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Tactile stimulation by humans: Do pigs prefer scratching or stroking?

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ABSTRACT

Scratching and stroking are tactile interactions used to improve the animal-human relationship and reduce stress in pigs. Both interactions resemble behaviours from the behavioural repertoire of pigs and have been applied in previous studies. To investigate the relative efficacy of these tactile interactions in eliciting positive emotions, we examined pigs' preferences for one of these interactions. Twelve recently inseminated gilts habituated to human contact were trained to discriminate between two handlers standing in two different locations in their home pen. One handler was providing stroking, the other one scratching. After 5 weeks of training, the pigs were tested for their preference. According to the preference index calculated based on the time the pigs spent being stroked and scratched, they did not significantly prefer one type of contact ($p = 0.182$, preference index median = 0.09, with −1 indicating an absolute preference for stroking and 1 an absolute preference for scratching). There was no significant difference between how often the pigs chose to approach the scratching or the stroking handler ($p = 0.115$, median scratching = 3.0, median stroking = 1.5), and neither did they approach one of them significantly earlier than the other (day 1: $p = 0.126$, median of difference between latency to approach scratching handler and latency to approach stroking handler = −55 s; day 2: $p = 0.148$, median of difference between latencies = −27 s). We did not find evidence for a general preference of one type of contact over the other. To improve the animal-human relationship, it might thus be most efficient to offer both types of tactile contact and adjust the contact depending on the pig's behaviour indicative of enjoyment.

1. Introduction

Human-animal relationships are determined by the relative strength of positive and negative emotions elicited during interactions between humans and animals (Waiblinger et al., 2006). Better human-animal relationships have advantages for the animals in terms of improved welfare (Waiblinger, 2019). They are also beneficial for farmers; in pigs, they lead to increased reproductive performance and easier handling (English et al., 1999; Hemsworth et al., 1986a, 1989). Gentle tactile contact by humans such as stroking (e.g. de Oliveira et al., 2015; Tomas et al., 2024), rubbing (e.g. English et al., 1999), patting (e.g. Hayes et al., 2021a; Lucas et al., 2024) or scratching (e.g. Lucas et al., 2024; Tallet et al., 2014) have been successfully applied in studies aiming to reduce stress by improving pigs' relationships with humans and presumably inducing positive emotions.

While previous studies largely agree in terms of the effects of tactile treatments, the application of the treatments themselves differed greatly. Different types of interactions were usually combined (e.g. stroking, patting and scratching, Hayes et al., 2021b). Also, tactile contacts were applied on different body areas, including for example the head, the area behind the ears, the abdomen and the back (de Oliveira et al., 2015; Hayes et al., 2021b); in most studies, however, the body area was not described. The durations of the treatments ranged from 1 to 4 min daily, and the treatments were applied on 3 – 7 days per week over

Abbreviations: EEG, electroencephalography; GLMM, generalized linear mixed effects model; LMM, linear mixed effects model.

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periods of about 1 – 16 weeks, leading to a total duration of 7 – 224 min. In some studies, the interactions were voluntary (i.e. the human interacted with the animals when they approached or in places where the animals were able to avoid the interactions; Hayes et al., 2021a, 2021b), while in another study the contact was forced upon the animals (i.e. they were caught and kept on the lap of the person or there was not enough space for the animals to avoid the contact; de Oliveira et al., 2015). This could have a large impact on how an animal perceives the interactions, as agency in itself seems to be perceived as positive (Špinka, 2019).With regard to standardisation of the interactions, some authors have described the speed of the movements (de Oliveira et al., 2015), whereas in many other studies the interactions did not seem to be standardised within the study (e.g. Hayes et al., 2021b) or were not described in any detail (e.g. Hemsworth et al., 1986b, 1981).

The studies described up to now were based on the assumption that these tactile interactions are perceived as positive, and although they have not tested it explicitly, the results support this assumption. Rault et al. (2019) examined whether a specific tactile interaction, 'belly rubbing', is perceived as positive by piglets. The experimenter stroked a piglet's abdomen with back-and-forth hand movements any time the animal laid down and exposed its abdomen during interactions with the person. Stroking of the abdomen typically elicited limb stretching and often also short-lasting grunts and eye closure, which might indicate positive emotions. Additionally, electroencephalography (EEG) total power was reduced, and EEG frequencies were increased, which might be an additional indicator of positive emotions (Rault et al., 2019). Moreover, scratching and stroking by humans resemble elements of the behavioural repertoire of pigs that are associated with positive emotions. Comfort behaviour in pigs includes scratching the body with the hind legs or rubbing against objects (Bolhuis et al., 2005), which makes it plausible that scratching by humans might be perceived as positive. Stroking might resemble allo-grooming or social nosing (Bus et al., 2023; Camerlink et al., 2023; Meynhardt, 1984), which are considered to be affiliative behaviours and as such probably perceived as positive.

