THE MODERN DOG: CANINE METABOLIC, BEHAVIOURAL AND COGNITIVE INDICATORS OF WELLNESS (I)

BY

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Abstract

Research investigating the relationship between cognitive bias, laterality and personality in animals has grown over the past several years, particularly in dogs. This study investigated these relationships, while modifying protocols for use in a dog's home; no previous studies have carried out cognitive bias testing in this setting. To assess cognitive bias, i.e., the degree of optimism or pessimism, a three bowl test was used where dogs were trained to associate two positions with reward or no reward. Upon completion of training, dogs were presented with a bowl in an ambiguous position; latencies to approach the three bowl positions were compared. Two tests of motor laterality based on preferred paw use were conducted: the first used a popular method involving food-retrieval from a small toy (Classic Kong™), and the second used a newer toy (Kong Wobbler™) which required different paw movements to dispense the treats. These behavioural measures were compared against personality assessment scores obtained using the Monash Canine Personality Questionnaire-Revised (MCPQ-R). Although the results to date are based on a small sample size (n=8), cognitive bias testing gave results that are comparable to those obtained in lab-based studies. Dogs who were more lateralized to the right (preferred right paw use) on the Kong Wobbler™ test also required more training trials to reach criterion in the cognitive bias task. There was a correlation between the direction of lateralization based on Kong Wobbler™ scores and the MCPQ-R personality dimension Amicability, with right-pawed dogs showing higher scores. These results suggest that the modifications made to the cognitive bias and laterality tasks are suitable for testing in the home environment, and the Kong Wobbler™ could be an effective new tool to assess laterality in canines.

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The Modern Dog: Canine Metabolic, Behavioural and Cognitive Indicators of Wellness (I)

The relationship between optimism and health in humans has been extensively explored in the literature (Careau, Réale, Humphries & Thomas, 2010). It has been shown that people who are more optimistic, i.e., hopeful and positive about their future, report better health and experience fewer chronic illnesses (Chopik, Kim & Smith, 2015). Cheng and Furnham (2001) reported that personality traits can influence how optimistic an individual is likely to be; extraverts tend to explain positive events optimistically while those who are high in neuroticism are more likely to explain negative events pessimistically. Thus, an individual's personality traits and cognitive response to situations interact and potentially influence overall happiness, health, and well-being. More generally, optimism and pessimism are referred to as opposites in a continuum of cognitive bias, which is a selective distortion in an individual's memory, reasoning or judgement, usually caused by past experiences (Mendl, Brooks, Basse, Burman, Paul, Blackwell & Casey, 2010). While cognitive bias was initially studied in humans, it has been increasingly investigated in non-human animals, particularly to investigate well-being and welfare (e.g., Mendl, Burman, Parker, & Paul, 2009). Concerns surrounding animal welfare are compelling reasons to determine if, like for humans, there is a credible link between cognitive bias and personality traits that may relate to an individual's overall health and wellness.

Cognitive Bias in Animals

Cognitive bias testing typically involves training individuals to associate one stimulus with a reward and one stimulus with no reward, and then measuring their behavioural response when they are presented with an untrained ambiguous stimulus that has properties of both the rewarded and unrewarded stimuli (Kis, Hernádi, Kanizsár, Gácsi & Topál, 2015). If they behave as if this ambiguous stimulus is similar to the rewarded stimulus, they show an optimistic

response to the ambiguity; if they behave as though the ambiguous stimulus is similar to the non-rewarded stimulus, they show a pessimistic response (Barnard, Wells, Hepper & Milligan, 2017).

Recent research has explored cognitive bias in a wide range of species. Brydges, Hall, Nicolson, Holmes and Hall (2012) showed that stress experienced by juvenile rats resulted in the development of anxiety-related symptoms and distorted cognitive bias in adulthood. Brilot, Asher and Bateson (2010) examined stereotypy, repeated undirected behaviour often related to the stress of impoverished captive environments, in European starlings (*Sturnus vulgaris)*. A study on the Grizzly bear (*Ursus arctos horribilis)* also attempted to use the cognitive bias task as an indication of welfare for captive animals (Keen, Nelson, Robbins, Evans, Shepherdson and Newberry, 2014). The results of these studies demonstrated that animals who have been previously exposed to enriched or impoverished environments are clearly influenced in their present behaviour by these past experiences. The results are such studies are supportive of an animal's cognitive bias indicating its overall welfare.

Studies directed towards canine cognitive bias specifically have been increasing, in part, due to the relationship between cognitive bias and welfare (Mendl et al., 2009). In an early study on dogs in two rehoming centres, Mendl et al. (2010) trained dogs to discriminate between positive and negative bowl positions. Bowls placed in the positive position would contain food, while bowls placed in the negative position would always be empty. Once training criteria had been met dogs were exposed to three ambiguous positions which were located various distances between the positive and negative positions bowl positions. For each trial the dogs latency to approach a bowl in an ambiguous position was recorded. Higher latencies to approach these bowls were associated with a pessimistic judgement. Dogs who scored higher in an independent test of separation anxiety were more likely to be pessimistic in the cognitive bias task, which

could have implications for successful re-homing. In a clinical application of the cognitive bias task, Karagiannis, Burman, and Mills (2015) demonstrated that dogs diagnosed with "separation-related problems" who were treated with fluoxetine and behaviour modification became less pessimistic by week 6 of treatment. Thus, shifts in cognitive biases are possible and may indicate improved welfare of individuals.

Several studies have since adapted this protocol including Kis et al. (2015), who used the cognitive bias test to look at the influence of intranasal oxytocin on canine cognitive bias. Dogs were brought to a lab and trained to associate bowl position with positive or negative (empty bowl) outcomes and then sprayed with oxytocin (or saline nasal spray for control animals). Subjects were then presented with one ambiguous bowl position located halfway between the previously trained positive and negative locations. The latencies to approach the ambiguous bowl were measured and results indicated that animals who were pretreated with oxytocin showed a more optimistic bias than the controls. Other studies have modified the protocol by using visual cues rather than spatial positioning (e.g., reward/no reward training on light and dark grey cards and testing with greyscale cards of ambiguous shades; Burman, McGowan, Mendl, Norling, Paul, Rehn & Keeling, 2011).

Cognitive Bias and Laterality

It has been suggested that tests measuring motor asymmetry, or laterality, in dogs can accurately predict an animal's cognitive bias and, therefore, any welfare risk (Wells, Hepper, Milligan & Barnard, 2017). Cerebral lateralization incorporates the unique specialization of brain hemispheres that can be seen at different sensory levels, including olfaction, vision and hearing (Siniscalchi, d'Ingeo & Quaranta, 2017). Many tests have been used to assess laterality: recording paw or hand used to remove objects from the head or face (Batt, Batt & McGreevy,

2007; Quaranta, Siniscalchi, Frate & Vallortigara, 2004; Tan & Çalşikan, 1987), recording paw of choice for tricks (Wells, 2003), first step when walking down stairs (Tomkins, Thomson, & McGreevy, 2010) or running (Hackert, Maes, Herbin, Libourel & Abourachid, 2008), and the popular Kong test (Branson & Rogers, 2006; McGreevy et al. 2010; Wells, Hepper, Milligan & Barnard, 2016). The underlying assumption of laterality is that motor asymmetries (e.g., mostly left paw use) reflect dominance of the contralateral brain hemisphere (e.g., right hemisphere) (Siniscalchi et al., 2017).

Recently, Wells et al. (2017) explored the relationship between laterality (using the Classic Kong™ test) and cognitive bias. To test paw preference, each dog was given a Kong stuffed with food. The paws which the dog used to restrict the toy's movement, i.e., the frequency of left and right paw touches, to a combined total of 100, were recorded. To conduct cognitive bias testing, the same dogs were brought into a lab and trained to associate bowl positions with reward or no reward, as described above. Three ambiguous positions (near-negative, middle, near-positive) were used to test for cognitive bias. Left-pawed dogs were more pessimistic, therefore suggesting a possible relationship between cognitive bias and laterality. If this relationship is replicated in other studies, the authors argue that laterality tests may be a less time-consuming way to predict a dog's cognitive bias.

Laterality

Studies investigating the concept of laterality more exclusively have historically been more varied in their methods and findings. While many studies have conducted paw preference tests using food-retrieval procedures (e.g., McGreevy et al., 2010), some authors have questioned whether food rewards *per se* influence outcomes. Siniscalchi et al. (2017) recently reviewed the literature on laterality in dogs and pointed out that some conflicting results include an association

between paw preference and sex which is found only in some studies, but not others (McGreevy et al., 2010; Siniscalchi, 2016; Wells, 2003). As well, the popular Kong test may have limited practical utility for pet dogs; Plueckhahn, Schneider and Delfabbro (2016) recorded Kong paw touches until 50 touches were reached or an hour had passed. They reported that only 60% of their 96 subjects completed the test and made suggestions that, in future studies, authors should report the time it took the dogs to complete the test and the number of dogs that failed to reach criteria. They also mention the importance of future studies analysing the relationship between alternative measures of laterality, other than the Kong test. This echos calls by Tompkins, McGreevy and Branson (2010), who also suggested that clear use of standardized measurements in studies of laterality, e.g., a laterality index (LI), should always be employed to make results from different studies comparable.

