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CATTLE'S BEHAVIOUR – PERCEPTIONS, RELATIONSHIPS, STUDIES AND MEASUREMENTS OF TEMPERAMENT

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Summary

Nowadays, the evolution of the worldwide agriculture has come to raise new aspects, and animal welfare is one of them. The measurement of cattle's behaviour and its assessment has consequently become more and more important. However, basic knowledge of general and applied ethology are needed in order to measure behaviour and draw conclusions. The authors' aim was to summarize and explain this basic information in order to support further studies about cattle's behaviour. For this purpose, the environmental perceptions of animals have been looked over to understand how animals have connection with their surroundings. Then, relationships of an animal with other animals of the same species and with humans have been detailed before to focus on temperament described as the reaction that an animal shows in response to a stimulation of its external environment. As measuring temperament under different test conditions is the main way of determining the behavioural type of animals, so the different methods of measurement also had to be explained. Finally, all knowledge in this review are suggested to use for further studies concerning animal behaviour.

Keywords: cattle behaviour, perception, human-animal relationship, temperament

A szarvasmarhák viselkedése – érzékelés, kapcsolatok, a vérmérséklet tanulmányai és mérése

Összefoglalás

Napjainkban a mezőgazdaság fejlődése során világszerte új szempontok vetődnek fel, amelyek egyike az állati jólét. A szarvasmarhák viselkedésének megfigyelése és értékelése következetesen egyre fontosabbá vált az évek során. Ugyanakkor az általános és alkalmazott etológiai ismeretek szükségesek ahhoz, hogy számszerűsíteni tudjuk az állat viselkedését, és következtetéseket vonjunk le. A szerzők célja az volt, hogy összefoglalják és kifejtsék ezeket az ismereteket, megalapozva a szarvasmarhák viselkedésének tanulmányozását. Áttekintik az állatok környezetet érzékelő képességeit, hogy megértsük az állatok környezettel való kapcsolatát, majd mielőtt rátérnének a vérmérséklet tulajdonság jellemzésére, részletezik a fajtársak és az állat-ember közötti kapcsolatot. A vérmérséklet az állat külső környezeti ingereire adott válaszreakcióját fejezi ki. Mivel a temperamentum különböző tesztekkel történő értékelése a legfőbb módja az állat viselkedési típusának megállapítására, ezért a szerzők a különböző mérési módszereket is ismertetik. Végül pedig javasolják a cikkben szereplő ismeretek felhasználását az állati viselkedés kutatásához.

Kulcsszavak: szarvasmarha viselkedése, érzékelés, ember-állat kapcsolat, vérmérséklet

Introduction

Nowadays, the entire dairy sector faces lots of new requirements and expectations from the national and European laws (the general minimum standards of European regulation are currently based on the council directive 98/58/EC). Indeed, with the development of the agriculture in Latin America and in other parts of the world, combined with the constant increasing of the costs for the farmers, some new ideas appeared among the consumers, and reached the attention of public authorities through media and Non Governmental Organisations (NGOs). These ideas are focused on the life of farm animals, their living conditions and the different experiences they have to face from their birth to their slaughter. In the last decades, because of the constant intensification of farming, farmers and people have often forgotten the fact that the cow is a higher mammal. Practically, it means that every animal has to be cared as one single animal, even in a large scale farming type. Its complex physical and mental system intuits special and complex needs that have to be taken into account by the breeders. Some NGOs have understood it, and have especially raised the attention of the consumers to the welfare of farm animals. So, it has become obvious and logical for the agricultural sector to examine these new factors.

However, some of these factors are not always easy to measure on the field. One way of judging some welfare standards is the study of the behaviour of farm animals. Indeed, by observing the behaviour of animals, their interactions and reactions to their environment, we can evaluate a certain level of welfare standards. In the dairy cattle sector, the temperament is already judged for the selection programs in order to answer the demand of quiet animals by the farmers. For example, in some EU countries, the temperament of dairy cattle has been introduced in selection programs as one point of the workability (*Interbull*, 2006). It has been demonstrated that nervous behaviour can cause various problems that could be disadvantageous for the production of these animals (*McDonald*, 2003).

Based on these facts, it could be interesting to manage a deeper study about temperament of dairy cows. It is already known that a nervous temperament can have unfavourable consequences in a herd, but it could be more remarkable to know the correct level of this correlation and the causes of a nervous temperament in a herd. This might help the farmers and the breeders' associations to determine better breeding systems, which are efficient and economically durable, respecting the welfare of cattle.

