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Does Clicker Training Lead to Faster Acquisition of Behavior for Dog Owners?

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by

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Abstract

Clicker training is a method of dog training that has increased in popularity over the past 20 years (Feng et al., 2017). However, while there has been an increased use of clicker training, studies examining the claims that clicker training leads to faster acquisition of new behavior (Skinner, 1951; Pryor, 1999) has only been investigated in a handful of studies with domesticated animals. In addition, all known published studies comparing a clicker-plus-food group to a food-only group have found no significant difference in acquisition of a novel behavior (Dorey & Cox, 2018; Feng et al. 2017), which suggests that a clicker is no more effective than using food only. Due to these past results, and that all prior studies measuring acquisition were conducted with professional trainers and researchers, this study aimed to understand if a clicker-plus-food would be more effective in helping pet owners teach two novel behaviors (cone-targeting and a spin behavior) than using food-only. While there was no significant difference in the number of pet owners that successfully taught the cone-targeting behavior using clicker-plus-food or food-only, a difference was observed when owners trained the spin behavior as only owners in the clicker-plus-food group successfully taught the trick. Taken together, these findings suggest that clicker training efficacy may be dependent on the specific behavior being trained. Future research should investigate whether certain types of trained behaviors (including behaviors that require potentially confusing or threatening body language from the handler like veterinary and grooming procedures) and environments (low distraction vs high distraction) may be better aligned to using a clicker with the pet owning public.

Keywords: Dog Training, Clicker Training, Conditioned Reinforcer, Pet Owners, Clicker Training Efficacy

Does Clicker Training Lead to Faster Acquisition of Behavior for Dog Owners?

Introduction

Clicker training is a method of dog training that has increased in popularity over the past 20 years (Feng et al., 2017). This method of dog training requires that a trainer emits an auditory signal (though a non-auditory stimulus can be used) immediately following the desired behavior (Feng et al. 2018). This auditory signal is then immediately followed by the delivery of a primary reinforcer (an unconditioned stimulus, usually food). Clicker training was introduced to the general public in an article in Scientific American by Skinner (1951) who originally proposed the use of a clicker and suggested that a cricket (the small plastic children's toy which is now known as a clicker) be used as this signal because it is high pitched and easily attended to by the animal. Skinner explained that the delayed delivery of food, for even more than just one second, could destroy the effect of reinforcement (Skinner, 1938). Therefore, using this "click" signal immediately following a desired behavior allowed for more time for the delivery of reinforcement, and thus more efficient learning for the animal.

Clicker training was further popularized by Keller and Marian Breland (Breland & Breland, 1951), who studied under Skinner and then created Animal Behavior Enterprises; a company that trained over 100 species for entertainment and military purposes (Bailey and Gillaspy, 2005). Breland and Breland (and later, with Bob Bailey) are considered the pioneers of using a clicker, or clicker-like devices (whistle) to train a variety of species (Morris, 2003). While Breland and Breland began this work with domestic and farm animals, this expanded to include the training of marine mammals and avian species in the 1960's. Both Keller and Breland are credited with creating the first manual for training dolphins with operant methods (Bailey and Gillaspy, 2005), however, their work from the 1950's through the 1990's was largely

unknown and the history of commercial animal training using operant methods was largely untold until the 1990's (Morris, 2003).

Clicker training's explosion in the dog training field is primarily attributed to Karen Pyror (1999), who has published multiple books on animal training (Pryor 1975, 1999, 2009; Pryor and Ramirez, 2014) and articles on training dolphins and porpoises to offer creative and innovative behaviors (Pryor et al., 1969; Pryor and Chase, 2014). She also founded the well-known clicker training school for professional animal training, The Karen Pryor Academy in 2007 (Karen Pryor Academy, 2013). While Pryor is widely considered the person who brought clicker training into the pet world, Pryor acknowledged in an acceptance speech (at the Association of Behavior Analysis in Chicago) that her work was based on the findings of Breland, Breland, and Bailey 30 years prior (Bailey and Gillaspy, 2005).

Currently, clicker training (also called marker training in the training industry to incorporate all clicker-like devices such as voice, whistles, and vibration) is a supported method of training by independent animal behavior and training certification bodies such as the Certification Council for Professional Dog Trainers (Certification Council for Professional Dog Trainers, 2019), and the International Association of Animal Behavior Consultants (International Association of Animal Behavior Consultants, 2019). However, even with a long history of clicker training, very little research exists to support these claims in pet dogs. In addition, the function of the clicker is also debated. The potential functions of the clicker, and a brief history of clicker training research, is discussed below.

Function of the Clicker

While competing theories exist to explain the function of the clicker, very little research has been done to investigate the underlying mechanisms. Feng et al. (2017) and Dorey and Cox

(2018) conducted systematic reviews of proposed theories as to why clicker training is effective and suggested that it appears to work as a conditioned reinforcer (pairing a neutral stimulus with an effective reinforcer), though more research is needed for confirm this assertion. Others have suggested that it may work as a bridging stimulus (Pryor, 1999). However, given the click's short duration (known as trace conditioning), this is contradictory to robust research (Williams, 1991) that suggests bridges are more effective when the emitting sound is played from desired behavior to delivery of the primary reinforcer (delay conditioning). Finally, the clicker may function as a marking stimulus, which hypothesizes that unexpected and novel events cause the animal to attend to the behavior immediately preceding it (Lieberman et al., 1985). However, as Dorey and Cox (2018) highlighted, a clicker is not unexpected or novel (as it is used repeatedly to train an animal), so its function as a marking stimulus is questionable.