Improvements in laterality test procedures, as well as standardization of data analyses, are important to consider. One issue with the popular Kong test is the length of time to complete the task. Although Wells et al. (2017) do not report how long the Kong tests took for dogs to make 100 paw touches, Plueckhahn et al. (2016) clearly report issues with dogs completing 50 paw touches within one hour. Thus, at the very least, the efficiency of the Kong test for evaluating laterality in pet dogs, is questionable. As well, the degree to which experience with a Kong or familiarity with similar toys influences whether dogs complete the Kong task has not been considered, i.e., lack of familiarity with the toy's use may contribute to a dog not reaching criterion, or high familiarity with its use may result in the dog successfully eating the food inside the toy before criterion has been met.

Personality Traits

The relationships between consistent individual differences, i.e., personality, cognitive bias and laterality have just begun to be investigated in non-human animals (e.g., Barnard et al., 2017; Siniscalchi et al., 2017). Studies have shown dogs with stronger lateralization of paw preference (whether left or right) are more self-assured in new environments (Marshall-Pescini, Barnard, Branson & Valsecchi, 2013). Dogs who were scored as ambilateral, i.e., no strong laterilized paw use, were more stressed when exposed to threatening stimuli (Branson & Rogers, 2006). Additionally, dogs who are lateralized tend to be more attentive on a body-weaveing obstacle when competing in agility (Siniscalchi, Bertino & Quaranta, 2014). With respect to directionality of lateralization, dogs who show left paw preferences have been scored as more fearful, stressed and reactive (Braccini & Caine, 2009; Rogers, 2009; Rogers, 2010) and were rated as more pessimistic in the cognitive bias task (Wells et al., 2017).

To date, however, there has been little work examining whether dog personality traits, as assessed by a valid and reliable canine personality assessment tool, correlate with the outcomes of cognitive bias testing or laterality tests. The Monash Personality Assessment Questionnaire-Revised (MCPQ-R) is one such reliable and valid measurement of canine personality across five dimensions (Hsu & Serpell, 2003; Ley, Bennett & Coleman, 2009). It is a owner-reported measure of canine personality that has been examined for its relationship to other canine personality assessment tools (e.g., Rayment, Peters, Marston & De Groef, 2016; Posluns, Anderson, & Walsh, 2017), and MCPQ-R personality dimensions have been shown to predict some dog social behaviours (e.g., in a dog park setting, Ottenheimer Carrier, Cyr, Anderson & Walsh, 2013).

This Study

The research conducted in this study included the MCPQ-R canine personality assessment, a cognitive bias test, and two laterality tests, all of which were conducted in the dog's home vs. a laboratory setting. Modifications of the Classic Kong™ laterality test were examined, and an additional test, using the new Kong Wobbler™, was piloted.

One goal of this study included examining the feasibility of testing dogs for cognitive bias in the home versus lab settings. Possible advantages of this change include the absence of stressors normally associated with travel in vehicles and testing in unfamiliar environments such as a university lab, which could influence test outcomes. One challenge of carrying out this testing in owner's homes is likely to be sufficient space for setting up the testing apparatus, although this may be overcome by reducing the number of ambiguous stimuli to one (vs. five or three, as per Kis et al., 2015). Thus, this study will examine whether a home-based cognitive bias test is feasible for future work. Another goal of the present study was to evaluate the Classic Kong™ food-retrieval test and modify it to be suitable for incorporation into an in-home evaluation, which, in total, should likely last between 2- 3 hours long (in order to not unduly inconvenience owners). To do this, we did not require a specific number of paw touches in the test; rather, the frequency of paw touches occurring within five minutes was recorded. In addition to evaluation of the currently popular Classic Kong™ test, we introduced a laterality test using the Kong Wobbler™, which potentially will increase the number of paw touches relative to the Classic Kong™ test. Currently, there is some debate regarding whether the Classic Kong™ test encourages the use of the dominant or non-dominant paw, with Wells et al. (2016) suggesting that dogs "hold" the Kong with their non-dominant paw. As this has significant implications for how we understand the results of paw preference studies, evaluating how dogs

use the Kong Wobbler™, which has different characteristics than the Classic Kong™, may be informative.

The major goals of this study were to investigate the relationships between cognitive bias scores, laterality and dog personality. Three hypotheses about these relationships are: 1) Dogs who treated ambiguous stimuli similarly to positive stimuli, i.e., had high "positive expectancy scores" would be more strongly lateralized, and would be more likely to show a right paw preference (right lateralization); 2) Dogs with higher positive expectancy scores would be more likely to score higher on the MCPQ-R personality dimensions Amicability, Motivation, and Extraversion; 3) Dogs who are more strongly lateralized to the left (left paw preference) would be more likely to score higher on the MCPQ-R personality dimension Neuroticism.

Ethical Statement

This research was completed in accordance with the guidelines of the Tri-Council Policy Statement on Ethical Conduct for Research Involving Humans (TCPS2) and was approved by the Interdisciplinary Committee on Ethics in Human Research (ICEHR # 20181651-SC). All animal testing protocols were approved under Memorial University's Institutional Animal Care Committee (Animal Use Protocol # 17-01-CW).

Methods

Subjects

Cognitive bias and laterality testing was completed on eight companion dogs from two breeds (beagle, N=1 and husky, N=7). Dogs were between the ages of 26-96 months (mean age 52 months ± 22.56). All dogs were altered, and four were male. The criteria to participate in the study included that the dogs: 1) were between the ages of 2-9 years old, 2) had lived with their

owner for at least six months, 3) were the only dog living in the home, and 4) were not taking any medications which could affect their metabolism.

Materials

Lifestyle Questionnaire. Printed questionnaires were provided to the owners to assess information about their dog's lifestyle. The questionnaire was a modified version of behavioural questionnaire developed by Tiira and Lohi (2014) at Helsinki University and The Folkhälsan Institute of Genetics (Finland), and based on the K9BEHAVIOURAL GENETICS QUESTIONNAIRES (San Francisco & University of Pennsylvania, Philadelphia). Owners reported dog demographic information, socialization history, frequency and duration of physical activities and social interactions with people and other animals (See Appendix A).

Personality Questionnaire. *The Monash Canine Personality Questionnaire - Revised (MCPQ-R)*. The MCPQ-R was printed and given to owners to complete during the first home visit. It uses a 6-point rating scale (1= really does not describe my dog to 6= really does describe my dog) for 26 adjective traits that assess five personality dimensions: extraversion, motivation, training focus, amicability and neuroticism (Ley, Bennett, & Coleman, 2009) (See Appendix B).

Behavioural Assessment. *The Canine Behavioral Assessment and Research Questionnaire (C-BARQ)*. The C-BARQ provides a standardized measure of canine behaviour, with an emphasis on problem behaviours, in particular (Hsu & Serpell, 2003). A website link (https://vetapps.vet.upenn.edu/cbarq/about.cfm) and pin number specific to this study were provided to the owners at the end of the first visit to allow them to complete the questionnaire online at their convenience.

Cognitive Bias Task. Two stainless steel dog bowls were used for this task along with treats as rewards (PureBites®Freeze Dried Chicken Breast, Beef Liver and Bison Treats, Vaudreuil-Dorion, Quebec, Canada). To control for olfactory cues, treats were hidden underneath the rim of both bowls using wire mesh and tape, bowls were washed in between visits. A 15-foot training lead (RC Pets®Training Leash 15 ft, Vancouver) was attached to the dog during the cognitive bias testing to allow for the owner to bring the dog back to the starting position a video camera (SONY Handycam DCR-SR60, Japan) was used to record the session.

Laterality Tests. *Classic Kong*™. This task used one of two different-sized Classic Kong™ (KONG Company, Golden, CO) toys, either Medium (4.0 inches tall) or Large (4.5 inches tall), depending on size of the dog. The Classic Kong™ is a rubber conical toy used as a treat puzzle for dogs. There is a 1.2-inch hole present at the bottom where treats can fall or be licked out. The same treats were used for both laterality and cognitive bias tests (PureBites® Freeze Dried Chicken Breast, Beef Liver or Bison Treats).

Kong Wobbler™. This task used one of two different-sized Kong Wobbler™ (KONG Company, Golden, CO) toys, either Small or Large) depending of the size of the dog. This toy mimics a "bobo doll" and is almost impossible to tip over. The positioning of the hole which dispenses the treats stimulates the dog to use its paws to tip the Wobbler over and release a reward. The hole being located on the side of the toy and is 0.5 inches in diameter. This task also used the same treats (PureBites®Freeze Dried Chicken Breast, Beef Liver or Bison Treats).

All Kongs were washed in between visits, and all tests were recorded for future video analysis.

