The effect of the owner's personality on the behaviour of owner-dog dyads

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We describe the relationships between dog owners' personality attributes (assessed via questionnaire), their behaviours and the dog's behaviours observed during brief dog-owner and dog-stranger interactions (N = 78). Interactions comprised the owner commanding the dog to sit, and the stranger showing a ball to the restrained dog and then hiding it. Owners scoring higher on neuroticism and openness used more commands (gestural and verbal) when asking the dog to sit, and the dogs of owners higher on neuroticism obeyed with a longer latency and spent more time looking at the stranger. More extraverted owners praised their dog more, and it took longer for their dogs to look at the stranger but they spent more time looking at the stranger, whereas dogs of more agreeable owners spent more time looking at the ball. Based on these results we conclude that some aspects of owners' personality appear to be tied to their dog's attentional concerns.

Keywords: dog-human interaction; personality; multivariate statistical methods

1. Introduction

1.1 Dog-human relationship

Humans engage in heterospecific interactions with a variety of agents ranging from different animal species (e.g. Podberscek, Paul & Serpell 2000; Robinson 1995) to social robots (Thrun 2004). Among these interactions the perhaps most widely studied one is the human-dog interaction.

Dogs are among the most popular pets in the western world (Hart 1995) and are present in almost every human society worldwide (Serpell 2003). They have evolved specialized skills for reading human social and communicative behaviour, which enabled them to perform tasks to assist humans (e.g. the comprehension of human pointing gestures is a basic skill in assistance dogs or following human gaze is useful in everyday cooperative situations) (Cooper 2003; Hare & Tomasello 2005; Miklósi, Topál & Csányi 2004). Dogs show attachment to their owner (Topál, Miklósi, Csányi & Dóka 1998; Prato-Previde, Custance, Spiezio & Sabatini 2003)

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that is, they have a special affectional relationship based on dependency between individuals that becomes evident through behavioural preferences (Wickler 1976). Furthermore they are considered to be a promising model species for studying several complex phenomena such the genetic basis of certain human illnesses (Overall 2000) or human-robot interaction (Syrdal, Koay, Gácsi, Walters & Dautenhahn 2010; Miklósi & Gácsi 2012).

1.2 Dog-human interaction and the role of personality

Owners keep and use their dogs for different purposes and also marked variation exists in the relationship between owners and their dogs (Hart 1995). There are highly coordinated owner-dog units, such as blind owners and their guide dogs (Naderi, Miklósi, Dóka & Csányi, 2001), while there are dogs that would not even reliably return when called (Serpell 1996). Associations have been reported between the owners' and dogs' personality. For instance, owners of highly aggressive English cocker spaniels tend to be emotionally less stable, shy, undisciplined and more likely to be tense than owners of low aggressive spaniels (Podberscek & Serpell 1997). Owners also showed some degree of similarity with their dog in their personality profile (Turcsán, Kubinyi, Virányi & Range 2011).

Several studies have already investigated the interaction of human-dog dyads in situations like interspecific play (Mitchell & Thompson 1986, 1990, 1991; Rooney, Bradshaw & Robinson 2001) and problem solving tasks (e.g. Topál, Miklósi & Csányi 1997). Other studies using "field-based" methodology and focusing on the aspects related to dog-training (e.g. Braem & Mills 2010; Fukuzawa, Mills & Cooper 2005) found that varying the way an experimental trainer communicates (e.g. posture, eye-contact) with the dog when giving simple commands like "come" and "sit" influences the obedience of the dogs.

Despite the extended literature on dog-human relationships, only a little is known about the effects of the owners' personality on the dog-owner dyadic interaction. It has been reported that the higher the owners score in neuroticism, the more they consider their dog a social supporter which is related to a low dyadic functionality (e.g. they engage less in shared activities with the dog) (Kotrschal, Schöberl, Bauer, Thibeaut & Wedl 2009). In contrast, the higher owners scored in extraversion, the less they tended to consider their dogs as social supporters and the more these owners appreciated shared activities with their dogs. However, the authors noted that due to the low sample size (N = 22) the results need to be interpreted cautiously. Data on the same subjects was later published with a slightly different focus (Wedl, Schöberl, Bauer, Day & Kotrschal 2010) concluding that the personality of the owners and dogs, the nature of the human-dog attachment, and the owner-dog relationship (e.g. shared activity) may influence dogs' social attraction to their owners.

