



Human-cattle interactions and attitudes within dairy farming in Sweden and The Netherlands

Interaktionen mellan människa och ko samt attityder inom mjölkproduktion i Sverige resp. Nederländerna

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I denna serie publiceras olika typer av studentarbeten, bl.a. examensarbeten, vanligtvis omfattande 7,5-30 hp. Studentarbeten ingår som en obligatorisk del i olika program och syftar till att under handledning ge den studerande träning i att självständigt och på ett vetenskapligt sätt lösa en uppgift. Arbetenas innehåll, resultat och slutsatser bör således bedömas mot denna bakgrund.

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Summary

Human-animal interaction is suggested to be a main feature within livestock production. The quality of handling, for instance, appears to be greatly depending on the attitudes and behaviour of the stock people. Various studies have been conducted on relationships between human and animals, but few have looked upon differences in human-animal interaction and attitudes between countries. Two countries often discussed in livestock production are The Netherlands and Sweden. It would be of interest to compare these two countries to find out whether (assumed) differences are reflected in the attitudes between animal handlers. The first aim of this study was therefore to determine whether there are differences in the attitude between dairy farmers and dairy stock people in Sweden compared to dairy farmers and dairy stock people in The Netherlands. The second aim was to observe if there are signs of differences in the human-cattle interaction, within a sample of Swedish and Dutch dairy farms. Data on attitudes towards dairy cattle and the work with dairy cattle was obtained by means of a questionnaire based upon 'Welfare Quality' material. Questionnaire data were categorized within four validated sub-scales 'patience during moving', 'patience during milking', 'importance of contact' and 'punish during milking'. Only data from respondents having completed all questions in either questionnaire were used in statistical analysis, i.e. 38 and 61 for Sweden and The Netherlands respectively. Median score and quartiles were calculated for each of the four sub-scales. Data on actual behaviour was obtained by behavioural observations performed on in total six dairy farms. Farms were equally distributed between the two countries and observations were made on three morning and three afternoon milkings per farm. Observed behaviours of humans and animals were categorized by type, nature of human-cattle interaction, i.e. positive/neutral/negative and visual/tactile/vocal. Some of the behaviours observed were excluded from statistical analysis due to too few recordings; remaining behaviours of handlers were statistically analyzed. The statistical model tested for the effects country, milking time and interaction between country and milking time. Results of questionnaires showed significant difference between the two countries solely for sub-scale 'importance of contact', median score for Sweden was 5.98 and 5.25 for The Netherlands ($p < 0.001$). The number of human-cattle interactions appeared higher on Swedish farms, both during milking and in total, (554 during moving; 1591 during milking) compared to Dutch farms (626 during moving; 310 during milking). Interactions of both positive (tendency, $p < 0.1$) and negative (significant, $p < 0.01$) nature occurred to a greater extent on Swedish farms during moving. In general for both countries, negative interactions seemed to occur to a lower level than positive interactions, e.g. on Swedish farms during moving were 20.9% in morning and 19.3% in evening, of the interactions of negative nature, whereas 29.8% in morning and 34.7% in evening were of positive nature. Interactions of a neutral character occurred more during moving on Dutch (64.6% in morning; 77.85% in evening) than on Swedish farms (41.3% in morning; 39.2% in evening) ($p < 0.0001$). Time of day was significant ($p < 0.01$) as well as interaction between country and time of day for milking ($p < 0.001$). Swedish cows in general appeared to show less fear to humans and accepting touch to greater extent (32%) than cows observed in The Netherlands (7%). Concluding, the results support the assumption that there are differences in attitude and handling of cattle between Sweden and The Netherlands with regard to the importance of contact. Swedish dairy farmers and stock people seem to find this more important than dairy farmers and stock people in The Netherlands. Neutral interactions are the most prominent occurring type of human-cattle interactions in The Netherlands, whereas interactions on Swedish farms more often tend to be either positive or negative. Taken together, results indicate that the human-animal relationship is more positive in Sweden.

Sammanfattning

Interaktionen mellan människa och djur föreslås spela en viktig roll inom animalieproduktionen. Kvaliteten på hanteringen av djur, till exempel, verkar mycket beroende på djurskötarens attityd och beteende. Olika studier har gjorts om relationer mellan människor och djur, få har dock studerat skillnader i människa-djur interaktion och attityd mellan länder. Två länder som ofta diskuteras i samband med animalieproduktion är Nederländerna och Sverige. Det skulle därför vara intressant att jämföra dessa två länder för att ta reda på om (påstådda) skillnader återspeglas i djurskötares attityder. Det främsta syftet med denna studie var därför att undersöka om det finns skillnader i attityden mellan mjölkproducenter och deras anställda i Sverige jämfört med mjölkproducenter och deras anställda i Nederländerna. Studiens andra mål var att undersöka eventuella skillnader i människa-ko interaktion, inom ett urval av svenska och nederländska mjölkgårdar. Information om attityder gentemot mjölkkor samt arbetet med mjölkkor erhöles med hjälp av en enkät baserad på "Welfare Quality" material. Enkätdata kategoriserades inom fyra validerade delskalor; "patience during moving", "patience during milking", "importance of contact" och "punish during milking". Endast data från personer som besvarat samtliga enkätfrågor analyserades statistiskt, detta var 38 och 61 för Sverige respektive Nederländerna. Median poäng och kvartiler beräknades för vardera av de fyra delskalorna. Beteendedata erhöles genom beteendeobservationer som utfördes på totalt sex mjölkgårdar. Gårdarna var jämnt fördelade mellan länderna och observationerna genomfördes under tre morgon- samt tre eftermiddagsmjölkningar per gård. Observerade beteenden kategoriserades efter typ av människa-ko interaktion, d.v.s. positiv/neutral/negativ och visuell/taktil/akustisk. Ett antal observerade beteenden exkluderades från statistisk analys på grund av för få observationer, övriga beteenden analyserades statistiskt. Den statistiska modellen testade för effekterna land, mjölkningstid och samverkan mellan land och mjölkningstid. Resultatet utav enkäterna visade endast signifikant skillnad mellan de två länderna för delskala "importance of contact", median poäng för Sverige 5,98 och 5,25 för Nederländerna ($p < 0,001$). Antalet människa-ko interaktioner föreföll högre på svenska, både under mjölkning och totalt, (554 vid förflyttning, 1591 under mjölkning) jämfört med nederländska gårdar (626 vid förflyttning, 310 under mjölkning). Interaktioner av både positiv (tendens, $p < 0,1$) och negativa (signifikant, $p < 0,01$) natur inträffade i större utsträckning på svenska gårdar vid förflyttning. Generellt för båda länder verkade negativa interaktioner ske till en lägre nivå än positiva interaktioner, t.ex. på svenska gårdar vid förflyttning var 20,9 % på morgon och 19,3 % på kvällen, av interaktionerna av negativ natur, medan 29,8 % på morgon och 34,7% på kvällen var av positiv karaktär. Interaktioner av neutral karaktär inträffade mer vid förflyttning nederländska (64,6 % morgon, 77,85 % kväll) än på svenska gårdar (41,3 % morgon, 39,2 % kväll) ($p < 0,0001$). Tid på dagen var signifikant ($p < 0,01$) samt interaktion mellan land och tid på dagen för mjölkning ($p < 0,001$). Svenska kor i allmänhet verkade visa mindre rädsla för människor och acceptera vidröring i större utsträckning (32 %) än kor som observerats på gårdar i Nederländerna (7 %). Avslutande, resultaten stödjer antagandet att det finns skillnader i attityd och hantering av mjölkkor mellan Sverige och Nederländerna gällande vikten av kontakt. Svenska mjölkproducenter med anställda verkar finna detta viktigare än mjölkproducenterna med anställda i Nederländerna. Neutrala interaktioner är de mest framträdande förekommande typen av människa-ko interaktion i Nederländerna, medan interaktioner på svenska gårdar oftare tenderar att vara antingen positiva eller negativ. Sammantaget visar studiens resultat att människa-djur förhållandet är mer positivt i Sverige.

1 Introduction

1.1 Background

A clear trend can be seen that farms are becoming more 'industrial' in character in Europe and North America (Short, 2000). In Europe the majority of dairy farming is represented by (specialised) intensive farming (EFSA, 2009). These farms are not only increasing in total milk production, but also in the herd size (Wilson, 2001). In general, with larger herds the contact between the cows and the humans decreases, both in terms of frequency as well as intensity (Waiblinger & Menke, 1999). This is due to increased number of animals per handler. Consequently, with an elevated number of animals per handler less time is spent per individual cow in the herd (Boivin et al., 2003; Raussi, 2003). The contact and closeness between cows and humans could even become limited to the milking times (EFSA, 2009). Furthermore, in the strive for increased efficiency various automatic handling systems, e.g. milking and feeding systems, together with more rapid handling procedures are becoming increasingly important and encouraged in dairy farming (EFSA, 2009; Marley et al., 2009). Taken together this lead to interactions between humans and animals to be reduced within dairy farming today and as humans cannot be completely replaced by automatic systems, the decreased habituation to humans can lead to great problems, e.g. handling difficulties and injuries of both humans and cows.

Human-animal interaction is said to be a main feature within livestock production, as stock people are the primary influencer on husbandry and more importantly; stock people rely on personal objectives and choices in their work (Seabrook & Bartle, 1992; Seabrook, 2001; Lensink et al., 2000a, b; Hemsworth, 2003). The quality and nature of handling of cattle, for instance, appears to be greatly depending on the attitudes and behaviour of the stock people (Hemsworth et al., 2002). Various studies have been conducted on human-animal interaction (e.g. Hemsworth et al., 1989; Hemsworth & Coleman, 1998; Boivin et al., 2003) and attitudes of stock people (e.g. Breuer et al., 2000; Waiblinger et al., 2002; Kielland et al., 2010), with different types of animals, e.g. chickens (Hemsworth et al., 1994) and pigs (von Borell et al., 2007), as well as with different production systems (Bruckmaier & Wellnitz, 2008). However, none or few studies have looked upon differences in human-animal interaction and attitudes between countries. Then, comparisons within livestock production today are not restricted to between local regions or even within single countries, but comparisons between countries are becoming more and more important. International comparisons receive increased importance with the increased global competition in trade. Two countries frequently discussed within livestock production are The Netherlands and Sweden. Sweden a country often recognized for having high animal welfare and where most dairy farms hold less than 50 dairy cattle (Jordbruksverket, 2012a). Whereas in The Netherlands almost more than 50% of all dairy herds are holding more than 70 dairy cows (LTO, 2012) and its livestock production often is mentioned as an example of highly utilized production systems maximising all input for maximised output. It would be of great interest to compare these two countries to find out whether these (assumed) differences also are reflected in the attitudes between animal handlers. Is there reason for discussion and exchanging of experience also regarding the human-cow interaction between different countries in order to maximise both countries milk production?

