

Owner's beliefs on the ability of their pet dogs to understand human verbal communication: A case of social understanding

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Abstract

We asked Hungarian pet dog owners to fill out a questionnaire about their verbal communication toward their dogs. Thirty-seven owners listed 430 different utterances (30 on average), which they thought their dogs knew. Twenty-one percent of these were synonyms. Utterances could be ranged into categories of actions (in ascending order of occurrence): Disallowance, Posture, Invitation, Referring to object or person, Unique, Information giving, Permission, Question. Owners believed that dogs executed 31 % of commands "every time", 53 % "in contextually adequate situations", and 16% only "occasionally". Age of the owners or dogs, breed of dogs, and the educational status of owners did not strongly affect the utterance structure. A large share of synonyms and actions were believed to be executed only in adequate situations, supporting our idea that the communication between dogs and owners could be described as a form of social understanding. Social understanding is defined as a complex cognitive process in which the subject is able to integrate contextual and social information, and modify his/her behav-

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our accordingly. The owners' verbal commands accompanying gestural and contextual cues could operate as information which facilitates the understanding process.

Key words: dog-human communication, acoustic communication, social understanding, dog-human co-existence, owners' belief.

INTRODUCTION

The evolutionary history of the dog started much earlier and has taken a different course from that of other domesticated animals. It is commonly assumed that dog's association with humans began tens of thousands of years ago (Vilá et al., 1997), a process that has often been described as kind of a co-evolution (Clutton-Brock, 1977; Csányi & Miklósi, 1998; Paxton, 2000; Vilá et al., 1997). Domestication relaxed the use of communicative signals in dogs (Bradshaw & Nott, 1995). During domestication dogs have been selected for characteristics that enhance their adaptation to, and cooperative abilities with human social units (Millot, 1994).

A working knowledge of dog communication indicates that not only strict training but consistently repeated and properly organised situations of interaction with the dog results in a harmonic coexistence between man and dog (McBride, 1995; Fogle, 1990). Dogs seem to be able to extract information from complex social situations that occur during interactions with their human companions. For example, there are reports on working herding dogs in which some parts of the predatory sequence of the wolf ancestor is predominant behaviour during herding (Coppinger, Glendinning, Torop, Matthay, Sutherland, & Smith, 1987) but at the same time they also take into account both the visual and acoustic signals provided by the shepherd (McConnell & Baylis, 1985). Not surprisingly, many authors suggest that dogs and their human owners provide a perfect model for investigating interspecific communication (McConnell & Baylis, 1985; Miklósi, Polgárdi, Topál, & Csányi, 1998; Tomasello, Call, & Hare, 1998).

The behaviour of dogs in complex social situations can be regarded as cases of social understanding. The term "social understanding" refers to a complex cognitive process by which the dog is able to integrate con-

textual and social information for planning its behaviour. Social understanding is inseparable from the situation, where the owner's behavioural, visual, acoustic, and other signals become the necessary releasers for the subsequent action of the dog. The most cautious interpretation of dogs' action is that they react to the situation as a whole in which the verbal command also has its appropriate role. At present we operationally define social understanding operationally as the expectation of the owner that the dog will act appropriately in a given social situation. Thus it could be the opinion of the owner that the dog has shown social understanding if the behaviour of the dog is in agreement with the expectations of the owner. For example, imagine the situation when an owner, preparing to take the dog on a walk, puts on his coat and says "We are going out now!". In this situation, the dog might go for its leash and give it to the owner. Naturally, this action can be regarded by the owner as the dog having understood the particular situation. However, for an observer these events only suggest that the dog behaved as if it understood the situation. Therefore, in this study social understanding is regarded as a concept in the mind of the owner, and not as a cognitive process that might or might not have taken place in the dog's mind.

We have already studied the role of visual cues in cognitive and communicative tasks. Dogs proved to be sensitive in responding to human-given visual cues, such as pointing, bowing, nodding, or glancing (Miklósi et al., 1998). However, dog-human verbal communication has been investigated only sporadically. Early reports investigated whether dogs were able to discriminate between human words (Schiche, 1922), and to our knowledge, only a single report has been published on dog's response to verbal commands (Warden & Warner, 1928).

In the present study, our aim is not to investigate the extent to which dogs can "understand" human speech. Instead, we regard communication between the dog and its owner as an interactive working system, where an event is said to occur if some form of communication by the owner is followed by an action by the dog.

