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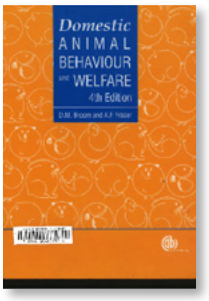

2 Describing, Recording and Measuring Behaviour

Levels of Description of Behaviour

The words used to describe behaviour are a consequence of how people think about what they see or hear. Those words in their turn, however, may change the way of thinking of the person who uses them or of the person who hears or reads them. This occurs especially when the word used to describe the behaviour implies something about the emotional state or the intentions of the animal whose behaviour is described. Hence it is important to be accurate and cautious when describing. As an example of the problem, suppose that a hen is seen to move rapidly, flapping her wings, over a distance of 3 m starting at the edge of one group of birds and finishing next to a wall where a single bird standing there moves away. An observer might describe this sequence of behaviour by saying that the hen is frightened, angry or aggressive. This may be true, but does not inform others about what has been observed. In order to communicate effectively with the listener or reader when describing behaviour, it is best to state what is seen in the manner of the descriptive sentence above.

In selecting measures for a particular study it is useful to know the array of behaviours the animal is capable of showing. A largely complete description of such an array is called an ethogram, and papers have been published which present an ethogram for a species. These papers are necessarily based on an extensive study of that species and they can be very useful if the behaviour description is precise enough. It is still necessary, however, for the observer to spend some time becoming familiar with the behavioural repertoire of the animal. It is likely that any detailed behavioural study will add to our knowledge of the repertoire and organization of that animal's behaviour, so no ethogram is ever complete. The actual selection of measures should take account whether or not the measures are independent of one another; for example, one activity may necessarily be preceded by another or may prevent the occurrence of another.

When considering the level of detail of description it becomes apparent that some behaviours like sleep are continuous, while others like walking are a series of repeated movement sequences and others like displays or grooming are made up of sets of recognizable units. Rowell (1961) distinguished between acts, such as a finch bill-wiping: 'bending forward, wiping the bill on the perch and resuming an upright posture' or a step during walking, and bouts such as a sequence of walking with a gap before the next sequence. The question of how to decide, for activities such as walking, preening, eating or displaying, when a bout ends is discussed by Broom (1981).

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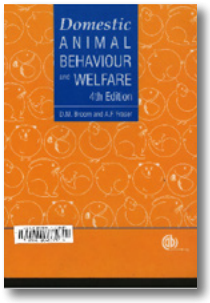

Design of Experiments and Observation Procedures

Before commencing a behaviour study it is important to consider whether the design of the procedures to be used is adequate to allow reliable conclusions to be drawn from the results of the work. The first precaution concerns the effects of the presence of the observer on the behaviour of the animals. As mentioned above, an animal that is being examined may behave in different ways in the presence and absence of an observer. Small animals like chickens, unless handled frequently and gently from an early age, treat man as a dangerous predator. Hence, their behaviour can be affected very substantially by the proximity of a person watching them. Other animals are also affected by human presence so it is advisable, when watching any of these animals, either to observe from a hide or to carry out checks to ascertain how much behaviour is changed by the observer.

Behaviour observation can be accurately replicable if the definitions of measures and precision of recording are sufficiently clear. It is desirable, if more than one observer is involved, however, for studies of inter-observer reliability to be carried out. The possibility of bias, deliberate or unintentional, should also be considered when designing observation procedures. If two treatments are being compared, wherever possible the observer should be 'blind' in the sense that the treatment category to which each animal belongs is not known at the time of observation.

Wherever experiments are carried out, one or more control situations should also be studied. For example, in a study of the effect of a hormone treatment on behaviour, a control group whose conditions are exactly the same as the experimental group, but with an inert substance given to the animal in the same way as the hormone, should be used. Studies of behaviour often require replication, since unknown variables can sometimes lead to spurious results. An illustration of such necessity is the study of orders of movement of a group of animals from one place to another. The order of animals on one occasion, or in one situation, will be affected by chance and may be substantially changed by local conditions, so orders should be recorded on several occasions and in several different situations before any conclusion about social relationships can be reached.