To our knowledge, there has been only one study that included a comparison of scratching and stroking in pigs (Tallet et al., 2014). Although the behavioural results suggest a positive perception of the interactions in general, no definite conclusions can be drawn with regard to whether the behaviour was mainly influenced by the tactile interactions themselves or by other properties of the handler and the interplay of curiosity, fear and habituation. The patterns of heart rate and heart rate variability in the test comparing scratching and stroking were inconclusive and possibly affected by a carry-over effect. Another possibility to test whether pigs perceive scratching or stroking as more enjoyable would be choice tests, which offer the possibility to assess the relative preference of pigs for a type of contact. Pigs might also perceive the less-preferred type of contact as rewarding or at least as not aversive (Duncan, 2005), and the evaluation of the duration of each type of contact would allow additional conclusions in this regard. To ensure a similar level of experience (Duncan, 2005) with scratching or stroking, pigs can be easily familiarised with both types of contact before being tested, with a simultaneous habituation to the test set-up.

Using gentle tactile interactions that elicit the most positive emotions will assist efficiently in improving the animal-human relationship in both research and industry practice. However, choosing the tactile interactions that pigs enjoy most requires knowledge of the animals' preferences for different types of interactions. If a caretaker or researcher already knows the individual preferences of the animals, they should provide the preferred type of contact for each animal. However, if this is not the case, it would be useful to know whether pigs in general enjoy one method of how tactile contact is applied more than others, as has been shown for other species (rats: Burgdorf and Panksepp, 2001; cattle: Schmied et al., 2008; horses: Thorbergson et al., 2016; Feh and de Mazières, 1993). With this knowledge, the generally preferred interaction could be applied and there would be a high probability of this interaction eliciting positive emotions. The aim of our study was thus to investigate whether pigs generally prefer scratching or stroking in a choice test. Due to a lack of previous results indicating which type of contact pigs prefer, we formulated a two-tailed hypothesis, predicting that pigs would spend more time with one type of contact than with the other.

2. Methods

2.1. Animals, housing and management

The study was conducted on the pig farm of the University of Veterinary Medicine, Vienna in Berndorf, Niederösterreich. Twelve Large White gilts aged 8 – 11 months were involved in the study. They had been inseminated 2 months to 2 weeks earlier. The pigs were housed in three pens with partially slatted floor, measuring 5.9 m × 3.0 m and including a covered lying area (2.15 m × 3.0 m) and lock-in feeding stalls with manually operated gates (2.4 m × 0.7 m; four stalls in pen 1, five each in pens 2 and 3). The pigs were housed in groups of three, four and five animals in pens 1, 2 and 3, respectively. Daily feed consisted of 2.5 l of mixed feed for pregnant sows (Garant, Pöchlarn, Austria) and was provided at 7:00 h and 13:30 h from an automatic feeding system. The gilts were stroked or scratched occasionally by the caretakers if they approached during routine procedures (e.g. pen cleaning, veterinary examinations).

2.2. Experimental design

The study was discussed and approved by the ethics and animal welfare committee of the University of Veterinary Medicine, Vienna in accordance with Good Scientific Practice guidelines and national legislation (project number ETK-13/01/2023).

Our experimental set-up consisted of three distinct phases: habituation, training and testing (Fig. 1). In the first week, each group of pigs was habituated to the handlers (both female, 1.55 m and 1.66 m height) via unstructured gentle interactions in the pen. From the second week onwards, the pigs were trained individually for 5 min per day to associate two different types of tactile contact (scratching and stroking) with two different handlers, standing in two different corners of the home pen. Until day 8, only one type of contact was provided per day, with each pig receiving each type of contact four times, alternating between days. From day 9 onwards, the pigs were allowed to choose between the two types of contact in all training sessions. Finally, two test sessions were conducted on the first (day 21) and last day of the sixth week (day 22). These entailed the same procedure as the preceding training sessions.