Morphological Measurements. A portable veterinary scale was used to record the dogs weight in pounds (Cardinal Detecto, Model VET330 Digital veterinary scale, MO, USA) and a homemade wicket (yardstick and balsa wood 'level') was used to measure the dog's height in inches from the floor to their withers (shoulders) (Appendix C).

Activity Log. Owners were provided with printed log sheets to record their dog's activity for two weekdays and one weekend. The form contained prompts for the owner to accurately describe the dog's physical, mental and social activities (Appendix D).

Procedure

The complete study occurred over the course of two visits to the dog's home. The first visit occurred between the hours of 6:00 pm and 9:00 pm in the evening and involved the owner-based lifestyle questionnaire and the MCPQ-R assessment, as well as the cognitive bias task and laterality tests. At the second visit owners were given a Voyce®sensor collar for the dog to wear. Owners were asked to record nutritional intake and activity over four days (Thursday-Sunday) while the dog was wearing the collar. The current study focuses on the first home visit only, specifically, on the behavioural tests and the personality assessment. Lifestyle questionnaire and C-BARQ data will be analyzed at a later date. Morphological data and data collected from the second visit onwards will be analyzed by Jessika Lamarre, Department of Biology Honours student (2018).

Home Visit One. Following obtaining informed consent, owners were provided with the lifestyle questionnaire (Appendix A) at the beginning of the first home visit. They were instructed to fill out as much information as accurately as possible while researchers were

preparing an area in the home to be used for the cognitive bias task. Owners were free to ask as many questions as needed.

Cognitive Bias Task. *Training phase.* With permission from owners, researchers began preparing an area in the home for the cognitive bias task. Using a pre-cut rope template, researchers measured and marked four locations with tape: a starting position/line, a position 3 m directly opposite the starting line (ambiguous stimulus position), and a position 1 m from the ambiguous position both to the left and to the right of this position (See Figure 1). It was ensured that there were no obstacles between any of the positions that would cause the dog to diverge from a straight path to each position. A camera was positioned in the room where it was able to record all four positions throughout the task.

Once the owner completed the lifestyle questionnaire, researchers discussed the cognitive bias procedure. The owner was asked to stand next to the dog at the starting position and restrain the dog verbally, by the collar, or by the leash which was provided to keep the dog in place. The bowl researcher (tasked with placing the bowls in the correct position, according to one of four predetermined patterns, Appendix E) stood facing away from the dog approximately 4 m from the start line. For each trial, the bowl researcher reached into the bag of treats and mimicked the sound of a treat being placed in the bowl, and then walked backwards and placed the bowl in a position. One bowl position was predetermined to be the negative position while the other was positive; the positions and patterns were counterbalanced across dogs with the positive position on the left for 50% of the dogs. Each pattern started with two positive trials and two negative trials. There were never more than two of the same trial types occurring consecutively, and there was always an equal number of positive and negative trials.

Once the bowl was placed down for each trial, the bowl researcher returned to a neutral position facing away from the dog. The researcher timing the dog verbally indicated to the owner that they were ready for the trial to begin. The owner then used the dog's release word ("Okay", "Go", etc.) once and then let go of the leash or collar. Once the owner spoke the dog's release word the timer was started. Once the dog's nose was visually estimated to be within 2 inches of the bowl the timer was stopped, and the dog was allowed to eat the treat (positive locations), which ended the trial, or investigate the empty bowl for 5 s (negative locations). The bowl researcher then returned to collect the bowl, the dog was brought back by the owner to the starting position and the next trial began. If the dog did not approach the bowl in 30 seconds the trial ended. There was a minimum of 10 trials and a maximum of 40 trials to allow the dog to learn to associate the positions of the bowls with reward/no reward. The association between bowl position and existence of a reward was determined to have been learned when the longest latency to approach the positive position in the preceding three positive trials was less than the shortest latency for the dog to approach the negative position in the preceding three negative trials.

Test phase. There was a 5 min break following the training phase and then the test phase began. The owner verbally or physically restrained the dog in the start position and the bowl experimenter prepared the bowl as in the training phase. The bowl experimenter followed the same predetermined position pattern, but with a total of eight ambiguous test trials (i.e., a non-rewarded bowl placed in the central ambiguous position) inserted every four training trials. Each test phase pattern started with two positive trials and two negative trials. There were never more than two of the same trial types consecutively and there were always an equal number of positive

and negative trials. As before, dogs were allowed to investigate the empty bowl for 5 s before it was removed, and the next trial began. There was a total of 40 trials during the test phase.

Scoring. To determine whether the dog showed a cognitive bias, a Positive Expectancy Score (PES=100-CBS) was calculated (Kis et al., 2015), using a "corrected running speed" Cognitive Bias Score (CBS) previously developed by Mendl, et al.(2010).

$$\text{CBS} = \frac{(\text{Latency to reach ambiguous position} - \text{Latency to reach Positive position})}{(\text{Latency to reach Negative position} - \text{Latency to reach Positive position})} \text{x}100$$

Higher PES scores demonstrate a more optimistic bias. If the PES score falls between 0-100, this means the latency to approach the ambiguous position was in-between the latencies for approaching the positive and negative positions. Scores greater than 100 indicate an impartial treatment between the positive position and ambiguous position (Kis et al., 2015).

Laterality Tests

These tasks occurred after the cognitive bias task. The Classic Kong™ task was always conducted first, followed by the Kong Wobbler™ task. An experimenter filled the Classic Kong™ and Kong Wobbler™ with the chicken, beef liver, or bison-flavoured treats. The flavour of treat used for the laterality tests was different than that used in the cognitive bias task (unless the owner reported the dog to be sensitive to chicken, or to dislike a particular flavour). The dog was allowed to sniff the toy before the start of the trial for 5 seconds. The dog was allowed to take the toy to any location within the house and researchers followed the dog to video-record the test, as well as live score the number of paw touches. If the toy became stuck under furniture, it was dislodged and placed down again. If during the first 5 min the dog did not interact with the toy, an additional 5 min was added, and the dog was encouraged by the experimenter for 30 s, who used an excited tone of voice saying, "What's this?!" and her hands

to dispense treats onto the floor. If the dog still did not interact with the toy or stopped interacting with the toy completely after 30 s, the dog was encouraged again every 30 s until the additional 5 min was over. The frequency of left and right paw touches were recorded. A paw touch was defined as the dog placing a paw on the toy. A new touch occurred when the dog removed a paw and placed a paw again on the toy. If a dog placed both paws on the toy at once, a paw touch for each paw was scored. The dog's paw touches were recorded for 5 min and then the toy was taken away by either a researcher or the owner. It was also noted if the dog had previous experience with either toy.

Statistical Analysis

The data were organised using a Google Excel spreadsheet and IBM SPSS Statistics (version 24). In general, nonparametric analyses were performed on the data due to expected deviations from normal distributions. P-values were set to 0.05 and tests were two-tailed, unless stated otherwise. Statistical analysis of cognitive bias and laterality measures were evaluated as per Wells et al. (2017).

Cognitive Bias Task. *Training Phase.* Sex differences in the number of trials to complete the training phase were evaluated with independent t-tests. Spearman's rho tests were used to determine if there was a relationship between the number of training trials and owner-reported MCPQ-R personality dimensions.

Test Phase. A Friedman's two-way analysis of variance by ranks was used to determine if there were significant differences between the average latencies to the three bowl positions (Positive, Negative and Ambiguous) in the test phase. T-tests were used to determine if latencies differed significantly between males and females, and if there were any significant differences in latencies for the first four ambiguous test trials versus the last four ambiguous test trials. A

Spearman's rho correlation was conducted to examine relationships between MCPQ-R personality ratings and PES scores.

Laterality Tests. *Inter-rater reliability.* The laterality tests were scored live and also scored by a second observer from archived video. Pearson's r examined the inter-rater reliability between observers for the Classic™ Kong test and Kong Wobbler™ tests.

Laterality Tests. To calculate paw preferences for the timed Kong Classic™ and Kong Wobbler™ laterality tests, scores were transformed into rates per minute (frequency of paw touches / 5 minutes). The rates were then converted into binomial z-scores in relation to left paw use (*z-score= (left paw rate -0.5 * total paw touch rate)/* $\sqrt{0.25 * total\ paw\ touch\ rate}$*)*. Z-scores greater than 1.96 were indicative of a left paw preference, while z scores that were less than -1.96 indicated a right paw preference. Dogs who were in between these values were classified as ambilateral. A Laterality Index (LI) was used to describe subjects on a scale ranging from left paw preference (1.00) to right paw preference (-1.00) and was calculated by the formula (left paw touches - right paw touches)/ (total paw touches). Strength of laterality (ABS-LI) was calculated using the absolute value of the LI score in which scores near 1.00 were very strong directionally (either left or right) and scores near 0 indicated no directionality in paw use (i.e., ambilateral).

Spearman's rho analysis were used to 1) determine whether there was a relationship between LI and ABS-LI scores for both Classic™ Kong and Kong Wobbler™ laterality tests, 2) quantify a relationship between MCPQ-R personality dimensions and LI and ABS-LI scores and 3) investigate the relationship between LI scores and PES scores from the cognitive bias task.

