



## Module 3

# Behaviour and Animal Welfare

## Lecture Notes

### Slide 1:

This lecture was first developed for World Animal Protection by Dr David Main (University of Bristol) in 2003. It was revised by World Animal Protection scientific advisors in 2012 using updates provided by Dr Caroline Hewson.

### Slide 2:

Today you will learn:

- how we know if performing a particular behaviour is important to an animal. As part of this, you will learn the basics of behaviour, i.e.
  - the importance of understanding the natural behavioural repertoire
  - the role of motivation in behaviour
  - how emotions and genetics can influence the way the brain processes information and how this can affect behavioural responses.

Then we will look at how to find out which behaviours are a priority for the animal, and will end by noting some examples of important behaviours in a variety of animals.

### Slide 3:

We are interested in behavioural measures of welfare, because they can tell us something about an animal's experience.

To review: an animal's experience may be broken down into the sequence shown on the slide. That is:

- the animal receives internal and external sensory input.
- the brain evaluates the input, which may generate emotions and the urge to perform a particular behaviour, as well as to exhibit physiological responses such as the stress response
- the responses should enable the animal to adapt and survive, and this information is stored by the brain, as shown by the arrow on the left.

## Slide 4:

Module 6 will look at the different types of physiological response that animals may have to a particular sensory input.

In short, most physiological responses are difficult to observe directly. Also, they are largely non-specific. For example, the stress response can occur when an animal experiences positive or negative sensory input. Therefore, measures of the stress response do not tell us if the animal is having a positive or negative experience.

In contrast, behaviour represents a more complex level of functioning than physiological responses, because animals' behaviours allow them to change and control their environment (e.g. run away, build a nest). Also, the behaviours an animal shows are relatively easy to observe.

Therefore measures of behaviour should tell us something more specific about an animal's experience than physiology alone can.

## Slide 5:

When we consider behaviour as a measure of welfare, we remember that animals' experience concerns three interrelated areas: physical (including functioning), mental (including feelings), and aspects of naturalness including the performance of behaviours that are important to the animal. So we can see that the performance of behaviours is one of the important elements of welfare. In addition, behaviours can reflect animals' physical functioning and associated feelings.

As vets, we are very aware of behaviour measures associated with physical functioning and feelings. We call those behavioural measures 'clinical signs', and we use them to diagnose disease (a physical functioning aspect of welfare), and to identify associated negative feelings such as pain and nausea.

However, veterinary medicine has not traditionally concerned itself with behaviours in other regards. That is:

- when advising our clients, we have not traditionally talked about the third area of welfare, i.e. about whether their animals have opportunities to perform behaviours that are important to them
- our clinical work has not typically included behavioural measures of how animals feel when they are unable to perform behaviours that are important to them.

## Slide 6:

Part of the reason for both these oversights in veterinary practice is that:

- animals may function very well even though they may be experiencing negative feelings as a result of being unable to perform important behaviours
- owners themselves are not aware of the broader behavioural aspects of welfare, so they do not typically consult vets about them.

This is changing, however, as public concern for animals grows and research shows how important some of these behaviours are to animals, and that not being able to perform them can affect physical functioning and mental state.

## Slide 7:

Other lectures in your degree programme will teach you how to use changes in behaviour to diagnose and treat disease and associated feelings such as pain, as illustrated in the upper two rings of this diagram. Today, we will focus on the bottom ring, and how the performance of behaviours that are important to the animal affects their welfare.

Then, in Module 7, we will look at behavioural measures of welfare more broadly.

## Slide 8:

If we want to know how important a behaviour is to an animal in human care, we first need to know what behaviours they are capable of performing. We therefore need to learn the full behavioural repertoire of the species. To do this, we need to observe the animal in the wild.

For example, domestic chickens are descended from jungle fowl, so studies of jungle fowl in the wild can tell us about the potential behavioural range of hens and broilers.

However, many domestic species no longer have relevant wild counterparts. In that case, we can put them in extensive, naturalistic conditions and study their behaviours there.