Our approach to social understanding should be contrasted with other experiments that were aimed at investigating the linguistic competence in apes (i.e., Gardner & Gardner, 1969; Premack, 1976; Savage-Rumbaugh, Rumbaugh, & Boysen, 1980). In these studies researchers trained their animals on a set of human-like linguistic symbols, followed by testing their level of understanding in a solely linguistic environment.

The most controversial claim of these studies is whether the apes can acquire, use, or generate grammatical rules, and whether they are able to build new sentences following some of the syntactic rules (see Wallman, 1992). Although the use of complex grammatical rules might be a human specific trait, recent studies (Greenfield & Savage-Rumbaugh, 1990) reported that *Kanzi*, a pygmy chimpanzee (*Pan paniscus*) used grammatical rules in production. Savage-Rumbaugh and Lewin (1994) also demonstrated *Kanzi's* comprehension of syntax and execution of sentence-reversals. Evidence for ape's comprehension of words and novel sentences is solid and congruous with the competence of a 2.5 year old child. In our case, however, verbal signals are regarded as only one component of a social situation, even if they can have a significant effect on the behaviour of the dog. In other words, we do not want to portray the dog as being able to understand human expressions, but these utterances can exhibit a significant modifying effect on the behaviour of dogs in complex social situations.

Dogs are special, "man-made" animals, living in their natural environment, the human settlement (Csányi & Miklósi, 1998; Paxton, 2000). Owners spend much time interacting with their dogs and we have tried to exploit their observations on "dog-human verbal communication". Whiten and Byrne (1988) argued that even anecdotal data in great number and on the same topic could reveal an overall pattern in some areas of behavioural research, so we asked owners to fill in a questionnaire about their beliefs on those utterances which they thought their dogs understood. However, many have noted that such anecdotal "data" might lead to misleading results (e.g., Heyes, 1993), and four caveats call for handling this database cautiously. First, the observer is inexperienced in observing the behaviour of animal, second, he/she is part of the situation that is being described, third, he/she uses an anthropomorphic method of describing the behaviour of the animal (but see, Spada 1996), and fourth, there is a delay between the actual behavioural act and its recording by the observer, and there is a possibility that the observer develops misleading interpretations (i.e., they "make up a story"). Therefore we assume that most of the anecdotes reflect the opinion of the observer rather than the actual reality.

In line with the foregoing discussion we have to convert owners' observations into more appropriate ethological categories, but we will handle these answers collected by the means of the questionnaires as beliefs about the behaviour of dogs and not as actually observed behav-

itorial units. These reported observations could provide evidence of ongoing communicative acts in social situations between man and dog, and a possible role of verbal utterances in these interactions. The actual participation and significance of acoustic communication must be investigated in separate experimental studies.

In the present study, we investigated a "human-dog vocabulary" based upon the data collected via questionnaires from Hungarian pet-dog owners. Based on this database, we devised categories of given utterances and the subsequent, behavioural responses elicited on the part of the dogs to functionally describe the situations in which social understanding occurred.

MATERIALS AND METHODS

Subjects

Thirty-seven owners from among participants of various dog obedience schools volunteered to fill in our questionnaire. At the time of the study they owned 40 pet-dogs altogether; two owners had 2 or 3 dogs. The data of these two and three dogs were averaged separately for further analysis. All owners were living either in the capital (Budapest) or in suburban villages. Our sample consisted either of dogs living in a flat or living in a family house with a garden. Subjects were questioned individually by one of the authors (P.P.).

The age of the owners ranged from 12 to 67 years (mean \pm SE: 33.62 \pm 15.85), their sex ratio was biased toward females (M/F = 9/28). The dogs' age ranged from 0.33 to 13 years (mean \pm SE: 4.41 \pm 3.30), and dogs showed a balanced sex-ratio (M/F = 21/19). Our sample was composed of a broad variety of pure breeds ($n = 15$), and a considerable number of mixed-breed animals (see Appendix).

Methods

The questionnaire was designed to collect the vocabulary of utterances of the owners. Owners were asked to list all utterances or sentences by noting both the corresponding action of the dog and the situation in which they produced the actual utterance. The filling in of the

questionnaire was done *in* the presence of one of the authors who provided help if it was asked for.

The following parameters of vocabularies were examined:

Total number of utterances (U): n of all distinct sentences or expressions listed by the owner.

Total number of synonyms (S): utterances that were considered by the owners to elicit the same response from the dog.

Categories of synonyms (CS): *i.e.*, the number of distinct actions of the dog which could be elicited by more than one utterance.

Net action count (N), which was obtained by the equation $N = (U-S) + CS$.

The number of one-, two-, and three-word long utterances and longer sentences.

