Factors affecting response of dogs to obedience instruction: a field and experimental study

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Abstract

Communication is an essential component of the translation of learning theory into the practical control of the behaviour of dogs. A handler sends a signal (e.g. a command), to which their dog responds. This response is dependent on the dog's perception of the signal rather than the intention of the sender. Previous research has shown that a dog's response can be influenced by specific changes in the verbal and non-verbal qualities of signals (i.e. the commands) used, but there has been little scientific evaluation of what happens in practice. Therefore in a first study, 56 dog handlers were videotaped giving their dogs a "sit" command and the significance of verbal and non-verbal factors on response was analyzed. Two factors were associated with a significant decrease in obedience: the dog's attention to its handler and the handler giving additional verbal information preceding the actual verbal command. Based on these results, a second more controlled study was run with 12 dogs that were trained to a new ("uff", i.e. jumping onto a raised surface) and a known ("sit", "down" or "paw") command. Once trained to predefined criteria, dogs were tested for their responsiveness with each of three additional types of verbal information preceding the command: the dog's name, the dog's name followed by a pause of 2 seconds and a "novel word", i.e. a word with no established relationships in this context ("Banane"). The results suggest that the addition of the novel word significantly reduced response to both the known ($p = 0.014$) and the new ($p = 0.014$) commands. The name plus a pause preceding the command significantly reduced the response to the new command ($p = 0.043$), but not the known one. The use of the name before the command without a pause had no significant effect on performance. The dogs' ability to generalize learned commands from the training context to a new context was tested by going through the same procedure in an unfamiliar environment. There was a significant reduction in correct responses only to the new command independent of the preceding verbal information (name ($p = 0.028$), name plus pause ($p = 0.022$) and novel word ($p = 0.011$)). This suggests that dogs may have more difficulties generalizing a less well-established command than an already known command.

Keywords

communication, dog, human, obedience, generalization, training

1 Introduction

Communication has two components: 1) the signaller who is responsible for encoding and transmitting the information within a signal sent to the receiver, and 2) the receiver, who decodes the information within the message according to their own perceptual biases (Shanker and King, 2002, Rowe and Skelhorn, 2003). Therefore the information extracted by the receiver is influenced by many factors ranging from the psychology, sensory and perceptual properties of the receiver him/herself to properties of the environment. The interspecific communication that occurs between handlers and their dogs has been described by Pongracz and colleagues as a form of "social understanding" (Pongracz et al., 2001). However, they emphasise that the social understanding is a concept in the handler's mind as opposed to a cognitive process in the dog. Training has been defined as "techniques used to ensure that learning comes about in a predictable way in response to human intervention" (Mills, 2002) and is a particular, controlled way of communication, which should ideally consist of the transmission of a clear signal from the human trainer to the trained individual to enable learning that will reliably elicit the desired learned response. To be clear, signals should be congruent and unambiguous even when originating from different modalities. The animal must be able to discriminate specific key elements of the command (signal) from more variable elements (noise) both in training as well as in every day situations, (Mills, 2005).

Although common in the laboratory study of learning, simple unisensory signals (i.e. signals that are very consistent and which relate to a single sensory channel such as a tone of specific frequency, volume and duration) are rare in real life situations. Multimodal signals, i.e. those in which information is conveyed through several sensory channels (visual, acoustic, olfactory, tactile, chemical) are the norm (Partan and Marler, 1999, 2005, Partan, 2004, Rowe, 2005). Several studies have examined the importance of variations within specific modalities on dogs' responses; for example the effect of nonverbal variations in a command on the obedience of dogs (Fukuzawa et al., 2005a, Fukuzawa et al., 2005b, McConnell and Bayliss, 1985, McConnell, 1990, Pongracz et al., 2003), or the influence of giving a dog visual communicative signals (Miklosi et al., 2000, Miklosi et al., 2005) or a choice of visual and/or olfactory information (Szetei et al., 2003). These studies illustrate the importance dogs give information from different modalities. Dogs appear to be particularly skilled at “reading” the visual information conveyed by human gaze and pointing gestures, outperforming wolves and some apes (Soproni et al., 2001, Soproni et al., 2002). This is thought to be due to their close association and possible co-evolution with humans during their domestication. Dogs and wolves also differ in what signals they choose to focus on as a source of information. Miklosi et al. (2003) compared the reactions of dogs and wolves to an insoluble problem and found that dogs tend to look at humans for help, whereas wolves continue to try to solve the problem on their own. There has been a recent resurgence of interest in the understanding of verbal language by dogs (Cracknell et al., 2008, Kaminski et al., 2004, Markman and Abelev, 2004), although it has been an area of scientific interest since at least the nineteen twenties and thirties (Sarris, 1931, Warden and Warner, 1928).

