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Short report

Reduction of biting and chewing of horses using differential reinforcement of other behavior

Adam E. Fox*, Shana R. Bailey, Ezra G. Hall, Claire C. St. Peter

West Virginia University, USA

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ABSTRACT

Biting and chewing by horses on crossties can result in injury to the handler and damage to equipment. Operant-conditioning techniques have been used to train horses and could be used to reduce or eliminate undesirable biting and chewing. Presently, a differential-reinforcement-of-other-behavior (DRO) schedule, in the context of a reversal design, was effective in reducing biting and chewing in two horses. In DRO schedules, a reinforcer is delivered contingent on the absence of a target behavior for a specified interval. Positive-reinforcement procedures offer an alternative to aversive-control techniques typically used in equine training and may provide for better equine welfare and horse–human interaction.

1. Introduction

The majority of techniques used to reduce undesirable behaviors in horses involve aversive control (see McGreevy and McLean, 2009; Murphy and Arkins, 2007) or indirect manipulations like increased exercise and opportunities to interact with other horses (see Cooper and McGreevy, 2002; Krzak et al., 1991). Although they can be effective, aversive-control techniques have been described as problematic because the animal may habituate to the aversive stimulation, resulting in a gradual increase in aversive stimulation to maintain effectiveness (see Cooper et al., 2007; Slater and Dymond, 2011). This could potentially lead to abuse of the animal (McGreevy and McLean, 2007; Slater and Dymond, 2011). Aversive-control techniques are also difficult to implement because untrained handlers may be unable to continue to apply aversive stimulation for the duration of some undesirable and violent behaviors (i.e. rearing and bucking), thus negatively reinforcing those behaviors (Slater and Dymond, 2011). Due to these potential negative consequences, a different approach is necessary. Positive-reinforcement techniques may be an effective alternative to reduce undesirable behavior in horses, while providing additional benefits such as fewer of the negative side effects associated with aversive control, improved equine welfare, and improved horse–human interaction (see Innes and McBride, 2008).

Operant-conditioning techniques have been used to train and modify horse behavior (Murphy and Arkins, 2007), and could be useful for the elimination of undesirable behaviors. Although differential positive reinforcement is effective for training and maintaining desirable behavior with horses (Ferguson and Rosales-Ruiz, 2001; Slater and Dymond, 2011; Williams et al., 2004), it is unclear if positive reinforcement can be used to reduce or eliminate undesirable behavior.

A differential-reinforcement-of-other-behavior (DRO) schedule involves the delivery of a reinforcer contingent upon the absence of a target behavior for a specified period of time (see Poling and Ryan, 1982). These differential-reinforcement schedules have been effective in reducing responding in humans (e.g., Cowdery et al., 1990) and several species of non-humans (e.g., Davis and Bitterman, 1971; Mulick et al., 1976), but not horses.

Being restrained on crossties may evoke problem behavior with horses. Crossties are ropes that attach to both sides of a horse's halter, and typically the wall on each side of the horse to restrict the horse's movement. While on crossties, horses sometimes bite or chew on the handler or equipment, which can result in injury or property damage. The present study extended the use of DRO to reduce undesirable biting and chewing of two horses while on crossties. DRO schedules were used because they effectively reduce behavior when maintaining reinforcers cannot be identified (e.g., Cowdery et al., 1990), as was the case in the present study. The present study also assessed the effectiveness of reducing the reinforcement rate for the DRO with both horses. An untargeted behavior, pawing, was also recorded during all sessions to test for generality or potential side effects of the DRO schedule to a non-targeted undesirable behavior.

* Corresponding author at: Department of Psychology, West Virginia University, WV 26506, USA. Tel.: +1 304 293 2001.
E-mail address: Adam.Fox@mail.wvu.edu (A.E. Fox).

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2. Method

2.1. Subjects

Darien, an 8-year-old gelded Hanovarian/Warmblood, and Wings, a 6-year-old Irish draught mare, were subjects. Each horse engaged in biting and chewing of crossties, lead ropes, grooming items, and occasionally handlers. Horses were fed at 6AM and 6PM daily and were approximately 8 h food deprived before each session.

2.2. Setting and materials

Sessions took place on Saturdays and Sundays at a barn in north-central West Virginia. Sessions were timed while each horse was on crossties with a lead rope (5 ft) attached and looped under the halter. Two consecutive 20-min sessions were conducted per horse, per day. The reinforcer was a handful of hay (approximately 6 g) delivered by an experimenter in a large rubber tray. The rubber tray was withdrawn after the horse removed the hay. Hay removal typically took approximately 5 s. Hay was used instead of treats or other highly preferred items, such as carrots (e.g., Ferguson and Rosales-Ruiz, 2001) because it was inexpensive and is typically available at any barn housing horses. Stopwatches were used for timing and data sheets were used to document the duration measures, frequency counts, and treatment integrity.