Using utterance lists from a pilot study we determined 8 main categories of actions that were characteristic of human commands (name of the category, aim of the action, examples).

(1) *Invitation*: command the dog to come to the person (*i.e.*, the name of the dog, Come here!); (2) *Disallowance*: disrupting any ongoing action by the dog (No! Stop it! Shut up!); (3) *Posture*: commands to take up a body posture or perform a simple action (Sit down! Stand up! Bark!); (4) *Object or person related actions*: actions in association with objects or persons (Find the ball! Give me the stick! Go to Mum!); (5) *Permission*: calling upon or encouraging of any action (You can eat it! Let's run!); (6) *Questions*: linguistic questions (Where is Mum? What do you want?); (7) *Providing information*: verbal information about the environment or future actions (Somebody is coming! Now you won't come with me); (8) *Unique (I will catch You! Show me your eyes!)*.

We also asked owners to judge whether their dog performed the action in question *every time* the utterance was made independent of the situation (1), or every time, but only if made in contextually *adequate situations* (2), or only *occasionally* (3).

Statistical analysis

The number of utterances were transformed into percentages. If data did not differ from the Gaussian distribution, we used parametric methods for analysis of variance and for post-hoc comparisons (independent samples *t*-test, one-way ANOVA and Student-Newman-Keuls post-hoc

test). When the distribution of the data differed significantly from the Gaussian curve, we used nonparametric methods (Spearman Rank correlation, Mann-Whitney U-test, Kruskal-Wallis ANOVA, and Dunn's post-hoc test).

RESULTS

Analysis of utterance structure

The owners listed a total of 430 different utterances. From all the utterances 238 occurred only once and 192 utterances occurred in at least two of the subjects. The total means of the sample for an average dog are shown in Table 1. According to the owners' opinion, most actions of the dogs were executed in contextually adequate situations. Nevertheless, around one third of the actions were performed by the dogs on command independent of the context (Table 2). The most common verbal category used by the owners referred to objects and names. However, all eight categories of actions could be regarded as quite common among the subjects. Even the rarest category, "Question", occurred in almost three quarters of dog-owner dyads. There was a tendency for the most common actions, such as "Referring to objects, names", "Disallowance", and "Posture", to give the largest percentage of the total utterances.

Table 1
Means and standard deviations of the sample for an average dog

	M	SD
Whole utterance count	29.06	± 17.19
Synonym*	22.29	± 18.46
Categories of synonyms	3.18	± 3.37
Net action count	86.92	$t 11.59$
One word	69.73	± 15.16
Two words	20.73	$f 10.30$
Three words	6.37	$f 7.73$
Four or more words	3.16	$f 5.67$

* all percentages are derived from the total utterance count.

Table 2
Owners' opinion about the reliability of execution of their utterances

Reaction of the dog	<i>M</i>	<i>SD</i>
Every time	31.80	± 9.78
Contextually adequate situations	51.47	± 16.45
Occasionally	16.86	± 12.88

Analysis of the correlation between the age of the owners/dogs and the utterance structure

Dogs of elder owners seem to react to more utterances (owner's age \times total utterance count; Spearman rank correlation test, $r_s(74) = 0.35$, $p < 0.05$). All the other parameters of utterance structure were unaffected by the age of the owners.

Similarly, elder dogs were reported to react to more utterances than younger ones (dog's age \times total utterance count; $r_s(74) = 0.51$, $p < 0.01$). Elder dogs also responded less often to invitation commands ($r_s(74) = -0.40$, $p < 0.05$) and to utterances regarding disallowance ($r_s(74) = -0.46$, $p < 0.01$). At the same time, elder dogs responded more often to utterances regarding unique actions ($r_s(74) = 0.43$, $p < 0.01$). All the other parameters of utterance structure were unaffected by the age of the dogs.

Analysis of the connection between the educational status of the owners and the utterance structure

We formed two groups of owners according to their educational status. Group 1 comprised owners with final exams of secondary school as the highest educational level ($n = 17$). Group 2 comprised owners with qualification of higher education (university or college; $n = 20$). We also sorted undergraduate students into Group 2.

Owners in the lower education group listed more one-word utterances (Student's *t* test, $t(35) = 2.64$, $p < 0.05$), while owners in the higher educational group listed three-word utterances in greater ratio ($t(35) =$

-2.35, $p < 0.05$). **None of the other variables were affected by the owners' educational status.**

Analysis of the connection between the genetic makeup of the dog and the utterance structure

The sample was divided into two groups depending on the genetic makeup of the dog. (Group 1: mixed breed dogs ($n = 8$); pure breed dogs ($n = 29$). We analysed the effect of breed with Student's t test (for independent samples). Pure breed dogs were believed by their owners to execute more commands referring to different postures ($t(35) = -3.75$, $p < 0.01$).

