The Old School, Brewhouse Hill, Wheathampstead,
Hertfordshire AL4 8AN, UK

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Can stroking during milking decrease avoidance distances of cows towards humans?

I Windschnurer*†, K Barth‡ and S Waiblinger†

† Institute of Animal Husbandry and Welfare, Department for Farm Animals and Veterinary Public Health, University of Veterinary Medicine, Veterinärplatz 1, 1210 Vienna, Austria
‡ Institute of Organic Farming, Johann Heinrich von Thünen-Institute, Federal Research Institute for Rural Areas, Forestry and Fisheries, Trenthorst, Germany
* Contact for correspondence and requests for reprints: Ines.Windschnurer@vetmeduni.ac.at

Abstract

This study investigated whether short-time stroking of loose-housed dairy cows in the daily farm routine could improve the cow-human relationship and consequently decrease avoidance distances, and whether this effect was persistent. Thirty-one cows (from two different breeds: Holstein Friesian and German Red Pied) received either a treatment (STROKING; n = 15) or no treatment (CONTROL; n = 16). In the STROKING group, each animal was stroked during morning and evening milking by an unfamiliar individual (experimenter) for 3 min over a 5-day period (Treatment 1) and again, 4 weeks later, over a 3.5-day period (Treatment 2). CONTROL animals could observe the experimenter during milking. Before and after treatment, the experimenter recorded the avoidance distances of cows (distance of first withdrawal when approached from the front) at the feeding place (AVOIDfeed) and in the barn (AVOIDbarn). Prior to Treatment 1, CONTROL and STROKING animals did not differ in AVOIDfeed or in AVOIDbarn. After Treatment 1, AVOIDfeed was significantly lower in STROKING animals compared to CONTROL animals. With regard to AVOIDbarn, no significant difference was found between STROKING animals and CONTROL animals after Treatment 1. After 4 weeks, before Treatment 2, CONTROL and STROKING animals did not differ significantly anymore in AVOIDfeed. After Treatment 2, AVOIDfeed was again significantly lower in STROKING animals than in CONTROL animals. Also, in the barn, (AVOIDbarn), STROKING animals avoided the experimenter less than CONTROL animals after Treatment 2. In terms of within-group evolution of avoidance distances, AVOIDfeed of CONTROL animals did not decrease in the course of the two treatments. Only after Treatment 2 were avoidance distances at the feeding place of STROKING animals significantly lower than initial avoidance distances. AVOIDbarn of CONTROL animals decreased after Treatment 1 but did not decrease significantly after Treatment 2. AVOIDbarn of STROKING animals decreased significantly after Treatment 1 and again after Treatment 2. It is suggested that short-time stroking during milking can affect the responses of cows to humans positively, although our results question the amount of contact necessary: even more contact might be required for lasting effects.

Keywords: *animal welfare, avoidance tests, cattle, human-animal relationship, stroking, tactile contact*

Introduction

The human-animal relationship can impact considerably on the overall welfare of farm animals (for a review: Rushen *et al* 1999; Boivin *et al* 2003; Hemsworth 2003; Waiblinger *et al* 2006). Moreover, various studies in several species have shown that the human-animal relationship and, consequently, the responsiveness of animals towards humans, can affect the ease of handling and animal productivity (for review: Hemsworth & Coleman 1998; Rushen *et al* 1999; Hemsworth 2003). The human-animal relationship is based on previous interactions. These interactions can comprise different forms of perception (visual, tactile, auditory, olfactory and gustatory), and their quality can be positive, negative or neutral (Hemsworth & Coleman 1998; Waiblinger *et al* 2006). Gentle handling, using different sensory channels by providing tactile and auditory stimuli, and offering feed, providing gustatory stimuli, (for example, Boissy & Bouissou 1988; Lensink *et al* 2001; Waiblinger *et al* 2004) was shown to decrease the fear reactions of cattle towards humans. In heifers, it has been shown recently that long-term brushing of the head, neck and shoulders during rearing in the home environment without restraint, reduced fear of humans, and the effect persisted after calving (Bertenshaw & Rowlinson 2008). Another recent study, with dairy cows in tie-stall housing, has found that stroking over a three-week period, without other forms of contact, can positively affect the human-animal relationship and result in reduced avoidance of humans (Schmied *et al* 2008a). No study, as yet, has investigated the effect of gentle tactile contact alone in loose-housed dairy cows over

