

BREAKING ACCIDENTAL BEHAVIOR CHAINS

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Thesis Prepared for the Degree of

MASTER OF SCIENCE

UNIVERSITY OF NORTH TEXAS

May 2010

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McKnight, Debra Gayle. Breaking accidental behavior chains. Master of Science (Behavior Analysis), May 2010, 21 pp., 1 illustration, references, 14 titles.

Accidental behavior chains are a common problem in dog training. Many handlers inadvertently reinforce undesirable behaviors. The behavior analytic literature already contains articles describing methods of breaking chains; however, those methods either are not used in dog training for practical purposes or are ineffective in dog training. This experiment investigated two ways to break a behavior chain, including extending the chain and introducing a delay into the chain. The results of extending the chain showed that it is possible to decrease the target behavior using this method, but it was not eliminated in this study. Adding a delay into the behavior chain resulted in a quick elimination of the target behavior.

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INTRODUCTION

Cues that precede a behavior that is followed with a positive reinforcer become conditioned reinforcers (Skinner, 1938/1991; Kelleher & Gollub, 1962). It has been shown that these cues can be used in a chain to reinforce the preceding behavior and function as a discriminative stimulus for the next behavior (Ferster & Skinner, 1957). For example, Ferster and Skinner (1957) described an experiment where a pigeon's pecks on a key when the key was lit green were reinforced. Pecks on the same key, lit red, were not reinforced. They discussed how pecking on the red key can be accidentally reinforced if the key turns green immediately after a peck on red. As one can see, it is easy for an accidental chain to be formed.

Accidental chains are a common problem in the dog training community. For example, if Fido lunges towards a squirrel or another dog and the handler says, "Leave it," and then reinforces when Fido attends toward them, they may have reinforced the lunging behavior as well. Another common chain is when the dog approaches a person, jumps up on them, the person tells the dog to sit, and then reinforces the sit. Many dogs then learn to jump up so that both the person will cue them to sit and they will get attention. Redirecting the dog to an appropriate behavior is a commonly used correction technique, but many dog owners are unaware that their cue may be reinforcing the bad behavior. Positive reinforcement dog trainers have known that these accidental chains are happening, but few have said how to break them (Dennison 2003, 2005; Laurence 2009).

In the behavior analytic literature, several articles point to potential techniques for breaking chains that may also apply to accidental chaining in dog training. Ferster and

Skinner (1957) described using a procedure in which behavior in the presence of the S-delta delayed the presentation of the discriminative stimulus. This is generally not used in dog training, as it would be impractical to let the unwanted behavior continue. In addition, the dog's unwanted behavior is probably being reinforced by changes in the environment. In the Ferster and Skinner example, pecking in the presence of the S-delta is not being reinforced and therefore there is no harm in letting it continue in order to avoid accidentally reinforcing it. However, if the dog is digging in the trash, one would not want to let that continue as his or her digging is probably being reinforced by whatever he or she finds in the trash.

Kuhn, Lerman, Vorndran, and Addison (2006) offer other alternatives as described by Michael (2000) for breaking a two-behavior chain: satiation, extinction, and unchaining. When using satiation, the subject is permitted non-contingent access to the reinforcer, the theory being that if the subject has free access to the reinforcers, he or she will not have to engage in the inappropriate behavior to access them. There have been no studies investigating using satiation in dog training. In dog training, this method is generally not used because more than one reinforcer often maintains most of the inappropriate behaviors that are built into chains with appropriate behaviors. For instance, in the lunging example the reaction of the squirrel, the adrenaline, and any number of other stimuli could be functioning as reinforcers. Therefore, non-contingent access to food, toys, or attention (the common terminal reinforcers in dog training) is unlikely to eliminate the problem behavior and is unrealistic in an applied setting.