Whenever sets of observations are replicated, the experimenter must be aware of any possible effects of learning on the results. No animal that has been exposed to experimental conditions can be assumed to be unaffected by them, so its behaviour may be different during any repetition of these conditions. In some studies these very changes are under investigation or, as in the case of regular movement orders, the situation is a very frequent one in the animals' lives so behaviour is not likely to change rapidly, because of previous experience of that situation. In other studies, however, an unusual stimulus is presented to the animal and a subsequent response to the same stimulus may be either much less, due to habituation, or much greater, due to sensitization. The design of experiments is explained in more detail by Lehner (1996) and Hawkins (2005).

Sampling and Measuring

Several decisions have to be taken when behaviour is to be measured and these are interrelated in that they are limited by the capabilities of the observer, and greater detail in one aspect means potentially less detail in another. The first decision concerns which animals to observe. If much detail from direct observation is required, then it will be possible to observe only one animal at a time. This may be an individual in its own pen or home or it may be a focal animal that can move around within a group. With appropriate sampling methods, data on several or many animals at once can be collected by scanning them, but information about each individual is lost by sampling.

The information about one kind of behaviour that can be obtained from observation and recording might include:

- The presence or absence of the particular activity.
- The frequency of occurrence of each activity during the observation period.
- The duration of each bout of each activity.
- The intensity of the activity at each occurrence.
- The latency of occurrence of the activity.
- The timing and nature of subsequent activities.
- The timing and nature of behaviour changes in relation to physiological changes.

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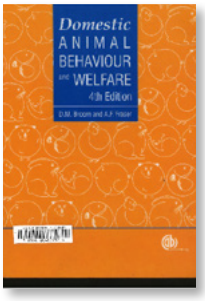

Continuous recording of behaviour

This technique can be difficult if many measures are used, and recording aids (see below) are often needed, but it offers opportunities for all the different methods of analysis. Sampling behaviour makes possible the collection of data on more than one individual and it allows an estimate of the duration of activities in situations where continuous recording is not possible, but some information is lost. There are three sorts of sampling that can be used: two types of time sampling and behaviour sampling (see Fig. 2.4).

Behaviour sampling

Also known as 'conspicuous behaviour recording', this involves continuous observation of animals but recording only certain kinds of behaviour. For example, a group of dogs may be watched and all occasions where one animal sniffs another recorded in detail. Behaviour sampling may also occur automatically in that a single action, such as pecking a key by a chicken, may be automatically recorded but all other actions are ignored. This method is particularly useful for rare behaviour patterns that might otherwise be missed.

Point sampling

Also known as 'instantaneous sampling', this involves observing animals at regular, predetermined points in time and recording whether or not each of a range of behaviours is being shown at that instant. As shown in Fig. 2.3, a useful estimate of duration of the more common activities is obtained if the observation period lasts long enough and if the interval between the samples is not too long. Rare activities might be missed altogether, however. It is a problem of the method that observers tend to try to include activities that do not actually occur at the moment of sampling. A further problem is that some activities take some time to recognize. For example, when a cow is ruminating it takes a few seconds to be sure of this since the characteristic jaw movement takes time to identify and the animal might be swallowing just at the moment of sampling. The major advantage of this method is that it can be used when many individuals are scanned, so one person can collect much information.

Period occurrence

This type of recording (Broom, 1968b), often rather confusingly called 'one-zero sampling', is another form of time sampling in which the events which have occurred during a predetermined time period are recorded at the end of the period. Several animals can be observed simultaneously because the data do not have to be recorded continuously. As