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a relatively short period of time. Compared to cows in tie-stall housing, loose-housed cows may be less familiar with close presence and contact with humans (Schmied *et al* 2008a). We were interested to see whether the cow-human relationship would also improve by providing an even shorter period of stroking than in the studies mentioned above and whether this effect would persist over time. With regard to implementation in farm practices, we were interested in the possibility of including stroking in the daily farm routine. In both intensive and extensive pasture-based systems, milking, as a regular husbandry procedure (implying close proximity of cows and humans) is an opportunity to provide positive contact. In dairy cows, avoidance distances (ie distance of first withdrawal when approached by a human) recorded at the feeding place and in the barn, are related to the stockpersons' behaviour during milking (Waiblinger *et al* 2002, 2003). Avoidance distances were lower and more animals could be touched in cases with a greater number of positively classified behaviours (vocal and tactile interactions, such as talking quietly or stroking). Therefore, we chose to perform the stroking treatment in the milking parlour and the cow-human relationship was measured by assessing avoidance distances. In the study by Schmied *et al* (2008a), stroking was most effective when directed onto regions commonly licked in allogrooming, especially the ventral neck.

Thus, the aim of the study was to investigate if short-time stroking of loose-housed dairy cows on the ventral neck during milking could improve the cow-human relationship and whether this effect would persist for a number of weeks.

Materials and methods

Animals and housing

The present study was conducted at the Institute of Organic Farming in Trenthorst, Germany, in November and December 2007. In total, 32 dairy cows were selected from two separate herds (16 animals from a Holstein Friesian herd with ~50 cows, 16 animals from a German Red Pied herd with ~40 cows). Selection was based on breed, age, number and stage of lactation, and milk yield. Severely lame animals were excluded from the experiment. Both herds were housed in identical, adjacent cubicle loose housing and milked simultaneously in the same 2 × 4 tandem milking parlour (WestfaliaSurge, Bönen, Germany), with one herd on the left and the other on the right of the parlour. The selected cows were multiparous and 5.7 (± 1.13) years of age to guarantee similar habituation to milking and the milking parlour. The cows were milked twice a day by their regular milkers and were used to different stockpersons.

Experimental set-up and treatment

The 32 cows were allocated to a treatment group (STROKING or CONTROL) and balanced for breed, age, number of lactations, lactation period, and milk yield. However, one cow was excluded from the STROKING group and thus from the experiment soon after the start of the treatment due to aggressive behaviour. Thus, the sample size was reduced to 31 animals. STROKING animals (n = 15) were stroked twice a day, 3 min during morning and 3 min during evening milking, by the same female experimenter over a 5-day period (Treatment 1: 10 treatment sessions) and a 3.5-day period (Treatment 2: 7 treatment sessions). Between Treatments 1 and 2 there was a pause of 25 days (see Figure 1). Altogether, each cow was stroked for 51 min in the course of 17 treatment sessions. The aggressive cow had received only 3 min of stroking in total and was excluded from the experiment after the second treatment session of the first treatment. The experimenter stroked the ventral neck in the same region and manner as Schmied *et al* (2008a), ie with a frequency of 40–60 strokes per min. The cows could not avoid this 'forced positive treatment' since they were restrained in the tandem milking parlour for the duration of the milking. CONTROL animals were able to have visual contact with the experimenter while she performed the treatment. Otherwise, they had only human interactions associated with routine husbandry.

