

# A Close Look at Equine Social Cognition: Working Horses and Their Responses to Familiar and Unfamiliar Humans

**Dr Bhavin Dhanavade<sup>1\*</sup>, Pankaj Saraswat<sup>2</sup>, Taskeen Zaidi<sup>3</sup>**

<sup>1\*</sup>Associate Professor, Department of Drvyaguna Vignana, Parul Institute of Ayurved and Research, Parul University, Vadodara, Gujarat, India, Email Id- bhavin.dhanavade86161@paruluniversity.ac.in, Orcid Id- 0000-0003-0587-9985

<sup>2</sup>Department of Computer Science & Engineering, Sanskriti University, Mathura, Uttar Pradesh, India, Email Id- pankajsaraswat.cse@sanskriti.edu.in, Orcid Id- 0009-0005-5532-0858

<sup>3</sup>Associate Professor, Department of Computer Science and Information Technology, Jain (Deemed to be University), Bangalore, India, Email Id- t.zaidi@jainuniversity.ac.in, Orcid Id- 0000-0002-1716-9262

## Abstract

Equine social cognition is a developing subject that investigates horses' cognitive ability to recognize and respond to human social indicators. This study examined working horses' behavioral responses to humans, whether they react to strangers, and whether these behaviors are linked to health or management-related welfare measures. The information was gathered through observational investigations and controlled tests, which ensured a variety of situations to detect subtle horse social reactions. This study was performed using SPSS, ANOVA to evaluate group differences, and Spearman tests to investigate any relationships between certain variables. In the walk-by and chin contact tests, horses showed indifference to human interaction and avoidance, respectively. When compared by test, horses' answers to the assessor differed from the owner's. Although some were highly significant, behavioral markers and descriptive and health-related factors exhibited low correlation coefficients. The horses' depressed attitudes and the existence of deep bodily lesions were shown to be most strongly correlated. According to the study, horses who have inflamed tendons and joints are more aggressive, and horses who are wearing shoes that are too small are avoidant or afraid. Along with displaying avoidance or fearfulness, older horses were to be numb to their owner's approach. Working horses' undesirable habits are associated with improper handling and husbandry techniques.

**Keywords:** Working Horses, Cognitive Ability, Horse Welfare, Human-Related Behavior

## INTRODUCTION

Horses were domesticated more than five thousand years ago. The domestication of horses and the ensuing revolution in mobilization were two key factors that propelled human civilization forward. The human-horse connection has been one of intimate cooperation and communication, with both species learning to read and respond to nonverbal indications such as body language, eye contact, and vocalizations. However, horses' sensitivity to human emotional cues in situations of ambiguity is mostly unknown (1). The connection between horses and humans might be improved with information about horses' abilities to adapt their behavior to their surroundings by using human feelings. Cooperation between animals and humans dates back thousands of years. In these kinds of scenarios, human-animal communication depends on the animal's receptivity to nonverbal clues. One of the first forms of nonverbal communication that infants exhibit is manual pointing, which is a kind of referential communication that allows people to convey intentions (2). Nowadays, it's not uncommon to see horses used in adapted sports, classrooms, and healthcare. Horses' amiability is a major selling point for them. For a long time, those who work in the field of mental and behavioral healthcare with horses have maintained that relational components drive the therapeutic change that takes place during encounters between humans and horses. In recent

