Acta Biologica Hungarica 53 (4), pp. 537–550 (2002)

DOES DOG-HUMAN ATTACHMENT AFFECT THEIR INTER-SPECIFIC COOPERATION?*

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(Received: June 5, 2002; accepted: July 1, 2002)

Leading a blind or blindfolded person is a complex cooperative task influenced by many factors. The aim of this study was to determine if quality of attachment affects the performance of dog and owner dyads showed on an Obstacle Course. Modified Ainsworth's Strange Situation Test was used for assessing attachment quality. Only one dimension of the attachment, the 'anxiety' factor was found to correlate with behavioural measures of the Obstacle Course (e.g. number of mistakes, initialisation index that reflects which participant initiates more actions in a dyad). We found significant differences of performance between the three groups of dog-owner pairs (pet dog, guide dog and police dog dyads), but we could not show significant differences in the 'attachment' factor among these groups. We concluded that it is not the attachment type that causes the main differences in the leading behaviour of our three study groups. Dogs have an innate ability for cooperation with humans that was enhanced by selective breeding during domestication and this basic ability can be modified by training but seem to be less affected by the relationship with the owner.

Keywords: Cooperation – attachment – dog-human interaction

INTRODUCTION

Human-dog co-existence dates back to the very early period of human history. According to recent findings, it is probable that the formerly assumed common past of 14 thousand years based on archaeological evidences [22] can be extended to even as much as cca.130 thousand years as a result of mitochondrial DNA analysis [29]. Some assume that this long period of cohabitation can be described as a co-evolutionary process [8, 18, 29] during which the behaviour of the wolf ancestors has changed significantly resulting in a domesticated animal, the dog.

One important consequence of this domestication process was, that under normal circumstances, dogs form stronger attachment to humans than to members of their

* Dedicated to Professor György Ádám on the occasion of his 80th birthday.

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own species. The reason for this is obvious since dogs are brought up normally in human families where contact with conspecifics is limited. At present, there is little experimental evidence that dog would form attachment preferentially to humans if given a choice [19], nevertheless it is very likely that dogs have been selected for abilities that promote interaction with humans. This latter assumption has gained strong support by recent analyses of dog-human communication [16, 17, 25, 26].

Interestingly, dog-human attachment can be described very well in the framework of human attachment models [3, 4]. Recently, Topál et al. [27] have used the Ainsworth's [1] Strange Situation Test to investigate the patterns of dog-human attachment. Originally, this test was used to study mother-infant relationship, and based on behavioural criteria different types of parent-infant attachment relationship have been identified [1, 2]. The test is aimed at activating the attachment behaviour of the subject by placing it into a novel environment, and separating it from its object of attachment (i.e. mother or dog owner in the present case) and at the same time compare the effect of the object of attachment with that of a strange person (for further details see the Material and Methods below). The key elements of the attachment behaviour involve the subjects' ability to discriminate and respond differentially to the object of attachment, a preference for the attachment object, and observable behavioural response to the separation from and re-union with the attachment object that is distinct from responses to others [9, 14, 21]. Based on a relatively large sample, in the study of Topál et al. [28], the dog-human relation was described along three identified factorial variables. 'Anxiety' was defined as a background variable that accounts for the dogs' behaviour in relation to the strange, novel situation (passivity, decreased play activity, increased contact with the owner). 'Acceptance' was characterized by behaviours displayed toward the stranger (i.e. contact with the stranger) and 'Attachment' factor variable was affected mainly by behaviour of contact seeking, and contact duration toward the owner.

Whilst researchers do not agree on the functional aspects of attachment behaviour, in the human psychological literature it has been supposed that attachment relationship might interact or influence other behavioural systems like communication, cooperation. For example, Matas et al. [15] investigated the relationship between quality of attachment of 24-month-old children and their efficiency in problem-solving tasks. They found that 'securely' attached infants were more explorative, enthusiastic and persistent. Interestingly, these children were found more co-operative with their mother in spontaneous interactive situation and also more effective.

