Differences between clicker and voice when used as event markers in shaping novel behaviors in dog training[3]

Mónica Teresa González Ramírez
PhD. Metodología de las Ciencias del Comportamiento
Universidad Autónoma de Nuevo Leon, México
Correo electrónico: monygzz77@yahoo.com

René Landero Hernández
PhD. en Filosofía
Universidad Autónoma de Nuevo Leon, México
Correo electrónico: rlandero1_mx@yahoo.com.mx

Minerva Vanegas Farfano
PhD. en Filosofía con especialidad en Psicología
Universidad Autónoma de Nuevo Leon, México
Correo electrónico: minerva.vanegas@gmail.com

Abstract

The principles of operant conditioning are often applied in canine training. Their correct application requires a good timing, well-defined criteria and a proper rate of reinforcement. Few studies have compared the types of markers of canine training events; the most used are the clicker and the voice. Objective: to compare the number of reinforcers required to shape seven new behaviors in two canine subjects, contrasting the use of the clicker and the voice as markers of events. Results: there is evidence of equivalence in the number of reinforcers needed to achieve the behavior to shape with the use of the clicker and the use of the voice. Conclusions: at least in this study, the timing and the shaping are not affected by the type of marker of events used.

Keywords

Diferencias entre el clicker y la voz cuando se utilizan como marcadores de eventos en la formación de comportamientos novedosos en el entrenamiento de perros

Resumen

Los principios del condicionamiento operante son frecuentemente aplicados en entrenamiento canino. Para su correcta aplicación se requiere un buen timing, criterios bien definidos y una correcta tasa de reforzamiento. Pocos estudios han comparado los tipos de marcadores de eventos en entrenamiento canino, los más usados son el clicker y la voz. Objetivo: comparar el número de reforzadores requeridos al moldear siete conductas nuevas en dos sujetos caninos, comparando el uso del clicker y de la voz como marcadores de eventos. Resultados: indicaron equivalencia en el número de reforzadores necesarios para alcanzar la conducta a moldear con uso del clicker y el uso de la voz. Conclusiones: al menos en este estudio, el timing y el moldeamiento no se ven afectados por el tipo de marcador de eventos usado.

Palabras Clave

Timing; clicker; condicionamiento operante, marcadores de eventos; moldeamiento.

Diferenças na utilização entre o clicker e a voz quando usados no moldado de novos comportamentos no adestramento do cão

Resumo

Os princípios do condicionamento operante são frequentemente aplicados em adestramento canino. Para a sua adequada aplicação requere-se um bom *timing*, critérios bem definidos e uma correta medida de reforçamento. Poucos estudos têm comparado os tipos de marcadores de eventos no adestramento canino; os mais comumente usados são o *clicker* e a voz. Objetivo: comparar o numero de reforçadores requeridos ao moldar sete novas condutas em dois sujeitos caninos, contrastando o uso do *clicker* e da voz como marcadores de eventos. Resultados: evidencia-se equivalência no numero de reforçadores que se precisam para atingir a conduta a moldar tanto quando é usado o *clicker* que quando é usada a voz. Conclusões: pelo menos neste estudo, o *timing* e o moldado não se vem afetados pelo tipo de marcador de eventualidades usado.

Palavras chave

Timing, clicker, condicionamento operante, marcador de eventos e moldado.

|ntroduction

Learning theory, specifically operant conditioning, is often used in dog training (Mills, 1997). Hiby, Rooney, and Bradshaw (2004) noted that traditional training based on positive punishment was popular for several years, but it has been surpassed by training using positive reinforcement, which is now the main method used during dog training (Fukuzawa & Hayashi, 2013). The reinforcement gives a means of controlling the behavior of the animal; it follows the principle that whenever something reinforces a particular form of behavior, it increases the chances that the animal will repeat that behavior (Skinner, 1951).

Clicker training is based on positive reinforcement. During clicker training, a clicker is used as a secondary reinforcer (Williams, Friend, Nevill, & Archer, 2004) that has previously been paired with a primary reinforcer (e.g., food). Thus, a clicker could be consider as a conditioned reinforcer. A clicker is a small plastic device with a metal lever that emits a sound when pressed, and it is used as a positive reinforcer and as event marker in operant conditioning behavior. Despite the continued use of clicker in training, Smith and Davis (2008) noted the absence of investigations of the efficacy of clicker training with dogs. Thus, they compared two procedures to train dogs to touch a traffic cone with their noses: half of the dogs were trained with a clicker (click + food), and the other half were trained with food only. The two groups did not differ significantly in the number of required reinforcements needed to learn the behavior.