Analysis of the connection between the action categories and the reliability of reaction to commands

To determine the effect of execution categories of each action category, a repeated-measures analysis of variance (Friedman nonparametric ANOVA) and a Dunn's post-hoc test were performed. ANOVAs proved to be highly significant in every action category. Figure 1 shows that while the three most frequent action categories (disallowance, posture, and invitation) were generally believed to be executed "every time", all the other categories of action were believed to be confined only to the proper situation.

Analysis of the connection between the length of the utterances and the reliability of the dogs' behaviour

One-word (one-way ANOVA, $F(2, 108) = 4.63$, $p < 0.05$), three-word (Kruskal-Wallis ANOVA, $\chi^2(111) = 11.84$, $p < 0.01$), and longer sentences ($\chi^2(111) = 9.12$, $p < 0.05$) showed a significant effect of the categories of the reliability of reacting to owners' commands. Figure 2 shows the significant group-differences, obtained by post-hoc Newman-Keuls or Dunn tests, respectively.

Owners believed that their dogs were more likely to react to one-word utterances "every time" than "occasionally". For three-word sen-

tences, dogs reacted mostly in contextually appropriate situations. Dogs were believed to react to longer sentences "occasionally" more frequently than "every time".

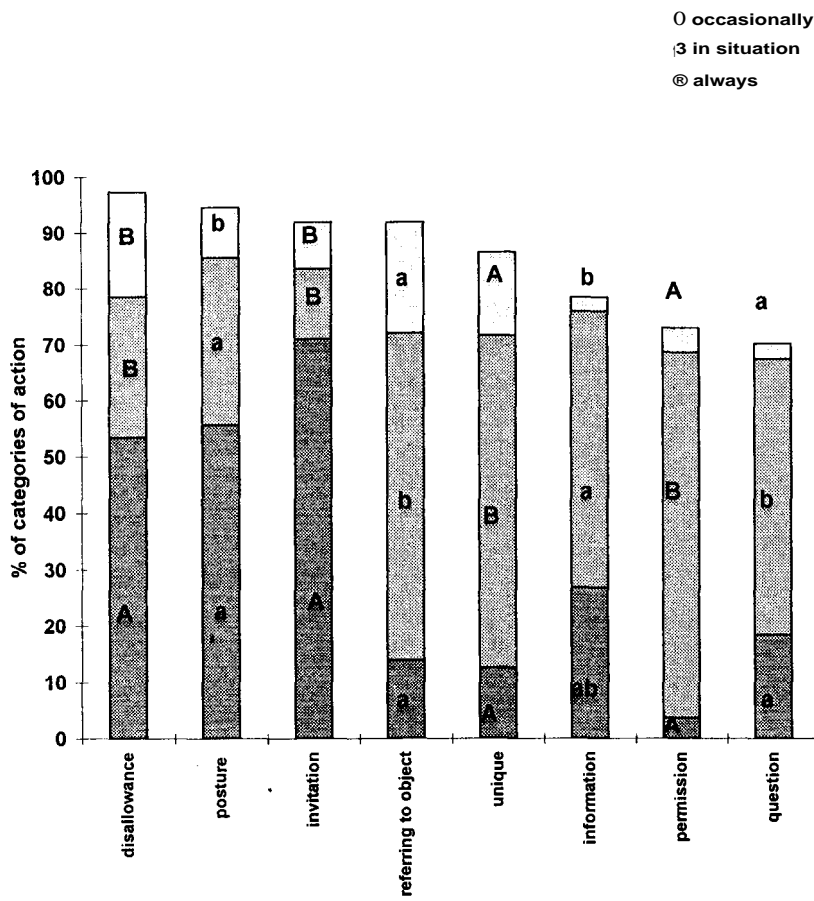


Figure 1. The effect of execution categories on the action categories. The overall height of the stacked bars represents the occurrence of the given action category among the subjects. Significant differences within an action category and between the three execution categories are indicated by different letters. Neighbouring categories are labeled alternately via lower case or capital letters for better discrimination.

