

## Social transfer of information in domestic animals

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### Introduction

Most domestic animals are especially social species, indeed an ability to live socially and have an elaborate social structure is a prerequisite for satisfactory domestication. There are several questions concerning the fundamental likelihood that there is social transfer of information within groups of domestic animals such as cattle, sheep, pigs and dogs. Firstly, is information about the knowledge or actions of group members of value to an individual in the group? Secondly, have individuals the ability to detect and respond to actions or other cues from others, some of which may be very subtle? Thirdly, do individuals respond to group members and to what information? In some circumstances, in order to use information effectively it is necessary to recognise individuals and respond to them differentially so a fourth question is whether or not this is possible. Since it will often be difficult to evaluate potentially available information and to act on it appropriately, a fifth question is whether or not the animals have the cognitive ability to do so.

Information which might be obtained from conspecifics, which would normally be other members of the social group in domestic animals, can be of value in defence against predators, finding appropriate food, finding suitable places to nest, modifying the physical environment effectively, and selecting an appropriate mate or social companions. Some of these biologically important functions are often overlooked by the owners of domestic animals, but they are no less important to the animal because of this. Examples of such functions are given below as the answers to the other questions posed above are considered. Further examples are described and discussed by Nicol (1995).

### Recognition of and response to other individuals

In most studies, individual recognition is evident because a behavioural response is shown, but there are also some physiological studies which provide information about the sensory and analytical basis for recognition. Unit recording studies by Kendrick and Baldwin (1987) and Kendrick (1992) show

that sheep have cells in their temporal cortex whose response is specialised for the detection of sheep in general, sheep with horns, individual sheep, humans or dogs. The cell which responds to a familiar, individual sheep but not to unknown sheep could be responding to the set of familiar visual cues provided by that sheep, i.e. to familiarity, rather than to that sheep exclusively. However, in a behavioural discrimination task Kendrick *et al.* (1996) found that sheep could recognise the faces of individual familiar sheep and of individual unfamiliar sheep. The experimental studies of Alexander and Shilito (1977) show that ewes can recognise their own lambs using olfactory and visual cues.

When cows are living in a large group, they respond to different individuals in different ways and the responses are sufficiently rapid and sufficiently independent of the current behaviour of the cow which they are observing to make it clear that it is a consequence of individual recognition. For example, Potter and Broom (1987) reported that subordinate cows responded to the approach of a dominant individual by putting their heads into a feeding place in a feed rail or stepping into a cubicle. No such change in behaviour was shown when various other cows approached. In a study of the feral Chillingham cattle, Hall *et al.* (1988) reported that bulls responded by a behaviour change, including vocalisations, to individuals with whom their home range was shared. There were two types of lows, type 1 and type 2, and the bulls switched from one to the other when the dominant animal was detected. Young calves also respond differentially to individuals, for example spending much time over a period of more than a year associating with particular individuals (Broom and Leaver 1978) and such responses indicate that they still recognise one another after a period of separation lasting for 7-8 months (Bouissou and Hövels 1976). It could be said that a cow or calf responds in a particular way to another individual because it is categorised as being of a certain social type rather than because it is that particular individual. However, in some cases it is the only one of the individuals observed which elicits a certain reaction. An animal might: avoid contact including eye contact with one individual, defer to another when threatened, stand next to another when feeding and lie next to yet another. Hence, although it might be that the subject animal regards these animals as being members of four different categories, it seems more likely that it has a concept of them as individuals.

Studies of social interactions in other farm animal species also provide evidence for individual recognition. Subordinate sows in a group, fed with an electronic feeder which recognises the transponders worn by individual sows, will look out from a place where they are inconspicuous and approach the feeder only if certain potentially aggressive individuals are not in the vicinity of

the feeder (Hunter *et al.* 1988). The subordinate sows may adopt either a fight-back or a submission and avoidance strategy (Mendl *et al.* 1992) but differential responses to individuals occur, probably according to the possibility of an attack and often before that individual has indicated that it recognises the presence of the subordinate.

Some examples of recognition with associated appropriate responses indicate impressive sensory ability, for example, dogs distinguishing individual humans, even identical twins, by odour after exposure to an item of clothing (Sommerville *et al.* 1990, Settle *et al.* 1994). The dog is able to retain information about the odour characteristics available on the item of clothing and to distinguish these same characteristics in one person out of a series of people sniffed. Hence this is recognition of an individual scent pattern with no necessity for any wider concept of that individual (see Johnston and Jernigan 1994), but the recognition of cohabiting humans by pet dogs is likely to involve elaborate concepts of those individual humans. The recognition and responses reported for a dog in a recent study by Sheldrake and Smart (1996), if correct, are particularly remarkable. A pet dog at home and its owner at work were video-recorded simultaneously. The owner worked at various distances from home and might return at any time during a three hour period but when the owner's behaviour indicated the intention of returning, the dog stood up and walked to the door. Since the frequency with which the dog showed this behaviour at other times was low, some form of communication between owner and dog is indicated.