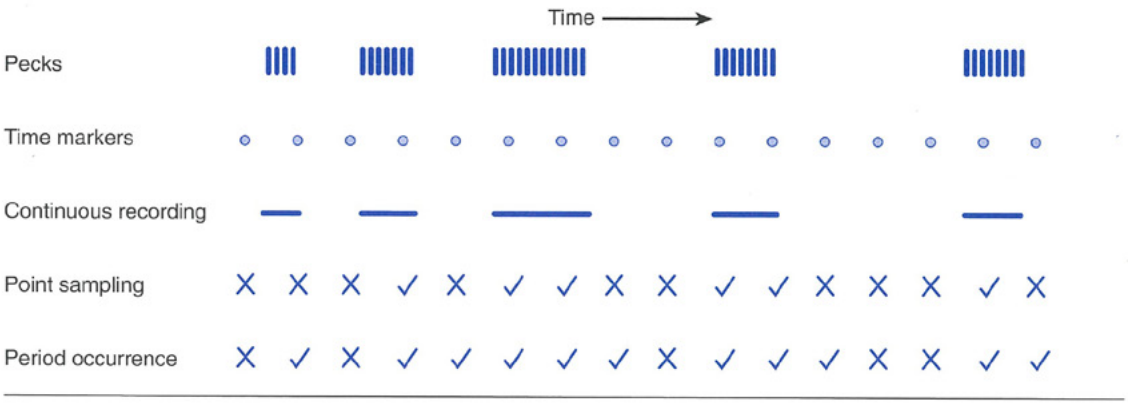

Fig. 2.4. Comparison of behaviour recording methods. A series of pecks by a chick are shown as if produced by an event-recorder moving at a constant speed. If Continuous Recording was used, lines like those shown – or precise times of stopping and starting each bout of pecking – would be produced. Point Sampling and Period Occurrence would produce Yes or No answers at each time mark, as shown.

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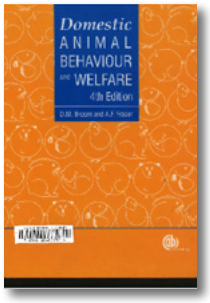

23 Abnormal Behaviour 1: Stereotypies

What is Abnormality?

In order to recognize that behaviour is abnormal, the person observing must be familiar with the range of normal behaviour of that species. For some abnormalities, indeed, recognition depends upon a knowledge of the behaviour of that particular individual.

The most obvious kind of abnormality is a distinct pattern of movements, but even this will usually have components which are shown as components of some normal behaviour. The most common abnormalities are those where the frequency of the movements, the intensity of the actions or the context in which the behaviour occurs is different from the norm. The animal may show the behaviour in an attempt to cope with some aspect of its environment. In some cases, that abnormal behaviour may help the individual to cope but, in other cases, it may confer no beneficial effect. Abnormal behaviour is behaviour that differs in pattern, frequency or context from that which is shown by most members of a species in conditions that allow a full range of behaviour.

Some abnormal behaviour has an obvious detrimental effect on either the animal showing it – for example, horses eating wood – or on other animals – for example, pigs tail-biting.

Stereotypies

It has long been known that some caged animals in zoos and some human prisoners in isolation cells will pace out the same route over and over again. Similarly, birds in small cages will fly or hop from perch to perch, following a route, and both monkeys in cages and autistic children will rock backwards and forwards for long periods. Hediger (1934, 1950) and Meyer-Holzapfel (1968) gave many examples of such behaviour in zoo animals, and Levy (1944) described examples of head-shaking in battery hens and various movement patterns in children. Brion (1964) described crib-biting and -sucking by horses, and Fraser (1975c) described bar-biting by pigs. A stereotypy is a repeated, relatively invariate sequence of movements that has no obvious purpose. Its occurrence and causation are described in detail by Broom (1981, 1983b).

A stereotypy is usually recognized because a sequence of movements is repeated several times with little or no variation. However, the behavioural repertoires of animals include many examples of repeated action patterns – for example, walking, flapping flight and various displays that would not be called stereotypies (Broom, 1983b).

Stereotypies occur in situations where the individual lacks control of its environment. In some cases, the animal is obviously frustrated and in other cases the future events are rather unpredictable. Frustration about food inadequacy is one factor leading to increased likelihood of stereotypies (Lawrence *et al.*, 1991; Mason, 1993; Vinke *et al.*, 2002).

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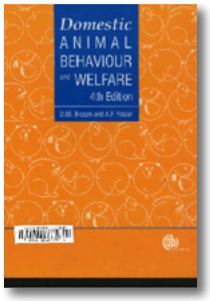

Pacing or route-tracing

The repeated action patterns during pacing or route-tracing are those used in walking or other locomotion, but the animal follows a path that returns to its point of origin and which is often repeated with only minor modifications. The route-tracing of zoo animals in cages, of some confined domestic animals and of confined or disturbed people has often been described. Some obvious frustration is normally evident, most frequently that the animal cannot escape from confinement in a cage or pen, but occasionally that access to a social partner, a sexual partner, food or some other resource is impossible.

Circling and tail-chasing

Animals of various species may sometimes turn in tight circles and dogs may do so, apparently trying to catch their own tails. Occasionally, this is a result of a neurological disorder. Tail-chasing is most likely to occur when a dog is excited and frustrated, for example, because there is a possibility that it will be taken for a walk, but it cannot control when or whether or not this happens. The behaviour usually stops when the frustrating situation is resolved.

