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The human ability to interpret affective states in horses' body language: The role of emotion recognition ability and previous experience with horses

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ABSTRACT

Background: Effective communication and bonding between species depend on understanding the emotional state and the expressive behavior of the counterpart. This is of particular importance for human-horse relationships, as misunderstanding horses' communicative signals can easily lead to severe injuries. While the published evidence suggests that the human ability to correctly interpret equine affective states is far from perfect, this evidence is inconclusive regarding the influence of previous experience with horses. Further, the role of emotion recognition ability as well as the interaction of the two factors – horse-experience and emotion recognition ability – are poorly understood.

Method: To fill this gap, we employed an online survey asking participants to interpret 32 different photographs of horses' body language depicting different affective states. Additionally, we assessed participants' emotion recognition ability by means of the Reading the Mind in the Eyes test and asked them to provide socio-demographic information (i.e., age, gender, horse-experience).

Results: Our results suggest (1) that horse-experienced individuals performed better in interpreting horses' affective states than horse-inexperienced participants and (2) that participants with a high emotion recognition ability performed better in interpreting horses' affective states than participants with a low emotion recognition ability. We did not find evidence for an interaction of emotion recognition ability and horse-experience. Importantly, our results remained significant irrespective of how we defined "experienced" vs. "inexperienced" and after controlling for unequal gender distributions across these two groups.

Discussion: Our study showed that previous experience with horses and emotion recognition ability both affect the interpretation of horses' affective states. The effect for previous experience was much larger than for emotion recognition ability. However, even horse-experienced individuals only correctly identified about 50% of the affective states. The findings are discussed with regard to findings from previous and directions for future research.

1. Introduction

Humans and horses share a long history. The earliest evidence of horse domestication traces back to about 6000 years ago. While horses were originally hunted for meat, they were later used as workhorses. Today, many horses are kept for sport and leisure activities and have the status of a companion animal for their owners (Hausberger et al., 2008). Effective communication and bonding within and between species depend on understanding emotions and expressive behavior of the counterpart (Hartmann et al., 2017). This is of particular importance for human-horse interactions, as misunderstanding horses' communicative signals can easily lead to severe injuries. So far, research on the human

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ability to read emotions in other species has mostly focused on dogs (Bloom and Friedman, 2013; Pongrácz et al., 2011; Pongrácz et al., 2005; Amici et al., 2019; Scheumann et al., 2014). To our knowledge, there are only a few studies focusing on the human ability to read equine emotions, the majority of which investigated the effects of previous experience with horses on the ability to interpret equine affective states. In two of these recent studies, the human ability to interpret equine acoustic communicative signals was examined. Greenall and colleagues (2022) investigated, whether humans are able to correctly interpret the valence and arousal of vocalizations of domesticated ungulates (including horses) and their closely related feral relatives. In this study, participants were able to correctly identify valence and arousal of horses' vocalizations above chance level. While previous experience with the species did not play a role in the identification rate, there was some tenuous evidence that participants' ability to correctly interpret horses and other ungulates' vocalizations was better for participants whose work involved animals, than for participants whose work did not. Similarly, Merkies and colleagues (2022) report that participants were able to correctly identify the valence of horses' whinnies in about 65% of the trials. Interestingly, in this study, women outperformed men, but previous experience with horses had no influence on the identification accuracy. While these two studies focused on the interpretation of horses' vocalizations, other studies focused on the human ability to identify affective states in horses' body language. A study by Bell and colleagues (2019), who presented short videos of horses in negative affective states to participants' recruited via equine-related facebook groups, yielded that experience of equine ownership helped with the recognition of negative affective states in the depicted horses. Gronqvist and colleagues (2017) investigated first-year veterinary science and undergraduate equine science students' interpretation of horses' expressive behaviour. They found that horse-inexperienced students misinterpreted horses' body language in some of the depicted videos. Interestingly, these misinterpretations were characterized by both negative emotions interpreted as positive emotions and positive emotions interpreted as negative emotions. In a similar study (Guinnefollau et al., 2019), fourth year students significantly outperformed first year students in interpreting horses' affective states and previous experience with horses was a significant predictor for correctly assessing the affective states of the depicted horses. Furthermore, a recent master thesis showed that horse-experienced lay people outperformed equine assisted mental health professionals in assessing the affective states of horses (Fox, 2023). In sum, the published findings regarding the influence of previous experience with horses on the human ability to interpret affective states in horses are not totally conclusive. While the two studies that focused on acoustic signaling of horses did not find an influence of previous experience with horses on the identification of affective states in horses, the studies employing body language as an indicator of horses' affective states strongly suggest that participants with previous experience perform better in identifying affective states in horses as compared to horse-inexperienced individuals.

