

# DOG-HUMAN RELATIONSHIP AFFECTS PROBLEM SOLVING BEHAVIOR IN THE DOG

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## ABSTRACT

In this paper we present evidence that simple problem solving in the dog is strongly influenced by the relationship with the owner. Twenty-eight dog-owner pairs were observed in a novel situation and when performing a simple problem-solving task. Dogs were categorized according to their relationship with the owners ("companionship" or "working relationship"). In addition to the behavioral analysis of the dogs, the anthropomorphic attitudes of the owners were assessed by a questionnaire. Factor analysis showed two factors of correlated behavioral variables ("social dependence," "social play") of the dogs that referred to the dog-human relationship. Dogs in a companion relationship behaved socially dependently, showing a decreased performance in the problem solving task and were viewed more anthropomorphically by the owners. Results suggest that the dogs' decreased problem-solving performance is less dependent on their cognitive abilities; instead the strong, dependent relationship with the owner prevents them from completing the task successfully. On the basis of our results, we argue that the decreased problem solving ability in the domestic dog is not due to their domestication but their strong attachment to humans.

Key words: Pet dog; Problem-solving; Dog-human relationship

## INTRODUCTION

**T**he human-log relationship has a history that is more than 14 thousand years long (Coren 1994). During this period, the dog (*Canis familiaris*) spread through every human culture and was employed for very different tasks, from hunting to babysitting

(Clutton-Brock 1984). Although we can only speculate on the function of the first dogs in human societies, it is certain that the dog was the earliest species neared as a companion for humans. We can assume that the persistent and close relationship with people, and the adaptational demand of parallel

accommodation to the infra- and interspecific (human) social systems led to special selection pressures in comparison to other Canids. This may have resulted in the change in physical and behavioral traits of the dog's ancestors.

The dog's ancestor was to a great extent, pre-adapted to be adopted by man (Messent and Serpell 1987), as it was a social species that displayed different kinds of social skills, so-called "socio-cognitive abilities" (Mot 1994). Members of this species must have had the ability to recognize siblings (Hepper 1986), they could restrict their own aggression (Bradshaw and Lea 1992) and as in other Canids, context specific social signals (Bekoff 1972; 1977) and metacommunication (Bekoff 1995; Fox 1978) played a significant role in their communication.

Like their wolf ancestors, dogs are highly social animals. However, throughout the thousands of years of domestication, dogs have been selectively bred for characteristics which humans have found desirable, namely for "infantile" features of adult behavior (Coppinger et al. 1987), willingness to assume a subordinate role in their social group (Bradshaw and Lea 1992) and for the tendency to be more responsive to social reinforcers and attenuators (Frank 1987). Some authors have emphasized that domestication not only entails socialization (Kretschmer and Fox 1975) but that genetic differences are related to the differentiation of social roles played in the human environment (Scott 1977). They form attachments to humans as easily as to conspecifics (Scott and McCray 1967; Scott 1980), so dogs were selected by humans to fulfil the needs and desires of their own species (Coren 1994).

There is a growing interest regarding human-pet dog interactions and their potential consequences on human behavior (e.g. Vormbrock and Grossberg 1988; Watson and Weinstein 1993). Pet dogs can enhance not only the social and emotional development of young children (Filiatre et al. 1986), but the dog as a companion animal influences the social behavior and the socialization process of the child. Dogs play an active role in the regulation of the pet-child interaction, and could promote the acquisi-

tion of a socially efficient behavioral repertoire in the child (Van Leeuwen 1981; Millot et al. 1988).

The beneficial effects of human-companion bonding on the pet-owner's physiological status have also been emphasized by several authors (see e.g. Baun et al. 1984). Although an increasing number of canine behavior studies look at the interactions with people (see review by Nott and Bradshaw 1993), the influence of these interactions on the dog's behavior (in stressful situations requiring problem-solving ability and/or learning skills) is an important but relatively neglected problem.

