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REDUCING PAWING IN HORSES USING POSITIVE REINFORCEMENT

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Aversive control is a common method to reduce undesirable behavior in horses. However, it often results in unintended negative side effects, including potential abuse of the animal. Procedures based on positive reinforcement, such as differential reinforcement of other behavior (DRO), may reduce undesirable behaviors with fewer negative consequences. The current study used DRO schedules to reduce pawing using a multiple baseline design across 3 horses. Results indicated that DRO schedules were effective at reducing pawing. However, individual differences in sensitivity to DRO and reinforcer efficacy may be important considerations.

Key words: differential reinforcement of other behavior, horses, pawing, positive reinforcement, stereotypy

Horses often engage in repetitive pawing: stomping, scraping, or dragging the front hooves on the ground. Sometimes referred to as stereotypic behavior, pawing and other repetitive behaviors are observed in 10% to 40% of stabled horses (Cooper & McGreevy, 2007). These behaviors are undesirable because they can cause injury to both horses and humans, impede training, and be financially costly due to equipment destruction and medical treatment (Cooper & McGreevy, 2007; Fox, Bailey, Hall, & St. Peter, 2012). For example, high rates of pawing can result in loosening or removal of horseshoes and damage to hooves. Despite these factors, relatively little is known about the variables that maintain most repetitive behaviors in horses, including pawing, and determination of the controlling variables is often difficult.

Aversive control techniques remain the most widely used method to control behavior in horses (Cooper & McGreevy, 2007). Although these techniques can reduce targeted behavior, they often result in unwanted side effects such as the horse avoiding future human interaction, learned helplessness, and potential abuse of the animal as the magnitude and intensity of aversive stimuli are increased to maintain effectiveness (McGreevy & McLean, 2009). In addition, aversive control requires consistent application of aversive stimulation; this can be difficult with a 1- to 2-ton animal. Escape via other undesirable behaviors (e.g., bucking, biting, or fleeing) becomes more probable, and is reinforced, in such situations.

Positive reinforcement schedules offer an alternative. Research has shown that positive reinforcement can be used to increase desirable behaviors (Ferguson & Rosales-Ruiz, 2001) and decrease undesirable behaviors in horses (Fox et al., 2012). Differential reinforcement of other behavior (DRO) schedules may be particularly useful for decreasing repetitive behaviors in horses because they do not require a priori knowledge of the variables that maintain the behavior to reduce it effectively (Cowdery, Iwata, & Pace, 1990; Fox et al., 2012). In DRO schedules, the absence of a target response is reinforced. The objective of the present study was to reduce pawing in three horses using DRO schedules in a multiple baseline design.

METHOD

Subjects

Three horses served as subjects: Ophelia, a 17-year-old thoroughbred mare, Patrick, a

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9-year-old Irish sport horse gelding, and Darien, a 10-year-old Hanoverian gelding. Darien had participated in a previous evaluation of DRO to reduce biting and chewing (Fox et al., 2012). All three horses were selected because they were observed to engage in pawing when on crossties and the owners expressed a desire for the behavior to be reduced or eliminated. All three owners completed an animal use and release form. A veterinarian screened all horses within 30 days before the start of participation and deemed them to be healthy.

Materials

The reinforcer differed across horses. During initial DRO sessions, Ophelia and Darien did not eat hay consistently when it was delivered on the crossties, so we used a mixture of pellet-sized apple treats and bite-sized carrot pieces for Ophelia starting in Session 8 and bite-sized carrot pieces for Darien starting in Session 14. Hay was used for Patrick. In all cases, reinforcer magnitude was 5 to 10 g. We used paper data sheets on clipboards to record the frequency of pawing in each session. In some sessions, we used a cellular phone application for which taps on the phone's screen could be used to count the frequency of pawing for Ophelia due to high response rates. We used a stopwatch to time intervals and sessions.

Procedure

Sessions were conducted on crossties in the barn between the morning and evening feedings that occurred at approximately 8:00 a.m. and 6:00 p.m. Crossties are pieces of rope that extend from the wall to both sides of a horse's halter to restrict movement. Crossties are typically used during horse–human interactions (e.g., tacking up the horse, grooming, etc.).