Before investigating the behaviour of cattle, it is necessary to gain some knowledge of the concept of behaviour. So, as described in dictionaries, the behaviour of an animal is its reaction to stimuli, which are largely determined by its perception of the internal and external environment. However, behaviour can be predictable, when there is enough information given about the context. Similar behaviours can be often linked to a specific stimulus, with a specific sense and a level of reaction.

Nevertheless, humans and animals can have totally different views of behaviour and reactions, the measurement and evaluation of them should be determined very carefully in order to avoid confusions and quick misunderstandings about the behaviour of an animal.

The behaviour has to be separated into different categories. First of all, we can separate the innate and learnt behaviour (*Graham*, 2005). Breathing, for example, could be considered as innate behaviour, as it does not need to be learnt and is not typically an answer to a stimulus, as described above. On the contrary, some stimuli create specific reactions and after a learning phase, it is useful for the animal to learn and remember the stimuli and the reactions needed.

Study of behaviour

The effective study of behaviour requires observations and experiments. The first part has to be a careful description of the behaviour, or of a sequence of actions that could be further considered as one reaction to a specific stimulus. Then, the behaviour and its exact level have to be linked to the environment of the animal. Finally, from all the knowledge we got, we are able to raise hypothesis about the function of this behaviour and about the factors which can control it.

Animal behaviour can be studied from two different views. The physiological level of a reaction might be concerned in order to know the mechanism by which a specific behaviour can occur. Besides, it can be also interesting to try to find answers to questions about the relation between the animal and its environment and social relationships. These two kinds of studies have to be carried out, on the one hand in laboratories in a controlled environment and on the other hand on the field under “natural” conditions (*Graham*, 2005).

In both cases, the study of behaviour can be summarised in few questions, to which an answer should be given when it is possible (*Phillips*, 2002). The questions are as follows:

- What is that behaviour? Here, a precise description of the behaviour should be given, resulting from relevant tools and methods of measurement.
- When does that behaviour occur? The answers to this question can be the number of times, but also a period of life, or even a sequence of an action (the animal shows a specific behaviour after a specific action or stimulus).
- Why does that behaviour occur? Surrounding the two other questions, the correct answer to this question makes a link between the behaviour and another factors, and as a result of the two other

questions, it is possible to conclude about the importance of one or more parameters characterising one specific behaviour.

When studying behaviour of cattle, more experiments are carried out on the field, under natural conditions. This is mainly due to the size of animals, of course, and also to the complexity of breeding these animals. Consequently, during the last years, scientists have studied more and more about the relation between cattle and their environment. Moreover, with the development of the ideas of animal welfare in the last decades, it has become really important to discover how the cattle are reacting to their environment because it is a way of judging welfare standards.

However, before to start this kind of study, it is important to know how the animals feel their environment and to identify which information can be the trigger of a specific reaction. So, the next part will describe the different ways of perception of cattle.

Environmental perception

Introduction

As described before, animal's behaviour is its reaction to stimuli. These stimuli come from the environment of the animal. Thus, the behaviour of an animal will be determined mostly by its perception of the environment. Two different kinds of environment can be defined: internal and external. The internal environment is created mainly by endogenous rhythms, which generate motivation but are influenced by exogenous circumstances. The external environment is determined by the senses of animals: vision, hearing, olfaction, taste and touch (*Phillips*, 2002). For cattle, sensory organs are a very important way of gathering information from their external environment, and these perceptions can help us to understand better their interaction with their environment.

Vision

Vision is one of the senses which is the most used and seems to be the most relevant for cattle. Vision is involved in the perception of most stimuli and, as in humans, is the dominant sense in many situations (*Blaschke et al.* 1984). In addition, it is responsible for approximately 50 % of total sensory information.

Colour vision

It has been proven that cattle have a good mechanism for dichromatic colour vision, which allows them to distinguish different colours (*Phillips and Lomas*, 2001), especially those with long wavelengths (yellow, orange, red). On the contrary, they have more difficulties to distinguish shorter wavelengths (grey, blue, green). Based on the previous statements, the principle used by the bullfighters can be explained, who show a red piece of tissue to attract the bull. The red is here just an indicator for the bull, which is more able to see this colour than others. Moreover, this ability of distinguishing the long wavelengths may also explain the food selection: green food is more attractive than red food (*Uetake and Kudo*, 1994).

