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# Can clicker training facilitate conditioning in dogs?

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ABSTRACT

In the attempt to verify clicker training efficacy in shaping dogs' novel behaviours, we studied 51 domestic dogs. Learning was evaluated in three different conditions: when the primary reinforcer (food) was presented in association with (a) a clicker; (b) a spoken word, a condition absent in previous works on clicker; (c) alone. The three groups were balanced with respect to age, gender and breed; all dogs were naïve with respect to training experience and were shaped by two trainers. After reaching a learning criterion of 8 consecutive correct trials out of 10, each dog was tested for its ability to generalize the learned behaviour in two conditions, one similar and one different from the training condition.

All dogs in our study proved to be equally able to learn the novel behaviour and generalize it to different testing conditions, with no differences associated with the specific acoustic secondary reinforcer used or when the primary reinforcer was presented alone. Although it is always advisable to be cautious in drawing conclusions from non-significant results, here we discuss whether and when there might be a direct advantage in using the clicker method over other secondary or primary reinforcers to model dogs' behaviour.



## 1. Introduction

The dog-human bond is special because it represents a unique example of coevolution dating back at around 15,000–30,000 years ago (for the debate on wolf/dog's domestication see for instance Vilà et al., 1997; Thalmann et al., 2013). Dog companionship is primarily due to dogs' communicative, relational and cooperative skills that made them able to engage successful interactions with humans (Bensky et al., 2013; Kaminski and Nitzschner, 2013). Very likely, these abilities made them particularly suitable, over the years of domestication, for numerous working roles.

Dogs can be trained with methods based on individual learning through which the dog creates an association between antecedents and their consequences. A novel behaviour can be elicited using different strategies summarized well by Kaplan et al. (2002). Briefly, by means of modelling and luring the dog is respectively coaxed or guided by a treat in the desired position and then it is rewarded with the aim of reinforcing that final position and hence the behaviour to reach it; by means of capturing, when the dog spontaneously manifests the desired behaviour it gets a reward. These methods, mostly known and applied by trainers and owners, suffer from intrinsic limitations, which are a repeated forced action from the outside, i.e. from the trainer in the modelling, and an unpredictable time from the dog showing the behaviour by chance in both luring and capturing. Alternatively, with the shaping technique it is possible to systematically reinforce increasingly closer approximations of the target behaviour. The final desired behaviour is reached by adjusting animal's spontaneous responses, which are small achievable steps progressively rewarded towards the definitive behaviour (Skinner, 1951).

The use of positive reinforcement through shaping is a good candidate as a generic method and its successful use dates back to the work of Most (1910/1954) and Konorski and Miller (1937), who anticipated the task analysis of the behaviourism and its employment in operant conditioning (Skinner, 1938; Burch and Pickel, 1990; Mills, 2005). Operant conditioning is a process of learning whereby an association is formed between an arbitrary stimulus and an arbitrary response in virtue of a positive reinforcer. An instance is shown in Fig. 1a: a dog is rewarded to emit a response (push the handle) in the presence of a stimulus (a bread box). The effect of the reward is that of strengthening the association between the stimulus and the response (Skinner, 1951). Another form of conditioning exists and it is called classical conditioning. Differently from the operant conditioning, in classical conditioning an initially neutral stimulus (e.g. a bell) is repeatedly paired with a second

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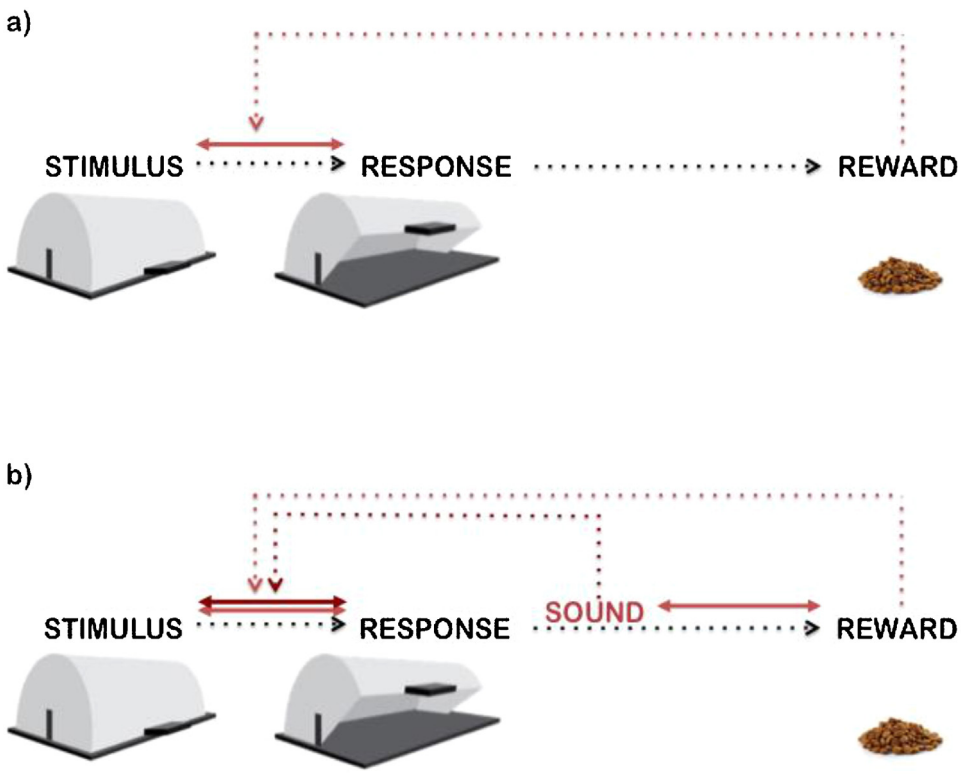


