INFLUENCE OF OWNERS' PERSONALITY ON PERSONALITY IN LABRADOR RETRIEVER DOGS

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Selective breeding of domestic dogs has created breeds that have various behavioral characteristics and unique morphologies. However, individual dogs within the same breed still show diversity in behavioral tendencies. Studies have demonstrated that a dog's personality may be associated with that of the owner. However, most of these studies used a mixed sample of various breeds. Given the potential bias of owners with different personalities to choose different breeds, we should look at this correlation within the same breed. Here we tested whether five personality dimensions (neuroticism, extroversion, conscientiousness, agreeableness, and openness) of owners were associated with their dogs' personality (fearfulness, aggression toward people, activity/excitability, responsiveness to training, and aggression toward animals) in a single breed, Labrador Retrievers. The results showed that dogs' aggression toward people was negatively associated with owners' extroversion, and dogs' responsiveness to training was positively associated with owners' openness. In contrast, dogs' fearfulness, activity/excitability, and aggression toward animals were free of the influence of owners' personality. These results suggested that dogs' personality is at least partly affected by the owners' personality.

Key words: domestic dog, personality, dog-human interaction

INTRODUCTION

Through their long history of domestication and selective breeding (Savolainen, Zhang, Luo, Lundeberg, & Leitner, 2002; Dayan, 1994; Ovodov et al., 2011; Thalmann et al., 2013), dogs have developed different morphologies (see Parker, Shearin, & Ostrander, 2010; Ostrander & Wayne, 2005, for reviews) and specific abilities for working with humans (Rooney & Bradshaw, 2004; Serpell & Hsu, 2005). Dogs have also acquired the ability to read humans' communicative signals (Cooper et al., 2003; Hare & Tomasello,

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2005; Miklósi, Topál & Csányi, 2007; Albuquerque et al., 2016). Genetically closed breeds show behavioral similarity (e.g., Goddard & Beilharz, 1982, 1983; Takeuchi & Mori, 2006; Wilsson & Sundgren, 1998). However, individual dogs within the same breed still show diversity in behavioral tendencies. What underlies the individual differences in dogs' behavior?

Several studies have reported that owners' personality or behavioral tendencies may be associated with problematic behavior in dogs, such as aggression and separation-related disorder (SRD; Hoffman, Chen, Serpell, & Jacobson, 2013; Konok et al., 2015; O'Farrell, 1997; Podberscek & Serpell, 1997; Jagoe & Serpell, 1996). For instance, Konok et al. (2015) used an internet-based questionnaire to investigate whether owners' attachment style, personality traits and the personality of the dog were associated with the occurrence of SRD. They found that owners scoring higher on attachment-avoidance were more likely to have dogs with SRD. Turcsán et al. (2011) found significant positive relationships between owners and dogs in all five personality dimensions (neuroticism, extroversion, conscientiousness, agreeableness, and openness). The correlations of each personality dimension between real dog-owner pairs were clearly significant and higher than those between randomly combined dog-owner pairs. Thus, results of several studies strongly suggest that dogs' personality is associated with owner's personality.

We point out two problems with these previous studies. First, the studies basically targeted a mixture of various dog breeds. Different breeds are supposed to have different behavioral tendencies (Lit, Schweitzer, & Oberbauer, 2010; Turcsán et al., 2011). According to the similarity-attraction hypothesis (SAH), humans are more attracted to others who have a similar personality (Byrne & Nelson, 1965), therefore it is possible that owners choose a breed which resembles them on personality dimensions. To reveal potential effects of owners' personality on dogs' personality, a study should be conducted within a single breed. Second, these questionnaire-based studies used the Canine-Big Five Inventory (dog BFI; Gosling, Kwan, & John, 2003), which is based on the five-factor model (FFM) established for human personality research. However, with regard to the FFM there is little consensus about the number or type of personality dimensions (see Rayment, De Groef, Peters, & Marston, 2015, for a review).

In this study, we examined whether owners' personality influences their dogs' personality. We focused on a globally common breed—Labrador Retrievers—and their Japanese owners. We used the Dogs Personality Questionnaire (DPQ), which was developed from several sources including dog and human personality literatures, questionnaires and supplemental items by dog experts, and confirmed as a valid tool for evaluating dogs' personality by Jones (2009). We expected that some owners' personality dimensions would be correlated with their dogs' personality, as demonstrated in previous studies.

