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Abstract (for dissemination)	After reviews on the attitude of humans towards robots and dogs, we present several sets of data. We compared university students' and dog owners' attitudes toward robots in comparison to dogs. People playing with AIBO and a puppy were interviewed and characteristics of the most popular dog breeds were also investigated. Results emphasise that detailed behavioural description is needed about dogs' faithfulness (attachment), individuality (personality) and emotions in order to enhance companionship between robots and humans. Further, we investigated personality traits of owner-dog dyads, and found several correlations. We developed a behavioural test battery for providing detailed description of more than one hundred dogs' behaviour in scenarios which are related to the showcases.

CONTENT

1 Reviews: Attitude toward robots and dogs

1.1 Who like robots, and what kind of robots do people like?

The *uncanny valley* theory holds that when robots and other facsimiles of humans look and act almost like actual humans, it causes a response of revulsion among human observers. The "valley" in question is a dip in a proposed graph of the positivity of human reaction as a function of a robot's lifelikeness. Masahiro Mori's original hypothesis (1970) states that as a robot is made more humanlike in its appearance and motion, the emotional response from a human being to the robot will become increasingly positive and empathic, until a point is reached beyond which the response quickly becomes that of strong revulsion. However, as the appearance and motion continue to become less distinguishable from a human being, the emotional response becomes positive once more and approaches human-to-human empathy levels (Fig. 1).

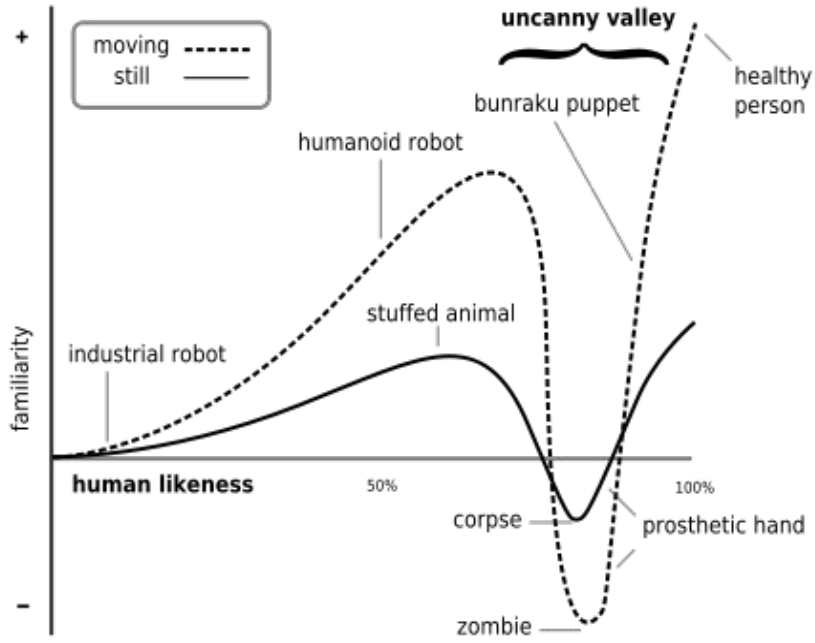

Figure 1. – The so-called 'Uncanny Valley'

The uncanny valley theory generated a broad genre of hypotheses in studying human-robot interactions along the following 40 years. There are plenty of research papers in the literature, which supports the theory. A recent test of schoolchildren showed that cartoon-character like robots were considered more friendly, while strongly human-like robots as 'frightening' (Woods, 2006). Others approach the question by arguing pro functionality and human-like behaviour / personality versus looks. For example, a robot was designed for encouraging stroke-patients to do their daily physiotherapy exercise (Mataric et al., 2007). There were people who interacted more with the robot (i.e. they took it with themselves for travels), and others only responded to its commands. Recognizing the differences between

the users' approach styles, and attributing it to the different personalities of the patients, in the next step of development, the robot was re-designed with adjustable personality. Now the robot could be set more introvert or extrovert, according to the user's own personality (Tapus et al., 2008). As Sherry Turkle, author of several books, book chapters and research papers stated "Success has nothing to do with the degree of humanoidness, success means fluid interaction between robots and humans, while they are doing something useful" (cited by C. Biever, New Scientist, 2006, July 20th).

The considerable success of absolutely non-humanoid utility robots like 'Roomba' (an autonomous vacuum-cleaner, of which more than two million copies were sold by 2008) gives further evidence that resemblance to humans seemingly has nothing to do with loveability of a machine. According to the studies of Grinter and colleagues, people give names to their Roombas, dress them, even introduce them to their parents. They re-design the house for an easier 'life' of their Roomba (Sung et al., 2007; 2008). Their attachment is not affected by the flaws and occasional malfunctioning of the robots. As professor Grinter said "They're more willing to work with a robot that does have issues because they really, really like it," and "It sort of begins to address more concerns: If we can design things that are somewhat emotionally engaging, it doesn't have to be as reliable." (cited by *Associated Press, 2007, Oct. 2.*). An important finding was of this research that so-called customizing kits proved to be especially successful in enhancing the attachment levels of Roomba-owners to their machines (Sung et al., 2009). The main factor behind this effect was thought to be personalization.

Many authors who agree with the uncanny valley theory forget seemingly that there are two possible routes leading out from the depths of eerie feelings about almost-human robots. Earlier we summarized a few examples of the potential success of affectionate non-humanoid robots. But a current and strong branch of robot-developing efforts concentrate on the 'right-side' of the uncanny valley – recognizing the possibility for creating such levels of humanoidness, which exceeds our aversion from less-than-perfect creatures. We should remember the original theory of the uncanny valley (or take another look to Fig. 1), and we will see that this is possible.

It is also worth to summarize briefly the reasons why the uncanny valley phenomenon may work in humans? There are several theoretical explanations for the repulsive effect of 'almost human' beings. Some of them hypothesize that it is a natural (biological / cognitive) avoidance from abnormal, less than perfect creatures, which can carry deleterious genes, therefore would fail to be adaptive mates for healthy humans (Rhodes and Zebrowitz, 2002). Others argue that almost but not entirely human-like androids (robots) elicit thoughts of our own death, perish, therefore we associate them with unpleasant feelings (MacDorman and Ishiguro, 2006). Finally, a different approach capitalizes on cultural heritage that may explain the uncanny valley effect (at least in particular parts of the world): artificial, but humanlike entities are considered a threat to the concept of human identity, as constructed in the West and the Middle East. This is particularly the case with the Abrahamic religions (Christianity, Islam, and Judaism), which emphasize human uniqueness. The experience of the very humanlike "living" robot can be so rich and compelling that it challenges humans' notions of "specialness" and existential defenses, eliciting existential anxiety (MacDorman et al., 2009).

With the exception of the last (cultural) negative response towards human-like artificial creatures, it is easy to understand that all the other difficulties can be solved at least theoretically with the perfection of the human-likeness of a robot. Exactly this is what some companies attempt to achieve. A good example is the homepage of the Kokoro Company (Japan) (see: http://www.kokoro-dreams.co.jp/english/robot/act/gallery.html).

Their highly successful 'Actroid' robots are now available for rental purposes, and the purchasable version is soon out (costs $250.000). According to the company's own words: "*Absolutely look like a real human! The "Actroid", humanoid, developed with a cutting-edge technology attract you with its human look-alike appearance and astonishing high expression ability.*" People can buy the new Actroids as 'doppelgängers' (exactly what the followers of the uncanny valley theory, like MacDorman and Ishiguro (2006) think as repulsive) – the robot will be able to playback its owner's speech, followed by convincing, life-like gestures of the hands, upper body and head/face (Fig. 2).

Figure 2. Kokoro's (Japan) 3rd generation Actroids

We can assume that robots, either as artificial looking household machines or similar companions, or highly sophisticated androids, will enter our lives sooner or later. But which extent will they find their way to the human *niche*? If we consider the next line of thoughts *(C. Q. Choi, 2007. Sex and marriage with robots. It could happen. Live Science, Oct. 12.)*, we may think the future is near to our wildest dreams – or nightmares?

David Levy said: *"But who knows, maybe some other relationships could welcome a robot. Instead of a woman saying, 'Darling, not tonight, I have a headache,' you could get 'Darling, I have a headache, why not use your robot?'"* Note that if we allow robots to become a part of everyday life and bond with them, we'll have to ask questions about what's going to happen to our social fabric. How will they change humanity and civilization? The main benefit of human-robot marriage could be to make people who otherwise could not get married happier, "people who find it hard to form relationships, because they are extremely shy, or have psychological problems, or are just plain ugly or have unpleasant personalities," (Levy, 2007). In his thesis, *"Intimate Relationships with Artificial Partners,"* Levy conjectures that robots will become so human-like in appearance, function and personality that many people will fall in love with them, have sex with them and even marry them.

Maybe as final relief to this rather scary future, we would like to cite from another study (Turkle et al., 2006). In this paper the authors report the outcome of their interviews with 9-10 years old children who had the opportunity to interact with such social robots like Aibo and 'My Real Baby'. As a typical response, let us cite the opinion of a 10 year old girl about Aibo: „Aibo can love but only because 'it is programmed to. If robots love then it is artificial love. And if it is an artificial love, then there really is not anything true… I am sure it would be programmed to show that it likes you, you know, the computer inside of it telling it to show artificial love, but it does not love you.' (Turkle et al, 2006).