Comparative studies (Frank and Frank 1982; 1985; Frank et al. 1989) reported that tamed wolves tend to solve problems by trial and error or social learning (observational learning/goal emulation; see Whiten and Ham, 1992), and they often do this more effectively than dogs. Frank (1987) concluded that domestication directed toward tractability and trainability relaxed the adaptational demands on cognitive abilities. This would explain the better performance of wolves in problem-solving situations and poorer performance in training tasks. The fact that dogs have smaller relative brain sizes and weights than those of the wild progenitor (Herre and Röhrs 1973), may support this conclusion. However, according to Hemmer (1976) this decrease in the relative brain size is not a result of domestication, but a consequence of the small relative brain of the ancestors (small Asiatic wolf, *Canis lupus palipes*). In addition, intelligence tests of various breeds of dogs have so far produced contradictory results with respect to relative brain size (Hemmer 1990; Coren 1994).

Alternatively, we can assume that the poor performance of dogs in problem-solving tasks is the consequence of their inherited tendency to behave socially dependently (Fox 1975) and not due to their inferior cognitive abilities. According to this hypothesis, the more socialized a dog (i.e., the more completely it fits into a human family structure and is attached to certain persons), the more likely it is to behave like a member of a social bond. Voith et al. (1992) reported that poor pet-owner relationships rather than poor obedience training results in behavior problems (inadequate dependency) in dogs. The behavior of a well-socialized dog is subject to its owner's actions, therefore in a situation requiring cognitive skills and/or problem-solving ability, the adaptive behavior is performed by some kind of interaction/cooperation with humans rather than by excluding social influences.

This hypothesis predicts that the dog-owner relationship (companion relationship or

working relationship; see Fox (1975) for more discussion on the use of these terms) is reflected in the dog's behavior in an unfamiliar situation, and (2) influences the dog's problem-solving behavior. That is, dogs living in the house as an integral member of the family (as a companion) will show poorer performance than dogs kept outside the house as a "guard" and excluded from close relationships with humans (working relationship).

In this study we examined whether the dog-owner relationship affects the behavior of the dogs in an unfamiliar situation and their performance in a problem-solving task.

## MATERIALS AND METHODS

### Subjects

Twenty-eight dog-owner pairs took part in our experiment; 14 women (mean age: 28.8 +/- 8.5 years; range 13-5 and 14 men (mean age: 31.5 +/- 11.2 years; range 17-60). Eight of the owners were graduates of a university, twelve were graduates of a secondary school and eight were graduates of a primary school. Fourteen breeds of dog (12 male and 16 female; mean age: 4.3 +/- 0.6 years; range 1-9) were represented in our sample. According to the American Kennel Club's (AKC) classification, animals were divided into five groups: Sporting dogs (5 individuals: 3 English setters, 1 Irish setter, 1 Magyar Vizsla), Non-sporting dogs (4 individuals: 2 Rottweilers, 2 Boxers), Working dogs (11 individuals: 3 Tervuerens, 3 German Shepherds, 1 Briard, 1 Kuvasz, 1 Caucasian Shepherd, 1 Bobtail, 1 Laika) and Terriers (3 individuals: 2 Giant Schnauzers, 1 Staffordshire Terrier). There were also five dogs classified as mixed-breed. The AKC has divided recognized breeds into 6 main groups according to their primary utility. Their categorization is primarily based upon behavioral characters rather than phylogeny.

Sixteen of the twenty-eight pairs were classified as "companion relationship" (dogs kept in the house as an integral member of the family) and twelve pairs were in a "working relationship" (dogs kept outside the house as a guard or for some other purpose). Twelve dogs were categorized as "trained" (they had a certificate of official obedience training), the others (16) were considered "untrained." Dogs from all five groups, as listed above, were represented in both the companion/working relationship and untrained/trained categories.

Before the experiment was performed, the owners were asked to fill in a questionnaire. As well as recording administrative data, thirteen questions addressed the owner's attitudes toward their dog (Table 1). Owners had to

TABLE 1.