METHOD

Participants

Sixty-three Japanese owners (20 men and 43 women; median age 52yr, range: 23–71, owner age is

missing in 1 case) of Labrador Retrievers (43 males and 57 females; median age 3yr 8mo, range: 2mo-13yr 6mo, $N=100$) filled out the questionnaires. Owners were recruited in the Kyoto Labrador Retriever conformation show (November 24th 2014 in Shiga prefecture), and the dog-owner database of the CAMP-WAN project in our Laboratory via mail.

Owners filled the questionnaires and returned them via mail. In return for their participation received a report of individuated results. Due to incompleteness of answers, we excluded 8 owners and their dogs ($N=10$) from the analysis. We also excluded dogs younger than 1 year old (10 dogs), because their behavioral tendencies cannot be considered stable. Thus, the final sample consisted of 47 owners (25 men and 55 women; median age 54yr, range: 23–71, owner age is missing in 1 case) and 80 dogs (34 males and 46 females; median age 4yr 4mo, range: 12mo-12yr 8mo). They had lived together for a median of 3 years and 11 months (range: 1yr-12yr 5mo). We included related dogs as subjects, because the purpose of the study was to examine association between dogs' personality and that of their owners.

A majority of dogs (63.7%) had some experience of a training course, such as dog manners training. The average number of family members was 2.95 people and 4 households had a pre-schooler. Twenty-five out of 80 dogs (31.2%) lived with other dogs. The study was approved by the Animal Experiment Committee of the Graduate School of Letters, Kyoto University.

Procedure

We began data collection in November 2014 and ended in January 2016. The dog owners were asked to fill out three different questionnaires. The main caretaker of the dog answered the questionnaires.

1. Demographic questions: We asked owners their gender, age, job, family-structure, number of preschoolers in the household, number of dogs raised, their dog's sex, age, coat-color, breeder, birth date, period of living together, neutering, experience of dog training and dog shows, and whether any other dogs shared the house.

2. Big Five Scale (BFS): We used the Big-Five Scale of Personality Trait Adjectives developed by Wada (1996) for owners. The questionnaire contained 60 adjective-items. For each item, the owners were asked to score themselves using a 7-point scale (from completely different to completely correspondent). The questionnaire contained five factors: extroversion (e.g., "talkative", "cheerful", "sociable"), neuroticism (e.g., "anxious", "nervous", "gloomy"), openness (e.g., "original", "multitalented", "progressive"), conscientiousness (e.g., "diligent", "deliberate", "well-organized"), and agreeableness (e.g., "gentle", "generous", "kind").

3. Dog Personality Questionnaire (DPQ; <http://gosling.psy.utexas.edu/wp-content/uploads/2014/10/DPQ-forms-and-scoring-keys.pdf>): We used the short form of the Dog Personality Questionnaire (45-items) developed by Jones (2009). We translated the items into Japanese. For each item, the owners were asked to score the dog's behavior using a 7-point scale (from strongly disagree to strongly agree). The questionnaire contained five factors: fearfulness (12 items; e.g., "Dog behaves fearfully towards unfamiliar people"), aggression towards people (6 items; e.g., "Dog behaves aggressively towards unfamiliar people"), activity/excitability (12 items; e.g., "Dog is boisterous"), responsiveness to training (6 items; e.g., "Dog is able to focus on a task in a distracting situation such as loud or busy places, or around other dogs"), and aggression towards animals (9 items; e.g., "Dog behaves aggressively toward dogs").

We prepared 8 patterns of questionnaire sheets by randomizing the order of each item and counterbalancing the order of questionnaire types (whether the owner's BFS or DPQ was the first).

Statistical analysis

Statistical analyses were conducted with R 3.2.2 software (R development Core Team). We used a linear mixed effect model (LMM) with lme4 package (Bates, Machler, Bolker, & Walker, 2015) to analyze the association between the DPQ factors and their owners' BFS. We analyzed 5 DPQ factors (fearfulness, aggression towards people, activity/excitability, responsiveness to training, and aggression towards animals) separately. The dogs' sex and age, which were expected to directly affect their behavior, and the 5 factors of owner's BFS (extroversion, neuroticism, openness, conscientiousness, and agreeableness) were added to the model as fixed variables. The owner's identity was included in the model as a random effect, because some owners had more than one dog. The significance of the effect of each variable was tested by the likelihood ratio test using Type II Wald chi-square tests (all p -values < 0.05). We also report a regression coefficient (β) and 95% confidence intervals.

