Article

Individual Responses in the Domestic Horse Regarding Human Behavior in Identical Settings

Kathrin Schütz [1], Annika Rötters [2] and Lara Oebel [2,*]

[1] Psychology School, Hochschule Fresenius University of Applied Sciences, Platz der Ideen 2, 40476 Düsseldorf, Germany; kathrin.schuetz@hs-fresenius.de
[2] Psychology School, Hochschule Fresenius University of Applied Sciences, Im Mediapark 4c, 50670 Köln, Germany; annika.roetters@gmail.com
[2] Psychology School, Hochschule Fresenius University of Applied Sciences, Im Mediapark 4c, 50670 Köln, Germany; lara-o@live.de
* Correspondence: kathrin.schuetz@hs-fresenius.de; Tel.: +49-211-436915-38

Simple Summary: Every horse rider knows that horses react to people. A horse shows whether it likes, respects or dislikes a person or personal behavior. This fact seems obvious but it has not been reported yet. In fact, there are scientists claiming that horses can only be trained and never show individual responses to certain individual human behavior. Therefore, in this study interactions between different horses and different humans in identical settings were examined. The results reveal that horses do not react in the same way in the same situations but in different ways to different people.

Abstract: Although there has been research regarding the horses´ responses to human behavior, there is still a gap concerning the knowledge about the interaction of horses and humans in showing individual responses to different human behavior in the same situation. In this work, the horses´ individual responses to different humans were examined to close this research gap and to identify whether horses do really respond differently to different people. To this end, 29 horse and human interactions (including two identical exercises in each situation) were videoed and then transcribed in the style of HANOS. The qualitative content analysis was appropriated on the basis of Mayring. Both of the methods were adjusted to the special study conditions as the nonverbal interactions between each person and one horse were focused but no verbal expressions. In total, just under 600 interactions were analyzed (quantitative analyses). Based on these analyses, it can be assumed that each human individual received an individual, different feedback from the horses.

Keywords: nonverbal communication; interspecific communication; domestic horse

1. Introduction

There has been data proving the fact that horses and humans do interact in interspecific communication. About a hundred years ago it was claimed that a

 doi:10.20944/preprints201802.0129.v1

stallion, known as "clever Hans", performed counting, reading, spelling, and even arithmetic skills. He was supposed to solve these intellectual tasks by tapping his hoof or moving his head. Pfungst (1911) found that it was not about Hans´ specific mental abilities but his skills to read his owner's facial expressions. He would guess the correct answer by reading small, involuntary body movements of the human interacting with him. Those movements initiated and ended Hans´ movements [1].

Malavasi and Huber (2016) investigated the horses´ searching behavior regarding a treat that was presented first and then hidden in a bucket by one person. The horse was not able to reach the treat on its own. Then another person was entering the setting, which induced the following behavior of the horse. All horses moved their heads and views from the person to the bucket and back to the person. The researchers interpreted this as an asking for help behavior [2]. In another study, horses were shown two apples being put into a container. Its contents were not visible for the horses. Then three apples were put into another container. The horses could (without prior learning) differentiate between these two containers and headed for the second container [3].

In a further study, Ringhofer and Yamamoto (2017) examined the horses´ ability to adapt their nonverbal communicational behavior according to the known state of humans. There were two settings. In the first setting, the person interacting with the horse witnessed somebody else hiding a carrot. In the second setting, the carrot was hidden without the interacting person observing. The horses differentiated between knowing and unknowing interaction partners. They increased their visual and tactile efforts to point out the carrot, which was not reachable for the horse, to the unknowing person [4]. Schuetz, Farmer and Krueger (2017) explored whether horses are able to learn by watching humans. After observing a person pressing a light switch to open a feeding box the horses were able to open this box by pressing the light switch as well [5].

Proops and McComb (2010) investigated the use of human-given cues by horses. They tested their ability to discriminate between different persons (attentive vs. inattentive) to obtain food. Some of the available cues were head orientation, body orientation or the experimenters' eyes (open vs. closed). The horses chose the attentive person more often [6]. Another study explored the differences between adult horses and youngsters (under the age of three) choosing an attentive person to approach for food. Younger horses used body orientation but not other (more subtle) cues to chose a person with a rewarded bucket. Older horses could read other subtle human body cues (open or closed eyes, head movement) [7].