Questionnaire for Anthropomorphic Attitudes  
Points that were scored for each answer are found in brackets

1. **How often do you allow the dog into your bed?**  
 never(0)                       sometimes(1)                       regularly(3)
2. **How do you play with the dog and how often?**  
 never(0)                       sometimes(1) (wrestling, some kind of action, with the dog's own toy, other...)  
 regularly but not daily(2) (wrestling, some kind of action, with the dog's own toy, other...)  
 every day(3) (wrestling, some kind of action, with the dog's own toy, other...)
3. **How often and why do you take your dog for a walk?**  
 never(0)                       only if it is essential(1) (e.g. to the veterinarian...)  
 regularly but not daily: to relieve itself(2) and/or for a walk(3)  
 every day: to relieve itself(3) and/or for a walk(4)
4. **How much and what do you talk to your dog?**  
 never(0)                       occasionally: only instructions(1), sentences(2), I talk to the dog continuously(4) \_\_\_\_  
 regularly: only instructions(2), sentences(3), I talk to the dog continuously(5) \_\_\_\_  
 every day: only instructions(3), sentences(4), I talk to the dog continuously(6) \_\_\_\_
5. **How often do you give presents to your dog? (Do you celebrate your dog's birthday?  Yes  No)**  
 never(0)                       occasionally(1)                       regularly(2)
6. **What do you think about your dog?**  
 I like my dog because it is useful(1)                       I like an animal around me(2)  
 I like to spend my free time with it(3)                       I like it very much(4)  
 this dog is the most important regarding my emotional relations(5)
7. **How obedient is your dog?**  
 disobedient(0)                       only after punishment(1)                       obedient(2)
8. **Is your dog clever?**  
 dull(1)                       not so bad(2)                       fairly clever(3)                       clever(4)                       extremely clever(5)
9. **How easily can you teach your dog a task?**  
 it is very difficult(1)                       by use of punishment(2)  
 only with a considerable amount of training(3)  
 it is easy (after some trials)(4)                       it is very easy(5)
10. **What kind of cognitive abilities does your dog have?**  
 it responds only to stimuli(1)                       it does not think but is trainable(2)  
 it does think simply (3)                       it thinks 'without a language'(4)  
 it thinks like a man(5)
11. **To what extent can your dog understand the human language?**  
 it does not understand(1)                       it understands only the emphases and emotions(2)  
 it understands some words(3)                       it understands some sentences(4)  
 it understands human language fairly well(5)
12. **To what extent does your dog identify with your emotions?**  
 far from it(1)                       with difficulty(2)                       easily(3)  
 it is affected at once and identify itself with it(4)
13. **To a child of what age would you compare your dog's mental capacities to?**  
 no comparison(1)                       like a 0-1 year old child(2)  
 like a 1-2 years old child(3)                       like a 2-3 years old child(4)                       like a child older than 3 years(5)

TABLE 2.

The Schedule of the Open Field Situation

(seconds)	Events	Commands from the Tape Recorder
0	Owner and dog are going into the room and the owner sits to the table	
60		Go to the ball and call the dog, then bowl the ball into the opposite direction to the waste paper basket! After this, sit back on your seat!
120		Go to the window and look out for 5 seconds! Then sit back on your seat!
180		Go to the box near the wardrobe and search in it for some time! Take out a toy and try to play with the dog!
300	The unknown person appears. He greets the owner and the dog (by making body contact). After sitting back at the table they start to talk.	
360	The unknown person offers a piece of cake to the owner	(to the unknown person) Stay up, call the dog and bowl the ball toward the dog! Go back to the owner!
480		(to the unknown person) Go to the wardrobe, open it, open the tap and close it and look out through the window then close it! Put the ball back in its place.
600	<u>end of the observation</u>	

choose answers from the presented alternatives and on the basis of their answers we could calculate a questionnaire score of anthropomorphic attitudes (the scoring system is shown in Table I). The maximum score possible was 54, the higher total scores reflected stronger anthropomorphic attitudes.