Image

We can also examine their visual acuity. To compare with humans, the visual acuity of cattle is less than 1/50th of that possible by humans, varying with estimates from 12 to 24 arc minutes. Moreover, cattle are able to make a difference between objects with different light intensity, but not as well as humans (*Phillips and Weiguo*, 1991). They may use this ability to select dark green grass, which has a better nutritional value.

Field of vision

The eyes of cattle are situated on the two sides of the head in order to give a wide field of vision, about 320° (*Tóthné Maros K.*, 2006). This is an advantage for the detection of possible predators, such as foxes. However, the limited overlap of the eyes can be a strong inconvenience: on the contrary to humans who have an overlap of about 140° and who consequently have a large stereoscopic vision, cattle have about 40° only. So, it can be supposed that they use other means to judge distance. For example, the memory of the size of a moving object can be applied (*Phillips*, 2002).

Hearing

Some previous conclusions about the auditory powers of cattle can already be drawn from the size and the morphology of the head. Compared to other mammals, cattle have better hearing at low frequencies and worse hearing at high frequencies (*Figure 1*). However, compared to humans, cattle have much better high frequency hearing limit (35 kHz in cattle but only 20 kHz in humans) (*Phillips*, 2002).

This may be proved by some of the predators of cattle, such as vampire bats (*Desmodus rotundus*), which use high frequency vocalisations (*Phillips*, 2002). The capacity of hearing the call of bats can be useful to run away to a safer place. This ability can also have an influence on the behaviour of farm animals. Since they can be disturbed by high frequency sounds coming from milking parlour machinery, while humans can not hear anything.

Auditory stimuli such as music may encourage dairy cows to approach automatic milking systems (*Uetake et al.* 1997). It is often used and well-known method among breeders to turn up the radio in the cow houses and also in the milking parlour. As a result of it, cows are habituated to the music, thus the foreign sounds in the milking parlour do not make them anxious. Cattle might also come not only into the milking parlour but to the feeding site in response to an auditory stimulus (*Albright et al.* 1966).

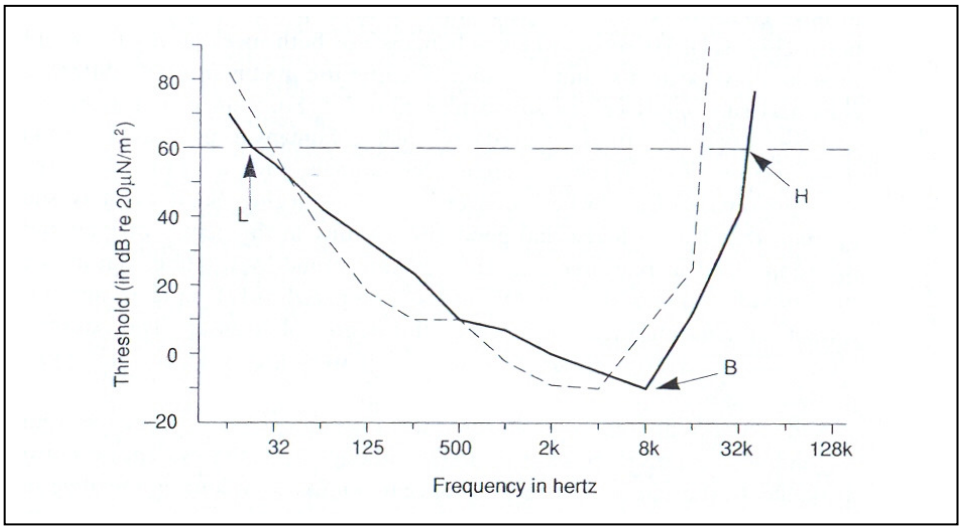

***Figure 1*: Hearing curve in cattle (—) and humans (---)** (*Heffner and Masterton*, 1990)
L: the low frequency hearing limit, B: the best hearing frequency, H: the high frequency hearing limit

1. ábra: A hallási tartomány szarvasmarha és ember esetében.
L: az alacsony frekvencia hallhatóságának alsó határa, B: a legjobban hallott frekvencia, H: a magas frekvencia hallhatóságának felső határa

Olfaction

This sense has a really important influence on the behaviour of cattle. They need this sense for intraspecies communication, mostly. Odours are used for reproduction, but also as indicators of fear or danger, and as territorial markers. Of course, odours may transmit lots of other messages, too, such as aggression or hunger.