Michael's (2000) extinction strategy suggests that in order to extinguish the first response in the chain, simply eliminate the conditioned reinforcer (and discriminative

stimulus for the next behavior) that had previously followed it. In our lunging example when the dog lunges, the handler would simply not cue “leave it.” As with satiation, extinction is unlikely to eliminate certain problem behaviors if other reinforcers maintain them. However, this description of extinction falls right in line with what dog trainers typically recommend for the problem behavior of jumping (Dennison, 2003). By not cueing the dog to do something else, the possibility of building a chain is decreased, and refraining from eye contact, vocalizing, or touching the dog decreases the possibility of reinforcing the jumping. While ignoring the dog when he jumps may work, many handlers have a difficult time doing that. Again, if the handler does not control the reinforcer for jumping, this procedure would not extinguish the behavior. Therefore, the nature of the relationship between the problem behavior and the reinforcers would dictate whether extinction, as described by Michael (2000), would break this chain.

Kuhn et al.’s (2003) third procedure, called unchaining, was based on Michael’s (2000) description of unpairing. This procedure involved reinforcing the second behavior in the chain when it occurred without the first, the theory being that the reinforcing value of the cue (that would normally follow the first behavior) would be lowered. In Michael’s (2000) description, as applied to our dog training example, one would reinforce the second behavior (sit) in the absence of the cue (verbal “sit”) and the absence of the first behavior (jumping up). For instance, if the dog approached a person and sat, without a cue, the sit would be reinforced. However, if the sit was reinforced in other conditions after a verbal cue, the reinforcing value of the verbal cue “sit” is unlikely to be lowered substantially. Kuhn et al. (2006) found unchaining, relative to satiation and extinction, to be the slowest way to disrupt a chain.

In practical dog training settings, the most commonly recommended technique is prevention (Dennison, 2003; Hetts, 1999; Ryan, 2004). This “prevention” could be described as disrupting the chain at a link prior to the obvious inappropriate behavior. For example, if the lunging scenario is considered a chain consisting of: walking by the handler’s side, seeing the squirrel, orienting toward the squirrel, lunging toward the squirrel, and responding to the handler’s “leave it” cue, then disrupting the chain at any point prior to the lunging could be considered preventing the lunging. As one can imagine, it can be difficult for a handler to pay attention to the early components of the chain. If the handler is enjoying a nice stroll in the park and looking at the scenery, then the lunging may take him or her by surprise. Ideally, all handlers could be trained to observe all the components of the chain, but that is probably not feasible.

Disrupting the chain has been proven effective repeatedly (Fisher, Lindauer, Alterson, & Thompson 1998; Hagopian, Paclawskyj, & Kuhn 2005; Kohlenberg 1970; Zlutnick, W., Mayville, W., & Moffat, S. 1975). Kohlenberg (1970) and Zlutnik et al. (1975) suggested punishing an earlier response in the chain, but it should be possible to interrupt the chain using reinforcement as well. Because there are usually some appropriate behaviors that precede the inappropriate behavior, one could use a primary reinforcer contingent upon an earlier appropriate behavior and then cue the dog to do something else. For instance, in the jumping scenario, the dog approaches the person before he jumps. If the handler were to reinforce the approach with food, prior to the jump, and then cue the dog to sit, the jump could be avoided. Many handlers tend to be reactive, letting the inappropriate behavior occur, rather than proactive and able to prevent the unwanted behavior. For those reactive handlers, a solution needs to be

found that can be applied after the problem behavior occurs. Zlutnick, et al. (1975), in addition to using punishment to disrupt the chain, also used a differential reinforcement procedure. Zlutnick et al. (1975) conducted an experiment to eliminate seizures in five subjects. With four of the subjects, when the precursor behavior was observed, the experimenter yelled, “No!” and then grabbed the child by the shoulders and shook him vigorously once. With the fifth subject, it was observed that one of the precursor behaviors to her seizure was raising her arms straight out at a 90-degree angle. When this occurred, the experimenter would put the child’s arms at her side, wait five seconds, then praise her for having her arms lowered and deliver a primary reinforcer. Zlutnick et al. (1975) stated that, “The time delay was used to ensure that reinforcement was not contingent upon an undesired chain of behavior...” With this differential reinforcement procedure the frequency of the child’s seizures was reduced from an average of 16 per day to a near-zero frequency.