RESULTS

We calculated the mean score ($\pm$ sd) of DPQ factors (fearfulness: 2.41 ± 0.9 , aggression towards people: 1.72 ± 0.75 , activity/excitability: 5.1 ± 0.73 , responsiveness to training: 5.1 ± 1.1 , aggression towards animals: 2.82 ± 0.7) and the owner's BFS (extroversion: 4.86 ± 0.7 , neuroticism: 3.72 ± 1.09 , openness: 4.74 ± 0.95 , conscientiousness: 4.5 ± 0.7 , agreeableness: 4.65 ± 0.75).

Association between the dog's fearfulness and the owner's BFS

None of the owner's personality traits, the dog's sex, or age associated with the dog's fearfulness.

Association between the dog's aggression towards people and the owner's BFS

The owner's extroversion affected the dog's aggression towards people ($\chi^2_1 = 8.13$, $P = 0.004$, $\beta = -0.45$, 95% CI $[-0.73, -0.16]$, Fig. 1(a)). With increasing extroversion scores for the owners, the dog's aggression towards people score significantly decreased. With the exception of extroversion, neither the owner's BFS nor the dog's sex or age had any effect on the dog's aggression towards people.

Association between the dog's activity/excitability and the owner's BFS

Although none of the owner's personality traits or the dog's sex, the dog's age significantly affected the dog's activity/excitability ($\chi^2_1 = 4.17$, $P = 0.04$, $\beta = -0.005$, 95% CI $[-0.009, -0.0004]$). The dogs become docile with age.

Fig. 1. Effects of owner's personality on dog's personality. (a) The association between dog's aggression towards people and owner's extroversion. (b) The association between dog's responsiveness to training and owner's openness. Lines represent fitted values from LMM. Shaded areas indicate 95% confidence intervals.

Association between the dog's responsiveness to training and the owner's BFS

The owner's openness was associated with the dog's responsiveness to training ($\chi^2_1 = 5.103$, $P = 0.024$, $\beta = 0.340$, 95% CI [0.057, 0.623], Fig. 1(b)). The higher the owner scored on openness, the higher the dog was scored on responsiveness to training was.

Association between the dog's aggression towards animals and the owner's BFS

None of the owner's personality traits, or the dog's sex or age associated with the dog's aggression towards animals.

DISCUSSION

We asked whether Japanese owners' personality affects their pet Labrador Retrievers' personality. We found that the two personality traits extroversion and openness were associated with dogs' personality.

First, we found that, with increasing owner extroversion, dogs' aggressiveness toward people decreased. Although Podberscek and Serpell (1997) demonstrated that owners of English Cocker Spaniels with high aggressiveness were significantly more likely to be tense, emotionally less stable, shy and undisciplined compared to owners of low-aggressive dogs, our result failed to reveal a positive correlation between dogs' aggressiveness toward people or animals and owners' neuroticism or conscientiousness. Because Podberscek and Serpell's (1997) questionnaires included both aggressiveness toward humans and other animals, we could not directly compare their results for English Cocker Spaniels with ours for Labrador Retrievers. However, the divergent findings might be due to the breeds that were studied. Labrador Retrievers may be a less aggressive breed than English Cocker Spaniels. Turcsán et al. (2011) investigated behavioral profiles of 98 breeds of dog. They showed that Labrador Retrievers scored higher than average on sociability and boldness. Thus, for Labrador Retrievers, the owner's personality might have little effect on aggressive tendencies. Another possibility might be that owners of this breed are generally less aggressive than owners of English Cocker Spaniels. Further research is required regarding personality differences between owners of different breeds.

We found that Labradors' aggression toward people was negatively associated with owners' extroversion. Dogs might have opportunities to learn about people by observing owners who are outgoing and comfortable with people in everyday life. According to some studies of dog cognition dogs discriminate humans' positive and negative facial/vocal expressions (Nagasawa, Murai, Mogi, & Kikusui, 2011; Müller, Schmitt, Barber, & Huber, 2015; Fukuzawa, Mills, & Cooper, 2005) and adjust their behavior accordingly (Buttelmann & Tomasello, 2013; Custance & Mayer, 2012). Merola, Prato-Previde, Lazzaroni, and Marshall-Pescini (2014) showed that dogs looked referentially at their owner when they encountered a strange object, and approached it more readily if the owner showed a positive emotional expression toward the object.

