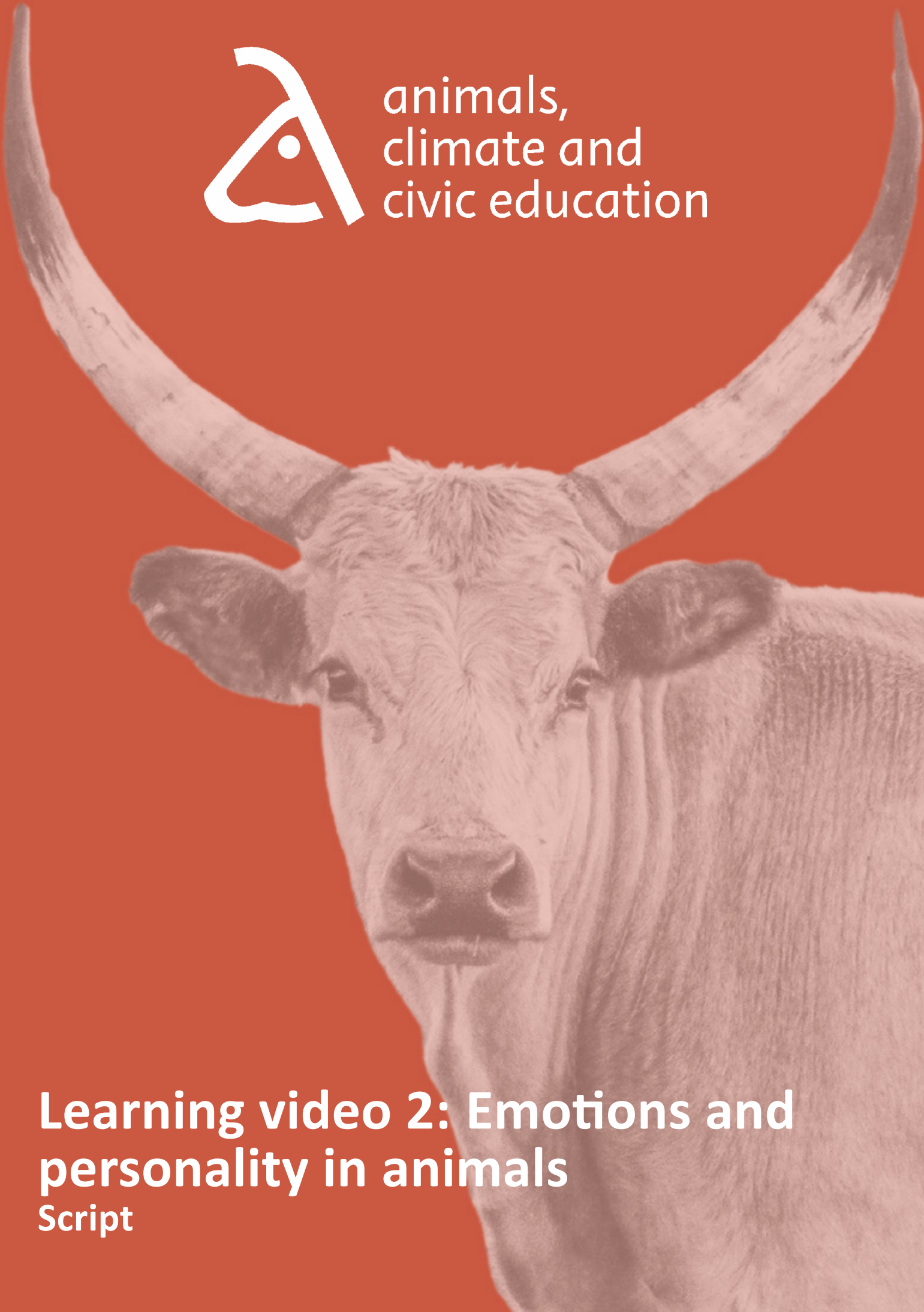
animals,
climate and
civic education



Learning video 2: Emotions and personality in animals

Script

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Script for the ALICE learning video 2:

Emotions and personality in animals

Have you ever seen animals suddenly start jumping or running around randomly, or rolling around on the floor? Have you ever noticed how some animals raise their neck or back hair in certain situations, or that their tails become very stiff, their heads are tensely pointed forward, their eyes are wide open, or their ears are pinned back? And did you intuitively think that these animals were feeling joy or fear? But how do we know exactly what animals are feeling? And what triggers feelings in animals in the first place?