#### Unfamiliar situation test

We observed the behavior of the dogs during a 10 minute period in an unfamiliar situation. We let the owner and the dog into a furnished room (7m x 4m x 2.5m) where there were 2 chairs, a table, a wardrobe, boxes and plastic dishes on the floor, a small aquarium on the table and pictures on the wall. The floor was divided into quadrates of one square meter. The owner sat down and released the dog. After a minute, the owner was asked, through commands from a tape recorder, to play with the dog two times and to walk and open a window without any interaction with the dog. After five minutes the experimenter came in, greeted the owner and the dog, and sat down opposite the owner. The experimenter offered the owner cake, tried to play with the dog, walked around and manipulated some of the objects. All of these actions were performed according to an exact schedule (see Table 2).

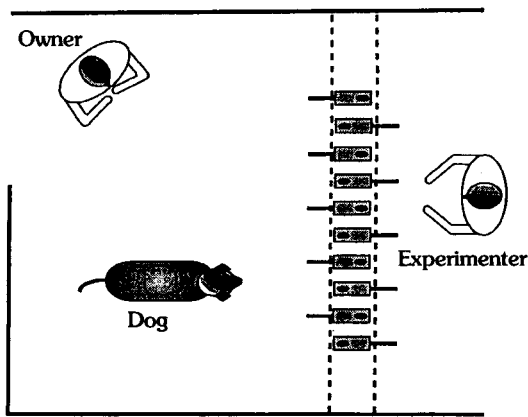
#### Problem solving

Shortly after the unfamiliar situation test, the owner was asked to go to an enclosure (2x2 m) with the dog. The owner sat down behind the dog and was asked not to say or do anything. The experimenter was situated outside the enclosure, opposite them. There were ten small food dishes containing food (meat) between the experimenter and the dog. The plastic handles of five dishes were directed toward the dog and the others directed toward the experimenter. The experimenter and dog were separated by a wire fence positioned 8 cm above the floor, so that the subjects could consume the reward only by pulling out the dishes from under the fence (Figure 1.).

During the manipulation task, the experimenter pulled out a dish by hand every 30 seconds and ate the food. After 150 seconds (when all of the experimenter's food items had been eaten) the owner was asked to encourage the dog to get food by manipulation of the dishes. After another 150 seconds, the experiment was terminated. This procedure was video recorded for each owner-dog pair and the behavior of the dog was analyzed later.

FIGURE 1.

Experimental Arrangement in the Problem Solving Task  
View from Above



Behavioral evaluation

The following behavioral variables were observed in the unfamiliar situation:

1. Time spent in exploration - EXP (seconds)
2. Time spent playing with the owner - PWO (seconds)
3. Time spent resting - R (seconds)
4. Mean resting distance from the owner - RDO (scoring: 0 = physical contact, 1 = within 1m, 2 = within 2m, 3, = within 3m, 4 = more than 3m)
5. Time spent following the owner (this was moving, parallel to the owner when he/she was instructed to do something) - FO (seconds)
6. Time spent playing with the stranger - PWS (seconds)
7. Mean resting distance from the stranger - RDS (score: 0-4)
8. Time spent following the stranger (moving, parallel to the stranger when he did something) - FS (seconds).

Four behavioral variables were observed in the problem-solving task:

1. Latency of first manipulation - LAM (seconds)
2. Number of glances at the owner - NG
3. Number of food items eaten without owner's encouragement - NFE I
4. Number of food items eaten when the owner encouraged the dog - NFE II

**RESULTS**

All of the behavioral variables were found to have normal distribution (with the exception of "NFE I" and "PWS" which required square root transformation), so parametric statistical methods were used.

**I. Analysis of Variance**

The observed behavioral variables were analyzed by ANOVA. None of these were found to be significant using the owner's sex, the dog's sex and breed as independent variables. Only the PWS (time spent playing with the stranger) was found to be significant according to the obedience training ( $F(1,27) = 4.7, p = 0.04$ ). That is, untrained dogs tended to play more with the stranger.

Four variables were found to be significant according to the types of relationship. The dogs belonging to the "companionship" group (living as a member of the family) tended to follow their owner ( $FO - F(1,27) = 5.3, p = 0.029$ ), glance at the owner more frequently in the problem-solving situation ( $NG - F(1,27) = 4.8, p = 0.037$ ), started to manipulate later (to get the food) ( $LAM - F(1,27) = 12.5, p = 0.001$ ) and consumed less food items while the owner was inactive ( $NFE I - F(1,27) = 4.8, p = 0.037$ ) (Figure 2, pg. 218). These results support the hypothesis that the type of relationship influences the dog's behavior in the unfamiliar situation and in the problem solving task.