To follow up on previous results indicating a relationship between paw preference and sex (McGreevy, Brueckner, Thomson & Branson, 2010; Quaranta, Siniscalchi, Frate, &

Vallortigara, 2004; Wells, 2003) an independent samples t-test was used to examine LI and ABS-LI by sex.

Results

Cognitive Bias Test. *Training phase.* One dog did not complete the training criterion within the 40 training trials and did not advance to testing. The average number of training trials to complete training was 22.0 ± 8.9. The minimum number of trials to criterion was 15. There was no significant difference between males and females for the number of training trials to criterion.

There was a significant negative relationship between the number of training trials and the LI scores for the Kong Wobbler™ test, $r_s(7) = -0.815$, $p = 0.025$. Therefore, dogs who required more training trials had a lower LI score indicating a preference for their right paw for this test.

Test phase. A related-samples Friedman's two-way analysis of variance by ranks test determined there was a significant difference in the latencies to reach bowls placed in the three positions, $N = 8$, $p < 0.004$, with latency to the ambiguous position being intermediate to the positive and negative positions (See Figure 2). A paired samples t-test showed there was a marginally significant difference between the mean latency of the first four ambiguous trials vs. the last four trials, $N=8$, $p<.059$ (See Figure 3). There were no correlations between PES score and MCPQ-R personality dimensions. The average PES score was 89.88% ± 48.61%.

Laterality. All of the dogs (N=8) completed the Classic Kong™ test, but one failed to complete the Kong Wobbler™ test. The mean rate per minute of total paw touches converted for the Classic Kong™ test were 4.53 ± 2.35 and 3.94 ± 2.93 for the Kong Wobbler™ test. Based on the standardized rate of paw touches, only one dog was significantly lateralized for the Classic Kong™ test ($z > 1.96$). The mean LI score for the Classic Kong™ test was 0.09 ± 0.59 and for

the Kong Wobbler™ test, it was 0.14 ± 0.48. The average strength of paw laterality (ABS-LI) for the Classic Kong™ test was 0.47 ±0 .33 and 0.34 ± 0.34 for the Kong Wobbler™ test.

There was no correlation between the LI scores for the Classic Kong™ and Kong Wobbler™ tests, $r_s(7) = 0.228$, $p > 0.05$, or the ABS-LI scores, $r_s(7) = 0.348$, $p > 0.05$.

There was a significant negative correlation between the LI score for the Kong Wobbler™ test and MCPQ-R Amicability score, $r_s(7) = -0.815$, $p<0.025$ (See Figure 4). Dogs who were rated as more amicable had lower LI scores, indicating more right paw use. There was no significant relationship between PES and LI scores and no significant differences in LI scores between males and females.

Discussion

The results from this study, to date, are the first to examine cognitive bias scores obtained from pet dogs in their own homes, and their relationships to laterality and personality measures. Data collection is ongoing in order to increase the sample size of this study; although the data presented are based on a small (N =8) sample size, there are several early findings that will influence the future course of this ongoing work.

Cognitive Bias Test

As expected, dogs showed significant differences in their latencies to approach the three bowl positions, indicating the modified cognitive bias task is feasible to conduct in owners' homes. The space required to set up the test was achievable in owners' homes, particularly since we modified it (after Kis et al., 2015) to include only one ambiguous (middle) position. Dogs who have learned the associations between bowl positions and the presence of reward should reach the positive position more quickly than the negative position; for all but one dog, this difference in performance was achieved in relatively few (< 40) training trials. Upon testing, the

dog's latency to the ambiguous position should be an indication of cognitive bias, i.e., how optimistic or pessimistic the dog is about whether or not there will be a positive outcome (reward) from approaching the bowl. Over the series of eight ambiguous position tests, there was a trend for the dog to respond more slowly, indicating that while they clearly were able to discriminate between the three bowl positions, they also began to learn that the "middle" bowl was never rewarded. This was shown in the significant difference in average latencies between the first half (trials 1-4) of the ambiguous trials and the second half (trials 5-8). However, another explanation may be that the dogs became satiated after consuming treats for the training trials and test trials and were no longer motivated by a food reward. If the dogs were satiated than it would be expected that the average latency to the positive re-training trials during the test phase (interspersed among test trials) would decrease, and this did not happen. Similar to Mendl et al., (2010), where ambiguous trials on average consistently showed a positive bias, the average PES score for this was 89%. In fact, at least one dog responded to the ambiguous position with latencies that were quicker than for the positive position. It is not yet clear why this was the case, and whether this pattern will be seen in other dogs as testing continues.

Unexpectedly, there were no significant relationships between the positive expectancy score (PES) and MCPQ-R personality dimensions. It is possible that any such relationship has a small effect size, and this lack of relationship was due to the small sample size. As well, it is likely that most of the dogs "volunteered" by their owners for a study like this are going to be friendly to strangers and non-aggressive; it is doubtful whether owners of highly nervous or aggressive dogs would participate in a study which required two strangers to enter their home and interact with the dog. Thus, we may not have a great deal of variation among some

personality dimensions, such as Amicability and Neuroticism, which would prevent any relationships that may exist between these personality traits and cognitive bias from emerging.

A negative relationship was found between the number of training trials to criteria in the cognitive bias test and LI scores for the Kong Wobbler™ test, indicating that dogs who were strongly right paw preferent took longer to learn the relationship between bowl position and reward. This finding is interesting given a previous study that found dogs who showed right paw preferences had less difficulty completing service dog training (Tomkins, Thomson & McGreevy, 2012). However, the scope of tasks involved in service dog training far exceed performance on any one cognitive test. Also, the correlation in this study is based on a small number of dogs, and thus could be spurious at this point.

Laterality

There was a significant negative correlation between Kong Wobbler™ LI scores and the MCPQ-R personality dimension Amicability, suggesting that dogs who were lateralized to the right had a friendlier nature than those who were lateralized to the left. To our knowledge this is the first evidence that right paw preferent dogs may be friendlier. Interestingly, Schneider, Delfabbro and Burns (2013) found that lateralized (vs. ambilateral) dogs scored higher in a measurement of stranger-directed fear, regardless of directionality. However, of the eight dogs tested in the current study, only one showed clear directionality for paw use, i.e., using z-scores, only one dog showed a paw preference significantly different from chance. Thus, it is possible that the relationship between right lateralization and Amicability rating may diminish with a larger sample size.

One of the goals of this study was to implement a new version of the Kong laterality test which might improve the frequency of paw touches and reduce issues with toy familiarity (as the

Kong Wobbler™ is relatively new). When looking at significant findings so far, only the Kong Wobbler™ test is related to training trials to reach criterion and the personality dimension Amicability. It is too early to say that the Kong Wobbler™ test is more effective for collecting paw preference data than its Classic Kong™ counterpart. Moreover, there was no correlation between the laterality index (LI), directionality of paw use, or the strength of laterality (ABS-LI) scores between the two tests. This could suggest that the Classic Kong™ promotes use of the non-dominant paw, while the Kong Wobbler™ may promote use of either both paws, or the dominant paw. While the low sample size limits the ability to determine this, the relationship between the two laterality tests will be investigated further.

One of the challenges of this study was conducting these behavioural tests in the dog's own home. This approach may be unattractive to some owners, who might not want researchers coming to their homes. However, for other owners, it might be preferable to coming to a lab setting for testing, which arguably involves less owner convenience and may further select against the participation of some dogs, e.g., those who are characterised as more neurotic by their owners, since it involves coming to an unfamiliar environment. Whether home visit-based and laboratory-based tests attract different types of owners and dogs is not yet certain, although this should be considered when comparing behavioural data across studies.

Limitations

It should be noted the modified method used to assess the number of paw touches- frequency of touches in a 5-minute time period- was easy to perform, however it did not yield a high number of paw touches, which limits its usefulness. It was unsurprising that there was difficulty collecting a large enough number of paw touches for the 5-minute Kong Classic™ test. A previous study reported that it was difficult to obtain 50 touches in one hour, and that dogs

who were rated as neurotic were less likely to complete the task (Plueckhahn et al., 2016). One reason for implementing the Kong Wobbler™ test was to try to increase the frequency of paw touches; however this test did not seem to generate significantly more touches. Based on the current sample, several dogs appeared to be uncertain how to "use" the Kong Wobbler™ to gather any treats. Thus, a lack of familiarity with the toy may have contributed to generating fewer, not more, paw touches. It should be noted that the only dog who did not complete the Kong Wobbler™ test was rated quite high in Neuroticism (87.5%), so may have been neophobic. A toy which is too familiar or too unfamiliar to any particular dog may not be ideal for testing laterality. A possible solution to both issues could be a familiarization period during the end of the first home visit, then conducting testing for 15 minutes instead of 5 minutes during the second visit. This would allow the dogs to become marginally familiar with the toys and also give them more time to produce paw touches.