The odour perception of cattle can be divided into three parts (*Phillips*, 2002):

- The Olfactory Receptor Neurons (ORNs), situated in the oronasal cavity, ended in cilia bathed in mucus.
- The chemosensitive trigeminal pathway, whose neurons also terminate in the nasal cavity. These neurons are responsible for the detection of irritants, especially.
- The vomeronasal organ, situated at the roof of the mouth, is composed by neurons as well, but ended in microvilli, which are really sensitive to hydrated low volatile compounds.

These compounds are applied in social and sexual communication. For example, bulls are able to detect females in oestrus by his vomeronasal organ. Cattle have a special way of collecting odours and leading them to the microvilli, the so-called Flehman expression. In this process, the head is directed upwards, with opened mouth, tongue out of the mouth and upper lips curled back, allowing the air to reach the roof of the mouth, where the receptors are situated. This technique may also be the indicator of a relaxed animal.

One important category of odours has to be also mentioned. The pheromones are a special group of attractive compounds produced by animals to stimulate others. There are much different chemical content of pheromones in cattle (alcohols, diols, alkanes, ethers, aromatic alkanes etc.). They are present in all the body fluids, including sweat, urine and blood. The reproduction pheromones can be found on the hindquarters and on the genital region in higher concentration, hereby it can be easy recognised for cows and bulls, which spend a lot of time sniffing the anovaginal areas of other cows to discover cows in oestrus (*Phillips*, 2002).

Taste

First of all, four primary tastes are identifiable and can be correlated to physiological requirements: sweetness for energy, saltiness to control electrolyte balance, bitterness to avoid toxins, and acidity to regulate pH (*Phillips*, 2002). All the other tastes derive from these four main tastes. As for humans, the areas of perception of every taste are on different areas on the tongue, although these areas are not situated at the same place. The number of taste buds changes by the age of cattle. *Davies et al.* (1981) have reported that 4 and 6-year-old Holstein Friesian cows showed an amount of 14,765 and 21,691 taste buds, respectively. Both salty and bitter tastes have the property to reduce the feed intake, whereas sweetness increases it. However, low concentration of salt in feed increases the palatability of the diet. Then, feeding medium concentration of salt, the change in the intake of animals is not significant, but in case of high concentration (more than 11 g Na/kg DM), the intake decreases (*Phillips et al.* 1999).

Sensibility to pain

As the cattle have evolved as prey animals, they are not likely to show pain, because in this way they look like less potential preys for predators. Consequently, they have a whole system inducing the production of endorphins to quell the sensation of pain.
On the breeders' side, the sensibility to pain, even if it is lower than for other species, has to be reduced on for some interventions, such as dehorning, using anaesthetics (*Graf et al.* 1999).

Relations in cattle breeding

Relations between animals

Animals are generally classified as solitary, aggregated or social creatures (*Phillips*, 2002). The difference between the aggregated animals and the social animals is that the aggregated animals are likely to live in groups, but there is only sexual communication in the group. Cattle are social animals, because they use complex communication channels, such as visual, olfactory, vocal or tactile communication. Cattle have a tendency to live in groups in the nature. It is clear that increasing the number of animals makes the task more and more difficult for predators to catch their prey.

Cattle develop social relations with their herdmates. It has been revealed, that cows can recognise 50 to 70 mates in the same group (*Frazer and Broom*, 1990). When there are more cows in a herd, cows are expected to form subgroups. In these groups, they recognise each other mainly visually, but also by the voice of other animals.
Lewis (1978) has established that cattle have shorter interanimal distances than other grazing mammals, but it depends on the activity of animals. For example, for dairy cows the personal distance is 2-3 meter at lying, 4-10 meter at grazing and 4-8 meter at standing. This is probably due to selection finished by humans in the last centuries. By selecting animals with aggressive behaviour in herds cattle have become calmer in the next generations, and so, they have been easier to manage in the practice.

Cattle in a herd can be separated into different groups by their dominance levels in the hierarchy. Dominance relations of a group are developed by serial social interactions including fights, as well (*Czakó*, 1978). Dominant animals are the ones that have a privilege to higher quality places, in all domains. For instance, in the presence of flies, they are in the centre of the group, where less flies can be found. On the feeding place, they are the first that can feed peacefully without any attack.

The older bulls are the most dominant animals in the group. Usually, two full-grown bulls try to keep a personal space and avoid direct confrontation, but if they are put together in a herd or a park, they become more and more aggressive. In the herd of cows it can be found relative stabile dominance ranking, which changes if a new animal get into the group (*Jensen*, 2006). In this case, the current hierarchy splits and a new hierarchy develops in 5-6 days, so that the access to resources, such as feed, drink or free place for laying can be determined (*Czakó*, 1978).

