STOCKMANSHIP AND FARM ANIMAL WELFARE

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Abstract *Animal Welfare 2003, **12***: 479-492

Human factors (attitudes, personality traits, self-esteem, job satisfaction) strongly determine our behaviour towards animals, animal production and animal welfare. Recent studies have emphasised positive human contacts as indicators of a stockperson's positive attitude towards animals and towards animal welfare in general. Stockmanship can be improved by careful selection of people and/or by training. However, little is known of the biological basis of the effect of stock handling procedures on the welfare of animals. The animal's perception of the stockperson (based both on emotional responses and cognitive aspects such as anticipation, recognition and categorisation), and the existence of sensitive periods in an animal's life, need to be explored in more depth, especially under farm conditions. We need to consider the complexity of human behaviour (eg husbandry practices, balance between positive and negative interactions, predictability, controllability) and its effect on animal welfare from the animal's point of view throughout its whole life. This paper identifies the importance of positive human contacts for both animals and stockpeople, and highlights the challenge to maintain such positive contacts despite the trend in modern agriculture to increase the number of animals per stockperson. This requires better knowledge of animal genetics, socialisation to humans during sensitive periods, and management of the social group. We emphasise the ethical importance of the human–animal relationship in the context of farm animal welfare and productivity.

Keywords: *animal behaviour, animal welfare, cognition, domestic animals, human–animal relationship, stockmanship*

Introduction

The role of the stockperson has been important since the beginning of animal domestication. Selecting animals and providing them with the appropriate environment to improve their production is the basis of good husbandry practice (Price 1999). Through the choices they make, their objectives and their ways of interacting and managing animals and their environment, stockpeople are a primary influence on husbandry and in turn on animal production and welfare (Seabrook & Bartle 1992; Seabrook 2001; Lensink *et al* 2001; Hemsworth 2003).

Some determinants of good and bad stockmanship have been well described by, for example, Seabrook (2001), Seabrook and Bartle (1992), Hemsworth (2003), or Lensink *et al* (2000c, 2001). They showed that the behaviour of stockpersons towards animals, and husbandry in general, was strongly influenced by attitudes (whether they described animals positively or negatively, whether they felt it important to pet or talk to the animals or,

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conversely, to hit or shout at them) and personality traits (introvert/extrovert, confident/unconfident). Such psychological characteristics are directly linked to animal production (growth and reproduction rate, milk production, meat quality) and welfare.

Hemsworth and Coleman (1998) and Seabrook (2001), suggest, but do not demonstrate, that increasing the number of positive human contacts will probably help to improve general animal care through the earlier detection of individual changes, diseases and injuries. In veal calves, Lensink *et al* (2000a,b, 2001) observed that positive interactions (petting, talking, especially during feeding) appeared to be linked to improved ease of handling, growth rate and meat quality. Stockpersons who behave positively towards the animals demonstrate not only a better attitude towards them but also, more generally, a better attitude towards animal rearing conditions (in particular, cleanliness). Thus, evidence of positive human–animal contacts could be used to predict improved welfare. However, these indicators should also be interpreted with care. Other factors, such as working systems and organisation (time constraints, number of animals) and motivation (linked to self-esteem, social recognition and job satisfaction), can modulate stockpersons' behaviour (Hemsworth & Coleman 1998; Lensink *et al* 2000c; Seabrook 2001).

The easiest ways to improve stockmanship are either to select people carefully, or to train them to improve their technical knowledge, working organisation and attitudes towards both animals and husbandry practices. The training programmes that already exist have been received with acclaim among stockpeople (Chupin & Sarignac 1998; English *et al* 1999; Hemsworth 2003). Most training approaches are based mainly on a combination of scientific and empirical knowledge about animal biology and animals' perception of human handling, human perception of animals and handling, and other external factors (eg social environment of the stockpeople). In addition, some of these approaches involve practical training with the animals. However, we still need clarification of the influence of stockperson–animal interactions on farm animal welfare.