Given the similarities of dog and infant attachment one could also suppose that the attachment relationship between dog and owner might also influence the dog's performance in problem-solving tasks. In a series of observations Frank et al. [10, 11] reported that tamed wolves are more effective in problem solving tasks than dogs. Based on their observations they concluded that domestication presented a relaxed selection pressure on the dogs' cognitive abilities. An alternative explanation for the dogs' poorer performance in problem solving can be their inherited tendency for social dependence [12]. Topál et al. [27] investigated this hypothesis experimentally by looking for the relationship between attachment behaviours of working dogs (liv-

ing in the garden) and companion dogs (living in the house) and their performance in a problem-solving task. It has been found that companion dogs behaved socially dependently and showed decreased performance in comparison to the independent working dogs.

In an earlier study we investigated how guide dogs for the blind cooperate with their owners [20]. We have shown a complex form of cooperation where dog and owner take turns in initialising actions. This suggested that blind leading is not an exclusive task for the dog but a truly co-operative situation that involves continuous interaction between dog and owner. One could assume some parallels with the human behaviour as Brownell et al. [5] have reported that 24-month-old children (unlike 18-month-olds) are able to cooperate with each other in a complementary way, which allows them to solve a simple cooperation problem by imitation of an adult. They claim that certain socio-cognitive capacities develop during this age period, like self-other differentiation, coordinating complementary behaviour, timing and sequencing their behaviour in relation to partner's behaviour. Complementary cooperation is an advanced form of behavioural interaction since in determining their own actions individuals have to take into account the actions of the other. This process is frequently characterized by initialisation actions in turns, i.e. one action is initialised by one individual the next by another. This was found to be true in the case of blind owners walking with their guide dog [20].

The aim of the present study is to investigate whether there is a correlation between the pattern of attachment relationship in dog-owner dyads and their performance in a cooperative task. We chose a complex cooperative task of guiding the blindfolded owner through an obstacle course.

MATERIALS AND METHODS

Subjects

Forty dog owners, 21 males (mean age: 37 years; range: 22–71 years) and 19 females (mean age: 27; range: 15–53 years) took part in this study voluntarily together with their dogs (23 males and 17 females; mean age: 42 months, range: 11–126 months). The subjects were selected from three different groups of dog owners. Thirteen pet dog-owner dyads volunteered from a pet dog training centre in Budaörs on 09.03.1996. 17 guide dog-owner dyads were tested in the Hungarian Guide Dog School in Csepel on three occasions: 10.08.1996, 04.10.1997 and 09.06.2001 on their regular yearly meeting and 10 police dog-owner dyads from the Dunakeszi Police Dog Training Centre were observed in the Biological Research Station at Göd on 25.06.1996.

All police dogs were German shepherds, all pet dogs were Belgian shepherds (9 Tervueren; 2 Groenandael; 1 Malinois) except one boxer. Seven blind persons owned a German shepherd, six Labrador retriever, two golden Retriever, one Rotweiler and one Leonberger was also included in this sample.

Procedure

Study I – Obstacle course

We used the same obstacle course described in Naderi et al. [20]. It consists of eight obstacles built from light wood and green plastic sheets. The course was 50 m long, and approximately 1.5 m wide. The order and distance of the obstacles was: 1. "pit" (13.5 m); 2. "gate" (19 m); 3. "screen" (26 m); 4. "grid" (30 m); 5. "slalom" (34.5 m); 6. "stairs" (39 m); 7. "ladder" (42 m); 8. "brick row" (48 m).

The procedure also followed the protocol described earlier [20]. Both the blindfolded owners and their dogs were familiarized with the obstacle course. This was done in two steps. First, an assistant helped the blindfolded owners to walk along the obstacle course. Second, after the dog had been seated at the start of the course and the owner had been positioned at the half point of the course, the owners were told to call in their dog. The same procedure was repeated with the owner standing at the end of the course and the dog sitting at the middle.