Assuming that the clicker functions as a conditioned reinforcer, it is important to understand the research regarding a clicker's efficacy in acquisition of new behaviors when compared to using food-only. Otherwise, introducing a clicker to pet owners may not be necessary, and would avoid the challenges of using a clicker (timing, coordination) as discussed by Feng et al. (2017). However, because there are only five studies that investigate the use of clickers with domestic dogs, it is important to also consider research that was done with other domesticated animals to get the full breadth of research conducted.

Clicker Training Efficacy

Systematic reviews of existing research on the effectiveness of clicker training with domesticated animals (e.g., goats, horses, dogs) have mostly found the clicker to be effective at training new behaviors, but no more effective than using food alone (Dorey & Cox, 2018; Feng et al. 2017). A chronological summary (see Table 2) of each of these studies are presented below

to illustrate the research thus far, but for more detailed analysis, refer to Dorey and Cox (2018), and Feng et al. (2017).

Table 2
Research investigating acquisition of new behaviors in domestic animals comparing clicker+food to food-only

Study	Species	Behaviors Taught	Clicker More Effective	No Difference
McCall & Burgin (2002)	Horse	Lever and Flap Press		x
Williams et al. (2004)	Horse	Cone Targeting		x
Langbein et al. (2007)	Goat	Match to Sample	x*	
Smith & Davis (2008)	Dog	Cone Targeting		x
Chiandetti et al. (2016)	Dog	Lever Press		x
Gonzalez Ramirez (2017)	Dog	See Appendix A		x**

Note. Only research that measured acquisition of new behaviors are included in the table. Extinction trials not included in the chart. For some studies, a short buzz or tone was used instead of a clicker.
* Langbein et al. (2007) used a differential marker (a different tone) for incorrect responses; different than other research that did not use a no-reward marker
** Gonzalez Ramirez (2017) compared clicker+food to voice+food

McCall & Burgin (2002) first studied clicker training efficacy by training horses to perform new behaviors in two conditions; buzzer (a short buzzing sound that was used instead of a clicker) plus grain, and grain-only. Two behaviors were trained, a lever press behavior and a flap press (similar to a lever, but slightly different) behavior. Both of these behaviors were then extinguished, which measured how many trials were required for the animal to stop offering the trained behavior once reinforcement was no longer available. No difference was found in the duration of time to acquire or extinguish either behavior, however, the buzzer-plus-grain group did offer significantly more flap pressing behaviors than the control group. This finding is further supported by research conducted by Williams et al. (2004) which also invested the use of

clickers with horses and found no difference in the efficacy of a clicker when training a new behavior, and extinction of those behaviors, when using a clicker plus food or using food only. Taken together, these findings indicate that a clicker (or buzzer) plus food is no more effective at teaching horses novel behaviors, nor are these behaviors more resistant to extinction than when behaviors are trained with food only.

Smith and Davis (2008) was the first study to investigate the use of clickers in training with domestic dogs. In this study, thirty-five Basenjis were taught how to touch a traffic cone with their nose and were divided into a clicker-plus-food group, and a food-only group. There was no significant difference in the number of trials required to teach the cone touching behavior. However, the clicker plus food group did require more trials and time to reach extinction (note that in this study, the click was used without food during extinction). This research suggests, again, that a clicker is no more effective at teaching new behaviors but may play a role in increased resistance to extinction.

Thorn et al. (2006) investigated teaching shelter dogs to sit and compared a clicker-plus-food group and a verbal praise-plus food-group. It is important to note that the design for this study is slightly different than the previous two studies discussed. Unlike Smith and Davis (2008) and McCall and Burgin (2002)], Thorn et al., (2016) compared the clicker to verbal praise (both paired with food). The latency to perform the behavior, sit, was the variable measured and while latency decreased for both groups, the verbal praise plus food group had a significantly decreased latency. These findings suggest that praise, when paired with food, was more effective than clickers, when paired with food, in reducing the latency in performing a sit behavior. However, the authors did not study the efficacy of acquiring this behavior.

The next study investigating clicker efficacy was conducted by Langbein et al. (2007), who taught dwarf goats a match-to-sample task on a touch screen. In this study, a brief tone was used instead of a clicker and was paired with water as the reward (tone-plus-water group) for correct responses. Also, in this group, if there was an incorrect response, a different tone was presented as feedback and no water was given. In the water-only group, goats were reinforced with water only for correct responses and did not receive any feedback for incorrect responses. The goats in the tone-plus-water group did reach criterion significantly faster than goats in the water-only group. However, it is essential to note that because the goats received a different tone for incorrect responses, we do not know if the increased efficacy was due to the tone paired with water, the different tone used as feedback for an incorrect response, or both. The differential outcomes effect, where each discriminative stimulus-response sequence always produces a particular outcome (Martínez et al., 2012), may help explain these results and should be investigated further.