Rocking, swaying and weaving

The individual remains in one place when carrying out this stereotypy, but the body is moved backwards and forwards or from side to side, with or without head-swinging. Monkeys in captivity, especially those deprived of their mother or of companions for some time, show rocking behaviour; so too do autistic children and other children in very disturbing circumstances. Horses, calves and adult cattle that are tethered or in small pens will sometimes rock and sway.

Weaving in horses involves swinging the head and neck and anterior parts of the body from side to side, so that the weight rests alternately on each forelimb. In most cases the forefeet remain on the stable floor during the behaviour but, in extreme cases, each foot is raised as the weight passes on to the other foot.

Table 23.1. Conditions leading to stereotyped pacing by hens (frp, Duncan and Wood Gush, 1972).

	Mean number of stereotyped pacing routines in 30 min
Deprived, fed	13.3
Not deprived, not fed	18.7
Deprived, frustrated (food under perspex cover)	161.0

Rubbing

Some part of the body is moved back and forwards against a solid object and the movement is repeated so many times that it could not function merely to alleviate a local irritation.

Cattle confined to stalls for extended periods, such as in winter, may rub their heads repeatedly against some part of the stall. This behaviour is more noticeable in horned breeds and more in bulls than in other stock. Head-rubbing in pigs is sometimes observed in animals subject to chronic restriction within narrow, single stalls. In this behaviour, the upper snout region of the sow is rubbed repetitively and vigorously along the underside of a bar across the front of the stall.

Pawing and stall-kicking

Although pawing is a normal behaviour of four-legged animals, it can be shown in abnormal form when it is performed with vigour in a persistent, stereotyped fashion. Dogs may show pawing in certain frustrating situations, and pawing may occur when horses are frustrated in obtaining food. The anomalous condition is shown in pawing that is so frequent and vigorous that holes may be dug in the stall floor and the hoof worn down severely. Continual pawing on a hard floor can result in various forms of leg strain and injury. Attempts to control this problem through negative conditioning have not been successful. It occurs most frequently in confined and isolated horses, so may be alleviated by turning the affected animal out to pasture in the company of other horses.

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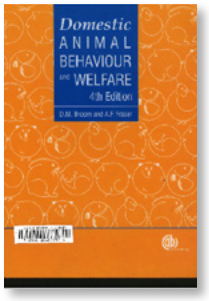

Eye-rolling

The eyes are moved around in the orbit at a time when no visible object is present, and moving in such a way as to lead to such movement. Young calves confined in crates sometimes stand immobile for extended periods and do not show the normal variations between lying and upright positions. During some of these episodes, the head is held motionless and the animal rolls its eyes within the orbits so that only the white sclera is shown, such eye-rolling being frequently repeated.

Sham-chewing

Jaw movements like those shown when chewing food are shown at a time when the animal has no food in its mouth. This condition is typically seen in sows that are tethered or kept singly in stalls in which no litter is provided. The animal chews vigorously at a time when all food available has been eaten and, since pigs are not ruminants, there can be no oral content except saliva. Constant features involve periodic chewing and mouth-gaping, while the chewing motion causes frothing and foaming of saliva. This foam collects on the outer edges of the lips (see Fig. 23.2) and the corners of the mouth and drops to the ground, where such material can remain in portions, for some time, as evidence of this activity. Sham-chewing occurs most often while the sow is lying in a prone position or on its haunches in a dog-sitting position. It can be maintained as a prominent activity enduring throughout consecutive days. Broom and Potter (1984) reported that sows spent up to 90 min sham-chewing (median 26 min) during the 8 h of daylight, and Sambraus (1985) describes sows that were sham-chewing for many hours, day after day.

Head-shaking or head-nodding

The head is moved vertically, laterally or with a rotary movement of the neck. Head-shaking occurs in the domestic fowl and takes the form of a rotary movement of the head, with a series of rapid side-to-side turns ending with a slight downward movement (Levy, 1944). These spasms of movement last only for a second or so but may be repeated in succession for several minutes. They are also shown by jungle fowl (Kruijt, 1964).