Table 1
Definition of the behavioural variables used for description of the joint actions of the dog-human dyads

Starting (strt)	Any locomotion in any direction from a standing position.
Stopping (stp)	Attainment of firm motionlessness that lasts for at least 2 seconds.
Avoidance (avo)	Change of less than 90 degrees in direction of locomotion that is followed by a similar change in the opposite direction. The manoeuvre should be executed to avert the collision with objects or persons.
Turning (trn)	Change of approximately 90 degrees in walking direction that results in prolonged change of the walking route.
Stepping down (stdwn)	Locomotion resulting in the continuation of the walk on a lower level (at least 5 cm), e.g. at stairs.
Stepping up (stup)	Locomotion resulting in the continuation of the walk on a higher level (at least 5 cm), e.g. at stairs.
Slowing down (sldwn)	Visible decrease in the speed of walking.

The task was to walk from the start to the far end and back in the obstacle course. A cameraman followed the walking dyad from the side keeping at least a 5 m distance between himself and the subjects. The assistant also escorted the subjects to offer help in case the blindfolded person ran against an obstacle. Otherwise they never interfered with the dog or the owner during the walks. At the far end of the obstacle course the helper gently re-oriented the dyad toward the start, so they walked through the obstacle course twice. The behavioural variables used to describe dog-human cooperation are presented in Table 1.

Data analysis

By analysing the video records we determined whether the dog or the owner initiated a joint action. The party who first performed the action was considered the initiator.

The relative contribution by one member of the dyad to the initialisations in a given type of action was calculated by an "initialisation index" (IDX): = [(number of initialisation by the owner)-(number of initialisation by the dog)]/total number of actions. Negative values of IDX suggest that dogs initiated that given action on more occasions than the human, whilst positive values show the reverse tendency.

Total time (tott) was defined as the duration needed for the dyad to walk along the obstacle course from the start to the end and back (consisting of obstacle time plus between obstacle time). If any member of a dyad bumped against an obstacle (it fell over, or moved) or they tried to leave the course an error (mistake) was recorded.

Study II – Attachment Test

Experimental Setting

The experimental setting and the testing procedure were described in detail by Topál et al. [28]. There were two chairs placed facing each other (one for the "Owner", one for the "Stranger") at a 1.5 m distance in an experimental room. There were some dog toys in the middle of the room.

The test procedure consisted of seven episodes, each lasting two minutes. Human participants followed a detailed protocol that determined the form and timing of their behaviour (Table 2). The behaviour of the dogs was videotaped and analysed later. Similarly to the original Ainsworth-test, the "Stranger" was always a woman unfamiliar to the dogs. The observer indicated the start of playing with a knock on the door.

Behaviour categories

We defined eight behaviour categories for analysis (Table 3). Each behaviour category listed was scored separately for both the "Owner" and the "Stranger" Four categories were non-overlapping; *exploration* (EXP), *passive behaviour* (PAS), *playing* (PLY), *stand by the door* (DOOR) and one was an overlapping category; *physical contact* (CON). We analysed the greeting behaviour of the dogs towards the entering person separately and described it by three variables; *contact seeking* (COS), *delay of contact seeking* (DEL) and the duration of *physical contact* while greeting (GCONT).

Table 2
Short summary of the experimental procedure in the Ainsworth's Strange Situation Test (SST)