More recently, Chiandetti et al. (2016) created an intriguing study design that compared groups in a way that accurately reflects the different approaches a trainer may take when teaching a new behavior. One group was trained using a clicker and food, the second group was trained using a verbal praise paired with food, and the final group was trained with food only. Fifty-one dogs were trained to open a bread box by using their muzzle (and then generalized this behavior to a similar task with a different bread box). The researchers found no significant difference between trials to reach criterion between any of the three groups. These findings are consistent with Smith and Davis (2008) and Thorn et al. (2006) that there is no significant difference in the efficacy of clicker-plus-food when compared to praise-plus-food, or food-only.

González Ramírez (2017) also compared praise-plus-food and clicker-plus-food by teaching seven new behaviors (see Appendix A), as opposed to one or two behaviors in previous studies, to two different dogs. There were no differences in the number of trials required to reach criterion for any of the seven behaviors. These findings provide further evidence that there is no difference in efficacy when teaching new behaviors with clicker-plus-food compared to praise-plus-food.

Finally, in the first study of its kind, Feng et al. (2018) examined the use of clickers with pet dog owners, as opposed to professional researchers or trainers. Because the reported use of the efficacy of clickers comes from dog trainers who train dog owners (Feng et al., 2017), this was a significant step at trying to understand the anecdotal evidence of clickers being more efficient when teaching new behaviors. The study evaluated 45 dog-owners pairs divided across three groups; two groups that that took part in a 6-week basic obedience course with blinded instructors for the clicker-plus-food, and food-only conditions, and a third group that was a waitlist control that did not take part in the 6-week course. The researchers used survey data and behavioral measures to assess impulsivity and dog-owner relationship and found no significant difference between the clicker-plus-food and food-only groups. The researchers also collected data on owner-reported training experiences. The clicker-plus-food owners found teaching their dog to nose-target an object easier, but no differences found for any other behaviors. The study concluded that no significant difference between clicker-plus-food and food-only groups was observed. Notably, owners using clickers perceived teaching their dog to nose-target an object easier than the group that used food-only, but there was no evidence to suggest this was due to clicker efficiency rather than preferred training method.

Research Goals

Of the existing eight research papers, seven concluded that a clicker-plus-reward (or clicker-like device such as a buzz or tone), is not a more efficient training method than using food-only in training new behaviors. The only study that did find a clicker-like device more efficient (in this case a tone) also included a different tone for incorrect responses, so it is unclear if the tone-plus-water (used as the reward) was more efficient than water-only, or if the tone for incorrect responses played a role. This requires further research to investigate the efficacy of incorrect response feedback (also called a no-reward marker in the dog training field), which is outside the scope of this research paper because we are focusing on acquisition of new behaviors without the use of a no-reward marker.

Only one of the eight studies worked with dog owners, and it did not measure efficacy of the acquisition of new behaviors. However, we know that owners perceived an object-targeting behavior easier to teach with a clicker based on survey data (Feng, 2017), so this behavior is a good candidate to use when working with pet owners to explore acquisition of new behaviors. We currently do not have any studies that measure the efficacy of clicker-plus-food and food-only groups when pet owners are teaching their family pets; which is supposed to be one of the major benefits of clicker training hypothesized by Pryor (1999).

Therefore, the goal of this study was to further investigate the use of clicker-plus-food compared to food-only groups with pet dog owners. More specifically, we aimed to assess the efficacy of pet owners teaching their dog two moderately challenging skills; a cone-targeting behavior, and a 360-degree spin using these two reinforcing methods. The cone-targeting behavior was chosen because it has been reported that owners find it easier to teach that behavior with a clicker (Feng et al., 2018). Noticeably this behavior was also taught in both the Smith and Davis (2002), and the González Ramírez (2017) studies, and both found no significant difference

in acquisition of behavior when comparing clicker-plus-food, food-only, or praise-plus-food groups when taught by professional trainers or researchers. The question as to whether clicker-plus-food leads to faster acquisition of the cone-targeting behavior for dog owners has not yet been measured. To our knowledge, this is the first time this has been studied.

In contrast to the cone-targeting behavior, a second behavior was chosen that requires the owner to move in a way that may communicate multiple social cues and could potentially confuse the dog. Rossi et al. (2014) discussed how dogs can be sensitive to head movements, body posture and pointing, and Edwards et al. (2019) discussed how interactions with dogs in a veterinary setting, such as restraint, leaning over, and staring, can cause distress and raise welfare concerns. A spin behavior, taught with a hand target, was chosen because it requires the owner to be close to their dog, involves leaning over, and other potentially confusing body positioning. This behavior presents an opportunity to investigate whether the clicker can be effective in training a behavior and allow the dog to clearly understand what is being reinforced in the presence of a human who may be moving in a manner that could be confusing in terms of what is being asked.

Therefore, our hypotheses for this thesis are:

1. As owners found teaching the cone targeting behavior with a clicker easier than without (Feng, 2018), we expect to see more dogs acquire the behavior in the clicker-plus-food group than in the food-only group.
2. We also expect to see the same results for the clicker when owners are training the spin behavior. Our reasoning is as such; given the added body language that may confuse the dog, we expect to see more dogs acquire the behavior in the clicker-plus-food group due

to the anecdotal evidence of a clicker giving the owners more precise timing (Pryor, 1999).

