision, the ACTION (stimulus) will promote a REACTION (emotion-feeling). In psychology, stimulus is a pattern recorded by sense organs that is processed in a complex way by the brain, and leads to different emotions and feelings (Paul and Mendl 2018). However, for behaviorism and classical conditioning, the stimulus is the basis for behavior (Amd et al 2017).

In this way, animals are directed to stimuli and repeat behaviors that they judge as positive, and avoid negative ones (Rolls 2013). Emotion caused by stimuli of a positive or negative nature is often described based on two characteristics: valence (how negative or positive the emotion

is) and the level of arousal involved (high or low) (Russell 2003).

Thus, it is possible to understand how (how positive or negative) animals experience their activities and situations, and how calm or excited they are (Figure 1). These external stimuli, therefore, can be considered by the animals as pleasurable, bad or even neutral.

Emotional states occur in response to stimuli or situations that are potentially rewarding or punitive. Reward and punishment, therefore, are at the center of all emotional states and determine their valence. Gratifying or punitive stimuli in nature include those who improve fitness (rewarders - food, water, shelter, partners) and those who threaten fitness (punishers - predator attack, heat stress, etc.) (Mendl et al 2010; Rolls 2013).

It is believed that the responses of different animal species to these stimuli have developed over evolutionary time and act as mechanisms that guide and coordinate the organism to achieve two main objectives of survival: maximize the acquisition of rewards that increase fitness and minimize exposure to punitive threats (Mendl et al 2010).

Therefore, a positive stimulus works as a reward and may be all that an animal will seek to achieve. On the other hand, a negative stimulus is synonymous with punishment, and represents everything an animal will avoid or try to get rid of. An example of a positive stimulus is stroking of body parts, which provokes emotions of positive valence. A negative stimulus can be represented by the sound of a noisy vehicle, which causes fear (Rolls 2013).

Figure 1, therefore, indicates which stimuli are received as positive and negative by dairy cows. The positive effects of stroking and tactile contact are already used to improve man-animal interactions. Gentle handling and stroking in dairy cows and heifers contribute to lowering the fear of humans, and reduce cortisol levels and heart rate during many procedures (Proctor and Carder 2014; Proctor and Carder 2015; Lambert and Carder 2019).

Previous studies have demonstrated the effects of tactile stimulation on the human-animal relationship by stroking different parts of the body of dairy cows (Schmied et al 2008; Westerath et al 2014; Buchli et al 2017). Schmied et al (2008) studied the social interaction between adult cows and observed that 64% of the positive interactions are directed towards the neck region. In addition, according to Westerath et al (2014), being stroked by a person is considered positive for calves, and Buchli et al (2017) affirmed that the positive contact between cow-calf and man-calf, even if restricted in

time, has a beneficial effect on the emotional reactivity and improves the social adaptation of the animals. With this, there is a distinction between action and reaction from positive and negative stimuli. Stimulation by caressing body areas demonstrates positive reactions and has effects similar to those found during positive social interactions between animals (Shahin 2018).

The aim of this article is to review the concepts and researches on emotions and feelings in farm animals that may be related to the expression of emotions.

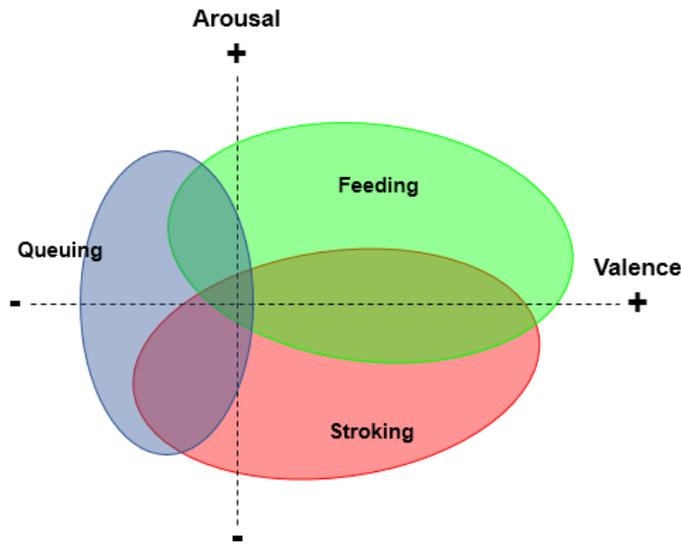


Figure 1 Representation of the diagram of level of excitation and valence caused by stimuli from feeding, stroking and queuing, in dairy cows. Adapted from Oliveira and Keeling (2018).