**Fig. 1.** Clicker training in theory.
(a) Diagram of the association formed by means of operant conditioning. (b) Combination of operant and classical conditioning as it is presented during clicker training.

unconditioned stimulus (e.g. food) that naturally evokes an unconditioned response (e.g. salivary reflex). After subsequent pairings of the two stimuli, the neutral stimulus becomes conditioned, as it is capable to evoke by itself the unconditioned response. In this form of conditioning, the dog learns that the conditioned stimulus is a predictor of the unconditioned one, which in case of food is a reward (Pavlov, 1927). The two forms of associative learning (operant and classical) can be used in combination. This is what happens in the so-called clicker training. In clicker training, the animal is reinforced to emit a response as it would happen in operant conditioning, but as soon as it displays the response and before the arrival of the reward, a conditioned stimulus (a distinct "click clack" sound emitted when a mechanical device is pressed and released) is provided (Fig. 1b). Because the clicker reliably anticipates the reward (i.e. the unconditioned stimulus) it then becomes a conditioned stimulus or secondary reinforcer.

The acoustic secondary reinforcer, in clicker training, is used also to mark the exact behaviour that results in food. While training a new and desirable behaviour, the clicker is retained to be effective in that the animal may instantaneously identify the precise behaviour that is rewarded and should be repeated in the immediate future. Also, the sound is meaning to fill in the temporal delay between the behavioural response and the primary reinforcer (Pryor, 1999).

An increasing number of professional dogs' trainers and pet owners is using clicker training to shape dogs' and other domestic animals' behaviour (Lindsay, 2000; Tillman, 2000). Pioneered by Marian Breland and her husband for training animals at a distance (Gillaspy and Bihm, 2002), today growing popularity of the technique is accompanied by the idea that dogs trained with food alone are slower in learning and that clicker is the most effective stimulus to be used as a secondary reinforcer (Pryor, 2005). Indeed, the clicker sound has specific features that can be more effective than the use of a word or a whistle, commonly adopted by trainers and owners, as for instance consistency across persons and moments, and high detectability.

Despite the alleged efficacy of clicker training, scientific evidence in its support is still lacking (Miklósi, 2015). In order to address the efficacy of learning through clicker training, one possibility is that of systematically comparing the training time needed to learn a new behaviour when clicker training is used as compared to other training methods. Two studies investigated this issue using clicker with horses (McCall and Burgin, 2002; Williams et al., 2004) and in both cases no reduction in training time was recorded when learning was assisted with clicker rather than without clicker. Similarly, results obtained with dogs showed no advantage related to clicker use: dogs trained with the clicker learned the new behaviour in the same amount of time as dogs trained with food alone (Smith and Davies, 2008).

Another possibility to verify training efficacy is that of evaluating the strength of conditioning, which can be assessed throughout extinction. Extinction occurs when the secondary reinforcer is presented alone and, since it no longer predicts the arrival of the primary reinforcer, conditioned responding gradually stops (Gleitman et al., 1954). If clicker training is more effective in shaping a new behaviour, this should resist longer to extinction than when it has been shaped with other training methods. One study on horses showed that no difference in extinction emerged between the groups trained with clicker and with food alone (McCall and Burgin, 2002). Conversely, a study on dogs showed that dogs trained with clicker required more trials to extinct the behaviour than dogs trained with food alone (Smith and Davies, 2008). However, a difference of treatment existed in this experiment between the two groups of dogs (i.e. those trained with clicker and those trained without secondary reinforcer): during extinction trials, the reward was withheld from both conditions, but dog in the clicker condition continued to get the secondary reinforcer whenever the target behaviour was displayed. The fact that dogs trained with the clicker

continued to hear the predictor of reward during the extinction phase could have possibly delayed extinction because dogs could have been waiting longer for a reward in virtue of the association between primary and secondary reinforcers.