1.2 ***Who and why like dogs?***

Recently, the DOGS magazine carried out an on-line survey about the behaviours of dogs, and we had the possibility to analyse the 14,004 responses (Kubinyi et al., 2009). The large amount of data allowed us to make general assumptions about the demography of dog owners, however, the results are biased by the use of Internet and the interest in filling in surveys. We examined the representativeness of our database to the whole German population, and we compared our descriptive statistics with German demographic statistics available on-line (www.destatis.de, www.bmi.bund.de, November 20, 2008). Overall, 44% of the population older than 14 years of age owns one dog, 5% owns two dogs and only 1% owns three or more dogs. This presents a significantly different distribution in comparison to our sample: people in our sample had more dogs per household than is characteristic for the German population. Although demographic statistics do not present the age distribution of dog owners in Germany, the comparison to the whole German population older than 14 years of age showed that the 19-60 year-old cohort was overrepresented in our sample, while the >60 year-old cohort was underrepresented (the majority of dog owners (64.9%) were between 31 and 60 years old, and only 5.4% were younger than 18 years old in our

sample). This could be because older people do not keep dogs, do not read dog magazines (particularly DOGS), or do not use the internet.

Similarly, although we do not know the gender distribution of German dog owners, by comparing it to the whole German population, we found that women were more frequent in our sample (80% vs 51.1%). This could be explained by assuming that women keep dogs more frequently than men, are more willing to fill in questionnaires, or use the Internet more frequently. However, the latter assumption might not be relevant because other authors who did not require their subjects to use the Internet for filling in questionnaires published very similar gender rates (e. g. 85% of respondents were women in Bennett and Rohlf, 2007).

We could not compare some of our results to that of the published demographic statistics. Half of the respondents (52.8%) resided alone or in a two-person household. Most of the respondents (40.4%) had secondary education, 25.9% had high school, 22.4% had primary school and 11.3% had a university degree. Family member (93.3%) was marked as the most common purpose of keeping the dog.

Demographic characters of people were associated with differences in four personality traits of dogs. For example, men had more extraverted (bold) dogs than women. Similar associations are published in Kubinyi et al. (2009) and in LIREC Deliverable 7.1. (2009).

People keep animals mainly for companionship (Endenburg et al., 1994). In addition there are several other factors influence companion animal ownership (social factors: childhood experience, tactile contact, attachment and taking care of an animal and non-social factors: being used to it, usefulness, companionship for other animal, health reasons, feeling sorry for the animal, aesthetic value, the uniqueness of the animal or the “need for power”). Dogs also facilitate human-human social interactions.

The majority (80-95%) of pet dog owners consider their dogs as family members (Albert & Bulcroft 1987, 1988; Rasmussen & Rajecki, 1995, Hirsch-Pasek & Treiman, 1981; Mitchell, 2001; Prato-Previde et al., 2006, Kubinyi et al., 2009). There is a considerable cultural variation (for example, when asked about the purpose of their dogs, 88% of German Shepherd owners in the USA and 26% of owners in Hungary offered “pet”, “companion,” “family member” or a similar term, Wan et al., 2009). Keeping conditions influence people's attitude toward their dog: Shore et al. (2006) demonstrated that owners in the USA who keep their dogs indoors tend to be more attached to their dogs than those who keep their dogs outdoors and we showed that people who keep their dogs in a flat are more devoted to their dogs (see LIREC Deliverable, 2.1, 2009).

Pet ownership is highest among households with children but devotion/attachment to pets is highest among people living without children (Endenburg et al., 1994, own unpublished data: LIREC Deliverable 2.1, 2009). Children use their pets for comfort when they are feeling unhappy, bored or lonely, they learn how to care for others from their experiences with animals. Emotionally disturbed children or adults who have been hurt in their relationships with people relate more easily to animals (Hart, 1995).

Among all companion animals, dogs are in many ways exceptional. They play affectionate and emotionally supportive roles (Topál et al, 1998, 2005; Gácsi et al., 2001), and adjust their interactions to the owners’ demands better than other companion animals, e.g. cats (Hart, 1995). According to a questionnaire survey, the main benefits of dog

ownership were companionship, protection and happiness or pleasure (Hart, 1995). Expressiveness, loyalty/affection, playfulness (Rooney et al., 2000; Rooney and Bradshaw, 2003), enjoyment of walks, greeting behaviour, attentiveness and physical attractiveness (evokes desire for grooming) are also highly valued traits by the owners (Hart, 1995).

2 Providing data: People's conceptions on robots and dogs

2.1 Attitude toward robots and dogs: a questionnaire survey

When we suggested the dog as a promising model for investigating human-companion interactions and humans' preferences of long-term companions we kept in mind the tremendous published data (for reviews see Miklósi, 2007, Topál et al., 2009) on dog-human relationship and our own experiences with owners. To our knowledge, however, no data has been gathered on the potential companion role of robots compared to that of pet dogs.

In order to attain these aims it is necessary to collect information on humans' ideas and conceptions on both dogs and robots. After this first step, a special focus has been set on developing instruments for interaction analysis that can be used for comparing human-dog and human-companion interaction in similar situations (see 2.2).

We surveyed two different populations asking about their views on robots and dogs: university students (N = 113, 28 males and 85 females, age: 19-27 years, Appendix 6.1) and dog owners (N = 66, Appendix 6.2).

Almost all university students answered that they like dogs (89%), only 3 of them disliked dogs (all males) and 8% were indifferent in this respect. However, only 11% thought that a complex companion robot can be loved the same way as a dog, 71% believed it is impossible and 18% had no idea. This result was interesting, as only 50% of the subjects had a dog at the time of the filling in, and 68% was a dog owner ever in his/her life.

If they could afford, 63% of them would buy a household robot but only 12% would buy a companion robot and 25% would not buy any robot.

We asked the subjects' potential choice on the shape of robot (assuming otherwise similar abilities). Most of them preferred AIBO (51%), less than a quarter of them liked the humanoid (21%), and about the same proportion of them preferred the Pioneer (13%), and the People-bot (15%).

Only 31% of the students answered that a useful household robot should speak. However, 83% of them found verbal abilities important in case of a companion robot.

Less than half of them (45%) suggested that they would improve the behaviour of the robot by new software if provided and 55% preferred to change it through teaching.

About the same proportion of the students believed that a sophisticated companion robot could relieve loneliness (40%) or not (42%), and 18% had no idea.

When asked about the potential danger robots may represent for humans in the near future, 43% of the subjects proved to be optimistic and 32 % thought robots might be dangerous. One quarter of them had no idea in this respect.

The four most important positive characteristics of dogs listed by the subjects as follows: *faithfulness* (54%), *smartness* (27%), *friendliness* (22%) and *good company* (20%). Further often mentioned appealing features: *playful* (17%), *unconditional love* (15%), *clinging* (14%), *amusing* (12%), *trainable* (12%), *reliable* (12%), *individuality (personality)* (10%), and *cute* (10%).

The analysis of the students' answers leaves open several questions related to the exact behavioural patterns of dogs. For example, how could we describe at the behavioural level *faithfulness, smartness, friendliness,* or *unconditional love*. These may mean different or similar set of concrete behaviour elements for dog owners vs. non dog owners, and even dog owners can have different preferences for the "ideal" extent of, for example, clinging or individuality.

In later studies we also should address the contradictions that seem to be present in respect of the necessary verbal abilities of the companion robots. Subjects claimed that robots cannot be loved as much as dogs, that is, robots cannot replace dogs as companions. However, they also suggested that effective companion robots should be able to communicate verbally with humans (what dogs are not able to do).

Dog owners were asked about their attitude toward dogs and companion robots. All of them walked their dog regularly and/or attended a dog school. Among the dogs there were 32 males and 34 females, their mean age was 3.34 years. Fifty percent of the dogs attended obedience training and almost 40% some special training courses such as agility, or therapy work. The owners spend an average of 1 hour daily interacting actively with the dog.

Interestingly most owners claimed that they keep dogs just because they love them (25%) and that their dog is their (best) companion/friend (14%).

When asked about what they like the best in their dogs, the most typical responses were: their attachment (16%), personality (15%), smartness (12%), kindness (11%), attentiveness (10%), and love 10%).

Only 5 respondents answered that they would buy a very skilful companion robot. Thus most dog owners attitude toward companion robots seems to be rather negative, mainly because a robot is not a living being (14%) and cannot replace a real dog (16%), and also because it does not feel (14%), and has no personality (13%).

The most frequent problems with dogs seem to be stubbornness (19%) and aggression (13%). Despite the fact that almost all owners could name their dogs' least liked characteristics, none of them would be ready to replace it with another dog of the same breed and age, which lacked the listed unwanted behaviours. Their typical explanation was: I love him/her with his/her bad habits (16%), and nobody is perfect, he/she would be boring otherwise (13%).

Thus it is not surprising that only 17% of the subjects thought that a nice robot can be as good companion as a dog, especially because robots cannot feel (20%). And again, the most important qualities why they prefer dogs to robots are: personality (19%) and emotions

(18%). They saw the advantages of a dog-like robot companion in less time necessary to spend (walk, feed…) (14%) and perfect obedience (does not go wrong) (12%).