Horses can understand human attentional states and modify their auditory or tactile begging behavior in a food-requesting situation. The results suggest that they do understand whether the experimenter's eyes were covered by his hand or were not covered. They produced more tactile or auditory begging behaviors when the person's eyes were covered than when they were open [8]. Futhermore, horses are able to rely on four human gesticular cues in an (two-way) object choice task. Food was hidden under one of two bowls and the horses were able to locate the reward by watching the experimenter using one of four cues [9]. In another object

 doi:10.20944/preprints201802.0129.v1

choice task, horses were able to use marker placement cues and distal sustained pointing spontaneously but not body orientation, momentary tapping and gaze (head) alternation cues [10].

Smith, Proops, Grounds, Wathan and McComb (2016) investigated whether horses are able to spontaneously discriminate between positive and negative human facial expressions in photographs. They showed that pictures of angry faces led to a quicker increase in the horses´ heart rate. Furthermore, the researchers discovered a left-gaze bias towards the pictures of angry faces, which they interpreted as a general association with the perception of negative stimuli [11].

Other authors dealt with a training program for horses with reward based operant conditioning. Horses learnt to communicate bay touching different visual symbols to express whether they wanted to have a blanket or not. They could differentiate between three different (neutral) symbols [12]. Hanggi (1999) showed that horses are able to discriminate between an open-center stimulus and a filled black shape (two-dimensional) by operant conditioning (e.g., circle, square, hexagon, flower, star). They touched the correct one with their nose. Correct reactions (choosing open-center stimuli) were reinforced by food and a positive word, incorrect behavior (choosing filled stimuli) was not reinforced [13].

Concerning the lack of scientific foundation whether horses are able to show individual responses to different human behavior, this study was conducted explorative in nature. The research question led to a qualitative design.

"Do horses react individually to different people in the same situations?"

The qualitative categories should be analyzed inferentially by Chi-square tests to prove that the distinct behaviors of the horses cannot be explained by coincidence. The goal of this examination was to provide evidence whether horses do show the same behavior in the same objective setting or adapt their behavior according to different human interaction partners.

2. Materials and Methods

To answer the research question, a group setting was chosen. This study was carried out in North Rhine-Westphalia (Germany) between September of 2016 and April 2017. Horse owners were informed of the study's aims. Their participation was voluntary and they signed an informed consent agreeing to participate in the study under the understanding that no economic benefit was involved.

The persons did two exercises with the horses (N = 5; two geldings, three mares; age range 12-18 years), whereby the exercises had an identical layout. The subjects were not allowed to carry edible treats for the horses on themselves during the study. A safety briefing about the handling of animals and horses in specific was mandatory for every test subject.

In the first exercise, the test subjects were allowed to choose one of two horses with which they wanted to go through the course after contacting them. The task was to lead the horse on the slalom course around four pylons, followed by bringing the horse to a halt over a rod so that the front legs were in front of the rod and the hind legs were behind it (figure 1).

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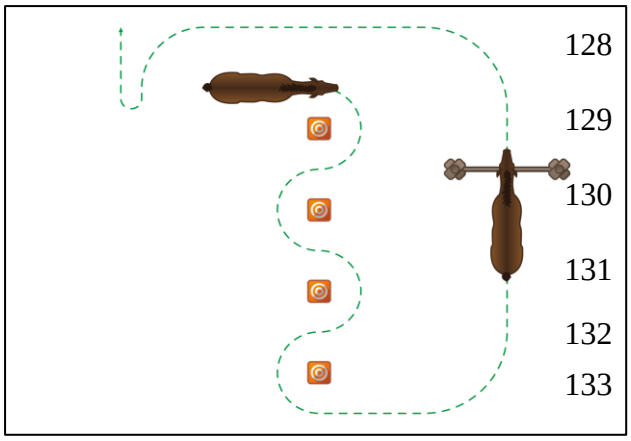

Figure 1. Tasks in the first setting

In the second exercise, three pylons were arranged in a triangle. After contacting the horses, the test subjects should supplement this triangle with the chosen horse by another triangle, so a star was built viewed from above (figure 2). The persons decided independently when they wanted to finish the task. The tasks were selected because of their simple design and because the horses knew them from at least ten times they practiced the exercises before. The test subjects did not know the tasks beforehand.