However, the cone-touch response of the group that was trained using the clicker extinguished more slowly. It is important to note that the conditioned reinforcer (the clicker) continued to be used during extinction and timing was not evaluated.

To encourage novel behavior, dog trainers often use a technique of reinforcing successive approximations to the desired behavior. Skinner called this technique shaping. Animal learning of novel behavior is limited by how well professional trainers can facilitate the learning process (Wood, 2007), it includes adequate timing and to select an effective primary reinforcer.

Skinner (1951) emphasized that the timing of the reinforcer following the approximation to the target response is critical. He suggested that the reinforcer must be given almost simultaneously with the desired behavior; a delay of even one second can attenuate learning the effect, he was talking about timing. Timing refers to the notion that, to be optimally effective, the consequences applied to a response, such as a reinforcement or punishment, must occur immediately after the response or before another behavior occurs (Yin, 2009). Yamamoto, Kikusui, and Ohta (2009) examined the effect of delayed delivery of consequences on the behavior of ten dogs and demonstrated that timing is an important factor affecting dogs' behavior both when learning new responses and when learning desirable behavior that happens during daily interactions with the dogs' owners.

Browne, Starkey, Foster, and McEwan (2011) proposed not providing immediate reinforcement may adversely affect learning. Later found that a delay of one

second in applying the secondary reinforcer (i.e., the clicker) impeded the learning of a task in 60% of the dogs studied (Browne, Starkey, Foster, & McEwan, 2013).

According to Skinner (1951) the best way to reinforce the behavior with the necessary speed is using a conditioned reinforce, something that works as a signal for the animal because always received food immediately after the signal, and the signal itself then becomes a reinforcer. Skinner added, the better the association between the two events, the better the result. Since then, he proposed using a device as a helper in learning process, he mentioned, for a conditioned reinforcer it is necessary a clear signal which can be given instantly and to which the subject is sure to respond.

A reinforcer such as a clicker can act as a signal when it is used with adequate timing (at the same time that behavior occurred) (Skinner, 1951). Thus a clicker is conditioned reinforcer and a reward or event marker that indicate the behavior that will receive reinforcement (Donaldson, 1996). Following those principles, clicker training is often used in shaping.

An alternative to using a clicker is to use one's voice as an event marker. Although Skinner (1951) proposed using a noise or a flash of light as an event marker, but clickers remain the most commonly used marker. Voice has been criticized as an inadequate marker by trainers as Pryor (2009), who suggested that using vocal cues as an event marker instead of the clicker makes it impossible to receive sufficiently immediate and precise feedback on whether the timing was appropriate. As an example, she

discusses the situation in which an individual tries to say "yes" when bouncing a ball. A central dilemma in this example is the individual does not know whether he/she is saying "yes" before or after the ball touches the floor. Thus, Pryor concludes, without tested in the laboratory, that the clicker offers better timing than vocal cues.

Recognizing the listening ability of dogs and its central role in training, sound variations have been considered as an important aspect to study; Wood (2007) argued that it is highly possible that the type of event marker used in a training scenario plays a critical role in animal learning. Consistent with Pryor, Wood noted that the sound of the clicker does not vary in length or tone and is easily transferred from trainer to trainer because each click is identical. She added that empirical analysis of the efficacy of event markers would be a significant contribution to the literature and to professional trainers. Nevertheless, in that research it was not consider to evaluate timing using voice or clicker as different event markers.

Because different type of stimuli used during "clicker" training have not been compared in their effectiveness in yielding learning, this study tested the effects of using different types of event markers in shaping of novel responses; with the hypothesis that voice as event marker is as useful as clicker, when timing is adequate. A former study was applied to evaluate timing using voice versus clicker as event markers across three different tasks. This previous study guaranteed that person who shaped novel responses in the main study was proficient using voice or clicker as event markers, thus both were

delivered with the same degree of accurate timing. In the main study, the number of required reinforcements between marker events (voice vs. clicker) was compared in two canine subjects learning novel responses.