years, there has been a rise in interest in equine-assisted services (EAS), with most empirical investigations examining EAS's usefulness in people's medical treatments (3). Nevertheless, there is a significant lack of information about the factors, such as behavior and temperament, that can influence or be predicted by a horse's ability to be an effective assistance animal. In addition, information on the physical and mental wellbeing of EAS horses is necessary for monitoring the potential effects of these activities on their wellbeing. Thus, it should come as no surprise that horses have expanded their human uses beyond mere labor to include athletes and beloved riding partners (4). Mutual perception emerges from reciprocal behavior in human-animal relationships, which are thought to be dynamic processes. Consistent interactions provide the basis of the connection, which can either strengthen or weaken it over time. Positive interactions and consistency are said to be the keys to developing a human-horse connection that benefits both species. Few researchers have examined the impact of HHIs on horses despite the abundance of evidence indicating their potential benefits to humans, particularly in the context of equine-assisted treatments (5). Animals and people alike are in danger due to the absence of standardized testing for how different HHIs, such as treatment, might affect animal welfare. Evaluating an animal's mental health is more difficult than evaluating its physical health, which are very simple. Behavior cannot be the best indicator of mental health in horses because of their domestication and the ease which they can be taught to tolerate the unpleasant stimuli used in HHIs. It is possible to determine a horse's mental state using physiological data gathered during HHIs. For a long time, horses were mostly seen as agricultural animals, serving as labor horses. Throughout history, horses have served as companions, athletes, and therapy animals (6). The field of cognitive psychology studies minds work from the moment an external stimulus enters the environment to the moment act in reaction. Over the last several decades, research into cognitive processes has made great strides using animal models for two main reasons: One has to do with the goals of comparative psychology, to get a better understanding of cognitive processes by comparing and contrasting human and animal thinking. The second concern is the objectives of cognitive ethnology, which seek to comprehend mental operations as a reaction to ecological and ethological limitations, especially those pertaining to evolution (7). Research into animal cognition seeks to shed light on "the way animals perceive, manage, gain, store and act upon knowledge originating from their environment" in both instances. The close relationship between thinking and feeling has been shown time and time again in studies of cognitive psychology. Cognitive (attention, memory, and judgment) biases are common in mental health issues, and long-term pain can have an impact on these areas as well (8). Horses are deeply ingrained in many cultures and have great symbolic value for many more. Although vehicles and other machines have supplanted horses in the previous century, equines continue to play an important part in society in a variety of capacities, including transportation, labor, combat, and recreation (9). Gaining a deeper comprehension of horses' perceptions and adaptations to human interactions is crucial for their shift from being used as vehicles to becoming companions or therapy animals. When working with horses, it can be helpful to employ a variety of interactions as reinforcements, as research in anthrop zoology supports the use of various incentives to enhance interspecies cooperation. In a choice experiment, canines choose human interaction above food incentives, according to canine-human research (10). Therapeutic EAS aim to improve human health and wellness via interactions between humans and horses. Individuals at risk for mental and emotional health issues can exhibit dysfunctional connections and lack adequate social skills, which can make human-horse interaction in EAS less than effective. During an equine-facilitated learning (EFL) program, this research examines how the physiological responses and behavioral patterns of horses are impacted by the attachment style (AS) of adolescents at risk (11). People of various species are able to recognize one another's emotions. Nevertheless, much research on the topic of interspecies emotional communication has concentrated on auditory and visual cues, with the sense of smell receiving comparatively little attention. Consequently, they set out to determine if horses react differently to human fear odors compared to non-fear odors To determine whether the interactions between horses and humans meet the requirements for an attachment bond, the research looked at how horses react to new things and when handled (12-13). Additional research is necessary to fill gaps in knowledge of horse-human interactions since there was substantial individual variance in the horses' replies (14). The importance of assessing horses' stress tolerance

during exercise cannot be overstated, if they are to preserve and enhance their wellbeing. This article provides a summary of the research that has been done on EAS. This review summarizes the existing research on the topic of EAS using horses, with a particular emphasis on the effects on horses rather than people (15). Indirectly impacting their utility and wellbeing are the general characteristics of independence and bravery in domestic horses. Findings demonstrated that horses differ in their independence and boldness associated with age (16). An increasing number of seniors are choosing assisted living as a means to sustain their bodily and emotional wellbeing. The Hacienda at the River Senior Living complex began an onsite equestrian program after learning that guided equine encounters can be beneficial for seniors. While one horse relaxed, the other two exhibited no discernible changes in HR or HRV. Sixteen pairs of horses and humans showed signs of social connectedness throughout sessions, including synchronized HRV peak frequencies (17). Because of its importance in developing the horse's responsiveness and flexibility, straightening the horse has been a primary focus of training in several equestrian sports for generations. Nevertheless, asymmetrical bodies, motor laterality, and sensory laterality are all aspects of laterality that occur naturally in horses (18). Further, it has been postulated that people experience psychological imbalance as a result of forcing themselves to counterbalance their motor laterality. To go further into this, the research on the role and origins of sensory and motor laterality in horses, particularly that taught on the ground or with a rider (19), was combed through.