Besides previous experience with a species, empathy has been discussed as a potential influencing factor of human's ability to interpret affective states in other species. Research investigating the relationship between empathy for other humans and empathy for animals is scarce, but the available data shows that empathy for humans and empathy for animals are correlated (Gómez-Leal et al., 2021; Kujala et al., 2017; Paul, 2000). Furthermore, two recent studies have shown that people scoring high on empathy perform better in interpreting dogs' emotions as well as different ungulates' (including horses') vocalizations as compared to people scoring lower on empathy (Kujala et al., 2017, Greenall et al., 2022). However, empathy is a complex and multifaceted construct, with a wide range of definitions that has received strong interest in research (for recent reviews, see Cuff et al., 2016; Hall and Schwartz, 2019). The ability to correctly identify other humans' emotions (i.e., the emotion recognition ability) appears to be a prerequisite for empathy (Bird and Viding, 2014; Coll et al., 2017; Happé et al., 2017). In the present study, we thus focused on the narrower construct of emotion recognition ability instead of the more complex construct of empathy. Abundant research has shown that humans are able to correctly identify other humans' emotions (cf. Lange et al., 2022). However, not all people are good at identifying emotions in their counterpart as emotion recognition is impaired in several psychological conditions (e.g., Castellano et al., 2015; Dalili et al., 2015; Yeung, 2022). In light of these findings, we hypothesize that the ability to recognize emotions in other humans, as a prerequisite of empathy, has an influence on the ability to correctly interpret affective states in horses.

Taken together, there are a few studies on the human ability to interpret affective states in horses. However, to date, the question whether horse-experience influences the human ability to interpret equine affective states is not conclusively answered. Moreover, it is unclear whether emotion recognition ability influences the human ability to interpret equine affective states and how the two factors – horse-experience and emotion recognition ability – might interact. The aim of the present study was to fill this gap. We employed an online survey asking participants to interpret 32 different photographs of horses' body language, using an eight-alternatives forced-choice paradigm. In addition, we assessed participants' ability to correctly identify human emotions with the Reading the Mind in the Eyes test (Baron-Cohen et al., 2001; Oakley et al., 2016) and asked participants to provide demographic information (age, gender, horse-experience). We expected horse-experienced participants and participants with a better emotion recognition ability to perform better in interpreting horses' body language (as an indicator for horses' affective states) than horse-inexperienced individuals and participants with lower emotion recognition ability. In addition, we explored whether there was an interaction of emotion recognition ability and previous experience with horses.

2. Methods

All data and code can be found in the Open Science Framework project associated with this study (https://osf.io/fcu9e/). This study was approved by our university's ethics committee (reference number 17–12).

2.1. Sample

We collected data from $N = 299$ participants (216 women, 83 men, 0 diverse with a $Mean_{Age}$ of 33.87 years, $SD_{Age} = 12.82$, range: 18–72).

2.2. Materials and measures

Demographic Questionnaire. We asked participants to answer demographic questions regarding their gender and age. Crucially, we also asked participants about the frequency of their contact with horses. Participants were asked to choose between 1) On a regular basis, 2) Every now and then, 3) Solely during childhood (defined as less than one year of horse experience more than 10 years ago) 4) Passively (e.g., via kids you bring to a riding lesson), and 5) Never.