Given that most signals are multimodal, it is important to understand the factors affecting an animal’s choice of information to follow when the signs from different channels are incongruent, such as a friendly voice combined with a potentially threatening body posture, or when incongruent information is conveyed within the same channel e.g. an angrily spoken “come” command. Szeitei et al (2003) found that if a dog is confronted with contradictory information about the location of hidden food, one olfactory (food odour) and the other visual (a human pointing to another location), it is more likely to follow the human pointing gesture, highlighting the importance that some dogs tend to place on information coming from people rather than the physical environment.

These studies provide insight into what dogs might focus on and react to when interacting with humans. However, most of these studies were conducted in artificial, controlled settings. This does not necessarily relate to what actually happens in normal daily situations (Kingstone et al., 2003). Therefore, the aim of this study was first to use a field-based methodology to evaluate the significance of a range of verbal and nonverbal interactive factors, which might influence a dog’s obedience, and then to evaluate the robustness of these findings in a more controlled experimental setting.

2 Study I: Field study

2.1 Animals, Materials and Methods

The aim of Study I was to identify, in a field setting, common significant nonverbal and verbal factors that might influence a dog's obedience to a command given by its handler. Fifty-six dog handlers agreed to be videotaped (using a Sony DCR-HC90E video camera) giving their dog the command "sit" during normal weekly training classes. The dog-handler teams were observed in four dog training schools (one in Switzerland, three in England). One of these classes was a "leisure" class (i.e. handlers wanting to do some basic obedience, but not interested in competing), two were obedience classes and one an agility class. Since we were interested in the most prevalent factors affecting dogs in a range of training settings, we did not control for demographic factors relating to the dogs or training experience, and sought a range of populations to sample. The first suitable situation recorded was chosen for analysis in all cases. The distance to the filmed individuals was variable since it was important not to interfere with the ongoing activity, however it usually measured several meters with a zoom option on the video camera used as necessary.

Of the 56 dogs, 33 were male (18 entire) and 22 were female (12 entire, 1 of unknown neuter status). The dogs' ages ranged from 4 months to 9.7 years with a mean of 2 years, (age of one dog unknown). The dog breed groups, using the FCI classification, were: 10 sheepdogs and cattle dogs, 5 Pinscher and Schnauzer or molossoid breeds, 6 Terrier breeds, 2 Dachshunds, 1 dog belonging to the Spitz and Primitive types, 1 scent hound breed, 2 pointing dog breeds, 20 retriever, flushing dog and water dog breeds, 2 companion and toy dogs, 1 sight hound and 6 mongrels. The ages of the handlers varied from one person just under 10 years, four people aged between 10 and 20 years, 39 people between 21 and 60 years, and nine people over 60 years of age. The age of three handlers was not declared. Nineteen of the subjects attended leisure classes, 18 obedience classes, 7 agility classes, 5 obedience and agility classes and 2 dogs were involved regularly in other types of training. Twenty of the handlers had less than a year experience with dogs, 17 had between 1 and 5 years of experience, 2 between 5 and 10 years and 12 had more than ten years of experience handling dogs.