Social transfer of information can occur accidentally with no cognitive ability required from the source animal and information processing in the recipient animal which, at its simplest, may involve associating some recognizable response to danger or food identifier with appreciation that a conspecific is carrying out an action which results in the cue. On the other hand, considerable cognitive ability is required when some information is transferred. Two examples, plus those described later in this chapter, should suffice to show that domestic animals have considerable cognitive ability and hence that social transfer of complex information could occur. Cattle and pigs are sometimes fed individually using systems in which the animal wears a transponder which activates a computer-controlled feed delivery. The animals learn rapidly to operate these systems and then, unless the design is very good, learn how to obtain a little extra food (Fraser and Broom 1990, p. 23). One sow, whose transponder was on a collar which triggered a once daily food drop in an electronic sow feeder, found a collar which had come off another sow and regularly obtained an extra meal by carrying it through the sow-feeder. It is likely that the sow initially carried the extra collar through the sow-feeder unit

by accident but, on receiving extra food in the feeder, put down the collar, ate the food, picked up the collar again, left the feeder and put down the collar until it was required again later for an extra meal. A second example is of flocks of sheep studied in alpine pastures by Favre (1975). Many small areas of pasture separated by steep and hence energetically expensive paths were exploited by the sheep. Once a pasture area had been grazed, sheep seldom returned until regrowth had occurred about three weeks later, so they remembered where they had grazed and husbanded their food resources effectively without wasting energy.

### Social facilitation

Social facilitation is defined by Fraser and Broom (1990) as behaviour which is initiated or increased in rate or frequency by the presence of another animal carrying out that behaviour. Galef (1988) suggests that contagious behaviour is a more precise name, but since dictionary definitions of 'contagious' refer to communication by contact as the original meaning or as one of the meanings, this use of the word is not more precise. The key point is that the behaviour performed by the second animal is the same as that performed by the first. However, there is a range of complexity of social facilitation. Indeed, as Niccol (1989) pointed out, it is possible for the frequency of an action in one individual to be increased by the mere proximity of another individual. She observed that preening by hens was stimulated by the presence of other hens which may or may not be preening. Hence this is not social facilitation according to the above definition unless the preening behaviour, rather than just the presence of the first hen, is necessary for the increase in preening in the second hen. This distinction was clear in the work of Tolman (1968) on social facilitation of pecking in chicks. The chicks pecked when an active companion was present but pecked most when that companion was seen or heard pecking.

An experimental study which demonstrated some of the consequences of social facilitation (Benham 1982) involved 31 cows whose behaviour was recorded throughout daylight hours for 15 days. After 5 days the herd was divided into a group of 16 with longer grazing duration and a group of 15 with shorter grazing durations; the long duration grazers were removed for 5 days. Hence the behaviour of the short duration grazers with and without the influence of the long duration grazers could be compared. In the presence of the long duration grazers, the short duration grazers spent less time lying, lay down later and stood up faster than they did in their absence. When the long duration grazers were still grazing, they had a social facilitatory effect on the

other animals for these finished grazing and stood still or walked around, lying down only when the long duration grazers did so. Cows feeding in groups generally eat more than cows fed individually and heifers also show social facilitation of mounting behaviour (Phillips 1993, p. 129). Pigs also show strong social facilitation of feeding behaviour (Hsia and Wood-Gush 1984).

The practical importance of social facilitation is also evident in studies of calves by Barton (1983). Calves which were fed from teats connected to a milk reservoir were found to go to the teat more often when there was another calf sucking the teat. If several teats were present, close together but positioned so that young calves could suck simultaneously, the social facilitation effects resulted in greater uniformity of weight, more with five teats than with two and more with two teats than with one. In a further experimental study of social facilitation (Barton and Broom 1985), calves confined alone in open-sided pens drank 5.5 l when offered unlimited milk but if a hungry calf was then put into the next pen with milk provided, the first calf drank 7.5 l. If the calves were put in a pen together with a muzzled hungry calf which attempted to get to a teat which would normally supply it with milk, the first calf drank 9.2 l.

Social facilitation also appears to be important in predatory attacks by dogs. If several dogs are in the vicinity of a flock of sheep and one attacks the sheep, the other group members are more likely to attack. This also happens (Borchelt *et al.* 1983, Podberscek 1994) in cases where young humans are attacked by dogs. When one dog in a group of 15 bit a girl, the others also did so and in a case where two Rotweilers killed a girl, first one reacted to her falling by attacking and then the other did so.