2.3. Habituation

During the habituation sessions, all pigs were free to move in their home pen, and both handlers were present inside the pen, talked in a gentle voice, gave a treat to each pig and, if possible, touched her briefly on the shoulders or the neck (on the same body areas as later during the treatments). The criterion for successful habituation was the acceptance of touch without showing an avoidance response. We conducted the habituation sessions daily until the criterion was achieved by all pigs. The habituation sessions were conducted between 15:00 h and 16:00 h. The handlers wore red overalls during the habituation sessions, as this colour was usually worn by the farm staff. As treats, we used M&M's (sugar-coated chocolates, Mars Inc., McLean, USA) in the first habituation session, as they had been used successfully in previous studies (Gieling et al., 2014; Grimberg-Henrici et al., 2016; van der Staay et al., 2017). However, we noticed that the pigs had difficulties taking the M&Ms from the hands of the handlers due to their small size. Thus, we used pieces of apple from the second habituation session onwards, which were readily accepted. In the first and second habituation sessions, both handlers stayed inside the pen until each handler had given

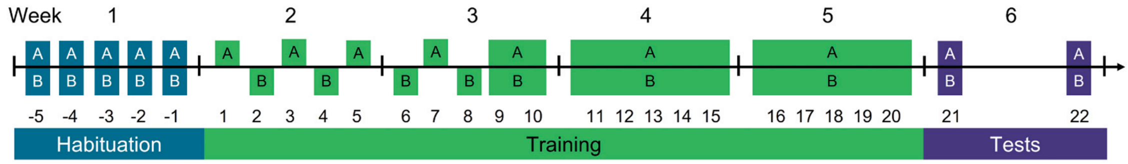

Fig. 1. Time schedule and experimental design. A and B represent the two handlers. The 12 pigs were habituated to handlers A and B from day −5 to day −1. During the training phase, the pigs were trained to associate two different types of contact (scratching and stroking) with handlers A and B. For half of the pigs, handler A provided stroking and handler B scratching, while for the other half, handler A provided scratching and handler B stroking. The type of contact provided by each handler remained constant within each individual pig for the duration of the study. On days 1–8, only one handler per day entered the pen and offered the respective type of contact, with the identity of the handler and thus the type of contact alternating across days. On days 9–20, both handlers were present during the training sessions, for the pigs to learn to choose between the two types of contact and to strengthen the association between handler and type of contact. On days 21 and 22, the pigs were tested for their preference of stroking or scratching.

each pig a treat. If it was not possible to give a treat to a pig while the handler was in an upright position, she crouched down, which has been shown to be less frightening (Hemsworth et al., 1986c). Ten animals could be touched in the first habituation session by both handlers; one pig could be touched by only one handler and another one not at all. All pigs accepted treats from both handlers during the first habituation session. In the second habituation session, all animals were touched and accepted treats. However, the pig that could not be touched in the first training session withdrew from the touch in the second training session, so we conducted further habituation sessions, during which the handlers fed treats to this pig and attempted to touch her. The pig withdrew from touch also in the third and fourth sessions. In the fifth habituation session, both handlers touched the pig without eliciting a withdrawal response. From the third session onwards, all other pigs were touched without feeding them, since we did not want to strengthen the pigs' association of the handlers with food.

2.4. Training and test sessions

In order to train each pig individually, the handlers needed to restrain all pigs in the feeding stalls before the start of the training session. To encourage voluntary entry into the feeding stall, about 30 g of feed per pig was placed in the trough of each stall by both handlers together. While the pigs were not trained or tested, they remained locked in the feeding stall. In the training sessions until day 8, the handler training a pig entered the pen and released the respective pig from the feeding stall. If the animal did not leave the feeding stall by herself, the handler used a paddle to move her, with a gradual increase in intensity while being careful to avoid signs of stress. From day 11 onwards, both handlers released the pig together and, if necessary, encouraged her to move using the paddle. After the pigs left the feeding stall, the handlers assumed their assigned positions in the corners of the pen opposite to the feeding stalls (Fig. 2).The pigs were trained to associate scratching and stroking with the two different handlers. For each individual pig, one handler provided stroking, while the other handler provided scratching. To scratch the pigs, the handlers were instructed to exert pressure with the fingertips while moving the hand backwards and forwards. To stroke the pigs, they were instructed to move the flat hand in caudal direction with a firm pressure. The handlers performed the movements at the same speed of about 1 time/second and applied the contact only on areas that can also be reached from outside the pen, i.e., on the back and shoulders of the animals. These are body areas where pigs appear to enjoy tactile contact, although to our knowledge this has not been studied systematically. If an animal did not approach the human for 20 s during a training session with only one handler, the handler tried to attract the pig by talking to her in a gentle voice.