RMET. To asses participants emotion recognition ability, we employed the revised version of the Reading the Mind in the Eyes Test (RMET; Baron-Cohen et al., 2001; Oakley et al., 2016). In the RMET, 36 photographs of human facial regions around the eyes are presented randomly, one after another. For each of the photographs, the participants are asked to choose which of four adjectives (e.g. joking, serious, alarmed, surprised) best describes what the person in the photograph is feeling or thinking. The presented adjectives vary between the photographs. Correct answers add up to an overall score that ranges from 0 to 36, with higher scores indicating a higher emotion recognition ability. Cronbach's alpha was .52 (values below the conventional minimum acceptable value of.70 are frequently observed for the RMET and it has been argued that this is due to variability in item difficulty or the dichotomous response format; see Higgins et al., 2023 for a recent review). However, the RMET is a well-validated and widely used instrument, which has been employed and validated in several different cultural backgrounds (for a recent large-scale study in 57 different countries see Greenberg et al., 2023).

BIT. To asses participants ability to interpret affective states in horses' body language, we employed a behavioral identification test (BIT). In the BIT, participants were randomly presented with 32 photographs of horses that express different affective states. The photographs were created in collaboration with the Stone Hill Ranch, the collaborating stable of the ISAAT-certified institute for animal assisted education and therapy (Institut für Tiergestützte Ausbildung und Therapie), Saarbrücken Germany and two experienced animal-photographers. To create the photographs, two longtime staff members of the Stone Hill Ranch, with whom the horses were highly familiar, induced different affective states in the horses. Thereby, the two staff members worked with one horse at a time in a round pen and ensured the horses' safety at all times. Two different horses were employed in the study: one purebred Arabian horse and one warm blood horse. Horses were regularly worked in the same round pen and were familiar with the surroundings. To induce nervousness and negative tension, the employees used a plastic bag filled with empty tin cans to make a loud noise that was unfamiliar to the horses. Alternatively, one of the employees threw an inflatable dolphin that was unknown to the horses over the wall of the round pen. The initial expression of nervousness and negative tension was followed either by fear and panic or by defensive behavior, threatening behavior or frustration. To induce attention and positive tension, one of the employees either whistled while standing in some distance or audibly walked around the round pen outside of the horse's sight. Before and after the inductions, the horses were given plenty of time to relax and explore the round pen, which allowed the photographers to take photographs of relaxation and exploration behavior or of neutral behaviors like leisured standing, yawning, flehming, and shaking. Both horses were depicted in each of the different affective states. Horses' body language depicted on the photographs was then judged according to the affective state by two horse experts (one agricultural scientist with a specialization on horse behavior and one equine veterinarian). Images that, according to the (informal) consensus of the two experts, best depicted the behavior were selected for the BIT.

For each of the 32 photographs, presented randomly, one after another, participants were asked to choose the affective state that they assumed behind the horses' body language out of the following list: 1) Defense, Threat, Frustration, 2) Fear, Panic, 3) Attention, Positive Tension, 4) Relaxation, Exploration, 5) Happiness, 6) Nervousness, Negative Tension, 7) Neutral (Neither depicts a positive nor a negative emotion or state), 8) Pout, Being Offended. Correct answers add up to an overall score that ranges from 0 to 32, with higher scores indicating a higher ability to interpret affective states in horses' body language. Importantly, the options 5) Happiness and 8) Pout, Being Offended, were not depicted in any of the 32 photographs as they do not represent typical affective states of horses. We chose to integrate these two distractors to decrease the guessing probability. Furthermore, our experience when employing equine-assisted interventions for horse-inexperienced individuals has shown that horse-inexperienced individuals often misinterpret horses' expressive behavior as pout/being offended or happiness. Out of the options captured in the photographs, options, 1), 2), and 6) describe affective states with a negative valence, the options 3) and 4) describe affective states with a positive valence, whereas option 7) describes neutral affective states. In sum, participants were presented with 11 photographs of negative valence, 11 photographs of positive valence, and 10 photographs of neutral valence. Example stimuli of the BIT are illustrated in Fig. 1.