There is general agreement among scientists that animal welfare is directly influenced by the animal's emotional perception of its environment, its feelings and its desires (Veissier *et al* 1999; Dawkins 2002). Fraser (1995) asserts several principles that could be directly influenced by the impact of stockpersons on their animals. The first principle is the absence of suffering (pain, fear). The second principle is the normal functioning of the organism (absence of disease, wounds or malnutrition) as a consequence either of human–animal interactions or of skilled human observation. The final principle is the existence of positive animal well-being, which could be provided through positive human–animal interactions. This paper will explore these assumptions for animal welfare in relation to stockmanship in the light both of existing knowledge on animal perception of stockpeople–animal interactions and of what remains theoretical. From these considerations, we shall suggest what might be investigated in the future.

Stockmanship and farm animal welfare: the animal's point of view

Stockpersons' attitudes may vary from negative to positive, leading to negative (hitting, shouting) or positive (feeding, petting) behaviours towards their animals. How do the animals perceive such contacts, and what are the factors that could influence this perception?

Do stockpeople induce fear of humans in farm animals and impair their welfare and production?

Farm animal husbandry is often perceived by the public as a constraint on the freedom of the animals and a source of suffering and discomfort. Applying Fraser's (1995) principles to

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stockmanship, suffering directly induced by the stockperson is the first point to check when evaluating the level of animal welfare. Welfare studies have mainly investigated the negative consequences of farm management on the animals. By the same logic, most of the studies about the human–animal relationship have investigated the animals' fear of humans and its consequences for animal welfare, production, and the stockperson's work (for a review, see Hemsworth & Coleman 1998; Rushen *et al* 1999; Hemsworth 2003). Fear is defined as an emotional state that is induced by the perception of any actual danger that leads the animal to avoid it (Boissy 1995). Most of these studies have recorded behavioural and physiological indicators of animals' fear of humans, stress and production parameters such as growth rate, reproduction rate, milk production, and food quality (eg meat tenderness).

Fear reactions can affect both human and animal safety and reduce worker comfort and time efficiency. Fearful dairy animals often kick during the milking process and do not give all their milk (Hemsworth & Coleman 1998; Rushen *et al* 1999; Hemsworth 2003). Fearful animals may injure themselves (Fordyce *et al* 1985; Jones 1996) and large animals such as beef cattle often threaten or charge at stockpeople during handling (Boivin *et al* 1992, 1994).

Understanding the factors that induce fear is a major challenge for animal welfare science. Many studies have demonstrated that the fear response to humans is based on an absence of habituation to human contact or a negative learnt association (Rushen *et al* 1999) interacting with a strong genetic background (eg in beef cattle [Le Neindre *et al* 1995]). Many husbandry procedures are evidently painful, such as dehorning, castration and branding (for a review, see Stafford *et al* 2002), but so are hitting or kicking by stockpeople (Hemsworth & Coleman 1998). Elements of handling (social isolation, restraint and close human presence) may be perceived by animals as very fear-inducing and potentially deadly. All of these elements have been shown to be aversive (Boissy *et al* 1997; Rushen *et al* 1999). In addition, as most farm animals live in a group, fear could also be transmitted, or reduced, by the dam or other group members through their behaviour or through alarm pheromones (for a review, see Veissier *et al* 1998). Other human characteristics that may generate fear include movements and postures (Hemsworth 2003). Empirically, some physical characteristics (eg loud harsh voice, large height, light-coloured clothes, certain smells) are often reported as fear cues for the animals. However, no scientific data support such assertions, even though some of these cues are effectively used by farm animals to discriminate between people (Rushen *et al* 1999; Hemsworth 2003). More systematic scientific study is required.

Are 'positive' human–animal interactions really positive for farm animals, their welfare and their production?