Another suggestion given by trainers is to have the dog do a few more behaviors before delivering the primary reinforcer. Laurence (2009) suggested extending the chain by putting more behaviors between the undesirable behavior and the primary reinforcer: “I do not treat the cessation of barking, which would open up the danger of making an error correction pattern, but the next behaviour: accompanying me to the house” (Laurence, 2009, p. 98). In the jumping example, then, when the dog jumps, the handler might cue three behaviors, such as “off,” “sit,” “stay,” and then reinforce with food or attention. However, based on what we know about cues functioning as reinforcers, this may not eliminate the problem behavior.

Another option is to add in a delay. Laurence (2009) mentioned this as well when describing how to teach loose leash walking: “Always insert that five second pause, after the dog has self corrected and is standing at your side. Be prepared to set a criteria [*sic*] higher than five seconds...” (Laurence, 2009, p. 101). Dennison (2003) recommended a delay and later clarified it even further (Dennison, 2005) suggesting that the handler “...redirect him to a more desirable behavior, wait passively for three seconds, ask for three simple behaviors, then reinforce” (p. 184).

A literature search of the *Journal of the Experimental Analysis of Behavior* and the *Journal of Applied Behavior Analysis*, using the term “behavior chain” as an abstract tag, revealed only Kuhn et al. (2006). With the exception of Zlutnick et al. (1975), there is almost no research on either extending the chain or introducing a delay to disrupt behavior chains to substantiate the suggestions made in the dog training world.

This study is an investigation of the effects of both extending the chain and introducing a delay on a behavior chain in a dog. An additional purpose is to find a procedure that fits the natural environment as closely as possible. Because of this, the delay was implemented after the third behavior in the chain to mimic interrupting the dog from the inappropriate behavior and moving him away from the inappropriate object if necessary.

METHOD

Subject

The subject was an 8-yr-old, female German Shepherd dog named Kyra. She was owned, trained, and handled by a professional dog trainer. She had an extensive background in clicker training and had been with the same handler since 11 weeks of age.

Setting

The setting was a small living room in the house where the handler and subject reside. Kyra had a long history of training in this room. The session occurred in an open area approximately 10 feet by 9 feet, covered by a large rug. The handler stood at the front of the room with the object placed 3-4 feet to the handler's left. Treats were delivered on the floor 2-3 feet to the handler's right. The video camera was placed on a table and was turned on by the handler before the objects were made available. Kyra was usually in the room following the handler or watching the handler. During the sessions Kyra was free to move about the room and leave the room. The two objects used in this study (box and cone) were in the room and visible during her daily activities. They were not available in the manner they are used in the study, unless a session was in progress.

Materials

Two objects were used in this study: a small orange cone (approximately 12 inches high) and a small canvas bin (approximately 8 inches deep, 8 inches wide, and

11 inches long) that was placed upside down to simulate a box. Kyra had no previous training with either object prior to the experiment. A clicker was used to mark the final behavior in each chain. The treats used were a variety of high-value treats (chicken, cheese, and freeze-dried liver) to which Kyra had been previously exposed.

Measurement

The frequency of target behavior (either a nose touch or paw touch) per minute was recorded. In addition, the frequency of “other” behavior per minute was recorded. A nose touch was defined as Kyra’s nose coming into contact with any part of the cone. This included Kyra picking up or grabbing the cone; however, if Kyra picked up the cone and brought it to the handler, it was also scored as an other behavior since bringing objects is a behavior in her repertoire. Touching the cone with her paw at the same time as her nose was scored only as a target behavior (nose touch). The paw touch was defined as the bottom of Kyra’s front paw touching the top or sides of the box. If she tripped on the box, that was not scored as a target behavior. Touching the box with her nose at the same time as her paw was scored only as a target behavior (paw touch). Other behavior was defined as whining, “talking” (a variation of a bark), no response to a known cue, an incorrect response to a known cue, and performing any previously learned behavior in her repertoire that was not cued.