Conclusion

This is the first study which has attempted to conduct cognitive bias and laterality tests in a dog's home environment. Based on the results so far, doing this testing in the home is feasible and may increase the likelihood of recruiting dogs whose owners may believe to be too nervous to be tested in a lab setting. The introduction of a potential new laterality test (Kong Wobbler™) has produced some interesting preliminary results which need to be further studied. It is possible that with some modifications to the test procedure (i.e., increased exposure to reduce neophobia) this new test will generate a pattern of paw touches that contrast to those obtained from the popular Classic Kong™ test. Finally, while this study did attempt to investigate the overall relationships between cognitive bias, laterality and personality, there simply was not enough

statistical power to uncover most hypothesized effects. However, data collection is continuing, and it is expected that these relationships will become apparent with an increase in sample size.

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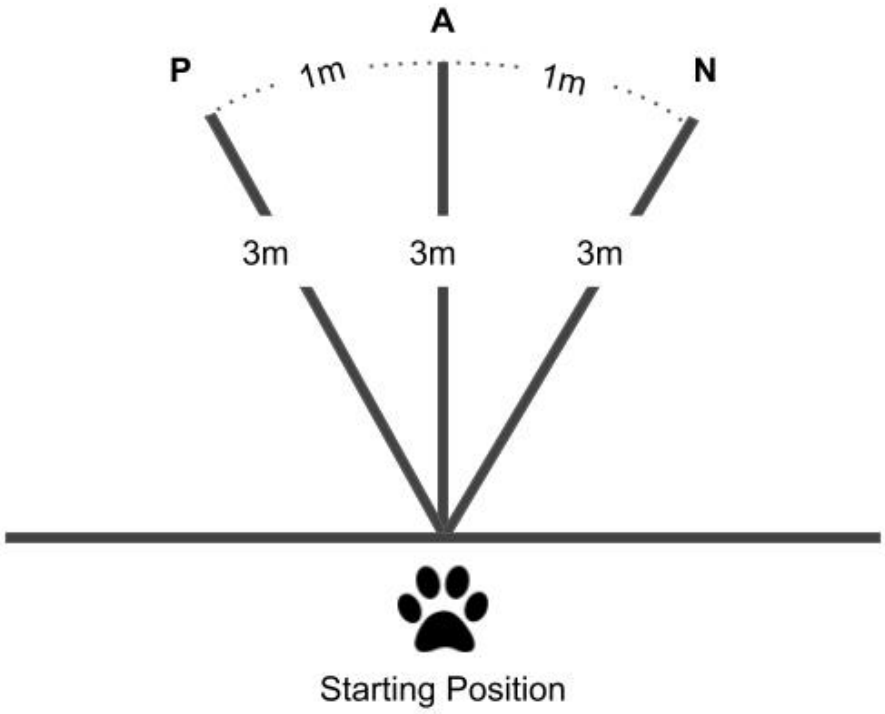


Figure 1. Cognitive Bias Task Positions.