Increased head-shaking sometimes results from the close presence of an observer from which the bird cannot escape. For example, it has been found that, in certain strains of birds, the incidence of head-shaking increases fivefold in the presence of an observer in an obvious position (Hughes, 1980). There appears to be more head-shaking in caged birds than in floor-housed hens, and it is affected by breed, space allocation, group size, transfer to novel conditions and social rank (Hughes, 1981; Bessei, 1982). These results and those of Kruijt (1964) and Forrester (1980) suggest that head-shaking is linked to attentional mechanisms and the preparation for making a response. Hence, the behaviour may have a function when shown occasionally but should be regarded as abnormal and a stereotypy when shown often.

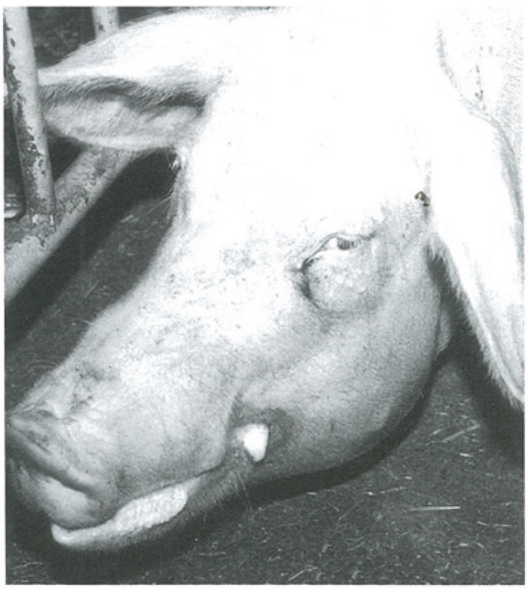

Fig. 23.2. Sham-chewing stereotypy in a sow (photograph courtesy of H.H. Sambraus).

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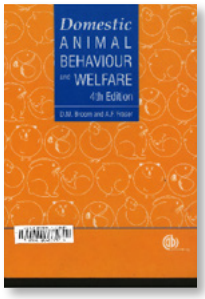

Licking or crib-whetting

In stereotyped licking, the tongue is applied repeatedly to an area of the animal's own body or to an object in the surroundings, with the same pattern of movement. This action may result in injury to the tongue, a wearing away of the area licked or ingestion of substantial quantities of hair or other materials (see Chapter 24). Stereotyped licking occurs in situations where animals have inadequate quantities of food, no teat from which to suck or insufficient total sensory input.

Bar-biting, tether-biting or crib-biting

The animal opens and closes its mouth around a bar, tether or stable door, engaging the tongue and teeth with the surface and performing chewing movements. Bar-biting has been described for pregnant sows housed in stalls or tethers that are very restrictive and do not allow the animal to turn around. The crate front and sides are made of metal piping. Tethers are commonly metal chains that the sow can bite and move up and down. Floors may be solid concrete or slats.

When engaged in bar-biting (see Fig. 23.4), the sow takes into its mouth one of the cross-bars at the front of the crate and bites it, rubs it with the body of the tongue or slides the mouth across the bar in rhythmic side-to-side motions (whetting). While biting the bar, the sow may take a firm grip on it with its jaws or may press the body of the tongue against the bar. In some instances the sow disengages from bar-biting and rubs its nose, above the snout, underneath the bar in side-to-side motions. Tether-biting occurs in much the same way but movements after the tether chain is taken into the mouth are more variable, as the tether can be moved more than can a bar. The sequences of movements include series of elements that are repeated exactly and others that are more variable. Breaks in these activities occur so that they are produced in episodes of activity. Trauma to the sow is not usually observed as a result of this condition.

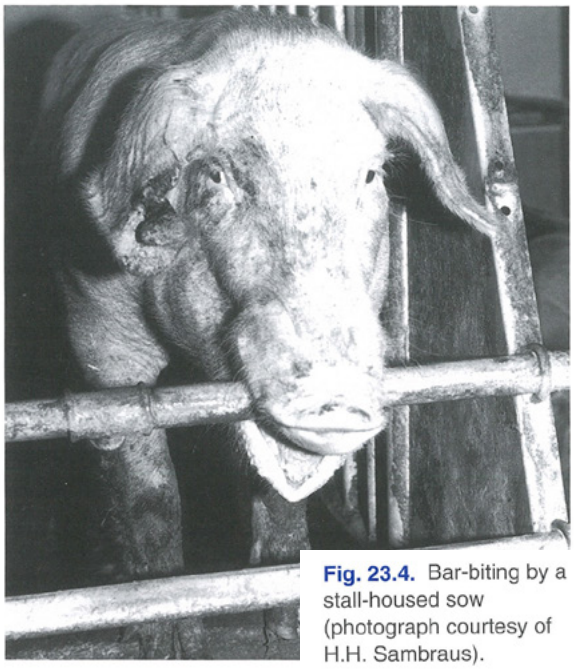

Fig. 23.4. Bar-biting by a stall-housed sow (photograph courtesy of H.H. Sambraus).