Yet another alternative to test clicker training efficacy is that of focusing on the comprehension of the association between the antecedents and their consequences. An advantage resulting specifically from clicker training may be displayed when the newly acquired behaviour is applied efficaciously to different novel situations, an ability known as generalization (Pearce, 1987). No study has been conducted on generalization ability after clicker training.

With the present study, we aimed at determining whether the use of a clicker to train domestic dogs to perform a novel behaviour decreases training time or increases ability to generalize the learned behaviour when compared to the shaping obtained with other reinforcers. Also, for the first time, we investigated whether the use of clicker significantly differs from the use of a spoken word, as would be expected if the clicker provides a sharper feedback. To this goal, we compared the performance of dogs either trained with clicker and a treat, or trained with a spoken "Bravo" and a treat, or trained with treat alone, and then we tested them in a generalization task. Dogs had to learn a novel motor action, which was pushing up a handle with the nose and the muzzle in order to open completely a bread box. Then, we presented dogs with two different boxes: a slightly modified version of the bread box and a completely different box in order to test dogs' generalization ability.

## 2. Materials and methods

The experiments comply with European Community (2010/63/UE) and Italian laws on animal experiments by the Ministry of Health (decreto legislativo n.26 del 4 marzo 2014). All dogs were recruited by direct contact with private voluntary owners and tested after authorization of dogs' owners.

### 2.1. Subjects

Fifty-one dogs (*Canis familiaris*) of various breeds and ages (Mean ± SEM = 42.5 ± 4.6 months) participated in the experiment (see Table 1). Dogs were recruited in the areas of Padova, Pordenone and Trieste, in the North-East of Italy. Owners were informed about the aim of the experiment, the conditions for participation (i.e., approximate time needed to complete the pre-training preparation and the test) and were asked to fill in a questionnaire in which dog's general information (i.e., age, gender, training experience and response on cue) was asked. None of the recruited dogs have had neither previous extensive training experience nor specific experience with clicker and were familiar with basic obedience commands only, shaped by un-experienced owners. Dogs have been assigned to the clicker (n = 17), bravo (n = 17) and reward only (n = 17) groups with equal distribution of gender and age (see Table 1) before starting with the preparatory phase (described in details in Section 2.4). Dogs were food-restricted for the 4 h preceding the training and test sessions.

### 2.2. Setting and apparati

All experimental sessions occurred in the same environment in each dog's home (room or garden). Two different female trainers, with basic experience in training using primary and secondary reinforcers, shaped the dogs. Each trainer shaped a comparable number of dogs in each condition and remained the same for each dog from the beginning of training to testing. The trainer was seated or standing approximately 1–2 m away from the training and test apparati. Small pieces of sausage or cheese, depending on dog's preference, were stored in a treat holder and delivered always in the same point near the trainer. For the clicker group, the trainer held a clicker. The same person administered the click-clack or the bravo sounds as well as the food reinforcement.

The training apparatus consisted of a transparent plastic bread box (46 × 31 cm and 19 cm high) with a curved pull-up front cover that could be easily opened by pushing a wooden handle coated with black rubber (Fig. 2a). Two test apparati have been used for the generalization test. A first apparatus, comparable to that of training except for the rear part, which was absent, and for the colour of the pull-up front cover and the handle (red and yellow respectively), was used for a simple generalization test (Fig. 2b). A second apparatus, consisting of a box (29 × 42 cm and 30 cm high) placed on a bigger panel (44 × 55 cm) in woody material with black plastic inserts for the guillotine opening, was used for a complex generalization test (Fig. 2c). The apparati were laid against one or more plastic boxes to adjust the position of the handle in height depending on the size of the dog tested; in between the bread box and the plastic box there was a rubber foam sheet to reduce the sound of the closing of the front cover. All the apparati were regularly cleaned.