As the aim was to observe handler-dog interactions in an everyday setting, the handlers were informed about the general aim of the project, but were not told which exact command was the focus of interest. Handlers were asked about the commands known by their dogs and the signals used to control this behaviour. The interactions filmed were not staged and the experimenter filmed throughout the training sessions. The behaviour on which the study focussed ("sit") was not a behaviour that was being trained, but a command with which all the dogs were familiar. Whether the dog obeyed or not was noted as well as the sequence of instructions used before the dog responded with the desired response. If the command was repeated, the first command was used for analysis. Hence the focus of this study was not on analysing factors that influence the *learning* of the "sit" command, but on identifying the most significant general interactive factors which influence *obedience to* a given command or not.

The parameters were analysed for the "sit" command of all subjects using the media-tagging program ELAN 2.5.0 (http://www.lat-mpi.eu/tools/elan/elan-description) and are given in Table 1. These were limited to clearly observable behaviours, since identification of more subtle non-verbal signals (such as type of eye gaze, facial expressions, etc.) was not feasible. Analysis focused around the first verbal command whereby information preceding the command within a few seconds was noted. Univariate and multivariate analyses were undertaken using a combination of the statistical software packages Minitab 13.0 and SPSS 11.0.

The study was approved by the relevant University ethics committee. All handlers provided written informed consent and in the case of minors, the consent was signed by the parents who were present during the class.

2.2 Results

2.2.1 Intra-observer reliability of assessment

All 56 dog-handler interactions were coded twice by the same observer several weeks apart. The intra-observer reliability of the results was evaluated using Spearman's correlation comparing "observation one" and "observation two". There was a significant and acceptable positive correlation between the two observations (rho = 0.886, $p < 0.01$, two-tailed). Observation two was then used for further analysis, as this data was associated with the greater experience of the observer.

2.2.2 Descriptive Analysis

Sixty-eight per cent (n=38) of dogs obeyed on first command, i.e. before additional instruction was given or the dog did not respond appropriately. Forty-eight percent had their face turned towards their handlers, which was coded as "paying attention to their handlers", however, all handlers were paying attention to their dogs when giving the command. Sixty-eight percent of the handlers did not give any additional verbal information preceding the actual verbal command. Verbal information preceded nonverbal information in 14% and followed the nonverbal information in 61% of the cases. Twenty-three percent of the handlers gave additional information simultaneously with the command. Sixteen percent of the handlers gave the command using only a single obvious stimulus modality (i.e. verbal, visual or tactile). Handler accuracy regarding their descriptions and implementation of the commands was as follows: 61% gave the "correct" verbal command (i.e. the command they said they used), 30% the correct visual command and 61% the correct tactile command (i.e. touch signal). Twenty-five percent of dogs and handlers were oriented towards each other. Thirty-two percent of the dogs showed at least one of the additional behaviours recorded (i.e. lip licking, etc). Thirty-four percent of the handlers tugged on the lead and 32% used a treat.

For analysis, the original categories describing the sequence of information were pooled to create the following categories (see Table 2): (1) "verbal information preceding nonverbal information", (2) "verbal information", (3) "simultaneous information", (4) "nonverbal information preceding verbal information" and (5) "only one type of command", as the data in the specific categories was insufficient for appropriate statistical analysis.

Sixty-one percent of handlers gave their dog some nonverbal information before giving it verbal information. Twenty-three percent of the handlers gave the dog simultaneous verbal and nonverbal information, whereas 16% of the handlers used verbal information preceding nonverbal information. Of the 16% who used a single command modality, 78% used a verbal command. Thirty-four percent of handlers gave the dog verbal information, such as the dog's name, before giving it the command.

2.2.3 Factors affecting obedience

An initial univariate chi-squared test was used to determine factors to be considered in a multivariate binary logistic model of the dog's obedience. Factors examined were whether the dog was paying attention to its handler or not and whether the owner was paying attention to the dog or not, the sequence of information given focussing on verbal and nonverbal information, the sequence of commands given (if two modalities were used), whether a treat was used to lure the dog, whether the handler tugged on the lead, used their arms or hands or showed any other detectable nonverbal information, whether the given commands (verbal, visual, tactile) were the ones the handlers had previously stated to be the commands used, proxemics (orientation and distance) of the dog and the handler, and additional behaviour information shown by the dog. Associations with p-values less than 0.2 were considered for inclusion and are given in Table 3. In order to reduce the number of factors to include in the multivariate model, associations between the independent variables were assessed by means of a further chi squared test. The following had a high level of statistical significance ($p < 0.005$, 1 df in all cases): "dog's attention" and "tactile agreement" (Chi = 17.352, $p < 0.001$), "dog's attention" and "dog behaviour" (Chi = 13.103, $p<0.001$) "dog's attention" and "orientation" (Chi = 14.900, $p < 0.001$), "verbal O preceding verbal C" and "verbal agreement" (Chi = 33.836, $p < 0.001$), "only one command used" and "nonverbal information followed by verbal information" (Chi =