Before and after the two treatments, the experimenter who also performed the treatment, recorded the avoidance distances of the cows, ie the distance of first withdrawal when approached from the front, at the feeding place (AVOIDfeed) and in the barn (AVOIDbarn). Thus, AVOIDfeed and AVOIDbarn were each performed four times in total (Test 1 to Test 4). A detailed timetable is shown in Figure 1. The day preceding Test 1, the experimenter had spent 20 min walking slowly and talking calmly in each herd to allow the animals a degree of familiarisation and to avoid overt reactions on the first test day due to complete novelty. Test 1 of AVOIDfeed and AVOIDbarn was performed the day prior to the start of Treatment 1, which started with the morning milking. Test 2 of AVOIDfeed and AVOIDbarn was performed the morning after the end of Treatment 1, which ended with the evening milking. Treatment 2 started during the evening milking of the same day on which Test 3 of AVOIDfeed and AVOIDbarn had been performed. Test 4 was performed the morning after the end of Treatment 2, which ended with the evening milking. That meant that the time between the end of both stroking treatments and the avoidance distance tests was one day.

Avoidance distance tests

Avoidance distance at the feeding place (AVOIDfeed)

This test has been used previously in dairy cows (Waiblinger *et al* 2003). After morning milking, cows exited the tandem milking parlour individually and went to the feed barrier. There, each cow was individually subjected to AVOIDfeed after feeding 3–5 min, starting at 0615–0630h and lasting until 0800–0830h. Cows were restrained in the head-lock feed barrier during the test. The experimenter only began the approach when the test animal had perceived the human, ie looked at her. The approach was performed from the front with one arm 45° in front of the body. Starting from a distance of 2.5 m, the experimenter

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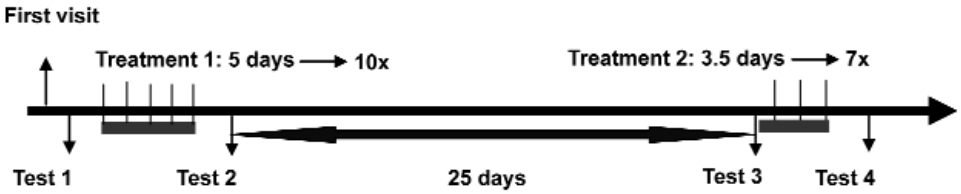
Figure 1



Timetable of the experiment. On the day preceding the start of the experiment the experimenter spent 20 min in each herd to allow the animals a degree of familiarisation (first visit).

constantly approached (at a speed of one step per second) until the cow withdrew or until touching. Withdrawal was defined as stepping back or turning the head more than 45°. If the cow accepted the touch on the muzzle, the experimenter tried to stroke the cheek of the animal for at least one and up to five seconds. The avoidance distance (ie, the distance between the experimenter's hand and the muzzle at the moment of withdrawal) was estimated in steps of 10 cm. In instances where withdrawing at the moment of touching the muzzle occurred, an avoidance distance of 0.05 was assigned. If the cheek could be reached and stroked for at least one second the avoidance distance was given as 0 m. Neighbouring animals were never tested after each other in order to avoid influencing the reaction of the following animal to be tested.

Avoidance distance in the barn (AVOIDbarn)

This procedure, where individual animals were tested in their home environment among their herd mates, was similar to the AVOIDfeed test and has been previously described for dairy cows (Waiblinger *et al* 2002, 2003). The experimenter only started the approach when the test animal had perceived the human, ie, looked at her. Moreover, the animal had to be free-standing (ie, not standing partly in a cubicle, nor being surrounded by other animals, nor standing in a dead end of an alley with no possibility of retreat): meaning the animal was readily able to withdraw and the reaction should not have been influenced by other animals. The experimenter approached the individual animal in a standardised way, from the front with one arm 45° in front of the body. Starting at a distance of 3.0 m, the experimenter constantly approached until the cow withdrew or until touching. Withdrawal was defined as stepping back or turning the head more than 45°. If the cow accepted the touch on the muzzle, the experimenter attempted to stroke the cheek of the animal for at least one and up to five seconds. As described for AVOIDfeed, the avoidance distance was estimated in steps of 10 cm.