A multiple baseline design across horses was used. Sessions lasted 20 min, and each was split into four 5-min blocks. One to three sessions were conducted per day, approximately 3 days per week. Sessions that occurred on the same day were separated by approximately 5 min. Pawing frequency was recorded in each block and then summed at the end of the session. *Pawing* was operationally defined as the lifting up of one front hoof with the hoof traveling forward, being placed on the ground, and then sliding back near its starting position. During baseline, pawing was recorded but no experimenter–horse interaction took place. Baseline lasted 4, 6, and 12 sessions for Ophelia, Patrick, and Darien, respectively.

Initial DRO intervals for the intervention phase were based on experimenters' judgments regarding baseline rates of pawing and pause durations between bouts of pawing for each horse. The initial DRO interval was 5 s for Ophelia, 60 s for Patrick, and 20 s for Darien. During the DRO phase, the absence of pawing for the entirety of the DRO interval was reinforced. The next DRO interval started when the horse stopped chewing for approximately 3 s after reinforcer delivery. Each instance of pawing reset the DRO. Reinforcers were delivered by hand by an experimenter. All other experimenter–horse interactions were limited, but trainers and owners interacted with the horses as they normally would. Owners and trainers did not feed horses during experimental sessions.

A second independent observer collected data during 36% of sessions in both baseline and DRO phases across all horses to assess interobserver agreement. We calculated agreement scores by dividing the smaller number of observations by the larger number of observations in each block. All four block-agreement values were summed and divided by four; the result was converted to a percentage. The range for interobserver agreement was 90% to 100%, with a mean of 98% ($SD = 2.5\%$).

RESULTS AND DISCUSSION

Figure 1 shows pawing frequency as a function of session for each horse. Results for Ophelia are

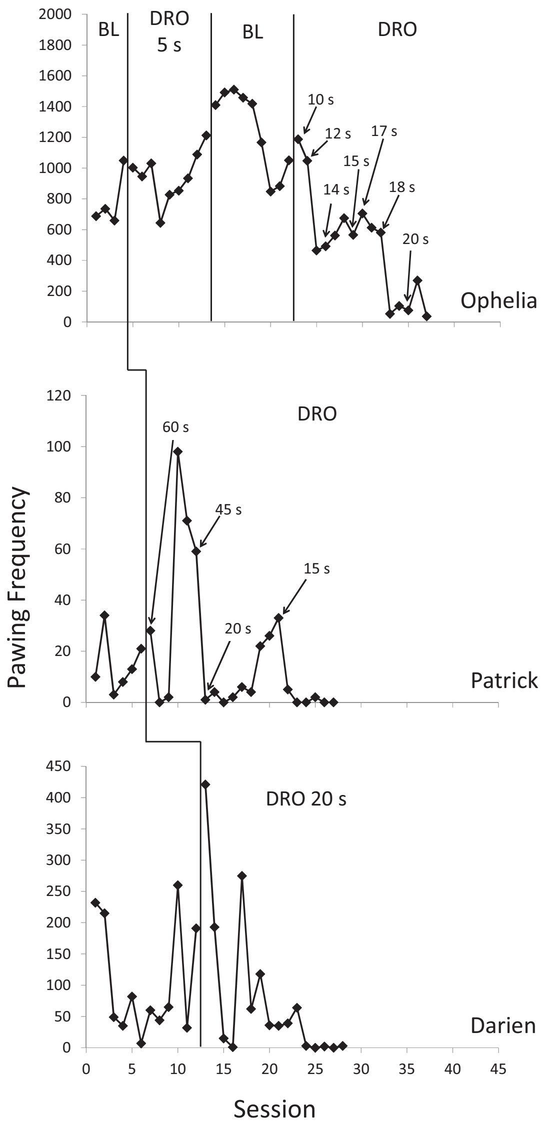

Figure 1. Pawing frequency across sessions for each horse. Note individual *y* axes.

shown in the top panel. Mean pawing frequency during baseline was 783 responses per session. The initial DRO 5-s schedule was ineffective. The high rate of pawing in the first DRO phase may have resulted in delayed reinforcement of pawing, so a second baseline phase was conducted to measure behavior again in the absence of the contingency. During the second baseline, pawing frequency was similar to that observed during the first baseline and DRO phases. Although pawing cccurred at a high rate, we noticed a distinct pattern of behavior in the first DRO phase: a bout of pawing, followed by a pause, reinforcer delivery, and initiation of another bout of pawing. This pattern was repeated for the duration of the sessions. In the second DRO phase, we attempted to take advantage of this pattern by increasing the DRO and systematically reinforcing longer pauses, even though overall pawing frequency remained relatively high. As the DRO increased from 10 s to 20 s, pawing frequency declined. Not only did pausing between bouts increase, but the number of paws per bout decreased. Over the last five sessions of the DRO, mean pawing frequency was 107.8 responses per session (13.8% of baseline frequency).