Bringing positive experience to the animals and enhancing their well-being is increasingly an important question for research, and is the third principle highlighted by Fraser (1995) with respect to animal welfare. Many experiments with rodents, pets or horses demonstrate direct or indirect physiological effects of friendly interactions between humans and animals (for a review, see McMillan 1999). Decreases, for example, in heart rate and arterial blood pressure in human and animals have been shown to occur during gentling or petting. Petting has also been used as a reward in an experimental conditioning process with rats and dogs (for a review, see Kostarczyk 1992). Many experiments on rodents have demonstrated the positive effect of early handling on general reactivity and learning ability. However, this 'handling' was mostly not 'petting', but rather involved putting the animal into a small closed box for a few minutes (Denenberg 1968; Nunez *et al* 1996). Such a handling procedure is far from the common definition of human–animal interaction and these effects on the animals' biology should be carefully considered before we generalise them to farm animals. Moreover, these

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results could have been induced not by a direct effect of handling but by maternal behaviour after handling (Liu *et al* 1997).

For farm animals, petting has been shown to decrease fear of handling (Rushen *et al* 1999). However, the positive perception of physical interactions such as petting is still unclear and, in most studies, seems to be just a habituation process (Mateo *et al* 1991; Boivin *et al* 1998a). Early petting associated with feeding influences later human–animal interactions, increasing motivation to interact with humans and increasing the likelihood of being reassured by humans when in stressful situations (Price & Thos 1980; Boivin *et al* 2000; Krohn *et al* 2001). Cattle or pigs approach the experimenter more than control animals if they have associated a food reward with the human presence (Hemsworth *et al* 1996; Lensink *et al* 2000a). However, few studies have investigated whether petting *per se* is rewarding, despite many affirmations that such contacts are 'positive' (Hemsworth & Coleman 1998; Seabrook 2001). For example, Jago *et al* (1999) and Boivin *et al* (1998a) could not demonstrate that cattle showed a higher motivation to interact with a human after having been petted or brushed than after having been simply exposed to the human's presence. One problem in demonstrating how positive such contacts are may be that we do not know how to correctly pet the animals! Feh and De Mazières (1993) demonstrated that grooming of horses by humans reduced their heart rate (a 'positive' feeling?) when it was performed exactly as the animals groom each other. This study requires confirmation. Finally, the effect of petting could also depend on the age of the animals. Young mammals like to play and are often groomed by their dam. Petting at an early age may be more effective than at a later age.

The complexity of the stockperson's behaviour towards the animals

It is relatively easy to separate negative and positive human contacts under experimental conditions. However, this is unlikely to reflect the reality of the stockperson–animal interaction on farm. The predictability and controllability of the human contact, the period when such contacts occur and their physical and social context all need to be considered.

a) The predictability and controllability of the stockperson's behaviour towards the animals

It is important to consider the inconsistency of human behaviours with the mix between positive and negative interactions. Although past studies have shown a strong bias towards determining the effect of negative human contacts on animal fear, welfare and production, scientists interested in this field should observe the effects of both positive and negative human contacts. De Jonge *et al* (2001) suggest that animals' reaction to stockpeople follows the principles of learning theories mainly studied on rodents (ie the effect of intermittent rewards/continuous rewards on animals' motivation to work, and predictability or controllability of the environment). Few studies exist that deal with farm animals. Both dairy cattle (Seabrook & Bartle 1992) and bulls (Renger 1975) have been shown to be more or less easy to handle depending on the characteristics of the stockperson (level of confidence, level of experience and degree of agitation). These reactions are probably linked to the degree of fearfulness of the human (eg quick movements) but also to human–animal communication, the number of signals the animals is able to understand from the handler and the predictability and controllability of the situation. Hemsworth *et al* (1987) also observed that when negative human behaviour is introduced at random among positive interactions and is therefore unpredictable (even at a frequency of only 1 in 6), pigs were as fearful towards humans and as chronically stressed as pigs handled negatively all of the time. However, this

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too needs to be confirmed by future work incorporating factors such as the period of life of the animals and the context of the interactions.