Episode/ /Duration	Time spent	Those present	Brief description of actions
Introduction		owner, dog, observer	Observer introduces owner and dog to experimental room, then leaves.
1/2 min	120 sec	owner, dog	Owner sits and is non-participant while dog explores. After one and a half minute play is stimulated.
2/2 min	240 sec	owner, dog, stranger	Stranger enters, greets the owner, stops for a while to allow the dog to respond and sits down. Silent for half a minute, then converses with the owner. Second minute: stranger tries to play with the dog. After 2 minutes owner leaves unobtrusively. Leaves the leash on the chair.
3/2 min *1st Separation*	360 sec	dog, stranger	Stranger's behaviour is adjusted to that of dog (offers play or petting to the dog)
4/2 min *1st Reunion*	480 sec	owner, dog	Owner calls the dog before entering, greets, stops for a while to allow the dog to respond and, if necessary comforts it. Then tries to settle it again in play. Stranger leaves unobtrusively. After 2 minutes owner leaves by saying, "Stay here!", and leaves the leash on the chair.
5/2 min *2nd Separation*	600 sec	dog, alone	
6/2 min	720 sec	dog, stranger	Stranger enters, greets dog, stops for a while to allow the dog to respond and adjusts her behaviour to that of the dog. If necessary comforts it, otherwise is non-participant.
7/2 min *2nd Reunion*	840 sec	owner, dog	Owner calls the dog before entering, greets, stops for a while to allow the dog to respond and, if necessary comforts it. Then tries to settle it again in play. Meanwhile stranger leaves unobtrusively.

Analysis of data

The behaviour of the dogs was recorded continuously from the video records. The relative duration of these behaviours was calculated and summed across Episodes 1–7. Apart from analysing the behavioural variables (Table 3) with one-way multivariate ANOVA, we also calculated the factor scores of individual dogs for each factor ('anxiety', 'acceptance', 'attachment') described earlier by Topál et al. [28]. This was based on the factor coefficients obtained in the previous large-scale study in which behavioural variables subjected to a factor analysis yielded 3 significant factors of correlated behavioural variables. Behavioural variables on the 'anxiety' factor indicated the stress-eliciting effect of the strange room. The 'acceptance' factor related to the dog's relation to the stranger. Finally, the 'attachment' factor contained variables that were associated with the dog-owner relationship. The generality of the factor analysis model [7] allows us to calculate individual factor scores for subjects that were not part of the original sample [28]. Therefore after standardizing the values for each behavioural variable we calculated the individual factor scores for the subjects in this study using the factor coefficients of the original study. These factor score variables were also subjected to a one-way multivariate ANOVA testing for

Table 3
The description of behavioural variables observed in the Ainsworth's Strange Situation test

Abbreviation	Behaviour categories
EXP	Exploration; activity directed toward the aspects of the environment (except the toys), including sniffing, distal and close visual inspection, oral examination.
PAS	Passive behaviour; sitting, standing or lying down without any orientation towards the environment, including grooming.
PLY	Playing; any vigorous, toy- or social partner-related behaviour including any physical contact with toys (i.e. chewing).
DOOR	Stand by the door; the time spent close to the door (<1 m) with the face oriented to the exit.
CONT	Duration of physical contact with a person (in sec).
COS	Contact seeking toward the entering person. The score is the sum of the following scores: – initiation of approach (+1), – full approach of the entering person, characterized by physical contact (+1), – little sign of avoidance behaviour i.e. looking away, intention movements (–0.5), – strong sign i.e. walking to the opposite direction except for retrieving a toy (–1). The maximum score can be 4 in the respect of the "Owner" and the "Stranger" as well, as both of them enter the room twice.
GCONT	Duration of physical contact while greeting the entering person (in sec).
DEL	Delay of contact seeking; the time passed (in sec) from the opening of the door to the start of the approaching behaviour. (If approach was not recorded DEL was considered to be 15 sec.)

differences among groups. *Post hoc* differences between two groups were analysed by the Student–Neuman–Keul test ($p < 0.05$).

Finally, we were looking for correlation coefficients between variables of the strange situation test and performance measures in the obstacle task.