3. In addition, because we expect more dogs to acquire both the cone-targeting and spin behaviors in the clicker-plus-food group, there would be a higher percentage of goal behaviors (touching the cone target or performing the full spin) when divided by the number of trials due to the faster/higher occurrence of acquisition
4. And finally, we expect to see more goal behaviors (touching the cone target or performing a full spin) performed in the clicker-plus-food group due to the higher occurrence of acquisition.

Methods

Participants and Facilities

Fifteen participants were recruited via a social media platform to complete the research by attending a one-hour group training session (without their dog), followed by a ninety-minute training session with their dog that was scheduled one-to-three weeks following the group session.

Seven adults, between the ages of 29 through 60 (M = 46.86, SD = 12.03) comprised of 6 females and 1 male, were randomly assigned to the clicker-and-food group. The seven dogs in this group were between the ages of 1 and 10 (M = 4.92, SD = 4.92) and comprised of 5 females and 2 males. The dogs in this group were owned for 1 to 9 years (M = 4.14, SD = 3.42). All dogs were mixed-breeds, with the exception of one Bull Terrier.

Eight adults, between the ages of 26 through 69 (M = 43.5, SD = 14.25) comprised of 7 females and 1 male, were randomly assigned to the food-only group. The eight dogs in this group were between the ages of 2 and 10 (M = 5.75, SD = 3.58) and comprised of 3 females and 5

males. The dogs in this group were owned from 3 months to 10 years (M = 4.71, SD = 3.75). All dogs were mixed-breed, with the exception of one Australian Shepherd.

The group training sessions took place in a training room that was approximately 14 feet by 12 feet. Group sessions were limited to 5 or fewer participants to ensure all participants had ample time and space to practice. Individual training sessions were conducted in a 12-foot by 8-foot room (see Appendix D). Participants chose between two clickers; a standard box clicker or an iClick which has a softer click for noise-sensitive dogs.

Materials & Procedures

Owners were provided with the choice of using one of three food treat choices: Happy Howie's beef role, Happy Howie's lamb role, and Happy Howie's turkey role. Multiple treat options ensured that all treats had the same texture and consistency but provided flexibility in case of diet restrictions for the dog. Treats were cut into small cubes, approximately the size of green peas. At least 100 treats were available for each training session. Small pea-sized turkey and hot dog treats were also available for dogs who were not interested in the Happy Howie treats (see Appendix E).

A video of the spin behavior and cone behavior was created by the author with a demonstration dog so the training and acquisition of the behavior could be seen by participants. The same videos were used for both the clicker-plus-food and food-only groups, only the audio was removed from the food-only group so the clicker could not be heard. This ensured that both groups saw the exact same video and received the same educational materials.

In the room, a chair was provided for the owner to sit on in between the training sessions. A dog bed was provided as a soft place for the dog to lay in between sessions. Three bottles of

water for the owner, and a bowl of water for the dog was also provided. The owner was encouraged to bring a book to read in between training sessions.

A small dog bowl was provided to hold the treats during the session. Owners were instructed to keep the bowl of treats on a 3-foot rolling table, or to carry it while holding it behind their back. This provided easy access to treats while training and ensured the dog could not eat directly out of the bowl.

A target stick from The Treat and Train device was used for the targeting training sessions (Appendix C). The base of the target was 5.5 inches in diameter, with the target portion of the device measuring 6 inches from base to the top of the red bulb.

Finally, a Nest Cam was used to record the training sessions on video. The Nest Cam was mounted using a standard mount. Walkie Talkies were used to communicate the start and end of the training and rest sessions to the owner, without disturbing the dog. The stopwatch app on the iPhone was used to time the training and rest sessions.

First, owners were invited to a group session, without their dogs, to learn about the two behaviors that they would be training and how those behaviors would be trained. Owners were randomly assigned (see Table 1) to either the clicker-and-food group (owner reinforces behavior by clicking then providing a treat) or the food-only group (owner would reinforce behavior by providing a treat only).

Table 1
Experimental Conditions

Behavior to be Trained First	Clicker + Food (7 dogs)	Food Only (8 dogs)
Cone-Targeting	4 dogs	4 dogs
Spin	3 dogs	4 dogs

Note. Assignment of dogs to the four experimental conditions

Sessions for the groups were separate as not to allow the participants to know the experimental conditions. The agenda of the meeting was as follows:

1. Owners were welcomed and thanked for attending. They were told that they would be training their dogs two behaviors and that the sessions would be recorded; spin and targeting a cone on the ground. This session, however, was precisely to teach them the concepts of reinforcement, treat delivery, and how to train those behaviors. This group session ensured that all owners come into their training sessions with equal knowledge.
2. Next, the researcher provided all of the clicker-and-food group a clicker and a bowl of food. The food-only group was provided a small cup of food. The researcher said that they were going to play a game where they needed to reinforce the researcher when they touched their finger to their nose. In the clicker-and-food group, the participants would click their clicker, pick up a piece of food, and feed the food into a cup when the experimenter's finger would touch their nose. In the food only group, the participants were instructed to reach into the cup and place a piece of food into a different cup when the researcher touched their nose. This was repeated between 10 and 20 times to allow the participants time to practice reinforcement techniques. The purpose of this activity was to teach reinforcement timing.
3. Participants were then shown a 2-minute video of the spin behavior being taught to a dog. Participants were then instructed that the spin behavior is taught by teaching a hand target, and then by gradually (1 to 2 inches at a time) start moving the hand target in either a clockwise or counter-clockwise direction around the dog, so they had to move gradually in the direction of a spin. Participants were also instructed that if their dog gets confused, go back to an easier step. A game was then performed with the researcher to