1.2 Literature review

First, this literature review begins with a general description of human-cattle interactions followed by a description of the influence of humans on cattle; considering the perspective of both humans as well as of dairy cows. Hence, how do humans influence and, how are cattle affected by humans.

Interactions between animals and humans occur frequently within modern livestock production (Hemsworth et al., 1993) and can either be of visual, auditory, tactile, gustatory or olfactory character. The interactions can also be of different nature; positive, negative or neutral, but frequent interactions should result in the animals becoming habituated to the presence of the stockperson (Hemsworth & Coleman, 1998). Most common is that the interactions occur by means of daily occurring actions such as feeding, cleaning and milking of the animals (Raussi, 2003). However, human-animal interactions often include more than just human presence in the stable. Sometimes animals have to be physically handled by the human (Hemsworth et al., 1993), for instance during routine practices in addition to the daily events such as hoof care and medical treatment. Human-cattle interactions might also begin as early as around calving by drying the calf and assisting the suckling from its mother or drinking from a bucket (Raussi, 2003). Moreover, handling of young heifers can be intense when they are inseminated for the first time, calving the first time, as well as being re-grouped and introduced to daily milking procedures (Raussi, 2003). The type and resulting effect which the human-cattle interactions have are partly dependent on herd size. For instance, close relationships can often be found between humans and animals on small and family run dairy farms (Waiblinger & Menke, 1999). However, as pointed out by the EFSA in their report from 2009, there can be stock people handling animals roughly on any farm of any size.

Studies reveal strong associations between handlers' attitudes, their behaviour toward animals and the consequential behavioural response of the animals to humans. For instance, less aversive handling was observed in studies where handlers' thought positive about the use of stroking, along with verbal and physical handling of cows (Breuer et al., 2000; Hemsworth et al., 2000; Hemsworth et al., 2002). Likewise, in a study by Hemsworth et al. (2002) direct effects of improved behaviour of stock people were observed and this led to the cows displaying shorter flight distance to the humans. The shorter flight distance indicates that the cows had less fear towards humans (Hemsworth et al., 2002), and fear is suggested to be a key factor when determining animals' response to humans (Hemsworth et al., 1993). Reducing fear towards humans in dairy farming is of importance as the total milk production has been found to be affected (Rushen et al., 1999; Breuer et al., 2000.) Moreover, improving the behaviour and attitude of stockpeople is inexpensive and a hands-on possibility, i.e. by training programs (Hemsworth et al., 2002).

1.2.1 Human behaviour and effects on cow welfare

Grandin (1999) states; "by looking at the cattle you can tell what kind of stockman a person is". In other words, even systems offering great welfare opportunities can fail unless it is accompanied by a sound management practice and good stockmanship (FAWC, 2003). Hence, stress responses by cattle prior to, and during milking can be avoided by a correct and good management (Svennersten-Sjaunja et al., 2000).

Animals are affected by humans via two main pathways; firstly via decisions on housing and general management practices, secondly by the quality of stockmanship. This is

depending on for instance how the animals are handled, the quality of the daily care (e.g. feeding and milking) or the quality of the health care (e.g. fast/slow recognition of sick or injured animals and efficiency in treatment) (Waiblinger & Spoolder, 2007). In these aspects owners and stock people differ considerably, for example in the way they interact with cattle as well as in decisions and management style (Ploeg van der, 1993; Hemsworth et al., 2000; Waiblinger et al., 2003). The most important underlying elements for these kinds of differences are personality, attitudes and empathy in cooperation with both experience and knowledge of the individual (Hemsworth et al., 2000; Ploeg van der, 1993). In addition, also the environmental or situational variables are of importance, for instance social influences by colleagues, time pressure and/or workload (Seabrook, 2001; Waiblinger & Spoolder, 2007; Spoolder & Waiblinger, 2008). Hence, the influence of the human on the well-being of the animals in her/his care is great, covering all necessities of the animal's life, from food to medical treatments. However, it also appears to be underlying factors affecting how people perform their care and hence interact with the animals.

Fear is a main factor when determining animal responses to humans (Hemsworth et al., 1993), and it is moreover likely to have practical consequences for the productivity in dairy (Rushen et al., 1999; Breuer et al., 2000, Hemsworth, 2003). The level of fear differs between individual cows and it is influenced by genetics, habituation, previous experiences, socialization during a sensitive period, associative and imitative learning, as well as the human behaviour towards the animal (Hemsworth & Barnett, 1987; Breuer et al., 2000). Hence, fearfulness could be caused by various factors. However, as an example; the intensity of handling seems more influenced by the effects of a stockperson's personality or attitude than other factors such as herd size (Waiblinger & Menke, 1999).

The initial response of animals when introduced to new environments usually is fear. But later, when fear lessens, the animal begins to explore attempting to get familiar with this new environment (Toates, 1980). Hemsworth et al. (1993) hence argues that the two motivations, fear and exploration, are in conflict with each other. Therefore animals in intensive production systems may express both stimulus-specific and general fear in response to stock people. In other words, a naïve animal's first response to humans might be comparable to its response to an unfamiliar object or animal of a different species. However, due to the nature and amount of subsequent interactions with humans a stimulus-specific response to humans is developed. Consequently, in tests with human stimuli the fear towards humans will be the main influencer on the animal's approach to the human stimuli. Thus, despite the animal being motivated to explore its environment the animal which is highly fearful towards humans will attempt to avoid the human stimuli (Hemsworth et al., 1993).

The welfare is put at risk in animals fearful of humans as the animals attempt to avoid the humans. During such attempts animals risk becoming injured and/or experience acute stress whenever a human is present, and finally animals risk effects on their immunity by chronic stress (Breuer et al., 2000). Physiological stress responses caused by fearfulness to humans may cause immunosuppression, and in order to have an effective immune system cows need to minimize such stressful experiences (Hemsworth et al., 2000). Not only will negative handling result in acute stress and fear responses affecting the production, handling and work with animals. Cows can also become vicious and dangerous through rough handling, constant yelling or beating and abusive handlers (Rebhun, 1995). Moreover, fear responses of cattle can also affect stock people's motivation, satisfaction and commitment to their work (Hemsworth & Coleman, 1998), which could cause frustration and result in unnecessarily forceful methods (Croney et al., 2000).

Studies show negative and significant relations between usage of negative interactions by stock people and insemination success, approach distance to humans, as well as milk, fat and protein yield (Hemsworth et al., 2000; Waiblinger et al., 2002). When stock people use aversive handling causing fearfulness in cows this interferes with the process that controls milk let-down. In turn this leads to incomplete or disturbed milk ejection and removal, resulting in decreased milk yield (Bruckmaier & Blum, 1998; Rushen et al., 1999). The study by Rushen et al. (1999) demonstrates this; having an aversive handler present during milking increased heart rate and movement and increased the residual milk by 70%. According to the authors, it is plausible that milk letdown was affected by a decrease in oxytocin secretion. The decreased secretion of oxytocin was most likely induced by stress or fear from the human handling given in the study (Rushen et al., 1999). Moreover, in another study heifers that failed to avoid humans were given moderate to forceful slaps shortly before or after milking. Heifers having received such slaps showed increased flight distance towards humans and tendencies for reduced milk yield (Breuer et al., 1997).

Correlations have been found between avoidance distance held by cows in the stable and the intensity, quality and continuity of contact between the milker and cows. For instance, cows allowed milkers that used behaviours defined as 'positive interactions' to stand closer to them (Waiblinger et al., 2003). Correspondingly, in the study by Munksgaard et al. (2001) cows held a longer distance away from the aversive handlers than they did from the gentle handlers.

In order to overcome fearfulness to humans the number of positive tactile interactions between humans and cows has to be increased (Hemsworth & Coleman, 1998). Gentle stroking of cows is an example of handling shown to give this kind of positive effects, reducing fear and increasing handling ease (Schmied et al., 2008a). In that study, stroking body regions that often are licked during social grooming among cattle resulted in greater responses than when humans stroked regions which are licked less often. Hence, when stroked by humans on the specific body regions cows may partially perceive the stroking similar to social licking (Schmied et al., 2008b). It has even been described that dairy heifers brushed for five minutes per week during the weeks prior to calving, improved the milk let-down and kicked less (Bertenshaw et al., 2008). On the other hand, Pajor et al. (2003) found little or limited evidence on cows actually appreciating positive interactions with humans, apart from being fed. Regarding beef cattle, accepting contact such as stroking or brushing, appears more as an effect of habituation than any positive reinforcement, with a long lasting effect observed even 18 months after the gentling period was ended (Boivin et al., 1998).

In cattle's strive to avoid negative effects from aversive handling they seem highly adaptable in learning numerous alternatives of avoiding humans and/or situations which the cow connect with something unpleasant, causing not only production drops but even hazardous situations.

1.2.2 Behavioural responses of cows when handled

The distinction between general and stimulus-specific responses to humans (Hemsworth et al., 1993) is supported by studies in which different handling treatments are practiced. For instance in the study of Hemsworth et al. (1996), a number of pigs and beef cattle were treated for four weeks with either of the three treatments; regular brief contact to either positive handling by a human, or to a number of novel objects, and thirdly minimal contact with both humans and the unknown objects. The results showed that both pigs and cattle that were in regular contact and positively handled by humans would faster approach as

well as stay close to humans longer; hence the animals developed a stimulus-specific response to humans (Hemsworth et al., 1993; Hemsworth et al., 1996). On the other hand, it is likely that fear increase in cattle when treated or handled aversively (Hemsworth et al., 2000). The effects of aversive handling can, according to Hemsworth and Coleman (1998), be very long lasting. Several handling treatments perceived as aversive by animals are concurrently performed by humans. Thus it is likely for animals to learn to associate aversive handling with people (Rushen, 1996). Previous experiences will affect the animals' response to handling (Grandin, 1984), but limited human contact also induces fear of humans in cattle (Boissy & Bouissou, 1988; Lensink et al., 2000a).