Analysis of the connection between the total utterance count and the utterance structure

We formed four groups of subjects, depending on their total utterance counts. Group 1: less than 20 utterances ($n = 13$); Group 2: 20-29 utterances ($n = 10$); Group 3: 30-39 utterances ($n = 5$); Group 4: more than 40 utterances ($n = 9$). We analysed the effect of the total utterance count, as the independent variable, on the reliability of reacting, on the percentage of synonyms and net action count, and finally on the percentage of action types.

The number of utterances in the dogs' vocabulary as judged by the owners had a significant effect on the reliability categories "every time" (one-way ANOVA, $F(3, 33) = 3.82, p < 0.05$) and "contextually

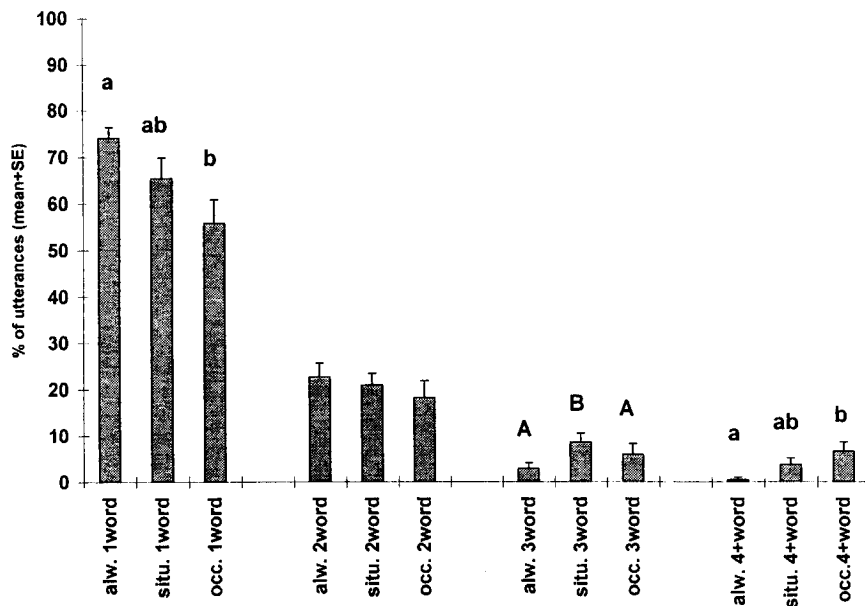


Figure 2. The reliability of execution of differently long utterances. Significant differences within an utterance-length category is indicated by different letters. Neighbouring length-categories are labeled alternately via lower case or capital letters for better discrimination.

appropriate situation", $F(3, 33) = 4.53, p < 0.01$). Figure 3 shows that dogs with more than 40 utterances were believed to react less frequently "every time" but far more frequently "in situation". In neither case did Groups 1-3 differ from each other.

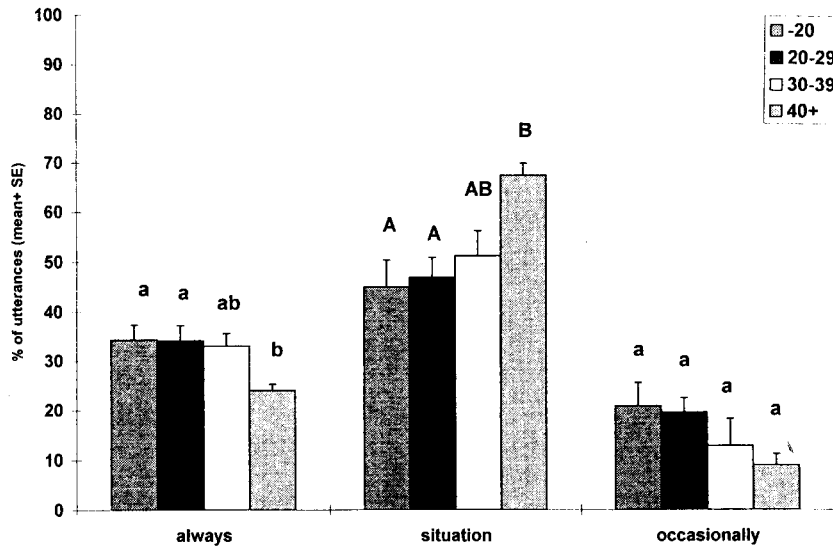


Figure 3. The effect of utterance count on the categories of reliability of execution. Significant differences within an execution category are indicated with different letters. Neighbouring execution-categories are labeled alternately via lower case or capital letters for better discrimination.

The most common actions

The vocabularies contained approximately 70 utterances, which occurred more than twice among the subjects. We found 12 utterances or actions, which occurred in more than half of the dogs.

