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The effects of social and physical environment on social behaviour in farm animals

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Abstract

The restricted conditions under which many farm animals are kept do not permit the animals to show many aspects of social behaviour. They also limit what the animals can learn and hence modify their future sexual and other social behaviour. Management methods are also important sources of environmental variation which can affect social behaviour. For example, many animals have difficulties in adapting to groups whose composition is often changed. Physical conditions such as temperature, humidity and floor conditions can also have an effect on the occurrence and frequency of certain social interactions.

Animals vary in their behavioural strategies in social situations so it is wrong to assume that all individuals in a group will be equally affected by any imposed condition. This variation may concern the proportions of affiliative or friendly behaviour and of aggressive behaviour. Most domestic animals spend far longer showing social behaviour in which aggression plays no part other than in competitive behaviour. There is also variation in the extent to which individuals become involved in social interactions or avoid them and this is affected by their previous experience as well as by their basic physiology. One theory about variation in the impact on an animal of its social world is that animals can be differentiated on the basis of how free they are to move around and to utilise resources. It seems to be correct that there is a scale ranging from very free to very much restricted by social pressures. Another theory about variation in the behaviour shown in difficult situations, including social situations, is that animals can be divided into active and passive copers or into active copers and depressed non-copers. Although both of these theories are helpful in explaining some situations, it is clear from a variety of studies that neither is correct in all situations.

Introduction

Social behaviour can be directly affected by the physical conditions in which animals find themselves. There are often limitations of the potential social

environment which are imposed by those conditions and human management often involves control of the social environment, for example when animals are kept individually or in single sex or single ageclass groups. The development of individuals and, as a consequence, their social behaviour can be substantially altered by the environment experienced when young so there are long-term, as well as immediate, environmental effects on social behaviour. The first three sections of this paper are concerned with : the effects of housing which imposes severe restrictions on space for animals, the effects of other physical conditions such as temperature and accommodation design, and the effects of management procedures. A variety of social strategies develop according to physical and social conditions so these are considered in the final section of the paper.

Effects of close confinement and social deprivation

Close confinement of farm animals by tethers or in crates, stalls or small cages results in much restricted ability to exercise, to explore, to show some maintenance behaviour and to interact with other individuals. In addition to any physical effects on animals and any frustration which results from inability to control interactions with the physical environment or with man, there will inevitably be prevention of much social behaviour. Indeed it is often difficult to determine to what extent indications of poor welfare in confined animals are a direct consequence of the confinement or are a consequence of the social deprivation which results from confinement. If animals are kept in individual pens or tethers but to some limited extent they can reach neighbouring animals, some of their behaviour is readily identifiable as being directed towards their neighbour. BARNETT et al. (1987) explained some of the behaviour of confined sows as being unfulfilled aggressive behaviour towards their neighbours and they pointed out that there might be considerable frustration associated with thwarted attempts at social interaction. MENDEL et al. (1993) found that stall-housed sows in their fourth parity used aggression more than group-housed sows, reached a clear result in a much smaller proportion of agonistic encounters and escalated their responses much more often (Table 1). These sows also showed much more stereotypy.

Animals reared in isolation may fail to acquire normal communicative skills and hence show abnormal social interactions (MASON 1961). For example, calves reared in individual pens over the winter and then mixed in spring with other calves are at a considerable disadvantage in competitive situations (BROOM and LEAVER 1978, BROOM 1982). Isolation rearing of males of various farm animal

species may also result in various inadequacies of reproductive behaviour (BEILHARZ 1985, PRICE 1985).

Tab. 1: Agonistic interactions in stall-housed and group-housed 4th parity sows

Behaviour	Stall	Small group	Large group
Total agonistic h ⁻¹	1.9	2.3	2.4
% agonistic in which aggression used	58.2 ^a	23.5 ^b	30.8 ^b
% agonistic in which no clear result	33.5 ^a	11.1 ^b	8.7 ^b
% agonistic in which escalation	21.5 ^a	0.7 ^b	5.4 ^c

data from MENDL et al. 1993

Effects of other physical conditions

In cold conditions, animals of various species will crowd together to minimise heat loss whilst they space themselves out much more when conditions are warm. The extent of aggregation can have a considerable effect on social interactions, especially in those species where they approach of another individual to within a certain small envelope of surrounding space will normally elicit flight or attack. One example of the influence of such factors is the response of hens to brightly lit areas in an otherwise dimly-lit building (HUBER and FÖLSCH 1985). The hens congregated in areas of bright light under windows and much more injurious pecking occurred in these areas than in other areas of lower density and lower light level.