### 2.3. Procedure

All dogs underwent an initial preparatory phase in order to get acquainted with the trainer and the general procedure. Two simple tasks were used in this phase: touching a box with the nose and placing a paw on a box. The two tasks were presented in two different single sessions separated by a 30-min interval. The preparatory phase served also to ensure that all individuals of the Clicker and Bravo groups started the experimental phase when the association between the primary and the secondary reinforce was already established. In our study, dogs assigned to Clicker and Bravo groups learned to treat the sounds (click-clack or spoken word respectively) as a food predictor in 2–3 presentations of the preparatory phase. Scott and Fuller (1965) reported that one single experience may be sufficient to make this association and in the study by Smith and Davies (2008), 16 of 18 tested dogs required fewer than 20 trials. Moreover, during the preparatory phase, dogs of all conditions learned the fixed position where the primary reinforcer (the food) would have always been delivered.

During the training phase, each dog was trained with food reinforcer to display the final behaviour, i.e., to open completely the bread box by pushing up the handle with the nose and the muzzle, through a shaping procedure. The task was chosen following two criteria: 1. The target behaviour does not belong to the species' specific behavioural repertoire (dogs unlikely use the nose to push up an handle) and 2. Dogs tested in this study have never been trained before to display such behaviour nor they have interacted with comparable apparati (which were modified or created in our laboratory).

Sessions were limited to 3 per day and, whenever the dog did not reach the learning criterion the first day, repeated the next day. Each session was always ended when the dog was providing a correct response so that the dog could be reinforced with a jackpot, with an interval of at least 5 min between them. All correct responses by dogs in the clicker/bravo group received a click-clack/bravo sound that was immediately followed by food placed in close proximity to the trainer. All correct responses in the reward only group were reinforced with food alone. This means that we followed a fixed ratio 1 schedule in which every response produced food and, for Clicker and Bravo groups, sound and food.

Each dog had to open correctly the bread box 8 times out of 10 consecutive attempts to proceed to the testing session. One week after reaching the learning criterion, each dog underwent a recall phase during which it had to repeat the correct target behaviour 3 consecutive times out of 5 consecutive attempts. Five hours later, each dog underwent 2 unreinforced test trials, in which

**Table 1**
Dogs included in the study. Dogs' breed, gender and age, their subdivision between conditions (Clicker, Bravo or Reward only) and their success (√) or failure (×) at test, in which they had to generalize the acquired motor response on a slightly modified apparatus (simple test) and on a completely different apparatus (complex test).

| Breed | Gender | Age (months) | Test Simple | Test Complex |
|---|---|---|---|---|
| | | **Clicker** | | |
| Jack Russell Terrier | Female | 49 | √ | √ |
| Labrador Retriever | Male | 120 | √ | √ |
| Jack Russell Terrier | Male | 11 | √ | √ |
| Labrador Mix | Male | 48 | √ | √ |
| Cross breed | Female | 71 | √ | √ |
| Cross breed | Male | 59 | √ | √ |
| Cross breed | Male | 23 | √ | √ |
| Cross breed | Female | 18 | √ | × |
| Golden Retriever | Male | 48 | √ | × |
| Flat Coated Retriever | Male | 114 | √ | × |
| Cross breed | Female | 24 | √ | √ |
| Cross breed | Male | 24 | × | √ |
| Flat Coated Retriever | Female | 14 | √ | √ |
| Siberian Husky | Female | 24 | √ | √ |
| Labrador Retriever | Female | 30 | √ | √ |
| American Staffordshire Terrier | Female | 8 | √ | √ |
| Belgian Shepherd | Male | 48 | √ | √ |
| **TOTAL** | **17** | **40.3** | **16** | **14** |
| | | **Bravo** | | |
| Cocker | Female | 36 | √ | √ |
| Boxer/Labrador/Pitbull mix | Male | 12 | √ | √ |
| Cross breed | Female | 38 | √ | √ |
| Cross breed | Male | 75 | √ | √ |
| Cross breed | Male | 36 | √ | √ |
| Cross breed | Male | 18 | √ | √ |
| Cross breed | Female | 51 | √ | √ |
| Cross breed | Male | 66 | √ | √ |
| Cross breed | Male | 60 | × | √ |
| Cross breed | Female | 36 | √ | √ |
| Cross breed | Female | 36 | √ | × |
| Border Collie | Female | 14 | × | × |
| Beagle | Female | 166 | √ | √ |
| Flat Coated Retriever | Female | 14 | √ | √ |
| Australian Shepherd | Female | 24 | √ | √ |
| Beagle | Female | 48 | √ | √ |
| Segugio Italiano | Female | 30 | √ | √ |
| **TOTAL** | **17** | **41.9** | **15** | **15** |
| | | **Reward only** | | |
| Pitbull/American Staffordshire Terrier mix | Female | 16 | √ | × |
| American Akita | Male | 120 | √ | √ |
| Golden Retriever | Female | 72 | √ | √ |
| Cross breed | Male | 62 | √ | × |
| Cross breed | Female | 27 | √ | √ |
| Cross breed | Female | 93 | √ | √ |
| Cross breed | Male | 16 | √ | √ |
| Cross breed | Female | 44 | √ | √ |
| Labrador Retriever | Female | 24 | √ | √ |
| Golden Retriever | Female | 9 | √ | √ |
| Cross breed | Female | 36 | √ | √ |
| Drathaar | Male | 24 | √ | √ |
| Cross breed | Female | 10 | √ | √ |
| Collie mix | Female | 26 | √ | √ |
| Cross breed | Female | 18 | √ | √ |
| Flat Coated Retriever | Female | 42 | √ | √ |
| Zwergpinscher | Female | 24 | √ | √ |
| **TOTAL** | **17** | **39** | **17** | **16** |