All sessions were videotaped; scoring and reliability were completed by watching the videos. The video camera was turned on before the object became available to Kyra. Timing began when the object became available to Kyra. Timing ended when the object was no longer available to Kyra. The observer was the experimenter/handler and

was aware of which behaviors were already in Kyra's repertoire. Reliability was established by having the observer watch approximately 25% of the sessions, including the sessions immediately before and after a condition change. The reliability observer was someone familiar with Kyra's known behaviors. The behavioral definitions were presented to the reliability observer along with the session videotapes. All occurrences of target and other behavior were counted. Within each session, the number of occurrences of target behavior was compared. For the target behavior, reliability across sessions was 100%. Within each session, the number of occurrences of all other behavior was counted. The totals of each session were compared and a percentage matching was calculated. For example, if the experimenter counted four other behaviors and the observer counted three other behaviors, a percentage of 75% was recorded for that session. For the other behavior, reliability across sessions averaged 92%, with a range of 50-100%.

Procedure

Sessions for the box and the cone occurred on the same day, with few exceptions. Sessions generally lasted between one to three minutes. The handler stood in a relaxed manner at the front of the room, either pretending to look at something else or glancing at Kyra. The handler made eye contact with Kyra when giving cues. During the three-second delay, the handler very deliberately turned her head away from Kyra and did not make eye contact. When the handler set the object on the floor, all touches would be scored as a target behavior, even if the handler was not yet in the pre-determined location. The objects were removed at the end of each

session. Training sessions were usually held after a mealtime when Kyra's energy level was typically the highest. If Kyra did not respond to a cue, the handler cued (approximately every four seconds) again until Kyra responded. During the session, Kyra was always free to move about the room or leave the room. If Kyra left the room, the session was terminated.

Baseline

Baseline included training a nose touch to the cone and a paw touch to the box. Both nose and paw touches (to other objects) were behaviors in Kyra's repertoire; therefore, no pre-training was required. Once the object was placed on the floor and available to Kyra, the handler would stand in a pre-determined location and wait to capture the target behavior. A nose touch to the cone was trained by cueing "sit" each time Kyra touched her nose to the cone. When Kyra responded to the cue "sit," the handler clicked and delivered a treat on the floor to the handler's right. A paw touch to the box was trained by cueing "sit" each time Kyra pawed the box. When she responded to the cue, the handler clicked and delivered a treat on the floor to the handler's right. Baseline was considered a two-behavior chain, including the target behavior and sit.

Extending the Chain

After baseline for the box was established, the handler began to extend the chain with the box. This extension involved increasing the number of behaviors between touching the box and the primary reinforcer. As in baseline, when Kyra pawed the box,

the handler cued “sit.” Then, when Kyra sat, the handler cued “down” and when Kyra responded, the handler clicked and treated. The next session, a second extension was made: after Kyra laid down, the handler added another cue (“sit”) and when Kyra responded, the handler clicked and treated. (At this point the chain of behaviors includes the target behavior, sit, down, and sit). The next session, a third extension added a fourth behavior between the target behavior and the primary reinforcer. In this third extension, when Kyra responded to the third cue, the handler gave a fourth cue of “stand.” When Kyra stood, the handler clicked and treated. This five-behavior chain was continued for five sessions. A fourth and final extension was made, requiring five behaviors between the target behavior and the primary reinforcer. In this last extension, when Kyra responded to the fourth cue, the handler cued “touch.” When Kyra touched the handler’s right hand, the handler clicked and treated.

Delay

After the condition in which the chain was extended, a delay condition was introduced. During this condition, when Kyra offered the target behavior (either nose touch or paw touch), the handler said, “uh-uh,” and then “come.” Once Kyra responded to the cue “come,” the handler cued “sit.” When Kyra responded by sitting, the handler turned her head away for a period of three seconds, after which the handler cued, and Kyra responded to, three different behaviors (“spin,” “take a bow,” and “bang”) before receiving the primary reinforcer. The handler clicked and treated when Kyra performed the final behavior (“bang”). “Uh-uh” is a verbal cue with which Kyra had previous

experience. It had been used in her training history to mark a behavior as one that would not lead to reinforcement.