Longer periods of adverse or difficult physical conditions can lead to prolonged effects on social behaviour. For example, in buffalo cows in Egypt the percentage of heat with clear behavioural signs was 48 % in the cooler season but only 25 % in the hot summer (BARKAWI 1981). Differences in the space and environmental complexity available to animals can substantially affect social behaviour. In general, more complex and interesting environments result in a lower incidence of behaviour which results in injuries to other individuals and a greater possibility for complex social structures to develop. Prolonged associations between individuals, collaborative activities such as mutual grooming or mutual defence, extensive individual recognition and consistent leading or social control are more frequently reported in groups which are stable and kept in a rich environment (see ARNOLD and DUDZINSKI 1978, FRASER and BROOM 1990, Chapters 15, 16).

Social interactions between mother gerbils and their offspring are affected by the presence of other individuals and by the space available to the mother (ELWOOD and BROOM 1978, BROOM 1981 p. 228). In pigs, as in gerbils, mothers which can leave their litters when they want to may show more and better responses to their young when they are in contrast (Rudd et al 1993).

The frequency of injurious behaviour can sometimes be reduced by relatively simple changes in the structure of farm animal accommodation. MCGlONE and CURTIS (1985) reported a reduction in aggression amongst weaned piglets if "pop holes", small spaces in the walls in which the head could be hidden, were fitted in the pens. In a study by WARAN and BROOM (1993) barriers extending half way across a flat-deck cage or strawed pen resulted in reduced aggression and better growth rates by the piglets (Table 2). The weaker piglets used the barrier most.

Tab. 2: Effects of a barrier in weaner pig pens

	Barrier	No Barrier	p
Frequency (h-1) of aggressive behaviour, wk 1-4	5.41	8.9	0.03
Frequency (h-1) of belly nosing, week 1-4	1.96	3.24	
Mean weight gain (kg wk- 1), wk 1	1.52	1.3	0.03

after WARAN and BROOM 1993

Effects of management procedures

In the daily management of farm animals, consistent predictable routines usually keep social problems amongst the animals to a minimum. Experimental studies in which food was presented in a predictable or an unpredictable way show that unpredictability can lead to increased aggression in pigs (CARLSTEAD 1986). Deliberate frustration by covering food which is expected to be available also increases aggression in hens (DUNCAN and WOOD-GUSH 1971). Even reducing the palatability of pasture by spreading slurry on it can increase the incidence of competitive interactions in cows (PAIN and BROOM 1978).

Fighting in groups of domestic animals is commonest when individuals are first mixed but is also affected by the amount of space available during mixing and later housing (ZAYAN 1990). The mixing of animals prior to or during transport

can result in fighting, injury and reduced meat quality (KENNY and TARRANT 1982, GUISE and PENNY 1989).

A further management factor which has a considerable effect on social behaviour is the nature of human contact and the previous experience of the individual animal in this respect. These topics are reviewed by SEABROOK and BARDE (1992) and by LE NEINDRE (1993).

Social strategies in relation to the environment

As stated above, animals kept in complex environments spend much time in non-competitive social behaviour. Indeed in studies of groups of suckler cows able to move from one area of pasture to another, BENHAM (1984) found that a relatively small proportion of all interactions involved any aggression. In many groups of farm animals, however, the stocking density and environmental complexity are such that descriptions of social behaviour centre on competitive interactions. Some descriptions make it clear that those individuals which are more successful in those interactions have greater freedom of movement within the group and better access to resources. For example, HUNTER et al (1988) found that sows of higher rank, based on the results of aggressive encounters had earlier access to an electronic sow-feeder whilst those of lowest rank would wait in a kennel until no high ranking animal was near before seeking food or water. GALINDO and BROOM (1993) found that some cows are forced to spend longer standing than others as a consequence of social exclusion from lying areas and that these animals were more likely to become lame. However in both of these studies, and in that of DANTZER and RAAB (1985), it was clear that position in a competitive order explains only part of the extent of freedom of movement of animals so it should not be assumed that high-ranking individuals are free to do what they want whereas low ranking animals are severely restricted and disadvantaged. GRIGOR (1993) has found that hens are sometimes deterred from moving close to dominant individuals but in large groups there is considerable freedom of movement.