Cattle support the social relations between themselves with grooming for comfort feeling and sexual interactions, as well (*Phillips*, 1993).

There is a special relationship between calf and its mother. Immediately after birth, the calf is not interested in its environment, but just in its mother. Then, within few hours, the mother and the calf develop communication with each other. Licking by the mother creates the first contact, due to salivary pheromones. Later, the calf is able to recognise its mother by the colour marks, the vocalisation and the odour (*Phillips*, 2002).

Relations between humans and animals

Humans have a really important role in the environment of cattle. By having a look at the different cattle, it can be seen that a big part of them has been domesticated for decades. Consequently, the human-animal relation has nowadays an important influence on cattle's behaviour. Moreover, this relationship has been studied by many researchers because of its importance in the breeding. Regarding the different kinds of management in the breeding, different types of perception of humans can be defined.

First of all, the reaction of animals towards humans is important to be considered. The concept of flight zone or animal's personal space determines the limit of the disturbing influence of humans around the animals. Every animal has a zone within it is likely to flee humans if it is possible. Out of this zone, it looks at the direction of handler, but in this zone, it turns to the opposite direction and try to run away (*Figure 2*).

This concept is well known from every farmer and used every day during handling cattle, efficiently and safely. Every farmer who has understood the concept of zone and balance is able to handle his animals much easier.

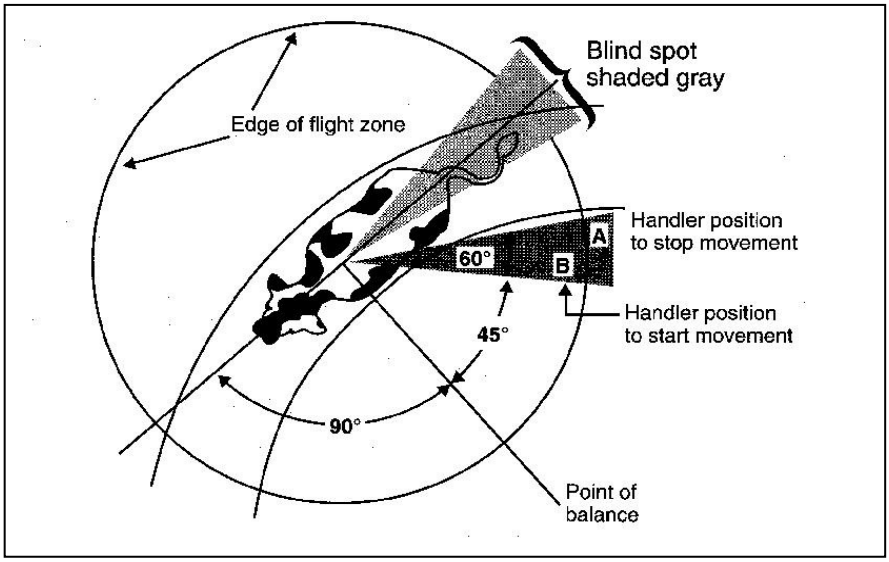

***Figure 2*: The flight zone of cattle** (*Grandin*, 1989)

2. ábra: A menekülési zóna határa szarvasmarha fajban

However, cattle's flight zone does not always have the same circumference. It depends on the species, the breed, the management and of course, on how calm an animal is. It gets bigger when the animal becomes excited or you approach the animal from the front. Completely calm animals have no flight zone and people can touch them (*Grandin*, 1989).

In function of the breeding system, the person who looks after the cattle can be seen for them as a more or less dangerous threat or as a dominant animal in the herd. Consequently, the relationship between humans and cattle can considerably depend on the position of the herdsman in the hierarchy of the herd. Indeed, there are different ways for breeders to achieve their purposes, which is to obtain the control of animals. The base of one of these methods is the full dominance of human on the cattle. Practically, it means that human can replace the head of the herd at the top of the hierarchy. The whole lack of dominance is another way can be used by breeders, for example in the breeding of fighting bulls. Spanish breeders tend to develop a relation in which both humans and animals try to avoid direct contact as far as possible. However, in case of contact, the bulls can show aggression towards humans, in the same way as among its fellows. The main forms of aggression are charging, pushing head, butting and occasionally kicking (*Phillips*, 2002). Mounting can be mentioned to have both aggressive and sexual functions. Charging can be noticed among bulls to make an impression on other bulls or humans. Then, pushing head has the same function, but it can also be seen among cows. Butting involves a typical upswing of the head or flanks of other animals. The result of these activities influences the hierarchy in the herd (*Phillips*, 2002).