practice the timing of reinforcement and delivery to the dog. The researcher used the target device and told the participants to think of the target as their dog's nose. The researcher then placed a jar on the ground in front of the owner and said that placing food in the jar represents feeding their dog. The 3-foot table with a small bowl of dog treats were also set up within 1 foot of the owner. The participants were asked to present their hand target at knee level, and the researcher would touch their hand with the target (again representing the dog's nose). In the clicker-plus-food group, when the target hit their hand, they were instructed to click, and within 1-3 seconds after clicking, reach to the food bowl on the table, pick up a treat, and drop it into the jar on the ground. This was repeated ten times for each owner. For the food-only group, they were instructed that when the target touched their hand, to pick up a treat from the food bowl on the table and place it in the jar. Participants were told that on their training day, they would perform three, three-minute training sessions, with a five to ten-minute break between each session. They were instructed to train for the entire three minutes, and repeat the behavior if their dog acquires the behavior in the session.

4. Next, a video was shown of the cone targeting behavior. The participants were told that they would be shaping successive approximation of their dog touching the cone by reinforcing the following four steps. First, when their dog approaches the cone (reinforcing when their dog is 1-2 inches from the cone). Participants were instructed to toss the food reinforcer 2 to 8 feet passed the cone so that the dog would have to get the treat and would turn back around and approach the cone and owner again. Next, the owners would reinforce when the dog looks at the cone. Participants were instructed to reinforce the dog anytime they look at the cone regardless of distance. Again the food

treat is tossed 2 to 8 feet passed the cone. Next, the owners were to reinforce the dog for both looking at and approaching the cone from any distance by tossing the food treat. Finally, owners were instructed to then reinforce for their dog touching the cone with their nose or paw (always tossing the reinforcer 2 to 8 feet passed the cone). Participants were also instructed that if their dog seemed confused for 5 seconds or longer, they could toss food to reset them (to reduce likelihood of frustration for human and dog participants). Participants were then allowed to practice with the experimenter. Just like in the training sessions, a cone was placed 4 feet from the owner. The owner was then instructed to toss a treat about 4-8 feet passed the cone to start the session. The experimenter walked towards the treat and picked it up and then turned to walk back towards the owner. The owner was instructed to reinforce the experimenter using the same steps above, noting that if the dog does not perform steps 2,3, or 4, always to reinforce step 1 (approaching the cone) or one of the previous steps if the dog offered that behavior.

After the group session was complete, owners scheduled their training session with their dog within 1 to 3 weeks. These sessions required that only one owner and their dog were in the training room at a time to avoid distractions. Owners were advised to feed their dog a light meal before the visit (light dinner being defined as 33% of their normal meal amount).

Owners were brought to the room, and the dog and owner were left alone in the room for 5 minutes to allow the dog to acclimate; the owner was instructed to let their dog sniff and do what they life for that time period while the owner was offered coffee or water. Prior to the owner and dog entering the room, a video recorder was set up to record the session. To ensure all sessions were recorded, the video began recording prior to the owners entering the room, and was stopped

once the entire session was over. A bowl of treats (as described in the materials section) was handed to the owner prior to the researcher leaving. About one-hundred pea-sized treats were in the bowl.

Before starting the first training session, participants were instructed to pair the clicker with food (clicker-and-food group) twenty times by clicking and feeding the dog 1-3 seconds after the click. For the food-only group, owners were instructed to practice delivering food twenty times. Once completed, owners were instructed to use the Walkie Talkie to inform the researcher. Next, the researcher explained that the remainder of the session will be six, three-minute training sessions, followed by a 5 to 10-minute rest period in between training sessions. The first three sessions would be to train the first behavior, and the last three sessions would be used to train the second behavior (half the owners taught spin first, while the other half taught target first). The participants were also shown a quick recap video of the two behaviors that they were taught in the group session.

The researcher would then use the walkie talkie to ask the owner if they were ready. If they confirmed, they were asked to put the walkie talkie down and that the training session would start in thirty-seconds, with the researcher counting down the last ten-seconds followed by “Go” to start the section. The owner would then train their dog on the specified behavior for three minutes, with the researcher using the walkie-talkie at the three minute mark to tell the owner to “Stop”. The owner would then stop training and use the Walkie-Talkie to confirm that they stopped the training session. The three-minute training session, was followed by a five to ten-minute break for the next five sessions (during which time they could use the water available for drinking). For session four, the owner was instructed to start training the second behavior.

Once all sessions were complete, the owner and dog were debriefed on the purpose of the experiment. The owner was presented with a certificate (Appendix B) recognizing their dog for helping with research, and the owner's address was also confirmed to receive a bark box (a gift-box service that includes dog toys and treats).

Coding Protocol

To ensure accuracy of behavior scoring, three video coders were recruited; all were either certified through the Certification Council for Professional Dog Trainers or The International Association of Animal Behavior Consultants (or had an application pending with either organization).