In the study by Munksgaard et al. (2001) cows held a longer distance away from the aversive handlers than they did from the gentle handlers. It has also been proposed that cattle can recognise individual people (Rushen et al., 1999). Cattle are even said to learn to discriminate between different handlers, partially based upon the colours of the clothes (Munksgaard et al., 1997). In order to distinguish between different people cattle use numerous cues, such as body height and face. Still, if the rest of the body is out of sight only the face would not be sufficient (Rybarczyk et al., 2001). Moreover, cattle can identify a location where aversive treatment is performed, as well as either avoid or approach one and the same person depending on location (Rushen et al., 1998). Lewis & Hurnik (1998) observed similar tendencies of cows showing more fear and being more likely to refuse entering a crush when having previous experience of painful treatments. In addition, neighbour animals may be influenced by other animals' responses to locations or handlers. For example, it was shown that animals would learn avoiding aversive handlers when the neighbouring cows kept a longer distance to the handlers (Munksgaard et al., 2001).

The level of fear towards humans can be determined by the number of negative tactile interactions in relation to the total number of tactile interactions (Hemsworth & Coleman, 1998). Another possible source of information regarding the level of fear in animals is vigilance. Vigilance time increases significantly in the presence of an aversive person, as compared to unfamiliar and gentle humans (Welp et al., 2004). Willis (1983) suggested that restlessness during milking, measured by the number of flinch, step and kick responses (FSK) could be an indication that cows are experiencing stress, and/or fear. Other studies have on the other hand found less kicking in stressful situations (Rushen et al., 2001). Still, studies comparing heifers handled positively during calving and heifers not being handled showed that the positively handled heifers had lower cortisol levels, less fear of humans and less flinch, step and kick (FSK) response with a human present at milking when compared with the heifers not handled (Hemsworth et al., 1989; Hemsworth et al., 1987). In a later study by Rushen et al. (2001) cows exposed to isolation or novelty conditions did also show some reduced signals of fear when a human was present. Nevertheless the milk yield did not increase through human presence during milking (Rushen et al., 2001).

1.2.3 Human attitudes and effects on cow welfare

Stock people being more agreeable and friendly have been observed to grade the importance of contact with cattle higher than their pessimistic colleagues (Waiblinger et al., 2002). More importantly, the agreeable stock people used more positive and less negative behaviour towards the cows whereas the pessimistic stock people showed less positive behaviour in comparison (Waiblinger et al., 2002). In turn, the results revealed cattle having low level of fearfulness when handled by the agreeable stock people. On the contrary, when the cows had been handled by stock people with more negative attitudes

and subsequent negative behaviour; cows showed higher level of fear as well as a lower milk yield (Waiblinger et al., 2002b), indicating a connection between attitude and behaviour of humans with effects on the performance of the cows.

Waiblinger et al. (2002) are not alone in demonstrating such connections. It was also observed by for instance Breuer et al. (2000) that restlessness, handling ease and fearfulness in cattle were correlated with the attitudes of stock people. In the process of moving cows, the usage of negative tactile interactions, movement speed and harsh voice were all correlated with restlessness in the presence of the stockperson, whereas a negative correlation existed between the usages of soft, quiet vocalization and restlessness in the presence of the stock person (Breuer et al, 2000). Grandin (1996) also proposes that a good stockman who handles cattle calmly will hold more calm animals than will a bad stockman who instead makes the animals excited.

The research on attitudes and behaviour of stock people may be somewhat limited in the dairy industry but more is done within the pig industry. Here evidence clearly exists also for how stock people behaviour towards farm animals can be predicted by the attitudes of the stock people. Hemsworth et al. (1989) and Coleman et al. (1998) for instance reported about stock people who hold more negative attitudes towards pigs also perform more negative behaviours when working with pigs. These findings are also supported by among others the study of Lensink et al. (2000c) with veal calves. In their study a significant correlation was found between the amount of positive contact given by farmers to their calves and their beliefs about the calves' sensitivity to human behaviour.

Other factors than attitudes are yet possible contributors for predicting stockpeople behaviour (English, 1991; Hemsworth & Coleman, 2011), such as farm size where farmers holding larger herds show less positive behaviour, likely due to high work load (Lensink et al., 2000c). Nonetheless, attitudes are useful in predicting human behaviour as they are externally directed towards an object (Fishbein & Ajzen, 1974). Hence attitudes are of evaluative predispositions (Fishbein & Ajzen, 1974; Hemsworth et al., 1989). Attitudes are even said to be the best predictor of stockperson behaviour (Hemsworth et al., 1989, 2000, 2002; Coleman et al., 1998; Lensink et al., 2000c). This is also supported by 'The theory of reasoned action' developed by Ajzen and Fishbein (1980). Ajzen and Fishbein (1980) argue that the key factors determining the behavioural intentions of a person consist of; firstly a personal or attitudinal component and secondly by a social or normative component. The first component is referring to the attitude of an individual towards performing the specific behaviour and the second component denotes to the subjective norm of the individual self. In turn, the subjective norm refers to the perception of the individual what he or she believes that most people in his or her immediate surroundings, people important to the individual, think about the behaviour in question. That is, how could it be perceived by the surrounding if, or not, the individual would perform the specific behaviour (Ajzen & Fishbein, 1980). An example could be seen in the study by Lensink et al. (2000c), in their questionnaire respondents were asked about negative contacts between cattle and humans. The questions asked in the questionnaire seemed unrelated between the farmers' attitudes and their behaviours towards the animals. Likely, as discussed by Lensink et al. (2000c), the lack of correlation depended on moderated answers or behaviours when the observer was present, concerning negative behaviours.

1.2.4 Sweden and The Netherlands – countries often compared

Within livestock production and perhaps dairy farming in particular, two countries are commonly discussed and even given as exemplary countries; Sweden and The

Netherlands. In discussions about animal welfare Sweden is often the given example of success by many, whereas The Netherlands often is given as an exemplary model for well utilized production systems maximising all means, from the cows to the cropland, for maximised output. Not only is Sweden well-known for animal welfare reasons, but also for having a long history of tied-up housing, a smaller average herd size, 65.4 in year 2011 (Jordbruksverket, 2012a) than The Netherlands. Moreover, most Swedish dairy farms hold less than 50 dairy cattle (Jordbruksverket, 2012b). In The Netherlands on the other hand, the average herd size is 80 dairy cows in 2011 (LTO, 2012). As late as in 2011 around 39% of all the Swedish dairy cows were held in tied-up housing systems (Svensk Mjök, 2012), whereas in The Netherlands the corresponding number in 2009 was around 10% (EFSA, 2009). But, how well do these numbers and assumptions on the production systems in these two countries reflect the actual situations? Is there any truth in the assumptions on Sweden as ‘world-leading’ on animal welfare and is the situation really as extreme like often assumed in The Netherlands? More importantly, are there differences between these two countries, often presented as each other’s opposites, reflected in the attitudes and behaviour of the people handling cattle? Is there reason for discussion and exchanging of experience also regarding the human-cow interaction between different countries in order to maximise both countries milk production?

1.3 Aim and questions

The aim of this study is to determine whether there are any differences in the attitude between dairy farmers and dairy stock people in Sweden compared to dairy farmers and dairy stock people in The Netherlands. The study also aims to observe if there are signs of differences in the interaction between humans and cattle, within a small sample of Swedish and Dutch dairy farms.

1.3.1 Research questions

1. Are dairy stock people and dairy farmers in either The Netherlands or Sweden considering patience during moving more important?
2. Do dairy farmers and dairy stock people in either of the countries find it more important with patience during milking?
3. Do dairy farmers and dairy stock people in either of the countries find it less or more important with contact with their cattle?
4. Are dairy stock people and dairy farmers in either The Netherlands or Sweden, more or less against punishment of dairy cattle in general, and during milking?
5. In terms of positive and negative interactions, are there differences between the two countries with regard to the behaviour of dairy farmers and dairy stock people?
6. To what extent is the human-cattle interaction different between the dairy farms in Sweden and The Netherlands, regarding interactions of a neutral nature?
7. Are there differences between the two countries with regards to the character (visual, vocal, tactile) of the human-cattle interaction on the farms?
8. Are dairy cows in one of the two countries displaying more fear towards humans than the cows in the other country?

2 Material and method

Data on attitudes towards dairy cattle and the work with dairy cattle was obtained by means of a questionnaire. The questionnaire enabled the comparison of attitudes between Swedish and Dutch dairy farmers and stock people. Data on actual behaviour was obtained by behavioural observations performed during the autumn of 2012 on in total six dairy farms. Farms were equally distributed between Sweden and The Netherlands. The observed behaviours of humans and animals were categorized by type, nature of the human-cattle interaction. However potential correlations could not be calculated between attitudes and behaviour in the two countries. This as observation data not were available for all respondents of the questionnaire, nor was questionnaire data available for all farms with behavioural data.

2.1 Questionnaire on attitudes, beliefs and behaviour

The questionnaire was originally developed by the 'Welfare Quality' project in 2009 (Quality Handling), and used in their multimedia study material aimed for improving attitudes and behaviour of people handling and working with dairy cattle. Similar material and questionnaire, then divided into three parts, was also used in the study of Waiblinger et al. (2002). Thereby questions were already well tested and more importantly validated for unraveling attitudes and beliefs of dairy handlers.

In the current study the questionnaire consisted of one unit being adjusted from the training software 'Quality Handling' developed within the framework of the 'Welfare Quality' project. The questionnaire was translated into Swedish and Dutch creating one questionnaire for each country. The two questionnaires were made available via two separate links and published online on November 11 2012 in The Netherlands and December 10 2012 in Sweden. The two questionnaires were closed January 13 2013 upon collection of data. Thus was the questionnaire open for 64 days in The Netherlands and 35 days in Sweden. The link, together with a shorter introductory text, was distributed via Dairy Campus, the livestock research center part of Wageningen University and Research Centre (WUR), and via a monthly electronic newsletter reaching almost 10 000 dairy farmers in The Netherlands, and directly to dairy farms. In Sweden the questionnaire was distributed via The Swedish Dairy Association and by directly spreading the word about the project to dairy farmers throughout Sweden. One reminder was sent out via e-mail directly to farmers in both countries, approximately two to three weeks before the questionnaires were closed for answering. The number of respondents answering all questions in the questionnaire was 61 out of 300 people opening the link, in The Netherlands and 38 of 161 participants in Sweden. Thus was the response rate 20.3 % and 23.6 % in The Netherlands and Sweden respectively.