dogs had to generalize the acquired motor response on a slightly modified apparatus (simple test) and on a completely different apparatus (complex test). The administration of the 2 test trials followed a counterbalanced order across subjects in order to avoid the interference of confounding variables that could not be entirely anticipated (as for instance a decrease of interest after solving the simple test or a feeling of frustration after failing to solve the complex one). Each test trial lasted 5 min at maximum; after this time, the trial was ended independently of whether the subject showed the generalization of the target behaviour or not.

Dogs' performance was video recorded and each trainer scored the dependent measures for the dogs trained by the other trainer.

As dependent measures, we scored the time and the number of attempts to display the first complete motor action (first behaviour), the time and number of attempts from the first behaviour to the first trial in the sequence to meet the criterion and the time and number of attempts to solve both the simple and the complex test. We then analysed the speed of learning and generalization by computing the indexes of performance calculated as the number of attempts over the time.

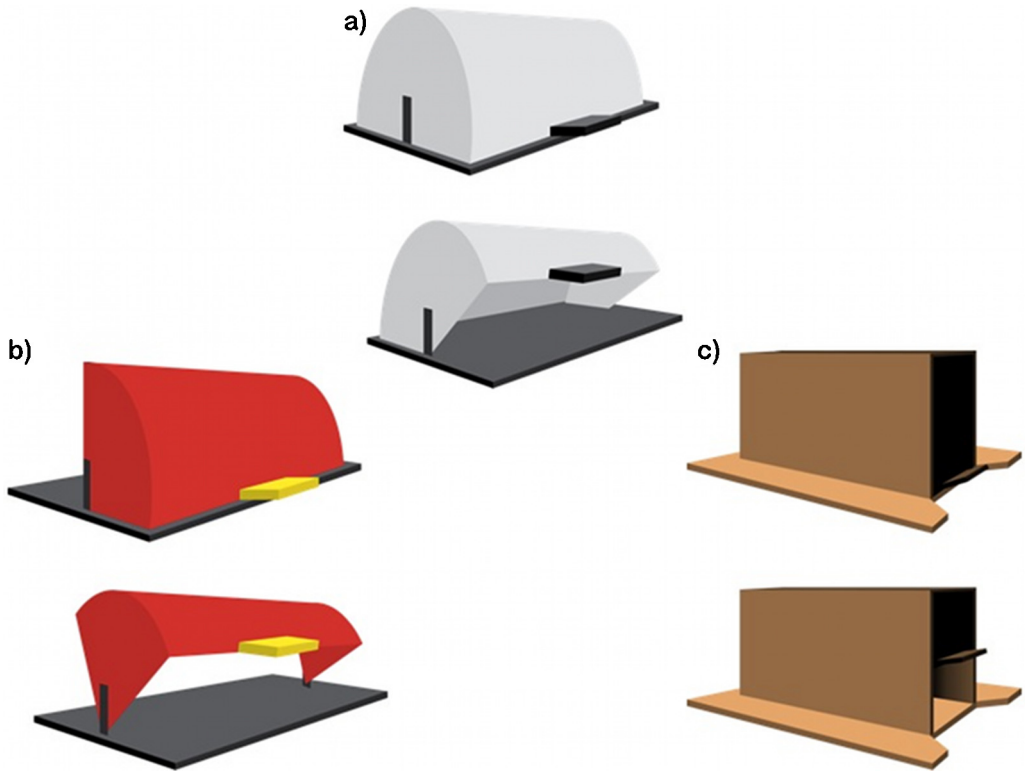


**Fig. 2.** Apparati.
All dogs in the study have been shaped to open with the nose a bread box (a) and then tested for generalization in a simple (b) and complex (c) version of the task in random order. See text for details on the apparati.