Welcome to the second part of the ALICE learning videos. In the first part, we looked at a few outstanding cognitive abilities in animals and looked at some examples provided by behavioural research. At the end of the video, we raised questions that call into question our approach to animals in general. And we hope that you have thought about how our actions, directly and indirectly, affect the lives of all our fellow inhabitants on this planet.

In this second part of the ALICE educational videos, we now look at two other important phenomena in behavioural biology. These are, firstly, sentience and ability to perceive emotions and feelings and, secondly, the individual differences in dealing with certain situations - also known as personality.

Emotions

Development of emotions in the brain

As we often intuitively suspect, non-human animals also have very similar emotions to us. Not only do they feel physical stimuli such as heat or cold, smell or taste, light or dark, but their brains process sensory perceptions in a similar way to ours and interpret them in such a way that emotions arise. Emotions help us to make decisions that are vital for survival. Even brain regions that are very old in evolutionary terms are involved in these processes. When certain stimuli are perceived, this information reaches the amygdala in the limbic system. It is located in the centre of our brain. Within a few milliseconds, a decision is made as to whether something is dangerous for us. As a result, certain hormones are released in the brain stem, which then lead to an appropriate behavioural response. For example, a snake can be recognised as potentially dangerous and can be avoided. This split-second decision is made before the feeling of fear even enters our consciousness.

A second, slower reaction chain runs via the cerebral cortex - a somewhat more recent development in evolutionary terms. All previous emotional stimuli from the amygdala are converted into an emotional memory in collaboration with the hippocampus. In the cerebral cortex, past situations are now compared with the present and appropriate behavioural responses are sought. In the prefrontal cortex, i.e. the front part of the cerebral cortex, the emotional stimuli are also converted into consciously perceptible feelings. In a later step, the prefrontal cortex is also responsible for ensuring that behaviour is not purely guided by emotions, since cognitive abilities such as impulse control and logical thinking are located here. So far, the prefrontal cortex has only been identified within mammals. However, birds, fish, molluscs and insects are also able to learn from their previous experiences and can adapt their behaviour to the situation. It can therefore be assumed that other parts of different nervous systems have taken over these, or at least similar, functions.

Evidence of emotions in animals

The fact that animals feel emotions can be demonstrated by neuronal, cognitive or physiological indicators, but also by their behaviour[1-3]. But how exactly do emotions manifest themselves in animals? And what actually triggers emotions in animals?

Neuronal indicators

Let's start with neuronal indicators for emotions. Depending on the type of emotion, certain areas are activated in the limbic system and the cerebral cortex. This can then be visualised using functional magnetic resonance imaging (also known as fMRI). In order to determine which areas of the brain light up with neuronal activity in animals, dogs were slowly accustomed to lying in an MRI tube voluntarily and without restraint for several minutes. Finally, recordings of the activity in the dogs' brains were made while videos were played to them. Dogs reacted very differently to the sight of their handlers than to unknown people[4]. The recordings showed that similar areas of the brain were involved that are activated in humans when they have strong positive feelings – for example in the mother-child bond. It was also found that dogs that had seen their handlers playing with an unfamiliar dog showed activity in areas of the brain that indicated that this situation triggered a kind of jealousy[5].

Also in horses, neuronal activity has been measured to find out how they are feeling. However, instead of trying to push them into an fMRI tube, a small cap with electrodes was simply placed on the horses' heads. The electrodes touched the horses' foreheads, thereby recording the animals' brain waves. EEGs (electro-encephalography) were obtained in this way, which were able to show that in horses that were kept out on the pasture with their herd all day, brain waves were recorded that are associated with calmness and well-being in humans. In contrast, horses that had to spend the whole day alone in their stalls more brain waves were recorded that are associated with stress and discomfort in humans[6].

Cognitive indicators

Behavioural experiments, this time with pigs, cattle and chickens, have also established a clear connection with living conditions and emotions. To find out how animals feel at a given time, for example, it can be investigated whether their decisions are influenced by the current emotional state[7]. One could also say it is investigated whether animals are in an optimistic or pessimistic mood. In other words, the question is whether they perceive the glass as half full or half empty. There are several ways to answer this question. One of them is to train the animals that a bowl is only filled with food if it is – let's say – on the right-hand side of the room. However, if the bowl is on the left, no food is to be expected. Then, the animals have to learn to only go to the bowl if it is positioned on the right. If the bowl is on the left, the animals learn to stay put because then it is not worth checking it out. The tendency to make optimistic or pessimistic decisions is now tested by creating an unclear situation. To achieve this, the bowl is placed in the centre. If the animal goes to the bowl to find out whether there is food in it, this is taken as a sign of a positive emotional state. If the animal does not go to the bowl because it does not expect a reward, it is assumed to have a rather pessimistic attitude. These and similar tests have confirmed what many people have already been suspecting. Pigs kept in deserts of concrete with minimal space to move tend to choose pessimistically, whereas animals with straw, more space and various objects to play with tend to choose optimistically[8]. Calves that are separated from their mothers also show a negative expectation in these tests[9] and chickens that hatch and grow up in automated incubators even retain a tendency towards pessimism throughout their whole lives[10].