Emotions in animals

Emotion is a reaction to an environmental stimulus that produces both subjective experiences and significant neurobiological changes (Amaral 2007). The word derives from the Latin term "emovere", where the "e" means "outside" and "movere" means "movement". Whether it is to deal with environmental stimuli or to communicate biologically relevant social information, the emotions present several adaptive components for mammals with complex social behavior and are crucial even for their survival (Widen and Russell 2010).

In recent years there has been a great increase in interest in the subject "emotion" and how it can be studied and translated from animals, especially between neuroscientists and ethologists (Paul and Mendl 2018).

Understanding emotions in animals is important for improving well-being. In fact, the assumption that animals are sentient beings, capable of feeling emotions such as fear, frustration, and pleasure is grounded in the science of animal

welfare, since an animal's ability to experience suffering is a prerequisite for this science (Spinka 2012).

For De Vere and Kuczaj (2016) emotion is a comprehensive concept that encompasses feeling, affection, and humor. It is defined as a short-term affective state caused by an event (Forkman et al 2007). In this way, they are differentiated from long-term affective states (as a state of depression), however, they are connected and one influences the other (Mendl et. al 2010).

Widen and Russell (2010) suggest the construction of two possibilities when defining emotions: the descriptive and the prescriptive. The descriptive definition is that offered by the dictionary, based on the understanding of the language. The prescriptive is a definition of the concept or construct that is used to choose the set of events that a scientific theory (in this case of emotion) intends to explain. However, this latest exposure still needs to be supported by scientific work (Paul and Mendl 2018).

Emotions do not exist to be locked inside an individual. They are expressed in some way and have great importance

for the welfare of animals, especially within the production chains.

Animals in production systems, such as dairy cattle, live in large social groups composed of different individuals. There are indications that dairy cattle transfer emotions to each other through behavioral signs. An example of emotional transference between cattle is the process called emotional contamination that occurs when an animal is surprised by someone, an object or some sudden movement (action), and all the animals in the group react by fleeing or retreating (reaction) (Spinka 2012).

In these cases, there is a first animal that receives the stimulus, processes it and expresses the emotion, communicating the other animals (Spinka 2012). This process can multiply positive and negative emotions within the herd and therefore is of great importance for animal welfare.

Despite the importance, the relationship between emotions and animal welfare is still a rather obscure issue for science. However, with the advancement of neuroscience, scientists are coming to a consensus that animals, especially mammals, feel emotions in the same way humans do. Charles Darwin's ancient records already illustrated different body postures and facial expressions associated with fear and aggressiveness in animals. It is very likely that cows, like other mammals, experience a dynamic and varied daily emotional life (Hess and Thibault 2009; Mendl et al 2017).

The investigation of the existence of emotion in animals reveals importance of this consideration for animal welfare, however, it is still necessary to understand how these emotions can be analyzed.

The affective side of emotions is more difficult to be studied, however, it takes an effort to evaluate what is observable, recordable and measurable: behavioral and physiological measures that can indicate positive and negative emotional states (Mendl et al 2010). These measures have been examined as a "window" for animal emotions.

In addition, Coulon et al (2015) found changes in heart rate in lambs when it was approached by humans. The reduction in heart rate was observed in other studies on the positive interaction of humans with horses (Feh and Mazierès 1993; Munsters et al 2012; Greve and Dyson 2013; Janczarek et al 2018; Janczarek et al 2019; Wiśniewska et al 2019) and cattle (Schmied et al 2008; Lürzel et al 2015; Lürzel et al 2016; Lürzel et al 2018; Shahin 2018).

