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Research

Do soothing vocal cues enhance horses' ability to learn a frightening task?

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ABSTRACT

When working with horses, it is frequently asserted that horses have an inherent understanding of harsh voice cues that would be used as reprimands versus soothing voice cues that may be used as positive reinforcers or calming modifiers. If horses are unable to understand this difference while their handlers assume they can, it may potentially lead to unfair or inappropriate training. A total of 107 horses from 2 different horse facilities in the United States and 7 different horse facilities in Europe were randomly assigned to either soothing voice treatment (SV; n = 58) or harsh voice treatment (HV; n = 49). The learning task involved horses of various breeds and ages learning to cross a tarpaulin. Methodology was standardized across locations. SV involved handlers saying "good horse" in a soft soothing manner whenever horses made forward progress toward the tarpaulin. HV involved saying "quit it" in a loud harsh manner whenever horses made forward progress toward the tarpaulin. Praat software was used to assess similarities in vocal spectrograms and acoustic parameters of different handlers and treatments. Mean pitch for SV and HV was 236.2 ± 2.2 Hz and 322.1 ± 8.9 Hz, respectively, both well within the equine hearing range and different at $P < 0.001$. Average intensity (loudness) for SV and HV was 51.2 ± 1.7 dB and 61.7 ± 1.2, respectively, different at $P < 0.001$. Contrary to our hypotheses, risk of failing the task (>10 minutes to cross the tarpaulin for the first time) was not different between treatments (22.4% failures on SV; 24.5% failures on HV; $P = 0.41$). Also, for those horses who did cross the tarpaulin, the total time to achieve the calmness criterion (crossing with little or no obvious anxiety) did not differ between treatments (139.9 ± 50.4 for HV vs. 241.6 ± 40.3 for SV; $P = 0.25$). There was no difference between the average heart rate (HR; n = 70 horses) of horses that crossed (82.9 ± 7.0 beats/minute) versus those that failed (77.4 ± 6.7; $P = 0.43$). Also, there was no difference between the average HR of HV horses (85.7 ± 3.9 beats/minute) versus SV horses (77.9 ± 3.7 beats/minute; $P = 0.16$). Furthermore, there was no difference between the maximum HRs, with HV horses registering a mean of 143.4 ± 11.25 beats/minute and SV horses registering a mean of 166.1 ± 9.5 beats/minute; $P = 0.20$. In the context of this study, soothing vocal cues did not enhance horses' ability to perform a novel potentially frightening task.

Introduction

There is a common belief among many animal trainers that animals have an intuitive understanding of humans' tone of voice. For instance, many riding theories recommend the use of soothing or harsh voice cues along with other cues, particularly when working with young horses (e.g., FN, 2012). It is assumed that long, low, soothing tones will quiet, calm, or slow an animal, whereas sharp harsh vocal cues are more likely to be used in reprimanding situations (McConnell, 1990). Recent work by Merkies et al. (2013) found that draft horses at liberty in a round pen showed more favorable behavioral responses to tape recordings of pleasant voice and low tones than stern voice and low tones. Overall, however, the field of bioacoustics has received comparatively little attention in terms of its impact on horse-human interaction. Thus, there is surprisingly

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Table 1
List of locations and other demographic data related to this study

Country	Facility type	Number of horses	Number of females	Number of males	Average age (years)	Number of HV	Number of SV	Behavior data	HR data	Handlers' vocal data
Germany	4 Locations, mixed	62	31	31	9.95	31	31	All	50	Yes
Italy	3 Riding stables	19	10	9	15.37	6	13	All	0	Yes
Michigan, USA	University farm	16	13	3	7.13	8	8	All	11	Yes
Delaware, USA	University farm	10	5	5	9.1	5	5	All	9	Yes

HR, heart rate; HV, harsh voice treatment; SV, soothing voice treatment.

little evidence-based literature on how horses respond to vocal cues of different volumes, tones, and intensities. There is slightly more research on the topic in dogs with respect to their responses to vocal commands. For example, when the same word cues are used, but with different than normal intensities or emphases, the compliance level of tested dogs dropped considerably (Fukuzawa, 2005a,b). Similarly, dogs were less likely to respond correctly to tape recorded rather than natural voice commands of their owners, although the context of their trainers' presence had not changed (Fukuzawa et al., 2000, 2005a, 2005b; Coutillier, 2006). According to Howard and Angus (1996), certain features such as frequency composition and resonance of human-generated speech differ from tape recorded speech, which may explain these differences. In practice, the situation is further complicated by the fact that cues are generally multimodal, that is, certain voice cues are accompanied by the handler's facial expression, body posture, or gestures (Partan and Marler, 1999; Partan, 2013), so that the handler intentionally or unintentionally conveys visual, as well as potentially olfactory or tactile, information via body language to the animal.