The difference between cattle in aggression can be affected by many factors. It has been observed that aggressive behaviour less occurs in dairy breeds than in beef breeds, but it mostly depends on the breeds compared and on the conditions around them. Indeed, in wild and semi-wild cattle that get enough resources, the level of aggression is lower (*Phillips*, 2002). So, the hypothesis that environment is more important for cattle than endogenous cues can be confirmed.

Individual variations in aggressive tendencies in competitive situations may relate to different factors, in a special order:

- variation in pain perception,
- determination to maintain privilege to resources such as feed and drink,
- position in the dominance order: a higher dominance position determines a higher level of aggression to keep the place in the hierarchy (*Phillips*, 2002).

The knowledge of these factors inducing differences can already be a good tool for breeders to measure and control their animals. By their level of aggression, it can be concluded the strategy and the behavioural type of animals considering the factors.

Moreover, it is possible to examine their environment and observing the formulation of the natural behaviour of cattle among its fellows some conclusions could be drawn about the environment and possible lacks influencing the welfare of animals or even the production results on the farm.

Temperament of cattle

The importance of temperament

Temperament can be defined as the type and the level of reaction of an animal to external stimulations. On the one hand, these stimulations can be induced by humans (moving of a herd, milking, visitors etc.), on the other hand, animals also react to their living conditions (different housing systems, different feeding methods etc.). By all these, it can be concluded that temperament can be defined as the type and the level of reaction of an animal to its entire environment (*Phillips*, 2002).

Nowadays, welfare has become an important aspect in animal breeding, thus in cattle breeding, as well. In order to assess this welfare, the behaviour and the environment of animals can be examined, such as the housing system, the handling methods and the daily routine of animals. By judging the temperament of cattle, their reactions may be compared to their environment with some welfare standards. Consequently, temperament has become a really important trait for assessing welfare.

Evaluating temperament can also be useful for other reasons, for example regarding the security of the farmers, who are more likely to work under safe conditions. Indeed, the breeding methods have become more and more intensive during last decades, and the main consequence of it is the increase of the number of animals, which increases the risks for the farmers.

Furthermore, a nervous temperament in cattle breeding can cause various problems that are disadvantageous in production:

- risk of damaging farm equipment, making them dangerous for humans,
- decrease of fatting results,
- decrease of daily gain, more loss of weight during transport,
- decrease of meat quality (*McDonald*, 2003).

Characteristics of temperament

Temperament can be described as a major parameter in the personality or the mood of cattle in relation to their reaction to humans (*Phillips*, 2002). Temperament, as an expression of sensibility of the nervous system, is closely related to metabolism, because both speed of metabolism and sensibility of the nervous system are regulated by thyroid hormones (*Stefler et al.* 1995). It is genetically unrelated to dominance order.

There are both genetic and environmental factors developing temperament. The heritability of temperament varies between 0.12-0.67 depending on the measuring methods (*Szentléleki et al.* 2005). *Table 1* shows the differences in heritability between temperament tests.

When the heritability is low or medium, the housing conditions principally affect the temperament of animals. Indeed, among environmental factors the management is one of the most important effects on the behaviour of cattle. Moreover, the previous handling experiences have also a strong impact on the temperament of cattle. Temperament is not the same for every animal since it depends on the frequency of handlings, on the level of unpleasant feeling during handling and also on the age on handling.

***Table 1*: Estimated heritability of temperament in different tests** (*Szentléleki et al.* 2005)

Methods of measurement(1)	h^2±SE	Breed(10)	Sex(14)	Age, month(18)
Non-restrained tests(2)				
Flight speed test(3)	0.54±0.16	Zebu derived (11)	Male and female(15)	6
Flight speed test(3)	0.26±0.13	Zebu derived(11)	Male and female(15)	18
Flight distance test(4)	0.40±0.15	Brahman crossed(12)	Male(16)	6
Flight distance test(4)	0.32±0.14	Brahman crossed(12)	Male(16)	12
Docility test(5)	0.22	Limousin	Female(17)	10-11
Restrained tests(6)				
Bail test(7)	0.67±0.26	Different beef cattle breeds(13)	Male and female(15)	10 or 22
Crush test(8)	0.25±0.20	Different beef cattle breeds(13)	Male and female(15)	10 or 22
Temperament score(9)	0.14±0.11	Brahman crossed(12)	Male and female(15)	6
Temperament score(9)	0.12±0.11	Brahman crossed(12)	Male and female(15)	12