The questionnaire comprised of 62 questions and statements in total. The purpose with the first four questions were to gain some background information on the respondents, for instance respondents were asked about the type of housing and milking system used on their own farm. The following 58 questions and statements were the validated questions from the 'Welfare Quality' material. These questions and statements were of various characters, both positive and negative, aimed for discovering patterns of beliefs and attitudes on dairy cattle handling. Some of the questions asked were; "sometimes it is necessary to drive a cow with a handling aid, e.g. with a stick, if she does not move into the milking parlour", "if a heifer stops while moving into the milking parlour, I would drive it by shouting at it" and "how important is it to pet or stroke an animal when standing next to it?" The answer options were made according to a seven-point Likert scale, ranging

from very important (1) to not important at all (7), and strongly agree (1) to strongly disagree (7). Later the answers were given a score, ranging from one to seven (in general high scores reflected positive results, except for questions on punishment). The complete Swedish questionnaire is available in Appendix 1.

The questions in the questionnaire were also categorized into four groups or sub-scales; 'patience during moving of animals', 'patience during milking', 'importance of contact' and 'punish during milking'. Some questions on the topic of punishment were kept apart from the sub-scales and later analyzed separately. The four sub-scales however, were validated like the questions on beliefs and attitudes, by previous studies of Waiblinger et al. (2002) and the 'Welfare Quality' project (2010).

2.2 Behavioural observations

Behavioural observations were performed between the 11th of September and the 28th of September 2012 in Sweden, and between the 22nd October and the 4th of November 2012 in The Netherlands. Three to four work days were spent on each farm. During the behavioural observations data was acquired both regarding the behaviour of the cows as well as the stock people handling the cows. Furthermore data on production and management, e.g. milk yield, feeding and milking regime, were collected on all farms.

The contact with the Swedish dairy farm owners was established through The Federation of Swedish Farmers, region southeast, (Lantbrukarnas Riksförbund Sydost, LRF). The Dutch dairy farm owners were contacted with the help of Dairy Campus, part of Wageningen University and Research Centre (WUR).

2.2.1 Participating farms and animals

The farms in Sweden were all in the county of Kalmar, Sweden (Table 1), and the farms visited in The Netherlands were located in the area around the city of Leeuwarden, The Netherlands (Table 2). The ethical application for the observations on the Swedish farms was approved by the regional ethical committee on animal experiments in Linköping (Diarie no. 77-12). The farm owners and stock people were only informed afterwards when all behavioural observations had been completed on the last day of the visit, what the exact purpose of the observations were and what specific behaviours that had been recorded during the observations; permission to use the data was given by all farms.

Table 1. Description of the Swedish farms where behavioural observations were performed

	Farm A	Farm B	Farm C
Cows entire herd	~200	220	520
Cows in lactation	175	185	450
Housing system	Loose housing with rubber mats	Loose housing with rubber mats	Loose housing with rubber mats
Milking system	Rotary with 22 places	Herringbone parlour with 16 places	Herringbone parlour with 24 places
No. people handling cows	3	4	5
Time spent per cow/year	~30 h/cow/year	25 h/cow/year	22.5 h/cow/year
Average longevity (time in production)	1.96 lactations	2.1 lactations	3-4 lactations
Average insemination doses/cow/gestation	1.8	1.3	2.2
Handling training	No, but regular daily human contact	Yes	No, but regular daily human contact and loose housing practice

The farms were selected based on herd size (around 200 lactating cows), housing system loose-housing with cubicles and the dominant breed being Holstein-Friesian. Moreover, milking should occur twice a day in milking parlour (either a rotary or herringbone) by mainly the same stock people and the cows were to have pasture access during summer time. On all of the Swedish farms milking was performed by one or two handlers, commonly by employed stock people and to a lesser extent by the farm owner, as compared with the Dutch farms. Conversely, on the farms visited in The Netherlands cows were in general milked by the farm owner. Moreover, the Swedish farms in this study had, when compared to the Dutch farms of the study, employed stock people to a greater extent. On the Swedish farms cows were milked in several groups, whereas the Dutch farms included in the study mainly milked all their cows in one large group. All farms, except for one had pasture access for their cows and two of the farms had more than 200 lactating cows.

The average milk yield varied between 9 413 - 10 950 kg ECM/cow/year (Swedish farms) and around 9 000 kg ECM/cow/year (Dutch farms). Average day in lactation ranged between 127-148 days for the Swedish farms and between 191-207 days for the Dutch farms. No dry-cows were included and in general cows from the group with highest milk yield were observed. Most farms included in the study did not perform specific handling training aimed to habituate cows to humans; many did however allow the heifers to practice in the loose housing system and/or the routines around milking. All Swedish farms

performed daily heat observations often combined with a general observation of all animals, as the stock people or farm owner were walking among the cows in the stable. Hence, the cows on the Swedish farms were in frequent and regular daily contact with humans more than only during handling procedures such as herding, moving into milking, claw treatment and milking.

Table 2. Description of the farms visited for behavioural observations in The Netherlands

	Farm D	Farm E	Farm F
Cows entire herd	230	363	195
Cows in lactation	204	325	175
Housing system	Loose housing with deep straw beds	Loose housing with rubber mats	Loose housing with rubber mats
Milking system	Rotary parlour with 36 places	Rotary parlour with 40 places	Herringbone/swing-over parlour with 40 places
No. people handling cows	3	3	2
Time spent per cow/year	10-15 h/cow/year	15 h/cow/year	Approx. 12 h/cow/year
Average longevity (time in production)	4-5 lactations	5-6 lactations	5-6 lactations
Average insemination doses/cow/gestation	2 (+ bull)	2.02	2.02
Handling training	No, only milking routine practice	No, only milking routine practice	No

Regarding the routines around the two procedures moving and milking the farms (irrespective of country) were similar in their methods. All farms initiated the moving procedure by closing off different areas in the stable creating corridors for herding. After opening the gate into the milking parlour the handler would on all farms visited, walk through the herd, usually combining cleaning of the cubicles with herding of the animals in direction of the milking area. In general handlers would begin (and remain) at the end of the stable behind most animals, urging those lying down to stand up and the herd to move forward. Some of the farms, in both countries, had specific waiting areas just before the milking parlour, however most common was that a part of the stable with cubicles immediately before the entrance to the milking parlour was used as waiting area. All farms had to move their animals around multiple corners, through narrow corridors and often over areas not used by most cows during the rest of the day, creating situations where cows would remain standing or collide with other members of the herd. The same was also true regarding the exit out of most farms' milking parlours, including the rotaries, with narrow corridors and sharp corners causing uneven (sometimes problematic) cow traffic. Later during milking, handlers in general remained in the parlour and only occasionally stepped out when there were problems with the cow traffic in or out the milking parlour.

2.2.2 Procedure of the observations

The behavioural observations were conducted during collecting and herding before both morning and evening milking, and during milking. The observation called ‘moving’ included both collection and herding of the animals. The two procedures ‘moving’ and ‘milking’ were both observed and analysed separately. All observations were performed by the same observer on all six farms. The observer wore clean dark coloured stable clothes similar to those worn by the people in the farms. In total three morning and three evening moving and milking procedures were observed on each farm. It was decided to have more observation periods per farm instead of increasing the number of farms in the study due to the large risk of variation between different days and periods of observations. The observations were direct visual observations with continuous sampling. The time was noted for the start, end and duration of both moving and milking procedures.

Observations started when the handler opened the gate leading into the milking- and/or waiting area. The observation of moving was defined as completed when the stock person closed the gate into the milking-/waiting area behind the last cow in the group. Start of milking was defined as opening of the gate into the parlour and/or when the first cow entered the parlour, depending on the routines of the specific farm. Recorded behaviours are described in three ethograms below (Table 3, 4 and 5), including their definitions and classification of the nature of the human-cow interaction. The definitions as well as the classification of behaviours together with the nature of interactions in the study are modified from previous studies (Breuer et al., 2000; Waiblinger et al., 2002; Waiblinger et al., 2003) and material from ‘Welfare Quality’ project (2010).

Table 3. Ethogram describing the vocal, acoustic interactions between handlers and cows, the nature of the interaction (positive/neutral/negative) is also described

Behaviour	Nature of interaction	Definition
Talk/whistle quiet	Positive	Stockperson talks or whistles with calm and/or soft voice
Talk dominant	Neutral	Stockperson talks to cow dominantly, resolute voice no softness (aroused state), aims to stop or move a cow
Talk impatient	Negative	Stockperson talks to cow impatiently and sharp, characterized by harsh short sounds
Shouting	Negative	Stockperson uses no talk but instead loud harsh vocalization to stop or move a cow
Clap/whistle/knock	Negative	Stockperson claps/whistles/knocks with tools and/or hands

Table 4. Ethogram describing the tactile interactions between handlers and cows, also the nature of the interaction (positive/neutral/negative) is defined

Behaviour	Nature of interaction	Definition
Petting	Positive	Stockperson gently strokes cow
Touching	Positive	Stockperson touches cow gentle and soft, and/or resting hand on cow, no sound
Hand gentle	Neutral	Hand of stockperson touches cow with a low use of force, intention to move cow, no or very low sound can be heard when hand touches cow
Hand forceful	Negative	Hand of stockperson touches cow with moderate to high force, clear sound heard when hand touches cow
Tailtwist	Negative	Stockperson lifts and twists the tail of cow forcing her to move
Tool/stick gentle	Neutral	Gentle hit with low force and using tool/stick, no or very low sound heard as tool touches cow
Tool/stick forceful	Negative	Moderate to high force hitting/slapping cow with tool/stick, clear sound can be heard as tool touch cow

Table 5. Ethogram of the visual interactions between handlers and cows, the nature of the interaction is also described

Behaviour	Nature of interaction	Definition
Arm waving	Negative	Arms lifted away from body and used for waving without touching cow
Walk/positioning	Neutral	Moves towards cow in slow to moderate speed, without vocal/acoustic/tactile interaction, aim to move or hinder cow

The behaviour of a cow was recorded only when a stockperson stood in close proximity to the cow. This was defined as when a stockperson either was working with (e.g. cleaning the udder or attaching milking cups) or standing next to the cow, within 0.5 meters, like previously described (Breuer et al., 2000; Waiblinger et al., 2002). If a cow was disturbed or showing behaviour caused by the presence of the observer, such recordings were excluded. Recorded cow behaviours, or animal reactions, were baulking, kicking, flinching, vocalization (high and low), avoidance of human, fleeing from human, and threatening handler, the definitions are presented in Table 6.