1.3 Aims of the study

In the present paper we aim to give a detailed behavioural analysis of the human-dog interaction in a short series of simple actions observing a large number of human-dog dyads. Behavioural observations were complemented by the measurement of human personality and some general information (including dog keeping practices). Our objective was to examine consistent relationships in the behaviours of dogs and their owners in interaction with each other or a stranger, and to discern influences of owner personality on dog behaviour by means of multivariate statistical methods.

2. Material and methods

2.1 Subjects

A total of 78 dog-owner pairs participated in the experiment. Owners from a database containing approximately six hundred volunteers were contacted in alphabetical order and they took part in the study if their dog could be described as "motivated to play with a ball" and they themselves were willing to participate in the experiment. The test was conducted in the Clever Dog Lab, Vienna from July to September 2009. Owners were 14 males and 64 females, all older than 18 years old with an average age of 43.8 (±19.0) years. Dogs were 40 males and 38 females from 27 different breeds and 15 mongrels. They were all older than one year with an average age of 4.2 (±2.6) years. Some of the owner-dog pairs had previously participated in other behaviour tests but all of them were naive to the current experiment. All tests were carried out by the same 22 year-old female, who was unfamiliar to all subjects.

2.2 Procedure

To assess the human personality we used the German version of the Big Five Inventory (BFI, John & Srivastava 1999) translated and validated by Lang, Lüdtke and Asendorpf (2001), measuring neuroticism, extraversion, openness, agreeableness and conscientiousness. Neuroticism refers to the tendency to be anxious, insecure, and self-pitying versus calm, secure, and self-satisfied. Extraversion refers to the tendency to be sociable, fun-loving, and affectionate versus retiring, somber, and reserved. Openness refers to the tendency to be imaginative, independent, and interested in variety versus practical, conforming, and interested in routine. Agreeableness refers to the tendency to be softhearted, trusting, and helpful versus ruthless, suspicious, and uncooperative. Conscientiousness refers to the tendency to be organized, careful, and disciplined versus disorganized,

careless, and impulsive. The questionnaire consisted of 44 items (e.g. "*I see myself as someone who is sometimes shy, inhibited*") and the owners had to rate themselves on each item using a five-point interval scale (disagree strongly – agree strongly).

After the owners completed the questionnaire the dog and the owner entered the test room (6.3 m × 4.8 m) together with the female experimenter (E). The test consisted of two phases where we observed human-dog interaction with the owner and the experimenter, respectively. We applied two short scenarios that resembled everyday life events. First the dog had to accomplish a simple and already known command that was given by the owner in a somewhat novel context. Then a stranger manipulated a ball calling the dog's attention to her actions in a social learning-like communicative context.

In the first test phase (duration: 37.3 ± 8.2 s) the owner was instructed to make the dog sit in the middle of the room as he/she usually does and to walk around the room while the dog was expected to stay in the same place. After walking around, the owner returned to the dog and was instructed to hold the dog's collar (video: http://www.cmdbase.org/web/guest/play/-/videoplayer/23). Then in the second phase, (duration: 19.6 ± 2.1 s) the E placed an opaque screen (30 cm wide x 50 cm high x 30 cm deep) and a tennis ball 2 m from the dog and 1 m from each other. First E called the dog to get its attention while standing next to the dog-owner pair, then she walked to the ball without looking at the dog. E picked the ball up, and said "Schau mal!" (the German equivalent of "Look!") to the dog. Next she walked to the screen and hid the ball behind it, then walked back to the subject showing her empty hands (video: http://www.cmdbase.org/web/guest/play/-/videoplayer/24).

Both phases were videotaped with a four-camera-system for later analysis.

2.3 Data analysis

Five behaviour variables were analysed to describe the dogs' reactions during the interactions. In *Phase 1* we measured the *Latency of accomplishing the command* from the moment when the dog-owner pair entered the room and the *Time spend looking at owner* from the moment when the dog took the sitting position. In *Phase 2* the *Latency to look at the experimenter, Time spend looking at the experimenter* and *Time spend looking at the ball* was measured from the moment when the experimenter called the dog. We also recorded the number and type of the commands the owners used in Phase 1 (Table 1). A *Verb* was defined as an utterance containing a single verb (e.g. "Sitz!" "Bleib!", that is the German equivalent of "Sit!" "Stay!"); an *Attention getter* contained the dogs' name and/or the utterance "Schau mal!" ("Look!"); a *Praise* was a positive

utterance such as "Super!" or "Gut gemacht!" ("Great!" "Well done!"). We also calculated the *Total verbal information* that was the sum of *Verbs, Attention getters* and *Praises*. A *Hand sign* was defined as a voluntary hand movement directed towards the dog.