The video coders were informed that they would be watching owners teach their dogs both the cone-targeting and spin behaviors. Audio was removed from the videos to prevent them hearing the clicker in the clicker-only group. It was important that the coders did not know that we were comparing a clicker-plus-food group to a food-only group due to potential bias that may result.

Coders were asked to watch the videos and score each reinforcement trial with an R, N, or S. R was scored when an owner reinforced successive approximations to the cone-targeting and spin behaviors. For example, during the training sessions for the cone-targeting behavior, an R would be scored if a dog was reinforced for approaching the cone, looking at the cone, or approaching and looking at the cone. For the spin behavior, an R was scored if the dog successfully touched the hand target of the owner. N was scored when the owner appeared to be resetting the dog. For example, in the cone-targeting sessions, if the dog neither looked at nor approached the cone for more than five seconds, owners were instructed that they could toss food to reset them and to help avoid the dog feeling frustrated. Similarly, for the spin behavior, if the

dog seemed confused by the hand target and did not target the hand after 5 seconds, they could toss a treat to reset the dog. While this may potentially be confusing for the dog, this step was added to prevent the dogs from feeling frustrated when working with novice trainers who were teaching complex skills through shaping. Finally, an S was scored for a trial if the dog touched the target with their nose in the cone-targeting videos, or completed a three-hundred and sixty degree spin for the spin videos. A behavior was considered acquired when four S's were scored, or three out of four trials were scored with an S.

Coders were asked to record the time-stamp in the video (using Apple QuickTime) when the owner released the food from their hand.

Based on these guidelines, the coders had an 100% accuracy rate (scoring whether the behavior was acquired or not) when we compared their scores to a random sampling of four of the dogs (25% of the sample size). See Table 3. In addition, a Fleiss Kappa score of 1.00 was obtained for the overall agreement ($p = .00$), and a score of 1.00 ($p = .00$) was obtained for both Yes and No (suggesting a very strong agreement). The remaining eleven dogs were then divided amongst the three scorers. When computing final scores, each coder's score was assigned five dogs to ensure equal weighting of coders in the final analysis.

Table 3
Agreement of coders on the acquisition of the spin and cone behavior for four dogs

Dog	Behavior	Coder 1	Coder 2	Coder 3	Agreement
Drew	Cone	N	N	N	Y
Drew	Spin	N	N	N	Y
Gladys	Cone	Y	Y	Y	Y
Gladys	Spin	N	N	N	Y
Pasha	Cone	Y	Y	Y	Y
Pasha	Spin	N	N	N	Y
Ruby	Cone	N	N	N	Y
Ruby	Spin	Y	Y	Y	Y

Following the completion of the session, the six three-minute training sessions were cut from the original video. For each behavior, the videos were named in sequence for the evaluators (three certified dog trainers who were not aware of the research design, groups, or training methods) so that it was easy for the evaluators to determine which order to watch the videos. For each behavior, the evaluators were instructed to watch each video and count the number of reinforcement events (the purposeful delivery of food to reinforce a behavior which was scored as an R). Evaluators were instructed to ignore times food was accidentally dropped, or times the food was tossed to reset the position of the dog (scored as an N). They were also instructed to indicate which reinforcement events resulted in the execution of the defined behavior (full three-hundred and sixty-degree spin or touching the cone with the nose or paw which was scored as an S). Once the desired behavior was executed four times, or three out of four trials in a row, the behavior was considered acquired. Finally, the evaluators were also asked to tally the total number of times the fully desired behavior (three-hundred-and-sixty-degree spin and touching the cone with nose or paw) was performed in each video.

Results

Table 4 shows the total number of times the behavior was acquired in each condition along with the means for total trials (R + N + S), the number of times the desired behavior was performed (S), percentage of trials that were scored S (S divided by R+N+S), and total trials until the behavior was acquired (the fourth S scored or when three out of four trails were scored an S).

Table 4
Acquired behavior counts (Yes and No) and associated means

Behavior	Condition	n	Yes	No	Total Trials	Mean number of trials the goal behavior was performed	% of trials that the goal behavior was performed	Mean number of trials for goal behavior to be acquired
Cone	Clicker+Food	7	1	6	83.29	1.57	1.86%	80.00
Cone	Food-Only	8	4	4	93.5	10.5	12.50%	45.00
Spin	Clicker+Food	7	3	4	71.29	11.14	13.71%	41.00
Spin	Food-Only	8	0	8	56.5	1.38	1.76%	N/A

Before analyzing the results, order effects were examined to determine if teaching cone first or spin first led to increased likelihood of acquisition for both behaviors (see Table 5). Of the five dogs who acquired spin, three taught cone first and two taught spin first. Of the three dogs that acquired spin, two were taught cone first and one spin first. As a result, the order of skills taught was deemed to be meaningless with a Fisher's exact test statistic of 1 (not significant)

Table 5
Order Effects; which behavior was trained first for acquired tricks

Behavior Acquired	Cone Taught First	Spin Taught First
Cone	3	2
Spin	2	1

To understand how the clicker-plus-food and food-only groups compared, fisher's exact test was used to compare these two conditions for both the spin and cone behavior using the acquired data (Y and N) from Table 4. For the cone behavior, three dogs in the Food-Only group and one dog in the clicker-plus-food group acquired the behavior. However, there was no significant difference between the number of dogs that acquired the behavior between the groups

(p = .28, Fisher's exact test). For the spin behavior, all three dogs that acquired the skill were in the clicker-plus-food group; no dogs in the food-only group acquired the behavior. For this behavior, the results are potentially trending significant (p = .077, Fisher's exact test).