Table 6. Ethogram describing the recorded animal behaviours during moving and milking

Behaviour	Definition
Avoidance	Turns head away from handler, followed by neck and/or body
Fleeing	Moves away from handler for min. two steps in quick flight or running
Vocalization high	Cow makes harsh/sharp/high sound with open or closed mouth
Vocalization low	Cow makes soft/low/deep sound with open or closed mouth
Kick	Hoof raised up to udder height before quickly with force pushed away
Threatening handler	Stands still neck bended, staring on handler, ears forward and no other behaviour performed
Baulking	Cow makes full stop/stands still and refuses to move further
Flinching	Sudden, small movements raising hoof quickly just above ground when touched/milked

2.2.3 Human approach test

On the second day of observations approximately three to five hours after completed morning milking (depending on feeding time) human approach tests were conducted in the barn, among the cows which were walking around freely. The human approach test was adjusted from previous studies by Waiblinger et al. (2002) and Rousing et al. (2004). The test was performed on roughly 75 % of the herd in order to be able to calculate a herd average (Waiblinger et al., 2002). Free standing cows were approached from straight ahead, by steady normal sized steps taken one per second. The experimenter, being entirely quiet, held one arm in a 45° angle from the body when approaching a cow with the aim to touch the cow's muzzle. The test was ended either when the muzzle of a cow could be touched, or when a cow withdrew by stepping away in either direction from the approaching experimenter. The distance between the experimenter and the cow was estimated at the moment of withdrawal, and together with the cow's reaction a score was determined. In cases where a cow withdrew when being touched on the muzzle, the distance was recorded as 0.05 meters. In cases where a cow either withdrew immediately when being approached, or walked further away than three meters the distance was recorded as 3.05 meters. The exact distance of 3.05 meters was used for making it visible in the data if a cow clearly had signalled that she did not at all wished to be close to the experimenter. The score ranged from one to five, modified after previous tests (Waiblinger et al., 2002; Rousing et al., 2004).

1. Avoidance and the distance to approaching person is more than 3 meters
2. Avoidance and the distance to approaching person is 1.5-3 meters
3. Acceptance of person standing closer than 1.5 meters, but avoidance of person when reaching out his/her hand
4. Acceptance of person reaching out his/her hand, but avoidance of being touched
5. Acceptance of being touched, 0-0.05 meters

2.3 Statistical analysis

The data from the behavioural observations was statistically analyzed using the software SAS (Statistical Analysis System, Cary USA, vers 9.3). Some of the behaviours described earlier were excluded from statistical analysis due to too few recordings; vocalization, fleeing, baulking, petting, too forceful, flinching (during moving), arm waving (during moving) and talk impatient (during moving). Some behaviours were excluded from analysis as they never were observed during any of the observations, these behaviours were shouting (during moving), tailtwist, kick (during moving) and cows threatening the handler. The remaining behaviours of handlers were statistically analyzed using the Generalized Model (proc genmod) with GEE (Generalized Equation Estimate). The model tested for the effect country (Sweden or The Netherlands), milking time (morning or afternoon) and interaction between country and milking time. As the behavioural data could not be assumed to have a normal distribution the model was done with Poisson distribution. The statistical unit in all tests was farm. Data is presented as median percentage \pm first and third quartile (Q1, Q3).

Data from human approach test and questionnaire were analyzed using the statistical software IBM SPSS Statistics²⁰. Only data from respondents having completed all questions in either questionnaire was analyzed, 38 and 61 for Sweden and The Netherlands respectively, hence will only this data be further discussed and presented. Questionnaire data was analyzed using the Descriptive Statistics with Frequencies and the non-parametric test Mann-Whitney. In Table 7 the answer frequency is presented. Data is presented for each of the four validated sub-scales (patience during moving, patience during milking, importance of contact and punish during milking) as median score \pm first and third quartile (Q1, Q3). Median score was also calculated for a group of questions separate from the validated sub-scales, hence creating a fifth question group. This group of questions was not previously validated; therefore this question group was kept separate and not included with the results of the four validated sub-scales. In addition were median score, median distance, including first and third quartile, calculated for cows in the human approach tests.

Table 7. The answer frequency for the questionnaires by country and extent of which respondents completed the questionnaire

	Sweden	The Netherlands
Total no. respondents opened questionnaire	161	300
Total no. respondents incomplete questionnaire	62	93
Total no. respondents complete questionnaire	38	61

3 Results

3.1 Questionnaire on behavioural attitudes

The only significant difference between the two countries are in the sub-scale ‘importance of contact’, where median score for Sweden is 5.98 whereas it is 5.25 for The Netherlands ($p < 0.000$) (figure 1). Median score is equal between both countries in regards of sub-scale ‘patience during moving’ (score 5.15, n.s., $p = 0.480$), whereas in sub-scale ‘patience during

milking' median score is 6.17 for Sweden and 6.00 for The Netherlands (n.s., $p=0.190$). Within sub-scale 'punish during milking' The Netherlands have median score 1.75 and Sweden 2.00 (n.s., $p=0.224$). Median and quartiles of the four validated sub-scales are presented in figure 1.

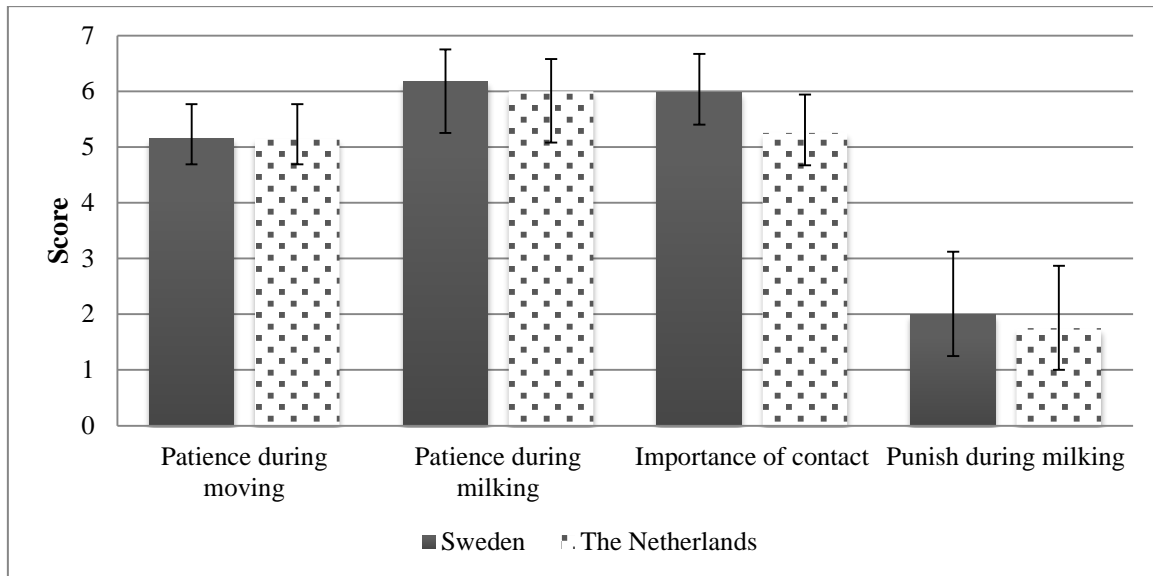


Figure 1. The median score for all four sub-scales of the questionnaires presented for The Netherlands ($n=61$) and Sweden ($n=38$), score ranges from 1-7.

Some of the answers to the individual questions within the four sub-scales were different between the two countries. The median score for some of these questions are presented for both countries in table 8 below. The Netherlands have a higher median score than Sweden for the question about 'patience during moving'. The Dutch median score is lower than the median score of Sweden for both questions about 'importance of contact' (table 8).

Table 8. Median score presented per country for specific individual questions from sub-scales 'patience during moving' and 'importance of contact', score range 1-7

Sub-scale	Question	Sweden	The Netherlands
Patience during milking	18. If an animal stops while moving into the milking parlour, I would move it with my hand, in older cows	2	6
Importance of contact	39. How important is it to brush the calves in loose-housing from time to time?	5	3
	40. How important is it to brush the animals in loose-housing from time to time, in young stock?	5	3

A number of questions asked in the questionnaire could not be placed in any of the validated sub-scales, such as the question "sometimes it is necessary to drive a heifer with a handling aid, e.g. a stick, if she does not move into the milking parlour". The median score for each country is therefore presented question by question for these questions in table 9. In general for these questions, the median score of Swedish respondents is higher, ranging between three and six, whereas the median score of the Dutch respondents

generally is lower ranging between two and six. The exception seem to be question 27 (“If the leading cows stop while moving into the waiting area I would try to move them with my voice”) where both countries’ have the same median score (table 9). However, only in regards of the median score for the complete group of these questions is the result significant ($p=0.000$), with a lower score for The Netherlands (2.91) compared with Sweden (4.59). These results indicate that Dutch respondents to a lesser extent agree with, as compared with the results of Swedish respondents, that handling aids or other similar methods are necessary in cattle handling for encouraging cows into movement.

Table 9. The median score presented by country, Sweden (n=38) and The Netherlands (n=61) for individual questions without sub-scale, score range 1-7

Question	Sweden	The Netherlands
15. If a heifer stops while moving into the milking parlour, I would make her move with a stick	5	2
16. If an older cow stops while moving into the milking parlour, I would make her move with a stick	5	2
19. If a heifer stops while moving out of the milking parlour, I would make her move by shouting at her	5	2
20. If an older cow stops while moving out of the milking parlour, I would make her move by shouting at her	5	3
23. If a heifer stops while moving out of the milking parlour, I would make her move with a stick	4	2
24. If an older cow stops while moving out of the milking parlour, I would make her move it with a stick	5	2
27. If the leading cows stop while moving into the waiting area I would try to move them with my voice	6	6
9. Sometimes it is necessary to drive a heifer with a handling aid (e.g. a stick), if she does not move into the milking parlour	5.5	3
10. Sometimes it is necessary to drive an older cow with a handling aid (e.g. a stick), if she does not move into the milking parlour	5	2
11. If a heifer stops while moving into the milking parlour, I would drive it by shouting at her	6	2
12. If an older cow stops while moving into the milking parlour, I would drive it by shouting at her	6	2

3.2 Behavioural observations

The total number of interactions between handlers and cows during moving and milking are presented by country, as well as by time of day (morning/evening) in table 10. In general, comparing the total result of the farms in Sweden and The Netherlands, both countries seem to have a higher number of interactions in the morning during moving. Regarding milking however, interaction frequency seems to be higher in the evening than during morning milking, for Sweden as well as for The Netherlands. Still, the total number or interactions between cows and handlers seem higher on farms visited in Sweden (table 10).