In horses, research has predominantly focused on tactile cues and on the effectiveness of different reinforcement schemes. For example, horses' responses to tactile cues diminished the farther the cue was moved from the originally trained location on the body (Dougherty and Lewis, 1993). Additionally, negative and positive reinforcement schemes (Innes and McBride, 2008; Heleski et al., 2008) have been compared, but vocal cues, if any, were used only in addition to other cues (Sankey et al., 2010; von Borstel and Euent, 2012). Based on experience from practice, and confirmed by both horses' hearing ability (Saslow, 2002) and learning theory (Voith, 1986; McGreevy, 2004), horses are well able to perceive and "learn" the meaning of certain words. However, although there is no doubt that horses can learn to perform certain actions in response to previously learned voice cues (e.g., a horse that stops at the word "whoa," ponies that learn to back up after reinforced verbal commands [Sankey et al., 2010]), it is not known whether horses intuitively understand the humans' tone of voice. If horses are unable to intuitively understand the difference between harsh and soothing voice cues, handlers may make poor assumptions that potentially lead to unfair or inappropriate training. Therefore, our objective was to see if horses performed better (when learning to cross a novel potentially frightening object—a tarpaulin) when soothing voice (SV) cues rather than harsh voice (HV) cues were used in place of a positive reinforcer after a correct response (i.e., moving toward the tarpaulin). We hypothesized that horses would perform better (e.g., cross more quickly, meet calmness criterion more quickly) and maintain a calmer demeanor (e.g., lower heart rate) when learning the task with SV cues as compared with HV cues.

Methods

Vocal cue collection and analysis methodology

Before testing, we recorded a minimum of 4 replicates of each of the 2 types of voice cues used for the 2 treatments (HV and SV; see the following text) from 5 of the handlers. Praat software (free acoustic analysis software; http://www.fon.hum.uva.nl/praat/, developed by P. Boersma & D. Weenink) was used to assess the acoustic qualities of the differing sets of vocal cues (n = 26 samples of HV and 25 samples of SV). The analysis of the acoustic qualities included assessment of pitch (measured as frequency in Hertz), volume or intensity (measured in decibels), and number of pitch periods (1 per frequency), often used to show similarities or differences in vocal samples.

Horses and testing procedures

A total of 107 horses were tested during 2011 and 2012: 62 from 4 horse facilities in Germany, 19 from 3 horse facilities in Italy, 16 from the university facility in Michigan, and 10 from the university facility in Delaware (Table 1). Horses were balanced for age and gender and then randomly assigned to either the HV or the SV treatment. Average age of horses on the HV treatment was 10.7 years and 10.4 years for the SV treatment. Ages ranged from 3 years to 26 years. Fifty-eight horses were females; 47 horses were males, including 5 stallions. Horses were of various breeds and were grouped for analysis purposes into the following breed-groups: Hotbloods (n = 22; Arabians, Thoroughbreds); Warmbloods (n = 75; e.g., Italian Warmblood, Hanoverian, Trakehner); and other, which included Coldbloods and ponies (n = 12; e.g., Gypsy horse, Haflinger, Fjord horse, and Shetland pony). For 2 horses, the breed was unknown, and thus, the breed-type information was set as missing for later analysis.

Horses were handled by 5 different female handlers (maximum of 2 handlers per location) with a traditional pressure-release method using a halter or head collar and lead rope without a chain. Whenever the tested horse stepped forward, the pressure on the halter and lead rope was released (negative reinforcement). When SV horses stepped forward, they additionally received a verbal reinforcer of "good horse" said in a soft soothing manner. When HV horses stepped forward, they additionally received a verbal reinforcer of "quit it!" said in a loud sharp manner. The process was repeated until our pre-established criterion was met (i.e., horses needed to cross with little or no obvious anxiety, e.g., rushing to cross, tucking the tail, whites of eyes showing; Figure 1).

We used the same methodology as 3 previous studies (Heleski et al., 2008; Heleski and Bello, 2010; McLean et al., 2008). A tarp or tarpaulin (1 tarpaulin per country, with the following specifications: green or gray, 2.44 × 3.05-m, high-density polyethylene material) was set up in the middle of an arena, which was used for the testing area. Boards were laid along the 2 outer edges to help stabilize it. We then placed 2 cones 13 m back from either side of the tarpaulin. This formed a starting line for each horse and the point at which a research assistant began timing each trial. The testing sessions were video recorded for later review. One helper per country scored behavior, timed trials, and recorded the number of trials to reach the calmness criterion (crossing with little or no obvious anxiety; e.g., no rushing to cross, no snorting or blowing, no whites of eyes showing). The behavioral scoring system was on a