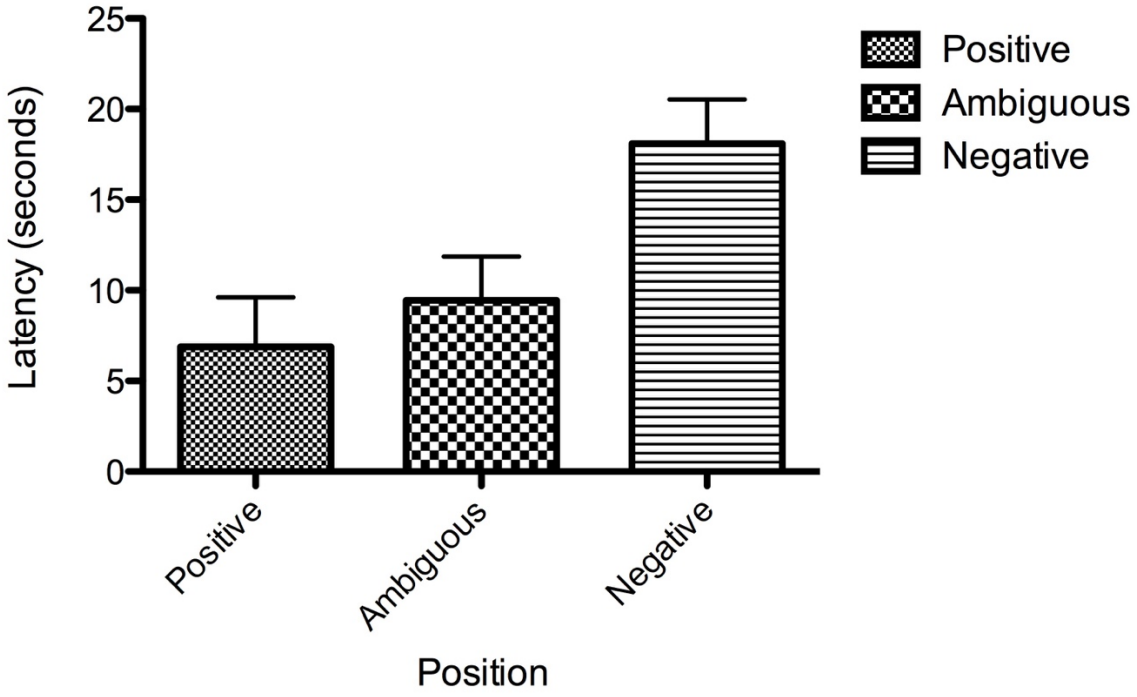


Figure 2. Mean Latencies of the Three Bowl Positions. P = 0.004

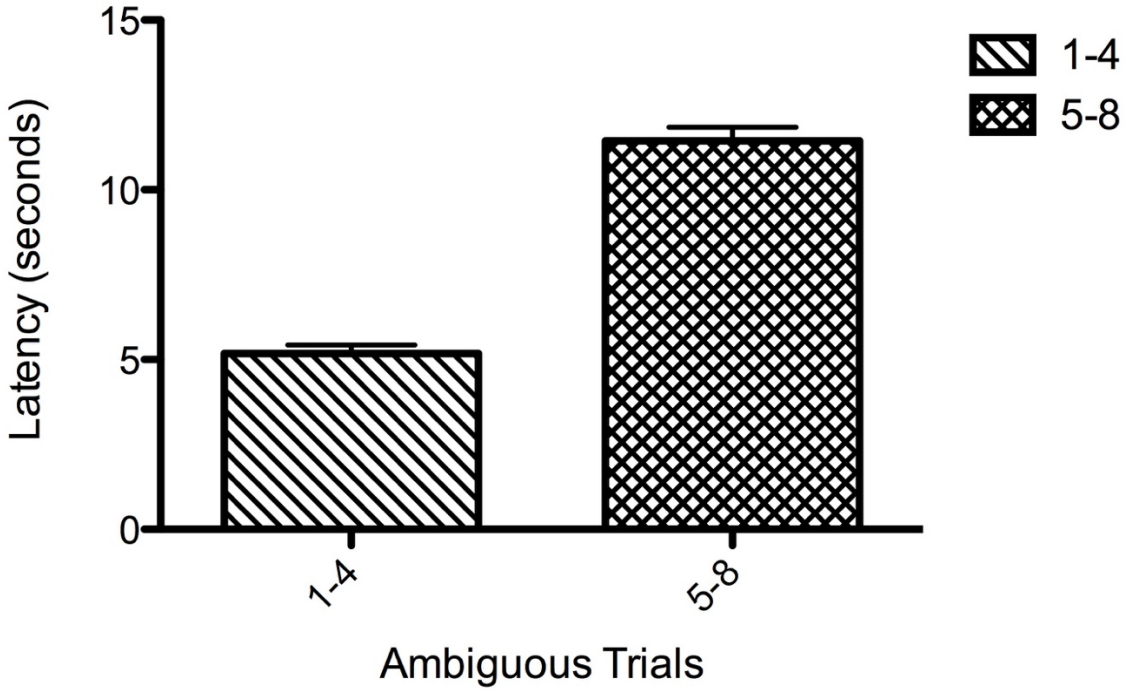


Figure 3. Mean Latencies of Ambiguous Trials 1-4 versus 5-8. P = 0.059

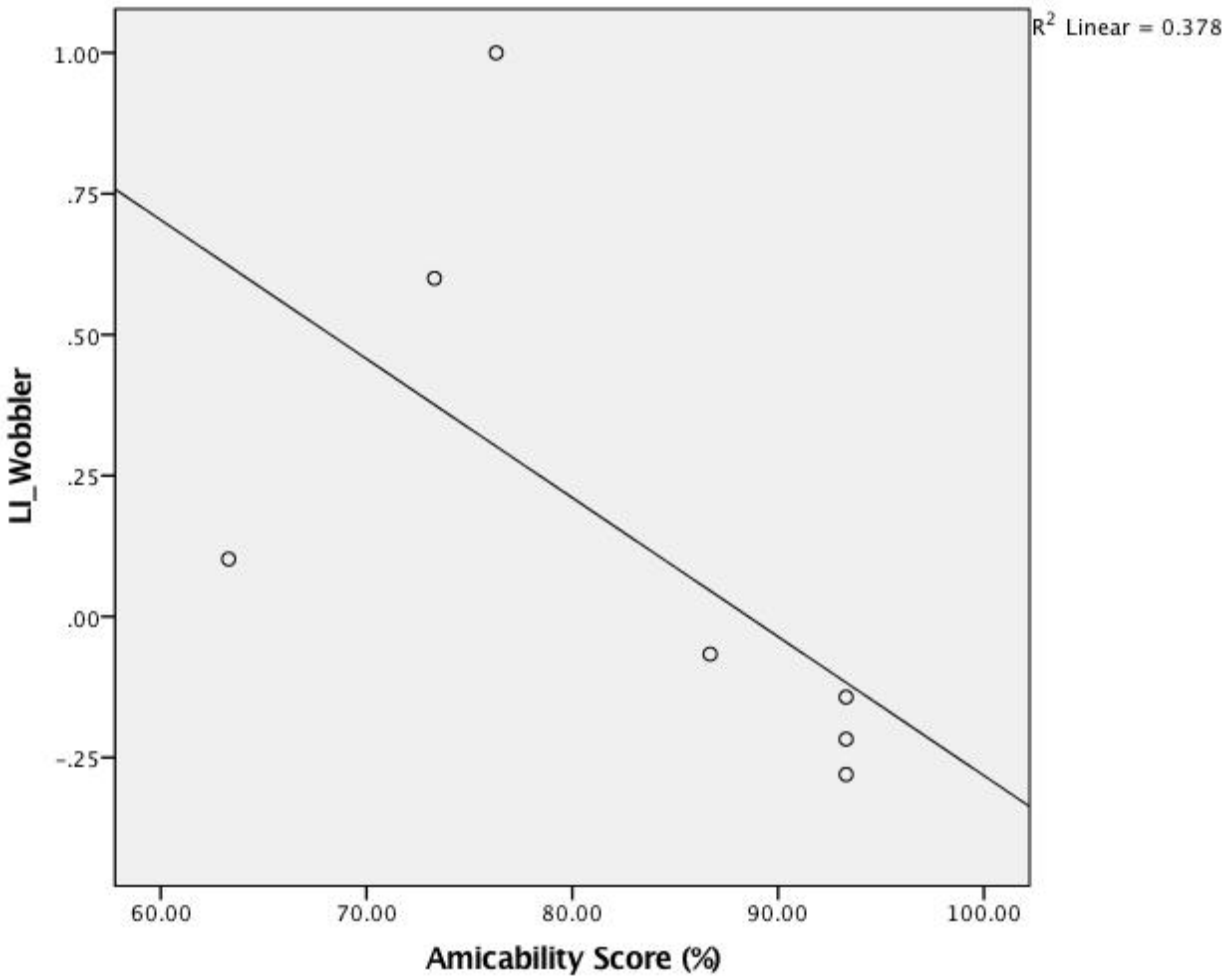


Figure 4. Negative correlational relationship between LI scores using the Kong Wobbler™ and MCPQ-R personality dimension Amicability. P = 0.025

Appendix A

Lifestyle Questionnaire

Dog Subject #: _____

Lifestyle & Health Questionnaire

Name of the owner:	
Address:	
Phone number:	
Email address:	
Breed:	
Dog's name (call name):	
Dog's birthdate (approximate, if unknown):	
sex: ☐ male ☐ female	
Is the dog spayed/neutered: ☐ yes ☐ no	
If you answered yes, at what age was your dog spayed/neutered:	
Dog's current age at first visit (in years):	
Today's Date (Visit #1):	
Dog Weight (lbs) (to be measured at visit)	Dog Height (inches)

This questionnaire includes questions which deal with your dog's lifestyle and health, including past and current experiences with socialization and training.

Please answer all the questions; if you are unsure of the meaning of any question, please ask one of the researchers. All information submitted is strictly confidential. Neither you nor your dogs will be identified at any time. Once the questionnaire is completed, this top page containing your contact information will be removed, and stored separately from the rest of the questionnaire, in which your dog will be identified only by an assigned subject number.

This questionnaire has been modified from behavioural questionnaires developed at Helsinki University and The Folkhälsan Institute of Genetics (Finland), and based on the K9BEHAVIOURAL GENETICS QUESTIONNAIRES (Univ. of California, San Francisco & University of Pennsylvania, Philadelphia).

1

Dog Subject #: _____

Background information

We are interested in your dog's lifestyle from puppyhood, and some of the following questions are designed to evaluate your dog's earlier experiences. If you do not know the answers (perhaps because your dog lived elsewhere when younger), please indicate that you "Cannot answer" and supply the reason. If you are uncertain of the meaning of any question, please ask one of the researchers.

1. At what age did the dog enter your household? _____

2. Dog was acquired from
- ☐ home breeder (non-registered)
- ☐ registered breeder (registered showline breeding)
- ☐ registered (registered working line breeding)
- ☐ large (commercial) kennel
- ☐ shelter or rescue group
- ☐ pet store
- ☐ other, please specify: _____

3. What age did the puppy get separated from the mother? It is often (but not always) the same as the age when puppy enters a new home.

- ☐ under 4 weeks
- ☐ at the age of 4 weeks
- ☐ at the age of 5 weeks
- ☐ at the age of 6 weeks
- ☐ at the age of 7 weeks
- ☐ at the age of 8 weeks
- ☐ at the age of 9 weeks
- ☐ at the age of 10-12 weeks
- ☐ over 12 weeks or older
- ☐ is still living in the same household with its mother
- ☐ cannot answer (Reason: _____)

Dog Subject #: _____

4. The following questions will require you to think back to your dog's experiences from about 7 weeks to about 3 months of age. It may not be possible to answer these question if your dog did not live with you as a puppy. If this is the case, please indicate this as the reason for the "Cannot answer" box. There may be other reasons why you may not be able to answer some of these questions. Please don't worry if this is the case, and simply provide a short reason in the blank spaces provided.

The socialization period: has the dog experienced the following events during the period between 7 weeks-3 months? How often?

Events *How often?*

Met strange adult dogs

- ☐ very often (several times per day)
- ☐ often (twice a week-once a day)
- ☐ sometimes (twice a month-twice a week)
- ☐ seldom (1-2 times at puppyhood - twice a month)
- ☐ rarely (less than 1-2 times during puppyhood)
- ☐ never
- ☐ **cannot answer** (Reason: _____)

Met strange women

- ☐ very often (several times per day)
- ☐ often (twice a week-once a day)
- ☐ sometimes (twice a month-twice a week)
- ☐ seldom (1-2 times at puppyhood - twice a month)
- ☐ rarely (less than 1-2 times during puppyhood)
- ☐ never
- ☐ **cannot answer** (Reason: _____)

Met strange men

- ☐ very often (several times per day)
- ☐ often (twice a week-once a day)
- ☐ sometimes (twice a month-twice a week)
- ☐ seldom (1-2 times at puppyhood - twice a month)
- ☐ rarely (less than 1-2 times during puppyhood)
- ☐ never
- ☐ **cannot answer** (Reason: _____)

Dog Subject #: _____

Met strange children

- ☐ very often (several times per day)
- ☐ often (twice a week-once a day)
- ☐ sometimes (twice a month-twice a week)
- ☐ seldom (1-2 times at puppyhood - twice a month)
- ☐ rarely (less than 1-2 times during puppyhood)
- ☐ never
- ☐ **cannot answer** (Reason: _____)

Visited city (or other place with traffic & many people)

- ☐ very often (several times per day)
- ☐ often (twice a week-once a day)
- ☐ sometimes (twice a month-twice a week)
- ☐ seldom (1-2 times at puppyhood - twice a month)
- ☐ rarely (less than 1-2 times during puppyhood)
- ☐ never
- ☐ **cannot answer** (Reason: _____)

Travelled by car

- ☐ very often (several times per day)
- ☐ often (twice a week-once a day)
- ☐ sometimes (twice a month-twice a week)
- ☐ seldom (1-2 times at puppyhood - twice a month)
- ☐ rarely (less than 1-2 times during puppyhood)
- ☐ never
- ☐ **cannot answer** (Reason: _____)

Travelled by bus

- ☐ very often (several times per day)
- ☐ often (twice a week-once a day)
- ☐ sometimes (twice a month-twice a week)
- ☐ seldom (1-2 times at puppyhood - twice a month)
- ☐ rarely (less than 1-2 times during puppyhood)
- ☐ never
- ☐ **cannot answer** (Reason: _____)

Dog Subject #: _____

Travelled by plane

YES ☐ **/ NO** ☐

If yes, age at travel by plane (if known): _____

☐ **cannot answer** (Reason: _____)

5. How many dogs have ever lived with your current dog? _____ If more than "0", can you state the length of time dogs lived together, and age of your current dog when the other dog(s) no longer lived with him/her?