### Young mammals learning from their mothers about food

Food preferences in young mammals such as rats and sheep (Galef and Sherry, 1973, Nolte and Provenza 1992) can be affected by the content of the mother's milk, which is itself affected by the mother's diet. The food which mothers eat must be known to their offspring by olfactory and visual means and there are several examples of the food preferences of offspring being altered as a consequence. Wyrwicka (1978) trained a mother cat to eat banana and potato which would not normally be eaten. The kittens of this cat also ate these foods when tested alone at 9–27 weeks. Similarly, Lobato *et al.* (1980) found that lambs would eat more of blocks containing molasses and urea if their mothers had eaten them in their presence than if they were not exposed to these blocks until after weaning.

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Table 9.1. *Effects of experience on consumption of strange foods by lambs*

	Consumption
Lamb never exposed to food or to any sheep eating it	x
Lamb exposed to ewe, not mother, eating food	2x
Lamb exposed to mother eating food	4x
Lamb exposed to mother eating food and eats the food itself	8x

Data from Thorhallsdottir *et al.* (1987).

*x* is the amount of a strange food consumed by a lamb which had never encountered it before.

the mother eat certain foods does not require that the lamb eat at the same time as the mother. Lambs kept at pasture do not normally accept whole grain wheat as food when it is offered to them. However, if lambs have been with their mothers during the suckling period and the mothers, but not the lambs, have eaten wheat, then those lambs accept wheat far more readily when it is offered to them many weeks later (Lynch *et al.* 1983). When lambs were with mothers which ate wheat for only five hours when the lambs were six weeks of age, in a consumption test at 34 months of age, the animals ate a mean of 357 g of wheat per day, but if they had been exposed to the wheat for the same period at the same age but without their mothers, consumption in the test was only 38 g per day. A comparison of the effects of various kinds of actual and observational experience of food by Thorhallsdottir *et al.* (1987) is shown in Table 9.1.

It seems likely that the kind of transmission of information about food which is indicated by these experimental studies of sheep also occurs in the grazing situation because Yousef *et al.* (1994) found that lambs avoided the pasture grass red fescue if the mothers avoided it.

### Experiments involving demonstrator and observer animals

As part of the training of animals to perform tricks, they are often shown a sequence of actions carried out by a human or by a conspecific in the hope that they will copy the action. Experimental investigations of such procedures were carried out by Adler (1955) and by Adler and Adler (1977) using cats and dogs. Those cats or dogs which had observed a trained conspecific pull a cart by a ribbon and had been rewarded with food, performed the same action much faster than others which had not observed the trained animals.

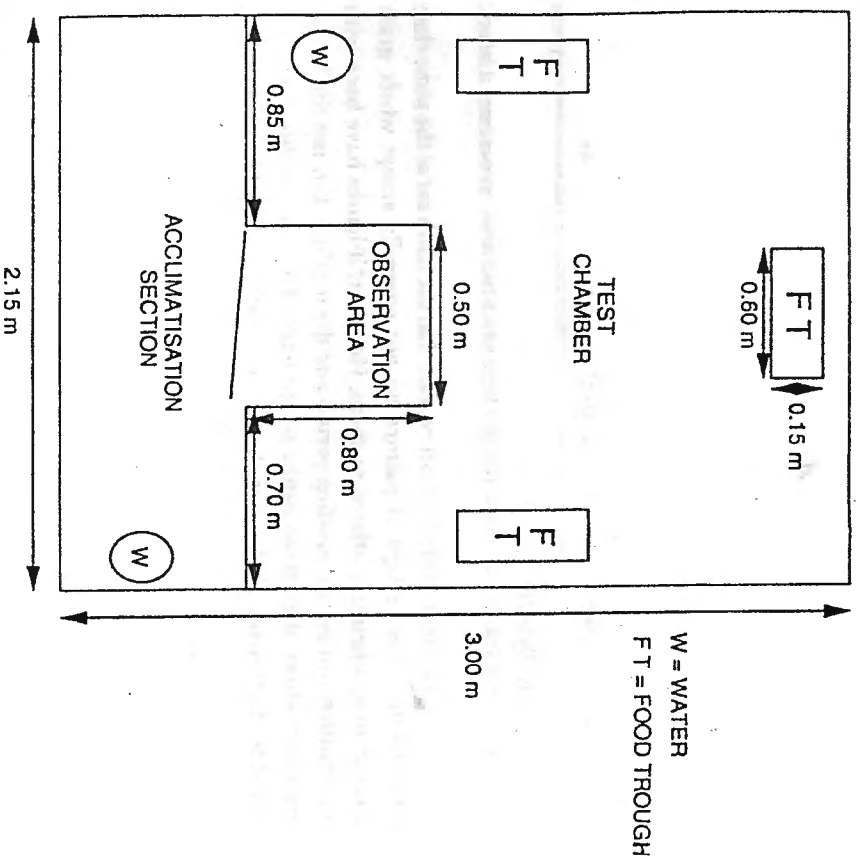


Figure 9.1. Plan of observation and test area for pigs used by Nicol and Pope (1994b).