RESULTS

Obstacle Course (OC)

We compared the initialisation indices of all the actions performed during walking on the Obstacle Course and found that initialisation indices in four variables out of the seven differed significantly between the three groups (Table 4a). Guide dogs initialised most stopping actions whilst the opposite was true for the police dog group. No such preference was observed in the hobby dog group. Both hobby and police dogs initiated less avoidance action than the guide dogs but in all groups there was a bias to the dogs to initialise avoidance. Positive values in the case of turning suggest that guide dog owners and hobby dog owners preferentially initialised this action, whilst police dogs took more often the lead in turning. Slowing down was initialised

Table 4a
Initialisation indices measured in the Obstacle Course that have been analysed by one-way ANOVAs. Group differences have been calculated by SNK – *post hoc* tests ($p < 0.05$)

Variable name	F	Sign. of F	Mean hobby (H)	Mean guide (G)	Mean police (P)	Sign. differences
idxstrt	0.74	0.487	0.89	0.85	0.77	
idxstp	**21.96**	**0.000**	**0.02**	**–0.46**	**0.58**	**G < H < P**
idxavo	**15.74**	**0.000**	**–0.34**	**–0.93**	**–0.32**	**G < H, P**
idxtrn	**10.58**	**0.000**	**0.75**	**0.40**	**–0.46**	**P < G, H**
idxstdwn	0.46	0.638	–0.68	–0.81	–0.81	
idxstup	0.20	0.819	–0.68	–0.52	–0.73	
idxsldwn	**8.94**	**0.001**	**0.23**	**–0.87**	**0.08**	**G < H, P**

Table 4b
Measures of performance on Obstacle Course that have been analysed by one-way ANOVAs. Group differences have been calculated by SNK – *post hoc* tests ($p < 0.05$)

Variable name	F	Sign. of F	Mean hobby (H)	Mean guide (G)	Mean police (P)	Sign. differences
idxtot	10.84	0.000	0.06	–0.22	0.02	G < H, P
tott	4.486	0.018	266.38	201.47	197.30	G, P < H
mistake	20.35	0.000	7.69	4.18	12.10	G < H < P

more often by guide dogs than by dogs in the other two groups. As expected, in general guide dogs initialised actions more often than their human companions (IDXTOT), in contrast to the other two groups where about half of actions was initialised by the dog and half by the human.

Hobby dog dyads spent significantly more time (TOTT) on Obstacle Course than the other two groups, and all the three groups differed from each other in the number of mistakes (MISTAKE) made during problem solving. Guide dog diads made the least; hobby dyads made more, and police dyads the most errors (Table 4b).

Strange Situation Test (SST)

We found that behaviour of the three groups of dogs differed in eight variables (Table 5). In six cases both hobby and police dogs differed significantly from guide dogs, but not from each other. Namely hobby and police dogs played more both in the presence of the owner and the presence of the stranger than the guide dogs. They were more passive in the presence of both human participants, and spent less time in physical contact with their owner. These dogs also sought less physical contact with the stranger in comparison with the guide dogs.

Hobby dogs explored significantly more in the presence of their owner, than guide or police dogs. Police dogs stood less in the door in episode five while being alone in the room than the other two groups of dogs.

Taking into consideration the individual factor scores of each dog-owner dyad represented on the three factors defined by Topál et al. [28] (anxiety, acceptance and attachment), we found that hobby and police dogs gained lower scores on the anxiety factor (i.e. played more both with owner and stranger and were less passive) but there was no significant difference between the three groups on the acceptance and attachment factor.

Correlations between and within behavioural variables of the Strange Situation Test and the Obstacle Course

There was significant positive correlation between factor scores of attachment and exploration. Dogs with higher ratings on the attachment factor showed more explorative activity in the presence of both the owner and the stranger. Dogs staying a lot at the door when left alone in the experimental room had also high scores on both the anxiety and the attachment factor.

Number of mistakes made and total time spent on the obstacle course correlated positively with total initialisation index of the actions (Table 6). This means that if initialisation index is low (i.e. the dog initiates more actions) than the dyad makes fewer mistakes and spends less time solving the problems raised by walking through the obstacles (“good performance”).