_____

_____

6. Has your dog ever lived with other pets in the household (e.g., cats, birds)?

YES ☐ **/ NO** ☐

IF Yes, please indicate the type of other pet(s) and whether the pet no longer lives in the household (PAST), or still currently lives with your dog (CURRENT) (e.g., cat 1 (PAST), cat 2 (CURRENT), cockatiel (PAST)):

_____

_____

_____

7. Is the dog participating in this study your first dog? Second? 10th? _____

8. Has your dog completed any training classes? **YES** ☐ **/ NO** ☐

IF Yes, please indicate the name of the class and training facility, followed by the approximate age of the dog in brackets, e.g., Puppy Start Right, Dynamic Canines (10 weeks); Foundations, Newfoundland Athletic Dog Association (8 months).

_____

_____

_____

CURRENT LIFESTYLE

For the following questions, **please consider the last 6 months**, and answer the questions with this timeframe in mind.

9. Your household includes _____ adults and _____ children.

Dog Subject #: _____

11. Has there been <u>any changes in either the pet or human composition of your household</u> **within the last 6 months** (e.g., child moved away to college, older dog passed away, etc.)?

YES ☐ / **NO** ☐

If Yes, please explain:

_____

_____

_____

12. Dog lives ☐ indoors ☐ outside/ in the kennel

☐ partly inside/partly in the kennel/outside

☐ other _____

13. Have you engaged any physical and/or training activities with your dog (e.g., walks, swimming, Schutzhund training classes, etc.) in the last 6 months? Please specify:

_____

_____

_____

_____

_____

_____

14. Activities with the dog – how much do you spend time in activities mentioned above? (daily walking excluded)

☐ nearly daily

☐ 2-4 times / week

☐ 1-2 times / week

☐ 1-2 times / month

☐ 1-2 times / half a year

☐ once a year

☐ zero

6

Dog Subject #: _____

15. How many times does your dog get exercise (e.g., walks, runs, playing ball in yard, etc.) in a typical day?

- ☐ three times or more
- ☐ twice a day
- ☐ once a day
- ☐ dog is outside all the time
- ☐ something else, please specify _____

16. During the daily walks, is your dog

- ☐ on the leash during the whole walk
- ☐ dog is leashed part of the walk, and partly dog is allowed to run free
- ☐ dog is mostly allowed to run free during the walks

17. How many hours/minutes does your dog get the above exercise in a typical day?

- ☐ three hours or more
- ☐ 2-3 hours
- ☐ 1-2 hours
- ☐ 30 min-1 hour
- ☐ less than 30 min

18. How much does your dog spend **alone** in the house/kennel during the **average working day** (e.g., Thursday)?

- ☐ 0 hours
- ☐ 0-1 hours
- ☐ 1-3 hours
- ☐ 3-6 hours
- ☐ 6-8 hours
- ☐ 8-9 hours
- ☐ 9-10 hours
- ☐ 10 hours or more

Dog Subject #: _____

19. How much does your dog spend **alone** in the house/kennel during the **average weekend** day (e.g., Saturday)?

- ☐ 0 hours
- ☐ 0-1 hours
- ☐ 1-3 hours
- ☐ 3-6 hours
- ☐ 6-8 hours
- ☐ 8-9 hours
- ☐ 9-10 hours
- ☐ 10 hours or more

20. In the last 6 months, estimate approximately how often does your dog has ridden in the car with you or another family member (to go anywhere)?

- ☐ almost daily
- ☐ 1-2 times per week
- ☐ 1-2 times per month
- ☐ 1-3 times in the past 6 months
- ☐ never

21. Do you do currently do any formal or informal training with your dog (e.g., agility training, on-line training courses, informal "tricks" training, etc.)?

YES ☐ **/ NO** ☐

IF Yes, what type(s) of training and how often do you train (daily, weekly, monthly)?

_____

_____

_____

22. Does your dog attend a doggie daycare/kennel facility? **YES** ☐ **/ NO** ☐

If YES, how often (e.g., days per week):

8

Dog Subject #: _____

23. Apart from any attendance at a day care facility, has your dog gone to a dog park or had a dog "playdate" in the last 6 months? **YES** ☐ / **NO** ☐

If yes, please describe type of activity and how often it occurred:

_____

_____

_____

_____

_____

Separation anxiety

24. Does your dog exhibit separation anxiety when left alone?

YES ☐ / **NO** ☐

If you answered yes, please explain how the dog behaves:

_____

_____

_____

25. Has the dog **ever** been treated with medication or other remedies for noise sensitiveness, anxiety, or phobias? **YES** ☐ / **NO** ☐

IF YES, please check all possible treatments below that you have used only **in the last 6 months**:

☐ Acerpromazine
☐ Benzodiazepine (e.g., Valiumilla or Xanaxilla)
☐ Bach's Rescue Remedy
☐ Other 'natural' or 'holistic' remedies
☐ Behavioural desensitization tapes, CDs, or videos
☐ Other? (e.g., BAT): _____

Dog Health

26. Has your dog **ever** been diagnosed with a chronic illness, such as diabetes or hypothyroidism? **YES** ☐ / **NO** ☐

If Yes, please provide details: _____

Dog Subject #: _____

27. Please list any current concerns you might have about your dog's health and/or behaviour (whether you have sought out professional advice or not)- e.g., food allergies, behavioural problems:

_____

_____

_____

28. Apart from an annual check-up (routine vaccinations, etc.), have you brought your dog to a veterinarian in the past 6 months? **YES** ☐ / **NO** ☐

29. Within the past 6 months, have you consulted with any health care practitioner, trainer, diet consultant, etc. who is NOT a veterinarian? **YES** ☐ / **NO** ☐

If Yes, please provide type of consultation and reason for it:

_____

_____

_____

30. On a scale of 1-5 for the weight/body condition of your dog, what score would you give your dog?

1	2	3	4	5
very thin	underweight	ideal	overweight	obese

31. On a scale of 1-5 for how happy your dog seems to you, what score would you give your dog?

1	2	3	4	5
never	rarely	sometimes	often	always

32. Does a particular reason come to mind for the score you gave your dog in the previous question (how happy he/she seems to you)? If so, please indicate it here:

_____

_____

_____

Appendix B

Monash Canine Personality Questionnaire (Revised)

Dog Name: _____ Dog Number: _____

Please rate your dog's personality using the Monash Canine Personality Questionnaire

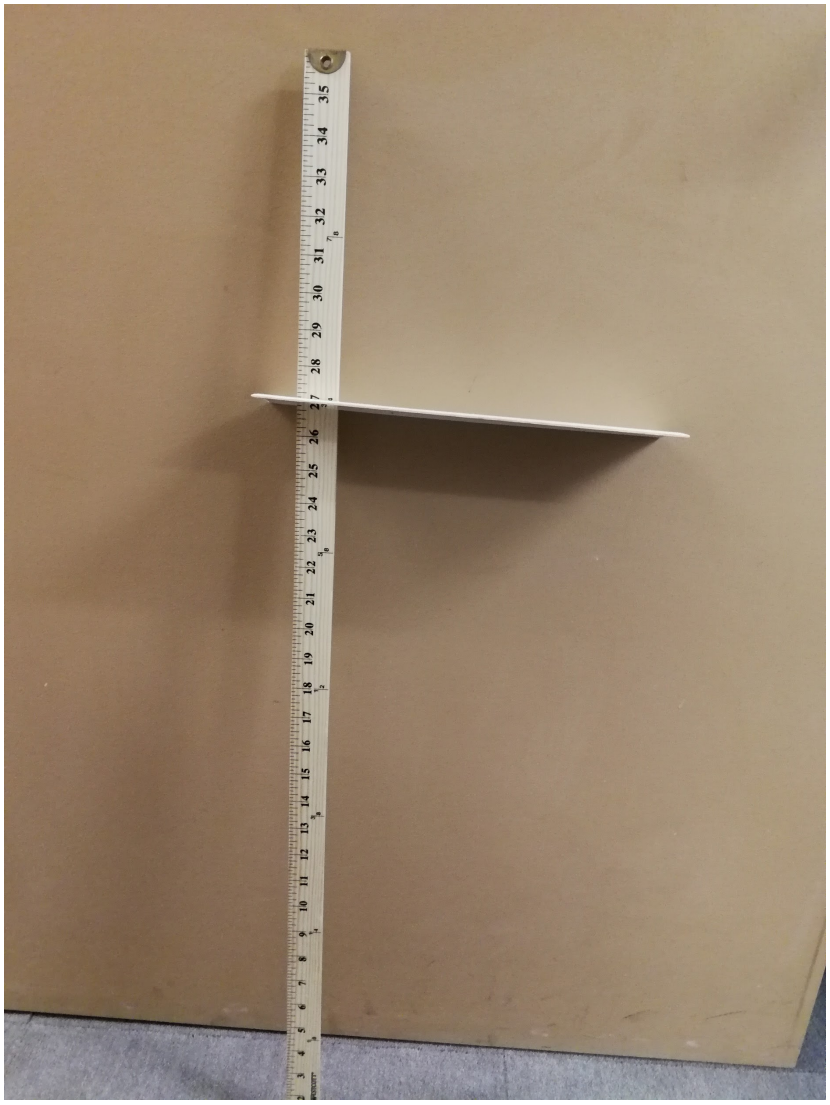
Please rate how well each word describes your dog's personality by marking the appropriate box.
1 = really does not describe my dog, 6 = really describes my dog