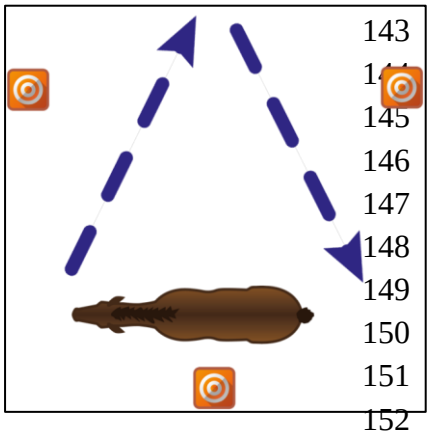

Figure 2. Task in the second setting

Before the second task was built, all subjects completed the first course. Every task was videotaped. Based on the videotaped exercises and the horses´ related reactions to the subjects´ behavior, the results were transcribed. They formed the basis for the content analysis and the following inferential statistical analyses. In the present study, no damage was inflicted on the horses. The animals´ ethical treatment is guaranteed.

Within the context analyses, the videos, which included solely the horses´ and the subjects´ behavior in the individual tasks, were used. At first, the videos were transcribed focusing on the body language. Spoken language was not written down. Only sequences including direct interactions between the horse and the

 doi:10.20944/preprints201802.0129.v1

human were transcribed. The transcription's screenshots and segments were summarized in an Excel table.

The basis for the analyses was the HANOS system ("Handlungsorientiertes NotationsSystem") by Englert (2014), describing not the camera perspectives but the interactions in front of the camera [14]. The subsequent qualitative content analysis (interaction analysis) was performed based on Mayring (2010) because under this method the material can exist in any symbolic manner and the focus is on communication [15]. The analytical steps by Mayring were abided. The first step was to inductively identify categories in form of relevant structural dimensions from the raw data. A deductive procedure was not possible due to the research gap. The next step was to define the categories. Certain categories showed consisting content, which leads to a reduction to a categorical system including in total eight categories. By explicating these categories, conditions for the classification of certain behaviors into the categorical systems were specified. Standard examples from the sample were used to ensure methodological traceability. The last step was to identify conditions for demarcation between similar categories [15]. The identical eight categories were found by each of three independent researchers. For a deeper analysis of the video material the total frequency of occurrences was counted. These data were then analyzed statistically.

2.1. Statistical Analysis

The transcription's screenshots and segments were summarized in an Excel table. In the style of HANOS qualitative categories were identified. The data were analyzed with the statistics software IBM SPSS Statistics 24. Chi-square tests of the frequencies of the horses' behavior in the different settings and of the horses' reactions towards the subjects were applied.

3. Results

The sample consisted of 29 people (age range 19-59 years; M = 36.93, SD = 11.09). 18 test persons were already experienced in the handling of horses and eleven test persons could not exhibit any experiences with horses. 21 test subjects (72.41% of the sample) were female.

Analyzing the video material, 594 clear reactions of the horses in answer to the subjects' behavior could be observed. These could be classified into eight distinct categories (rejection, lack of interest, obedience, limits, interest, fatigue, ambiguity, satisfaction; table 1). In regard to the research question, it can be concluded that the horses were able to recognize and to reflect body conditions, such as relaxation. They reacted to positive and negative behaviors. If the subjects, for example, radiated self-assurance the horses responded in a congruent manner by standing still or by hesitating to move forward. On friendly gestures towards the horses, such as scratching, the horses responded in a friendly manner by licking their hand or looking for closeness.

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Table 1. Categories of the horses´ reactions

Category	Description	Example
Rejection	The horse does not participate.	Horse snuffles the pylons.
Lack of interest	The horse does not show interest in the subject.	Horse turns away.
Obedience	The horse cooperates.	Horse follows the subject in the setting.
Limits	The horse shows resistance.	Horse does not move.
Interest	The horse shows interest in the subject.	Horse looks at the subject; ears rotated towards the subject.
Fatigue	The horse shows tired behavior.	Horse yawns.
Ambiguity	The horse does not show any distinct class of behavior / offers different behaviors.	Horse goes forewards, sideways, backwards; seems confused about the task.
Satisfaction	The horse shows signs of friendly relaxation.	Horse licks the subject´s hand, snorts.