Design

This experiment used a multiple-baseline design across objects. Both the cone and the box were initially under baseline. The box was targeted first for extending the chain and then introducing the delay. Once the results of the delay condition were seen on the target behavior with the box, the delay condition was replicated with the cone.

RESULTS

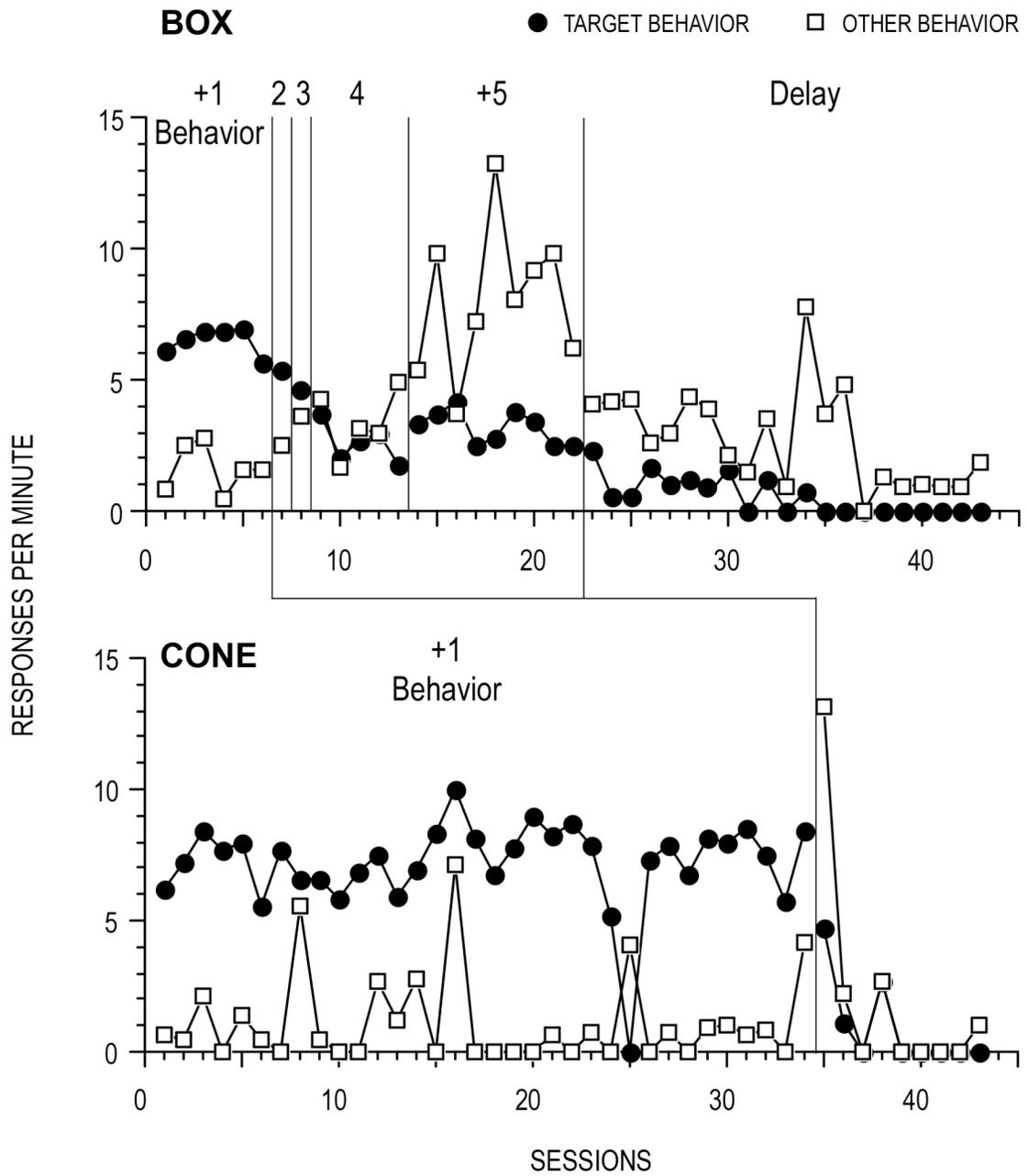


Figure 1. Graph of the frequency per minute of both target behaviors and other behavior.