Method

Former Study

Participants

Three people participated: two women and one man. One woman was a professional dog trainer and typically used her voice as an event marker. The other two people were psychology undergraduate students who were familiar with conditioning concepts, reinforcement, and timing research, but did not have prior experience using clickers or any other event markers in the shaping of behavior.

Apparatus

The participants used the same clicker and ball during all tasks. A video-recorder was used to film every task, and the resulting recording were shown to several judges for evaluation. The study was performed in an empty classroom of the Psychology Faculty of Autonomous University of Nuevo León, Mexico. The classroom was closed, with only the three participants involved in the study and the video-recorder inside.

Procedure

Each participant completed three basic exercises that are used in workshops when training people to use the clicker. In the first exercise, participant should bouncing a ball while using the clicker at the exact moment when the ball hit the floor. Both sounds must overlap and be heard as a single sound. The second involved throwing a ball in the air and using the event marker at the highest point of the ball's flight. The third was a combination of the previous two exercises, which involved using the event marker at the highest point of the ball's flight and when the ball hit the floor. The three exercises were conducted using voice as the event marker and then using the clicker as the event marker, for a total of six exercises with 10 repetitions each. All three participants performed each of the six exercises and were recorded for subsequent coding.

In the other exercise, voice was used as event maker. Consistent with the description of clicker made by Pryor (2009) and Wood (2007), sounds that did not vary in length or tone were selected by each participant. Two of the participants used a sound similar to the English word "cue" and the third subject used a sound similar to the English word "click." It is noted that those sounds "cue" and "click" do not have a meaning in Spanish language. So, the event marker used was a sound, not a word, which was easy to repeat by humans and could be easy to identify by dogs.

The coding of the videos was performed by five evaluators who were provided with the participants' videos and coding forms to indicate whether each repetition was marked correctly. The

evaluators performed their coding activities independently.

The internal reliability of the evaluators was estimated using the following formula: the number of coincidences was divided by the total number of opportunities, and this result was multiplied by 100 (Martin & Pear, 2007). When the evaluators did not reach an agreement level of 100%, an attempt was considered correct or incorrect when three or four evaluators were in agreement (Table 1). Two attempts by one participant were disregarded because one evaluator did not complete the coding form and half of the evaluators assessed the attempts as correct, whereas the other half labeled them incorrect. The three participants achieved good timing, with the percentage of correct attempts ranging from 75% to 100%. The internal reliability of the evaluators was adequate, as it was at least 80% for all cases (Table 1). The following analysis was based on these results.

Table 1.
Comparison of the voice and clicker as event markers.

Exercise / Participant	Percentage of correct voice attempts	Internal reliability of observers	Percentage of correct clicker attempts	Internal reliability of observers	Difference between the voice and clicker (Mann Whitney U-test)
Exercise 1 / Participant 1	100	94.5%	90	92%	Z=-1.049; p=.294
Exercise 2 / Participant 1	70	88%	100	96%	Z=-1.831; p=.067
Exercise 3 / Participant 1	100	96.4%	80	86.7%	Z=-1.522; p=.128
Exercise 1 / Participant 2	100	97.5%	100	90%	Z=0; p=1.0
Exercise 2 / Participant 2	80	97.5%	100	97.5%	Z=-1.453; p=.146
Exercise 3 / Participant 2	75	80%	100	92.5%	Z=-1.630; p=.103
Exercise 1 / Participant 3	100	98%	100	88%	Z=0; p=1.0
Exercise 2 / Participant 3	100	92%	100	100%	Z=0; p=1.0
Exercise 3 / Participant 3	100	90%	100	80%	Z=0; p=1.0

The difference between the number of correct attempts with a clicker versus voice as the event marker was determined using Student's t-test. No significant difference was evident for this comparison (t [178] = -1.300; p = .195).

In addition, the number of correct attempts for each exercise for each participant was compared using the Mann Whitney U-test considering the number of cases to compare. This analysis revealed no significant difference with regard to each exercise and subject.

Results for each subject and exercise are presented in Table 1.

