

Environmental design

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Investigations of the behaviour of farmed animals kept in intensive conditions in Europe and America have indicated that their welfare is generally of concern. The inherent features of the modern systems for housing animals are confinement and restriction. Today's husbandry systems appear to be problematic for animals in that they prevent them from behaving in the way intended by nature. Consider, for example, the plight of the pig, a highly exploratory and socially sophisticated animal. When the sow gives birth, it is generally in a crate that prevents her from squashing her piglets. It also prevents her from building a nest, something she is highly motivated to do prior to parturition, and she is prevented from moving about, turning around and interacting normally with her piglets. Piglets are weaned at an unnaturally early age (3–5 weeks) and are moved into weaner accommodation that is typically cramped (0.2 m²/pig) and barren (no bedding, no rooting substrate). They remain in grower accommodation until they reach slaughter weight, when they are often mixed with unfamiliar pigs and transported in cramped conditions to the abattoir.

Many of the animals in intensive systems exhibit abnormal behaviours which are sometimes stereotypic¹. Stereotypies are defined as behaviours that are performed with monotonous regularity and are fixed in all details. Some researchers believe that they are mechanisms enabling the animal to cope with an environment that does not satisfy its expectations². Others believe that they are associated with levels of feeding; pigs that are confined and fed low-maintenance diets are more likely to exhibit such behaviours than those fed higher levels. What does seem clear is that animals do not show these behaviours if they are kept in husbandry systems that are similar to the natural environment of their species.

In general, animal housing in the western world has evolved to suit the requirements of humans rather than of animals. The importance of the ease of cleaning and managing housing, and of handling, moving and observing animals, has quite correctly been catered for in most environments; but the actual behavioural needs of animals appear to have been compromised in many cases. Certain natural behaviours are not seen in the modern housing system, and more often than not animals perform abnormal or stereotypic behaviours. Behaviours such as feather-pecking in battery hens, belly-nosing in

weaner pigs, and bar-biting in stalled sows are thought to be indicative of welfare problems in these animals, and are probably caused for the most part by the conditions under which they are kept.

Recently there has been a growing concern about the welfare of animals in intensive conditions, and with this, a growing interest in the design of so-called *ethologically sound* environments: environments that facilitate the species' typical behaviour and also enable that animal to be farmed effectively. There have been two broad approaches used in the past in designing environments that suit the behavioural needs of animals, or ethologically sound environments. The most well-known approach, and innovative at the time, was that used by the late David Wood-Gush and Alex Stolba (of Edinburgh, Scotland) and others in the designing of housing for pigs. This 'start-from-scratch' approach enabled the researchers to identify key features in the pigs' normal environment that appeared to elicit or release certain behaviours³. These key features were then incorporated into a new housing system for pigs called the Edinburgh Family Pig Pens. The second approach is one of modifying an existing environment through the improvement of the quality of limited space, either by artificial enrichment devices (such as food-balls and hanging tyres/chains for pigs) or by incorporating certain features thought to be important to the animals (such as dust-baths and laying-boxes for hens)^{4–6}.

Start-from-scratch designs

In general, it is often suggested that domestic animals have been heavily selected for certain features of domestication (for example, docility, trainability and a reduced fear of novel situations) and have 'adapted' in ways that suit the modern farming systems; in the process, they have lost the ability and the need to exhibit the behaviours their ancestors would have shown in their natural environments. In order to test this theory, in 1978, David Wood-Gush, Alex Stolba and colleagues released ordinary domestic large white sows and boars in a semi-natural environment in the Pentland Hills outside Edinburgh³. The Edinburgh Pig Park, as it was called, consisted of a 1.1 hectare site on the side of a hill which had forested and open areas, different types of grasses and shrubs, and various degrees of slopes. The group composition of 2–5 sows and 1–2 boars plus



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1–10 juveniles was adhered to, and the pigs were allowed to live and breed as normally as possible. Over a number of years, various studies on the behaviour of sows and piglets were conducted. These studies suggested, contrary to the opinion at the time, that pigs exhibited most, if not all, of the behaviours that had been recorded in groups of wild pigs. It was possible to identify certain key features in the pigs' environment that were important in the release of certain behaviours, such as rooting (i.e. digging with the snout) and defecation sites, and nesting sites. Based on this Stolba and Wood-Gush³ attempted to recreate the 'natural' environment in a more restricted indoor area that could easily be managed. Although their aim was to develop an environment that allowed pigs to exhibit more natural behaviours, and to live in a more natural grouping, they also wanted to make this alternative style of housing more economically viable.

In 1980 the first Edinburgh Family Pig Pen was built at Easter Howgate Farm, south of Edinburgh. The Pig Pen housed four sows and their offspring. The sows remained there until all their breeding life, and were joined by a familiar boar 2–3 weeks after farrowing. Subsequent study of this system resulted in alterations in the original design, and a further two layouts were tested. Despite these alterations, there were still problems with the design. The monopitch roof of the building coupled with the cold Scottish weather was blamed for the high incidences of piglet mortality, and it was difficult to maintain an optimum group size of four sows since the addition of new individuals to the established group caused problems. However, the system did appear at the time to be economically viable – the number of piglets weaned was comparable with the better intensive systems, food conversion and growth were also compa-

rable, and production records were good. The system did not take off commercially but the approach highlighted the importance of certain features for pigs, and showed that pigs could be kept in groups. The system is still being refined to this day: A research group in Aberdeen (Scotland) is working on a pen that operates on these lines, and a group in Switzerland (the home of the late Alex Stolba) is also developing the system.