animal carrying out an action, it is possible that any increased likelihood that a behaviour is shown is a result of reduced fear in the experimental situation rather than social transfer of information. Johnson *et al.* (1986) reported that chickens acquired a key peck response more readily if they spent some time observing another chicken pecking at a key when a light on the key was illuminated and then receiving food. In order to control for the possibility that this effect was due to fear reduction in the observer bird, Nicol and Pope (1992) repeated the study with a trained demonstrator hen and a control hen which was untrained. The observer hen acquired the key-pecking response much faster if the demonstrator hen was trained than if it was untrained. An enhancement of key-pecking in observer hens was also seen in a flock of eight hens which included a trained bird. The presence of an additional food source

did not affect the result but the increase in key-pecking was greater if the demonstrator bird was a dominant individual (Nicol and Pope 1994a).

Similar studies, involving demonstrators and a food reward, have been conducted using pigs and horses. Nicol and Pope (1994b) used the observation and test situations shown in Figure 9.1. A young observer pig was put into the room at normal feeding time. There it observed a demonstrator eating standard food from a shallow trough. The demonstrator did not eat from the other troughs because they contained sawdust. In the test situation, the pigs were able to eat from any of the troughs, each of which contained normal food with a layer of sawdust over it. The observer pigs fed earlier and for longer from the demonstrator trough. However, in another experiment, there was no increase in consumption of blue mint-flavoured food if the demonstrator pig was observed to eat it. A similar result was obtained by Clarke *et al.* (1996), whose observer horses saw a demonstrator walk 13 m in an arena and select a black and white bucket but not a yellow bucket on 20 occasions. When compared with horses which had not had this experience, observers had a shorter approach latency (18 s versus 119 s) and a shorter latency to eat (35 s versus 181 s) but no preference for the black and white bucket.

## Discussion

A range of studies indicate that domestic animals have various strategies for controlling their lives and that in order to have this control they use their considerable sensory and cognitive ability. Each of the species which has been investigated carefully has been found to be able to attend to the activities of others and to learn from them. It is likely that most of the behaviour in these very social species is affected by social transfer of information.

Sceptics ask, however, whether the animals are indeed aware of what is happening when their behaviour is changed and what is the proof that cows, sheep, pigs, dogs, etc. acquire information from other members of their social group. In answering this, some basic scientific attitudes may be questioned. Awareness is a state in which complex brain analysis is used to process sensory stimuli or constructs based on memory (Broom 1998) and there are different degrees of awareness (Sommerville and Broom 1998). Most of the examples described in this paper of domestic animal behaviour changes consequent upon observation of the behaviour of others are best explained as requiring 'assessment awareness' in the observer, i.e. that observer must have been able to assess and deduce the significance of a situation in relation to itself over a short time span. The sceptic's explanation might be that all behaviour changes

by the observer animal are explicable in terms of a series of automatic responses.

The argument that whenever there are two explanations for an observed phenomenon, the simpler of the two is preferable is dangerous when complex systems such as those in the vertebrate brain are under consideration. The ready rejection of the less simple explanation on all occasions where there is some doubt has led to serious impairment of scientific progress in the area of brain functioning. As evidence accumulates concerning the complexity of animal awareness, it seems that on many occasions where a simple explanation is under consideration as an explanation for a behavioural phenomenon, this explanation is wrong and an explanation which assumes more elaborate brain processing is correct. These animals are so far from being automata that it is naive to assume that they are. It is likely that information is obtained frequently from other individuals and that much of the processing of that information is similar in domestic animals and in humans.

Many of the experimental studies of social transfer of information in domestic animals have concerned feeding because the results of transfer of information about food are relatively easy to recognise and the principal objective of the experimenters was to demonstrate whether or not such information transfer can occur. However, as should be apparent from some of the other observations which have been mentioned, it is likely that social learning is a significant aspect of the whole of the life style in many of these species. Herd-living herbivores like sheep, cattle, goats and horses are likely to learn from one another about: plants in pasture which should or should not be selected, locations of patches of high quality food and methods of husbanding these plant resources. Pigs would also learn about methods of obtaining food and carnivores such as dogs would learn about methods of hunting. In addition, individuals of each of these species would learn from one another about methods of avoiding predation and other dangers and about the social capabilities and general individual qualities of other group members. The abilities of individuals in the group to detect food or danger, avoid danger, fight, mate, or care for offspring might be evaluated, not only by direct observation of those individuals but also by interpreting the behaviour of other individuals. Individuals in groups of domestic animals may collaborate in achieving objectives and exact retribution for previous cheating or other misdemeanours so they must be obtaining sophisticated information from one another in order to do this.

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