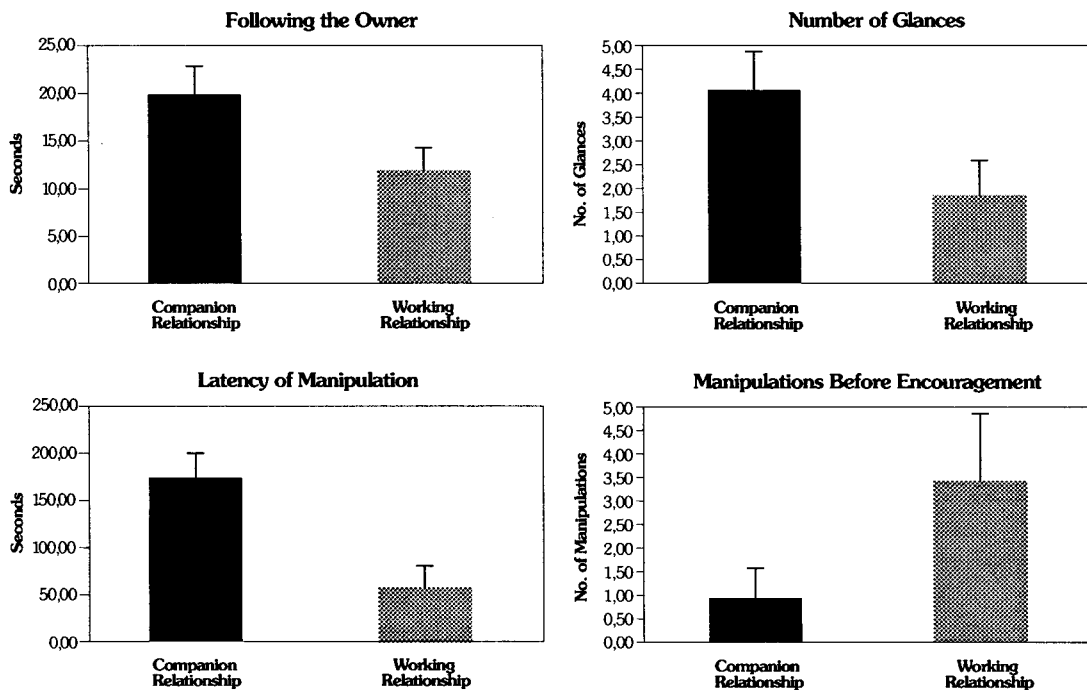
**II. Correlations Between Behavioral Variables**

For the present analysis, only significant correlations of  $r = 0.45$  or larger were taken into account ( $p < 0.001$ ). In the unfamiliar situation test we found that if the dog was ready to play with the owner, then it behaved more playfully toward the stranger ( $PWO-PWS: r = 0.58$ ). The dogs that rested in close proximity to the owner, spent more time resting ( $RDO-R: r = -0.45$ ) and were more willing to follow the owner closely if she/he moved ( $RDO-FO: r = -0.49$ ). The dogs that played more with the owner, tended to rest at a greater distance from the owner ( $PWO-RDO: r = 0.45$ ). There was also significant negative correlation between resting and exploration ( $R-EXP: r = -0.611$ ).

Regarding the problem solving task, it is striking that those dogs which glanced frequently at the owner tended to start manipulation later ( $NGLAM: r = 0.45$ ) and thus consumed a smaller number of food items while the owner was passive ( $NFE I-NG: r = -0.58, NFE I-LAM: r = -0.64$ ).

There are some intercorrelations regarding the unfamiliar situation and problem-solving task. The dogs that behaved dependently in the latter task (manipulated later, consumed less reward while the owner was passive), followed the owner more closely ( $FO-NFE I: r = -0.53, FO-LAM: r = 0.49$ ).