During the training and test sessions, one handler wore a blue overall and the other a yellow overall to facilitate discrimination between the two handlers (Koba and Tanida, 1999). To avoid confounding a preference for one type of contact with a preference for one of the handlers,

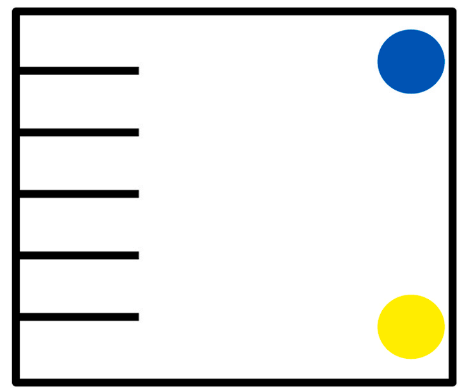

Fig. 2. Schematic drawing of a pen. The circles mark the positions of the handlers. The short lines to the left represent the feeding stalls. In the stalls, pigs had access to a trough connected with the automatic feeding system and a drinker system with a vacuum valve. Pigs could be locked inside the feeding stalls and released for individual testing. Handler A always wore a blue and handler B a yellow overall. Handler A provided stroking and handler B provided scratching for half of the pigs, while for the other half of pigs it was the other way around. The positions of the handlers were constant for each individual pig and counterbalanced across pigs.

handler A provided stroking and handler B provided scratching for half of the pigs, while the treatments were reversed for the other half (Table 1). Within each individual pig, the contact provided by a specific handler and the corner where this handler stood remained constant over the course of the experiment. The starting treatment (whether the pig was scratched or stroked in the first session), and the location of the interactions provided (whether scratching or stroking was provided in the right or left corner of the pen) were also balanced across pigs.

Training took place between 14:00 h and 18:00 h. All training sessions were recorded on video using a camera surveillance system (NAS & Surveillance Station v.3.3, Synology Inc., Taipeh, Taiwan) to generate video material used for training the observer for the behavioural

Table 1
Distribution of treatments across pigs.

Pig	Scratching handler	Corner	Stroking handler	Corner
861	Handler A	left	Handler B	right
863	Handler B	right	Handler A	left
874	Handler A	right	Handler B	left
875	Handler B	left	Handler A	right
852	Handler B	left	Handler A	right
853	Handler A	right	Handler B	left
859	Handler A	left	Handler B	right
856	Handler B	right	Handler A	left
866	Handler B	left	Handler A	right
862	Handler A	right	Handler B	left
864	Handler A	left	Handler B	right
860	Handler B	right	Handler A	left

analysis. During the test sessions, the handlers followed the same procedures as in the training sessions with both handlers. The test sessions took place between 14:00 h and 17:00 h. Both test sessions were recorded on video.

2.5. Behavioural observations

During all training and test sessions, the handlers assessed directly how easy it was to move the pigs out of the feeding stall on a scale from 0 to 2 (0 = no paddle needed, 1 = only rattling or one brief touch with the paddle needed, 2 = touched more often and more forcefully with paddle).

From the videos of the test sessions, a trained observer coded the type of contact using the software BORIS (version 8.17.1; Friard and Gamba, 2016). For each 300-s session, the duration and frequency of the two applied types of contact, i.e. scratching and stroking, as well as the latencies to interact with the person performing the type of contact were recorded. For the observations, stroking was defined as the handler moving the flat hand repeatedly in caudal direction while in physical contact with the pig, and scratching was defined as the handler moving the hand backwards and forwards while in physical contact with the pig. A new bout of scratching or stroking was coded if an interruption of > 1 s occurred. To assess inter-observer reliability, the observer and a second person each coded one training session of each of the ten pigs. Inter- and intra-observer reliability were almost perfect (k = 0.99 for both treatments).

2.6. Statistical analysis

Before the start of the experiment, we performed a power analysis to determine the sample size. We could not obtain suitable data on the random effects for the present study, so we calculated the sample size for a matched-pairs *t*-test, using the G*Power software (Faul et al., 2007). This sample size should allow detecting an effect of $d_z = 0.9$ at a significance level $\alpha = 0.05$ with a power of 0.9.

The statistical analysis of the obtained data was conducted using the statistical software environment R (version 4.2.1; R Core Team, 2022), fitting linear mixed effects models (LMMs) and generalized linear mixed effects models (GLMMs) where possible. Assumptions of LMMs were checked using qq plots and graphs depicting residuals vs. fitted values, assumptions of GLMMs using plots and test functions from the package "DHARMa" (version 0.4.6; Hartig, 2022). To reduce the probability of type 1 errors, we adjusted the p values using the Bonferroni-Holm correction (Abdi, 2010) across the four hypothesis tests of duration and frequency of contact and latency until establishing contact, the latter of which was analysed separately for day 1 and day 2.

For the durations of scratching and stroking, we calculated a preference index (Fraga et al., 2020) to circumvent the problem of the two durations being dependent on each other. We subtracted the duration of stroking from the duration of scratching and divided the difference by the sum of the durations of scratching and stroking of the respective test session. The resulting values lie in the range of −1–1, with negative values indicating that more time was spent with the stroking handler and positive values indicating that more time was spent with the scratching handler. The indifference level (0 in the raw data) indicates that the pig did not spend more time with one type of contact than with the other.