Table 5a
Behavioural variables of the Strange Situation Test that have been analysed by one-way ANOVAs. Group differences have been calculated by SNK – *post hoc* tests ($p < 0.05$)

Variable name	F	Sign. of F	Mean hobby (H)	Mean guide (G)	Mean police (P)	Sign. differences
EXPO	**3.69**	**0.035**	**20.49**	**9.58**	**8.54**	**G, P < H**
EXPS	0.23	0.797	16.31	14.11	17.55	
PLYO	**10.79**	**0.000**	**67.66**	**39.94**	**85.11**	**G < H, P**
PLYSTR	**5.07**	**0.011**	**55.13**	**27.93**	**59.45**	**G < H, P**
PASO	**28.27**	**0.000**	**10.42**	**47.32**	**2.92**	**H, P < G**
PASS	**5.33**	**0.009**	**14.99**	**37.98**	**8.20**	**H, P < G**
CONTO	**24.36**	**0.000**	**10.20**	**35.72**	**4.58**	**H, P < G**
CONTS	0.01	0.995	5.14	5.42	5.10	
DOOR5	**7.78**	**0.020**	**48.44**	**60.24**	**13.23**	**P < H, G**
DOORO	1.18	0.320	0.33	3.27	0.33	
DOORS	1.52	0.231	13.16	25.08	14.55	
COSO	0.65	0.525	3.12	2.88	2.45	
COSS	**5.92**	**0.006**	**0.38**	**1.91**	**0.60**	**H, P < G**
DELO	2.57	0.090	1.31	7.59	2.30	
DELS	0.87	0.428	14.00	10.35	14.20	
GCONTO	1.31	0.283	6.31	6.35	3.90	
GCONTS	1.22	0.305	0.77	3.47	12.80	

Table 5b
The factorial scores of individual dogs for all three factors are compared in the 3 experimental groups by one-way ANOVAs. Group differences have been calculated by SNK – *post hoc* tests ($p < 0.05$)

Variable name	F	Sign. of F	Mean hobby (H)	Mean guide (G)	Mean police (P)	Sign. differences
ANX	**21.73**	**0.000**	**–0.44**	**0.79**	**–0.77**	**H, P < G**
ACC	0.19	0.831	–0.01	0.00	0.12	
ATT	0.12	0.886	–0.01	0.00	–0.01	

Correlation between the SST factors and the variables of the Obstacle Course are the most interesting for our study. The 'anxiety' factor scores correlate negatively with the total initialisation index, thus if the dog is more initiative then the dyad has higher scores on this factor. Anxiety factor scores correlate negatively with number of mistakes suggesting that those dyads which make fewer mistakes have higher scores on the anxiety factor. Dogs standing at the door when left alone made fewer errors on the Obstacle Course.

Table 6
Significant correlations (r > 0.3) of behavioural variables observed in the Strange Situation Test (Door 5, EXPO, EXPS), factors scores (ANX, ATT) and behavioural variables measured in Obstacle Course (idxtot, mistake, tot)

Correlation	r	p
ANX-DOOR5	0.36	0.022
ATT-DOOR5	0.32	0.044
ATT-EXPO	0.34	0.034
ATT-EXPS	0.44	0.005
idxtot-mistake	0.49	0.001
idxtot-tott	0.40	0.010
ANX- idxtot	–0.39	0.012
ANX- mistake	–0.39	0.012
DOOR5- mistake	–0.43	0.006

DISCUSSION

The above-mentioned differences are reflected in the comparisons of the three factors among the groups: guide dogs have gained higher scores on the 'anxiety' factor than the others. We can conclude that the novel environment caused more stress for the guide dogs than to the others. In contrast, we could not find any difference in the acceptance of the stranger and the attachment to the owner between the different groups. This suggests that contrary to our expectation, in general the dog-owner relationship in these groups was relatively similar.