In summary, this first study showed equivalence between using the clicker or voice as event markers when timing was analyzed.

Main Study
Participants

To reduce variability among individuals across conditions in terms of propensity

for learning, the study was conducted with two trained female dogs owned by the same person: a 3.5-year-old Border Collie and a 1.5-year-old Belgian Malinois. Both had previous obedience and agility training. Some of their previously learned responses were trained using verbal markers and others were trained using a clicker, and both dogs had the same training background. In both cases, most training used luring instead of free shaping.

The professional dog trainer who participated in Study One was the person who shaped novel responses with both canine participants. Thus, based on the previous results, her timing was equivalent when she used a clicker or voice as the event marker.

Apparatus

The same clicker was used with both dogs. The verbal markers were the same used previously training some responses with each dog. Thus, with the Border Collie the sound was "cue," and the verbal marker used with the Belgian Malinois was "hi".

Procedure

The testing area used was an empty room in the house of the dogs' owner. To eliminate most distracting noises, the door to the room was closed. Only one task was performed each day. All sessions were videotaped. The coding of these videotapes was performed independently by two evaluators who were provided with the participants' videos and coding forms to count number of required reinforcements per task. The evaluators performed their coding activities separately and had 100% internal reliability.

The procedure was the same in each session. The marker, that is, the click or the spoken sound, was paired with a treat ten times before training the novel response began. Table 2 lists the responses shaped in both dogs with the clicker or the vocal sound as the event marker. The experimenter then placed the dog next to the object to be used during that specific task and stood in front of the dog and the item, looking at the object. The target response (see Table 2) of each dog was shaped by reinforcing successive approximations to the target response. Every correct approximation was marked with the assigned event marker (a single depression of the clicker or the vocal sound) and rewarded with small pieces of sausage. As Skinner (1951) indicated, at first any activity which was part of the final completed task was reinforced, for example, in task number one the first activity reinforced was to watch the bascule; next, to approach to it; next, to place one paw on it, etc. Objective was to perform the task, time used to performed it was not considered.

Each dog was required to perform successively three correct responses for the task to be considered shaped. To be consider as correct, the dog should perform the complete task, immediately that experimenter placed in front of the object without talk. After dog performed response, experimenter stood up, called the dog and waited a minute before placed herself in front of the object to let the dog perform the task again, without an instruction.

Table 2.
Target responses to be shaped

	Tasks	Border Collie	Belgian Malinois
1.	Dog had to place front paws on a bascu-le and keep them on it for 3 seconds	Clicker	Voice
2.	Dog had to place back paws on a book and keep them on it for 3 seconds	Voice	Clicker
3.	Dog had to get into a cardboard box and keep four paws inside for 3 seconds	Clicker	Voice
4.	Dog had to climb on a cooler and to keep sett-le down position on it for 3 seconds	Voice	Clicker
5.	Dog had to go under a small table and to keep sett-le down position under it for 3 seconds	Clicker	Voice
6.	Dog had to turn around a trash can once	Voice	Clicker
7.	Dog had to stick her complete head (to the neck) into a pot and keep it, for 1 second	Clicker	Voice

Statistical analysis

The statistical analysis included a Mann-Whitney U-test for comparisons based on breed and type of event marker. A two-factor ANOVA was used to evaluate the interaction between breed and type of event marker. The dependent variable was the mean number of required reinforcements per task to achieve the target response.

Results

The number of reinforcements per task required to achieve the target response was the same for both markers, as shown in the data reported in Table 3 (Clicker: M = 15.0; S.D. = 4.4; Voice: M = 13.6; S.D. = 7.7; Z = -0.769; p = .442) and breeds (Border Collie: M = 12.3; S.D. = 5.9; Belgian Malinois: M = 16.3; S.D. = 6.0; Z= - 1.090; p = .276) when average of required reinforcements per task were compared.

Differences in terms of the effectiveness of each type of event marker were also analyzed for each canine subject. Event markers were equal effective in both subjects (Border Collie: Z= - 1.962; p = .057; Belgian Malinois: Z= 0.0; p = 1.000), although the Border Collie required fewer reinforcements when voice was used, which nearly reached a significant level.