Finally, because our data was non-parametric, Mann-Whitney tests were run to analyze the total number of trials, the total number of times the goal behavior was performed (S), percentage S (S divided by the number of total trials), and number of trials required until the behavior was acquired as reported in Table 4. When these variables were analyzed for the cone behavior, total trials (U = 21.00, p = .42), total S (U = 12.50, p = .070), S percentage (U = 21.00, p = .16), and Trials until acquired (U = 1.00, p = .48), there was no significant difference found between the clicker-plus-food and food-only conditions.

Similarly, for the Spin behavior, total trials (U = 13.50, p = .09), total S (U = 19, p = .18), and S percentage (U = 16.00, p = .16) were not significantly different between the clicker-plus-food and food-only conditions. Number of trials until acquired could not be compared for the spin behavior because no dogs in the Food-Only group acquired that behavior.

Discussion

Clicker training is a method of dog training that has dramatically increased in popularity over the past 20 years (Feng et al., 2017). However, while there has been an increased use of clicker training, studies researching the claims that clicker training leads to quicker acquisition of new behavior (Skinner, 1951; Pryor, 1999) has only been investigated in a handful of studies with domesticated animals (Table 2). In addition, all studies that have compared a clicker-plus-food group to a food-only group have found no significant difference in acquisition of a novel behavior (Dorey & Cox, 2018; Feng et al. 2017).

It is important to highlight that all of these past studies used professional trainers or professional researchers to train the novel behaviors. Much of the anecdotal research (Pryor, 1999) on clicker training seems to suggest that clickers help novice animal trainers, like pet owners. This study examined if pet owners could successfully teach their dogs two new behaviors, a cone-targeting behavior and a spin behavior, using the two different training methods, clicker-plus-food, and food-only and whether differences would be found in the efficacy of training these two behaviors.

For the cone-targeting behavior, there was no significant difference in number of dogs that acquired the behavior across the two training methods. This finding aligns with previous research by Williams et al. (2004) and Smith & Davis (2008) which found no significant difference between in acquisition rates when domesticated animals were trained with a clicker-plus-food or food only. However, in the case of the spin behavior, there was a difference in the number of dogs that acquired the behavior in the two training groups. Of the three dogs that acquired the spin behavior, all of the dogs were in the clicker-plus-food group, and none of the dogs in the food-only group acquired this skill. This seems to suggest that a clicker may be beneficial for dogs in situations where conflicting information is present such as added body language from the handler (Rossi et al., 2014; Edwards et al., 2019). However, it is important to note that these results were based on three dogs and only showing a trend thus caution must be taken when interpreting this finding.

When examining the total number of trials, the number of trials the goal behavior (cone-targeting or spin) was performed, the percentage of trials the goal behavior was performed, and trials required to acquire the behavior, there was no significant difference in either group. This suggests that using a clicker-plus-food does not result in any efficacy benefits compared to food-

only when measuring how often the desired behavior was performed; either as a total or as a percentage of trials. In addition, in the case of cone-targeting, there was no difference in the number of trials to reach the behavior acquisition criteria. A striking difference was found in the case of the spin behavior, only 3 dogs in the clicker-food group reached criterion of acquisition and no dogs in the food-only group acquired that skill.

The results of this study confirm what previous studies have suggested, that there is no significant difference in the acquisition of new behavior with a clicker-plus-food vs food-only but there may be a difference depending on the behavior being taught. Therefore, claims that clicker training (pairing a clicker with food) leads to faster acquisition of behavior compared to using food-only needs to be treated with caution. Additional investigation is required to determine the types of behaviors or environments in which a clicker may be more effective than food-only in teaching new behaviors. In this study, for example, it appears that pet owners benefited from using a clicker when teaching a skill that required lots of extra body movements, and leaning over their dog; this can lead to confusing or distracting information from the handler, something the clicker may be able to overcome. These types of behaviors from the handlers can also cause fear in a dog, so using a clicker in husbandry-training (cooperative veterinary and grooming care) should be investigated (Edwards et al., 2019) further based on the findings of this study

In conclusion, statements such as clicker training being more effective than using food-only may not be accurate. The efficacy of clicker training in certain situations, including those that include distracting environments, or when training behaviors that require handlers to use body language that could be perceived as confusing or threatening, needs further investigation. In particular, more research is needed to investigate if and when clicker training is likely to be

more effective for the pet owning public, professional trainers, and researchers. Furthermore, given that the evidence suggests that clicker training is effective, but no more effective than using praise paired with food or using food only, it is important to give pet owners control over what reinforcement method they feel works best for both them and their pet dog. Training of a highly social species such as a dog makes the relationship between the trainer and the animal important. Thus, selecting a reinforcement method that works best for the individual relationship may be more important than the general effectiveness of reinforcement methods. Breland and Breland (1961) discussed the limitations of behaviorism, and the need to use the concepts of behaviorism after first understanding the species and the individual being trained from an evolutionary and ethological perspective. Because dogs have lived within our societies for 20,000 to 40,000 years (Botigué et al., 2017), the function of the relationship between the trainer and dog needs to be strongly considered when making training choices for dog owners and their pets.