2.3. Measurement

Biting and chewing was defined as any head movement when the horse opened and closed its mouth, whether contact was made with another object or not, excluding chewing of the reinforcer. The onset of an instance of biting occurred when the horse's mouth opened and ended when the horse's mouth closed. When the bite resulted in chewing on an object, the duration of that behavior continued to be recorded until chewing ended. Offset of chewing was defined as the point when the object was no longer in the horse's mouth. Hence, a bite typically lasted 1 s or less, while chewing bouts could last several minutes. Pawing was defined as lifting up one front hoof with the hoof traveling forward and then returning to its original position.

During sessions, the experimenters stood approximately 5–7 ft in front of the horse with a clipboard and stopwatch. Each session was divided into four, 5-min blocks. Independent observers recorded pawing frequency and biting and chewing duration for each 5-min block and aggregated the data at the end of each session. Interobserver agreement (IOA) was obtained by dividing the smaller duration or frequency in each block by the larger, averaging the quotients, and then multiplying by 100. For Darien, IOA was calculated for 50% of sessions and was 79% (range 25–99%) for biting and chewing and 95% (58–100%) for pawing. For Wings, IOA was calculated for 49% of sessions and was 89% (66–99%) for biting and chewing and 92% (25–100%) for pawing. When IOA was less than 80%, absolute differences between observers were never more than 7 s within any block for biting and chewing, and never more than 2 paws within any block for pawing.

2.4. Procedure

Experimental control was demonstrated through a reversal design. A minimum of 4 and maximum of 10 sessions were conducted for each condition. Visual inspection was used to determine condition changes and DRO interval changes in the second DRO condition.

Table 1
DRO schedule in effect in each session for individual subjects.

Subject	DRO interval (s)	Session(s)
Darien	30	11–16; 21–24
	45	25
	68	26–27
	94	28–32
	120	33, 34
	45	**35**
	68	**35**
	94	**35**–36
Wings	20	11–14; 19–24
	30	25
	45	26–27
	68	28–31
	94	32–33
	120	34–38
	20	**39**
	30	**39**
	45	**39**–41

Note. Bolded sessions indicate when DRO intervals were increased within a session. See Section 2.4.3 for details.

2.4.1. Baseline

The experimenters did not interact with the horse. No reinforcers were delivered.

2.4.2. DRO 30 s/20 s

The initial DRO interval for each horse was based on the estimated time between bouts during baseline: 30 s for Darien and 20 s for Wings. An independent observer timed the DRO interval from the start of each session and the same observer delivered a reinforcer when there was an absence of biting and chewing for the specified DRO interval. A new DRO interval began after reinforcer consumption, defined as approximately 5 s of no chewing after reinforcer delivery. Each instance of biting or chewing and each reinforcer delivery reset the DRO interval.

2.4.3. DRO leaning

During the second DRO condition, the DRO interval was increased (thereby reducing reinforcement rate) by a factor of 1.5 until 68 s was reached. The next interval was DRO 94 s and finally, DRO 120 s (see Table 1). Visual inspection of data was used to determine when to increase the DRO interval. Because biting and chewing increased at the DRO 120-s schedule, within-session leaning was implemented for both horses to regain suppression of biting and chewing.

During within-session leaning, the DRO interval increased following a specified number of consecutively earned reinforcers. For Darien, the DRO interval started at 45 s and was leaned to 94 s following 2 consecutively earned reinforcers at each schedule value. For Wings, the DRO interval started at 20 s and was leaned to 45 s with a requirement of 4 consecutively earned reinforcers at each schedule value. See Table 1 for session numbers and schedule values. A more conservative within-session leaning technique was used for Wings because of longer and more variable durations of biting and chewing during baseline and the 120-s DRO condition.

3. Results and discussion

The top panel of Fig. 1 shows results for Darien. Biting and chewing duration during the initial baseline for Darien was variable and averaged 183.1 s per session. Pawing was also variable, averaging 61.8 paws per session. Approximately 5 h prior to sessions 7 and 8, Darien was visited by a veterinarian and given shots and a sedative during a routine examination; time spent engaging in chewing and pawing was somewhat decreased during these sessions.