Figure 4 shows, how the owners believed the execution of these common actions. "No", "Come", "Sit down", "Down" and "Cat" were believed to be executed mainly "every time", while the other utterances were believed to operate "only in the proper situation".

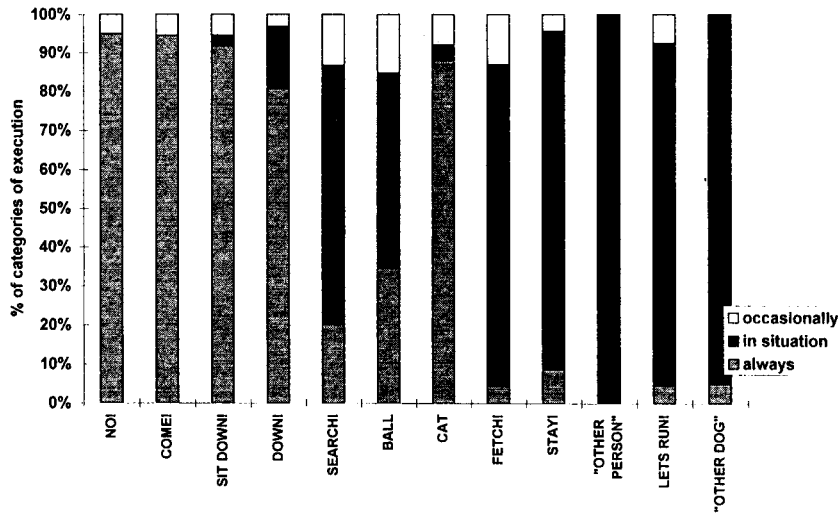


Figure 4. The actions, which occur in more than half of the dog-owner dyads of our sample. The figure also shows the reliability categories of execution of the given utterances.

Table 3
Contribution of the action categories (in percentages) to the total utterance count and occurrence of the categories of actions among subjects

Action category	Total utterance count (<i>M</i> ± <i>SD</i>)		Occurrence among subjects (%)
Referring to objects, names	27.40 ±	14.96	94.60
Disallowance	17.12 ±	9.52	97.30
Posture	15.04 ±	8.42	94.60
Unique	12.48 ±	8.01	86.50
Invitation	8.43 ±	5.26	91.90
Providing information	8.22 ±	8.63	78.40
Permission	6.07 ±	6.01	79.00
Question	5.33 ±	5.43	70.30

DISCUSSION

Since in their response to our questionnaire most owners declared that their dogs understood human utterances "quite well", one can consider the vocabularies to be a collection of anthropomorphic anecdotes. However, we have to take into account that owners made their decisions after continuous observations of their dogs' behaviour. Possibly only the adequate behaviour of dogs allowed owners to judge the dogs' responses as signs of understanding. Recently questionnaire-studies have revealed that preconceptions such as phylogenetic, anthropomorphic closeness to humans, familiarity and affectional bonds with the given animal are all important factors for making a decision upon an animal's "smartness" or intelligence (i.e., Driscoll, 1995; Eddy et al., 1993; Nakajima, 1992; Rasmussen et al., 1993). In these investigations, subjects were asked to rank the animal categories without any evidence that they performed some human-like activity. Since the answer of the subjects was based mainly on their preconceptions, considerable anthropomorphic effects were revealed. However, Mitchell and Hamm (1996) showed that if subjects had to attribute human-like feelings and psychological states to a particular animal after some realistic example of social activity had been presented for them, they tended to attribute the behaviour and feelings of humans in a surprisingly similar manner to different animals (chimpanzees, elephants, bears, dogs, etc.). The most important cue to describing an animal's behaviour was the actual activity it had been doing, and no anthropomorphic bias occurred in the case of any of species. This result suggests that our human subjects could determine the behavioural response of their dogs via the actual activity and not on the basis of prejudice. It is worth noting that according to the owners' judgment, the majority of the actions elicited had been executed "every time" or "always in the contextually proper situation" (Table 2). The relatively low percentage of actions with the execution category "occasionally" could indicate the owners' caution to judge some sort of utterance as known by the dog. However, the low percentage of the utterances to which dogs reacted "occasionally" could also be the sign of the owners' haughtiness toward their dogs. It seems that our human subjects reported in moderate style about their dogs knowledge in verbal understanding. There were no extraordinary, fabulous cases of understanding, not even in the richest vocabularies (over 70 utterances!). This suggests that owners tended to report only situations that happened repeatedly which

might explain why most vocabularies collected lack typical anecdotal elements.