2.3. Procedure

The study was conducted online using SoSci Survey (Leiner, 2014). Participants participated via QR code or link on their own devices. We advertised the study on campus and via social media. After receiving general information about the procedure of the study and information about the anonymity of data, each participant actively gave their informed consent to participate in our study. Participants first completed the demographic questionnaire, before then completing the RMET and, subsequently, the BIT.

2.4. Statistical analyses

To test our hypotheses and explore a possible interaction of emotion recognition ability and horse-experience, we computed a two-factorial ANOVA with the overall score in the BIT as the dependent variable and the two-levelled factors "Experience" (Experienced vs. Inexperienced) and "Emotion Recognition Ability" (High vs. Low). We defined horse-experienced participants as participants who reported to have contact with horses on a regular basis in the demographic questionnaire and summarized all other participants as horse-inexperienced. This resulted in 140 participants (128 women, 12 men, 0 diverse) classified as experienced and 159 participants (88 women, 71 men, 0 diverse) classified as inexperienced. For creation of the two levels of the factor "Emotion Recognition Ability", we split the RMET overall score at the median. The median of the RMET was 25 (*Mean* = 24.4, *SD* = 3.82, *Min* = 15, *Max* = 35).

For all statistical analyses, we applied the significance criterion of $p < 0.05$. We analyzed the data using R (Version 4.0.4, R Core Team, 2021) and R Studio (Version 1.4.1106; RStudio Team, 2021). Please see the analysis script for the specific packages we used. To assure that our findings are comparable across designs, we report the sizes of our effects as generalized eta-squared η^2_G (an extension of the explained variance R^2; Olejnik and Algina, 2003). This effect size can be compared against the following benchmarks: η^2 =.01, η^2 =.06, η^2 =.014, indicating small, medium, and large effects, respectively (Cohen, 1988).

Fig. 1. BIT Task Example Stimuli. *Note.* Example stimuli of the BIT. The left photograph depicts 3) Attention, Positive Tension, the right photograph depicts 2) Fear, Panic.

3. Results

The ANOVA yielded a significant main effect for Experience (F(1, 295) = 197.74, $p < .001$, $\eta^2_G = .40$), indicating a large effect, with higher BIT scores for experienced (M = 14.83, SD = 3.36) than for inexperienced participants (M = 9.55, SD = 3.28). Further, the ANOVA yielded a significant main effect for Emotion Recognition Ability (F(1, 295) = 16.33, $p < .001$, $\eta^2_G = .05$), indicating a small effect, with higher BIT scores for participants with a high emotion recognition ability (M = 12.65, SD = 4.03), than for participants with a low emotion recognition ability (M = 11.55, SD = 4.33). The two-way interaction for Experience × Emotion Recognition Ability did not reach significance (F(1, 295) = 1.54, $p > .215$). The results are illustrated in Fig. 2.

To assess the robustness of our results, we altered our definition of experienced and inexperienced participants. This time, to create two more extreme groups, participants that reported to have contact with horses every now and then were excluded from the group of inexperienced participants. This resulted in 140 participants (128 women, 12 men, 0 diverse) classified as experienced and 116 participants (60 women, 56 men, 0 diverse) classified as inexperienced. This new allocation did not influence the pattern of results yielded by the ANOVA. Again, there was a significant main effect for Experience (F(1, 252) = 216.27, $p < .001$, $\eta^2_G = .46$), indicating a large effect, with higher BIT scores for experienced (M = 14.83, SD = 3.36) than for inexperienced participants (M = 9.20, SD = 2.96) and a significant main effect for Emotion Recognition Ability (F(1, 252) = 15.50, $p < .001$, $\eta^2_G = .06$), indicating a medium effect, with higher BIT scores for participants with a high emotion recognition ability (M = 12.83, SD = 4.17), than for participants with a low emotion recognition ability (M = 11.74, SD = 4.26). Again, the two-way interaction for Experience × Emotion Recognition Ability did not reach significance (F(1, 252) = 1.63, $p > .202$).