As the values of the preference index are bounded, we fitted a GLMM with a beta error structure and logit link function using the package "glmmTMB" (Brooks et al., 2017). The preference index was transformed to a range between 0 and 1 by adding the absolute lowest attainable value of the preference index (i.e. 1) and dividing the sum by the resulting maximum attainable value (i.e. 2). As the beta distribution does not include the values 0 and 1, the transformed index was transformed according to $(y \times (n - 1) + 0.5) / n)$, with y corresponding to the response variable (i.e. the transformed index) and n to the number of observations (Smithson and Verkuilen, 2006). This procedure compresses the range of the values slightly towards the average to avoid 0 and 1. We centred the value of day before including it as a fixed effect into the model, so that the back-transformed estimate of the intercept would indicate the average value of the response variable across both test days and be comparable against the indifference level of 0.5 in the transformed data. The individual pig was included as random effect. We back-transformed the estimate of the intercept using the function "invlogit" from the package "arm" (Gelmann et al., 2024). All model assumptions were fulfilled.

For the frequency of seeking out each type of contact, it was not necessary to calculate an index, since the frequencies to visit the scratching and the stroking handler do not depend on each other. To analyse the frequencies, we fitted a GLMM with a Poisson structure and log link function using the package "lme4" (version 1.1–33; Bates et al., 2015). We included type of contact as a fixed effect into the model, and additionally, handler, corner, and test day as well as the two-way interactions between type of contact, handler, and corner with test day to control for these potential confounding variables. The individual pig was included as a random effect. To avoid cryptic multiple hypothesis testing (Forstmeier and Schielzeth, 2011), we compared the full model to a null model lacking the effects of interest (type of contact and its interaction with test day) with a likelihood ratio test (function "anova"). All model assumptions were fulfilled.

The latency data contained six missing values, which were caused by subjects not approaching a handler. For the analysis of the latencies, we set all missing values to the maximum latency possible, i.e. the duration of the session (300 s). We calculated the difference between the latencies by subtracting the latency to interact with the stroking person from the latency to interact with the scratching person. Negative values thus indicate that the scratching handler was approached earlier, while positive values indicate that the stroking person was approached earlier. A difference of 0 indicates that none of the handlers was approached earlier than the other. As the assumptions of normality and homoscedasticity of residuals were violated for a GLMM based on the beta distribution and we did not find a more suitable distribution, we decided to calculate one Wilcoxon signed-rank test per test day on the untransformed difference between latencies to compare the index to the indifference point of 0.

As there was a possibility for the ease of moving a pig affecting the total duration of contact, we fitted a LMM using the package "lme4" (version 1.1–33; Bates et al., 2015) with the sum of durations of scratching and stroking as dependent variable. We included the ease of moving the pig (use of paddle no or yes; scores 1 and 2 were pooled), the test day and their interaction as fixed effects into the model. The individual pig was included as a random effect. We compared the full model with a null model lacking the effects of interest (ease of moving and its interaction with test day) with a likelihood ratio test. The plot of residuals vs. fitted values showed a slight pattern possibly influenced by the relatively low sample size. An additional non-parametric Kruskal--Wallis H test per test day confirmed the results of the LMM.

We depicted the duration, frequency and latency data graphically as Tukey-style boxplots. The black lines in the middle of the boxes represent the median, the edges of the boxes represent Tukey's hinges, defined as those values that lie at the median of the upper or lower half of the values if split at the median of the complete data set. The whiskers represent the most extreme values that are still within Tukey's fences, which expand to 1.5 times the inter-quartile range from the upper and lower hinge. All graphs presenting data were created using the packages "ggplot2" (version 3.3.6; Wickham, 2016) and "cowplot" (version 1.1.1; Wilke, 2020).

3. Results

The pigs spent about half of the session durations in contact with the handlers (median: 156 s), spending on average 97 s being scratched and

58 s being stroked (Fig. 3A; individual data in Fig. 4). There was no significant difference between the preference index and the indifference point of 0.5 (GLMM: back-transformed intercept = 0.618, p = 0.182; preference index median = 0.09, first quartile Q1 = −0.13, third quartile Q3 = 0.74; Table S1).

The median frequency of approaching was 3 (Q1 = 2, Q3 = 4) for the scratching handler and 1.5 (Q1 = 1, Q3 = 3) for the stroking handler. There was no significant difference between the two types of contact with regard to the frequency with which they were accessed (Fig. 3B; GLMM: full-null model comparison χ^2 = 5.938, df = 3, p = 0.115; Table S2). The median latency to approach the scratching handler was 14 s (Q1 = 5 s, Q3 = 48 s) across both days, the median latency to approach the stroking handler was 89 s (Q1 = 29 s, Q3 = 164 s). The pigs did not approach one of the handler significantly earlier than the other on either test day (Wilcoxon signed-rank test: day 1: V = 13, p = 0.126, median difference = −55 s, IQR difference = 110 s; day 2: V = 9, p = 0.148, mean difference = −27 s IQR difference = 89 s; Fig. 3C).