16.673, p <0.001), “tactile agreement” and “orientation” (Chi = 12.078, p = 0.001), “tactile agreement” and “dog behaviour” (Chi = 8.828, p = 0.003), “tactile agreement” and “lead” (Chi = 44.442, p <0.001), “orientation” and “lead” (Chi = 9.586, p = 0.002).

In the interest of parsimony, the independent factors “dog’s attention”, “verbal information preceding verbal command”, “simultaneous verbal and nonverbal information”, “Nonverbal information preceding verbal information”, “only one command”, “orientation”, and “dog behaviour” were then used in the binary logistic regression model predicting obedience.

Variables were initially included in a forward stepwise analysis in increasing order of their significance in the Chi-square test. The model achieved most efficient reliability (92.1% predictability of obedience and 66.7% predictability of failure to respond, 83.9% overall) after the sequential inclusion of “dog’s attention”, “verbal information preceding verbal command” and “simultaneous information” (Chi-square 24.269, df = 3, p < 0.001), additional factors reduced the log-likelihood by less than 0.01%. The Wald statistics (1 df in all cases) confirmed that the factors “dog’s attention” (8.384, p =0.004) and “verbal information preceding verbal command” (7.550, p = 0.006) significantly predicted the outcome of obedience (simultaneous information Wald 3.344 p=0.067). A backward stepwise procedure was then undertaken, using the same criterion for termination. The proposed model (89.5% predictability of obedience and 61.1% predictability of failure to respond, 80.4% overall) was extracted after 6 steps (Chi-square = 28.870, DF = 4, p < 0.001), when it included “dog’s attention”, “verbal information preceding verbal command”, “nonverbal information preceding verbal information” and “only one command”, suggesting similar convergence. The Wald test (1df in all cases) confirmed the significance of all of these factors (dog’s attention: 8.034 p=0.005, verbal information preceding verbal command: 5.507, p=0.019, nonverbal information preceding verbal information: 4.827, p=0.028, only one command: 5.101, p=0.024).

From this it was concluded that “dog’s attention” and “verbal information preceding verbal command” i.e. whether the dog was paying attention to his or her handler and whether the handler gave additional verbal information prior to the actual verbal command, were the most consistent factors affecting response in this study, with the nature of verbal information preceding the command taken forward for further investigation in Study II.

3 Study II

This study aimed to test the hypothesis that “dog’s attention” and “verbal information preceding verbal command” affected response to an obedience command.

3.1 Animals, Material and Methods

Twelve dogs of various breeds (one Labrador retriever, one Spanish Waterdog, one Cavalier King Charles, one English Springer Spaniel, one Jack Russell Terrier, one Staffordshire Bullterrier, one Border Terrier, one Soft Wheaten Terrier, and four mixed breeds) were used. Seven were male (3 entire) and 5 female (1 entire). The ages of the dogs ranged from 6 months to 10.5 years with a mean of 2 years. The dogs were voluntarily recruited through local advertising at the University of Lincoln.

The choice of additional verbal information was based on the previous study, and consisted of: 1) the dog’s name, 2) the dog’s name followed by a pause of about 2 seconds, and 3) a novel word the dog was unlikely to have encountered in combination with the commands, in this case the German word “Banane” was used.

The same experimenter trained all dogs, wearing the same types and colour of clothes for all sessions, standing in the same position, hands behind her back and looking straight ahead (while the dog was seated to her left on a mat) whilst giving the command. This minimized the impact of inadvertent instructor related variables.