FIGURE 2.



The effect of relationship (companion vs. working) on following the owner (FO) in the unfamiliar situation test and on the number of glances at the owner (NG), latency of manipulation (LAM) and number of successful manipulations before the owner's encouragement (NFE I) during the problem solving task.

### III. Factor Analysis

The observed variables were factor analyzed, resulting in three factors (Eigenvalue >1.5), which accounted for 62.3% of the total variance (table 3). In the first factor, six behavioral variables are represented with high loadings. The dogs frequently glance at the owner, do not manipulate, wait for the owner's encouragement, tend to closely follow the owner and strive to rest near to the humans. As individuals that scored high values on this factor behaved "dependently," this factor seems to be related to dog-human bonding and therefore it will be referred to as "social dependence." Since the second factor loaded highly on playing with the owner and the stranger, a large resting distance and a small amount of resting, this was labelled "playing." The third factor is characterized by the exploration of the physical environment and the interest in the activity of the unknown person, so this related to the unfamiliar situation and was labelled "exploration."

The factor scores of the three main factors for each dog were also calculated (Table 4). They

were analyzed by ANOVA using the five independent variables (owner's and dog's sex, breed, obedience training and types of relationship). Only the scores of the first factor (social dependence) were found to differ significantly according to the types of relationship ( $F_{(1,27)} = 12.6, p = 0.0015$ ). That is, dogs living together with the family as a companion show more dependent behavior (Figure 3). This result supports the hypothesis that intimate human-dog companionship rather than a working relationship predisposes the dogs to behave dependently in an unfamiliar situation and in a problem-solving task

### IV Analysis of Questionnaire

As the ANOVA showed, neither the sex (of the dog or the owner) nor the obedience training had a significant influence on this score. However, dogs considered as having a companion relationship had higher "anthropomorphic attitude" scores ( $t_{(1,27)} = 6.22, p = 0.019$ ) (Figure 4). The only breed specific differences we found was that the owner of mixed breed dogs showed poorer anthropomorphic attitudes toward their pets ( $F_{(1,27)} = 3.1, p = 0.03$ ).

TABLE 3.

Factor Loadings (correlations between the Factors and the Behavioral Variables)  
Following Varimax Rotation

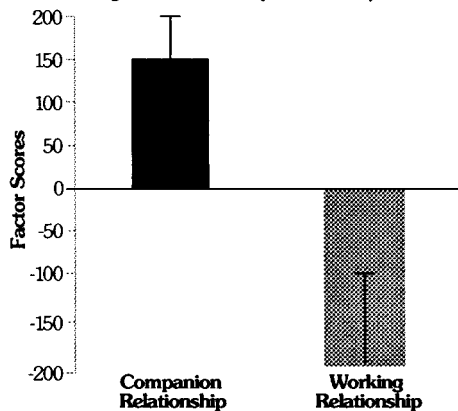
The factor pattern yielded three factors (Eigenvalues > 1.5) that account for 62.3% of the total variance.

Variation Explained	Social Dependence (28.1%)	General Playing Activity (21.4%)	Exploration (12.8%)
PWO	0.21	0.84	-0.05
PWS	0.3	0.68	0.03
FO	0.71	0.08	-0.24
FS	0.00	0.07	0.69
RDO	-0.42	0.58	0.29
RDS	-0.52	0.47	-0.11
EXP	0.18	0.23	0.67
R	0.06	-0.68	-0.55
LAM	0.91	0.09	0.13
NG	0.74	0.27	0.00
NFE I	-0.85	-0.04	0.23
NFE II	0.02	0.38	-0.59

TABLE 4.