To assess the robustness of our results in light of the unequal distribution of women and men among the experienced participants, we excluded all male participants from both the experienced and inexperienced group (as defined initially, i.e., horse-experienced participants were defined as participants who reported to have contact with horses on a regular basis in the demographic questionnaire and all other participants were summarized as horse-inexperienced) and reanalyzed our data. This resulted in 128 participants (128 women, 0 men, 0 diverse) classified as experienced and 88 participants (88 women, 0 men, 0 diverse) classified as inexperienced. The ANOVA yielded the same pattern of results as before. Again, there was a significant main effect for Experience (F(1, 212) = 111.39, $p < .001$, $\eta^2_G = .34$), indicating a large effect, with higher BIT scores for experienced (M = 14.93, SD = 3.35) than for inexperienced participants (M = 10.27, SD = 3.23). Further, the ANOVA yielded a significant main effect for Emotion Recognition Ability (F(1, 212) = 7.35, $p = .007$, $\eta^2_G = .03$), indicating a small effect, with higher BIT scores for participants with a high emotion recognition ability (M = 13.35, SD = 3.95), than for participants with a low emotion recognition ability (M = 12.77, SD = 4.06). Again, the two-way interaction for Experience × Emotion Recognition Ability did not reach significance (F(1, 212) = 0.10, $p > .756$).

On an exploratory basis, we counted answers as correct, if the valence of the emotions or states depicted in the photograph was judged correctly and computed the same analysis as before. That is, we counted answers as correct if the chosen option had the same valence as the correct response. For instance, for a photograph depicting fear or panic the options “1) Defense, Threat, Frustration“ and “6) Nervousness, Negative Tension” (i.e., the other options with a negative valence) also counted as correct answers. This analysis yielded the same pattern of results as before. Again, there was a significant main effect for Experience (F(1, 295) = 105.08, $p < .001$, $\eta^2_G = .26$), indicating a large effect, with higher BIT scores for experienced (M = 17.91, SD = 3.26) than for inexperienced participants (M = 13.89, SD = 3.59). Further, the ANOVA yielded a significant main effect for Emotion Recognition Ability (F(1, 295) = 12.68, $p < .001$, $\eta^2_G = .04$), indicating a small effect, with higher BIT scores for participants with a high emotion recognition ability (M = 16.40, SD = 3.83), than for participants with a low emotion recognition ability (M = 15.29, SD = 4.03). Again, the two-way interaction for Experience × Emotion Recognition Ability did not reach significance (F(1, 295) = 2.49, $p > .115$).

To further explore our data, we also analyzed the distractor options of the BIT (i.e., the options "5) Happiness" and "8) Pout, Being Offended"). A two-factorial ANOVA with the number of times a distractor option was chosen in the BIT as the dependent variable and the two two-levelled factors “Experience” (Experienced vs. Inexperienced) and “Emotion Recognition Ability” (High vs. Low), yielded a significant main effect for Experience (F(1, 295) = 67.34, $p < .001$, $\eta^2_G = .19$), indicating a large effect, with experienced participants choosing distractor options less often (M = 3.41, SD = 2.19) than inexperienced participants (M = 5.87, SD = 2.91). Further, the ANOVA yielded a significant main effect for Emotion Recognition Ability (F(1, 295) = 8.50, $p = .004$, $\eta^2_G = .03$), indicating a small effect, with participants with a high emotion recognition ability choosing distractor options less often (M = 4.33, SD = 2.78), than participants with a low emotion recognition ability (M = 5.02, SD = 2.91). The two-way interaction for Experience × Emotion Recognition Ability did not reach significance (F(1, 295) = 1.63, $p > .202$).