In order to reduce command predictability and to evaluate the effect on two different types of command, two commands were chosen for each dog, (a) a known command (KC) with which the dog was already familiar. This was a “down” for 10 dogs, a “beg” for one dog and a “paw” for another dog, and (b) a new command (NC) unfamiliar to all dogs which was taught by the experimenter. The owners were not present during the training sessions and were not informed about the command or behaviour being taught until after termination of the test in order to avoid the risk of them undertaking any training of this command at home. The word “uff”, unknown to any of the participating dogs, was used to signal jumping up onto an elevated surface for a potential reward.

The dogs were trained in a 10m x 8m room in the middle of which there was an elevated platform (~ 1m x 1m raised 30cm). All training sessions were videotaped using a Sony DCR-HC90E video camera over a period of 4 months from June 2006 to September 2006 at the University of Lincoln, UK.

During the training phase, dogs were trained to their two commands using positive reinforcement. Once a dog passed an acceptable threshold for each of the responses, it entered the test phase, which consisted of a random sequence of commands including eight combinations with different adjunctive information to the trained command (Table 4).

Dogs had to pass a pre-test check of reliable responding to the commands alone (i.e. as trained) at the start of every weekly or bi-weekly session (referred to as “basic command”) before passing on to the test with commands rendered “complex” with either the dog’s name (n), the dog’s name and a pause (n + p) or the novel word (b). This required the dog to respond acceptably to at least 5 out of 6 (83%) KC and at least 4 out of 6 (67%) NC given in random sequence within one session (Research Randomizer, www.randomizer.org, 2006). The dogs’ behaviours were scored using a 5-point scoring system adapted from Fukuzawa et al. (2005b), with 0 being the “lowest” score and 4 being the “highest” (Table 5). Scores 3 and 4 were considered acceptable responses to the command, i.e. the dog obeys, whereas scores 0 to 2 were considered as “incorrect responses”. Different thresholds were used to complement differentiation between the two types of command and the effects of the variables of interest on these (i.e. the new command was less well established). The sequence of the combinations (n, n

+ p, b) used in the tests was varied between subjects by using a double Latin square to control for sequence order.

The training phase and initial test took place in the same room (“Room A”). After completing these, the dog was run through the same pre-tests in Room A and, if it passed, it was then moved into a novel environment (“Room B”) of similar size and arrangement, but with additional furnishings. The dogs had neither been trained in Room B nor had the opportunity to familiarize with it in advance. This allowed assessment of the impact of the novel environment on performance. An additional test, giving the dog only the “basic command” (C) in Room B was added to the combination, which assessed the ability of the dog to generalise the commands to the new context. A different sequence in the Latin Square was used for each subject in Room B compared to Room A.

3.2 Analysis and Results

The number of training sessions necessary for the individual dogs varied from five to nine, with an average of 6.9 sessions required.

A Wilcoxon Signed Rank Test was used to compare the following situations within subjects: 1) Room A: comparison of the number of correct responses in the pre-test (basic commands) and the test (complex commands) in Room A, both for the KC and the NC; 2) Room B: comparison of the number of correct responses to the pre-test in Room A and the test in Room B, both for the KC and the NC. 3) Comparison of the corresponding complex command contexts in Room A and Room B, both for the KC and the NC.

1) Room A, i.e. training room (Fig 1)

The responses to the basic commands were compared with the responses to the complex commands in the same room. A significant decrease in correct responses was found for “b” preceding the KC ($p = 0.014$) and “n + p” ($p = 0.043$) and “b” ($p = 0.014$) preceding the new command (NC).

2) Room B (Fig 2)

The responses to the simple commands in Room A were compared with the responses to the basic commands and complex commands in Room B. A significant decrease in correct responses was found for the following complex versions of the KC: “n + p” (p = 0.043) and “b” (p = 0.036). The correct responses to the basic NC were significantly decreased in Room B compared to Room A (p = 0.013) as well as when preceded by the “n” (p = 0.013) “n + p” (p = 0.008), and by “b” (p = 0.008) (Fig 2).