2.2 Playing with a robot versus playing with a puppy: Behavioural analysis and questionnaire survey

Previous questionnaire studies on human-robot interaction showed, that people describe their relationship with AIBO similar to a relationship with dog puppy (Kahn et al., 2003), attribute animal characteristics to the robot and view it as a family member (Beck et al., 2004). However, the analysis of their behaviour tended to show that in parallel they behave differently toward the AIBO and a living dog puppy (Turner et al., 2004). We addressed these issues in a previous study (Kerepesi et al., 2006; LIREC Deliverable 3.1, 2008). We asked children (N = 28) and university students (N = 28) to play with an AIBO or a dog for 5 minutes. According to the results, both children and adults spent more time moving the toy in front of the AIBO, terminated action series (temporal patterns) more frequently when played with AIBO, and adults initialized action series more frequently when playing with dog, There were no differences in the latency of the first touch of the dog/AIBO, in the duration and frequency of stroking, looking at the dog/AIBO or duration of moving the toy in front of the dog/AIBO (Kerepesi et al., 2006).

Further on, we have not found significant differences between neither the latency, nor the duration and frequency of verbal utterances towards the dog and the AIBO. This suggests that under the present conditions the robot was as an affective playing partner for both children and adults as the dog puppy. However, people talked 3.5 times more to the dog than to the AIBO (35 vs 10 s); started to talk to the dog 4.5 times sooner than to the AIBO (10 vs 42 s). The frequency of utterances were almost the same, but both the subjects' utterances were longer (5 vs 1 s), and the length of speech-breaks were shorter (8 vs 21 s) when they spoke to the dog (LIREC Deliverable 3.1, 2008).

University students were also asked about their attitudes toward AIBO and animals/dogs after the experiment. (These data have been analyzed in this Deliverable). More than half of the responders (53%) had a dog at home. 92% claimed that they preferred playing with the puppy during the experiment, because it is a living being (46%), warm, hairy (23%), soft, pay attention at the partner (31%), moves sophistically (15%), communicative (15%), provides feedback (15%) curious (8%), has feelings (8%), trainable (8,%), and not always calculable (8%).

8% preferred AIBO, because it moved interestingly. 81% of them said that they would not buy AIBO for their children, although 78% would buy a dog. In spite of this, 62% answered that they do not have bad feelings in connection with robotic pets (81% claimed that they do not afraid of that children will not be able to distinguish living beings from robots). 48% see their advantages as well, although 81% are worried that other robots (not companions) will be used for cruel purposes in the future.

There were no differences among the answers of the participants according to their gender, religion and dog owner status, although religious students claimed that they are less

experienced in technical issues. Female students said the same, and they were also scored themselves lower in the previous knowledge about AIBO and programming language items.

Although the results of the traditional ethological analysis both in our and other studies (e.g. Kahn et al., 2004; Bartlett et al., 2004) suggest that people interacting with AIBO in similar ways than with a real dog puppy, and that playing with AIBO can provide a more complex interaction than a simple toy or remote controlled robot, the analysis of the action series (temporal patterns) revealed some differences in the initialisation and termination of the interactions (Kerepesi et al., 2006). This could have a significant effect on the human's attitude toward their partner, that is, in the long term humans could get "bored" or "frustrated" when interacting with a partner that has a limited capacity to being engaged in temporally structured interactions. This hypothesis is strengthened by the questionnaire study, where 92% of the participants indicated that they preferred playing with the puppy in contrast to the AIBO.

In summary, contrary to the findings of previous studies, it seems that at a more complex level of behavioural organisation, human-AIBO interaction is still different from the interactions displayed, while playing with a real puppy. In the future more attention should be paid to the temporal aspects of behavioural pattern when comparing human-animal versus human-robot interaction.

2.3 What are the characteristics of the most popular breeds?

We carried out two studies in order to learn about the most significant characteristics of popular breeds. Both behaviour and outlook appearance might influence attitudes toward dogs.

In the first experiments we asked 75 non dog owners (34 male, 41 female, 14-25 years) to assess pictures about 20 black and white dog portraits by 15 characteristic-pairs (see Fig. 5). There was an 8 cm line between the opposites, and respondents were asked to put an "X" wherever they felt it is appropriate.

After a cluster analysis, the 20 breeds formed four groups (Figure 4.). After visual inspection of the breed-group with the most positive responses, we could not form a general assumption about the outlook appearance of the "ideal" dog-portrait therefore we ranked the portraits by each characteristic-pairs. The results are presented on Figure 5.

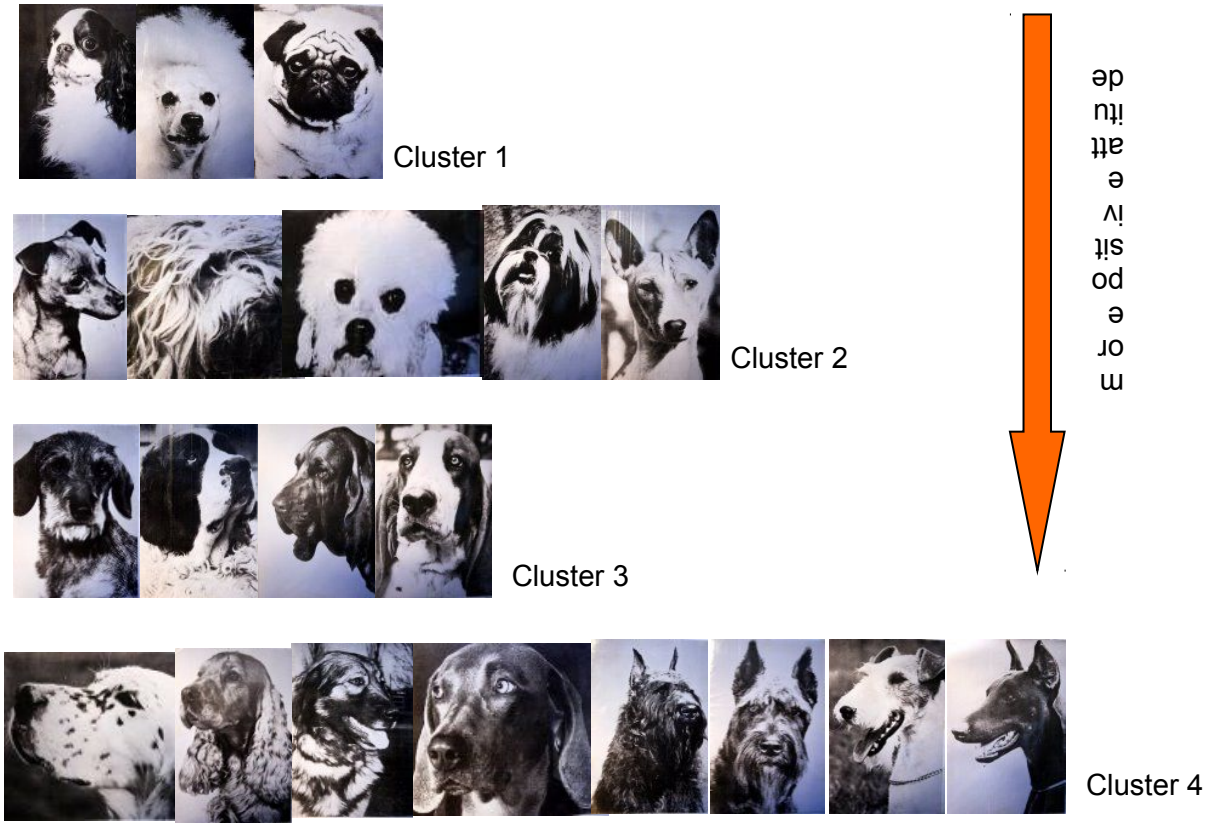

Figure 4. Groups of dog portraits after a cluster analysis based on 15 characteristics