b) The importance of the period of life

Many studies have suggested, for example in ungulates, a stronger impact of contact given early in life (Lyons *et al* 1988a; Boivin *et al* 1994), at weaning (Boivin *et al* 1992; Boivin & Braastad 1996) or at parturition (Hemsworth *et al* 1989) compared to during other periods of life. Such sensitive periods of contact could allow a durable reaction of the animal towards the stockperson to be built in only a few days (Boivin *et al* 1992; Markowitz *et al* 1998; Krohn *et al* 2001). However the durability of the result of brief contact during sensitive periods is still under discussion; further regular contacts are probably very important in maintaining the relationship (Boivin *et al* 2000). Moreover, the quality of the interaction (in association with food reward or, by contrast, with strong aversive contact) is also important (Hemsworth & Coleman 1998; Boivin *et al* 2000). In addition, the mechanism behind the sensitive period is unclear. Imprinting (Lorenz 1935), socialisation based on an attachment process (Scott 1992) or emotional experiences and changes in the emotional system (Denenberg 1968; Bateson 1979) have all been suggested. Particularly at an early age, young herbivores enjoy playing and interacting with their dam (eg licking, grooming). Interactions with humans at this age may have a different meaning from those at later ages. However, despite the importance of such work for stockmanship, there are few scientific papers dealing with farm animals and all have been performed in experimental farms. Once again, more work needs to be done.

c) The importance of the physical context

Animals can clearly discriminate between different people (unfamiliar or familiar, aversive or positive). However, animals may not discriminate between known people when the environment differs from the usual handling environment (for a review, see Rushen *et al* 1999). From experimental data, Boivin *et al* (1998b) hypothesised that the animal's response to different humans may depend on the overall impact of all incoming sensations and that these responses could be plotted on a bell-shaped curve, with the x-axis representing the quality of the situation (positive to negative) and the y-axis representing the level of discrimination between humans (no discrimination to full discrimination). When the situation is very positive for the animals (such as when they are expecting food), the importance of the human identity would be strongly reduced. In the same way, when the environment is very stressful, such as during isolation in a new pen or during a new handling procedure, the importance of the identity of the stockperson is also reduced. An optimum of discrimination would arise somewhere between these two extreme situations. Such a theory could partly explain why some experiments clearly show strong differential reactions towards known and unknown persons when, in other studies, the response to an unfamiliar person is strongly related to the response to a familiar one. These results are probably linked to the degree of predictability and controllability of the situation for the animals, which could be defined as 'confidence'.

In any case, consideration of the physical context should be applied to any test situation designed to measure animals' reactions to humans, especially under farm conditions. A habituation period to the test arena has been used in many experiments (eg in goats [Lyons *et al* 1988a], in pigs [Hemsworth & Coleman 1998], in sheep [Boivin *et al* 2000], in beef cattle [Boivin *et al* 1992] and in dairy cattle [Krohn *et al* 2001]). However, the time

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necessary to habituate the animal to such a situation is unknown. It could vary from 30 s (Boivin *et al* 1992) to 24 h (Krohn *et al* 2001). Such methodological considerations would also be valuable for the assessment of animals' reactions to handling. Many papers describe tests involving different handling facilities (eg crushes, yards, paddocks) where the degree of knowledge of the facilities by the animals or the human presence and handling behaviour is not clearly described (eg Burrow *et al* 1988; Grandin *et al* 1995; Watts & Stookey 2001).

d) The importance of the social context

All domestic farm species are social. Thus the social context of the human contact can influence its perception by the animals, especially during testing procedures. This problem is exacerbated for gregarious animals reared in groups such as cattle and, particularly, sheep. The familiarisation period to the test pen which often precedes an individual test is clearly not only a habituation period but also a social distress period (Boivin *et al* 2000). This aspect has been investigated very little and should receive more attention. To avoid such social isolation effects, some tests have been performed to test animals in groups by letting them approach or by approaching them (Murphey *et al* 1980; Fisher *et al* 2000; Hemsworth *et al* 2000). The repeatability of individual flight distance is much lower when measured in a group in a paddock than when animals are individually tested in a yard (Fisher *et al* 2000). Depending on the circumstances and probably on the species, breed and group compositions (including how fearful the animals are), fear from one animal could be transmitted to the others via behaviour, vocalisation or smell. Alternatively the (reassuring) presence of others could mitigate its distress (Veissier *et al* 1998). Fisher *et al* (2000) observed that yard flight distances measured in groups were lower than those measured individually. The influence of the social context is of course less important when animals are reared individually (veal calves, tied beef or dairy cows and pigs), but these husbandry systems are used less and less frequently. One solution for animals living in groups could be to test them when they are individually tied for feeding (Hemsworth *et al* 1999; Lensink *et al* 2001). However this represents only part of the farm system. Testing animals in a group remains one of the biggest problems in this area, especially under commercial farm conditions where animals are generally reared in bigger groups than on experimental farms.