3) Comparison Room A and B (Fig 3)

In order to examine possible influences of the location on the dogs’ responses to the basic and complex commands, the average number of correct responses (scores 3 and 4) within the following situations: command only; command preceded by the dog’s name (n); command preceded by the dog’s name and a pause (n + p); and command preceded by the novel word (b); were compared for both the KC and the NC in Rooms A and B. A significant difference between Room A and B was found only for the NC, not for the KC. The situations “n” (p = 0.028), “n + p” (p = 0.022) and “b” (p = 0.011) preceding the NC resulted in significantly fewer correct responses in Room B than in Room A for all three situations.

4 Discussion

The aim of this study was first to use a field-based methodology to evaluate the significance of a range of verbal and nonverbal interactive factors which might influence a dog’s obedience, and then to evaluate the robustness of these findings in a more controlled experimental setting.

There are many factors that can influence a dog’s obedience including its training history (Hiby et al., 2004, Pongracz et al., 2001, Rowe and Skelhorn, 2003), the experience of the dog handler (Lynge and Ladewig, 2005) and the familiarity of the dog with its handler (Coutellier, 2006, Lefebvre et al., 2007). The current study suggests that two immediate factors are the focus of the dog’s attention and verbal information preceding the command, and that the effect of the latter may at least in part be affected by how well established the command has become. Many handlers will "chat" to their dogs in quite a complex way (Mitchell and Edmonson, 1999). However, the influence of this "chatting" on obedience, has not, to our knowledge, been examined experimentally previously. Pongracz et al. (2004) reported that one of the most important factors for a dog to successfully follow a human demonstrator was for there to be continuous talking directed towards the dog during the task. In this case, talking may be a way of keeping the dog's attention on the handler, rather than a process of specific information transfer, since Pongracz's aim was for the dog to learn by observation and not respond to a verbal instruction. There is therefore a need to distinguish between verbal utterances, which serve as an attention getting mechanism and verbal utterances, which convey important communicative information. In obedience work, the dog is expected to respond reliably to an identifiable spoken command, and in this context it seems that additional verbiage may be counterproductive, especially if the animal's attention is already on the handler. Our results draw attention to the importance of the content of the acoustic exchange associated with obedience instruction, but it is important to emphasise that non-verbal signalling also plays an important role in practice. For example, Fukuzawa et al. (2005a, 2005b) found that a dog's obedience could decrease if a command was given by a handler wearing sunglasses, changing posture, visibility or at varying distance from the dog. Pongracz et al. (2003) found that dogs are less likely to follow verbal commands alone (i.e. with no visual information) than verbal signs combined with visual signs. Soproni et al. (2002) found that the position of a pointing arm was more important for showing the dog the direction to a food source than the direction of movement of the arm. If the pointing gesture became unclear for the dog for any reason, it tended to rely on the body position rather than the direction of the arm.

Pongracz et al. (2001) stated that "there is no evidence for the role that actual utterances might play in eliciting actions from the dogs. It is possible that the effect of verbal commands is marginal in most situations, and that dogs cannot discriminate between human verbal signals such as humans do". The results of this study support the suggestion that dogs do not generally understand words in the same way as humans. Although they can discriminate between human verbal signals (Fukuzawa et al., 2005b), the current results suggest that responsiveness is affected by familiarity with the verbal information in both its verbal and geographic context. Since attention capacity is limited, it might be suggested that these factors reduce the signal : noise ratio within the message trying to be conveyed. Response appears impaired particularly when additional verbal information precedes a less well established command, as both the “name and pause” (n + p) and the “novel word” (b) preceding the new command (NC) significantly decreased the number of correct responses. The known command (KC) was only influenced by “b”. The name preceding the command did not significantly influence the probability of a correct response for either the KC or the NC. It seems reasonable to assume that a dog’s name is often used in every day life situation and so dogs might learn to discriminate this element of any instruction. In this case, hearing its name preceding a command has no influence on the information that follows, i.e. it does not have a “confusing effect” on the following instruction. However, response to both commands declined significantly when the novel word was inserted prior to the command, suggesting that the type of verbal information preceding a command is important. By contrast, Sarris (1931) observed that his dogs were capable of recognising important information (i.e. a command) within a series of words (in Sarris’ study the German command was embedded in a Greek song). However, teasing out the important information seems to be even more difficult in a new and unfamiliar context, as demonstrated by the results from Room B.