	Really does not describe my dog					Really describes my dog
friendly	1	2	3	4	5	6
persevering	1	2	3	4	5	6
nervous	1	2	3	4	5	6
energetic	1	2	3	4	5	6
attentive	1	2	3	4	5	6
easy going	1	2	3	4	5	6
independent	1	2	3	4	5	6
trainable	1	2	3	4	5	6
non-aggressive	1	2	3	4	5	6
hyperactive	1	2	3	4	5	6
submissive	1	2	3	4	5	6
determined	1	2	3	4	5	6
relaxed	1	2	3	4	5	6
tenacious	1	2	3	4	5	6
timid	1	2	3	4	5	6
biddable*	1	2	3	4	5	6
active	1	2	3	4	5	6
intelligent	1	2	3	4	5	6
sociable	1	2	3	4	5	6
restless	1	2	3	4	5	6
fearful	1	2	3	4	5	6
obedient	1	2	3	4	5	6
lively	1	2	3	4	5	6
reliable	1	2	3	4	5	6
assertive	1	2	3	4	5	6
excitable	1	2	3	4	5	6

***biddable: your dog's willingness to follow directions/obey commands**

Appendix C

Homemade Wicket



Appendix D

Activity Log

Set Times Food Diary and Activity Log

Feel free to contact the researchers at any time.
Jessika Lamarre: 819-918-7396
Arynne O'Reilly: 709-683-7429

Day 1
Date:

Dog ID number :

Times Fed	Type of food given (Brand + dry/wet, scraps, treats, homemade)	Amount of food eaten (teaspoon, tablespoon, oz, cup, ml)	Activity: approximate time during which it took place	Type of activity (walk, run, play (e.g. retrieving), rough play (e.g. tug-of-war), interaction with other people/animals)
e.g. 5 pm	PC Salmon & Potato Premium Adult Dry	1.5 cup Ate all of it	e.g. 7 to 9 pm	Leisure walk to dog park (~1h) Dog park; playing with other dogs (~1h)
Hours spent in presence of owner or other known person:			Hours spent by him/herself:	

Set Times Food Diary and Activity Log

Feel free to contact the researchers at any time.
Jessika Lamarre: 819-918-7396
Arynne O'Reilly: 709-683-7429

Day 2
Date:

Dog ID number :

Times Fed	Type of food given (Brand + dry/wet, scraps, treats, homemade)	Amount of food eaten (teaspoon, tablespoon, oz, cup, ml)	Activity: approximate time during which it took place	Type of activity (walk, run, play (e.g. retrieving), rough play (e.g. tug-of-war), interaction with other people/animals)
e.g. 8 am	Greenies original regular size dental treat	1	e.g. 12 to 1pm	Throwing balls and playing tug-of-war outside in deep snow
Hours spent in presence of owner or other known person:			Hours spent by him/herself:	

Set Times Food Diary and Activity Log

Feel free to contact the researchers at any time.
Jessika Lamarre: 819-918-7396
Arynne O'Reilly: 709-683-7429

Day 3
Date:

Dog ID number :

Times Fed	Type of food given (Brand + dry/wet, scraps, treats, homemade)	Amount of food eaten (teaspoon, tablespoon, oz, cup, ml)	Activity: approximate time during which it took place	Type of activity (walk, run, play (e.g. retrieving), rough play (e.g. tug-of-war), interaction with other people/animals)
e.g. 7 pm	Table scraps: beef rice with gravy	2 thumbs size 1 hand palm	e.g. 6 to 10 pm	Family came to visit: dog initially excited, back and forth interacting and sleeping

Hours spent in presence of owner or other known person:	Hours spent by him/herself:

Set Time Food Diary and Activity Log

Feel free to contact the researchers at any time.
Jessika Lamarre: 819-918-7396
Arynne O'Reilly: 709-683-7429

Day 4
Date:

Dog ID number :

Times Fed	Type of food given (Brand + dry/wet, scraps, treats, homemade)	Amount of food eaten (teaspoon, tablespoon, oz, cup, ml)	Activity: approximate time during which it took place	Type of activity (walk, run, play (e.g. retrieving), rough play (e.g. tug-of-war), interaction with other people/animals)
e.g. 3 pm	Purebites Freeze Dried Treats Beef Liver	2 handfuls	e.g. 2h30 to 3h30 pm	Training to learn new commands with food reward

Hours spent in presence of owner or other known person:	Hours spent by him/herself:

Ad libitum Food Diary and Activity Log

Feel free to contact the researchers at any time.
Jessika Lamarre: 819-918-7396
Arynne O'Reilly: 709-683-7429

Day 1
Date:

Dog ID number :

Times of refilling bowl; Times food given	Type of food given (Brand + dry/wet, scraps, treats, homemade)	Amount of food eaten (teaspoon, tablespoon, oz, cup, ml)	Activity: approximate time during which it took place	Type of activity (walk, run, play (e.g. retrieving), rough play (e.g. tug-of-war), interaction with other people/animals)
e.g. 7 am 6 pm	PC Salmon & Potato Premium Adult Dry	1.5 cup filled bowl 0.5 cup left; 1 cup added	e.g. 7 to 9 pm	Leisure walk to dog park (~1h) Dog park; playing with other dogs (~1h)
Hours spent in presence of owner or other known person:			Hours spent by him/herself:	

Ad Libitum Food Diary and Activity Log

Feel free to contact the researchers at any time.
Jessika Lamarre: 819-918-7396
Arynne O'Reilly: 709-683-7429

Day 2
Date:

Dog ID number :

Times of refilling bowl; Times food given	Type of food given (Brand + dry/wet, scraps, treats, homemade)	Amount of food eaten (teaspoon, tablespoon, oz, cup, ml)	Activity: approximate time during which it took place	Type of activity (walk, run, play (e.g. retrieving), rough play (e.g. tug-of-war), interaction with other people/animals)
e.g. 8 am	Greenies original regular size dental treat	1	e.g. 12 to 1pm	Throwing balls and playing tug-of-war outside in deep snow
Hours spent in presence of owner or other known person:			Hours spent by him/herself:	

Ad Libitum Food Diary and Activity Log

Feel free to contact the researchers at any time.
Jessika Lamarre: 819-918-7396
Arynne O'Reilly: 709-683-7429

Day 3
Date:

Dog ID number :

Times of refilling bowl; Times food given	Type of food given (Brand + dry/wet, scraps, treats, homemade)	Amount of food eaten (teaspoon, tablespoon, oz, cup, ml)	Activity: approximate time during which it took place	Type of activity (walk, run, play (e.g. retrieving), rough play (e.g. tug-of-war), interaction with other people/animals)
e.g. 7 pm	Table scraps: beef rice with gravy	2 thumbs size 1 hand palm	e.g. 6 to 10 pm	Family came to visit: dog initially excited, back and forth interacting and sleeping
Hours spent in presence of owner or other known person:			Hours spent by him/herself:	

Ad Libitum Food Diary and Activity Log

Feel free to contact the researchers at any time.
Jessika Lamarre: 819-918-7396
Arynne O'Reilly: 709-683-7429

Day 4
Date:

Dog ID number :

Times of refilling bowl; Times food given	Type of food given (Brand + dry/wet, scraps, treats, homemade)	Amount of food eaten (teaspoon, tablespoon, oz, cup, ml)	Activity: approximate time during which it took place	Type of activity (walk, run, play (e.g. retrieving), rough play (e.g. tug-of-war), interaction with other people/animals)
e.g. 3 pm	Purebites Freeze Dried Treats Beef Liver	2 handfuls	e.g. 2h30 to 3h30 pm	Training to learn new commands with food reward
Hours spent in presence of owner or other known person:			Hours spent by him/herself:	

Appendix E

Cognitive Bias Task Training Patterns

COGNITIVE BIAS TASK - TESTING PHASE			
1	2	3	4
P	P	P	P
P	P	P	P
N	N	N	N
N	N	N	N
A	A	A	A
P	N	P	N
N	P	N	P
N	P	P	N
P	N	N	P
A	A	A	A
P	P	N	N
N	P	P	N
P	N	P	P
N	N	N	P
A	A	A	A
N	N	P	P
P	N	N	N
N	P	N	P
P	P	P	N
A	A	A	A
N	P	P	N
N	N	P	P
P	N	N	P
P	P	N	N
A	A	A	A
N	N	N	P
P	P	N	P
P	N	P	N
N	P	P	N
A	A	A	A
P	P	N	P
P	N	P	N
N	P	N	N
N	N	P	P
A	A	A	A
P	N	P	N
N	P	N	P
N	P	P	N
P	N	N	P
A	A	A	A
P-	P-	P-	P-