The effect of previous contact between humans and animals on their relationship is also likely to differ markedly according to the social context. Young goats' response towards humans was shown to correlate with the positive response of an adult goat, especially the dam, towards humans, which suggests a facilitating role of a tamed dam in the development of a positive human–young animal relationship (Lyons *et al* 1988b). However, Boivin *et al* (2002) observed that the presence of the dam could limit the efficiency of early human contact given to lambs on later reaction to their stockperson.

How to describe the complexity determining the animal's perception of the stockperson: theoretical conception of the stockperson–farm animal relationship

Stockpersons are by definition persons that take care of livestock. They feed them, move and handle them, and take care of their health through surveillance, cleaning and medical treatment. However, the simple description of these actions fails to capture the complexity of the relationship between stockpeople and their animals. A general concept of these interactions, developed by Estep and Hetts (1992), is based on the assumption that animals perceive humans as, for example, predators or conspecifics.

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The concept of human–animal interactions

It is evident that farm animals and stockpeople interact with each other. Seabrook (2001), Hemsworth and Coleman (1998), and Lensink *et al* (2000c) have all noted the importance of human communication, especially vocal communication, towards (or with) the animals as an indication of their attitude towards the animals. There has been less emphasis on the active contribution of the animals to the human–animal relationship, and especially the ways in which animals communicate to stockpeople, and how this active part could influence the quality of the relationship.

Some scientists have recently investigated animal vocal communication in the presence of humans or during handling (Schwartzkopf–Genswein *et al* 1997; Grandin 1998). Their main assumption is that they can measure emotional changes in animal vocalisation and use it as an indicator of welfare (for a review, see Watts & Stookey 2000). It would also be interesting to identify which signals animals use when interacting with humans as tools to assess the quality of the stockperson–animal interaction (Marchant *et al* 2001). Few scientific studies have been done in this area despite a large empirical knowledge base.

The concept of a human–animal relationship

Estep and Hetts (1992) argued that stockperson–animal *interactions* can form the basis for human–animal *relationships*. Such relationships can be studied by investigating the positive or negative perception of each partner by the other. An important consequence of the concept of relationships is that it should determine and so allow us to predict the course of later interactions. Concepts of 'relationship' and 'animals' perception of humans' are not only relevant for the animal welfare aspect as described previously — they also allow us to address the complex motivation of the animal when interacting with a human. It is important to understand that when we are watching animals, they are also watching us. Their reaction to a motionless human, a standing or seated human, a human stretching his arm, looking into the animal's eyes or presenting his back are all important determinants of the farm animal's reaction to humans (Hemsworth & Coleman 1998; J M Chupin, personal communication 2000). The following section describes the theoretical categorisation of the human by the animals and reviews some of the relevant evidence relating to farm animals.

Theory of the animal's categorisation of the human–animal relationship

Theoretical papers on the human–animal relationship suggest that animals may categorise humans as predators, as neutral or valuable objects (eg food or water suppliers) in the environment, or as conspecifics (Hediger 1956; Estep & Hetts 1992; Seabrook 2001). Estep and Hetts (1992) use the term 'symbiont' to describe a strong and necessary relationship between individuals. However, this term, inspired by ecological theory, is a description more of observed behaviour than of an animal's actual perception of the stockperson. One important area for the scientist investigating these theoretical considerations is to develop operational definitions that could lead to experiments and not simply a human vocabulary for human–animal relationships. Such experiments should take into account both the phylogenetic history of the domestic species (eg their anti-predator strategies) and proximal causes such as the animals' motivation and their emotional state.