When doing this, we need to observe many different types of behaviour. 'Ethology' is the scientific study of animal behaviour in the wild, and detailed discussion of the full behavioural repertoire of our different domestic species is beyond the scope of this lecture.

However, briefly, there are several broad categories of behaviour. Within each category, each species has typical behavioural patterns which may be unique to that species and are often very complex.

Examples of these categories of behaviour are:

- reproductive behaviour – this includes courtship behaviour, mating behaviour, parturient behaviour, and maternal behaviour

- feeding behaviour – this includes behaviours directed towards seeking and obtaining food and behaviours involved in consuming food. For example, predators seek and obtain food by using their senses to detect prey, which they then chase and kill. The consumption of the dead prey may follow a particular pattern within the social group, e.g. the group leader feeds first, or the oldest animals are unable to compete and feed last.

By making detailed behavioural observations over many days, we can establish the relative amounts of time that animals allocate to performing different behaviours within the categories. This is known as their time budget, and we can use this as a point of comparison for how animals allocate their time in captive conditions.

### Slide 9:

A landmark study of the behavioural repertoire of domestic pigs was carried out in 1989 (Stolba & Wood-Gush, 1989), when domestic sows were introduced to a large woodland enclosure. These animals had been reared and lived in intensive conditions, as had generations of pigs before them, so they had not had experience of natural living.

As adults, the sows had been confined in stalls, as shown in the photo. Studies of sows in such conditions have indicated that typically they tend to be still and show relatively few behaviours, and that some of them bite the bars of their stalls repetitively:

However, in the 1989 study, when the sows were released into the woodland enclosure, they soon showed a wide range of behaviours and spent very little time doing nothing. For example, they rooted, moved through the woods, interacted with others, wallowed when the temperature was warm, and created nests with grass when they were about to give birth. They no longer showed the repetitive biting behaviour.

This indicated that when the environmental cues were different, the sows had the urge to perform a range of behaviours. This provided impetus for research on whether close confinement might cause them to suffer because they were unable to perform those behaviours.

Note that captive animals do not need to perform the full range of behaviours shown in the wild. That is, some of the behaviours are only necessary to enable the animal to survive in adverse conditions (e.g. escaping from a predator). In conditions of good husbandry, the animals should not need to perform those behaviours.

## Slide 10:

Having observed our domestic species and established its full behavioural repertoire, we then need to establish which of all the possible behaviours animals choose to perform. Therefore, we are concerned with the strength of the animal's motivation for performing the different behaviours.

There is no universally agreed definition of motivation. However, a simple one is: the urge to perform a behaviour. This urge results from sensory input to the brain. As we saw earlier, sensory input can be internal or external. When the brain evaluates that sensory input, this can create an emotion and an associated urge to perform a particular behaviour. The result is a measurable behavioural response.

Some behaviours are motivated largely by internal stimuli, others by external stimuli, and yet others by a combination of both.

## Slide 11:

Behaviours that are mainly to do with preserving the animal's physical state are generally the result of internal sensory cues – the behaviour is motivated by internal sensory input.

Examples are the motivations to feed, drink, rest and groom.

- Animals need to perform these behaviours in any environment and research shows that, if animals are housed in such a way that they cannot eat, drink, rest, etc., the motivation to perform these behaviours increases until these life-sustaining behaviours can be performed.
- They must therefore be housed in such a way that they can satisfy these basic motivations.
- Note that some farming systems may not completely satisfy these basic motivations. So, although farm animals are fed, the food may not be delivered in a way that satisfies their species-typical feeding behaviour.
- For example, calves who are housed in groups and fed on milk from a bucket will sometimes suck each other; however, this occurs much less if calves consume their milk ration via free access to a teat – either the cow's own teat or an artificial nipple drinker. This suggests that there is strong motivation for sucking behaviour in young calves, and that the ingestion of milk does not satisfy the urge to suck – only sucking can do that.