The experimenter had to be careful that the withdrawal reaction was provoked by her and not by another animal approaching the test animal. After the test, the experimenter would attempt to take the start position for testing the next closest animal. In cases where this animal had observed the test situation and reacted too, it was not tested immediately afterwards, but at least a couple of minutes later. The test was always performed one hour after the AVOIDfeed test starting around 0900–0930 and lasting until 1230–1330h.

Data analysis

Data were analysed with the statistical software package SPSS (version 14.0.2). Non-parametric tests were used due to the non-normality of the data.

Data were analysed for differences between tests within the STROKING or CONTROL groups by means of the Friedman test and, in instances where there was a significant difference, by means of the Wilcoxon test. The Mann-Whitney *U*-test was used for testing for differences between the two breeds as well as between the STROKING and CONTROL group. Results with a $P < 0.05$ were considered significant.

Results

The breeds did not differ significantly in any of the avoidance distance tests ($P > 0.05$). Descriptive statistics of the avoidance distance tests and the results of the within-group and between-group comparisons for STROKING and CONTROL animals are shown in Table 1. Prior to Treatment 1, CONTROL and STROKING animals did not differ in the avoidance distance at the feeding place (AVOIDfeed: $Z = -0.78$, $P > 0.05$) or in the barn (AVOIDbarn: $Z = -1.57$, $P > 0.05$).

No significant differences between the individual test sessions of AVOIDfeed in CONTROL animals were seen (Chi-square = 0.65, df = 3, $P > 0.05$). A significant difference was found between the individual AVOIDfeed test sessions of STROKING-animals (Chi-square = 8.50, df = 3, $P < 0.05$). Only after Treatment 2, ie at the last test (Test 4), AVOIDfeed of STROKING animals was significantly lower than at the first test (Test 1) ($Z = -2.53$, $P < 0.05$). With regard to between-group comparisons, STROKING animals avoided the experimenter less than CONTROL animals after Treatment 1 ($Z = -2.28$, $P < 0.05$). For Test 3, recorded before Treatment 2, no significant difference was seen anymore ($Z = -1.31$, $P > 0.05$). After Treatment 2, STROKING animals avoided the experimenter once again less than CONTROL animals ($Z = -3.15$, $P < 0.05$).

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Table 1 Mean (± SD), median, minimum and maximum avoidance distances (m) of the STROKING- and CONTROL-group in the two tests performed in the home environment.

Test	STROKING-animals	CONTROL-animals	Mann-Whitney *U*-tests
AVOIDfeed			
Test 1	0.20 (± 0.277), 0.10, (0.00–1.00)[a]	0.25 (± 0.243), 0.10, (0.05–0.70)	$Z = -0.78$, $P > 0.05$
Test 2	0.13 (± 0.190), 0.05 (0.00–0.70)[ab]	0.35 (± 0.339), 0.30, (0.05–1.10)	$Z = -2.28$, $P < 0.05$
Test 3	0.13 (± 0.164), 0.05 (0.00–0.60)[ab]	0.30 (± 0.322), 0.18, (0.05–1.20)	$Z = -1.31$, $P > 0.05$
Test 4	0.07 (± 0.079), 0.05 (0.00–0.30)[b]	0.36 (± 0.339), 0.25 (0.05–1.10)	$Z = -3.15$, $P < 0.05$
Friedman tests	Chi-square = 8.50, df = 3, $P < 0.05$	Chi-square = 0.65, df = 3, $P > 0.05$	
AVOIDbarn			
Test 1	0.74 (± 0.575), 0.70, (0.05–2.40)[a]	1.08 (± 0.715), 1.30 (0.05–2.30)[a]	$Z = -1.57$, $P > 0.05$
Test 2	0.34 (± 0.504), 0.05, (0.05–1.50)[bc]	0.72 (± 0.703), 0.50 (0.05–2.50)[b]	$Z = -1.64$, $P > 0.05$
Test 3	0.36 (± 0.417), 0.30, (0.05–1.60)[b]	0.61 (± 0.517), 0.50 (0.05–1.40)[b]	$Z = -1.39$, $P > 0.05$
Test 4	0.20 (± 0.299), 0.10, (0.00–1.10)[c]	0.57 (± 0.504), 0.45, (0.05–1.50)[b]	$Z = -2.33$, $P < 0.05$
Friedman tests	Chi-square = 15.22, df = 3, $P < 0.05$	Chi-square = 10.33, df = 3, $P < 0.05$	

Different supercripts within a column differ significantly (Wilcoxon test: $P < 0.05$).