Second, we found that increases in owners' openness was associated with increases in dogs' responsiveness to training. The owners scoring high on openness showed high scores

for the question items such as “be original”, “have foresight”, “be imaginative”, “be interesting many things”, “be curious about many different things”, and so on. We suspect that these owners might devise various ways to training their dogs effectively. It may be interesting to obtain more information about training methods used by owners of high versus low openness.

In contrast, we found no association between owners’ personality and dog’s activity/excitability, fearfulness, or aggression toward animals. However, dogs’ activity/excitability was positively associated with age. This result is consistent with Kubinyi, Turcsán, and Miklósi (2009), who conducted a questionnaire study to test the relationship between 4 dog personality traits (calmness, trainability, dog sociability and boldness) and dog-owner demographics (owner’s sex, age, education, experience with dogs, the number of people and dogs in the household, and purpose of having the dog). They found that dogs’ calmness was influenced primarily by their age in an internet-based questionnaire. Also, O’Farrell (1997) reported that owner anxiety was not associated with higher incidence of phobias in dogs. These personality dimensions in dogs might be influenced by factors other than the owners’ personality that are yet to be identified.

Recently, genetic studies have revealed the existence of several behavior-related genes in dogs (Hejjas et al., 2009; Hori, Kishi, Inoue-Murayama, & Fujita, 2013; Konno, Inoue-Murayama, & Hasegawa, 2011; Kubinyi et al., 2012; Wan et al., 2013). For instance, Konno et al. (2011) found an association between androgen receptor gene (*AR*) polymorphisms and aggression in Japanese Akita dogs. Male Japanese Akitas with short alleles had higher aggressiveness scores than those with longer alleles. Kubinyi et al. (2012) reported that German shepherd dogs with at least one short allele of the tyrosine hydroxylase (*TH*) gene were more active and impulsive than dogs with long alleles. An interesting issue for future study concerns genetic influences on personality of dogs as well as owners.

We used a questionnaire to obtain behavioral characteristics of dogs and owners. We did so because this method of asking the owner to report their dog’s behavior in everyday life might successfully collect information not obtained in formal testing of dogs’ personality. However, to minimize any effect of subjectivity, it may be fruitful to combine both naturalistic observations and formal behavioral tests in the future.

Our focal breed, the Labrador Retriever, is one of the commonest breeds in the world. They are trained for a variety of tasks such as guide dog, detector dog, gundog, show dog, and as household pets. In the U.K., Lofgren et al. (2014) found that Labrador Retriever gundogs had higher scores for ‘fetching tendency’ and ‘trainability’ than show dogs or pet dogs. They suggested that the working status of dogs was associated with differences in their personality. Another interesting future study should add the dogs’ working status as an environmental factor along with owners’ personality traits, demographic factors, and other dogs in the family.

To summarize, the present study demonstrated (1) a negative correlation between dogs’ aggression toward people and owners’ extroversion, and (2) a positive correlation between owners’ openness and dogs’ responsiveness to training. In contrast, dogs’ fearfulness, activity/excitability, and aggression toward animals were not associated with

owners' personality. These results suggest that dogs' personality is formed under the influence of their owners' personality but that as-yet unidentified other factors are involved as well. Further research is required to reveal how dogs' behavioral-related genes and specific circumstances (owners' personality, dogs' working status, and so on) influence dogs' personality.