The two-factor ANOVA indicated that neither the main effect of the breed ($F(1,10)$ = 2.2, p = .165), the main effect of the type of event marker ($F(1,10)$ = 0.508, p = .492), nor the interaction between breed and event marker ($F(1,10)$ = 4.4, p = .061) were significant.

Table 3.
Number of required reinforcements per task and canine subject.

	Task	Border Collie	Number of required reinforcements	Belgian Malinois	Number of required reinforcements
1.	Dog had to place front paws on a bascule and keep them on it for 3 seconds	Clicker	19	Verbal marker	14
2.	Dog had to place back paws on a book and keep them on it for 3 seconds	Verbal marker	11	Clicker	17
3.	Dog had to get into a cardboard box and keep four paws inside for 3 seconds	Clicker	11	Verbal marker	15
4.	Dog had to climb on a cooler and to keep settle down position on it for 3 seconds	Verbal marker	3	Clicker	8
5.	Dog had to go under a small table and to keep settle down position under it for 3 seconds	Clicker	20	Verbal marker	28
6.	Dog had to turn around a trash can once	Verbal marker	9	Clicker	17
7.	Dog had to stick her complete head (to the neck) into a pot and keep it, for 1 second	Clicker	13	Verbal marker	15

Summarizing the results, the study suggested that different types of event markers were equally effective when these are used to shape novel responses. Also, ANOVAS's results showed number of reinforcements required to learn a novel response was equivalent considering breed, type of event marker or the interaction between the breed and event marker for these two dogs.

Discussion

Few previous studies have compared types of training or their effects on dog learning. Although there is an antecedent with the comparison about clicker vs. voice as marker events performed by Wood (2007), where the clicker was more effective than saying the word "good"; our study differed from existing research in methodology and variables studied. For example, Wood did not provide data about an evaluation of timing when each kind of event marker was used or regarding the trainer proficient using both event markers. This study introduced new methodological features to preserve the same conditions for each task, each dog background and to guarantee that timing was equivalent when voice or clicker were used as event markers, thus timing as a variable did not affect results of this study.

Blandina (2010) reviewed Wood's experiment and suggested that the reason why the verbal marker did not compare well against the clicker could be because word "good" was selected as the event

marker in Wood's study. She noted that "good" is a word that dogs may hear all the time based on their interactions with humans. Based on that observation, we used vocal cues instead of specific words to compare clicker and voice as event markers. Sounds "hi" and "cue" do not have a meaning in Spanish language.

Then, the study was designed to control variables that could explain results of previous studies, such as trainer's proficient using both event markers, type of sounds used as event markers, level of difficulty in the tasks performed, dog's training background and the place each task was performed.

Although results were equivalent between subjects, the Border Collie generally required fewer reinforcements to perform the novel response. Only in the first task, she required more reinforcements than the Belgian Malinois, and the results of the statistical analysis do not change excluding this task from analysis. It has also been our results that timing and number of reinforcements required to achieve a target response were not influenced by the type of event marker.

A limitation of the study is the sample size; thus our results are no conclusive regarding the differences based on breed. Differences have been noted by several authors. For instance, according to Coren (2006) Border Collies are considered the brightest dogs for obedience and working intelligence. This breed requires fewer than five exposures to demonstrate understanding of a new command. Conversely, Belgian Malinois dogs are considered to be excellent working dogs that require five to fifteen repetitions to learn a new command (Coren, 2006). Shaping

could be considered a means of demonstrating problem-solving skills. Both Belgian Malinois and Border Collie dogs have been classified as extremely good at learning and memory but not as skilled at problem solving (Coren, 2006). We suggest to continue with research about breed differences, increasing sample size and breeds to compare.

In summary, the results support our hypothesis and suggest that a verbal cue is as effective as clicker, and using verbal cues as event markers in dog training is a good option. Some people could be more comfortable using voice and having hands free and others could prefer to use clicker instead of voice, the decision should be taken according to preference of handler.

For future research it is good to emphasize, in the selection of the sample, the training background of the subjects in addition to the breed. In this study, because the selected dogs came from the same owner with similar daily routines and training background, these issues did not affect the conclusions of the study. Thus, although it is important to perform new studies with more subjects, variables such as age, sex, breed, previous training and daily routine could affect the conclusions of a study with a larger sample.

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