## **MATERIALS AND METHOD**

The study elucidates how horses negotiate social connections by observing and analyzing data, with a focus on their capacity to differentiate between people. The study delves into several reactions, such as shyness, aggression, friendliness, apathy, curiosity, and playfulness, providing light on the complex dynamics of human-horse interactions. In addition to advancing the field of equine social intelligence, the findings have practical implications for handling and training working horses, possibly enhancing their performance and well-being in human-centered settings.

### **Dataset collection**

There were 451 horses in the dataset, including 12 geldings, 61 mares, and 81 stallions. During the day, all of the horses were checked to make sure everything was equal at a number of marketplaces and along the side of the road. Based on the chronological ages of the horses, three age groups were identified: young ( $n = 50$ ), medium-aged ( $n = 350$ ), and elderly ( $n = 100$ ).

### **Statistical Analyses**

There were three tests that the owner and assessor ran on the horses, and for each one, they determined the horses' behavioral responses to humans. The percentage of horses whose behavior was constant towards the owner and assessor throughout three tests was determined. The purpose of comparing these results was to find out whether the familiarity of the tester affected the horses' behavior. Spearman rank correlations were calculated to look at the relationship between responses to behavior and satisfaction indicators connected with leadership or healthcare. Statistical Package for the Social Sciences (SPSS) was used in this investigation, along with ANOVA to assess group differences and Spearman tests to look into potential correlations between certain variables.

### **Considered Metrics**

In this investigation of working horses, three categories of variables were examined: health-related, descriptive, and behavioral.

### Health-Related Indicators

Based on their location, three different kinds of lesions were identified as indicators of specific welfare issues in this research. So, lesions at the corners of the lips could mean that the bit isn't fitting properly; lesions at the points where the harness touches the body are usually a sign of inadequate fitting or misuse of the saddle; Injuries at the hip points can indicate that the horses' sleeping areas are unforgiving, without bedding, or on harsh, abrasive surfaces. These issues tend to worsen when the horses' overall health is poor. It was believed that excrement on the side of the rump indicated that the barn flooring, where the horses slept, had not been adequately cleaned, and that feces under the tail indicated that the horse had diarrhea.

### The Horse Owners' Questionnaire as a Descriptive Indicator

Table (1) displays the evaluated descriptive indicators together with the possible notations for them. After obtaining the owners' consent to participate in the research, this data was captured using a brief questionnaire.

**Table (1).** Horse owner questionnaire

(Source: author)

The Classification of Variables	Explanation
<b>Age</b>	
<4/4-16/>16 years	Documented in line with the owners' statement
In the companionship of other animals, such as horses, not one, not a single horse	Documented in line with the owners' statement
Easy access to potable water If not twice a day, then three times daily, or as needed	Documented in line with the owners' statement
<b>Gender</b>	
sex, gender, and castration	Recorded by examination of the evaluated horses' external genitalia
Field of equestrian activity Physical exertion	Plowing, forestry labor (wood carrying), heavy cart pulling (e.g., building materials, stone, gravel, bricks, sand), and at least 150 d/yr
Mild labor	A little bit of heavy lifting and light cart hauling once a week at most
Easy tasks	One hundred days per year of light cart hauling, moving people or various commodities
<b>Access to free exercise</b>	
No one	Indefinite tethering: summertime tethered grazing within the barn
Imperfect	During the summer, horses should have unrestricted access to free pasturing and a spacious outside arena that can accommodate various gait types (at least 1 hour per day, six months per year). Fixed dwellings for the duration that remains
Unrestrained	Affordable home for at least nine months each year with a yard big enough to practice rolling and other gait exercises

## Measuring Behavior

The data recorder assessor made note of the horses' overall alertness, while the other assessor took note of the owner's questionnaire responses. The evaluator kept track of the horses' reactions while instructing their owners to follow the same protocol. We were able to capture the horses' responses to a known individual in this manner. Horses' responses to humans were categorized as "aggressiveness and "avoidance/fear. Ears moving, lips relaxed, eyes partially closed, or "friendliness." Display a relaxed face, wide eyes, forward ears, and no wrinkling around the lips or nose.