Adding an arbitrary pause between the dog’s name and the command can lead to a further decline in performance. Although the KC was not influenced by the “n + p” in the familiar context, it was in the unfamiliar one and the NC was affected in both situations. As already noted, the NC was, in general, influenced more by extraneous factors. This may relate to familiarity with the command and/or the degree to which it had become established. Overall, the results of this study support the supposition by Pongracz et al. (2001) that “human-dog acoustic communication could be highly situation-dependent”.

Although dogs are able to generalise a command from one signaller to another, e.g. from the handler to another person giving the same command (Miklosi et al., 1998), the current study indicates that they might have trouble generalising from one location to another and that this may be a function of experience.

5 Conclusion

The results suggest that the focus of a dog’s attention and additional verbal information given prior to the command can decrease its apparent obedience. In particular responsiveness may be affected by non-informative verbiage preceding important information. The change in response is also affected by the novelty of the environment relative to where it was taught and also familiarity with the command, with less well established commands being more susceptible to even familiar preceding verbiage such as the dog’s name. In practical terms, these findings suggest that there might be a difference in the usefulness of additional verbal information in an obedience context. These results are consistent with the experience of dog trainers and handlers. Dog handlers should be aware of how different types of verbal information and the change of context can influence their dog’s responsiveness and of the extent to which dogs need to be taught to generalize command stimuli to novel contexts.

6 Acknowledgements

This study was financially supported by the Swiss National Science Foundation.

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8 Tables

8.1.1 Table 1: overview criteria analyzed when observing 56 dogs responding to a “sit” command in every day training situations.

8.1.2 Table 2: Consolidation of original categories

Table 3: Association of observed factors with dependent the variable “obedience”

Table 4: Combinations of adjunctive information (“decoration”) preceding the known command and new command used in test phase

Table 5: Scoring system used to score the dogs’ responses to the commands

9 Figures

Figure 1: Average number of correct responses in initial training room (Room A) in the pre-test situation compared to test situation, when either one of six variants of the known command (KC) or of the new command (NC) is given without or with various forms of preceding adjunctive information.

n = name, n + p = name and pause, b = novel word, KC = known command, NC = new command

Figure 2: Average number of correct responses in initial training room (Room A) to the basic command compared to a novel room (Room B), when either one of six variants of the known command (KC) or of the new command (NC) is given without or with various forms of preceding adjunctive information.

n = name, n + p = name and pause, b = novel word, KC = known command, NC = new command

Figure 3: Average number of correct responses to either one of six variants of the known command (KC) and of the new command (NC) given without and with various forms of preceding adjunctive information.

n = name, n + p = name and pause, b = novel word, KC = known command, NC = new command

Table 1

dog's attention	whether the dog was looking at the handler or not at the time the command was given.
handler's attention	whether the handler was looking at the dog or not when the command was given.
sequence of the verbal and nonverbal information given by the handler	"information" is defined as either the actual (verbal, visual or tactile) command (C) or other (consciously or unconsciously given) verbal, visual or tactile information (referred to as "other information"(O)) that might influence the dog's behaviour. Examples are tugging on the lead, a gesture with the hands or using the dog's name. The following distinctions were made within this category: • "Verbal information preceding nonverbal information": the verbal as well as the nonverbal information can be either C or O). • "Nonverbal information preceding verbal information": the verbal as well as the nonverbal information can be either C or O). • "Verbal information preceding verbal command", e.g. "Tinka…sit!" • "Simultaneous verbal and nonverbal information": two information forms were considered to be simultaneous if they started at the same point in time. The duration of the two information forms was not included in this analysis. • "Only one command was given": this refers only to C, not to any other information (verbal, visual or tactile) the handler might have given during the interaction.
nonverbal information shown by the handler apart from the commands	This information was categorised as follows: • "treat": which included moving a hand to where the treat was kept (pocket, bag, etc), holding a treat in his/her hand throughout the command and luring the dog with a treat. • "lead": which was defined as tugging on the lead ranging from a gentle movement to a rough tug. • "Other": which included possible information given by the hands or arms, such as lifting a finger or an arm; by the head, such as nodding; by the legs, such as taking a big step back, or bending down over the dog.
relative orientation of the dog and handler to each other	the relative orientation refers to the orientation of the body, not the head, hence differs from points 1 and 2, which refer to attention. Hence, a dog might be evaluated to be oriented towards the handler, but not looking at its handler.
dog's behaviour before, during and immediately after the command	it was noted whether the dog showed one or several of the following behaviours: lip licking, blinking, yawning, scratching, sniffing, turning head away from handler, turning back to handler, slow movements, shaking, other.
using the "correct" commands	in a questionnaire preceding the taping, the handlers were asked to describe their usual verbal, visual and tactile commands for a series of behaviours, including the command "sit". This information was then compared with what they actually did and scored as either being "correct", i.e. what the handler had said agreed with what he/she did, or "other". A correct score included both giving the correct command as well as not giving