Table 1. Variables used in the present study (with the abbreviations in parenthesis where applicable) and the reliability measures in the case of behavioural variables

Source	Dog	Owner
Personality questionnaire		Neuroticism Extraversion Openness Agreeableness Conscientiousness
Phase 1	Latency of accomplishing the command (LatSit), κ = 1	Total verbal information (SumCommand)
	Time spend looking at owner (LookOwn), κ = 0.9	Verbs, κ = 0.89 Attention getters, κ = 0.9 Praise, κ = 0.9 Hand signs, κ = 0.85
Phase 2	Latency to look at the exp. (LatLookExp), κ = 0.8	
	Time spend looking at the exp. (LookExp), κ = 0.8	
	Time spend looking at the ball (LookBall), κ = 0.8	

Behavioural variables were coded with frame-by-frame inspection of the recordings using Solomon Coder (© András Péter, http://solomoncoder.com/), a widely used behaviour coding software (e.g. Horn, Virányi, Miklósi, Huber & Range 2011; Marshall-Pescini, Passalacqua, Barnard, Paola Valsecchi & Prato-Previde 2009). Reliability measures (Cohen's Kappa) for both phases were obtained by coding of 20 videos. According to the categorization by Landis and Koch (1977) almost perfect agreement (0.81–1) was found for all variables. The personality questionnaire was evaluated only after the behaviour test.

Based on these data we gave a multivariate description of the dyads' interaction using Redundancy Analysis (RDA, Wollenberg 1977). Behaviour variables from both the owner and the dog were entered into the same statistical model and the owner's personality factors were used as explanatory variables. This method

is suitable to qualitatively analyze data sets where the explanatory variables (in this case the owners' personality) are supposed to influence the other variables (in this case the behavioural variables coded in the two test phases) without the latter having an influence on them. Although human personality might depend on several factors, based on a definition by Funder et al. (1997) suggesting that personality is stable across time and situations, for this analysis we expected that the owners' personality was not influenced by the dogs' behaviour. We further assumed that as the owner may actively choose the breed or individual (s)he wants to live with, in this way (s)he might be able to impact on the behaviour of his/her dog.

For statistical analysis we used Syntax 2000 (© János Podani, http://ramet.elte.hu/~podani/subindex.html), a widely used multivariate statistical analysis software (e.g. Altobelli, Bressan, Feoli, Ganis & Martini 2006; Bourgeois, Kenkel & Morrison 1997).

3. Results

In order to give a general picture of what happened in the two phases of the test, first we provide descriptive results (average and SD). During the first test phase the owners used 2.5 (±1.9) hand signs and 9.7 (±7.6) pieces of verbal information out of which 6.6 (±4.8) were verbs, 1.9 (±2.0) were attention getters and 0.7 (±1.2) were praise. The dogs needed 18.7 (±14.7) seconds to accomplish the "Sit!" command, and they were looking at the owner 86.4 (±13.5) % of the time. In the second phase, the dogs looked at the experimenter with a mean latency of 0.55 (±0.70) second when she called their attention. The dogs were looking at the experimenter 66.2 (±28.3) % of the time, and at the ball 28.1 (±27.6) % of the time.

An RDA was carried out on data gathered from the interaction test with the owner's personality factors as explanatory variables. Owner-dog pairs were therefore positioned in an N dimensional space (with N being the number of axes) according to both the owners' and the dogs' behaviour. The axes are expressed in arbitrary units and were similarly derived as those of a Principal Component Analysis (PCA), that is data reduction method was used to decrease the number of axes/dimensions by reducing the number of variables through computing behavioural factors containing more than one variable. The analysis results in a treeplot (Figure 1) where the first two dimensions/axes (the ones with most explained variance) are plotted with the two axes representing behavioural factors expressed in arbitrary units. The two canonical RDA axes explained 70% of the total variance (for comparison see ecological studies using the same method: e.g. Tinya,

Márialigeti, Király, Németh & Ódor 2009). In order to make visible the behavioural variables which constitute the factors, the variables are also plotted (black circles) and labeled on the figure. A bigger distance from zero means a bigger load on the factor. Each dog-owner pair is plotted according to their values for the two behavioural factors (axis 1 and 2).