With regard to AVOIDbarn, significant differences were found between the individual test sessions within STROKING animals (Chi-square = 15.22, df = 3, $P < 0.05$) and within CONTROL animals (Chi-square = 10.33, df = 3, $P < 0.05$). AVOIDbarn of STROKING animals decreased after Treatment 1 ($Z = -2.01$, $P < 0.05$) and again after Treatment 2 ($Z = -2.46$, $P < 0.05$). The first avoidance distance in the barn (AVOIDbarn) of CONTROL animals was higher than all subsequent attempts ($Z = -2.58/-2.20/-2.45$, $P < 0.05$), but no further decreases were found after Test 2. With regard to between-group comparisons, STROKING animals avoided the experimenter less than CONTROL animals only after Treatment 2 ($Z = -2.33$, $P < 0.05$).

Discussion

The aim of this study was to investigate whether short-term stroking of loose-housed dairy cows on the ventral neck during milking could improve the cow-human relationship and if this effect could persist for several weeks. After the first short-term treatment (10 × 3-min sessions) results are weak. Thus, Treatment 1, alone, appears to have been too brief for a clear treatment effect. After the second short-term treatment (additional 7 × 3-min sessions), however, the avoidance distances of the stroked animals differed significantly from their initial avoidance distances as well as from the avoidance distances of the animals in the control group. This suggests that stroking dairy cows on the ventral neck during milking can decrease the avoidance towards humans in loose housing, even when the treatment is only provided for a short period of time.

Several studies have suggested that gentle interactions with cattle (such as stroking, patting, brushing, talking gently, allowing calves to suck the stockperson's fingers) and the provision of food are rewarding and can improve the human-animal relationship (eg Lensink *et al* 2000; Krohn *et al* 2001; Raussi *et al* 2003; Waiblinger *et al* 2004). However, few studies have provided tactile contact without any other form of contact and the results are ambiguous. In studies with beef and dairy calves, Boivin *et al* (1998) and Jago *et al* (1999), respectively, could not detect a clear effect of brushing or stroking on reactions of calves to humans, while Schmied *et al* (2008a) and Bertenshaw and Rowlinson (2008) found a fear-reducing effect on cows and heifers. One reason for this difference in findings between calves or heifers and cows may have been the choice of anatomical regions in which the animals were brushed or stroked; stroking the ventral neck was especially effective in cows (Schmied *et al* 2008a). Other potential factors may be the duration of positive contact, differences in the test animals (age, initial fear of humans) or different treatment and test conditions. With respect to the duration of positive contact, Boivin *et al* (1998) considered that the brushing treatment of 5 min per day on 5 days per week over two weeks (in total 50 min per beef calf) might have been too short to obtain significant effects. In the study by Jago *et al* (1999), the calves were stroked for 3 min for 15 days (in total 90 min per calf). In the present study, only 51 min (17 × 3 min) of contact were provided. As mentioned above, one reason for finding an effect in the present study might have been that the study was performed with dairy cows, which are generally used to a routine of daily handling. In contrast, the calves stroked or brushed from an early age onwards were not habituated to close human contact before the treatments (Boivin *et al* 1998; Jago *et al* 1999). A certain degree of prior habituation to human contact appears to be necessary before close

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contact is provided to avoid the animals perceiving it as aversive. Bertenshaw and Rowlinson (2008) suggested that reduction of fear, habituation and an increase in exposure to a 'positive treatment' were necessary to reinforce such a treatment as a 'pleasant experience' and that only animals with a lower level of fear of humans would perceive such a treatment as positive. This is in line with Price (1984) describing habituation and positive associative conditioning — apart from imitative learning — as learning processes by which animals can become tamer or 'the threshold for avoiding people is raised'.