1) The human as a predator

Kendrick (1998) observed sheep neurones in the temporal cortex that reacted similarly to the sight of a human or a dog. The dog is said to be a natural predator of sheep. Such results have

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often been interpreted as a potential categorisation of the human by the sheep as a predator (Rushen *et al* 2001; Beausoleil *et al* 2002). However, very little information was given by Kendrick (1998) about the 'human–dog–experimental sheep' relationships. Sheep in his experiment were probably very well habituated to humans. However, in order to fit the hypothesis of perception of humans as predators (like dogs), were the sheep behaving towards humans as they behaved towards dogs? Were the sheep as fearful of humans as of dogs? Unfortunately, the response of the neurones themselves does not answer these questions. Nevertheless, fear reactions to humans, especially strong escape attempts or fear aggression, are typically behavioural expressions of animals trying to preserve their life, and are often seen in farm animals, especially in outdoor beef cattle. This occurs despite thousands of years of domestication. A strong genetic influence appears to exist behind such behaviours that interacts with husbandry conditions (Boivin *et al* 1994; Le Neindre *et al* 1995). Boivin *et al* (1992) observed that outdoor cattle which were regularly and gently approached by humans for two weeks did not express fear aggression towards humans when tested several months later, in comparison to non-handled control animals. They hypothesised that the human contact procedure could have induced a change in the animal's perception of the human, so that it no longer considered the human as a potentially deadly stimulus ('predator'?).

2) The human as a conspecific

Most domestic animals are gregarious and social, and such strong motivation is probably one of the reasons for their domestication (Hale 1969). Such characteristics allow farmers to keep several animals together in the same environment and to handle them more easily in a group. It is also supposed that humans use animals' intraspecific socialisation periods to integrate into their social environment. They communicate with them and can obtain obedience, as the animals are used to social communication and to hierarchy establishment within the group (Hale 1969; Kretchmer & Fox 1975; Scott 1992; Price 1999). Such a general way of considering the animal's socialisation to a human is empirical: the human is said to be part of the social group in the case of dogs and horses (Estep & Hetts 1992; Miller 1996; Rooney *et al* 2000). Dog or horse trainers efficiently use such concepts to solve animals' behavioural problems. For dogs or horses, several authors have suggested that large farm animals should consider the stockpeople as a member of the social group and as friend and dominant or a leader for the animals (Lott & Hart 1979; Grandin 2000; J M Chupin, personal communication 2000). This approach allows us to have animals that are not fearful towards humans but respect them (ie show no fear or social aggression and show obedience to human orders).

However, are people really seen by animals as conspecifics and/or social partners, or as something else? This question is not easy to answer. According to the definitions found in many ethology books (eg McFarland 1990), social behaviours (including communication) which lead to social relationships and then to the organisation of the social group are only defined as intraspecific — resulting from the species' evolution. To our knowledge, such concepts have never been applied to interspecies relations, except by scientists working on human–animal relationships. Of course, such a problem of definition could be solved if we could effectively show that animals can categorise humans as members of their own species. Unfortunately, to our knowledge, very few scientific data exist to confirm this assertion, even for dogs and horses, as very few experiments have really quantified 'social' behaviours towards humans and other animals in the group. Sambraus and Sambraus (1975) used the concept of sexual imprinting to test this question with pigs, goats and sheep reared in the

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presence of humans only. Animals exhibited sexual behaviour towards humans rather than towards conspecifics. However, other factors linked to the way they were reared could explain their preferences, such as unfamiliarity towards the conspecifics presented. Price and Wallach (1990) noticed more aggression towards humans with dairy bulls reared in isolation and hand-fed, but they did not prove whether this was a consequence of the human–animal relationship or of the absence of peers in their social environment. These results do not necessarily show that animals categorise humans as conspecifics. Very recently using dogs, Rooney (Rooney *et al* 2000; Rooney & Bradshaw 2002) has started to revisit such theoretical questions by investigating social play behaviour towards both humans and conspecifics, but it currently appears difficult to conclude anything solid from their results.