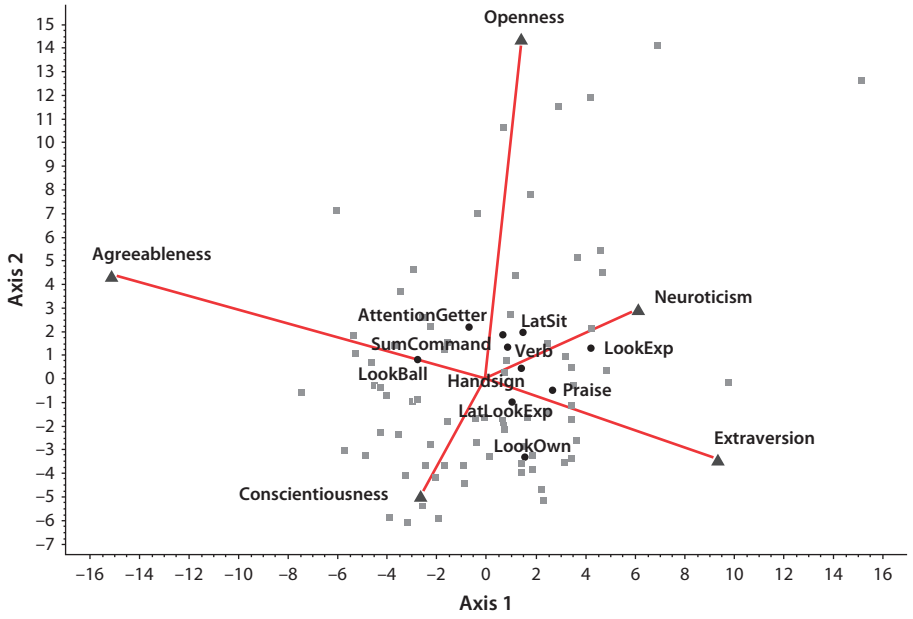

Figure 1. Treeplot showing the results of the Redundancy Analysis. The light grey squares are the individual dog-owner pairs, the black circles are the behavioural variables observed in Phases 1 and 2 of the social interaction test and the dark grey triangles represent the personality factors of the owners. The black circles, which appear close to the lines connecting the triangles to the point of zero, indicate close association. Variable abbreviations are provided in Table 1

Explanatory variables (personality factors of the owner) are plotted according to their relatedness to axes 1 and 2 (gray triangles). The visual examination of the treeplot (Figure 1) showed that the first axis (explained variance 42%) was associated positively with the owners' scores on extraversion and negatively with the scores on agreeableness. The second axis (explained variance 28%) was associated positively with the owners' scores on openness and negatively with the scores on conscientiousness. Owners' neuroticism was associated positively with both axes to some extent.

The treeplot of the RDA provides information also on the relationship between the owners' personality traits and the behaviour of the dyads; the physical distance

between the lines connecting the personality factors (plotted as gray triangles) to the origo and the behavioural variables (plotted as black dots) means relatedness. Owners' neuroticism was associated with the dogs' accomplishing the "Sit!" command with a longer latency and looking more to the experimenter in the second phase. Furthermore, neuroticism and openness traits were positively related to the number of hand signs and commands the owners used in the first test phase (total verbal information, attention getters, and verbs). The owners' extraversion trait was also related to the number of times the owners praised the dog in this phase. Moreover, owners who rated themselves higher on extraversion had dogs which looked with a longer latency at the experimenter and spent more time looking at her in the second test phase. Dogs with highly agreeable owners spent more time looking at the ball in the second test phase.

4. Discussion

4.1 Analysing dog-human interaction

In the present paper we described the social interaction of dog-human dyads while accomplishing simple tasks and revealed that the owners' personality relates to the observed behaviour in dogs and their owners. The main advantage of the present study is that the use of a multivariate method allowed us to describe the interaction of a large number of owner-dog dyads by the means of a single statistical model. These descriptive statistics are widely used in ecological studies (e.g. Guisan 2000) where a lot of field data are available in order to give a unified description of the whole study area. However, behaviour observations carried out with relatively low sample sizes are usually analyzed with univariate methods (although see Everitt 2009 for multivariate analysis of behavioural data) focusing on only one variable in each statistical test.

It has already been proposed that owner-dog dyads might function as one unit (Mitchell & Thompson 1991; Naderi et al. 2001), for example due to a common goal. We suggest that there is a variation to what extent owner-dog dyads form a unit. In the present study we showed that dyadic behaviour can be studied not only in complex situations (such as playing or mastering an obstacle course) but also in a very simple situation.