Information provided by the questionnaires indicates some of the basic rules of the human-dog acoustic communication. Owners could give verbal commands, or may merely talk to their dogs, and when the dog does something which seems to be an appropriate reaction to these utterances, the owner considers this event as an evidence to the effect that the dog might have understood her/him. Human verbal communication toward dogs could be divided in calls for different types of actions. An actual call for an action could be modified with an object, or/and some adverb. In a longer sentence, the distinct verbal units do not bear special meaning for a dog, and it is treated as one acoustic signal. There is almost no such situation, where acoustic signals are given in isolation. The main point is that utterances constitute only one component of a communicative situation. Therefore the complexity of the situation affords a more complicated form of social understanding, than merely a signal-response process (McBride, 1995). Dog-human communication occurs often in social situations, where the whole situation could be essential for the emergence of the proper behavioural action in the dog. The relatively large percentage of actions that owners thought of as having occurred only in contextually adequate situations, might be a sign of social understanding.

The vocabularies showed that the previously chosen 8 categories of actions describe an average pet-dog's knowledge of responding to its master utterances quite well. The rarest action was reacting to "Question", but with more than 70 percent of occurrence among the subjects it could be regarded as common. Utterances eliciting "Postures", or given as "Disallowance", or "Names of objects and persons" were the most numerous among the total utterances. These categories were also well represented in the repertoire of another dog, *Fellow*, reported by Warden and Warner (1928). However, it is striking that an average pet dog could be controlled by a relatively small number of commands. Only 12 utterances were reported at least in half of our subjects. These utterances could hardly be replaced by other synonyms and we should regard them as a basic set for living together with a pet-dog. However, it is worth remembering that trained shepherd dogs were working well with a comparably small set of commands (McConnell & Baylis, 1985) in no more than 8 categories of herding actions. Pet dogs are believed to

know much more but their repertoire is highly variable due to the many special situations in their family.

Roughly one-fifth of the utterances were synonyms. Owners believed therefore that in some types of actions more than one utterance could elicit the same response from the dog. This relatively large percentage of synonyms shows that pet-dog owners do not use the same utterance every time, in some cases their "conversations" with the dogs deviate from the most effective known verbal signal, suggesting a multiple relationship between verbal signals and actions (McConnell & Baylis, 1985). Stereotypy is an important aspect of signals involved in animal communication. In animal groups, each member sends the same signal in a remarkably similar way (Wilson, 1975), and this is true especially for the signals used in inter-specific interactions (McConnell & Baylis, 1985). Pet dog owners' acoustic communication with their dogs is rich in synonyms and differs from the very "laconic" form of animal communication and from those languages taught to participants in language projects (Wallman, 1992). However, it is worth mentioning that we have no evidence yet 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 (see Warden & Warner, 1928).

Elder owners tended to list more utterances, but the structure of these vocabularies were the same as those of younger owners. As there was no correlation between the ages of humans and dogs, it is unlikely that elder owners had kept their dogs for a longer period, and therefore had taught them more utterances. However, it could be that they had had more dogs previously and acquired more experience in communication with dogs, or that they were merely more sensitive to the reactions of the dogs. The age of dogs also correlated with total utterance count, and with some other parameters of the utterance structure. Elder dogs were reported to react relatively rarely to invitation and disallowance, but their repertoire was believed to contain relatively more unique actions. This could indicate a shift toward a more variable and sophisticated form of the dog-human interactions as the years go by. At the same time the "basic set" of commands referring to disallowance and other simpler commands remains on the same level. Age of a dog is a good indicator of the length of time it previously spent together with the owner. Elder dogs could have had more time to develop their repertoire of responses

to their owner's utterances, which might explain why the owners of elder animals believed their dog had understood more.

This latter observation may indicate that the learning process of utterances in dogs could sometimes differ from classical signal-conditioning. Warden and Warner (1928) noted that the proper method of training of the dog, *Fellow*, remained unknown, and his owner reported that *Fellow* had been raised and spoken to as a child growing up in a family. The emergence of language in human children differs in important aspects from learning of a set of individual signals. Learning a new word (especially in the mother-tongue, or learning a language in early childhood) does not require complicated teaching nor any classical reinforcement. According to many theories, children rely on pre-existing strategies in assigning words to situations (Pinker, 1994). Learning to respond to human utterances may be a lifelong process for a dog, its intensity and speed not only depend on the teaching efforts of the owners, but on the social environment and on the plasticity of joint activities. It is worth considering that the 8 categories of actions of dogs are more extensive than the usual "sit down" "come here" "don't do that" repertoire. "Question", "Providing information", "Unique" actions are hard to explain via signal conditioning. Perhaps even the owners themselves would not be able to describe, how their pets acquired this knowledge. The answer could be related to the species specific features of the dog. The capacity for attachment and social attraction enables dogs to coexist and cooperate with humans easily (Topál et al., 1998). Studies have demonstrated their competence in the acceptance of human-given cues and social rules (Miklósi et al., 1998).