## Slide 12:

Other behaviours are motivated by external sensory input, such as the sight of a predator causing flight, or the smell of food causing approach behaviour.

Other behaviours are the response to both external and internal sensory input. This is true of many social behaviours. For example:

- an animal may commence play behaviour in response to the external sensory input of seeing another animal who has played with them in the past, and the internal cues that motivate play behaviour in their species
- however, if they see another animal who had not responded to their attempts at play, and may even have responded aggressively, the first animal will not commence in play behaviour, despite being motivated to play.

Sometimes cues may give rise to conflicting motivations. For example:

- an animal may be thirsty and have the internal cue to go and drink from a known water source nearby. However, he or she may smell or see a predator nearby, or may know that the predator is often there. Therefore the urge to seek water and drink it may conflict with the urge to avoid the predator.

## Slide 13:

As vets in practice, it is essential that we understand the motivation underlying animals' behaviour so that, for example, we can tell if animals are fighting or playing. The study of applied animal behaviour is therefore very important because without that knowledge we may misjudge welfare in our patients.

For example:

- when animals interact, we need to understand if they are playing or fighting. Playing is a measure of a positive emotional state and therefore of good welfare. Fighting can be a sign of poor welfare; if it is a repeated occurrence it may reflect unstable social groupings caused by factors such as uniformity of age within a group, and overcrowding
- another example is aggression in dogs. When a dog growls at a vet during examination in the clinic, the vet may interpret this as dominance aggression and may try to dominate the dog. However, because the vet is not a member of the dog's social group and is not competing with the dog over the dog's resources, dominance cannot be the dog's motivation. Instead, the motivation is generally fear, which is very different from social dominance and requires a different solution.

These two examples illustrate how, as clinicians, we need a full, scientific understanding of animal motivation and behaviour in order to correctly handle our patients and to accurately assess their welfare.

## Slide 14:

As with physiological responses to sensory input, the brain is also central to behaviour.

The brain is where emotions arise, in turn creating behavioural urge or motivation, all as a result of evaluation of sensory input. That evaluation is a consequence of the brain's capacity to store information. It enables animals to learn, to anticipate negative or positive events, and to have expectations.

The capacity of the brain to perceive, process and store information is called 'cognition'. For example:

- a sheep's brain stores information about where within a pasture he or she can find his/her preferred plants
- this ability to remember creates expectations about where to find the plants
- however, these expectations may in turn be modified by whether the sheep is dominant or subordinate
- so, when you see sheep grazing, the behaviour of the group reflects subtle and complex processes within each animal's brain.

## Slide 15:

There is growing evidence that an animal's cognitive capacity is affected by his/her emotions.

The influence of emotion on judgment and other cognitive processes such as memory is termed 'cognitive bias'.

Cognitive bias is a well recognised concept in human beings.

- Anecdotally, many of us may have found that when we feel sad we tend to be more pessimistic about future events than when we feel happy.
- Psychological research supports this: people who are in a negative emotional state tend to pay more attention to negative memories and to make more negative judgments about ambiguous stimuli than happier people. In this way our mood can tend to make us judge uncertain events positively or negatively.

There are many neural similarities between human beings and many domestic animals, so the possibility of cognitive bias arises in animals too.

- For example, if animals are kept in conditions that induce mainly positive or mainly negative emotions, this may affect how their brains process new sensory information. In particular, animals who are already experiencing negative emotions, such as fear, may be more likely to interpret an ambiguous stimulus as a threat rather than a signal of something neutral or positive. Therefore their wider experience may be unnecessarily distressing.

## Slide 16:

Research on the effect of emotion on cognition is now being conducted on animals. The most common area of research focuses on whether animals who are already in a negative emotional state are more likely to respond to ambiguous cues as if they predict a negative event (a 'pessimistic' response) than animals who are in a more positive state.

There are many scientific challenges in designing appropriate tests of this hypothesis, and we do not yet have enough data to tell us how we might recognise cognitive bias in our veterinary patients. However, it is likely that this will become known during your professional lifetime.