1. táblázat: A vérmérséklet becsült örökölhetőségi értékei a különböző tesztekben
mérési módszerek(1), kötetlen tesztek(2), menekülési sebesség teszt(3), menekülési távolság teszt(4), szelídségi teszt(5), kötött tesztek(6), nyakrögzítő teszt(7), szorító teszt(8), vérmérsékleti tesztek(9), fajta(10), zebu leszármazott(11), Brahman keresztezett(12), különböző húsmarha fajták(13), ivar(14), nő- és hímivar(15), hímivar(16), nőivar(17), életkor, hónap(18)

By measuring temperament, the fearfulness of the animal and its reaction to an unknown stimulus can be determined, not its aggressiveness (*Lanier et al.* 2000). Remembering the definition of temperament, it is clear that it cannot be measured by observing aggression, but by the reaction to handling by the herdsman. Indeed, aggressiveness is a threatening or offensive behaviour against animals of the same or other species for defending or possessing the more favourable position, for instance in territory, feeding or mating. Additionally, it is in connection with the dominance level in the herd (*Czakó*, 1978). The fearfulness can be expressed by escaping or with nervous activity, when the animal attacks the handler. However, there are a lot of other aspects and ways to assess temperament of an animal, for example during a specific activity like milking of dairy cows.

Methods of measuring temperament

Many different types of measurements of temperament have been developed by researchers. In order to get correct data about cattle's temperament, it is important to examine and define precise ways of measuring it.

Temperament is investigated in different tests, as a behavioural reaction of animals to handling by humans (*Bucherauer*, 1999). Two different categories can be distinguished: the restrained and the non-restrained tests (*Burrow,* 1997).

Non-restrained tests

In non-restrained tests the animal has freedom in movement because the measurements are carried out in a relatively large area. These methods of measurement are more applied in extensive systems, where animals are kept outside on pastures. Indeed, under these conditions the non-restrained tests are easier to manage. However, different methods exist in this category and some of them are used for dairy cattle, as well. Then, in function of the tested parameter, there can be different types of tests:

- In approachability and flight distance tests, the measured parameter is the shortest distance for an unknown person to approach the actual animal before it reacts to the approach of the person. The observer actively takes part in these experiments and the reaction of the animal reflects its fear induced by the entrance of an unknown person into its personal space (*Murphey et al.* 1980; *Kabuga and Appiah*, 1992).
- In approach and behavioural tests, the observer has passive role and the animal is expected to move towards the observer. Indeed, in these experimentations the time is measured taken for an animal to approach an unknown person to a touching distance and the number of touches is also counted in a fixed time interval (*Murphey et al.* 1981; *Boissy and Bouissou*, 1988).
- In open-field and pound tests, the reaction elicited by a new stimulation or an unknown person appearing in the visual field and the speed of movement are recorded in presence or absence of an observer. The scoring system is also based on a 1-5 scale (*Kilgour*, 1975).
- In yard test, animals are put individually in a small square yard test and the handler should try to hold that one animal in one corner of the yard, away from the other animals for about 30 seconds. The animal is scored on a scale of 1 to 5 according to its behaviour during the test (1: easily held in the corner and the handler can get close enough to put his stick on the animal, 5: cannot be held in the corner, but also aggressive towards the handler) (*McDonald*, 2006).

- In docility tests (*Figure 3*), the handler has 2 minutes to lead an animal to the corner of a testing pen, has to keep it for 30 seconds in that 2x2 meter zone, and then strike it with a short stick. Then, the docility is assessed in function of the behaviour of the animal on a scoring system going from 6.5 to 17.0 (*Le Neindre et al.* 2000).