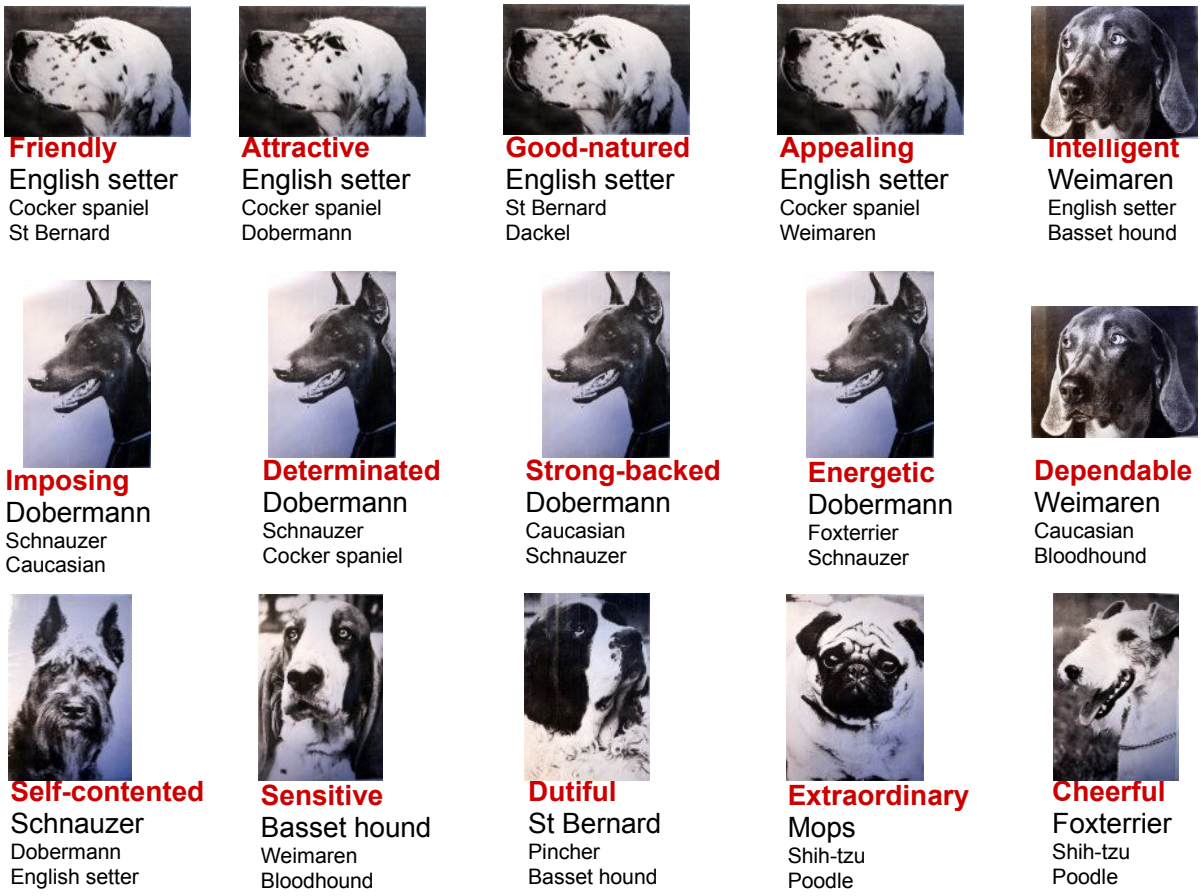

Figure 5. Dog portraits ranked at the 1-3. places on each characteristics

According to the results, non dog owners attribute friendliness, attractiveness, and good-nature to dog breeds that can be characterized by bright, soft, long hair and floppy ears. Black, short hair, long nose, ears stand erect were associated with energy and confidence.

In a second study, we ranked breeds based on four personality traits (the original sample consisted of 14,004 individuals, Kubinyi et al., 2009). The questions and traits are presented in Appendix 6.6.

The 5 most popular breeds (with 521-200 representatives in the sample) had average scores (i. e. they were within the standard deviation) in Calmness, Trainability and Boldness traits among altogether 95 breeds, but Dog sociality scores were outstanding for each (Table 2). The result suggests that people do not prefer breeds with outstanding Calmness, Trainability and Boldness, but dog-sociability (which is supposedly related to general sociability (Wan et al., 2009, Horváth et al., in prep.) is important for the majority of dog owners (if we assume that inner characteristics, and especially these four personality traits are significant factors for choosing a companion dog).

Breed	N	Calmness	Trainability	Dog Sociality	Boldness
Labrador Retriever 	521	0.16	0.15	**0.38**	0.25

German Shepherd 	404	-0.07	0.10	**-0.48**	0.17
Golden Retriever 	364	0.08	-0.09	**0.34**	0.05
Jack Russell Terrier 	324	-0.32	0.16	**-0.33**	0.30
Beagle 	200	0.00	-0.08	**0.37**	-0.02
Standard deviation		*0.37*	*0.45*	*0.33*	*0.34*

Table 2. Average personality scores of the most popular five breeds in Germany. N: number of representatives/breed. Bold is associated with outstanding scores, which exceeds standard deviation in either positive or negative direction.

3 Personality matching in owner-dog dyads

Difference between dog owners and non dog owners is relatively understudied (see Podberscek and Gosling, 2000 for a review). Although Gosling et al. (2003) analyzed the personality-profiles of both owners and their dogs, they did not compare them. Podberscek and Serpell (1997) investigated, whether there is a personality difference between owners of low aggressive and high aggressive English Cocker Spaniels. They found that the owners of the high aggressive dogs were more likely to be tense, emotionally less stable, shy and undisciplined than owners of low aggressive dogs. Ragatz et al. (2008) investigated the personality of owners of 'vicious' dogs. The results of this study suggest that owners of vicious dogs are higher in sensation seeking and primary psychopathy (dog personality was not investigated in this study). Cavanaugh et al. (2008) replicated (partly) the analyses of Gosling et al. (2003) and they compared the personality-profiles of the owners and their dogs. Moreover, the authors examined also how both personalities impact relationship satisfaction. According to their results owners reported higher relationship satisfaction when their dogs exceeded their own levels of Openness, Agreeableness and Neuroticism.

Although Gosling and Vazire (2002) have suggested that comparative approach in the personality research can have a great scientific contribution, cross-species comparisons of personality are relatively rare. The personality differences are mainly used in within-species

framework. For example: when a Border Collie is rated high on activity, does it mean that this dog is active compared to other dogs or other Border Collies or to cats. To make comparisons among species, both must demonstrate the same personality dimensions (Gosling and Bonnenburg, 1998, Gosling and John, 1999).

In case of dogs Gosling and John (1999) suggested that the human Five Factor Model (BFI) could provide a common language for cross-species personality comparisons. According to the authors, there is a considerable generality across species in three human factors (Neuroticism, Extraversion and Agreeableness). Traits related to Openness dimension were identified only in 7 of the 12 investigated species (including dogs). Conscientiousness was not a separate dimension in any of the species (except in chimpanzees). The four reviewed personality dimensions of the dogs (Energy, Affiliation, Emotional Reactivity, Competence) were also related to these human factors (Energy = Extraversion; Affiliation = Agreeableness; Emotional Reactivity = Neuroticism; Competence = Openness). Based on these findings, Gosling et al. (2003) provided a new method for human-dog personality comparisons; they adapted the standard human Big Five Inventory questionnaire (BFI) to dogs. Most of the human items could be applied to canine targets (except the item „I see myself as someone, who has few artistic interests", which was not applicable to dogs). For example the human item "Is original, comes up with new ideas" was changed to "Is original, comes up with new ways of doing things". From the 5 human factors 4 were also detected in dogs. Conscientiousness was not an independent trait. The authors investigated also the reliability and validity of this canine-BFI questionnaire and they provided evidences of consistency (across items), consensus (owner and peer judgments agree), and correspondence (owner and independent observer judgments agree) of dog personality judgments.

Gosling and Bonnenburg (1998) and Gosling and John (1999) suggested, there can be additional important aspects of dog personality (e.g. trainability) that are not captured by a human-oriented instrument. It can be also an interesting question, whether these additional dog-personality traits (that are uncharacteristic for humans) associate to the personality of the owner. Moreover, does the human Conscientiousness dimension associate to any of the dog's factors?

The assessment of dog's personality may be biased by the anthropomorphism (for example people could tend to project general human characteristics onto dogs). But, as Kwan et al. (2008) pointed out, people's projection of their self–views or their views of others onto dogs are not stronger than their projections onto other humans.

There is some evidence that the owner's personality influences the dog's behaviour (e.g. owner's anxiety, neuroses or shyness may result in more aggressive behaviour in dogs: O'Farrell, 1995, 1997; Podberscek and Serpell, 1997). Such questions can be also investigated by analyzing the additional personality traits of dogs.

3.1 Personality of dog-owner dyads assessed by the Big Five instrument

In this study we aimed to answer the following questions:

1. What is the relationship between the personality traits of the owners and their dogs?

2. Is there an association between "relationship satisfaction" and dog/owner personality traits?

3. What kind of independent variables affect "relationship satisfaction"?

Participants were volunteers and were collected via email or in person in the Clever Dog Lab (Vienna, Austria). Owners were at least 18 years old, and dogs were more than 1 year old. The owners were later divided in two subgroups: owners with one dog (N = 120) and owners living with more dogs (N = 26).

The personality of the dog-owner dyads was measured by a pair of questionnaires filled out by the owner. The 44-item Big Five Inventory (BFI, John and Srivastava, 1999) was used for the personality judgments of humans. The German version of this questionnaire was created by Beatrice Rammstedt (Rammstedt and John, 2006) and it is already validated (Lang et al., 2001). For the judgments of dogs the 43-item Canine Personality Questionnaire (Dog-BFI, Gosling et al., 2003a) was used.

Owners were asked to score themselves and their dogs using a 5-point scale (from disagree strongly to agree strongly). Both questionnaires measure 5 factors (Extraversion, Agreeableness, Openness, Neuroticism, Conscientiousness), 4 of them are comparable between owners and dogs (except Conscientiousness which is reported to be not valid trait in dogs). We added 5 additional questions to the dog questionnaire that are aimed to measure the dogs' trainability trait (Kubinyi et al., 2009).

The owner-dog similarity scores were created by computing the discrepancy between human and dog score on each trait (Cavanaugh et al., 2008). Spearman Rank Order correlations were used for the personality comparison.

Univariate GLM was used to examine the effects of the human and dog personality traits and the similarity scores on the relationship satisfaction. The GLM analyses were made only on the group of owners living with one dog.