In every individual case of the interaction, the horses´ reactions did not correspond to the other individual cases. This can be considered as an indication that the horses do mirror human experience as well as reacting in a different manner according to the situation.

This can be interpreted as an expression of diverse experienced realities. In the objectively same situation, the horses did not respond uncertainly on uncertainty but expressed their different experiences in diverse ways. It was apparent that the respective horse did no longer follow the subject and stopped, hesitated or changed the direction independently and thus pulled the subject into the direction of choice. The different reactions demonstrate clearly that the horses approached every subject individually.

A Chi-square test of the frequencies of the horses´ behavior in the different settings showed that the horses´ reactions were not equal in the same settings but different in each context with a different human test subject (χ^2 (196, N=29) = 390.92, $p < .001$). The differences were highly significant and prove horses to react distinctly, which indicates more significant factors influencing a horse's behavior than the objective task presented to the horse in the setting.

Furthermore, the horses´ reactions towards the 29 subjects were put into relation by a Chi-square test. The result is highly significant and it indicates that in the same situation horses do not react in the same way to different subjects. There were no significant differences in the frequencies between the two tasks as another

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Chi-square test revealed ($\chi^2(7, N=8) = 4.02$, $p > .05$, n.s.). This means that the mode of exercise did not have a direct influence on the horses´ behavior. The horses investigated in this study are not trained to show a standard behavior in a specific situation, which is empirically proven.

4. Discussion

The presented results strengthen the hypothesis that horses react to objectively identical behaviors in different ways due to the form in which the behavior is carried out by a person. This supports the theory of Meyer (2008) who claimed that horses are able to reflect human inner processes like for example the emotional state of a person, shown in tiny changes in human body language [16]. If it is indeed a reflection and whether the participation of mirror neurons in the horse brain can be a part of the shown behavior remains yet to be focused on further research.

Evolutionary-biological the horses´ behavior can be explained as critical for the surviving of the species. Horses are gregarious animals known for their preference for flight in critical situations. To secure the survival of the herd, it is important for every horse to be able to rely on to the leader. To ensure a reliable leader the leading competencies are constantly verified. If the leader is proven not to be reliable, horses are known to actively change the hierarchy by taking the lead [17, 18].

Opgen-Rhein (2011) suggested a transfer of the nonverbal abilities regarding the leading horse to a leading human during the process of domestication. According to Opgen-Rhein, horses learnt to react instantly to individual human nonverbal behavior and are therefore able to interpret human nonverbal behavior correctly [19]. Horses are therefore not only able to be of therapeutic use to humans but able to show an objective reflection of human behavior [20, 21, 22, 23, 24, 25, 26].

This study gave proof that horses show different reactions in the same settings due to different human behavior. On the other hand, it has to be discriminated, that the feedback-session right after the first setting could have possibly had an impact on the second setting. This extraneous variable was held constantly throughout the whole study, as it could not be eliminated or variated systematically. The study was conducted in the field, therefore objectivity and reliability were considerably smaller, whilst the external validity is to be interpreted as much higher than in a laboratory experiment.

The critical point of view regarding the use of horses in therapeutic contexts cannot be scientifically supported. On the contrary, this study had shown that horses are able to react individually to human behavior and leads to further questions. If the horses´ reactions were not trained before – where does the horses' behavior come from? Are horses really able to correctly interpret human emotional state? Are they furthermore able to reflect human emotions? (How) Are horses capable of detecting slight differences in human behavior even other humans do not notice? How is the horses´ behavior influenced by the dynamic of the interaction between human and horse during the whole study? Is the interaction moderated by behaviors shown by the investigators? These questions are to be explored in the near future.

 doi:10.20944/preprints201802.0129.v1

Acknowledgments: There was no funding.

Author Contributions: K.S, A.R and L.O. conceived and designed the experiments; K.S. and L.O. performed the experiments; L.O., K.S. and A.R. analyzed the data; K.S, A.R and L.O. contributed reagents/materials/analysis tools; K.S, A.R and L.O. wrote the paper.

Conflicts of Interest: The authors declare no conflict of interest.

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