REFERENCE

- Albuquerque, N., Guo, K., Wilkinson, A., Savalli, C., Otta, E., & Mills, D. 2016. Dogs recognize dog and human emotions. *Biology Letters*, **12**, 20150883.
- Bates, D., Machler, M., Bolker, B. M., & Walker, S. C. 2015. Fitting linear mixed-effects models using lme4. *Journal of Statistical Software*, **67**, 1–48.
- Buttelmann, D., & Tomasello, M. 2013. Can domestic dogs (*Canis familiaris*) use referential emotional expressions to locate hidden food? *Animal Cognition*, **16**, 137–145.
- Byrne, D., & Nelson, D. 1965. Attraction as a linear function of proportion of positive reinforcements. *Journal of Personality and Social Psychology*, **1**, 659–663.
- Cooper, J. J., Ashton, C., Bishop, S., West, R., Mills, D. S., & Young, R. J. 2003. Clever hounds: Social cognition in the domestic dog (*Canis familiaris*). *Applied Animal Behaviour Science*, **81**, 229–244.
- Custance, D., & Mayer, J. 2012. Empathic-like responding by domestic dogs (*Canis familiaris*) to distress in humans: An exploratory study. *Animal Cognition*, **15**, 851–859.
- Dayan, T. 1994. Early domesticated dogs of the Near East. *Journal of Archaeological Science*, **21**, 633–640.
- Fukuzawa, M., Mills, D. S., & Cooper, J. J. 2005. The effect of human command phonetic characteristics on auditory cognition in dogs (*Canis familiaris*). *Journal of Comparative Psychology*, **119**, 117–120.
- Goddard, M. E., & Beilharz, R. G. 1982. Genetic and environmental factors affecting the suitability of dogs as guide dogs for the blind. *Theoretical and Applied Genetics*, **62**, 97–102.
- Goddard, M. E., & Beilharz, R. G. 1983. Genetics of traits which determine the suitability of dogs as guide-dogs for the blind. *Applied Animal Ethology*, **9**, 299–315.
- Gosling, S. D., Kwan, V. S., & John, O. P. 2003. A dog's got personality: A cross-species comparative approach to personality judgments in dogs and humans. *Journal of Personality and Social Psychology*, **85**, 1161–1169.
- Hare, B., & Tomasello, M. 2005. Human-like social skills in dogs? *Trends in Cognitive Sciences*, **9**, 439–444.
- Hejjas, K., Kubinyi, E., Ronai, Z., Szekely, A., Vas, J., Miklósi, Á., . . . Kereszturi, E. 2009. Molecular and behavioral analysis of the intron 2 repeat polymorphism in the canine dopamine D4 receptor gene. *Genes, Brain and Behavior*, **8**, 330–336.
- Hoffman, C. L., Chen, P., Serpell, J. A., & Jacobson, K. C. 2013. Do dog behavioral characteristics predict the quality of the relationship between dogs and their owners? *Human-Animal Interaction Bulletin*, **1**(1), 20–37.
- Hori, Y., Kishi, H., Inoue-Murayama, M., & Fujita, K. 2013. Dopamine receptor D4 gene (DRD4) is associated with gazing toward humans in domestic dogs (*Canis familiaris*). *Open Journal of Animal Sciences*, **3**, 54–58.
- Jagoe, A., & Serpell, J. 1996. Owner characteristics and interactions and the prevalence of canine behaviour problems. *Applied Animal Behaviour Science*, **47**, 31–42.
- Jones, A. C. 2009. *Development and validation of a dog personality questionnaire*. (Ph.D. Thesis). University of Texas.
- Konno, A., Inoue-Murayama, M., & Hasegawa, T. 2011. Androgen receptor gene polymorphisms are associated with aggression in Japanese Akita Inu. *Biology Letters*, **7**, 658–660.
- Konok, V., Kosztolányi, A., Rainer, W., Mutschler, B., Halsband, U., & Miklósi, Á. 2015. Influence of owners' attachment style and personality on their dogs' (*Canis familiaris*) separation-related disorder. *PLOS ONE*, **10**, e0118375.
- Kubinyi, E., Turcsán, B., & Miklósi, Á. 2009. Dog and owner demographic characteristics and dog personality trait associations. *Behavioural Processes*, **81**, 392–401.
- Kubinyi, E., Vas, J., Hejjas, K., Ronai, Z., Brúder, I., Turcsán, B., . . . Miklósi, Á. 2012. Polymorphism in the