### 2.4. Results

All dogs learned the novel behaviour and no differences arose during training between the three groups. After having verified that the assumption of homogeneity of variances was satisfied with the Levene's test,[1] we run an ANOVA with Groups (Clicker vs. Bravo vs. Reward only) as between-subjects factor and Time and Attempts as dependent variables. The analysis showed no heterogeneity, neither from the beginning of training to the first behaviour ($F_{(2,48)} = 1.474$, $p = 0.239$; $F_{(2,48)} = 1.064$, $p = 0.353$) nor from first behaviour to criterion ($F_{(2,48)} = 0.538$, $p = 0.587$; $F_{(2,48)} = 0.160$, $p = 0.853$) as shown in Fig. 3a.[2]

At test, almost all dogs generalized the acquired response to the novel situations (see Table 1). The ANOVA showed that the three groups proved to be equally able to generalize the learned behaviour in terms of both Time and Attempts to the simple ($F_{(2,45)} = 0.529$, $p = 0.593$; $F_{(2,45)} = 0.256$, $p = 0.775$) and the complex test ($F_{(2,41)} = 1.168$, $p = 0.321$; $F_{(2,41)} = 1.104$, $p = 0.341$) as shown in Fig. 3b.

We then considered the indexes of performance. For the training, a first index was calculated by dividing the number of attempts by the time to display the target behaviour the first time; a second index was calculated by dividing the number of attempts by the time to reach the learning criterion. The ANOVA on these indexes of learning did not reveal any difference between the three groups (from the beginning of training to the first behaviour: $F_{(2,48)} = 0.895$, $p = 0.415$; from the first behaviour to criterion: $F_{(2,48)} = 0.804$, $p = 0.453$, Fig. 3c). Comparably, analyzing the performance indexes at test, as depicted in Fig. 3d, no difference emerged at test, either simple ($F_{(2,45)} = 0.913$, $p = 0.409$) or complex ($F_{(2,41)} = 2.100$, $p = 0.135$).

## 3. Discussion

Clicker training might rely on the combination of operant and classical conditioning. While the animal learns to provide a response in the presence of a given stimulus thanks to the reward, this association would also be strengthened by the presence of an acoustic secondary reinforcer that, presented immediately after the response and just before the reward, predicts the arrival of the reward. Indeed, what we expected, in line with what referred by dog trainers and owners, is that the standard acoustic characteristics of the clicker would provide a more stable predictor of the reward than the less consistent spoken words or whistles commonly used by owners and trainers.

Although this combination of associative learning forms and clicker features may be efficacious in principle, no significant positive effects associated with the presence of an acoustic reward predictor emerged in our study, nor when the acoustic reinforcer used was the stable "click-clack" sound of the clicker device rather than the spoken word "Bravo". There were no significant differences in dogs' performance during training, nor they emerged when dogs were tested for their ability to generalize the acquired response from the situation in which they were trained to the novel situations, no matter whether more or less similar to that of training. Learning seems to be independent from the type of sound anticipating the food reward and, even more strikingly, it seems to be equivalent either with or without the clicker sound or the word "Bravo".

[1] Minutes to first behaviour: $p = 0.206$; attempts to first behaviour: $p = 0.885$; minutes to criterion: $p = 0.131$; attempts to criterion: $p = 0.818$.

[2] We found one dog in the Reward only condition that can be defined an outlier in 3 measures (minutes and attempts to first behaviour and minutes to criterion are two standard deviations from the mean). At any rate, the analysis run without the outlier does not change the results; hence, we do not discard it.