4. Discussion

The present study aimed to investigate whether humans are able to correctly interpret horses' affective states. In line with our hypotheses,

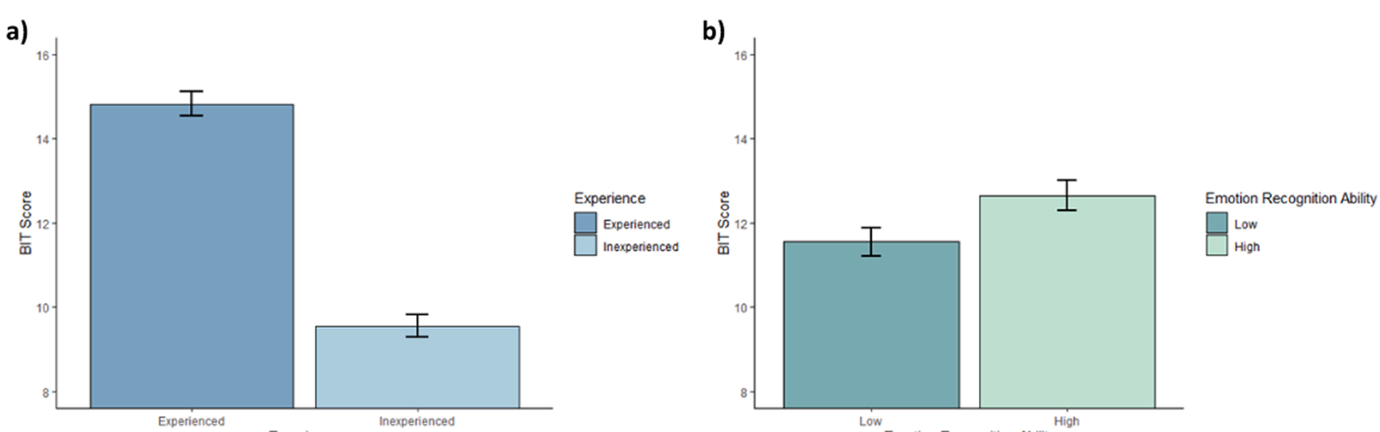

Fig. 2. Main Results. *Note.* Main effects for a) Experience and b) Emotion Recognition Ability on the BIT score. Error bars depict standard errors.

we found (1) that horse-experienced individuals performed better in interpreting affective states in horses' body language than horse-inexperienced participants and (2) that participants with a high emotion recognition ability performed better at interpreting horses' affective states than participants with a low emotion recognition ability. Importantly, the effect of horse-experience on the interpretation of affective states was much stronger than the effect of emotion recognition ability. Furthermore, we did not find evidence for an interaction of emotion recognition ability and horse-experience. Notably, our results proved robust against alterations in our definitions of "experienced" and "inexperienced" as well as against alterations in the distribution of male and female participants in both of these groups. Moreover, we found the same pattern of results in an exploratory analysis, in which we defined correct answers in terms of correctly judged valence instead of correctly judged emotion. In addition, and supporting the previous findings, our exploratory analysis of the distractor items showed that experienced participants and participants with a high emotion recognition ability chose distractor items less often than inexperienced participants and participants with a low emotion recognition ability, respectively.

Our result that horse-experienced individuals performed better in interpreting horses' affective states than horse-inexperienced participants are in line with previous findings that show that previous experience with horses does have an influence on the interpretation of affective states in horses' body language (Bell et al., 2019: Gronqvist et al., 2017; Guinnefollau et al., 2019; Fox, 2023). However, our results stand in contrast to previous studies that show that horse-experience does not have an influence on participants' ability to correctly identify the valence of horses' vocalisations (Merkies et al., 2022, Greenall et al., 2022). While all of the above referenced studies aimed to assess the human ability to correctly interpret affective states in horses, most studies (including our study) used body language as indicators of horses' affective states, while both Merkies and colleagues (2022) and Greenall and colleagues (2022) used vocalizations. Both horses and humans use vocalizations and body language to communicate emotions. However, horse communication is primarily based on body language, while human communication is primarily based on vocalizations. Consequently, it is reasonable to assume that humans are generally better at identifying vocalizations than body language in other mammals. Thus, the role of previous experience with horses may be stronger for body language than for vocalizations. To test this hypothesis, future research could directly compare the ability to identify horses' vocalizations and horses' body language in large samples of participants with and without horse-experience.