Drinker-pressing

This stereotypy (see Fig. 6.4), pressing an automatic drinker repeatedly without ingesting the water, is shown by pregnant sows kept in stalls or tethers and provided with a nipple drinker. The drinker is one of the most interesting items in the animal's surroundings, and some individuals spend long periods manipulating it (see above). In a study by Broom and Potter (1984), sows spent from 2 to 74 min pressing their drinkers during 8 hours of daylight. The median time spent was 10 min, which is considerably longer than necessary for drinking.

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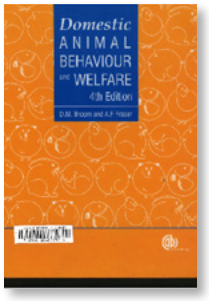

25 Abnormal Behaviour 3: Addressed to Another Animal

Feather-pecking, body-pecking and eating pecked matter

Feather-pecking is a form of anomalous behaviour common in poultry. Under conditions of intensive management it can occur in all ages and many species, including chicks, adult hens, turkeys, ducks, quail, partridge and pheasants. The normal exploration and food investigation behaviour of such birds involves pecking, so it is not surprising that in a barren environment they investigate the feathers of other birds in this way. Hens crowded together on wire floors have few objects at which to peck. In these conditions birds peck on the backs, tail, ventral region and cloaca of associate birds. Mutual pecking, in which chicks in close parallel and opposite positions peck at each other, is common. In other cases, several birds may be involved so that chains of peckers may form. Young birds have been observed to show no resistance or other response when their feathers are pecked, but adult birds try to avoid being pecked.

Birds that feather-peck may subsequently start to peck and remove blood, skin and flesh from other birds (Brantas, 1975; Blokhuis and Arkes, 1984). Body-pecking and consequent cannibalism can begin when wounds arise when blood-filled new quills from the wings or tail are pecked and start to bleed (Sambraus, 1985). The outlet of the uropygial gland, which protrudes slightly, and the protruded cloaca after egg-laying elicit body-pecking. The most severe effects often ensue after the cloaca has been pecked. Wounds in the cloacal region can rapidly become severe, and the intestines can extrude through a cloacal wound. These are likely to be the subject of more pecking and, in due course, be pulled out and ingested. Mortality is therefore frequent once a wound has been produced.

Egg-eating

Egg-eating is a habit found in chickens kept in pens and cages. It appears to occur more on wire mesh floors than among flocks on litter. The behaviour begins with a bird pecking at an egg until it is broken. The contents of the egg are then partially ingested. When a bird acquires this habit it is likely to increase the practice, and other birds may also acquire the habit through mimicry. In some cases, significant amounts of eggshell are eaten and this leads to the suspicion that the diet of affected birds may be deficient in grit.

Control of this condition involves the elimination of affected birds, but this may be difficult in a large flock as the perpetrators are difficult to identify. It is sometimes found possible to inject strong food dye into the substance of an egg and have this egg left lying on the ground. An egg-eating bird choosing this egg will be marked by coloration about the head. It is advisable to provide a supply of grit or oyster shell chips in dealing with problems of this nature. It is important to lay out the grit in long troughs so that all birds can have occasional access to it. In cages, the problem is reduced if eggs can roll away out of reach of the birds. The provision of nest boxes in larger cages reduces egg-eating, as floor-level eggs are eaten most frequently.

Animals Treated as Objects

The behaviour preceding activities described in this section is often indistinguishable from that which precedes activities reported in Chapter 20. The animal approaches another individual, or more often a particular part of that individual, as if it were exploring its environment or looking for food. In circumstances where the animal approached is unable to move away because of lack of space or the close proximity of other animals, an action may be completed that is damaging to that animal. If the animal that is showing the behaviour can readily obtain the resource that it seeks, such behaviour is less likely; for example, provision of straw and other enrichment for pigs results in less behaviour directed at pen-mates (Beattie *et al.*, 2000).