While the concept of social organisation may be enlarged to interspecies relationships, no experimental studies on farm animals have yet been published to show that the stockperson can be a leader or dominant among the animals. Rather than working directly on dominance/subordination relationships, it is probably necessary to investigate the animals' motivation to stay in a group (including humans), which is the first characteristic of a social relationship, and then to see whether they consider humans at least as a social substitute. As socialisation among animals or to humans is based on attachment theory and sensitive periods (as demonstrated in dogs [Scott 1992]), it is necessary to study farm animal attachment behaviour to humans. Attachment behaviour is seen as the motivation to be with the attachment object and to discriminate it from other objects. We have already seen in previous sections that positive human contacts towards animals could induce such motivation and indeed animals do discriminate between humans. However, attachment is an emotional concept which in effect means a reassurance in the presence of the attachment object and, by contrast, distress behaviour when the attachment object is removed (Kraemer 1992). Price and Thos (1980), Boivin and Braastad (1996), and Boivin *et al* (2000) have all suggested such reassurance in sheep and goats in the presence of a familiar stockperson (reduction in vocalisation or agitation). Boivin *et al* (2000, 2002) also observed greater distress when a familiar stockperson left the test pen and the animal was alone, compared to the reaction of non-handled animals or to their reaction with an unfamiliar person. It appears that the human being in certain situations could effectively be considered as a social substitute for the animals. However, all of these studies were performed on artificially reared animals which had strongly associated the human with food rewards since the start of their lives. Therefore the possibility cannot be excluded that food rewards play an important role in the animal's perception of the human. This question needs to be further addressed. Further studies are also required to demonstrate whether the human could be more than an attachment object who could effectively integrate into the social organisation of the animal group and could therefore be perceived as a social partner. It is also interesting to study how two social individuals from different species can understand completely or partially the social communication signals of the other species. For example, recent studies indicate that dogs were more skilled in understanding some human communication signals than chimpanzees (Hare *et al* 2002). However, too few studies exist at present to permit a definitive conclusion to such a question.

Conclusions and animal welfare implications

This paper has considered the stockperson–farm animal relationship, not simply the behaviour of humans working with animals. This approach seeks to understand how animals perceive stockpeople according to the animals' own species characteristics and behavioural repertoire, in particular their cognitive abilities. Scientific evidence supports the promotion of

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positive interactions (petting, feeding and talking) with animals on a daily basis and especially during sensitive periods of development. Benefits accruing from habituating animals to humans include reduced fear, improved docility, and decreases in working time, discomfort or risk of injuries for both humans and animals. Improved 'stockwatching' can contribute to prevention of disease, and improved production, welfare, and product quality. It can also greatly improve job satisfaction for the stockpeople.

It is probably much easier as a first step to decrease negative human contact during handling through training than to increase positive human contact with the animals. Positive behaviours are probably more strongly related to the personality of the stockpeople. Nevertheless stockmanship can be improved by training (Hemsworth 2003). This gives hope for the future. However, the trend in modern husbandry is to increase working time productivity by reducing the number of stockpeople and increasing the number of animals per farm. Thus, one of the major questions for the future is 'What is the number of animals that a stockperson is really able to care for with respect to animal welfare and productivity'. Given this goal, research should focus on the optimal way for a stockperson to watch and handle groups, for example through better knowledge of the group itself and/or through the control of certain key individuals, as suggested empirically by Grandin (2000). More knowledge is also particularly required concerning the way animals integrate humans into their perceptual world, by studying their genetic potential and their socialisation and cognitive abilities.

To conclude, the question of stockmanship and animal welfare has strongly motivated biologists and psychologist, as demonstrated in this paper. However, the issues are also sociological and philosophical. Larrère and Larrère (2000) have suggested that we should maybe return to the social contract between humans and domestic animals that seems to have been broken by the industrialisation of agriculture. It can be considered that animals have actively participated in the process of domestication (Budiansky 1999), building a common life between social individuals for mutual benefit (respect of animal needs in exchange for the use of their products by humans). However, modern husbandry systems and modern biotechnology have strongly distorted this social contract. How acceptable is this from an ethical point of view, and how does the general citizen of today consider the stockpeople, the main actors of these changes?

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