## RESULT

### Equine Welfare Indicators and Their Correlations with Human Behavior

Horses that exhibit positive correlations between their behavior and markers of welfare towards people exhibit things like responsive obedience, eagerness to participate in activities, and calm body language. Negative interactions could show themselves as aggressiveness, fear, or stress, which are all symptoms of diminished wellbeing and damaged interpersonal connections.

### General Awareness and Its Correlation with Other Social Welfare Measures

There are strong relationships between the horses' level of general awareness and the other variables, as seen in Table (2). Depression and deep body lesion occurrence were the only variables for a correlation coefficient greater than 0.4 was discovered. The horses that were evaluated, only 2.66% had a generalized depressed mental state, meaning they were less receptive to environmental cues.

**Table (2).** Significant relationships exist between horse alertness, depression, and health-related wellbeing measures

(Source: author)

Alertness and Health Indicators	$r_s$
Heavy work	0.12 <sup>a</sup>
Gait, abnormal	0.09 <sup>b</sup>
Company, none	0.10 <sup>b</sup>
thin , BCS	0.12 <sup>a</sup>
deep , Body lesions	0.36 <sup>a</sup>

### Examining the Relationships among Human Behavior and Physical Health Welfare indicator

In Table (3), the significant associations varied between the familiar owner and the unknown assessor and across the three tests (Spook and Standstill test). Only the negative connection between horses' Spook test indifference to the assessor and deep body lesions had a  $p > 0.3$  correlation coefficient for the assessor method; there were at least 0.15 connection coefficients for dyspnea, aching tendons/joints, thin body condition score, deep body lesions, insufficient horseshoes, and aberrant coat condition. Not all indicators were consistently connected with various actions in the same or different experiments. Horses who were either barefoot or wore inadequate footwear exhibited either apathetic or friendly behavior towards the evaluator in all three trials, with the exception of the standstill test, when the absence of shoes produced a positive response.

**Table (3).** Horses' behavioral responses were statistically associated with human health-related wellbeing indicators

(Source: author)

Assessor Approach	$r_s$	Owner Approach	$r_s$
<b>Avoidance/fear</b>			
Unusual condition of the hoof horn	0.0.10 <sup>a</sup>	Tears in the eye, greenish	0.11
Joints and tendons that are swollen	0.10 <sup>a</sup>	There are swollen tendons and joints	0.18
Present with harness sores	0.11 <sup>a</sup>	Long/short feet, absent	0.14
No lesions on the lips.	0.09 <sup>a</sup>	Sole appear, uncharacteristic	0.09
Surface lesions on the body	0.10 <sup>a</sup>	superficial body lesions	0.10
Good, BCS	-0.08 <sup>a</sup>	thin ,BCS	0.09
Lack of proper horseshoes	0.11 <sup>a</sup>		
<b>Friendliness</b>			
Lesions on the foot, superficial	-0.15 <sup>b</sup>	superficial lesions of the foot	-0.09
My coat is in good shape	0.13 <sup>a</sup>	Coat condition, normal	0.12
No sign of harness sores	0.11 <sup>a</sup>	Absence of harness sores	0.10
absent , Lacking proper horseshoes,	0.18 <sup>b</sup>		
absent, varying lengths of hoof	0.12 <sup>b</sup>	thin , BCS	-0.15
Tears in the eye, greenish	-0.11 <sup>a</sup>	Normal gait	0.09
fat ,BCS	0.91 <sup>a</sup>	Fat, BCS	0.09
<b>Aggressiveness</b>			
Lesions on the lips present	0.09 <sup>a</sup>		
Dyspnea, present	0.16 <sup>b</sup>	There are not enough horseshoes	0.12
Irritated joints and tendons	0.10 <sup>a</sup>	swollen joints and tendons	0.09
<b>Indifference</b>			
Lesions on the lips present	0.09 <sup>a</sup>	thin , BCS	0.10
Subpar footwear, absent	0.09 <sup>a</sup>	good , BCS	-0.12
Hip lesion cases, absent	0.09 <sup>a</sup>	Absent, Hip lesions	0.12
<b>Play fullness</b>			
Lesions on the lips, absent	0.10 <sup>a</sup>	sole area, abnormal	0.10
Pressure ulcers, absent	0.12 <sup>a</sup>	Sores on the harness, absent	0.11
<b>Curiosity</b>			
Dyspnea, present	0.17 <sup>b</sup>	There are not enough horseshoes	0.13
Surface lesions of the foot	-0.16 <sup>b</sup>	superficial lesions of the foot	-0.10
Present with harness sores	0.12 <sup>a</sup>	Hooves: missing, long or short	0.15