Figure 1 shows the frequency of responding per minute of both target behaviors paw touch (top graph) and nose touch (bottom graph) and other behaviors (both top and bottom graphs) during three conditions: baseline, extending the chain, and the delay. During baseline, the frequency of paw touches (the target behavior with the box) remained steady at an average of 6.5 responses per minute. As the chain was extended to three and four links, the frequency of paw touches dropped to four responses per minute. When the chain was extended further, to five links, the frequency of paw touches leveled out at an average of three responses per minute. When the sixth link was added, the final phase of extension, the frequency of paw touches remained steady at approximately three responses per minute. When the delay condition was introduced, the frequency of paw touches slowly began trending downward, averaging one response per minute, until it reached zero after 12 sessions and remained at zero for the last eight sessions. The frequency of other behavior remained low during baseline, at approximately three responses per minute. As the chain was extended to three and four links, the frequency of other behavior increased. Once the fifth link was introduced, the frequency of other behavior returned to baseline levels initially (three responses per minute) but then began to climb. When the chain was extended to six links, the frequency of other behavior continued to climb, averaging eight responses per minute. During the delay condition, the frequency of other behavior dropped drastically, averaging 3.5 responses per minute, and leveled off at one response per minute for the last six sessions.

The frequency of nose touches (the target behavior with the cone) remained steady during baseline, averaging between 7.5-8 responses per minute. When the delay condition was introduced, the frequency of nose touches dropped to five cone touches per minute the first session, and continued downward, until it reached zero after four sessions. During baseline, the frequency of other behavior stayed low, between zero and one response per minute. Once the delay was introduced, the other behavior spiked during the first session, up to 13 responses per minute, but quickly leveled out to baseline levels (less than one behavior per minute).

DISCUSSION

The results of this study demonstrated that a delay in presenting conditioned reinforcers was more effective at decreasing behavior than simply extending the chain. Before introducing the delay condition, there were five behaviors intervening between the target behavior and the primary reinforcer (sit, down, sit, stand, and touch), but the target behavior had not been fully eliminated. With the delay condition, there were still five behaviors happening between the target behavior and the primary reinforcer (come, sit, spin, take a bow, and bang); however, putting a three-second delay between the sit and the spin prevented the cues from functioning as conditioned reinforcers for the paw and nose touches. Different behaviors were used in the delay condition; however, it is not believed that the specific behavior had an effect on the procedure. In the delay condition, the frequency of target behavior dropped and eventually the target behavior was eliminated, suggesting that the delay was effective in reducing the effectiveness of the prior cues as conditioned reinforcers.

While extending the chain did decrease the frequency of the target behavior, a decrease in the frequency without complete cessation of the behavior may not be acceptable. Many owners need a problem behavior to completely stop, not just decrease in frequency. For example, if the dog is jumping on people, even a low frequency of jumping on grandma or a toddler is too much. However, it can be beneficial to know that the frequency of target behavior can be decreased through increasing the number of behaviors between the target behavior and the primary reinforcer.

Kyra's training history may have contributed to the persistence of the target behavior in this study. That is, the setting (handler with a clicker and treats and giving no outward cues) has been a condition under which Kyra has been previously reinforced for offering behaviors. This was how much of her training took place and she has been reinforced in the past for offering behaviors when the handler was sitting or standing in the living room with a clicker and treats. While not all dogs have a reinforcement history in the context in which the problem behavior generally occurs, many have. Her history of reinforcement for offering behaviors in the living room mimics other stimulus conditions in which reinforcers have been presented for offering behaviors. For instance, every owner whose dog begins to bark as soon as he or she gets on the phone understands that certain stimulus conditions evoke certain behaviors. If the owner has been telling that dog to be quiet and then giving the dog a treat, this procedure may be helpful.