Owners' educational status did not greatly affect utterance structure. While owners in the higher educational group tended to believe their dog reacted more to three-word sentences, and owners with lower schools listed more one-word utterances, this could merely reflect dissimilarities in the view of the two groups, how they were thinking about their conversations with the dogs.

The genetic makeup of the dogs did not have an overall effect on the utterance structure. As owners in the sample mainly kept their dogs as pets, the utterances they use may be the same in the common situations when they are together with their dogs. If we targeted special types of breeds, or not pet-dog owners, but shepherds, policemen, etc., we might have observed larger differences. These results show that both mixed breed and pure breed dogs could work quite well as a pet.

Owners believed that dogs reacted "every time" or "always in the contextually adequate situation" to most of their utterances (83 %) and less than 20 percent of the utterances evoked only actions "occasionally" (Table 2). However, dogs responded with high reliability mostly in contextually adequate situations (more than 50%). This indicates that human-dog acoustic communication could be highly situation-dependent, and the utterances themselves might be contextually dependent on other communicative cues. Warden and Warner (1928) tried to test *Fellow's* capacity to "understand" verbal commands by changing the usual social context. They found that only a part of *Fellow's* repertoire was independent from the situation in which these verbal commands were usually employed. Dog-human acoustic communication does not occur in isolation, dogs may rely simultaneously on visual and perhaps other cues. The increase in the number of utterances given by the owners increased the percentage of reactions in "contextually adequate situations" (Figure 3). This suggests a basic action-set, which could be enriched in dog-human dyads with a more varied life-style. Owners reported that their dogs tended to react to one-word utterances more reliably, while longer sentences were reported as ones with more unreliable execution (Figure 2). This indicates that longer sentences were applied in a "conversational manner" and one-word utterances were used for commanding the dogs. Similar conclusions can be drawn, if we consider that Disallowance, Posture, and Invitation consist of utterances to which the dogs responded almost always (Figure 1). These actions are indispensable for controlling a dog (McConnell & Baylis, 1985), while the others make the coexistence more "interesting". In further investigations we plan to decompose some examples of the social situations where human verbal cues are assumed to play an important role. In the future, we want to experimentally investigate the contribution of acoustic communication and the role of other factors in social understanding between man and dog.

ACKNOWLEDGEMENTS

The authors are grateful to Professor Duane Rumbaugh, Professor Csaba Pléh and two anonymous reviewers for their useful comments on the manuscript. Also we would like to thank for her generous help Katalin Timár-Geng (and the "Fényes Dezsó" Club of the Mudi breed) and Márta Gácsi (and "Top Mancs" Dog-training School).

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Appendix

The breed of dogs used in our investigation

<i>Breed</i>	<i>Number of dogs</i>
Mixed breed	9
German shepherd	6
Tervueren	4
Foxterrier	3
Mudi	3
Airedale terrier	2
Hungarian vizsla	2
Rotweiler	2
Yorkshire terrier	2
Bobtail	1
Golden retriever	1
Great Dane	1
Husky	1
Irish wolfhound	1
Kuvasz	1
Sky-blue terrier	1

Still other dog owners view their animals as both simultaneously; as subjects when cuddling on the couch and as objects that can be relinquished if they become a nuisance (e.g., because they have become too expensive, potentially dangerous, or are no longer needed; see Irvine 2009a, 7). Despite these variations, Sanders (1993, 1999) reports that dog owners generally have a very high regard for the relationships they have with their pets and often describe their dogs as people or as possessing human qualities. Sanders (1993, 211) writes that dog owners "routinely used their day-to-day experie Owners' beliefs on the ability of their pet dogs to understand human verbal communication. A case of social understanding. *Current Psychology of Cognition*, 20: 87-107. Warden C.J. (1928). *The Sensory Capacities and Intelligence of Dogs, with a Report on the Ability of the Noted Dog "Fellow" to Respond to Verbal Stimuli*, *The Quarterly Review of Biology*, 3 (1) 1. DOI: <http://dx.doi.org/10.1086/394292>. The views expressed are those of the author(s) and are not necessarily those of Scientific American.