**Human-Related Behavior Prevalence and Variations in Behavior towards Familiar and Unknown People**

Table (4) shows the prevalence of horses' four reactive behaviors toward humans. The percentage of animals act similarly toward the owner and assessor is also indicated. The assessor had less indifferent responses from horses in two tests, which included individuals approaching and walking with horses, than the owner. The findings showed a higher level of avoidance/fearfulness and polite responses. It is unsettling since spook and standstill tests reveal considerable degrees of human aversion. The discoveries of two separate tests, the Spook test and the Stand Still test, which were performed on 450 horses, are shown in Table (2) and Figure (1). The reactions are arranged

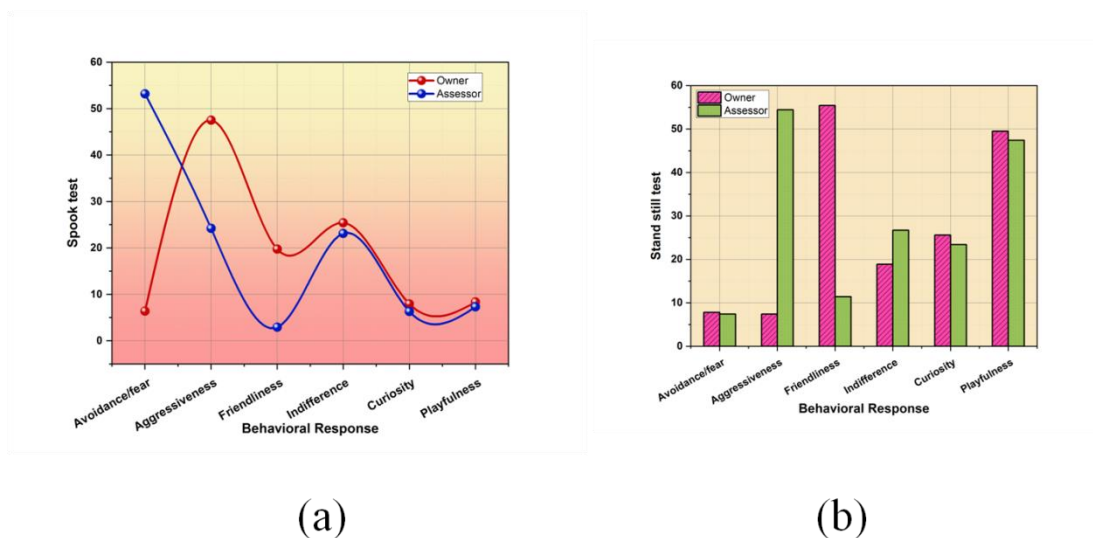


according to several personality attributes, including aggression, friendliness, apathy, curiosity, playfulness, and avoidance/fear. Both the owner and the assessor spent a certain amount of time engaging in each activity during the testing, and the numerical numbers reflect that. During the Spook test, the examiner noted heightened levels of shyness and playfulness, in contrast to the owner's reports of friendliness and aggression. The owner reported heightened avoidance/fear and playfulness throughout the Stand Still test, whereas the assessor found raised levels of aggression and friendliness. The significance of different viewpoints in behavioral evaluations is underscored by these results, which imply that the owner and an outsider can have different interpretations of the subject's actions.