There was no significant association between the use of the paddle and how much time the pigs spent in contact with the handlers (Fig. 5; LMM: full-null model comparison χ^2 = 2.648, df = 2, p = 0.266; Table S3).

4. Discussion

Contrary to our expectations, the pigs in general did not spend more time with one type of contact than with the other. Neither was there a significant difference in how often or how soon the pigs approached the stroking and the scratching handler. Based on our results, pigs do not seem to have a general preference for one type of contact. Possibly, the two types of interactions are perceived as largely similar by the pigs. Both types of contact have been applied successfully to improve animal-human relationship of pigs (e.g. de Oliveira et al., 2015, Hayes et al., 2021a), thus they are probably perceived as positive.

Previous studies comparing the animals' reactions to different ways of interacting positively did not find pronounced differences, either. Pigs reacted similarly in a free-form interaction session and in a session with standardized imposed contact (Truong et al., 2024). When heifers were stroked according to their perceived momentary preferences versus in a standardized way at the lower neck, which is a generally preferred body region (Lange et al., 2020a), there were differences in some ear positions, but not in other behavioural or cardiac indicators. In these studies, as in ours, both conditions were designed to be perceived as positive by the animals. They might thus have been too similar to produce behavioural differences in the animals, or the behavioural differences were too subtle to observe (Truong et al., 2024) or too small to confirm statistically.

Another reason why the pigs in our study did not show a general preference for one type of tactile contact could be high individual variation, as has been found for other species in different contexts. For example, Meagher et al. (2017) simultaneously offered heifers their familiar total mixed ration and one out of four types of roughage. They did not find the expected general preference for the varying types of roughage but pronounced individual differences with regard to preference of varied over standard feed: While some heifers did not feed on the varied feed at all, others spent nearly half of the time feeding on it. Similarly, there might be individual differences in the preference for a type of tactile contact in pigs.

Individuals might also prefer a different type of tactile contact on different days. In a study investigating whether calves perceive being brushed by a person as positive, some animals preferred a compartment with a person who would brush them over an empty compartment on one of the two testing days but not the other (Schulze Westerath et al., 2014). While a higher number of choices of brushing in the second than in the first test session might be explained by learning effects, some animals showed a preference for being brushed in the first test session but not in the second one. The authors suggest that the perceived valence of brushing might vary from day to day, which would influence the motivation for being brushed. Similarly, the motivation for being stroked or scratched might not be consistent in pigs due to a varying positive perception of each type of tactile contact.

It is, however, noteworthy that the numerical results pointed all in the same direction: across both test days and all pigs, the pigs spent on average almost twice the time being scratched than being stroked, accessed the scratching handler one and a half times more frequently and took less than half of the time to approach this handler than the stroking handler. This represents a weak indication that scratching might be perceived as more pleasant than stroking. If the topic of preferences for different types of contact in pigs should be further investigated, we would thus suggest formulating a one-sided hypothesis and focusing on the duration and latency as measures of preference, as these measures showed statistical tendencies or significance before correction for multiple testing.

An aspect that could theoretically have influenced the measure duration of contact in our study is the interactions involved in moving the pigs out of the feeding stalls. The potentially aversive perception of this interaction could have led to the pigs avoiding the handlers afterwards. However, there was no significant association between the ease of moving the pigs out of the feeding stalls and the total duration of