The frequency of other behaviors almost tripled in the last phase of the extension. As defined earlier, these other behaviors included vocalizations, not responding to cues, and offering different behaviors. These other behaviors, and in particular the vocalizations, were a clear sign of how frustrated the dog was. So, not only did the target behavior continue, but also many other behaviors that may or may not be appropriate were introduced into the situation. These behaviors could be disruptive to the training session (offering numerous other behaviors, barking, jumping on the trainer, biting at the leash, etc), cause the animal to leave the training session, and possibly be dangerous to the handler or animal (aggression due to frustration). In contrast, when the delay condition was introduced, not only did the target behavior

decrease and eventually disappear, the frequency of other behavior also dropped drastically. Therefore, it appears that the delay did not create nearly the amount of frustration that extending the chain did, thus providing additional rationale for choosing this procedure over the procedure that simply extended the chain.

While the delay condition was clearly effective in eliminating the target behavior, the effectiveness may or may not have been affected by the use of “uh-uh.” From this data it is not clear if the “uh-uh” would have been enough without the delay. Given Kyra’s training history, using “uh-uh” to both verbally mark (a no-reward marker or NRM) the instance of the inappropriate behavior and bridges the time between the inappropriate behavior and the three-second delay may be important. Among some dog trainers, it is common practice to verbally mark a timeout if it cannot be given instantly. For example, if a dog is barking at a person for attention, the person could instantly look away, and no verbal marker would be necessary. However, imagine that the dog tries to beg for food from a guest. The instant the begging behavior occurs, the handler could mark it with an “uh-uh” and then get up and place the dog outside for a few seconds as a time out. The verbal marker (“uh-uh”) buys the time it takes for the handler to get up, retrieve the dog, and then walk the dog outside. More research is needed to determine if the effect seen was affected by the NRM. It may not be an important part of using the delay as neither Dennison (2003, 2005) nor Laurence (2009) mentioned using a verbal marker such as “uh-uh” when suggesting a delay to break a chain. Additionally, Zlutnick et al. (1975) did not use a NRM in his delay procedure and he had success. For use in dog training, I would suggest using the delay without the

NRM to see if that is effective. If not, an NRM could be employed. Future research will determine if the NRM is a necessary part of the delay.

There may be limitations to the generality of the findings reported here including the number of reinforcers maintaining the behavior. When working with dogs there is always the possibility that more than one reinforcer is maintaining any given behavior. In the example used earlier of a dog lunging after a squirrel, many stimuli in the environment may be functioning as reinforcers. While one cannot control those completely, the purpose of this experiment was to make sure the handler is not adding yet another reinforcer to the situation. Owners should take the competing reinforcers into account, determine what effect they might have, decide if they can be controlled, and, if the competing reinforcers are a big problem, another procedure might be a better choice. However, as long as the behavior is maintained by accidental chaining, the procedure described in the current study should work.

A combination of techniques could potentially expedite the results. For example, it would have been interesting to see if the frequency of target behavior decreases more quickly if other behaviors are reinforced, specifically appropriate behaviors that occurred prior to the target behavior. If standing in front of the handler while making eye contact had been reinforced, Kyra probably would have been less likely to perform the target behavior. As it was, standing in front of the handler while making eye contact was ignored. Reinforcing any other desirable behavior is what many trainers would suggest; however, most owners only notice when the dog misbehaves, they correct the dog, and then they go back to ignoring the dog. Therefore, this procedure was designed to be

used effectively by handlers that are not vigilant enough to prevent the unwanted behavior from occurring.

As mentioned above, both reinforcing other desirable behaviors and managing the situation so that the subject does not have the opportunity to perform the inappropriate behavior are preferable to allowing unwanted behavior and using this delay procedure after the fact. However, there are those times when management breaks down and mistakes happen, and this procedure offers a simple, low-frustration way to interrupt a bad behavior and to redirect the dog to something more appropriate without reinforcing a behavior unintentionally. This procedure will hopefully add another useful technique in the trainer's toolbox for appropriately handling problem behaviors.

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