Schmied *et al* (2008a) found an effect after a stroking treatment of 5 min per day on 5 days per week for three consecutive weeks (in total 75 min per cow). The study was performed with tethered cows, ie used to regular close interactions with humans. Thus, finding an effect with loose-housed dairy cows after 17 sessions of 3 min is encouraging. Nonetheless, the results of the present study question the amount of contact necessary. In the present study, 10 sessions of 3 min (Treatment 1) were not sufficient for clear and lasting effects, while 51 min were (Treatment 1 and 2). It needs to be investigated what amount of contact is effectively necessary in a practical situation and whether (and how often) regular reinforcement is needed. The question of the durability of the effect of short-term stroking cannot be answered. In the present study, no definite decrease in avoidance distances could be detected after the first treatment. With regard to AVOIDfeed, a significant difference was found between the control and treatment group, but not within the treatment group. AVOIDbarn of stroked animals decreased significantly after the first treatment, but this was also the case for the control group. In the study by Schmied *et al* (2008a), the effect of stroking the ventral neck over 3 weeks persisted over at least 8 weeks without further reinforcement.

The decrease in avoidance distances can be interpreted as improved cow-human relationship, which was also caused by positive reinforcement and not purely by habituation. Bertenshaw and Rowlinson (2008) were able to conclude that the brushing treatment of unrestrained heifers during rearing (in total ~4 h) was perceived as positive, because the animals sought further 'positive treatment' by re-approaching a retreated human a few months later. It is likely that stroking on the ventral neck during milking, which was shown to be especially effective in improving the cows' relationship to humans and in eliciting signs of relaxation (Schmied *et al* 2008a,b), could also be perceived as positive by many cows. However, there appears to be differences in individual responses to the stroking treatment that means cows accepted the close interaction more or less readily. For one cow in our study, the treatment must have been aversive resulting in aggressive defensive behaviour. Reasons why this cow might have considered the treatment as potentially aversive might have been her temperament, previous experiences, or a temperament-experience interaction, emphasised perhaps by being restrained. It may be that the positive effect of stroking would have been stronger for all cows had it been provided in a different context and not during restraint. In the study by Bertenshaw and Rowlinson (2008), where a significant decrease in fear was found for heifers that were brushed, animals could end the brushing treatment and retreat, ie they had control over the situation. Behavioural, physiological and emotional responses of animals depend on their evaluation of the environment, and the ability to control the environment could even be a 'source of positive emotions' (Boissy *et al* 2007; Veissier & Boissy 2007).

Moreover, the effect of stroking might have been more distinct without the potential visual habituation of the control group to the experimenter in the milking parlour. This is also true for possible social learning. According to Munksgaard *et al* (2001), cows that had observed neighbouring cows receive a gentle treatment later kept a shorter distance to the person performing the treatment, ie they were shown to be capable of social learning.

In the present study, animals being stroked in the milking parlour learned to generalise their perception of the human to other locations. Hence, the treatment affected the responses of the cows in other situations, ie when approached by the experimenter in the barn or at the feeding place. Thus, these short periods of tactile contact in the milking parlour had the potential to change the cow-human relationship, in general. This is also supported by studies in which links between milkers' behaviour and avoidance behaviour of cows at the feeding place and in the barn were found (Waiblinger *et al* 2002, 2003).