Table 10. Total number of human-cow interactions on observed farms in The Netherlands (n=3 farms) and Sweden (n=3 farms), presented by procedure (moving/milking) and time of day (morning/evening)

	Sweden	The Netherlands
<u>Moving</u>		
Morning	320	361
Evening	234	265
Total	554	626
<u>Milking</u>		
Morning	726	139
Evening	865	171
Total	1591	310

Interactions of positive nature seem to occur to a greater extent in general on dairy farms in Sweden, when compared to The Netherlands, as presented in figure 2. However, results for moving show only a tendency ($p=0.0539$, $\text{Chi}^2=3.72$). Regarding milking, the results are not significantly different between the two countries ($p=0.1944$, $\text{Chi}^2=1.68$). There is however a significant difference between morning and evening milking ($p=0.0078$, $\text{Chi}^2=7.08$) as well as a significant interaction between country and the time of day for milking ($p=0.0006$, $\text{Chi}^2=11.86$) (figure 2).

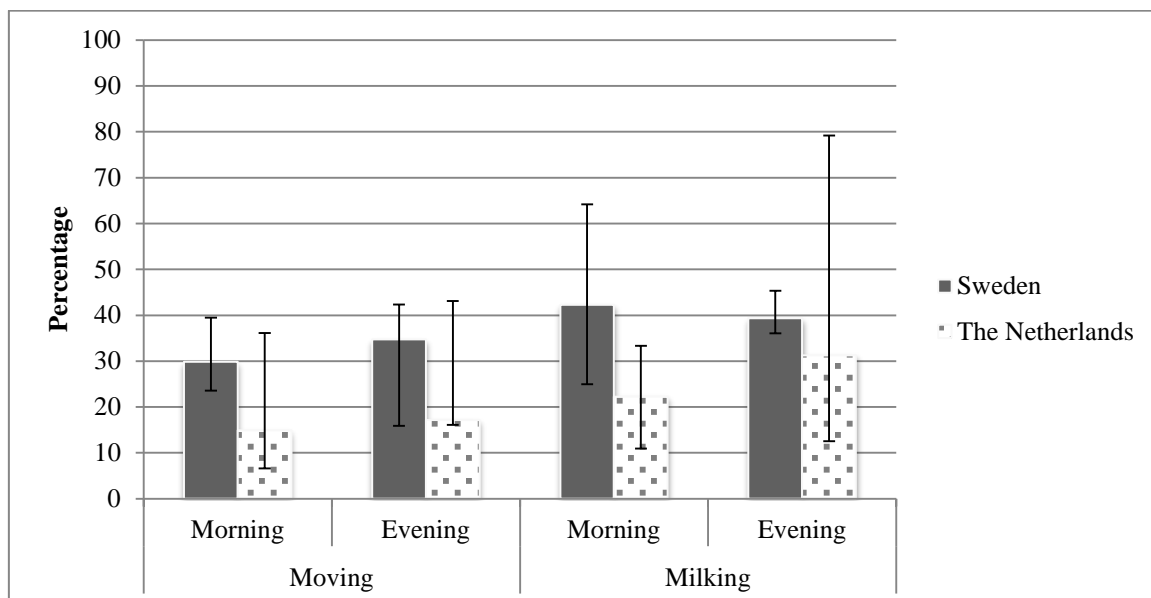


Figure 2. The median percentage of positive interactions during moving and milking, presented by time of day (morning/evening) for both The Netherlands (n=3) and Sweden (n=3)

Regarding the interactions of a neutral character it seems that dairy farms in The Netherlands in general have higher percentage of occurrence, as indicated in median percentage by figure 3. Results are significant both for moving ($p < 0.0001$, $\text{Chi}^2 = 15.31$) as well as for milking ($p = 0.0184$, $\text{Chi}^2 = 5.56$). Furthermore, there are no significant differences between morning and evening milking's, or interactions between country and morning/evening milking (figure 3).

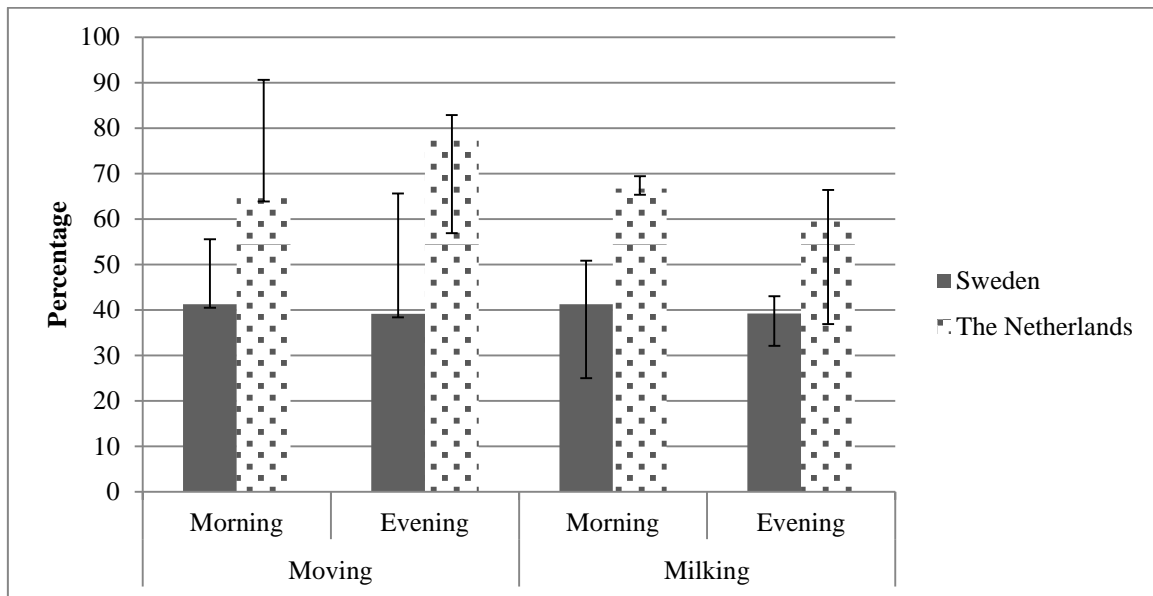


Figure 3. The median percentage of neutral interactions during moving and milking, presented by time of day (morning/evening) for both The Netherlands ($n=3$) and Sweden ($n=3$)

Results of this study indicate that interactions of a negative nature occur to a greater extent on dairy farms in Sweden during moving, ($p = 0.0054$, $\text{Chi}^2 = 7.75$) (figure 4). There seem to be significant difference for time of day as well during moving; interactions in the morning are to greater extent of negative nature in both countries ($p < 0.0001$, $\text{Chi}^2 = 21.55$). Moreover, it is a significant interaction between country and time of day ($p = 0.0052$, $\text{Chi}^2 = 7.80$). During milking there is no significant difference in negative interactions between morning and evening and only a tendency for more negative interactions in Sweden ($p = 0.0512$, $\text{Chi}^2 = 3.80$). Still there is significant interaction between country and time during milking ($p < 0.0001$, $\text{Chi}^2 = 18.43$), thus indicating that in Sweden on observed dairy farms negative interactions occur to greater extent during evening milking (figure 4).

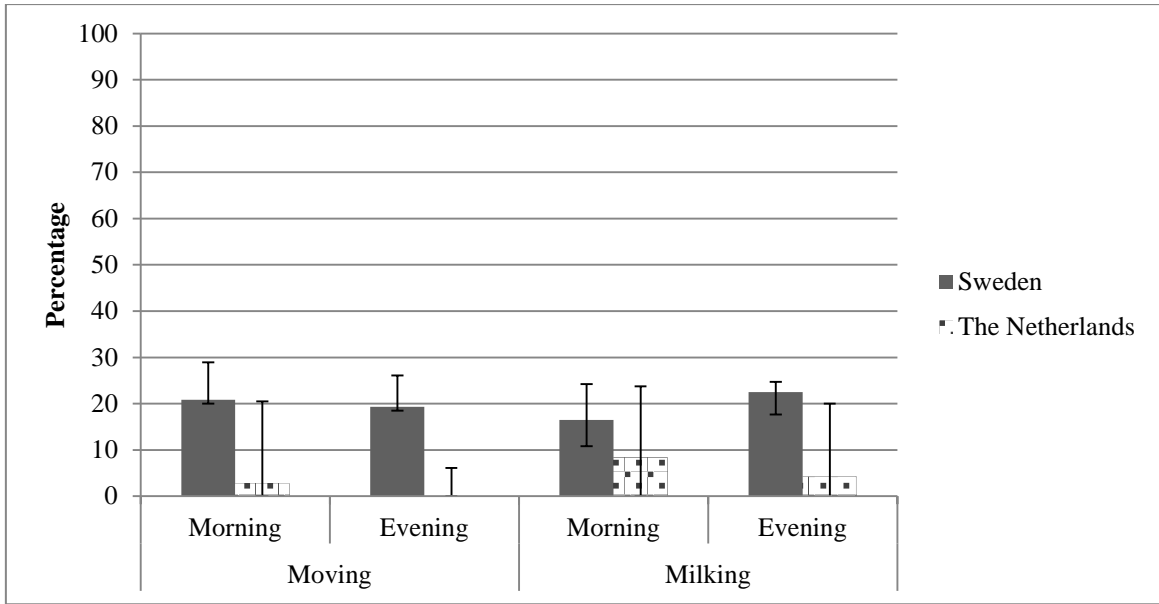


Figure 4. The median percentage of negative interactions during moving and milking, presented by time of day (morning/evening) for both The Netherlands (n=3) and Sweden (n=3)

The distribution of the different types or nature, of interaction between cows and handlers during moving is presented in figure 5, for the observed farms in both countries. It seems that on observed farms in The Netherlands interactions mainly are of neutral-tactile (TacNeu) character and to a large extent interactions also are of visual-neutral (VisNeu) character during moving. Whereas it appear that vocal-positive (VocPos) interactions occur to a lesser extent than on observed farms in Sweden, during moving. Vocal-positive interactions seem however, together with tactile-neutral interactions, to dominate the nature of interactions between cows and handlers on observed dairy farms in Sweden (figure 5).