Our finding that participants with a high emotion recognition ability (as a prerequisite of empathy; Bird and Viding, 2014; Coll et al., 2017; Happé et al., 2017) performed better at interpreting horses' expressive behavior than participants with a low emotion recognition ability is in line with the previous result that empathy is linked to a better ability to identify emotions in different ungulates, including horses (Greenall et al., 2022). Interestingly, in our sample, the effect of horse-experience was much stronger (as indicated by a large effect size) than the effect of general emotion recognition ability (as indicated by a small effect size). Thus, our findings indicate that the ability to read emotions in other humans may play a role in the recognition of emotions in animals, but at least in our sample, the previous experience with a species was a more important factor.

Importantly, a closer look at our data reveals that even horse-experienced individuals correctly interpreted only about 50%, while horse-inexperienced individuals correctly interpreted about 30% of the depicted behaviors (with a guessing probability in the eight-alternatives forced-choice paradigm of 12.5%). Thus, our results suggest that, although horse-experienced individuals may be better at identifying equine expressive behavior, the identification rate is far from perfect. One may argue that the identification rate is low due to task difficulty. However, in our exploratory analysis, in which we defined correct answers in terms of correctly judged valence (instead of correctly judged emotion), we found only slightly higher identification rates for horse-experienced individuals (about 60%). The finding that identification is far from perfect (and does not seem to be dependent on the task difficulty) is of particular importance for all equine activities, including equine-assisted therapies, since the recognition of emotions in horses is a prerequisite for effective communication and bonding between humans and horses and for the safety of equine activities.

4.1. Limitations

A few limitations of our study have to be taken into account. First, we employed photographs of horses depicting their body language in different situations as stimulus material. We decided to use photographs, because our instrument to assess the emotion recognition ability in humans also relied on photographs and thus we were able to create very similar task for the recognition of human and horse emotions. Nevertheless, since nonverbal communication is such a complex and dynamic process, it may be desirable for future studies to employ video sequences instead of photographs to obtain a more realistic representation of horses' expressive behaviors.

Second, even though we included men and women in our study, the vast majority of our participants self-identified as women. Thus, future studies should aim for gender-balanced samples to be able to generalize findings to self-identified men.

Third, our recruiting procedure may have led to a biased sample, as we selectively recruited participants via social media and on the Campus of Saarland University. Thus, our findings may not be generalized to the general population. Furthermore, our assessment method relied solely on self-report. Future studies should also include other measures. For example, it would be interesting to assess physiological measures as indicators of emotional contagion. Finally, we categorized participants as inexperienced and experienced according to the frequency of their contact with horses, which might not completely match with the actual horse-experience. Future studies should additionally include a subjective assessment of horse experience (e.g. How highly do you rate your experience with horses?) measured on a Likert-scale.

5. Conclusion

In the present study, horse-experienced individuals performed better in interpreting horses' body language than horse-inexperienced participants and participants with a higher emotion recognition ability performed better in interpreting horses' body language than participants with a lower emotion recognition ability. In light of diverging findings regarding the role of previous experience from previous studies and considering the fact that horse communication is primarily based on body language, while human communication is primarily based on vocalizations, we hypothesize that the role of previous experience with horses may be stronger for body language than for vocalizations as indicators of horses' emotions. We call future research to test this hypothesis.

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CRediT authorship contribution statement

Sopp Marie Roxanne: Writing – review & editing. **Michael Tanja:** Resources, Supervision, Writing – review & editing. **Link-Dorner Ulrike:** Resources, Writing – review & editing. **Lass-Hennemann Johanna:** Conceptualization, Project administration, Supervision, Writing – original draft, Writing – review & editing. **Braun Moritz Nicolai:** Data curation, Formal analysis, Project administration, Visualization, Writing – original draft, Writing – review & editing. **Müller-**

Klein Alicia: Conceptualization, Investigation, Writing – review & editing, Project administration.

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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