There are, however, additional problems in this approach. Although the pigs were seen to exhibit certain behaviours in a more natural setting, no attempt was made to determine the importance of these behaviours for the animal. The need to show a behaviour, or the strength of the preference for an environmental feature, was not measured at the time, and the fact that the animals exhibited certain behaviours when given the opportunity to do so was taken by the researchers to indicate that these were important for the animals' well-being. This need not be the case since some behaviours may be considered as 'luxury behaviour': the animal may show it if it can but is not highly motivated to perform it if it cannot.

Recently, methods of assessing an animal's need to exhibit a behaviour have been developed⁷. If these methods are used in conjunction with the 'start-from-scratch' approach, a clearer idea of the importance of each of the key features may be gained.

Altering the existing designs

The second approach, that of modification or enrichment, involves changing something in an existing environment to encourage more natural behaviour. Examples of this can be seen in most European/American zoos, where man-made termite mounds have been built into chimpanzee enclosures to encourage more natural foraging activities and tool-use⁸. This approach has also been extended to farmed animals. Pigs have been provided with chains to manipulate, straw to root and balls to 'play' with. The addition of such objects has been claimed to reduce excitability, making the pigs easier to move and manage. It is claimed in addition that 'toys' help reduce the stressfulness of the often barren environment in which pigs live⁵.

Modification of the environment can help solve the problems associated with some very intensive farming conditions. For example, in Europe and America over 90% of laying hens are housed in 'battery cages'⁹. These are so called because a large number of cages are placed in tiers within one hen-house. Layers are kept in groups of 3–6, with an individual space allowance of 300–450 cm² per bird. The cages pose problems for the birds since, although they are provided with adequate food and water, they are not able to fly, perch, walk about, peck the substrate, nest, or escape from each other.

There has been a widespread call for a ban on these cages but alternative forms of managing large flocks of birds have not yet been fully developed. The Edinburgh modified cage is an attempt to improve the hens' welfare by enabling them to live in larger cages, fitted with perches, nest boxes and dust baths. Production is above average in these cages, and all facilities are heavily used. Feather, foot and claw damage is also reduced. It is felt that further development of such modified cages would lead to vast improvements in hen welfare.

In conclusion, environmental design is a broad subject encompassing the physical, social as well as developmental needs of the animal. Designing animal environments to take these needs into consideration, as well as the needs of the humans operating the system, is a difficult task, and in order to do it effectively we must have an understanding of the impact the environment can have on the well-being of the animals. A logical sequence of events leading to a new system would, therefore, be: (i) define the behavioural requirements; (ii) determine if existing systems contravene these require-

ments and, if so, determine the consequences for the animal; and (iii) if there is a need following (ii), then a new system(s) requires to be designed taking into account behavioural requirements and other management and economic considerations.

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Stereotypies in the stabled horse: Causes, treatments and prevention

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The environment for most stabled horses is far removed from that of its wild ancestors. The horse is a social animal, and in natural groups in the wild it lives in harems, usually consisting of one stallion, a few mares and all their offspring up to two-years old¹. They restrict their movements to a specific home range within which the major requirements are food, water and shelter. Home ranges of free-ranging horses vary greatly in size and are correlated with resource availability². In contrast, the stabled animal is removed from this normal open range and often deprived of social contact. Many performance horses (e.g. racehorses, show jumpers, etc.) in Europe and also in India are confined for up to 24 h a day with the exception of short periods of time reserved for exercise, and others are turned out to pasture for merely a few hours a day.

This restricted environment often has a significant effect on the normal time budget of the horse as it can no longer spend the majority of the day foraging and expending energy looking for suitable resources². Feeding with concentrated food also has consequences for the

horse, since it eliminates the additional time that confined animals can occupy themselves with ingestion and manipulation of food². Free-ranging horses spend a high proportion of their time grazing. A study by Boy and Duncan³ on free-ranging feral Camargue ponies during spring and summer revealed that 57.5% of their time was spent grazing. This proportion of time is likely to be greater in the winter months, when grass is scarcer. In the stabled environment, however, if fed on hay, horses will spend 40% of their day eating, which is reduced by one tenth if fed chiefly on concentrates⁴.

As already highlighted, the stabled horse is often deprived of social contact, both visual and physical. The design of the majority of housing for horses does not take into consideration their behavioural needs, often enclosing the animal in small individual loose boxes or stalls, where it is deprived of social contact and exercise. Rees in her book *The Horse's Mind*¹ describes the confined horse as being like 'a fish out of water'. She notes that many learn to accept confinement, but others kept in these unnatural conditions, deprived of freedom,