**Table (4).** Human-related replies as a percentage of 450 horses in each assessment exam

(Source: author)

Behavioral Response	Spook test		Stand still test	
	Owner	Assessor	Owner	Assessor
Avoidance/fear	6.38	53.21	7.82	7.42
Aggressiveness	47.52	24.2	7.42	54.43
Friendliness	19.75	2.93	55.43	11.43
Indifference	25.42	23.12	18.89	26.72
Curiosity	7.95	6.3	25.62	23.41
Playfulness	8.37	7.32	49.51	47.41



**Figure (1).** Human-Related Behavior Prevalence and Variations

(Source: author)

## DISCUSSION

The study adds to the growing body of evidence from the world about the physical and mental wellbeing of working horses. This topic has received a lot of attention. According to some experts, these animals can evolve physiological

adaptations to deal with specific living and working environments. Similarly, working horses' behavioral reactions reflect the impact of their unique living environment, which includes the resources available to them, the responsibilities and expectations placed on them, and the humans in their immediate vicinity. An animal's preexisting connection with humans, shaped by its experiences with humans in the past, determines how it sees human contact. Therefore, it is reasonable to assume that the specific geocultural conditions, the temperamental features of the horses (both individual and breed-related), and the methods of interaction employed by owners and caregivers will play a role in modulating the frequency and kind of human-related responses observed in working horses. In this research, horses were considered to be indifferent if they showed no signs of fear or pleasure in response to the testing environment and if they also had a negative attitude. From this perspective, the chin contact test showed more indifference to the examiner than the spook test. Figure (1) indicates in all three tests, horses that disobeyed the assessor's instructions and those who reacted to their owner had similar percentages. Even when the horses were friendly toward people, they showed a lack of interest when watered twice a day. The research also found that horse owners need to take more care to provide their horses with the daily free exercise that is essential for good health and which can't be substituted by the activity that is required for employment. Adverse effects on horses' wellbeing and mental health can result from limiting or eliminating their chances to engage in natural activities.

## CONCLUSION

This research and others show that working horses' wellbeing and human-related behavioral profiles depending on their working, environmental, and farming situations. The high frequency of adverse behavioral reactions to people (aggression, avoidance/fear) is problematic, especially considering that the horses in our research were evaluated in their typical working environments. There were significant variations in the horses responded to the unfamiliar assessor and their familiar owner, according to the findings of the individual behavioral tests. As a result, two-way comparison testing of this kind is more appropriate and meaningful than the assessor-only evaluation of the horses. The analyzed working horses' unpleasant behaviors stemmed from the various health and management difficulties that were relevant to their attitudes toward humans. Horse owners' desire and propensity to care for their horses, rather than their financial capabilities, are the key to solving some of the difficulties.

## REFERENCE

- [1] Schrimpf, A., Single, M. S., & Nawroth, C. (2020). Social referencing in the domestic horse. *Animals*, 10(1), 164. DOI: <https://www.mdpi.com/2076-2615/10/1/164>.
- [2] Liehrmann, O., Cosnard, C., Riihonen, V., Viitanen, A., Alander, E., Jardat, P., & Lansade, L. (2023). What drives horse success at following human-given cues? An investigation of handler familiarity and living conditions. *Animal Cognition*, 1-12. DOI: <https://doi.org/10.1007/s10071-023-01775-0>.
- [3] Brubaker, L., Schroeder, K., Sherwood, D., Stroud, D., & Udell, M. A. (2021). Horse behavior towards familiar and unfamiliar humans: Implications for equine-assisted services. *Animals*, 11(8), 2369. DOI: <https://www.mdpi.com/2076-2615/9/12/1030>.
- [4] Scopa, C., Contalbrigo, L., Greco, A., Lanatà, A., Scilingo, E. P., & Baragli, P. (2019). Emotional transfer in human-horse interaction: new perspectives on equine assisted interventions. *Animals*, 9(12), 1030. DOI: <https://www.mdpi.com/2076-2615/11/8/2369>.
- [5] Kelly, K. J., McDuffee, L. A., & Mears, K. (2021). The effect of human-horse interactions on equine behaviour, physiology, and welfare: A scoping review. *animals*, 11(10), 2782. DOI: <https://doi.org/10.3390/ani11102782>.
- [6] Mellor, D. J., Beausoleil, N. J., Littlewood, K. E., McLean, A. N., McGreevy, P. D., Jones, B., & Wilkins, C. (2020). The 2020 five domains model: Including human-animal interactions in assessments of animal welfare. *Animals*, 10(10), 1870. DOI: <https://doi.org/10.3390/ani10101870>.