Results for Patrick are shown in the middle panel. During baseline, Patrick engaged in a mean of 14.8 paws per session. An initial DRO interval of 60 s was implemented because of the low frequency of pawing and long interresponse times. Initial delivery of hay as part of the DRO resulted in a marked increase in pawing. Many horses, including Patrick, paw during daily feedings. Hence, hay delivery on the crossties may have been a discriminative stimulus for pawing, resulting in an increase in pawing. The DRO was reduced from 60 s to 45 s to 20 s to 15 s, and pawing decreased. A total of two paws occurred across the last five sessions of the DRO 15-s schedule (2.7% of baseline frequency).

Results for Darien are shown in the bottom panel. Mean baseline pawing frequency was 106 responses per session. A DRO 20-s schedule was implemented during the intervention phase. Pawing increased initially but decreased as the phase progressed. Across the last five sessions, a total of eight paws were recorded (1.5% of baseline frequency).

These results, in conjunction with previous research (Fox et al., 2012), suggest that DRO schedules are a viable alternative to aversive control techniques to reduce undesirable behaviors in horses. The present research also highlights some important considerations when using positive reinforcement with horses. First, we did not conduct a stimulus preference assessment. We started with hay as a reinforcer, but switched to alternatives for Ophelia and Darien when they stopped consistently consuming hay on the crossties. We could have avoided this reinforcer efficacy issue and implemented a more effective intervention immediately if we had started with a highly preferred reinforcer. Second, the effectiveness of DRO, at least initially, varied across subjects. This is consistent with previous reports of DRO treatments implemented with children with developmental disabilities (e.g., Vollmer, Iwata, Zarcone, Smith, & Mazaleski, 1993). Our findings suggest that the DRO should be tailored to the specific behavior in question, and careful modification will likely be necessary to enhance effectiveness after the intervention has begun. For example, starting with a richer DRO for Patrick and gradually adjusting to a leaner schedule may have been more effective than starting with a lean DRO. Similarly, individual variability in patterns of target behavior may be important, as with Ophelia. With Ophelia, increasing the DRO interval before observing a reduction in behavior was most effective. In doing so, we were able to take advantage of her distinct pattern of pawing.

Two limitations of DRO interventions to reduce undesirable behavior in horses are the number of people and the amount of time required. At least two researchers needed to be present to implement the DRO schedule, and it took over 5 hr of intervention across several weeks to reduce pawing to near zero levels for Darien, whose behavior showed the greatest sensitivity to DRO. This type of commitment may not be feasible for horse owners and is impossible for a single trainer. The density of the DRO interval in the present case may also pose practical problems for trainers and handlers.

In addition, the variability in our findings and the extensive individualization of the DRO procedure that was necessary to achieve a reduction of pawing may limit the practical use of the intervention. It is unlikely that the average horse owner has the necessary expertise to implement a DRO schedule and make the necessary adjustments to reduce behavior effectively. Some expertise is necessary because treatment integrity failures during DRO implementation can greatly undermine the effectiveness of the schedule. Noncontingent reinforcement schedules (see Vollmer et al., 1993), however, may also be effective, and owners and trainers could likely implement them with less time and effort. The effectiveness of DRO in our study may have been due to response competition associated with consumption of the reinforcer rather than the contingency itself. To the extent that this is true, noncontingent reinforcement may effectively reduce behavior as an initial intervention or as a maintenance procedure after DRO.

DRO schedules may also increase other behavior inadvertently. Fox et al. (2012) reduced biting and chewing using a DRO schedule; however, pawing increased for one horse when the DRO was in place. Although there were no observed increases in other behavior in the present study while the DRO was in operation, this is still a concern for future research and practical use of DRO schedules with horses.

Overall, the reduction of pawing using a DRO schedule in this experiment adds to the growing body of literature suggesting that positive reinforcement schedules can be used to eliminate undesirable behavior (Fox et al., 2012) in horses. These techniques offer an alternative to traditional aversive control techniques while avoiding some unwanted side effects.

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