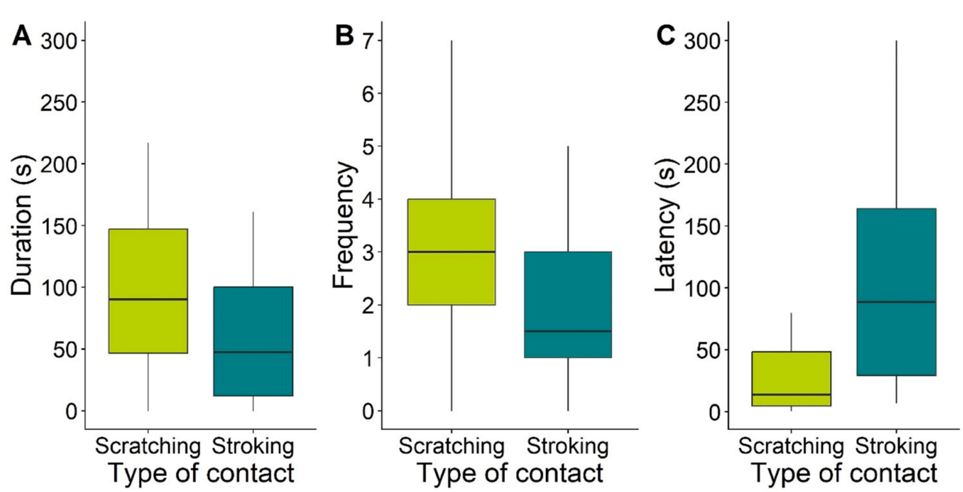

Fig. 3. Duration (A) and frequency (B) of each type of contact and latency until first access (C), averaged per animal across the two test sessions. Twelve gilts were individually allowed to choose freely between two handlers in their home pen; one handler stroked them on approach, the other one scratched them. The test lasted 300 s. Statistics: A) GLMM, comparison with point of indifference ns, B) GLMM, full-null model comparison ns, C) Wilcoxon-signed rank test, ns.

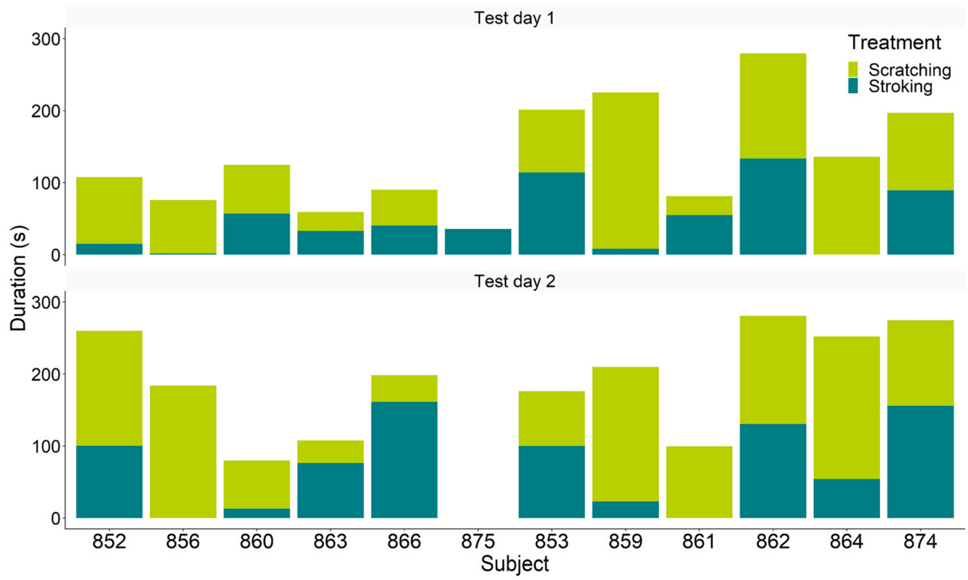

Fig. 4. Duration of scratching and stroking for each pig on both test days. Twelve gilts were individually allowed to choose freely between two handlers in their home pen; one handler stroked them on approach, the other one scratched them. The test lasted 300 s. The first six subjects were stroked by handler A and the other six subjects by handler B.

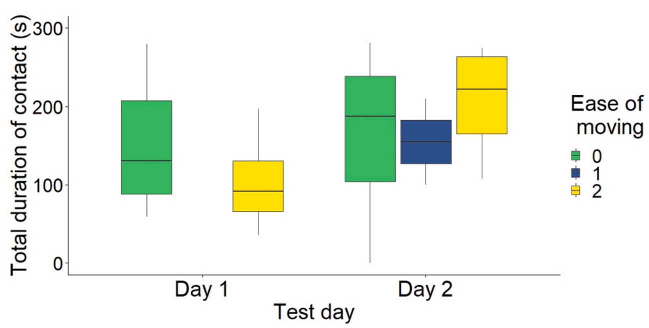

Fig. 5. Total duration of contact in relation to ease of moving the pig out of the feeding stall on both test days. The test lasted 300 s. Scores: 0, no paddle needed; 1, only rattling or short touch with the paddle needed; 2, touched more often and more vigorously with paddle. On Day 1 no pig received a score of 1, so score 1 and 2 were pooled for statistical analysis, testing of the influence of using the paddle as a binary variable (yes/no). Statistics: LMM, full-null model comparison ns.

contact with the handlers.