Traditionally, most animal welfare research focuses on negative emotions such as pain, fear, anxiety, frustration, anger, boredom, and their relationships to animal suffering and stress. However, research has developed to investigate the link between positive emotions and animal welfare (Spinka 2012; Rolls 2013; Mellor 2016; Meunier et al 2017; Mendl et al 2017; Paul and Mendl 2018).

The study of emotions in humans can be based on communication. People are aware of their emotions and can

use the communicative language to express themselves. In animal studies we do not have this reference channel up to now, despite several current studies evaluate vocalization (Scheumann et al 2017; Halachmi et al 2018; Liu et al 2018; Todorov and Aviezer 2018). In any case, we need to indirectly access subjective components such as behavioral and physiological changes, which we can measure. Based on these answers, inferences can be made about the emotional states of animals (Reimert et al 2017).

Mendl et al (2010) suggested behavioral and physiological components as indicators of emotions. With this, we have that emotional states can be represented as places within a two-dimensional space (Mendl et al 2010; Paul and Mendl 2018; Oliveira and Keeling 2018), with valence (positive / negative) and arousal level (high / low). Emotional experiences can be perceived as positive or negative, rewarding or punitive, pleasurable or unpleasant, and can be represented in a two-dimensional space, as shown in the Figure 2.

There are implications of the emotion experienced by the animal on the well-being of individuals in production systems, such as stress caused by environmental factors. The actual reach of these implications needs to be studied and for this we have sought to correlate body areas such as ears, tail, eye, mouth, nostril and other areas to the expression of emotions in cattle (Proctor and Carder 2014; Frondelius et al 2015; Lambert and Carder 2017; Lambert and Carder 2019), sheep (Boissy et al 2011; Coulon et al 2015; Bellegarde et al 2017; Tamioso et al 2018; Raoult and Gygax 2018) and pigs (Reimert et al 2013; Reimert et al 2017; Camerlink et al 2018).

Feelings in animals

Feelings differ from emotions because they are less intense, longer lasting and not accompanied by intense organic manifestations (Amaral 2007). According to Broom (1998) are aspects of the biology of an individual that must have evolved over time to somehow assist their survival.

While emotions arise when the brain receives an external stimulus, the feeling is a response to emotion and concerns how the individual feels about that emotion (Figure 3).

Today, there are scientific methods to understand the subjectivity of psychological issues in animals, which provided a scientific approach to the understanding of emotional states of animals for the evaluation of well-being (Mellor 2016). Direct observation of subjective experiences is not possible, however, there are reasons to suppose that feelings exist in nonhuman animals (Ross and Mason 2017).

Similarities in the anatomy of the nervous system between species of vertebrates, and in the physiological and behavioral responses to stimuli that trigger feelings in humans, suggest a great capacity of feelings in animals (Kirkden and

Pajor 2006; Sheng et al 2010; Allen-Hermanson 2018; Paul and Mendl 2018).

Fraser et al (1997) described three concepts of animal welfare that define it in terms of physical health, ability to

express natural behaviors and feelings. These different concepts influenced the criteria used by researchers to select variables for general analysis of animal welfare status.