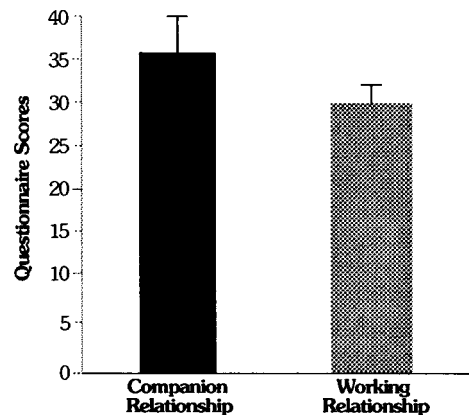
The Factor Scores of Individual Dogs on the Three Main Factors

Dog	Social dependence	Playing	Exploration
1	206	-400	197
2	285	149	180
3	163	-166	129
4	34	-141	86
5	-398	379	118
6	179	96	-106
7	32	-200	-32
8	325	87	108
9	322	123	150
10	-282	37	200
11	170	114	-169
12	-471	28	272
13	-96	87	120
14	507	65	4
15	-640	142	337
16	-221	-104	245
17	74	-169	-284
18	61	-136	-243
19	294	-186	-146
20	-565	-290	19
21	97	116	-159
22	66	-79	-220
23	-270	-297	-302
24	18	88	-110
25	100	879	7
26	-216	116	107
27	431	41	157
28	-15	-267	-187

**FIGURE 3.****The Effect of Relationship (companion vs working) on the Scores of "Social Dependence" (Factor 1)**

Regarding the individual scores for the three factors (social dependence, playing, exploration - see Table 3), only the scores of "social dependence" correlated significantly with the anthropomorphic attitude scores ( $r = 0.41$ ,  $p < 0.001$ ). The dogs viewed anthropomorphically by the owner showed more dependent behavior in the experimental situation and thus scored higher on the social dependence factor.

The owners living in small families (or alone) were willing to consider their dogs as a family member ( $r = -0.49$ ,  $p < 0.001$ ). Since laboratory studies have also shown how important the critical period for socialization is (see e.g. Scott and Fuller 1965), the date of arrival at the owner's home might influence the dog-owner relationship and thus the dog's behavior in our experimental situation. For this reason, the dogs' age (in weeks) on arriving at the owner's home was recorded (starting date of the dog-owner bond - SDOB). The correlation analysis showed that the older a particular dog was when arriving in the family home, the more it played both with the owner (SDOB-PWO:  $r = 0.52$   $p < 0.001$ ) and the stranger (SDOB-PWS:  $r = 0.53$   $p < 0.001$ ). The resting distance from the owner was also larger the older the dog was on its arrival at its present family (SDOB-RDO:  $r = 0.45$   $p < 0.001$ ). Individual factor scores of "playing" were influenced by the starting date of the dog-owner relationship (SDOB-F2:  $r = 0.53$ ,  $p < 0.001$ ). Neither the individual scores for "social dependence" nor for "exploration" were correlated significantly with the starting date of the dog-owner relationship.

**FIGURE 4.****The Effect of Relationship (companion vs working) on the "Anthropomorphic Attitude" Scores of the Owners****DISCUSSION**

The application of ethological methods represent an increasing trend in studies that aim to investigate the functions and mechanisms behind pet-human relationships (Hart 1989). In this paper we presented an example of how to estimate the quality of this interspecific relationship.

Following, glancing, latency of manipulation and number of food items eaten were strongly related to the dog-owner relationship, but obedience training, sex and breed did not influence the behavior of the dogs in the unfamiliar situation and in problem solving. Not surprisingly, the above four variables constituted one major factor in our factor analysis. This result has enabled us to estimate the relative "social relationship" of a dog-owner pair by ethological analysis of the pet's behavior. The dog-owner relationship seemed to be solidified by the anthropomorphic attitudes of the owners toward their pets and influenced by the social role played by the dog in the family (companion/family member or a working pet). We found that in the unfamiliar and in the problem-solving situations, dogs considered as family members (companion relationship) tended to behave socially dependent. This result confirms that the more a dog fulfills the role of a child substitute (see also Berryman et al. 1985), the more dependently it behaves towards its owners (Fox 1975). In parallel with our study, there are other observations that the behavior of the owner has a strong influence on the behavior of a dog (Podberscek and Serpell 1996). However, obedience training did not significantly influence the anthropomorphic attitude scores of the owners, as has been found previously by others (Voith et al. 1992).