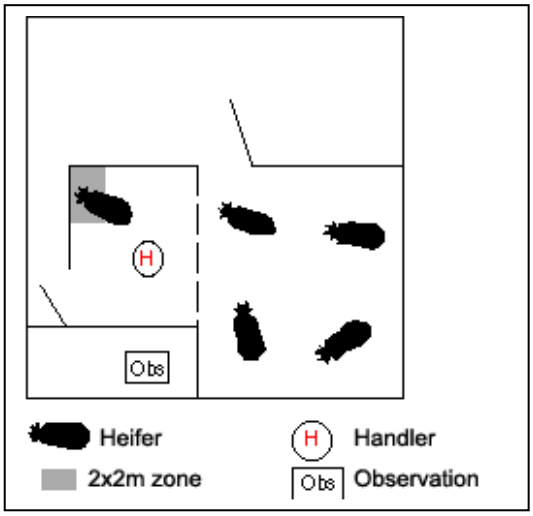

***Figure 3*: Docility test** (*Le Neindre et al.* 1995)

3. ábra: Szelídségi teszt

- In the flight speed test, the tested parameter is the time taken for an animal to move to a set distance after opening the door of the weighing scale (*Burrow et al.* 1988). It is supposed, the faster the animal leaves the scale the more nervous it is.

Restrained tests

In restrained tests, the measurements are carried out in places where animals are restricted in their movement. Similarly to the non-restrained tests, there can be different kinds of tests:

- Bail test evaluates the behaviour of animals in iron collar. The temperament is scored on a 1-8 scale from peacefully stand till violently struggle (*Fordyce et al*. 1982).
- Crush test is constructed in a confined place where animals have to stay for 30 seconds. The temperament is scored during the stay in the crush area and exiting the crush, on a 1-5 scoring system going from docile till aggressive (*McDonald*, 2006).
- In scale test, temperament of an animal is assessed on a weighing scale a 1-5 points scale (1: calm. 5: nervous) while it stays for 30 seconds on it (*Trillat et al.* 2000).

Dairy temperament tests

Apart from these two categories (non-restrained and restrained tests), a special category has been formed for tests of dairy cows (*Szentléleki et al*. 2005). The dairy temperament tests directly connected to milk production are assessed subjectively with different scoring systems during the milking procedure. These systems are based on 1-3, 1-4 or 1-5 scales (*Gupta and Mishra*, 1979, *Budzynska et al.* 2005).

The objectivity of the measurements

There is one important difference between all these temperament tests, that is the objectivity. Indeed, a test should be as objective as possible in order to be compared with others and to be repeatable without any changes in the results. However, some of the methods are based on completely subjective scoring systems. In these cases, an observer gives a score by a scale for the behaviour of the animal like in scale test. The score shows simply the viewpoint of the observer, contrary of flight speed test for example, where measurable traits recorded by a machine represent the temperament of an animal.

Table 2 presents the objectivity of main methods applied in evaluating temperament of cattle.

Table 2: **Methods applied in evaluating temperament of cattle and their objectivity** (*Szentléleki et al*. 2005)

Methods(1)	**Name of tests(4)**	**Objectivity(16)**
Non-restrained(2)	Pound test(5)	objective(17)
	Approach test(6)	objective(17)
	Approachability test(7)	objective(17)
	Flight speed test(8)	objective(17)
	Flight distance test(9)	objective(17)
	Open-field test(10)	objective(17)
	Docility test(11)	objective(17)
	Behavioural test(12)	objective(17)
Restrained(3)	Scale test(13)	subjective(18)
	Bail test(14)	subjective(18)
	Crush test(15)	subjective(18)

2. táblázat: A szarvasmarhák vérmérsékletének mérésére alkalmas tesztek és azok objektív értékelése módszerek(1), kötetlen tesztek(2), kötött tesztek(3), a tesztek elnevezése(4), karám teszt(5), közelítési teszt(6), megközelíthetőségi teszt(7), menekülési sebesség teszt(8), menekülési távolság teszt(9), nyitott térben végzett teszt(10), szelídségi teszt(11), viselkedési tesztek(12), mérleg-teszt(13), nyakrögzítő teszt(14), szorító teszt(15), objektivitás(16), objektív(17), szubjektív(18)

Conclusion

The temperament of cattle has been studied for years. It was first studied in order to answer to the main questions concerning animal behaviour, and then it has become obvious that the observation of the behaviour of animals is one of the ways for better farm management. In addition, nowadays it could be a method for evaluating animal welfare. Indeed, as topic of animal welfare have become more and more important in the animal breeding, temperament is revealed to be one of the main behavioural traits for reflecting this welfare. Based on all the information in this article, it is possible to examine temperament in one specific herd and compare it with the management of this herd.

Then, the consequences of this farm management may be also determined by the production results of the animals. Finally, due to these results, we could draw conclusions about the effect of a specific farm management on economic results and on animal welfare.

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