A practical example of some of the research to date concerns dogs in a shelter.

- 24 dogs from a shelter were exposed to a known test of separation anxiety. They were then exposed to a test in which they learned where they might find a bowl containing food, or an empty bowl. After that, they were exposed to ambiguous cues about whether they would find food or not.
- The authors concluded that dogs who showed higher levels of separation-related behaviour in the first test also showed pessimistic-like behaviour in regard to finding food.
- Because of their controlled study design and methods, the authors were able to conclude that this difference among dogs was due to cognitive bias, and not to other factors such as differences in motivation, learning ability, etc.

Cognitive bias is a relatively new field of research. So far, the data support the idea that animals' emotions can influence their behaviour because emotion influences how the brain processes information. Research continues to answer questions about how animals' experiences affect their emotional state, so that we can better predict the effect of housing and husbandry on their feelings and, so, their welfare.

## Slide 17:

While cognitive bias research looks at how animals' emotions create different expectations about future events, earlier research has examined how emotions can be the motivations for behaviour in the present.

This research indicates that negative emotions such as pain, fear and frustration typically motivate behaviours that meet an immediate need. This slide gives two examples.

## Slide 18:

In contrast, positive emotions seem to motivate behaviours that are not needed urgently for survival in the present moment, but that bring a long-term benefit to the animals.



## Slide 19:

We have now seen that emotions are closely linked to the urge to perform a behaviour. Emotions modify how animals process sensory input. We have just seen that emotions can give rise to behaviours that have short-term or long-term survival value. Just before that we learned about cognitive bias and how an animal's current emotional state can affect how he or she processes new sensory input.

There are other internal factors that can affect motivation in animals and therefore affect the behaviours we perceive. Genetics are very important here. Good stockpeople have used breeding to select lines of animals who show calmer behaviours. However, new scientific tools such as genetic mapping can give more specific information about the influence of genetics on behaviour, by quantifying differences in the genes themselves within a given part of the chromosome.

Examples are given below.

- Hens and other poultry commonly peck the feathers and body of other birds in the group. This is thought to be a form of redirected feeding behaviour, arising partly because the housing does not permit normal pecking in the search for food. Hens can be selected for a low tendency to feather-peck, and this is associated with higher levels of egg production and with measurable numeric differences in genes within a locus on the chromosome.
- Similarly, dairy cows with more docility in the milking parlour show quantifiable differences in genes from cows who are less docile.

The genetic details of this do not concern us today. The point is only that research at the molecular level shows us that genes can strongly affect animals' motivation to perform a particular behaviour in a particular context.

## Slide 20:

In addition to emotional state and genetics, there are other internal and external factors that can affect motivation. These factors can interact in a complex way, which is why research into which behaviours are the most important for animals to perform can take many years.

Some examples of the many other factors that affect the motivation and therefore expression of a behaviour include:

- the stress response – this can inhibit eating, defecation and urination. As vets, this means that when we hospitalise animals, they may not eat readily or eliminate readily
- availability of substrate – some behaviours are directed towards specific substrates. If the substrate is not present in the animal's environment, the behaviour may not occur at all, or his/her motivation may be so strong that the animal will redirect the behaviour towards whatever other substrate they can find that suffices
- disease – when an animal is debilitated by disease, or feels unwell, the resulting feelings of weakness, pain, etc. may inhibit the performance of behaviours that might otherwise be important to the animal.

## Slide 21:

To sum up what we have covered so far:

- We are examining how we can find out if performing a particular behaviour is important to animals.
- We have seen how you can establish an animal's behavioural repertoire, and that all behaviours are the response to urges or motivations which are brought about in response to internal and external cues.
- We have also seen that the capacity of the brain to process and store information, known as cognition, can modify animals' motivations and behaviours.
- We have also seen that cognition and resulting behaviour may be affected by factors such as animals' pre-existing emotional state and their genetics.

We shall now move on to measures of behavioural priority, and how these can tell us which behaviours are important for an animal.