- [7] Hausberger, M., Stomp, M., Sankey, C., Brajon, S., Lunel, C., & Henry, S. (2019). Mutual interactions between cognition and welfare: The horse as an animal model. *Neuroscience & Biobehavioral Reviews*, 107, 540-559. DOI:<https://doi.org/10.1016/j.neubiorev.2019.08.022>.
- [8] Lyon, P., Keijzer, F., Arendt, D., & Levin, M. (2021). Reframing cognition: getting down to biological basics. *Philosophical Transactions of the Royal Society B*, 376(1820), 20190750. DOI:<https://doi.org/10.1098/rstb.2019.0750>.
- [9] Kieson, E., Felix, C., Webb, S., & Abramson, C. I. (2020). The effects of a choice test between food rewards and human interaction in a herd of domestic horses of varying breeds and experiences. *Applied Animal Behaviour Science*, 231, 105075. DOI:<https://doi.org/10.1016/j.applanim.2020.105075>.
- [10] Westcott, R., Ronan, K., Bambrick, H., & Taylor, M. (2017). Expanding protection motivation theory: investigating an application to animal owners and emergency responders in bushfire emergencies. *BMC psychology*, 5, 1-14. DOI:<https://doi.org/10.1186/s40359-017-0182-3>.
- [11] Arrazola, A., & Merkies, K. (2020). Effect of human attachment style on horse behavior and physiology during equine-assisted activities—A pilot study. *Animals*, 10(7), 1156. DOI:<https://doi.org/10.3390/ani10071156>.
- [12] Sabiniewicz, A., Tarnowska, K., Świątek, R., Sorokowski, P., & Laska, M. (2020). Olfactory-based interspecific recognition of human emotions: Horses (*Equus ferus caballus*) can recognize fear and happiness body odour from humans (*Homo sapiens*). *Applied Animal Behaviour Science*, 230, 105072. DOI:<https://doi.org/10.1016/j.applanim.2020.105072>.
- [13] Hartmann, E., Rehn, T., Christensen, J. W., Nielsen, P. P., & McGreevy, P. (2021). From the horse's perspective: investigating attachment behavior and the effect of training method on fear reactions and ease of handling—a pilot study. *Animals*, 11(2), 457. DOI:<https://doi.org/10.3390/ani11020457>.
- [14] Monterrubio, C., Dashper, K., & Hernández-Espinosa, R. (2023). Human-Horse Relationships, Horse Welfare, and Abuse in Mexico: A Social Representation Approach. *Society & Animals*, 1(aop), 1-20.
- [15] Ferlazzo, A., Fazio, E., Cravana, C., & Medica, P. (2023). Equine-assisted services: An overview of current scientific contributions on efficacy and outcomes on humans and horses. *Journal of Veterinary Behavior*, 59, 15-24. DOI:<https://doi.org/10.1016/j.jveb.2022.11.010>.
- [16] Burattini, B., Fenner, K., Anzulewicz, A., Romness, N., McKenzie, J., Wilson, B., & McGreevy, P. (2020). Age-related changes in the behavior of domestic horses as reported by owners. *Animals*, 10(12), 2321. DOI:<https://doi.org/10.3390/ani10122321>.
- [17] Baldwin, A. L., Rector, B. K., & Alden, A. C. (2021). Physiological and behavioral benefits for people and horses during guided interactions at an assisted living residence. *Behavioral Sciences*, 11(10), 129. DOI:<https://doi.org/10.3390/bs11100129>.
- [18] Krueger, K., Schwarz, S., Marr, I., & Farmer, K. (2022). Laterality in horse training: Psychological and physical balance and coordination and strength rather than straightness. *Animals*, 12(8), 1042. DOI:<https://doi.org/10.3390/ani12081042>.
- [19] Kuhnke, S. (2020). Horse's laterality: methods of determination, genetic aspects, interaction with human handedness and the influence on horse-rider communication, horse's muscle status, sport success and risk of injury.