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26 Abnormal Behaviour 4: Failure of Function

Abnormalities of Basic Movements

Some types of animal housing prevent certain movements from occurring or make normal sequences of movement difficult to carry out. Movements that are prevented include wing-flapping and flying by hens in battery cages, walking by calves in crates, sows in stalls or tethered animals and running by many housed farm animals. Abnormalities in grooming by calves in crates or confined sows, which cannot reach the back of the body, have been described in Chapter 24. Hens in battery cages have insufficient room for normal preening with associated stretching (see Chapter 30).

Abnormal lying and standing

Hooved animals kept on slippery slatted floors have especial difficulty in lying down and standing up again.

This very unusual way of lying may be less hazardous for the animals in these difficult circumstances. The lying behaviour of sows in stalls and in farrowing crates is different from that of sows in a larger area, because lateral movements are not possible. The sow normally moves her body to the side in the course of lowering her body to the ground but, if bars prevent this from happening, she is forced to drop down from a greater height. Such movements are more likely to result in sow injuries and much more likely to lead to piglets being squashed by the sow. Another factor contributing to this abnormal lying behaviour is weakness of leg and other muscles consequent upon lack of exercise (Marchant and Broom, 1996). Sows that have been in stalls or tethers for a long time may be unable to lie down slowly and carefully because of their inactivity during the non-farrowing period. Other abnormalities of lying behaviour are a consequence of lameness or other localized body pain.

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SCIENCE TEXTS

Extended Written Texts (Non-Fiction)

Broom, D.M. and Fraser, A.F. ***Domestic Animal Behaviour and Welfare*** (4th edition). CAB International (2007). *Extracts from chapter 27 (pp. 255, 256 & 257).*

27 Abnormal Behaviour 5: Anomalous Reactivity

Very low or very high levels of activity and responsiveness are also abnormalities of behaviour. Just as in certain circumstances people can become very lethargic or hyperactive, so too can domestic animals. The causes are occasionally specific neurological disorders but, most frequently, they are an inadequacy in rearing or housing conditions, including especially lack of social contact.

Prolonged inactivity has been reported for sows in stalls and tethers; for example, Jensen (1980, 1981b) recorded that tethered animals were lying for 68% of the daytime period, while the pigs in an area of woodland and field studied by Wood-Gush and Stolba spent 50% of the daytime rooting and only a short period lying (Wood-Gush, 1988). Various factors must affect the level of activity, but it is frequently found that confined animals are less active. Prolonged lying in sows can lead to urinary tract disorders (Tillon and Madec, 1984), and this is discussed further in Chapter 29.

Hysteria

The occurrence of the extensive alarm reaction in poultry is often termed hysteria. Flightiness in the domestic chicken appears in different types of nervous and hysterical behaviour occurring in differing environments and age groups. Hysteria in the caged laying hen is characterized by sudden flying about, squawking and trying to hide. The incidence of hysteria in penned poultry is higher at greater flock density. Flocks of 40 have been found to have 90% incidence of hysteria while flocks of 20 had an incidence of 22%. Claw removal in birds has been found to reduce hysteria, although some strains are resistant. Even in cages hysteria can occur, but it is less of a problem in multiple-hen cages containing three to five rather than the larger numbers of birds.

Unresponsiveness

Measures of activity level can be obtained accurately, but it is difficult to know whether reduced activity means poor welfare. In descriptions of abnormal behaviour, Wiepkema *et al.* (1983) emphasized that confined sows may be unresponsive to events in the world around them, in addition to being inactive. Such behaviour is sometimes called apathetic. In studies of sows in stalls, Broom (1986d, e, 1987a) measured their responsiveness to three different stimuli. All animals video recorded were responsive to stimuli associated with the advent of food, but they showed little response to a stranger standing in front of them or to 200 ml of water at room temperature tipped onto their backs whilst they were lying awake. Group-housed sows, in contrast, were much more likely to take notice of strangers and to sit or stand and carry out other activities when the stimulus was presented. This work shows that stall-housed sows are abnormally unresponsive to such stimuli (see Table 27.1). The results of such work are likely to depend upon the precise nature of the stimulus presented, for a very frightening stimulus might elicit a maximal response in all sows. The behaviour of head-pressing (see Fig. 22.2) is shown by animals that may be in pain and are unresponsive to most stimuli. Studies of this kind indicate parallels with the behaviour of human depressives (Broom and Johnson, 2000; Goodyer, 2001).

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