Physiological indicators in interaction with behavioural indicators

Empathy

But animals don't just feel for themselves. They are also able to perceive the feelings of others. This even goes so far that in certain cases a so-called emotional contagion takes place. This means that an animal feels the same emotion that another animal in the neighbourhood is feeling. This way of empathising with the emotional world of another individual is one of the basic building blocks for empathy[11]. Ultimately, prosocial behaviour such as helping others is based on this phenomenon.

Bovines are known to be particularly social. It is therefore no wonder that, as empathic creatures, they mirror the feelings of others. They perceive the stress of other bovines through their sense of smell and then begin to show symptoms of stress themselves. Their stress hormone levels rise and they eat less[12]. However, it also works the other way round. If an animal is stressed, the mere presence of a calmer animal often helps. For that reason, contact with calming conspecifics is sought out and is even favoured over food[13].

Mother hens are also known to be particularly caring. It is therefore not surprising that hens show signs of concern and stress when they notice that their chicks are not feeling well[14,15]. The hens' heartbeat and body temperature increase, for example. However, if the mother's reaction is relatively moderate, this can in turn trigger a sense of security in the chicks, which results in the chicks also showing a lower stress response[16].

In contrast to the general perception, pigs are also very social creatures that can empathise with each other. Pigs are able to recognise the emotional state of others and mirror it. This happens, for example, when they meet other pigs who have either negative or positive expectations. They then also show the same emotional behaviour as their companions – either adopting an increase in attention and stress hormone level, or wagging their curly tail and starting play behaviour[17,18].

Just as rats[19], pigs are not only able to perceive and reflect the mood of others, but also help each other out of a difficult situation. The more stressed the pigs were, the more likely they were to receive help from other pigs[20].

Play behaviour

Play behaviour is considered to be one of the indicators of positive emotions in animals. Intuitively, it is assumed that during playing animals feel joy. However, the exact reasons behind play behaviour are not yet fully understood. In particular young animals may play in order to train their motor and mental skills[21]. However, adult animals can also be observed playing. So, could there be more to it? We know that when animals are in the mood to play, they keep on playing, even when others have had enough already. They then look for new play partners or, if no one else is in the mood, they look for things in their environment. These observations suggest that playing makes happy[22].

This has also been proven on a neurobiological level. Dopamine, one of the endorphins, is involved in the regulation of play behaviour, for example. Already the perceived possibility for play is enough to trigger the release of endorphins. In rats, for example, even the mere anticipation triggers an increased release of dopamine in the brain[23]. However, many of the brain regions associated with emotions are also activated[24]. For example, the amygdala mentioned at the beginning. Whether rat, human, goat or emu - it is hard to deny that play is also fun.

Mental engagement

Interestingly, it has also been discovered that animals not only enjoy playing, but also solving tricky problems. Just as we sometimes spend time with a puzzle book, animals also seem to love a cognitive challenge. Bovines[25] as well as pigs[26] , goats[27] and chickens[28] sometimes prefer to work on a problem for food. They even prefer to solve that problem over helping themselves to freely available food. It is assumed that the joyful expectation of success in a difficult search for food causes this behaviour. For similar reasons, we probably also go mushroom or berry picking, or rummage through the flea market for rare treasures. It is somewhat reminiscent of a kind of gambling paired with mental engagement.

Mental engagement is actually one of the cornerstones of a balanced life. It does not only refer to thinking about complicated problems, but it also includes very basic things such as social interactions with conspecifics, or a varied diet and different visual, olfactory or tactile stimuli - in other words, not always having to see, smell and feel the same things. For farmed animals in particular, the lack of mental stimulation is often a major restriction on their quality of life. However, the same also applies to animals in other facilities such as zoos or laboratories.