Personality comparison

Significant correlations were found between the owners' and dogs' personality assessment in Extraversion and Neuroticism traits. Owners with one dog assessed their dogs similarly to themselves in Neuroticism ($r = 0.542$, $p<0.001$; Fig. 3) and Extraversion ($r = 0.383$, $p<0.001$). Owners with more dogs assessed their first dogs similar to themselves in Neuroticism ($r = 0.749$, $p<0.001$).

In case of the second dog, the correlation in Neuroticism was negative ($r = -0.391$, $p=0.048$) and the owners assessed their dogs similarly to themselves in Extraversion ($r = 0.615$, $p<0.001$).

The first and second dogs from the same household did not differ from each other in either personality trait therefore these differences in the owner-dog similarity cannot be explained by consistent personality differences between the dogs housed together.

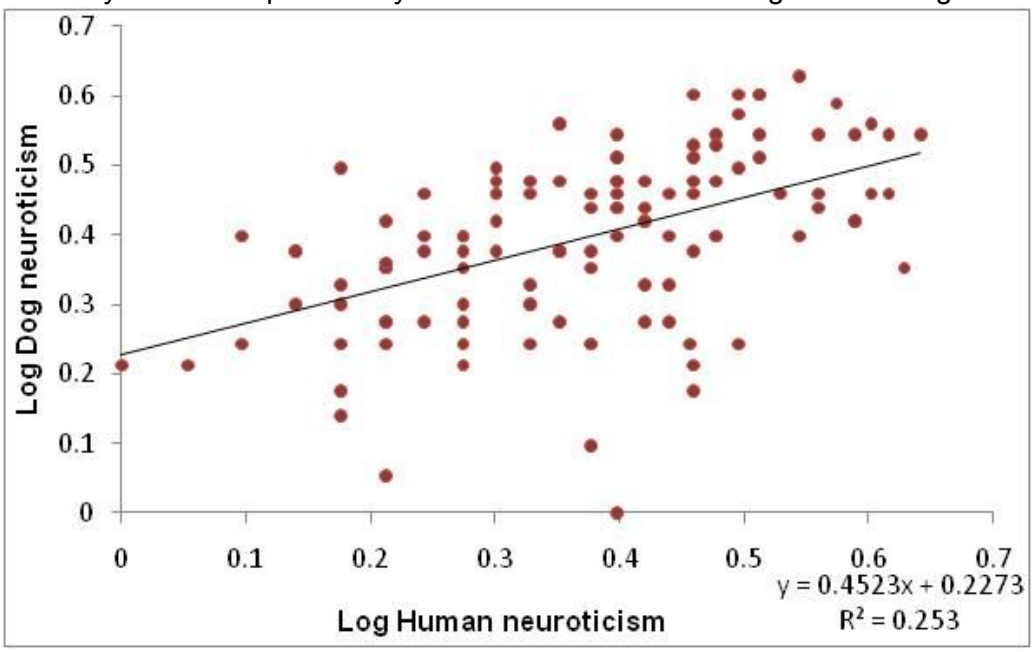

Figure 3. The association of the Neuroticism traits in the owner-dog dyads.

Relationship satisfaction

The relationship satisfaction reported by the owner was affected only by the dog personality traits (Neuroticism, Extraversion and the additional Trainability trait), none of the human factors and similarity scores had an effect.

Independent variables

The similarity in Neuroticism was affected by the dog gender, neutering status, age of acquisition, the number of training types and dogs' keeping place.

The similarity in Extraversion was affected by the dog gender, owner gender, dog age, number of adults in the household, time spent together, who is responsible for the dog, how the owner got the dog, number of training types, relationship satisfaction and the length of ownership.

The relationship satisfaction was affected by neutering status, number of adults in the household, number of training types, time spent together, owners' experience, who is responsible for the dog, age of acquisition and dogs' keeping place.

3.2 Human-dog interaction behaviour test for the showcases

Questionnaires are not telling about the actual behaviour of subjects. In order to provide detailed description of movements, which might be implemented in robots, we have developed a test-battery which is modelling scenarios from the Robot House showcase (and to some extent in the Office Buddy showcase). A robot in the Robot House showcase has the

role of a socially aware and personalized, adaptive assistant that helps with tasks requiring physical activities. Because the robot will demonstrate socially interactive, conforming behaviour, special emphasis is taken on the dogs' position in relation to that of the owner. The test battery consists of 12 subtests related to six scenarios (the total length is appr. 15 min):

The proximity-seeker
Greeting & Farewell (unfamiliar person and owner)
Fetch & Carry
Social reference
Social learning
Social mediator

In addition, owners are asked to fill in questionnaires:

Human TIPI (Gosling et al, 2003b): Big Five scales about the owner's personality (Openness, Conscientiousness, Extraversion, Agreeableness, Neuroticism)

Dog Big Five (Gosling et al., 2003a): Big Five scales about the dog's personality (same as above)

Dog Attention and Hyperactivity Rating Survey (Vas et al, 2007): Activity-impulsivity and Inattention traits

Budapest Canine Personality Survey (Wan et al., 2009, Horváth et al., submitted): Liveliness, Confidence, Aggressiveness, Attachment traits

The detailed protocol, the description of the coded variables and the questionnaires are presented in Appendix 6.3, 6.4 and 6.5. Dogs are tested in an approx 4 m x 4 m unfamiliar room. The room is at the department of Ethology (Dogservatorium lab). Four cameras are set in different corners of the room. A demo video is available at the LIREC's website (lirec.org). Until now we have tested 90 dogs in the test battery. The behavioural analysis is currently under way, but we provide some preliminary results on the relationship between the personality traits of the owners and their dogs.

		Owner				
		Extraversion	Agreeableness	Conscientiousness	Emotional stability	Openness
Dog	Energy	0.25*	-0.02	0.15	-0.13	0.18
	Affection	0.21	0.28*	**0.43*** **	0.17	0.28*
	Conscientiousness	0.18	0.19	0.39***	-0.10	-0.05
	Neuroticism	-0.17	-0.23*	-0.23*	-0.24*	-0.03
	Intelligence	0.14	0.11	0.23*	-0.01	0.15
	Activity-impulsivity	-0.04	-0.28*	-0.39*	-0.16	-0.09
	Attention	-0.23*	-0.13	**-0.44** **	0.12	-0.01
	Liveliness	0.16	-0.08	-0.11	-0.19	0.19
	Confidence	0.22	0.27*	0.32*	0.04	0.04
	Aggressiveness	-0.09	0.00	-0.27*	-0.34*	-0.02
	Attachment	0.10	0.32*	**0.48** **	-0.03	0.25*

*Table 1. Correlations of owners' and their dogs' personality traits (Spearman rho, *p < 0.05, ** p < 0.01). Bold indicates that the significance remains even after Bonferroni corrections are applied.*

Results suggest that Conscientiousness trait of owners is significantly related to a large domain of dog personality traits. Note, however, that the instrument for measuring owner's personality had 10 questions altogether (Gosling et al., 2003b). Another concern is that the personality traits of dogs are assessed by the owners, thus the results are not independent. Detailed behavioural analysis with independent observers will help to validate the results of the questionnaire.

4 Conclusion

The main task for the present deliverable was to investigate humans' attitude towards robots. Although this problem is very important, it is also clear that we are lacking means to achieve our goal. The main reason is that there is no general agreement on what should be considered as a robot and even more there is no agreement (and clear vision on the function (role) of robots in our society. Robotics is just at the dawn of the Stone Age. There is a general practical view that robots (stones) are important and even useful in many respects, but we are far from making a systematic manufacture and plans about the respective functions of robots (stones). In the case of human technology it took several hundred thousands of years until people learned the significance of stones, and learnt to manufacture them for given purpose. Robotics will not need such a long time for this, but one should see the problems ahead.

In this situation one seemingly good idea is to use an analogy of pets, which could be considered as biological being that live in a social relationship with humans which may resemble an imagined future social relationship between humans and some robots.

However one should take this comparison seriously. This means that many aspects of this human-pet (especially dog) relationship should be investigated which have received no or little attention so far. The studies presented in this deliverable represent a small step in this direction. Dogs are especially good subjects of such studies because they live in very different relationships with humans, and display diversity in look and behaviour. Nevertheless we need to answer questions about factors that influence directly or indirectly the partners, or the interaction itself. Even these preliminary results revealed important aspects which should be taken into consideration in robotics.

First, humans have a very strong sense of "living", they discriminate living creatures form artificial ones.

Second, humans prefer to individualise relationships, that is, whether it is an object, animal or another human, the relationship is "special". This suggest some robustness engineering terms, if they have a relationship they tolerate "non-optimal" characteristics of the partner.

Third, measure for relationship is time (s). This means that the more time the partners invest in each other the "stronger" (intensive) relationship develops (not necessarily good relationship). Relationship cannot be studied on a minute basis, in laboratory situation when the human is encountering a dog or a robot for the first time.

Fourth, people have special characteristics that make them feel good or bad any type of companionship. “Dog people” may love dogs, just because they are dogs, as time goes by some people “may love robots” just because they are robots, but one should not expect that all humans will develop relationship with robots. For this perspective, apart from genetics, the developmental environment of the humans and actual “needs” may play an important role. For example, many people, who never owned a dog, get one after divorce.

Fifth, long-term social relationships affect the partners in both ways. Thus robots need the ability to adapt to this situation. Some data show that there is some association between personality traits in humans and dogs.