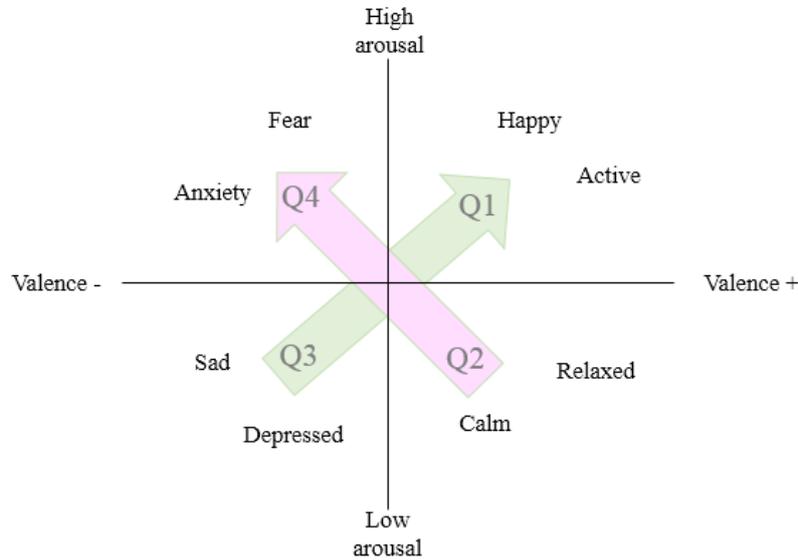


Figure 2 Two-dimensional representation of emotional experiences. Adapted from Mendl et al (2010).

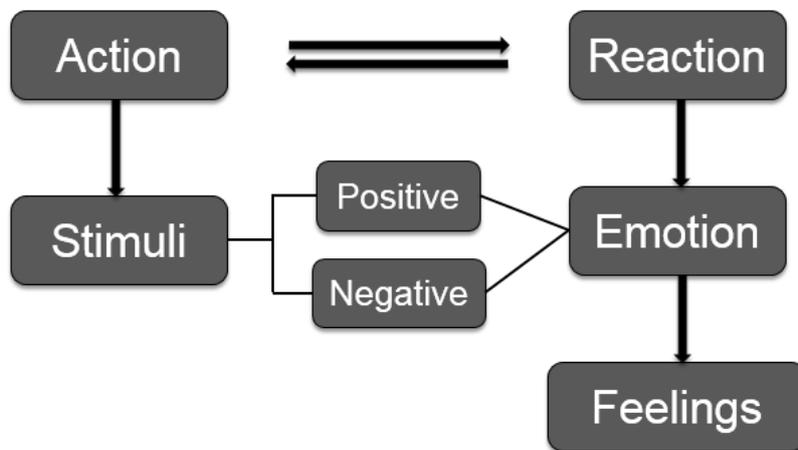


Figure 3 Relationship between stimulus, emotions and feelings.

Different research philosophies emphasize different concepts or a combination of them. Most consider feeling as an important part of animal welfare. Other lines consider it as a sole criterion. Studies that emphasize natural behaviors follow the line that feelings are irrelevant, non-measurable and that their assessment is redundant (Kirkden et al 2006).

Although it is not evident that feelings play a causal role in behavior, the opposite is supported (Veasey 2017; Wookey 2018). Even if feelings have no observable

consequences, the correlation between reported feelings and behavioral responses to stimuli in humans suggests that these responses reflect the strength of the associated feelings (Cohen et al 2010). In animals, this force refers to the so-called affective state.

The term "affective state" is used to indicate the abstract experiences, feelings, and emotions that motivate animals to behave in some way towards a goal, which may be accompanied by success or failure to achieve such goals

(Mendl et al 2017; Ahloy-Dallaire et al 2018). This motivated behavioral effect may be positive (interpreted as rewarding and pleasurable) or negative (experienced as aversive). Such effects associated with positive or negative situations reflects the animal's perception of its external environment, and generate emotions accompanied by feelings (Mellor 2015).

Thus, it is possible to use behavioral and even physiological information to analyze the feeling, and especially the immediate emotion that triggers it (Ahloy-Dallaire et al 2018). Feelings are part of the affective life of animals and arise in response to emotions and therefore need to be studied in long-term (Paul and Mendl 2018; Weary and Robbins 2019; Beaver et al 2019).

Final considerations

It is quite likely that animals experience emotions and feelings at different levels throughout their activities. Most of these emotions are triggered by stimuli from the environment. Therefore, the relationship between environmental stimuli and emotions is important for the welfare of farm animals, such as dairy cows. The use of body indicators such as ears, tail, and face can bring important information about the emotional state of animals in production systems and function as a good tool to identify emotions. In addition, they can be measured quickly. Therefore, it is possible to develop methods for identifying emotional states and, from these responses, to stimulate positive emotional experiences in animals. However, further studies are needed to correlate body parts with the expression of positive and negative emotions.

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