Another theoretical approach to understanding the strategies used in social situations is that which divides individuals into active or passive copers. Studies of tree shrews, mice and rats have shown that some moles which are defeated by conspecific moles defend themselves actively whilst others become very inactive and show little defence or response to external stimuli (VON HOLST et al 1983, FOKKEMA 1985, BENUS 1988). The second response was characterised by

a large adreno-cortical response and early death. These studies seem to have parallels in other species in that it is often possible to distinguish active and passive responses to difficult situations. However, the authors cited above and KOOLHAAS et al. (1983) often tend to refer to animals as being either active or passive copers and indeed to refer to genetic lines where one or other response is preponderant. However the same individuals may show both kinds of response in different circumstances or even in quick succession. For example, as discussed further by BROOM and JOHNSON (1993), young domestic chicks exposed to a disturbing stimulus often show a passive freezing response at first followed by an active escape response (BROOM 1969a) and the proportions of each response are altered by current conditions and previous experience (BROOM 1969b).

In a recent study by MENDEL et al (1992) the behaviour of sows in a group-housing system with an electronic sow feeder was recorded in detail and the animals were categorised as high success animals (HS) which was more than half of their competitive interactions, low success animals (LS) which engaged in many interactions but lost most of them and no success animals (NS) which never won and avoided encounters where possible. The frequencies with which these pigs were aggressive and received aggression and the percentage of time inactive are shown in Figure 1. On the basis of the active passive copper hypothesis, it might have been expected that the NS passive avoider sows would be the least successful in other aspects of life. However an adrenocorticotrophic hormone (ACTH) challenge test showed that the cortisol response to ACTH was the same in the high success HS and no success NS sows and was 63 % higher ($p = 0.029$) in the low success LS sows. The total weight of piglets born alive after the first pregnancy was also lowest in the LS group (Fig. 1).

The results described above show that the coping strategies adopted in a competitive social situation by sows, although superficially similar to those adopted by male rats, mice and tree shrews which are attacked, are actually different. The avoidance of those social encounters which might be dangerous was a better strategy than fighting back and being beaten again in the sows.

However it is important to emphasise that the sows were in a large enough space to be able to avoid many encounters whereas the space available to the attacked rats, mice and tree shrews was usually insufficient for effective escape or hiding.

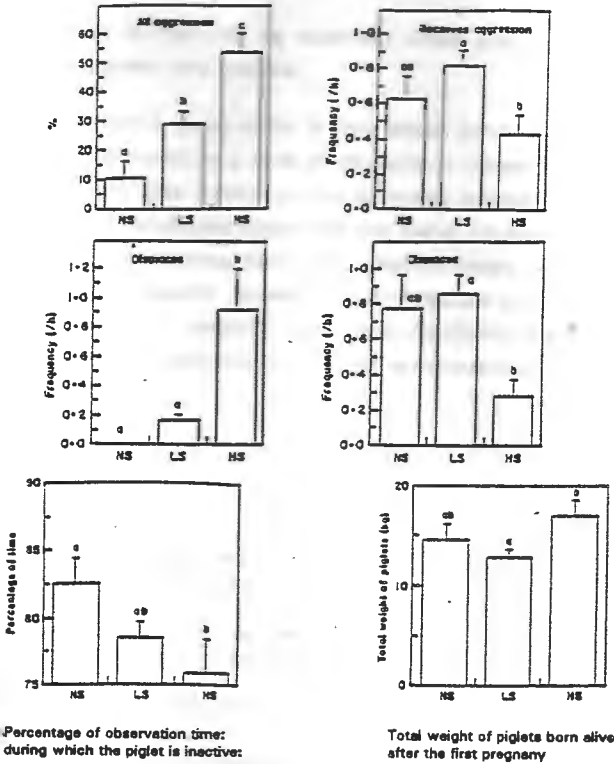


Fig. 1: Differences between animals which won most competitive encounters (HS), those which were involved in encounters but lost most of them (LS) and those which avoided encounters (NS)

Conclusions

In farm animals, as in other species, social behaviour is affected very much by the physical environment, by the other individuals of their own species, and by humans and members of other species, present at the time or in the previous experience of the individual. Hence it is not accurate to refer to the social behaviour of a species without referring to the present and previous environment.

In good conditions, the majority of the social behaviour of our very social farm animal species is non-aggressive. Studies of animals in relatively poor conditions have resulted in over-emphasis of competitive behaviour and of rank orders.

However such studies can be important when attempts are made to improve animal management and welfare.

Individuals within a group differ in their social behaviour. The ideas that all behaviour is determined by a level of freedom of movement determined by social rank is incorrect and recent studies of social behaviour have tended towards studies of how individuals cope with the social situation. Generalisations about active and passive coping, each with a limited range of physiological correlates have stimulated research. However the hypotheses generated are in part limited in their application to certain experimental conditions. Species vary in the range of coping strategies adopted and in the consequences of adopting the various strategies.

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