4.2 The effect of the owners' personality on dog-human interaction

It was reported earlier (Kotrschal et al. 2009) that the higher the owner's score in neuroticism, the greater their attachment was to their dogs. In parallel we revealed

that owners scoring higher in neuroticism use more commands and hand signs when making the dog perform a simple obedience task (sit and stay) which might be a sign of social relatedness (Furrer & Skinner 2003). The close social relationship of owners with their dogs associated with neuroticism was also reported to be linked to low dyadic functionality by Kotrschal et al. (2009). Similarly we found that higher scores on neuroticism in owners were also related to longer latencies when accomplishing the "Sit!" command in dogs. Braem and Mills (2010) found also that with the handler giving additional verbal information besides the command (that is comparable with the total verbal information in our test), the dog's obedience decreased (comparable to latency of accomplishing the command in the present experiment).

Owners scoring high in extraversion seem to have more extraverted dogs according to a questionnaire survey (Turcsán, Kubinyi, Virányi et al. 2011). Similarly, we found that the owners' extraversion was positively associated with the dogs' looking at the owner in the first test phase and their looking at the experimenter in the second phase, while less social behaviours like looking at the ball were negatively related to this personality trait. However, we also found previously unreported connections of the owners' openness and agreeableness to the dog and owner behaviour: the owners' openness trait was positively related to the number of hand signs and commands they used in the first test phase (total verbal information, attention getters, and verbs) while dogs with highly agreeable owners spent more time looking at the ball in the second test phase.

4.3 Dog-owner interaction in a broader sense

Similarly to other findings (Kotrschal et al. 2009; Turcsán, Kubinyi, Virányi et al. 2011; Wedl et al. 2010) we found a relationship between the behaviour of owners and their dogs in many aspects.

Mitchell and Edmonson (1999) described how owners talk to their dogs in a play situation. They found that many of them "chatted" to their dogs in quite a complex way using repetitive talk. Similarly, we found that owners in this context used imperatives (verbs) and attention getters the most frequently during the interaction.

It is also important to point out that, as we have seen, the owners' personality has an impact on how the dogs behave, which might also bias the results of such cognitive tests where the owners are allowed to participate actively (e.g. Elgier, Jakovcevic, Mustaca & Bentosela 2009; Prato-Previde, Marshall-Pescini & Valsecchi 2008).

5. Conclusion

In sum, the present paper provided a qualitative description of associations between the owners' personality and the behaviour of owner-dog dyads during a simple interaction task. We found that the owners' personality influenced the dyad's performance: neurotic owners used more commands and their dogs obeyed with a longer latency; extroverted owners used more praises and their dogs spent more time looking at the experimenter while dogs of agreeable owners spent more time looking at the ball. These results might contribute to our understanding of human-companion relationships in a broader sense.

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Authors' biography

Anna Kis joined the Family Dog Project of the Department of Ethology at the Eötvös University in 2007 where in 2010 she obtained her BSc degree in biology studying human-directed aggression in dogs. During her studies she also gained research experience in the Department of Cognitive Biology of the University of Vienna and in the Konrad Lorenz Institute at Altenberg on the topic of "A-not-B" error in dogs and marmosets. Her current research interest focuses on dog-human interaction and etorobotics.

Márta Gácsi is a post-doctorate researcher of the Family Dog Project at Eötvös University. She gained her Ph.D. in 2003 on the attachment of dogs towards their owners. Since then she has been supervising several graduate and undergraduate students on various topics. Her current research interest focuses on dog aggression, attachment toward the owner, dog-human communication and etorobotics.

Borbála Turcsán is a Ph.D. student at the Department of Ethology at Eötvös University. She graduated at the same university in 2009 with a thesis about species typical behaviour in dogs. She has been a member of the Family Dog Project for five years and has participated in several projects concerning the personality and behavioural genetics of dogs. She also spent five months in the Clever Dog Lab in Vienna. Her current research interest focuses mainly on dog and owner personality and its relation to dog-owner relationship.

Ádám Miklósi has been the head of the Department of Ethology at Eötvös University since 2006 and at the same time leader of the Family Dog Project. He graduated at the same university in 1986 as a biologist and obtained his Ph.D. in 1995. His current research interest focuses on the ethology of dogs including several subdisciplines from behavioural genetics through social cognition to etorobotics. In 2008 he published a book entitled Dog Behaviour, Evolution, and Cognition at Oxford University Press.