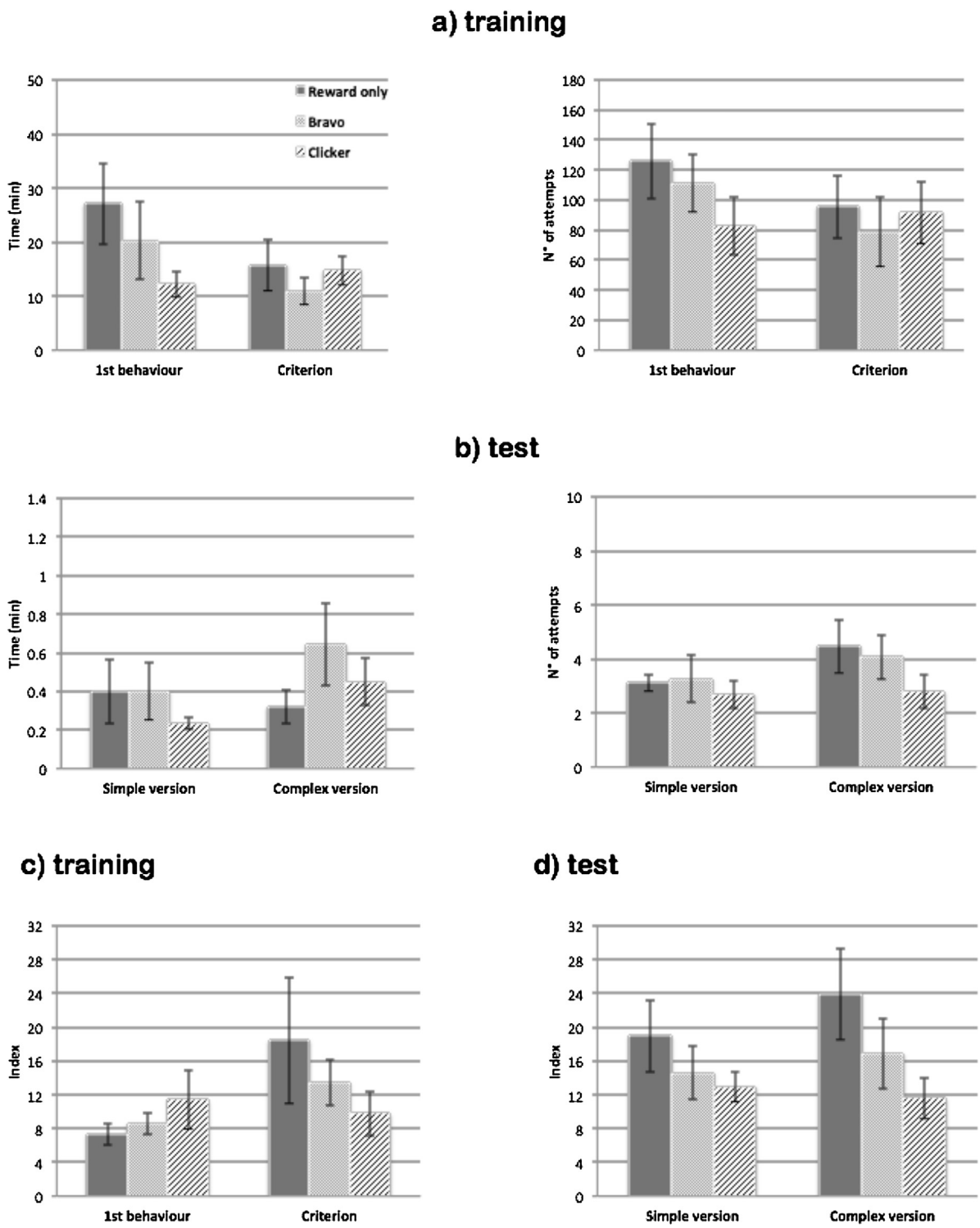


**Fig. 3.** Results.
(a) Performance of the three groups of dogs at training. Means and SEMs are shown for the time and the number of attempts required to display the first complete target behaviour and to reach the criterion. (b) Performance of the three groups of dogs at simple and complex versions of the generalization test. Index of performance during training (c) and test (d) calculated on the basis of attempts over time.

One possibility to explain the absence of a difference between the two types of acoustic secondary reinforcers is that in the present study the word "Bravo" was reproduced with the most consistency possible across trials, something that probably common owners are less prone to do, as they usually shape their dogs without applying a rigorous scientific method.

The reason why we found no positive effects associated with the use of a secondary acoustic reinforcer, with respect to the condition in which we presented the dogs with the reward only, is something we did not anticipate.

On the one hand, dogs are sensitive to human cues (Miklósi et al., 1998) and in our experiment they could have responded to the bowing of the trainer, who was moving toward the position where

the primary reinforcer was delivered. The trainer was not looking at the dog, but the bowing itself could have acted as a secondary reinforcer.

On the other hand, it could be hypothesized that to strengthen the stimulus-response association there is no need of any additional reward predictor, which instead may result in redundant information that can be disregarded. It has been shown that, in classical forms of conditioning, a visual cue like a flashlight can enhance learning because it acts as a marker eliciting a search for the best likely predictors in recent memory traces (Thomas et al., 1983, 1987). This seems to hold true only under specific temporal delays between the response and the reward (Lieberman et al., 1985). However, in instrumental forms of conditioning, a secondary reinforcer did not facilitate the increment of response rates (Pearce and Hall, 1978). These are examples of an application of secondary reinforcers to the distinct forms of either operant or classical conditioning and, to the best of our knowledge, no study has ever been conducted to demonstrate any advantage in learning when the combination of the two forms of associative learning is provided; furthermore, the role of a secondary reinforcer in this peculiar combination has been assessed only in 3 works other than the present study.