- tyrosine hydroxylase (TH) gene is associated with activity-impulsivity in German Shepherd Dogs. *PLOS ONE*, **7**, e30271.
- Lit, L., Schweitzer, J. B., & Oberbauer, A. M. 2010. Characterization of human-dog social interaction using owner report. *Behavioural Processes*, **84**, 721–725.
- Lofgren, S. E., Wiener, P., Blott, S. C., Sanchez-Molano, E., Woolliams, J. A., Clements, D. N., & Haskell, M. 2014. Management and personality in Labrador Retriever dogs. *Applied Animal Behaviour Science*, **156**, 44–53.
- Merola, I., Prato-Previde, E., Lazzaroni, M., & Marshall-Pescini, S. 2014. Dogs' comprehension of referential emotional expressions: Familiar people and familiar emotions are easier. *Animal Cognition*, **17**, 373–385.
- Miklósi, Á., Topál, J., & Csányi, V. 2007. Big thoughts in small brains? Dogs as a model for understanding human social cognition. *Neuroreport*, **18**, 467–471.
- Müller, C. A., Schmitt, K., Barber, A. L. A., & Huber, L. 2015. Dogs can discriminate emotional expressions of human faces. *Current Biology*, **25**, 601–605.
- Nagasawa, M., Murai, K., Mogi, K., & Kikusui, T. 2011. Dogs can discriminate human smiling faces from blank expressions. *Animal Cognition*, **14**, 525–533.
- O'Farrell, V. 1997. Owner attitudes and dog behaviour problems. *Applied Animal Behaviour Science*, **52**, 205–213.
- Ostrander, E. A., & Wayne, R. K. 2005. The canine genome. *Genome Research*, **15**, 1706–1716.
- Ovodov, N. D., Crockford, S. J., Kuzmin, Y. V., Higham, T. F., Hodgins, G. W., & van der Plicht, J. 2011. A 33,000-year-old incipient dog from the Altai Mountains of Siberia: Evidence of the earliest domestication disrupted by the Last Glacial Maximum. *PLOS ONE*, **6**, e22821.
- Parker, H. G., Shearin, A. L., & Ostrander, E. A. 2010. Man's best friend becomes biology's best in show: Genome analyses in the domestic dog. *Annual Review of Genetics*, **44**, 309–336.
- Podbersek, A. L., & Serpell, J. A. 1997. Aggressive behaviour in English cocker spaniels and the personality of their owners. *Veterinary Record*, **141**, 73–76.
- Rayment, D. J., De Groef, B., Peters, R. A., & Marston, L. C. 2015. Applied personality assessment in domestic dogs: Limitations and caveats. *Applied Animal Behaviour Science*, **163**, 1–18.
- Rooney, N. J., & Bradshaw, J. W. S. 2004. Breed and sex differences in the behavioural attributes of specialist search dogs—a questionnaire survey of trainers and handlers. *Applied Animal Behaviour Science*, **86**, 123–135.
- Savolainen, P., Zhang, Y. P., Luo, J., Lundeberg, J., & Leitner, T. 2002. Genetic evidence for an East Asian origin of domestic dogs. *Science*, **298**, 1610–1613.
- Serpell, J. A., & Hsu, Y. 2005. Effects of breed, sex, and neuter status on trainability in dogs. *Anthrozoös*, **18**, 196–207.
- Takeuchi, Y., & Mori, Y. 2006. A comparison of the behavioral profiles of purebred dogs in Japan to profiles of those in the United States and the United Kingdom. *Journal of Veterinary Medical Science*, **68**, 789–796.
- Thalmann, O., Shapiro, B., Cui, P., Schuenemann, V. J., Sawyer, S. K., Greenfield, D. L., . . . Wayne, R. K. 2013. Complete mitochondrial genomes of ancient canids suggest a European origin of domestic dogs. *Science*, **342**, 871–874.
- Turcsán, B., Kubinyi, E., & Miklósi, Á. 2011. Trainability and boldness traits differ between dog breed clusters based on conventional breed categories and genetic relatedness. *Applied Animal Behaviour Science*, **132**, 61–70.
- Wada, S. 1996. Seikakutokuseiyougo wo mochiita Big Five shakudo no sakusei [Construction of the Big Five Scales of personality trait terms and concurrent validity with NPI]. *The Japanese Journal of Psychology*, **67**, 61–67.
- Wan, M., Hejjas, K., Ronai, Z., Elek, Z., Sasvari-Szekely, M., Champagne, F. A., . . . Kubinyi, E. 2013. DRD4 and TH gene polymorphisms are associated with activity, impulsivity and inattention in Siberian Husky dogs. *Animal Genetic*, **44**, 717–727.
- Wilsson, E., & Sundgren, P. E., 1998. Behaviour test for eight-week old puppies—heritabilities of tested behaviour traits and its correspondence to later behaviour. *Applied Animal Behaviour Science*, **58**, 151–162.