Sixth, not only the behaviour but the shape (body) of the partner needs careful attention. Humans are prepared to associate characteristic traits based on the body and face both of which have an evolutionary and developmental significance. This issue has been also neglected in robotics but could be investigated with dogs as a natural model.

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6 Appendix

6.1 *Attitude toward robots and dogs: Questionnaire for university students*

Please answer the following questions. There are no „good" or„wrong" answers, we just want to know your opinion. Many thanks for your cooperation.

ELTE, Department of Ethology

Gender: male female
Age: 15-20; 20-25; 25-35; 35-45; >45

In this questionnaire we don't ask about machines which are used in the factories programmed for defined and limited actions/movements, but autonomous robots that can have some relationship with humans.

1. Which robot would you choose, if they had the same abilities?

a) b) c) d)


2. What type of robot would you buy, if you could afford?

household robot entertainment/companion robot I wouldn't buy one

3. Is it important for the robot to be able to use verbal utterances for communication?

household robot: yes no

companion robot: yes no

4. Which one would you prefer: changing the behaviour of a companion robot by teaching or through programming?

by teaching by program

5. Do you think a companion robot with complex behaviour could relieve people's loneliness in the long run?

yes no I don't know

6. Do you think the robots might be dangerous for humans in the near future?

yes no I don’t know

7. Do you like dogs?
yes no indifferent

8. Why? List the three characteristics of the dog, which mostly influenced your answer.
1. ……
2. ……
3. ……

9. It is possible to love an advanced companion robot as much as a dog?
yes no don’t know

10. Do you have a dog? yes no

11. Have you ever had a dog? yes no

6.2 ***Attitude toward robots and dogs: Questionnaire for dog owners***

Owner's name: ……

Dog's name: …… Breed: ……. Gender: …….. Age: ……..

What kind of training have your dog got?

no training at all

basic obedience training

special (IPO exam, rescuing, agility, hunting, therapy)

How much time do you spend actively interacting with your dog?

less than one hour

more than one hour

Do you walk your dog or attend a dog school regularly? (Yes/ No)

Why do you keep a dog?

……

What do you like most in your dog?

……

If a very clever and skillful robot dog was improved, would you buy/keep one? (Yes/ No)

Why?

……

What do you like least about your dog?

……

If you could replace your dog to one that is of the same breed, gender and age, and is free from these features, would you replace it? (Yes/ No)

Why?

……

Do you think that a nice robot can be as good companion as a dog? (Yes/ No)

Why?

……

List those features that make dogs better than robots, whatever skillful and cute the latters are.

……

What kind of advantages would a well-functioning, intelligent, dog-like robot have, compared to a real dog?

……

6.3 ***Protocol of the Human-dog interaction behaviour test for the showcases***

The aim is to develop a testing protocol for evoking behavioural patterns that are expected to occur in robot house showcase (and to some extent in the office body showcase).

Method

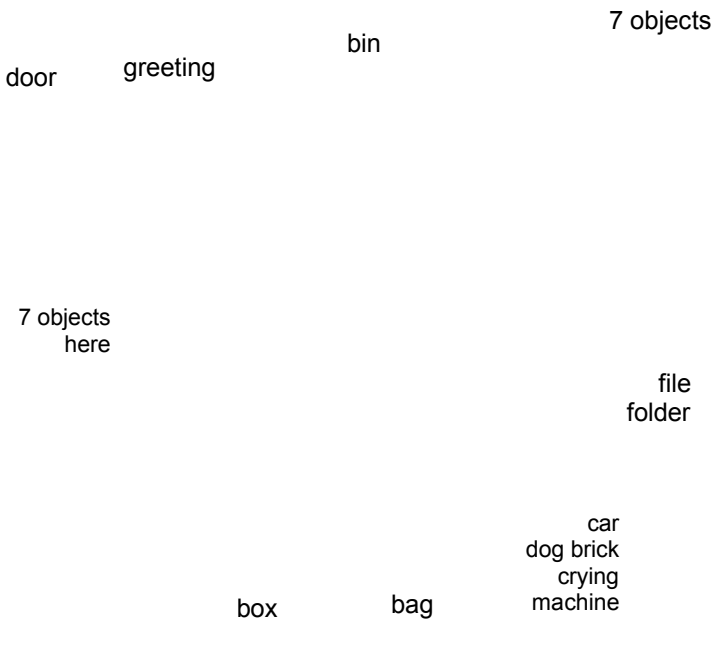
Subjects

Owner (O); Dog (D), Experimenter (E)

60 retrievers (labrador and golden) + 60 border collies
60 mixed breed dogs: 30 untrained + 30 trained dogs (14 assistance + 16 trainers' dogs)

Place + arrangement

All dogs are tested in an approx 4 m x 4 m unfamiliar room. The room is at the department of Ethology (Dogservatorium lab). Four cameras are set in different corners of the room.
E1 has the guiding role in the experiment; briefly informs the O about the protocol and his/her tasks prior to the test, and then measures the duration of the subtests and navigates the O and E according to the protocol (see task of E1 in detail in the supplement).
The tester E is a woman, who participates in some episodes of the test as an unfamiliar person. She has been pretrained for her role in the test.
E1 is sitting in a room nearby and watching the monitor showing the camera views of the test room.
The O is wearing a headset during the whole test through which the E1 can instruct her/him. Communication is onesided, O cannot speak to E1 through the headset.



Procedure

Each O fills in 3 questionnaires: Basic, Tipi, DOG BFI43
The test runs continuously without breaks (13 minutes + 2 for instructions). The test starts when O and D enter the room. D is on leash while entering, and then O lets it go and puts the leash on the back of the chair. D can move freely all the time except it is stated otherwise in the protocol. (O should switch off her/his mobile phone for the duration of the test.)
There are a chair, a large bag (some books in it), a file folder, an empty waste bin, a small table (with short legs), an empty paper box, and a drawers.
There are 7 small objects of different size, material and type placed on the floor too. They are numbered (printed on a sticker), the numbers give the order of their manipulation:

1 - pen, 2 - nylon bag, 3 - candle,
4 - magazine, 5 - wooden cube, 6 - pot, 7 - a glove.

Scenario: The proximity-seeker

O and D are in the room.

1. *Passive Owner* (PASO) 30 s

   O is sitting in a chair and filling a questionnaire (Basic, Tipi). O can look at D, but cannot talk to or touch it.

2. *Searching* (SEARCH) 60 s

   O moves slowly around in the room pretending that he/she is "searching" something in the 5 objects placed around (waste bin, table, box, bag, file folder).

3. *Passive Owner 2* (PASO2) 30 s

   O is sitting in a chair and filling a questionnaire. O can look at D, but cannot talk to or touch it.

4. *Active Owner* (ACTO) 60 s

   O manipulates objects in the given order. O has to pick up the 7 small objects one by one and carry to a predetermined point in the numbered order. When finished, O puts all 7 objects into the drawers and sits on the chair.

Observed variables

in all 4 episodes:
- proximity to O: close – mid – far (s)
- explorative behaviour (s)
- looking at owner (s/No)
- duration of tail wagging (s)

only in the 2nd & 4th. episodes:
- following owner **(s)**
- approaching object that O has already manipulated (No)
- manipulating object that O has already manipulated (No)

only in the 4th episode:
- approaching object that O hasn't yet manipulated (No)
- manipulating objects that O hasn't yet manipulated (No)

Scenario: Greeting & Farewell

5. Greeting Stranger (GREO) 5/10 + 20 s

E enters the room (does not touch D while opening and closing the door, but keeps it inside by gently using her leg if necessary), steps one step aside to the sign *(see drawing*) and stand still for 5 s. When/if D approaches the E (E can reach D), she strokes/pets D.

If D hasn't approached her, E greets O ("Hello") and talks kindly to D for another 5 s ("Hello dog, …"). When/if D approaches E, she strokes/pets D.
After this, or if D hasn't approached her, E goes to O, stands about 2 steps from O and talks to her/him for 20 s. If D approaches E, she strokes/pets D.

Observed variables during greeting:
- latency of approaching O (s)
- latency of approaching E (s)
- duration of physical contact with O (s)
- duration of physical contact with E (s)
- looking at O (s)
- looking at E (s)
- avoidance (yes-no)
- latency of tail wagging (s)
- duration tail wagging (s)

Scenario: Fetch & Carry – Social learning

6. Fetch and carry with O (FCO) max 1 min

E is standing in the background.
O stands up, takes the glove out of the drawers, places it on the chair and tries to get D to catch and carry it, and to place it on the small table.
O can use any verbal or gestural cues to communicate the task to D, but cannot touch the object or D.

Observed variables:
- looking at O (No)
- proximity to O: close – mid – far (s)
- duration of task (s)
- physical contact with O (s)
- verbal cues (No, type: order, att.getter/name, praise, inhibit)
- non-verbal cues (No)
- pointing gestures (No)
- duration of tail wagging (s)

7. Fetch and carry with E (FCE) max 1 min + 20 s

Now O and E change roles. O is standing still in the background.
E places the glove on the chair (if D hasn't touched it, E picks it up and puts it back). E tries to get D to catch and carry it, and to place it on the small table.
E can use any verbal or gestural cues to communicate the task to D, but cannot touch the object or D.
At the end E puts the glove into the drawers. O sits down. E and O talk for 20 s.