Interestingly, not only in the treatment, but also in the control group, the first avoidance distances in the barn (AVOIDbarn) were significantly higher than subsequent ones. Several reasons might account for the decrease in AVOIDbarn of the control group. One could be the aforementioned observational learning. Another influence could have been the novelty of the test procedure in the first test and later habituation to this procedure (Waiblinger *et al* 2006). This means that the first decrease in AVOIDbarn of the stroked animals cannot be attributed with certainty to a treatment effect. Furthermore, Rushen *et al* (1998) demonstrated that the distances that dairy cows kept from a human can be influenced by the location and previous handling. In comparison to the feeding place, the cows of the present study had less human contact in the barn, which was generally only entered in order to move them to the milking parlour. In the course of the first test, the cows might have become habituated to the test person also being in the barn (without trying to move them). This may have partly accounted for the first decrease in AVOIDbarn of animals in the control group. As a way of dealing with this 'habituation' effect in the control group, we analysed the relative differences between the corresponding test sessions of AVOIDbarn (ie, Test 1 minus Test 2, Test 3 minus Test 4). No significant difference was found comparing the control and treatment group with regard to the relative differences between Test 1 and Test 2 ($Z = –0.119$, $P = 0.905$). This supports the idea that there is a strong effect of habituation to the novelty of the test situation which contributes very much to the reduction in AVOIDbarn seen after Treatment 1. The habituation effect

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might have been too strong to find an additional small treatment effect. However, with regard to Treatment 2, a tendency for a difference between the relative differences between Tests 3 and 4 was found ($Z = -1.877$, $P = 0.060$), thus an effect of stroking seems further supported.

The avoidance distance tests were sensitive to the form of gentle contact provided in the present study and changed in the predicted direction. Hence, the validity of avoidance distance tests to reflect the cow-human relationship in loose housing is further supported. With regard to the avoidance distance test at the feeding place, so far only convergent validity was shown, ie correlations with other measures of human-animal relationship, such as stock-person behaviour or other behavioural tests assessing the responsiveness of loose-housed dairy cows towards humans (Waiblinger *et al* 2002, 2003; Windschnurer *et al* 2008). However, now the validity of the test could also be confirmed by means of a handling study.

For future experiments it would be interesting to investigate the way in which cows perceive stroking while they are restrained in the milking parlour, for a clearer view if the decrease in avoidance is effectively caused by positive reinforcement. Moreover, physiological parameters such as heart rate, heart-rate variability or cortisol measures could be used in order to obtain information on how gentle tactile contact was perceived under our treatment conditions. Another interesting question is the existence of individual differences in the responsiveness to stroking and why some animals would perceive it as more positive than others or even as aversive, such as the cow that had to be excluded from the experiment. Furthermore, it would be interesting to test for a possible effect on milk yield. For instance, a pair of milkers providing increased positive tactile and vocal interactions were shown to have achieved a significantly higher milk yield than a team providing more negative interactions (Hanna *et al* 2006). In instances where stroking has been found to exert an influence on milk yield, it would be beneficial to investigate the underlying physiological mechanisms.

Conclusion and animal welfare implications

The results of the present study suggest that stroking loose-housed dairy cows on the ventral neck during milking can decrease their avoidance of humans and allow them to be approached more closely in the barn or at the feeding place. This could reduce their stress in daily routine handling, thereby improving their overall welfare. It is important to outweigh obligatory negative interactions due to routine husbandry by rewarding or positive interactions (Hemsworth 2003). Besides, the presence of a positive handler can even lower stress during aversive husbandry procedures (Waiblinger *et al* 2004). Our results cannot answer the question of durability of short-term treatment and also leave in doubt the amount of contact and reinforcement necessary. However, it is not overly time consuming to stroke individual cows from time-to-time during milking. Of course, stroking each cow for 3 min is not feasible, especially on larger farms. However, different cows could be stroked for some seconds at different times. One could focus particularly on first lactating cows that tend to be more nervous. There is usually some time during milking to provide such contact, eg once the milk cups have been attached. It should therefore be integrated into daily routine handling practices and performed whenever the opportunity arises. This study, in conjunction with earlier work (Waiblinger *et al* 2002, 2003; Bertenshaw & Rowlinson 2008; Windschnurer *et al* 2008), offers further validity of avoidance distances to reflect the cow-human relationship.

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