Limitations

When interpreting the results from this thesis, it is important to consider key limitations that can be addressed in future research. While the sample size was sufficient for seeing trends, a larger sample size is a requisite to draw further conclusions. In addition, focusing on tricks or behaviors that are more varied (tricks vs husbandry and cooperative care behaviors), and potentially done in more distracting environments (rather than a neutral, low distracting room) would help to determine behaviors and environments that may be more conducive to clicker training. In addition, while no participants had already taught their dogs these skills in the past, previous training experience was varied; controlling for training experience would be beneficial for future research. Finally, focusing on behaviors that require more awkward body language and

inadvertent communication (leaning over, performing grooming or veterinary tasks) should absolutely be investigated based on these results. Given the significant welfare implications of cooperative care for veterinary and grooming procedures, this could potentially be a very high impact area of study.

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Appendix A

Tricks taught in Gonzalez Ramirez (2017)

Trick
Place front paws on a bascule
Back paws on book
Get into cardboard box
Climb on a cooler and lay down
Go under a table and lay down
Turn around a trash can
Stick head into a pot

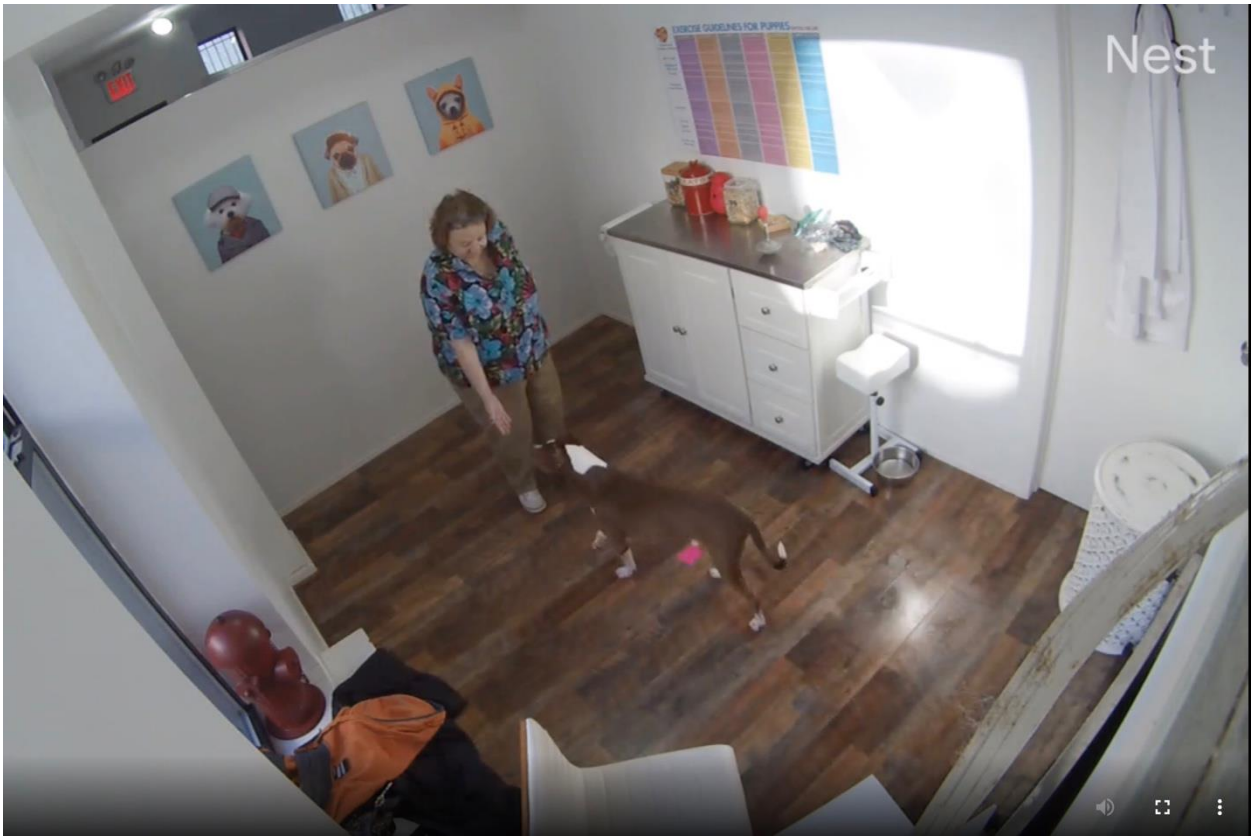
Note. Compared clicker-plus-food group to voice-plus-food group. *No significant difference found between groups in the acquisition of these behaviors*

Appendix B


CANINE SCIENTIST CERTIFICATE
is happily presented to
SADIE
for participating in Hunter College canine research at Instinct Dog Training
BRIAN BURTON
Hooman Scientist
HUNTER
The City University of New York
INSTINCT
DOG BEHAVIOR & TRAINING®

Appendix C

Appendix D



Appendix E