Comparing initialisation indices of the obstacle course (negative index indicates that dog initiates more frequently), we found group differences in case of stopping, avoiding, turning and slowing down actions. Guide dogs initiated most stopping, as they were taught to do so for indicating an obstacle. Hobby dogs initiated less, but police dogs were the least initiative in this action. Probably the reason was that policemen made the most mistakes, and bumping into an obstacle resulted in stopping. Guide dogs initiated the most avoidance actions, again because they had been already trained for this behaviour, as part of their blind-leading task. Police dogs were the most initiative in turning. This behaviour is very uncommon on the obstacle course and occurs mostly when the dog tries to escape from the task, which leads to making mistakes. Slowing down is a signal, which is used by the guide dogs to indicate an obstacle (beside of stopping), and as it could be predicted, guide dogs initiated it significantly more than the other dogs. Initialisation in the hobby and police dyads was very well balanced, close to 50–50%, while guide dogs were more dominant in initiating actions, which reflects that the behaviour required for solving the task was familiar to them.

As expected, guide dogs made fewer mistakes than hobby dogs but in general police dogs showed the worst performance. The analysis has shown that those dyads performed better on the obstacle course in which dogs initiated more actions. They made fewer mistakes and spent less time at an obstacle with solving a problem. Interestingly, those dyads made fewer mistakes on the obstacle course, in which the dog showed more anxiety-related behaviour in the attachment test (they were passive/played less and spent much time in contact with the owner). However in our case this result can be explained since mostly guide dogs scored high on the anxiety factor and made few mistakes only.

In the present sample we could not find any direct evidence that attachment level affects cooperative behaviour. This could be due to the fact that the so-called attachment factor explains only a relatively small part of the total variance, making the detection of any effect difficult. Our three samples were unfortunately too small to allow for statistical consideration of within-group differences among independent variables. At least under the circumstances of this study the effectiveness and organisation of cooperative activity was not affected to a great extent by the attachment relationship.

John Paul Scott [23], who developed the general theory of critical periods claims that similarly to human infants, there is a sensitive period in dog puppies for formation of attachment to humans which begins around 3–4 weeks of age and lasts until 7–9 weeks of age. The decline of attachment is associated with developing a fear response to the strange person. If an opportunity for attachment is postponed until the fear response is thoroughly established, attachment is difficult to induce without using drastic methods of restraint and forced contact over long periods [23]. In the course of testing several hundred puppies of several different breeds, Scott never found a puppy that did not show any attachment to humans. The process of attachment seems to be so essential to existence that little or no genetic variation is possible.

Attachment is not exclusive, as during the critical period a puppy may become attached to any animal that is associated with it, even including prey animals such as rabbit [6]. The process of social attachment may be extended from the parent species to a non-related species, like humans. The dog is unique in a degree to witch an individual does not remain in the social organisation peculiar to its species but normally becomes a part of human society through a process of adoptation in an early age [24].

It is important to make distinction between attachment formation during the sensitive period and later attachment showed in adulthood. The original Strange Situation Test is formed for 12–18 month-old children but for assessing later attachment, additional methods have been developed (modified classification systems, questionnaires, etc.). There is a huge literature of comparison of early attachment style to the parents and its connection to later behavioural traits in the life span of the human subjects. In our study we observed the behaviour of adult dogs and concluded that their behaviour is analogous to the behaviour of children according to the criteria of attachment defined by Ainsworth and Wittig [1]. We can say that they show similar behaviour in Strange Situation and conclude that they are attached to the

owners similarly as 12–18 month-old children are attached to their parents. In the framework of our study we cannot specify the detailed mechanism and the long-term consequences of the phenomena on social adaptation and communication skills.

In our paper we showed no significant differences of attachment between our three study groups that does not mean that our dog subjects were not attached to their owners, rather that the variance of their attachment behaviour in Strange Situation was not higher between groups than within the groups and that the significant differences were connected to their fear and anxiety rather than to their attachment. This result fits to the idea of Scott [23] that attachment is such a basic trait that relatively little variance is allowed.

ACKNOWLEDGMENTS

This study was supported by the Hungarian Scientific Research Fund (OTKA-T029705) and by the Hungarian Academy of Sciences (F226/98). During the preparation of this manuscript Á. Miklósi and V. Csányi also received support from the Ministry of Health (261/2000) and Sz. Naderi from the Soros Foundation.

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