Learned helplessness and depression

Studies on the emotional world of animals have not only shown that animals feel, but also how they feel. For example, all social animals suffer when they are not able to be in a group. If they are kept alone in cramped stables and without anything to do, their frustration level increases. If this condition persists, the animals adopt an attitude that can be described as mourning: They sit apathetically in their box, head hanging and eyes half-closed. This can often be misinterpreted by the uninformed as laziness. In truth, they have given up trying to deal with the situation. Both humans and animals that are exposed to constant stressful situations that they cannot influence themselves often develop this form of helplessness. This is how boredom turns into frustration, which ultimately ends in depression.

Personality

Depending on an animal's personality, another effect of such living conditions can be the development of behavioural disorders[29]. Just like us, animals also have certain characteristics that make them unique. Be it genetically determined or caused by external factors during the early stages of development: Animals have personalities. These are certain variations in their behaviour that remain the same over longer periods of time. Similar to what has been described in humans, five pillars of personality have been identified in animals. These are sociability, aggressiveness, willingness to explore, boldness and activity[30]. These characteristics can be examined using a wide range of behavioural tests. For example, sociability and aggressiveness can be assessed by observing behaviour in social situations. Willingness to explore, boldness and activity, on the other hand, can be assessed by the reaction to unfamiliar objects or environments. The combination of these factors can then describe an individual's style of dealing with stressful situations. This description is often referred to as a behavioural phenotype or coping style.

How does personality influence behaviour?

In general, a distinction is made between two coping styles: proactive and reactive. The coping style can for example be identified by certain hormone levels. When animals experience stress, adrenaline is released, resulting in an increased heartbeat. Cortisol levels also rise, which increases the willingness to flee. However, it is usually not possible for animals in stables, zoos and laboratories to flee - i.e. to avoid the

stress-inducing stimulus. Just like us in our overworked society, animals also develop chronically high cortisol levels[31].

Reactive individuals are more susceptible to stressors and show higher cortisol levels than proactive individuals. They often react more cautiously to new things. However, once they have plucked up the courage, they are more attentive and therefore more capable of learning about their environment. To constantly stressful situations that animals cannot escape from, reactive individuals react with depression-like states[29].

Proactive individuals, on the other hand, actively face life's challenges. They investigate their surroundings more quickly, but are more superficial and less flexible in terms of their behavioural routines. They are also more prone to aggressive behaviour. If proactive animals are constantly exposed to stressful situations, they are more likely to develop behavioural disorders[29]. These include stereotypies or self-harming behaviours.

Behavioural disorders

Stereotypies are described as monotonous, repetitive movement patterns that have no apparent goal. They occur either in relation to an object, for example the bar biting in pigs, or as an idle action, for example tongue rolling in bovines, or head weaving in horses, bears or elephants.

In addition to stereotypies, self-harming or other atypical behaviours are also considered behavioural disorders. These include for example excessive preening. In birds, this can develop into uncontrollable feather plucking, which ultimately can result in losing the ability to fly or regulate body temperature.

These behaviours initially act as a kind of outlet for the animals to channel their frustration in one direction. In the initial phases, the behaviours trigger a release of endorphins in the brain, which means that the situation is no longer perceived as quite so bad. If the behavioural disorders are practised for a longer period of time, it can change the brain structure and thus limit the animals' cognitive abilities[32]. Behavioural disorders in the mother, if they occur during pregnancy, can even have an impact on the brain structure of the offspring and thus have a lasting effect on also their behaviour[33]. If animals develop behavioural disorders at an early age, this likely cannot be reversed even if their living conditions are improved.

Animal Welfare Science

In order to investigate which conditions lead to such behaviour, animal welfare science has been studying the extent to which animals' needs must be satisfied[34]. The various indicators of animals' moods, feelings and emotions are analysed and compared under certain conditions. The aim of this research is to make recommendations on how improvements in animals husbandry should be implemented. With the help of numerous studies, animal welfare organisations and other political actors have already been able to achieve important improvements. However, there is still a long way to go, as not only the interests of the animals are taken into consideration, but also the benefits of the animals and possible improvements for humans. The current assessments are discussed controversially in animal ethics, as the needs of animals are given too little consideration and the interests of humans are often taken into account to a far greater extent.

Conclusions

In order to steer animal welfare in a truly progressive and meaningful direction, we must not only address the needs of animals, but also reflect on our own thoughts and actions. The attitude of every human being, to either regard animals as consumer goods or to recognise them as equal co-inhabitants on this earth,

plays a central role here. Most people are far removed from actively inflicting suffering on animals, yet we are always indirectly involved. Progress in dealing with animals is based on humanity's interest in learning more about their cognitive abilities and their emotional world. Only on the basis of this knowledge can we reflect on what harm we may cause. As a society, we must now decide what our ethical principles are and whether they apply not only to human but also to non-human animals.

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