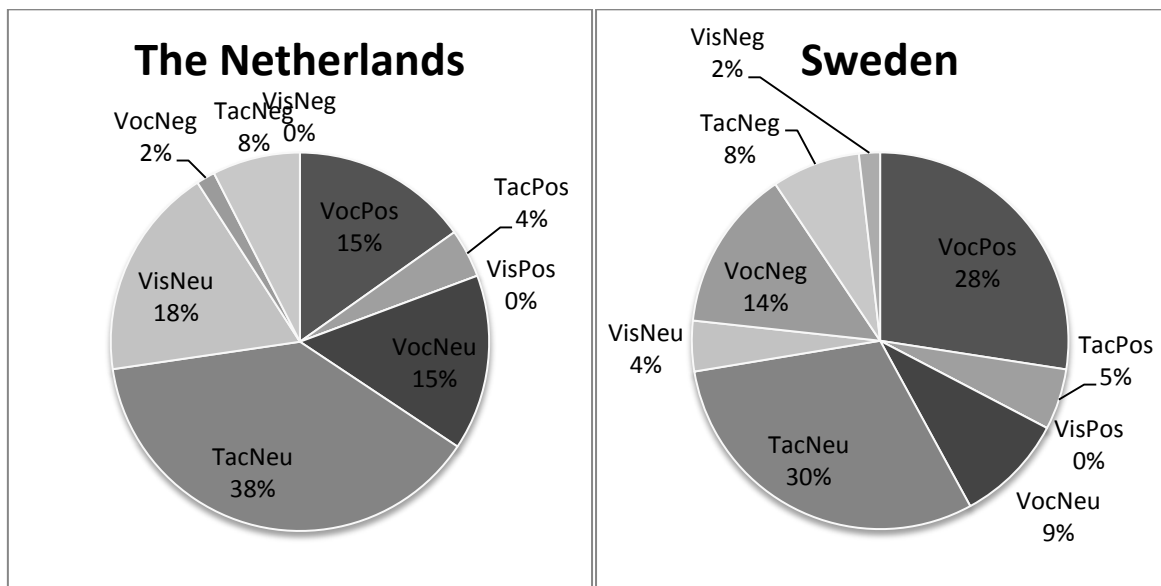


Figure 5. Detailed distribution of the nature of interaction between handlers and cows during moving on farms in The Netherlands and Sweden, given in percent

A detailed description is presented in figure 6 for the nature of handler-cow interaction during milking. It appears that tactile-neutral interactions represent the largest part of human-cow interactions, also during milking, on the farms in The Netherlands. Moreover, vocal-positive interactions seem to occur to a lesser extent on farms in The Netherlands when compared with farms visited in Sweden. Visual interactions, irrespective of positive, negative or neutral, seem in both countries to occur to a limited extent (figure 6). However, there is no statistical analysis made supporting these detailed results.

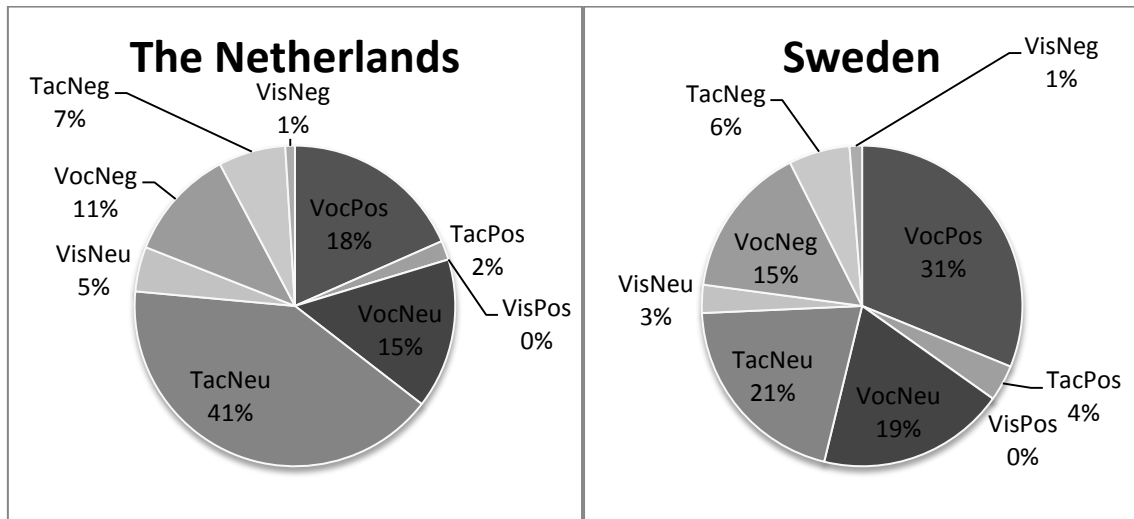


Figure 6. The distribution, in percent, of the nature of interaction between cows and handlers during milking in both The Netherlands and Sweden

The behaviours of the cows whenever a handler was standing close (< 0.5 meter) during moving and milking are presented for Sweden (n=363 cows) and The Netherlands (n=526 cows) in table 11. Avoidance rate during moving appear to be equal for both countries (Table 11). Regarding kick and flinch rate the countries appear to differ; in Sweden during milking kick rate is higher than in The Netherlands, whereas the rate of flinching seem higher in The Netherlands as compared to Sweden (table 11). However, there is no statistical analysis to support these indications.

Table 11. The rate of cow behaviours when a handler was in close presence of the cows (<0.5 meter) during moving and milking, calculated per total number observed cows in The Netherlands (n=526 observed cows) and Sweden (n=363 observed cows)

Procedure	Cow behaviour	Sweden	The Netherlands
Moving	Avoid	0.17	0.17
	Flee	0.02	0.02
Milking	Avoid	0.09	0.02
	Flee	0.02	0.01
	Kick	0.60	0.19
	Flinch	1.28	2.09

3.3 Human approach test

Cows accepting to be touched held an avoidance distance of 0-0.05 meters which equaled score 5, and cows refusing to be touched held > 3 meters distance to the experimenter, i.e. score 1. 28.3 % of the Dutch cows refused to be touched whereas 2.7 % Swedish cows refused to be touched by the experimenter, i.e. held > 3 meters avoidance distance. It appears that cows tested on Swedish farms show less fearfulness towards humans as when compared to cows tested on the Dutch farms; however there is no statistical analysis to verify these results (table 12). Median approach score, median avoidance distance and the percentage cows that accepted to be touched in the human approach test are presented for both countries in table 12.

Table 12. Median score, median avoidance distance and percentage of cows accepting to be touched, by country; Sweden (n=597 cows) and The Netherlands (n=526 cows)

	Sweden		The Netherlands	
Approach score, median (Q1, Q3)	4	(3.00, 5.00)	2	(1.00, 3.00)
Avoidance distance, median (Q1, Q3)	0.4	(0.05, 0.90)	2.8	(0.70, 3.05)
Cows accepting touch (%)	32		7	

The median approach score, median avoidance distance and percentage of cows accepting to be touched is presented on farm level in table 13 below. The median score appeared identical for all Swedish farms whereas for farms visited in The Netherlands median score ranged. There was also variation in percentage of cows in The Netherlands (9.9%, 55.0% and 0.8% respectively) with score one, i.e. cows that held an avoidance distance of >3 meter to the experimenter when human approach test ended. In Sweden the results were more even between the three farms; 0.0 %, 0.0 % and 4.85 % of cows held an avoidance distance of >3 meter to the experimenter when human approach test ended (table 13). No statistical analysis was made for support of these results.

Table 13. Median approach score, median distance in meter, and percent animals accepting to be touched, i.e. distance held by the cows to experimenter 0-0.05 meter, per farm within Sweden and The Netherlands

	Sweden			The Netherlands		
	Farm A	Farm B	Farm C	Farm D	Farm E	Farm F
Approach score (median)	4	4	4	3	1	2
Avoidance distance (median)	0.15	0.65	0.5	0.8	3.05	3.0
Cows accepting touch (%)	45.7	35	25	10	0	15

4 Discussion

In general, results representing Sweden in this study indicate that Swedish dairy stock people and farmers find it more important with the contact between themselves and their cows thus habituating the cows to people. On the other hand, results of this study could give indication for Swedish stock people and farmers to be more open for punishment when compared with Dutch dairy farmers and stock people. However no significance was found for these results. Interestingly, a lower rate of kicking during milking appears to be shown by the cows on farms visited in The Netherlands. At the same time, interaction frequency between cows and humans was higher in total on the farms visited in Sweden, than on farms visited in The Netherlands. The percentage of interactions of a positive nature was larger on Swedish farms while on Dutch farms interactions were of negative nature to a lower extent compared to Swedish results. Still Swedish cows in general showed less fear towards humans, with shorter avoidance distance and accepting touch to a greater extent than cows observed on farms in The Netherlands.

4.1 Human-cattle relations and some implications

The aim of the study was to investigate possible differences between the two countries regarding the human-cattle interactions. Farms of similar management and production characteristics were selected in order to limit the influencing factors, partly due to time limitations. The primary reason however, was that the study aimed to look into whether there were other possible factors causing any potential difference, due to the different backgrounds of the two countries, reflected in human-cow interactions. A larger farm size (around 200 lactating animals) was chosen due to the 'industrial' trend of modern dairy farming today which places cows and humans not only further away, but also in new situations as the production system changes. It could therefore be guessed or assumed, that these two allegedly very different countries also would approach this new situation differently based upon different attitudes on dairy cows and dairy cattle production. Given earlier studies and research, such differences in attitudes should be reflected also in the behaviour of humans as well as the behavioural responses of cows.

In general, comparing the results for the four sub-scales (patience during moving, patience during milking, importance of contact and punish during milking) median score of both countries were relatively equal. Only regarding 'importance of contact' were significant differences found. According to Hemsworth et al. (2002), cattle handlers should take time walking between and among their cows quietly, as such actions could reduce fearfulness to humans. This treatment habituate's cows to human presence by learning the cows that people not necessarily equal veterinarian treatments, for instance. In general, cows risk learning to associate humans with mainly negative or aversive treatments. This is instigated by the fact that several handling treatments which by animals are perceived as aversive or in any way negative, most often are performed by humans (Rushen, 1996).