any other command, if previously noted in the questionnaire that this was the case. If the information given by the handler differed from what they had predicted in the questionnaire, it was labelled as “other”, independent of whether this was giving another command, giving other verbal, visual or tactile information or not giving a command when claimed to give one in this situation.
This category was subdivided into “verbal agreement”, i.e. the handler gave the actual verbal command he/she had predicted and “tactile agreement”, i.e. the handler gave the actual tactile command he/she had predicted.)

9.1.1 Table 2

9.1.2 Category	**Details**	**Frequency**	**%**	**Total**	**Total (%)**
Verbal information preceding nonverbal information	Verbal C -> nonverbal C	1	1.8	9.0	16.1
	Verbal C -> nonverbal O	4	7.1		
	Verbal O -> nonverbal C	2	3.6		
	Verbal O -> nonverbal O	2	3.6		
Verbal information	Verbal C -> verbal O	1	1.8	19.0	33.9
	Verbal O -> verbal C	18	32.1		
Simultaneous information	Simultaneous C	4	7.1	13.0	23.2
	Simultaneous verbal C -> nonverbal O	9	16.1		
	Simultaneous verbal O – nonverbal C	0	0.0		
Nonverbal information preceding verbal information	Nonverbal C -> verbal C	3	5.4	34.0	60.7
	Nonverbal O -> verbal C	31	55.4		
Only one type of command	Only verbal C	7	12.5	9.0	16.1
	Only nonverbal C	2	3.6		

Category = new category; Details = old categories, Frequency = number of participants showing the behaviour in absolute numbers and as percentage (%); Total = number of participants showing behaviour of new category in absolute numbers and as percentage (Total (%)); C = command; O = other information

Table 3

Obedience	Chi square	DF	p-value (2-sided)
dog's attention	10.574	1	0.001
verbal information preceding verbal command	10.206	1	0.001
simultaneous information	3.656	1	0.056
only one command	2.175	1	0.14
verbal agreement	2.944	1	0.086
tactile agreement	2.944	1	0.086
orientation	2.729	1	0.099
dog behaviour	5.38	1	0.02
nonverbal information preceding verbal information	2.944	1	0.086
lead	1.309	1	0.253
treat	1.197	1	0.274

Table 4

combination	name	"nonsense" word	pause	known command	new command
1				x	
2	x			x	
3	x		x	x	
4		x		x	
5					x
6	x				x
7	x		x		x
8		x			x

Table 5

Score	Explanation	
0	No response within 5 seconds of the command	Responses 0 to 2 are considered as "incorrect response"
1	A nonspecific response to the command; for example the dog orients towards the trainer, raises a paw or wags its tail, or the dog shows the behaviour that corresponds to the other command	
2	An incomplete response to the command; e.g. the dog may stop a started command, "change its mind"	
3	A complete but delayed response to the command, with the delay to completion not exceeding 5 seconds, correct response to repetition of the command (max 1 repetition)	Responses 3 and 4 are considered as "correct response"
4	A complete and instant response to the command	