Observed variables:
- looking at O (No)
- looking at E (No)
- proximity to E
- proximity to O
- duration of task (s)

physical contact with O (s)
physical contact with E (s)
verbal cues (No, type)
nonverbal cues (No)
pointing gestures (No)
duration of tail wagging (s)

Scenario: Greeting & Farewell

8. Farewell – Separation – Greeting (FW, SEP, GR) 5+30 + 5+30 + 5/10+30 +10 + 5/10 =2m

a) Farewell: E says good bye to O and leaves. (FWEO)
Dog is with O for 30 s.

Observed variables during farewell:
following E to door (yes-no)
duration of tail wagging (s)

Observed variables during separation:
standing by the door (s)
explorative behaviour (s)
proximity to O: close – mid – far (s)
duration of tail wagging (s)

b) Farewell + Separation: O leaves the room (E1 prior instruction to O: leave D the usual way you leave it alone). (FWOS)
Dog stays alone for 30 s. (SEP)

c) Greeting + Separation: E returns (see detailed description above, max 10 s) (GRES)
E sits down and dog is with E for 30 s. (SEPE)

d) Farewell + Separation: E departs again (without saying anything to D) (FWES) 10 s

e) Greeting: O returns to the room (the same way as above) (GROS)
Then O sits down. max 10 s

Scenario: Social reference – Embarrassed behaviour

9. Encountering novel stimulus (CAR) 60 s

O is sitting on the chair, with D beside him/her. O holds D's collar.
E returns to the room, takes out a remote controlled car from the drawers. She places it on the floor very far from O and directs it toward (chases) D for 20 s. (Should D be frightened, this part can be shorter.)
O holds D's collar until the car starts moving. At the end the car should be parked under the O's chair. The behaviour of D is recorded for 1 minute (included the 20 s).
At the end E puts the car into the drawers.

Scenario: Social learning – Embarrassed behaviour

10. Training a new task (TURN) 60 s

O tries to teach D to turn around its own body for the command "turn".

O can use any training method (commands, touch/lure dog…) to motivate D except food reward or toy. O can't use the known command (if D is already trained for this task). E is standing in the background.

Scenario: Social learning – Social reference

11. Problem solving (BRICK) 120 s

E takes out a wooden interactive dog game (dog-brick) from the drawers. E fixes the box to the ground, and places food in the holes. O sits in the chair, D sits beside O and watches E (O holds its collar). When ready, E steps back, and O releases the collar.
O can encourage D to find the food pellets (can point and verbally encourage D, but should not use trained/known commands relevant to the task like "catch", "nose"…).
O cannot touch D or the box. If D chews or bites the dog-brick, O must inhibit it.
At the end E counts the food pellets left in the box, tells the number loudly (to the camera) and puts the box back into drawers.
O sits on chair.

Scenario: Social mediator

12. Emotional reactivity (CRY) 80 s

a) E sits on the chair, watches D, but doesn't speak or move. O sits on her heel/on the floor. 10 s
b) O pretends crying (using an MPEG for playing back human cry). The crying sound lasts for 1 minute.
c) When the crying ends, O stands up, and can settle D. 10 s

After the test O receive/fill BFI44 questionnaire.

6.4 ***Definitions (and occurrences) of the Human-dog interaction behaviour test for the showcases***

Human-related variables

Approach O/E (Yes/No)

The dog approaches the person in one arm length. At greeting sessions it is coded only when O/E has stepped away from the door.

5. Greeting stranger (both)
9. Encountering novel stimulus (only O)
12 Emotional reactivity (only E)

Looking at O/E (duration: s)

The dog looks at the face/upper body of the person, except for looking at objects in O's hand.

1 Passive Owner
2 Searching
3 Passive Owner 2
4 Active Owner
5. Greeting Stranger (only O)
6. Fetch and carry with O (only O)
7. Fetch and carry with E (both)
9. Encountering novel stimulus (only O)
10. Training a new task (only O)
11. Problem solving (only O)
12. Emotional reactivity (both)

Proximity to O/E (duration: s)

Close: The dog's distance from the person is less than a dog-length (calculated from the dog's body part that is most close to the owner).
Mid: The dog's distance from the person is between one and two dog-length.
Far: The dog's distance from the person is more than two dog-lenth.

1 Passive Owner
2 Searching
3 Passive Owner 2
4 Active Owner
6. Fetch and carry with O (only O)
7. Fetch and carry with E (both)
12 Emotional reactivity (CRY) (only O)

Physical contact with O/E (duration: s)

Any part of the dog's body touches any part of the O/E's body.

5. Greeting Stranger (both)
6. Fetch and carry with O (only O)
7. Fetch and carry with E (both)
12. Emotional reactivity (only E)

Follow (FOLO, FOLE) (duration: s)

When O/E is moving in the room, the dog walks behind her/him or on her/his side in the same direction. Both of them must be moving.

2 Searching
4 Active Owner

When O/E is approaching the door, the dog follows him/her. Both of them must be moving.

8. Farewell-separation-greeting

Avoidance (AVO) (Yes/No)

The dog moves away from the O/E either moving the whole body or just the head.

5. Greeting Stranger (E)
8. Farewell-separation-greeting

Exploration (duration: s)

The dog walks or looks around the room, sniffs, maps the environment.

1 Passive Owner
2 Searching
3 Passive Owner 2
4 Active Owner
8. Farewell-separation-greeting
9. Encountering novel stimulus
10. Training a new task

Object-related variables

Approach of object that owner has already manipulated (No)

The dog approaches, orients or smells (without physical contact) towards the object.

2 Searching
4 Active Owner

Approach of object that owner hasn't manipulated yet (No)

The dog approaches, orients or smells (without physical contact) towards the object.

4 Active Owner

Latency of approaching car (duration: s)

The time elapses till the dog is as close to the car that it can smell it.

9. Encountering novel stimulus

Manipulation of object that owner has already manipulated (duration: s)

The dog touches or carries the object.

2 Searching
4 Active Owner

Manipulating object that owner hasn't manipulated yet (duration: s)

The dog touches or carries the object.

4 Active Owner

Manipulating the object (duration: s)

The dog shows interest: touches, orients, smells, kicks the problem solving box (dog brick).

11. Problem solving

Manipulating the gloves (duration: s)

It is about the dog's interest in executing the task. It is enough if the dog tries to be involved in the action and has a physical contact with the gloves (e.g. sniffing or touching).

6. Fetch and carry with O
7. Fetch and carry with E

Object Avoidance (duration: s & No)

The dog avoids the toy car: he/she backs, steps backwards or runs away.

9. Encountering novel stimulus

Destructive behaviour against the problem solving box (No):

The dog chews or bites the problem solving box (dog-brick).

11. Problem solving

Orient (duration: s)

The dog orients towards the problem solving box (dog brick).

11. Problem solving

The owner's/stranger's behavioural variables

Verbal cues (Sum No)

All of them are discrete variables. All pieces of the cues have to be measured one by one, but when more words express one well-defined meaning, these will be counted as one. For example „sit, sit, sit!" command means 3 orders, but „sit down" is only one.

Order (No)

O/E makes the dog do something by using verbs (e.g. sit, come, turn, fetch, etc.).

Attention getter (No):

O/E tries to catch the dog's attention with special words (name, watch...).

Praise (No):

O/E praises verbaly the dog.

Inhibit (No):

O/E tells the dog not to do something by using inhibitory words (no, don't do it…).

6. Fetch and carry with O
7. Fetch and carry with E
10. Training a new task
11. Problem solving

Non-verbal cues (No)

O/E directs the dog or tries to catch its attention with non-verbal cues (e.g. clapping, clicking, tutting, squelching, whistling).

6. Fetch and carry with O
7. Fetch and carry with E
10. Training a new task
11. Problem solving

Pointing gestures (No)

O/E points with his/her hand to direct the dog. Continuous pointing is counted as one. A bigger movement of the arm which is different from formers means the beginning of a new pointing gesture and it has to be calculated as a new one.

6. Fetch and carry with O
7. Fetch and carry with E
10. Training a new task
11. Problem solving

Way of making the dog sit (physical/order)

In the beginning of the "exploration and social reference" and "problem-solving" tasks the owner's method to make the dog sit: whether he/she does it physically (e.g. grabbing the dog and turning it) or by means of verbal cues (commands).

11. Problem solving
9. Encountering novel stimulus (CAR)

Way of leaving the dog (physical contact/verbal contact)

The way how the owner says farewell the dog:

- no farewell at all
- kind physical contact (pet, stroke)
- short verbal farewell (maximum 3 words)
- long verbal farewell (more than 3 words)
- nonverbal: gestures (waving)

8. Farewell-separation-greeting

Other variables

Stand by the door (SBD) (duration: s)

The dog is (standing, sitting, lying) by and orients to the door in one dog length after the E or the O has left the room. It starts when the E or the O has already closed the door.

8. Farewell-separation-greeting

Vocalisation (No)

The dog shows acoustic vocalisation (barks, growls, yelps, whines).

9. Encountering novel stimulus
11. Problem solving
12. Emotional reactivity

Stress behaviour (s)

The dog makes continuously sounds (barks, growls, mainly yelps, whines); jumps on or kicks of door; jumping up by the wall.