On all farms visited in Sweden farm owners and stock people had regular daily contact of visual, vocal/acoustic as well as tactile character, not only during milking or milking related actions. The Swedish farmers and stock people performed heat control (often combined with general observation of all animals) once, or twice, per day during which the farmer or stockperson would walk between and among all animals in the stable. Not one of the Dutch farms reported any similar regular human contact outside milking procedures. Moreover, during milking related procedures cows are in general not handled or interacted with on an individual level but instead the entire herd are being handled. Important to remember is also that during these procedures the main objective is to move animals,

together with other demands decided by the human for the cows. It might therefore be logic to conclude that the character of these interactions almost certainly will be of neutral, sometimes even of negative nature. The reason for this is that interaction probably only occur as animals are moved and neutral, as well as negative, interactions in general are performed in order to move animals. It is therefore plausible to say that the findings in this study on interactions mainly being of neutral character on the farms observed in The Netherlands, are logical results which could be expected. Swedish farms, on the other hand, had the highest median percentage positive as well as negative interactions during both moving and milking.

The study struggles with small sample sizes in both the behavioural observations as well as in the investigation on attitudes. However, other studies having similar approach (higher number of repetition on behalf of farm number) argues that despite small sample sizes indications are visible which shouldn't be overlooked (e.g. Hanna et al., 2006). The current study should also be seen as a kind of pilot study, investigating whether there firstly are any reason to compare countries in this manner and if the assumptions frequently expressed on Sweden and The Netherlands. Here it seems to be justifications for continuation on the topic, the differences observed between the two countries is not always significant but still there are interesting indications for possible differences which should be investigated further.

Still, the low answer frequency of the questionnaires, 20.3% in The Netherlands and 23.6% in Sweden, is interesting. It could for instance be interpreted as an indication on level of interest or perceived importance level for the topic human-cattle interactions in the two countries. The argument for this is that more or less active actions were required from respondents as the questionnaires were distributed electronically and available via a link which had to be opened in order to reach the questionnaire. Secondly the question could be asked whether, or not, respondents of the questionnaires can be seen as representative for the two countries. For instance, perhaps respondents which chose to answer the questionnaire of this study were more, or less, in favour of punishment than any other by random selected dairy stock person from either of the two countries.

The total number of interactions differs between Sweden and The Netherlands in this study but perhaps more important is the difference regarding positive and negative interactions. Like reported by among others Hemsworth & Coleman (1998), the number of positive interactions are good in the sense that they reduce fear towards humans in animals. On the other hand, studies show that (tactile) negative interactions are important and well-known factors increasing fearfulness towards humans (Rushen, 1996; Rushen et al., 1998; Hemsworth et al. 2000). Thus these results may seem somewhat contradictory. Added to this interesting picture should also be that cows in Sweden were less fearful towards humans in the approach tests; Dutch cows had much greater avoidance distance. Swedish cows also kicked more during milking than Dutch cows. Here several factors are possible to affect these results, some examples are; stable situation (i.e. sudden technical failure causing stress among humans or disrupted routines for cows) and in Sweden mainly stock people were handling cows during milking related procedures (larger variation in people handling animals). It also seems to be large variation between farms, seen when comparing the farm results on human approach tests. As an example, in this test median avoidance distance ranged between 0.8-3.05 meter for the Dutch farms and for Swedish farms the range was 0.15-0.65 meter.

The benefits of a larger herd and especially loose housing are many; such benefits were discussed by among others Bouissou et al. (2001) and Raussi (2003). Perhaps the most important benefit when comparing with tied-up systems is that cows are gregarious

animals and thus group-housing is a step in the direction of improved animal welfare (Bouissou et al., 2001). Through group-housing it is also possible for cows to avoid human contact to a relatively large extent (Raussi, 2003), possibly limiting the risk for fear and stress experienced by the cow as she gains more control over the situation by the choice of whether or not to approach or avoid a human. However, as stated by Raussi (2003) this does at the same time mean that habituation decrease. Thus, the individual cow becomes more difficult to handle and restrain at moments when this would be needed, e.g. for any treatment.

In The Netherlands group-/loose housing systems have a longer history than in Sweden where only recently a larger shift towards loose housing has been occurring. Thus, dairy farmers and stock people in The Netherlands have been working under such conditions longer and then handled cows in systems where there is less (in general) interaction and time spent per individual cow. One might, based upon this background and that Swedish production systems often are given as examples of great animal welfare, assume that there should be differences in the interaction between cows and humans in the two countries. This should also be reflected in both the attitudes of the animal handlers and in the behavioural reactions of cows in close presence to humans, as confirmed by numerous other studies where correlations have been found between these factors. Unfortunately no correlations were calculated in this study; still some tendencies could be distinguished.

4.1.1 Human attitudes in relation to country and possible implications

Some tendencies for differences can be noted between Swedish and Dutch respondents when the results of individual questions were compared. However, when comparing median score of all questions asked in the questionnaire variation seemed to exist between the two countries for some questions only.

Some questions regarding punishment, e.g. “Sometimes it is necessary to drive a heifer with a handling aid, e.g. a stick, if she does not move into the milking parlour”, could not be placed into any of the four validated categories. These questions were nevertheless used in the questionnaires as they were used in earlier studies by Waiblinger et al. (2002), and were considered to be important for the study. In the comparison of these questions it seems that the Swedish dairy farmers and stock people in general are less against punishment than their Dutch colleagues. In general, median scores of Swedish respondents was higher, and varied between three and six, whereas the median scores of the Dutch respondents generally was lower and ranged between two and six. The exception was the question “if the leading cows stop while moving into the waiting area I would try to move them with my voice” where both countries had median score six.

4.1.2 Human behaviour in relation to country and possible implications

The total number of interactions between handlers and cows during moving and milking varied between farms visited in Sweden and farms visited in The Netherlands. During moving the Dutch farms in the study had a higher number of interactions between humans and cows, whereas this number was higher for the Swedish farms during milking. When the time of day (morning/evening) was considered the results of both countries indicated similar trends, namely that the number of interactions were higher during moving in the morning. On the other hand, when comparing results from milking interaction frequency was higher in the evening, observed on farms in both Sweden and The Netherlands.

Comparing the results from behavioural observations between countries it appeared that interactions mainly were of tactile-neutral nature in both The Netherlands and Sweden, during moving before milking. At the same time, vocal-positive interactions occurred to a greater extent on farms observed in Sweden than on farms in The Netherlands. Interestingly, a tendency can be seen that interactions mainly seem to be of tactile nature in The Netherlands. In Sweden on the other hand, the interactions mainly seemed to be of vocal or acoustic nature.

The nature of the interactions between cows and humans during milking was mainly of vocal-positive nature on Swedish farms whereas the tactile-neutral was dominant on Dutch farms. Concurrently vocal-positive interactions were the second most common type of interaction on the farms visited in The Netherlands and the tactile-neutral interactions second most common in Sweden.

4.1.3 Cow behaviour in relation to country

Earlier studies analyzing interactions between cows and humans have indicated and shown clear connections between the attitudes and behaviours of people and cows' behavioural responses together with other welfare effects. In the current study cows on Swedish farms had a higher kicking rate during milking than did cows on Dutch farms, indicating aversiveness towards the handler (Breuer et al., 2000; Rushen et al., 1999). Interestingly, the rate of flinching was 2.09 in The Netherlands and 1.28 in Sweden. On the other hand, cows on Swedish farms were found to be less afraid of humans in the human approach test performed on a total of six farms equally distributed between The Netherlands and Sweden. These results would indicate that the farmers and stock people on the farms in Sweden were handling the cows more positive according to among other studies Waiblinger et al. (2002); when handled positively cows avoid stock people less and allow humans to come closer.

The comparison between all farms individually gives a clear picture on the great variation on farm level. For instance the median score for Dutch farms were from 1-3, whereas the median score was identical (4) for all Swedish farms. The variation was also evident when analyzing the percentage of cows avoiding an approaching human as much as possible; in The Netherlands the three farms had results that varied between 55% and 0.76%, Sweden showed more even results between the three farms; 0 %, 0 % and 4.85 %.

4.2 The connection between the behaviour of cows and humans

No correlations were made between behaviour of cows, humans and human attitudes. Still it is interesting to compare the different results within this study and when doing so an interesting picture appears. Significant results from behavioural observations and human approach tests of cows show that cattle in Sweden to a greater extent both accepted to be touched as well as displayed less fear to humans. Cows tested in The Netherlands on the other hand seemed more fearful to humans but showed less kicking behaviour during milking, which gives an indication of less stress experienced when handled during milking. At the same time were interactions of both positive and negative nature occurring to a greater extent on the Swedish farms, whereas on Dutch farms interactions mainly were of a neutral nature. According to Breuer et al. (2000), negative handling of cattle would result in an increase of restlessness during milking and fear towards humans (Rushen et al., 1999; Munksgaard et al., 2001; Waiblinger et al., 2002). Likely cows displayed less fear towards humans on Swedish farms due to the higher level of positive interactions, which more importantly outweigh and compensate for the interactions of a negative nature. This is

possible as when interactions mainly are of a positive nature, fearfulness to humans decrease and handling ease increases of cattle (Hemsworth & Coleman, 1998; Schmied et al., 2008a, b)

The increased automation and elevating herd sizes which we see today are often connected with for instance increased efficiency, higher production, and higher income but perhaps more importantly the work load of the farmer is decreased when systems are made more efficient. However, the critical question is what the farmer chose to do with this gained extra time as automatic system take over his or her tasks. Human contact is inevitable in dairy production as there are many handling procedures still performed by humans, e.g. claw trimming, re-grouping, dehorning, medical treatments (Boivin et al., 2003; Raussi, 2003). Moreover, an important aspect of humans in comparison to an automatic system for instance, is the visual and direct observation by humans. Hereby are injuries or other health aspects likely to be detected which otherwise risk remaining undetected longer when solely relying on technical solutions (Marley et al., 2009).

It would be of great interest in any future studies to estimate correlations between parameters on both cow and human behaviour, as well as with attitudes of humans handling the cows.

5 Conclusions

Support has been found for the assumption that there are some differences in attitude and human-cattle interactions between the Swedish and Dutch farms within this study. Regarding the importance of contact, Swedish dairy farmers and stock people seem to find this more important than dairy farmers and stock people in The Netherlands. However no significance was found when comparing the two countries with regards to importance of patience during moving and milking, as well as punish during milking. Neutral interactions are the most prominent occurring type of interactions between dairy cows and humans in The Netherlands, whereas interactions on Swedish farms more often tend to be either positive or negative. Importantly, Swedish cows displayed less fear towards handlers than Dutch cows. Taken together, results indicate that the human-animal relationship is more positive in Sweden.

There are some interesting results within the study which are encouraging for future studies on country comparisons, and therefore it is prospective for future work substantiating the results of the current study.

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