The goal of our study was to investigate if pigs generally enjoy one type of contact more than another, to establish a method for improving the relationship with an animal in situations in which the caretaker or researcher does not know the individual type of tactile contact that the animal prefers. One might argue that this requires a higher number of tests, but several studies demonstrated differences in perception of different treatments with only two or three test sessions (cats: Soennichsen and Chamove, 2002; cattle: Schmied et al., 2008, horses: Lee et al., 2011). In our study, there were two practical reasons for not testing more often. First, the animals might not have been as motivated to approach the handlers to experience tactile interactions if they had the opportunity every day. During the training sessions, the motivation to approach either handler seemed to decrease over the course of the week, whereas it increased during the 2-d breaks without the opportunity for tactile interactions (qualitative observation). Second, it is possible that the pigs might not have remembered the association between the handler and the corresponding treatment if the interval between the test sessions had been too long. Pigs have been shown to remember their past experience with a human for at least 5 weeks (Brajon et al., 2015a) and to discriminate between humans based on their previous experiences with them (Brajon et al., 2015b). However, the pigs in that study discriminated between two handlers that were associated with a positive versus a negative experience. In our study, the contrast between the handlers was not as large, as scratching and stroking are both potentially perceived as positive and not perceived as aversive in animals with at least a neutral relationship with humans. Therefore, we decided to have two test sessions with a substantially shorter interval in the present study and implemented two test sessions with a break of 2 days between the last training and the first test session and 3 days between the two test sessions.

While a general preference is expressed by the majority of animals either choosing one option more often than another (e.g. Færevik et al., 2005; Lee et al., 2011) or showing more behaviour indicative of enjoyment (e.g. Schmied et al., 2008; Soennichsen and Chamove, 2002), stable individual preferences refer to the response being repeatable within individuals across time (Creamer and Horback, 2024; Rozin, 1990). To test for stable individual preferences, it would be necessary to perform repeated tests on the same individuals to assess if the behaviour is repeatable (Laskowski et al., 2022), but this was outside of the scope of our study.

The perception of the tactile interactions and the preference for a specific type of tactile contact might be influenced by different factors, such as the age of the animals. Piglets have softer skin than mature pigs (Brown et al., 2010) and therefore might prefer stroking over scratching, although this hypothesis has not been tested conclusively: There is only one study that investigated reactions of piglets to different tactile interactions, which did not find a difference (Tallet et al., 2014). Other studies (e.g. English et al., 1999; Hayes et al., 2021b) indicated that combinations of stroking, scratching and/or other types of tactile contacts are perceived as positive, as they were successfully used to improve the animal-human relationship, but they did not compare stroking and scratching. However, de Oliveira et al. (2015) used only stroking in a study with piglets, and their choice of the tactile contacts might have been influenced by a perceived preference of piglets for stroking, but the authors did not report the reasoning for their choice of stroking over scratching or a combination.

Another aspect that would need to be examined to make tactile interactions more enjoyable for pigs is the body area on which the tactile contact is applied. Several species have shown different reactions to stroking of different body regions, partly in line with differences in intraspecific social interactions (cattle: Schmied et al., 2008, cats: Soennichsen and Chamove, 2002; horses: Feh and de Mazières, 1993). It is also possible that pigs show preferences for a specific type of tactile contact on certain body areas, while they prefer other types of tactile contact on other body areas. The skin thickness differs between body areas in pigs (Turner et al., 2015), which might affect the perception of different types of tactile contacts.

Furthermore, it might be important to give the animals some control not only over whether to interact at all (Lange et al., 2020b), but also over how to interact (Rault et al., 2020). Giving them the possibility to indicate where they want to be stroked and reacting to this preference (Lange et al., 2020a) allows them to perceive control over the situation, at least to a certain extent, which can in itself be a source of positive emotions (Boissy et al., 2007; Špinka, 2019). In our study, the pigs could position themselves differently and therefore influence which part of the back or shoulders was stroked or scratched; however, body parts other than the back and shoulders were not touched, which might limit the control perceived by the animal.

5. Conclusion

We did not find a general preference for one type of tactile contact in our study. Both scratching and stroking could be applied equally when interacting with pigs to improve their relationship with humans, and if an animal shows behavioural signs of enjoying one type of contact more than the other, the person interacting can react accordingly. Furthermore, it remains to be investigated in more detail whether scratching, stroking and other types of tactile contact are generally perceived as positive and which factors might influence this perception.

CRediT authorship contribution statement

Lena Lidfors: Writing – review & editing, Supervision, Methodology, Conceptualization. **Hemsworth Paul Hamilton:** Writing – review & editing, Methodology, Conceptualization. **Stephanie Lürzel:** Writing – review & editing, Supervision, Project administration, Methodology, Funding acquisition, Formal analysis, Conceptualization. **Janina Weißenborn:** Writing – review & editing, Methodology, Investigation, Data curation. **Susanne Waiblinger:** Writing – review & editing, Supervision, Project administration, Methodology, Conceptualization. **Marietta Amann:** Writing – original draft, Visualization, Project administration, Methodology, Investigation, Formal analysis, Data curation, Conceptualization.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Appendix A. Supporting information

Supplementary data associated with this article can be found in the online version at doi:10.1016/j.applanim.2025.106768.

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