8. Farewell, separation

Tail wagging (duration: s)

The tail of the dog is moving cadently.

1 Passive Owner
2 Searching
3 Passive Owner 2
4 Active Owner
5. Greeting Stranger
6. Fetch and carry with O

7. Fetch and carry with E
8. Farewell-separation-greeting
9. Encountering novel stimulus
10. Training a new task
11. Problem solving
12. Social mediator

Turns (No)

Number of full turns around its own body.

10. Training a new task

Other tasks (No)

Instead of the expected task the dog offers some other previously learned task.

10. Training a new task

Embarrassed behaviours (Yes/no)

The dog shows out-of-context behaviours: mouth-licking, scratching itself, yawning.

10. Training a new task
11. Problem solving
12. Social mediator

Duration of task (s)

Time that the dog needs to fulfil the task (or if the dog isn‘t successful we use the a priori determined maximal time).

6. Fetch and carry with O
7. Fetch and carry with E

Number of found food pellets (No):

The number of food pellets the dog couldn’t take out from the dog-brick. (Maybe it’s easier to count those pellets which remained in the box than count during the task.)

11. Problem solving

6.5 ***Questionnaires for the Human-dog interaction behaviour test for the showcases***

TIPI MODUL

You find statements below, with which you agree or do not agree.. Please write the number next to the certain sentences, which express in what extent you agree with them!

Disagree	Disagree a little	Neither agree nor disagree	Agree a little	Agree strongly
1	2	3	4	5

I see myself as…..

_____ extraverted, enthusiastic.
_____ critical, quarrelsome.
_____ dependable, self-disciplined.
_____ anxious, easily upset.
_____ open to new experiences, complex.
_____ reserved, quiet.
_____ sympathetic, warm.
_____ disorganized, careless.
_____ calm, emotionally stable.
_____ conventional, uncreative.
_____ someone who likes animals.

DOG BIG FIVE MODUL

Think of your dog. Here are a number of characteristics that may or may not apply to this dog. For example, do you agree that your dog likes to spend time with others? Please write a number next to each statement to indicate the extent to which you agree or disagree with that statement.

Disagree	Disagree a little	Neither agree nor disagree	Agree a little	Agree strongly
1	2	3	4	5

I see my dog as an individual who . . .

____ 1. Is talkative, vocal
____ 2. Is disagreeable, difficult to please
____ 3. Does things thoroughly
____ 4. Is down, depressed, blue
____ 5. Is original, comes up with new ways of doing things
____ 6. Is reserved
____ 7. Is helpful and unselfish
____ 8. Can be somewhat careless
____ 9. Is relaxed, handles stress well
____ 10. Is curious about many different things
____ 11. Is full of energy
____ 12. Starts quarrels with others
____ 13. Is a reliable dog
____ 14. Can be tense
____ 15. Appears contemplative, thoughtful
____ 16. Shows a lot of enthusiasm
____ 17. Has a forgiving nature
____ 18. Tends to be disorganized
____ 19. Worries a lot
____ 20. Is unimaginative, dull
____ 21. Tends to be quiet
____ 22. Is generally trusting
___ 23. Tends to be lazy
___ 24. Is emotionally stable, not easily upset
___ 25. Is inventive, finds new ways to get his/her way
___ 26. Has an assertive personality
___ 27. Can be cold and aloof
___ 28. Perseveres until the task is finished
___ 29. Can be moody
___ 30. Appreciates sensory experiences
___ 31. Is sometimes shy, inhibited
___ 32. Is considerate and kind
___ 33. Does things efficiently
___ 34. Remains calm in tense situations
___ 35. Enjoys learning and doing new things.
___ 36. Is outgoing, sociable
___ 37. Is sensitive to the needs and feelings of others
___ 38. Is planful, determined
___ 39. Gets nervous easily
___ 40. Appears to “reflect,” mull things over
___ 41. Is cooperative
___ 42. Is easily distracted
___ 43. Is sophisticated

Dog-ADHD Rating Scale (Vas et al., 2007; Wan et al., 2009)

	Questions	**never**	**seldom**	**often**	**very often**
1 [a]	Your dog has a difficult time learning, because he/she is careless, or other things can easily attract his/her attention.	☐	☐	☐	☐
2 [a]	It is easy to attract your dog's attention, but he/she loses his/her interest soon.	☐	☐	☐	☐
3 [a]	It is difficult for your dog to concentrate on a task or play.	☐	☐	☐	☐
4 [b]	Your dog leaves from his/her place when he/she should stay.	☐	☐	☐	☐
5 [b]	Your dog cannot be quiet; he/she cannot be easily calmed.	☐	☐	☐	☐
6 [b]	Your dog fidgets all the time.	☐	☐	☐	☐
7 [a]	It seems that your dog does not listen even if he/she knows that someone is speaking to him/her.	☐	☐	☐	☐
8 [b]	Your dog is excessively difficult to control; if he/she lunges, it is hard to hold him/her back.	☐	☐	☐	☐
9 [b]	Your dog always wants to play and run.	☐	☐	☐	☐
10 [a]	Your dog solves simple tasks easily, but he/she often has difficulties with complicated tasks, even if he/she knows them and has practiced them often.	☐	☐	☐	☐
11 [b]	Your dog is likely to react hastily, and that is why he/she is failing tasks.	☐	☐	☐	☐
12 [a]	Your dog's attention can be easily distracted.	☐	☐	☐	☐
13 [b]	Your dog cannot wait; he/she has no self-control.	☐	☐	☐	☐

[a] Inattention scale

[b] Activity-impulsivity scale

Budapest Canine Personality Survey (Wan et al., 2009)

		5	4	3	2	1	
1 [a]	Very playful	☐	☐	☐	☐	☐	Not at all playful
2 [b]	Confident	☐	☐	☐	☐	☐	Nervous
3 [b]	Relaxed in unfamiliar situations	☐	☐	☐	☐	☐	Timid in unfamiliar situations
4 [d]	Strongly attached	☐	☐	☐	☐	☐	Not at all attached
5 [a]	Highly excitable, impulsive	☐	☐	☐	☐	☐	Calm, placid
6 [d]	Obedient	☐	☐	☐	☐	☐	Disobedient
7 [a]	Active, energetic	☐	☐	☐	☐	☐	Inactive, lazy
8 [c]	Friendly	☐	☐	☐	☐	☐	Unfriendly
9 [d]	Intelligent	☐	☐	☐	☐	☐	Slow in thinking
10 [b]	Brave	☐	☐	☐	☐	☐	Timid
11 [a]	Curious	☐	☐	☐	☐	☐	Not curious
12 [b]	Can handle being alone	☐	☐	☐	☐	☐	Cannot handle being alone
13 [d]	Requires lots of care and attention	☐	☐	☐	☐	☐	Does not require lots of care and attention
14 [a]	Pushy	☐	☐	☐	☐	☐	Not pushy
15 [a]	Highly possessive	☐	☐	☐	☐	☐	Not at all possessive
16 [c]	Aggressive with unfamiliar people	☐	☐	☐	☐	☐	Not aggressive with unfamiliar people
17 [c]	Aggressive with unfamiliar dogs	☐	☐	☐	☐	☐	Not aggressive with unfamiliar dogs

[a] Liveliness scale

[b] Confidence scale

[c] Aggressiveness scale (Item 8 is reverse-scored.)

[d] Attachment scale

6.6 Canine personality questionnaire

(Kubinyi et al., 2009)

ITEMS	CALMNESS	TRAINABILITY	DOG-SOCIABILITY	BOLDNESS
The dog is cool-headed even in stressful situations	**0.82**	0.04	0.15	-0.03
The dog is emotionally balanced, not easy to rile	**0.79**	0.06	0.16	0.04
The dog is calm, even in ambiguous situations	**0.78**	-0.01	0.11	-0.07
*The dog is sometimes anxious and uncertain	**0.73**	0.07	0.05	0.33
* The dog can be stressed easily	**0.71**	0.05	0.18	0.22
The dog is intelligent, learns quickly	0.10	**0.72**	0.03	-0.14
* The dog often does not understand what was expected from him/her during playing	0.16	**0.71**	0.01	-0.01
The dog is very easy to warm up to a new toy	-0.04	**0.68**	0.07	0.23
The dog is ingenious, inventive when seeks hidden food or toy	0.06	**0.64**	-0.04	0.06
* The dog is not much interested except in eating and sleeping	-0.10	**0.62**	0.13	0.17
The dog gets on well with conspecifics	0.19	0.08	**0.82**	0.01
*The dog fights with conspecifics frequently	0.15	0.02	**0.81**	-0.08
*The dog is bullying with conspecifics	0.09	0.06	**0.76**	0.19
The dog is ready to share toys with conspecifics	0.10	0.02	**0.54**	-0.09
*The dog is rather cool, reserved	-0.08	0.19	0.04	**0.77**
*The dog is unassertive, aloof when unfamiliar persons enter the home	0.12	-0.05	0.00	**0.71**
*The dog is sometimes fearful, awkward	0.32	0.15	-0.09	**0.70**
Explained variance	23.81%	13.86%	11.41%	8.60%
Cronbach alpha	0.85	0.71	0.75	0.65
Eigenvalues	4.05	2.35	1.94	1.46