We trained and tested the dogs in their familiar living environment, on the assumption that they would have been more prone to concentrate and focus on the training. It remains to be explored whether an advantage related to the use of either one specific secondary reinforcer or the primary reinforcer alone could be observed if the same study is conducted in a neutral or a novel environment. Also, generalization could occur at two levels: the level of the stimulus and the level of the context. Learning could be specific for the stimulus or specific for the context. Here we tested generalization vs. specificity of the stimulus and a further comparison could inform about the effects of different reinforcers in the generalization of the context.

Certainly, if clicker training is more convenient for the trainer than ordinary shaping with food reinforcer only, it does not have to be more efficient to be preferable. Indeed, in using a secondary reinforcement there are practical advantages, which reside in the new originated association: there is no need to use the food to evoke the behavioural response (despite it has to be presented at least occasionally in order to avoid extinction) so that both owners and dog trainers can avoid transporting large amounts of treats and there are no negative side effects related to un-controlled food intake. Furthermore, when the dog has to perform an action suddenly and the immediate use of a food treat is precluded, or the dog has to act farther from the trainer or in an open environment, without the option of well-timed primary rewarding, the use of a secondary reinforcer may show its concrete advantages. However, this holds true whatever the nature of the secondary reinforcer. If there is no evidence supporting one kind of secondary reinforcer over another, i.e., if there is no advantage related to the systematic click-clack over the more mutable spoken word, other factors should guide the choice of the secondary reinforcer.

The fact that dogs pay high attention to other human cues besides the rewarding ones, as for instance those communicative signals shown with ostensive communication (see for a review Reid, 2009), makes social forms of learning more effective than learning based on clicker training, as recently demonstrated by Fugazza and Miklósi (2015). In this sense, we can expect that an enthusiastic regulation of the trainer's tone of voice might modulate the efficacy of the learning. Indeed, dogs (and horses) respond congruently to verbal commands (McConnnell, 1990) as human infants do. In our experiment, the word "Bravo" was pronounced in a neutral and consistent way across trials, thus resembling more the automatic click-clack of the clicker than an enthusiastic trainer. A further investigation should consider the possibility that the melodic contour of the trainer's voice could improve the dogs' learning. Indeed, other types of reinforcer may support effective learning, but little research has been devoted to explore this issue. There is evidence that other positive rewards, as for instance social interactions like petting, are less effective than food reward (Feuerbacher and Wynne, 2012; Fukuzawa and Hayashi, 2013). However, the possible advantage of the group receiving petting is limited by contextual and familiarity factors: to make an example, if the dog is not familiar with the trainer, the interaction will act as a reward with less efficacy than a treat (Feuerbacher and Wynne, 2014; Miklósi, 2015). Another social reward is also the possibility to let the dog do something it likes to do (as playing or meeting other dogs), an alternative reinforcer that paves the way to further investigations in this field.

## 4. Conclusions

Although we should be cautious in drawing any strong conclusion from statistically non-significant results, our study is consistent with previous works conducted in different laboratories with both dogs and horses (Smith and Davies, 2008; McCall and Burgin, 2002; Williams et al., 2004), which, taken together, point toward no advantage in favor of the shaping method using one acoustic signal over another. Moreover, at best the allegedly beneficial effect of clicker would seem to be rather small to justify its systematic usage during training, despite some clear advantages discussed in the previous section. Being equally efficient, the choice of the acoustic signal could rather be related to other features (Fugazza and Miklósi, 2014) like dogs' temperament, breed or professional trainers' expertise, which have, to date, never been systematically studied in an experimental investigation.

Trainers, as well as other variables (as for instance previous owner-dog interactions, age, breed, gender and alterations because of castration), could exert a certain role on dogs' propensity to learn (Rooney and Cowan, 2011; Hart, 1995; Jensen, 2007; Svartberg and Forkman, 2002; Serpell and Hsu, 2005). Indeed, dogs' past experience plays an important role in solving new problems. Marshall-Pescini et al. (2008) showed that highly trained dogs perform significantly better when facing a new problem than untrained dogs, with trained animals proactive in exploration and untrained animals dependent on experimenter's or owner's feedback. In our experimental design, all these individual factors have been randomized across conditions but how they interact with training with secondary acoustic reinforcers (in terms of speed and efficacy) remains an open question for future investigation.

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