While it seems that the type of dog-human relationship is one of the main factors in the process of socialization, neither the obedience training nor the breed specific differences were found to be effective modifiers of the dog human bond under the present experimental conditions. Since fearfulness (Mahut 1958; Goddard and Beilharz 1985), confidence (Elliot and Scott 1965), timidity (Plutchnik 1971), human aversion (Brown et al. 1978) and neotenic features (Coppinger et al. 1987) are all reported as varying considerably between different breeds, we do not want to dismiss the role of genetic make-up in dog-human attachment. The absence of breed effect could also be due to the relatively small sample size.

There was another group of correlated behavioral variables (factor 2) that referred to general playing activity. Dogs that showed distinct willingness for social play behaved as a companion irrespective of their partner's identity (owner or stranger). This factor seemed to represent another aspect of the dog-human bond and was influenced by age of the dog when the dog owner bond commenced. The later the dog arrived at its new owner's home the more it engaged in social play. This observation is further supported by the results of Fox (1975), who showed that dogs reared with different handlers are more resistant to stress and show more play activity in stressful situations.

Beyond the ethological analysis of the dog-human relationship, this study could provide a new way for interpreting the dog's problem solving ability. Manipulation test performance (problem-solving ability) is thought to be one of the manifestations of mental capacities. Our results show that the decrement in the cognitive test performances of dogs demonstrated previously in comparison with wolves (Frank and Frank 1982; 1985; Frank et al. 1989), may be due to the dog's sensitivity to its relationship with humans (tendency to behave socially dependent) and not due to some cognitive disability. The existence of well-developed cognitive abilities in the dog is confirmed by several recent papers (Gagnon and Doré 1992; 1993) that show dogs can solve high level, object permanence tests. It is therefore interesting that this capability, which is thought to be the adaptive component of predatory behavior in many species (including the dog), seems to have been unaffected by the relaxed selection of domestication. In our view, this contrasts with the general notion by Frank (1985) that dogs show poorer performance in problem-solving tasks (e.g., observational learning) because during domestication the "buffering" of humans decreased the effects of selection

on cognitive demands in this species. It is more likely that the dogs used in Frank's studies (1982, 1985) were more attached or showed more dependent behavior toward the owners or caretakers than the wolves.

The use of eye contact seemed to be a good measure of the tendency of problem solving in the dog. Similar observations were also described in problem-solving situations involving a gorilla (Gomez 1990). Gomez argued that the gorilla applied eye contact to the experimenter to check whether he was also aware of the situation. In a number of cases the gorilla then tried to get help from the experimenter instead of solving the problem alone. It is not certain that similar arguments can be applied to our situation. Dogs living in houses as companions had no opportunity to work for their food, as in most cases their food was prepared by the owner. This experience would promote the first strategy used by dogs when faced with a problem of getting food, that of getting help from the owner: In companion dogs, which are neared "anthropomorphically" like a "child," this kind of dependent behavior seems to have a strong influence on their behavior. The increased performance after the owner's encouragement seems to also support the view that "dependent" dogs also possess the cognitive ability to solve this problem. A more parsimonious account would be that the dogs were looking or waiting for the owners' permission (verbal command or gesture) to eat the food. If this were true, however, there should have been a difference between dogs with and without obedience training, since during obedience training dogs are taught not to eat food without permission from the owner.

Our results affirm the hypothesis that one significant consequence of the Canid's domestication is the development of the tendency to interact with man as a "social unit." Dogs are probably genetically predisposed to interact with humans (to form an interspecific bond) as they would with conspecifics. The role of selective breeding regarding the willingness to form social attachments has been documented by Scott and Bronson (1964). They found breed differences in the readiness for forming social attachments to people. As others have emphasized, genetic differences are responsible for the differentiation of individuals within intraspecific social relationships (Scott 1977). But the ease with which dogs form strong attachments to humans may depend not only on their genetic make-up, but also on their individual experiences. This study, similarly to some others (e.g. Fox 1975), shows that the quantity and quality of social experiences influence later social behavior and social preferences. The proper socialization of dogs may enhance their relationships with people.

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