We shall conclude with examples of behaviours that are known to be priorities in different species.

## Slide 22:

Behaviours that are important for animals to perform have a very strong motivation. The strength of motivation can be identified using a variety of research methods. We shall look at them very briefly here.

First, you can measure how hard an animal will work for the opportunity to perform a particular behaviour. This methodology has shown that:

- when hens are ready to lay they will squeeze through narrow gaps, or push open heavily weighted doors, in order to gain access to a nesting area. Therefore nesting behaviour seems to be important for hens to perform when they are getting ready to lay
- in one test, heifers pressed a panel repeatedly in order to have the opportunity to rest for a total of 13 hours per day. They were not motivated to work for the opportunity to rest for longer than 13 hours. So, resting for 13 hours a day seems to be important to heifers.

A second methodology concerns the fact that, in particular housing conditions, animals may develop behaviours that not typically seen under natural conditions. When this happens, it can indicate that an important motivation is not being satisfied.

- An example is cross-sucking between group-housed calves who are not fed from a teat. You do not see this in calves who are reared with their mothers, and providing access to the mother or to a nipple drinker largely eliminates the behaviour. Therefore, as noted earlier, sucking seems a very important behaviour to calves.

- In other situations, when an animal's environment prevents him/her from performing a behaviour that is highly motivated, his/her behaviour may suggest frustration. For example, when hens are ready to lay but do not have access to a nesting site they pace when they have the room to do so. As veterinarians, we need to be aware that the housing of some of our animals may neither allow them to perform important species-typical behaviours nor to relieve their frustration at this by performing other behaviours. In the case of laying hens, traditional cages do not provide nesting areas and do not have the space to allow the hens to pace.

### Slide 23:

There are other categories of behaviour that animals may show if their urge to perform an important behaviour is not met. Two important ones are:

- stereotypies, and
- redirected behaviours

Stereotypies are repetitive behaviours that are relatively constant in form and serve no obvious purpose in the context in which they are performed. Stereotypies are thought to occur as a way for an animal to cope with being unable to perform an important behaviour; for example, sows biting the bars of their stalls. There are many other examples of stereotypies in confined animals, and we will come back to this in Module 7 when we discuss behavioural indicators of welfare more generally.

Redirected behaviours are behaviours that are not abnormal in themselves, but that are directed towards an abnormal substrate. In our calves example, the sucking behaviour that they show towards other calves is performed normally; however, it is not normal to direct it towards other calves.

### Slide 24:

We have looked at some of the important tools used by researchers to establish which behaviours are important for animals to perform.

Such research has supported the idea that animals have "behavioural needs" (Widowski, 2010) and that depriving animals of the opportunity to perform these behaviours could cause suffering. Some academics disagree that "behavioural needs" is an appropriate or accurate term. However, the idea of animals having "behavioural needs" is useful to us as vets in practice.

We shall conclude with some examples of behaviours that research has shown are important to different species. Some of them are now legally required for the species concerned in certain countries. For example:

- in EU countries, laying hens must have access to a nesting area and so cannot be kept in barren cages (Nicol, 2011)

- in EU countries, pigs must have access to rooting materials (Nicol, 2011)
- in Switzerland, hamsters used in research must have access to bedding that is at least 40 cm deep (Hauzenberger et al., 2006).

### Slide 25:

In this lecture we have focused on the area of animal welfare shown in the bottom ring on the slide, aspects of naturalness. We have done this because, as vets, we may otherwise overlook this area of welfare in our clinical work, and focus only on the physical and the negative mental state that arises when animals are diseased.

Today's lecture has given you a brief overview of how we can understand behaviour in domestic animals, including the concept of motivation and the close relationship between behaviour, cognition and emotions.

The lecture has also shown you how we know that performing certain behaviours is important for animals. We have also seen that the inability to perform the behaviours may give rise to negative feelings, especially frustration. Other modules which look at welfare problems in individual species will describe in more detail the behaviours and the consequences of frustrating them.